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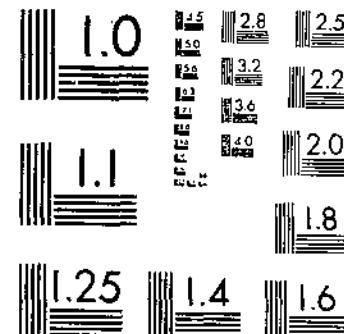
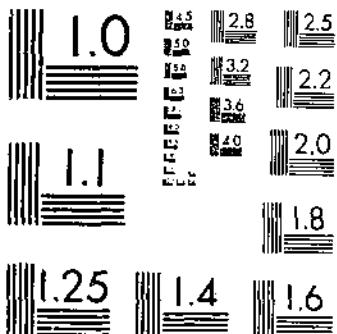
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FRANKLINTELLA, REDEFINITION OF GENUS AND REVISION OF MIUTA GROUP  
SAKIMURA, K. O'NEILL, K. 1081

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# FRANKLINIELLA, REDEFINITION OF GENUS AND REVISION OF MINUTA GROUP SPECIES (THYSANOPTERA: THRIPIDAE)

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# FRANKLINIELLA, REDEFINITION OF GENUS AND REVISION OF MINUTA GROUP SPECIES (THYSANOPTERA: THRIPIDAE)

By K. SAKIMURA and KELLIE O'NEILL<sup>1</sup>

## ABSTRACT

The pattern of abdominal ctenidia and associated setae is used to redefine the thrips genus *Frankliniella* Karny. The redefined genus includes species that were previously misplaced or unrecognized because they lack major pronotal anterior marginal setae or have seven-segmented antennae. The *minuta* group of species is characterized and its species are keyed, with redescriptions and synonymies of the known species, descriptions of new ones, and illustrations of each. The status of dubious types is clarified.

Species of the revised *minuta* group, with known males indicated, include *achaeta* Hood (♂); *bertelsi* (De Santis), n. comb. (= *Isochaetothrips bertelsi* De Santis) (♂ newly described); *caudiseta*, n. sp.; *colombiana* Moulton, n. status (= *minuta* f. *colombiana* Moulton, = *minuta* f. *colombiensis* Moulton, incorrect original spelling, not *stylosa* f. *colombiensis* Moulton) (♂ newly described); *crawfordi*, n. sp.; *curta* Hood (= *Isochaetothrips*

*unicolor* Moulton, n. syn.); *davidsoni* (Moulton) (♂ newly described); *desantisi*, n. sp.; *deserticola*, n. sp. (♂); *ewarti*, n. sp.; *floydandrei*, n. sp.; *fuscicornis* Moulton; *jamaicensis*, n. sp.; *konoi*, n. sp.; *n.agellanica*, n. sp. (♂); *minuta* (Moulton) (♂); *nakaharai*, n. sp.; *oxyura* Bagnall (♂ newly described); *pestinae*, n. sp.; *serrata* Moulton; *trisetosa* Hood; *tuttlei*, n. sp. (♂); *tympanona* Hood (♂); *valdiviana*, n. sp. (♂); and *verbesinae* Sakimura. Excluded from the *minuta* group are *adadusta* Moulton, n. status (= *inutilis* f. *adadusta* Moulton), *hawksworthi* O'Neill, *inutilis* Priesner (= *varitibia* Moulton, n. syn.), and *maculipes* Hood.

The *minuta* group is indigenous to South America north to western North America and may be introduced or indigenous to Florida. One species was introduced into the Hawaiian Islands including Midway atoll. Species are flower inhabitants as far as is known.

## INTRODUCTION

A revision of the *minuta* species group of the thrips genus *Frankliniella* Karny became necessary when species of this genus were found to lack the fully developed cephaic and anterior pronotal setae that were previously used to define the genus. The lack of these setae or their weak development caused some of these species to be placed in the genus *Isochaetothrips* Moulton

(Sakimura, 1967a).<sup>2</sup> Other species were not previously described because of doubt about their generic placement, and some new species were found in unworked material. Also, species that have antennae with seven instead of eight segments were not previously recognized as belonging to *Frankliniella*. The distinctive pattern of abdominal ctenidia (O'Neill, 1970) and setae associated with them is used to redefine the genus.

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<sup>2</sup>The year in italic after the author's name refers to Literature Cited, p.34.

The revised *minuta* group contains 12 known and 13 new species. Two specific names are synonymized, and two infraspecific names are raised to specific status. Keys are given to the female and available male adults of these species. The new species are described, and the known species, most of which were never adequately described, are redescribed. Moulton's (1948) revision left the identity of several type-specimens in doubt and each of those in the *minuta* group is clarified in this revision.

The *minuta* group is New World in origin and is distributed from western North America to the Strait of Magellan. Of the 25 species, 17 are in Central and South America, 6 in western America north of Mexico, 1 in Florida, and 1 on both continents and in the Hawaiian Islands including Midway atoll. Species of this group are probably flower inhabitants, as are most species of

*Frankliniella*. Collection data are the only source of information about their feeding habits or host preferences.

This study was based primarily on material in the National Collection, U.S. National Museum of Natural History (USNM), Beltsville, Md., and the Moulton collection, California Academy of Sciences (CAS), San Francisco. Other material studied was from the late Floyd Andre, whose collection is in the British Museum (Natural History) (BMNH), London; the California Department of Agriculture (CDA), Sacramento; the Canadian National Collection (CNC), Ottawa; the Florida State Arthropod Collection (FSAC), Gainesville; the Museo de La Plata (MLP), Argentina; the University of California at Riverside (UCR); R. L. Post, Fargo, N. Dak.; and K. Sakimura, Honolulu, Hawaii.

## REDEFINITION OF FRANKLINIELLA

Karny (1910) erected the genus *Frankliniella*, and he (1912) published the first key to world species. Hood (1925) outlined the concepts for the species groups, including the *minuta* group, and reported the dilation of the pedicel of antennal segment III as a characteristic of the *tritici* group. Moulton (1948) published a key to the 148 world species and forms of *Frankliniella* then known and assigned 11 species to the *minuta* group. This is the only key to world species. Priesner (1957) placed *Frankliniella* in his new subtribe Thripina. Bailey (1957), Priesner (1964), and Stannard (1968) summarized the generic concept; O'Neill (1970) altered the definition of the genus to include its distinctive ctenidia; and Schliephake (1972) analyzed the relationships among European genera of Thripina including *Frankliniella*.

The original definition of the genus *Frankliniella* (Karny, 1910) as having four long setae on the anterior margin of the pronotum applies to most of its species. However, every species of the genus has the characteristic pattern of tergal ctenidia (O'Neill, 1970) and associated setae (fig. 1, a). The ctenidium is a distinctive, comb-bearing, oblique stria that occurs on each side of tergite VIII and usually appears on some of the tergites before VIII (fig. 1, a).

Ctenidia are related to macroptery, for specimens and species with reduced wings often lack ctenidia on tergites before VIII. Macropterous *Frankliniella* specimens have ctenidia at least to tergite V, where they are between setae ii and iii. On tergites VI-VII they extend laterad of seta pair iii, and on VIII they end laterally before the spiracles. Seta pair ii is reduced on tergites V-VII, and, as in many other thripines, seta pair iii is reduced on tergites VI-VIII.

*Frankliniella* can be distinguished from most other ctenidia-bearing genera of Thripina by the reduction of tergal seta pair ii and the position of the ctenidia on tergite VIII. Other characteristics of the genus are given in the generic diagnosis to follow.

Four species of the *Frankliniella minuta* group were mistakenly assigned to *Isochaetothrips*. The latter (revised by Sakimura, 1967b) is recognizable by the lack of the mesal pair of antecellar setae; presence of three pairs of posteromarginal pronotal setae diminishing in size from seta i to seta iii; ctenidium (fig. 1, b) on each side of tergite VIII ending posteriorly near seta iii, not before the spiracle; normal size of seta ii of tergites V-VII (fig. 1, b); reduced size of seta iii on tergites VI-VIII; and often accessory setae.

*Isochaetothrips* also has long interocellar setae, postocular series of alternately long and short setae, fairly long anterior mesal (discal) setae on

tergite IX in both sexes, and the discal three pairs of setae on male tergite IX fairly large and subequal.

### Genus FRANKLINIELLA Karny

*Frankliniella* Karny, 1910: 46; 1912: 334; Hood, 1914: 37; 1925: 73; 1937: 96; Moulton, 1933: 109; 1948: 56; Bailey, 1957: 174; Priesner, 1957: 166; 1964: 61; Stannard, 1968: 309; O'Neill, 1970: 454; Schliephake, 1972: 271; Jacot-Guillarmod, 1974: 758.

Type-species.—*Thrips intonsa* Trybom, 1895, by subsequent designation (Hood, 1914).

**Diagnosis.**—Typical thripine; head (fig. 4, *a-i*) with two pairs of minor anteocellar setae (ocellar pairs *i-ii*; O'Neill, 1970), one pair of minor or major interocellar setae (ocellar pair *iii*; op. cit.), and six or fewer pairs of postocular setae that are uniform in size and disposition except for one pair, usually *iii* or *iv*, which is directed posterolaterally and usually is longer or stouter than the rest; antennae (fig. 2, *a-t*), each eight- or rarely seven-segmented, with one forked sense cone on each of segments III and IV, and with segments VII-VIII or VII forming a short style; mouth cone moderate; maxillary palpi, each three-segmented. Pronotum (fig. 4, *a-i*) usually with one pair of anteroangular and one pair of anteromarginal major setae, always with two pairs of posteroangular major setae, and between inner pair of posteroangular setae with five pairs of smaller, posteromarginal setae; posteromarginal pair *ii* largest, *iv* occasionally larger than rest, and *i* or a lateral pair or two rarely lacking; metaspinula wanting; wings fully developed or reduced; forewing with hind marginal fringe cilia wavy and normally with rows of setae on both longitudinal veins continuous and regularly spaced; tarsi two-jointed. Abdomen with a ctenidium (fig. 1, *a*) on each side of tergites V-VIII and sometimes IV or III-IV in macropterous forms, sometimes only on VIII in

brachypterous forms; lateral ends of ctenidia on tergite V outside and about level with seta pair *ii*, on tergites VI-VII outside and about level with seta pair *iii*, and on tergite VIII before spiracles; ctenidia before V usually rudimentary (fig. 9, *j*), often ending near seta pair *iii*; macropterous forms with tergal seta pair *i* (fig. 1, *a*) not approximate, *ii* reduced on V-VII, *iii* reduced on VI-VIII, *iv-vi* normally developed; neither tergal nor sternal accessory setae present; tergite VIII with posterior marginal comb often complete, sometimes widely interrupted, rarely lacking; sternites and anterior tergites without or with only traces of posterior marginal combs or craspeda; female tergite IX (fig. 10, *f*) with anterior mesal seta pair weakly developed and two pairs of pores present; tergites IX-X with normal major setae; tergite X with longitudinal split almost complete; male sternites III-VII each with one elongate or rarely circular glandular area, or very rarely two areas on each sternite or none on distal sternites (fig. 9, *p-q*); male tergite IX (figs. 12, *f-i*; 13, *a, e*) with two pairs of pores, four pairs of primary setae, and three pairs of secondary setae; primary setae, one mesad and one laterad of posterior pore, two on or near lateral margin of tergite; secondary setae, one behind posterior pore, one behind each lateral primary seta; primary setae usually long and thornlike, seta mesad of pore sometimes thin, short to moderately long; seta laterad of pore usually thicker and much longer than mesal one (fig. 12, *f-g*), rarely same length and thickness as mesal seta (fig. 12, *h-i*); lateral primaries longest; secondaries fine, weak, shorter than nearby primaries.

### REVISION OF FRANKLINIELLA MINUTA GROUP

Hood (1925) divided *Frankliniella* into four species groups—*tritici*, *cephalica*, *intonsa*, and *minuta*. He defined the *minuta* group as having the interocellar seta shorter than the diameter of the ocelli. Moulton (1933, p. 109; 1948) combined the *tritici* and *cephalica* groups and subdivided the *intonsa* group.

To define the *minuta* group, Moulton (1948) gave an arbitrary limit—up to 28  $\mu\text{m}$ —for the length of the interocellar seta, and he indicated that the postocular and anterior pronotal setae are also reduced and the antenna is compact.

Because the smaller species of the *intonsa* group are otherwise difficult to separate from

species of the *minuta* group, the use of arbitrary limits is continued here. Reduction of the principal postocular seta (the most conspicuous member of the series, usually iii or iv, rarely ii) was more useful for defining the *minuta* group than reduction of the interocellar seta. The former seta is more consistently short and thin than the latter in this species group and is less variable within each species. Reduction of the principal postocular seta is usually accompanied by reduc-

tion of the interocellar and anterior pronotal setae. Members of the *minuta* group usually can be separated from those of other groups by having both the principal postocular and the interocellar setae less than 20  $\mu\text{m}$  and the anterior pronotal setae less than 30  $\mu\text{m}$  long. However, because the division is arbitrary, large individuals, especially of *minuta* itself, will exceed these measurements and small individuals of other groups may fall within them.

## FRANKLINIELLA MINUTA SPECIES GROUP

**Diagnosis.**—Head often smaller and appearing more nearly quadrate than in other groups; postocular and interocellar setae greatly reduced, often minute; principal postocular seta (fig. 3, *n*, *p*–*q*) minute or nearly so, thin, shorter than about 20  $\mu\text{m}$ ; interocellar seta usually subequal to principal postocular seta, rarely slightly larger; antenna (fig. 2) usually compact; segment II not produced anterodorsally and III with pedicel simple, not angularly dilated or elaborated. Anterior pronotal setae minute to moderately developed, not longer than about 30  $\mu\text{m}$ ; or if one pair exceeds 30  $\mu\text{m}$ , the other is decidedly reduced; or if both pairs exceed 30  $\mu\text{m}$ , the cephalic setae are minute; mesanepimeron reticulate along mesal margin; metascutum usually with pores (figs. 8; 9, *a*–*h*). Tergites VI–VII often with traces of craspeda forming weak, shallow scallops along hind margins or a few small teeth at each side; tergite VIII with comb complete in both sexes, with long, broad-based teeth; female sternites III or III–IV each with one small glandular area in a few species; male tergite IX (fig. 13, *a*) with two primary setae near each posterior pore stout, moderately long, usually subequal, but outer pair rarely longer (fig. 13, *d*).

**Differential Characters.**—Sculpture varies among species in density on the occiput, pronotum (figs. 4–6), and mesonotum (fig. 7) and in pattern on the mesal area of the metascutum (figs. 8; 9, *a*–*h*). The distance between striae on the pronotum ranges from 5–6  $\mu\text{m}$  to 10–12  $\mu\text{m}$ , the widest spacing occurring in *minuta* (Moulton), *oxyura* Bagnall, *tympanona* Hood, and *valdiviana*, n. sp. (figs. 4, *d*; 6, *b*, *j*, *r*). Density of striae on the mesonotum is determined only where they run transversely, and descriptions do

not include the area where they converge posteromesally.

Setal length and position are used to distinguish species. The interocellar setae (fig. 3, *j*–*k*, *m*) vary in position; the postocular series (fig. 3, *n*, *p*–*q*) varies in the number visible dorsally; the posteromarginal series (fig. 3, *r*–*t*) varies in the comparative development of setae ii and iv with each other and the others; and the mesal pair of mesonotal setae may be before or between the submesal pair (fig. 7, *b*–*c*, versus 7, *d*–*y*). Females have characteristic length ratios among the major setae of tergites IX and X and between tergite X and the lateral major seta of IX (figs. 10; 11; 12, *a*–*e*).

Metanotal pores, which are fairly consistent in their presence or absence in species of the genus *Frankliniella*, are absent in a few species of the *minuta* group (figs. 8, *a*, *e*, *p*–*q*; 9, *c*–*d*).

Body parts differ in shape among species. Antennae (figs. 2; 3, *a*–*i*) show specific differences in segments II and III in length versus width, which must be measured in exact dorsal view, and in the base of segment VI, which in two species forms a short pedicel like that of segment V (figs. 2, *r*; 3, *b*). The absolute length of segment III used by Moulton (1948) fails to allow for differences in size of individual specimens. The shape of female tergite X (figs. 10; 11; 12, *a*–*e*) varies with the species, but because the basal width is easily altered by pressure of the cover slip or opening of the ovipositor sheath, the best index of this character is the ratio between the lengths of tergites IX and X.

Sternal glandular areas, which are unusual in females of Thripina, occur in three South American species of the *minuta* group. Their con-

spicuousness makes them useful when they are adequately supported by other characteristics, but their value for the identification of single individuals is limited by their occasional absence and the ease with which females that normally have them may be confused with intersexes (Mound, 1971).

**Measurements.**—Measurements are in micrometers and indicate length unless otherwise stated; those for width are specified by the letter "w" with a period. Total lengths of the body and the antennae are estimated as if the intersegmental membranes were fully distended, with half the length of an adjacent tergite allowed for areas between abdominal tergites and amounts judged to be appropriate allowed for membranous areas between adjacent antennal segments and anterior parts of the body. The length of the head is measured from the tip of the interantennal carina to the hind margin of the occiput; that of the

mouth cone, from the same tip to the base of the labial palpi; and that of the ovipositor, from the base of the anterior valves (Jones, 1954) to the apex of the posterior valves. The only species observed in sufficient numbers to show the full range of the ratio of length to width of antennal segments II and III and the total length of the antenna is *minuta* (fig. 2, *m-n*). Broader ranges than those given must be expected in species now known from fewer specimens.

**Illustrations.**—In the illustrations, all setae are shown as if flattened to the plane of the page and arranged symmetrically. Abdominal segments IX and X are shown as if the ovipositor were fully retracted and the ventral sheath of the ovipositor were closed; segment XI is omitted. Sakimura made all drawings using a grid, except figure 5, *h*, which P. Hollyoak (U.S. Dept. Agr.) redrew from O'Neill's camera lucida drawing.

## ABBREVIATIONS AND DEFINITIONS

aa – anteroangular seta, a major seta in one of the anterior angles of the pronotum.  
 am – anteromarginal seta, a major seta of the pair on the anterior margin of the pronotum between the anteroangular setae and the meson.  
 caudal seta – any of the long setae of tergites IX and X; a subpostermarginal seta.  
 d – discal seta, a seta on the disc of tergite IX; in the female (fig. 11, *d*), a seta of the anterior mesal pair; in the male (fig. 13, *b*), a seta of the lateral pair in the group of three pairs on the disc.  
 i to vi – setae, numbered outwardly from the meson; where preceded by I to X, setae of the abdominal segments.  
 I, II, etc. – segments or subsegments of any segmented structure.  
 io – (fig. 3, *j-k, m*) interocellar seta, a seta of the posterior pair of primary dorsal cephalic setae before the posterior common tangent of the posterior ocelli; ocellar pair iii of O'Neill (1970).  
 IXi, ii, iii – (figs. 11, *d*; 13, *b*) major or subpostermarginal setae of tergite IX. Sakimura (1969, *p. 124*, fig. 7, and *p. 128*, fig. 16) inadvertently labeled these setae as XI instead of IX. These are part of the *caudal setae*.

pa-i and pa-ii – (figs. 3, *r-t*; 4) posteroangular setae, the mesal seta and the lateral seta of the long pair in each posterior angle of the pronotum; postangular setae of authors, chiefly J. C. Crawford (U.S. Dept. Agr.).  
 pm; pm-i, pm-ii, etc. – (figs. 3, *r-t*; 4) the postermarginal series; posteromarginal seta i, ii, etc.; the series of setae on the posterior margin of the pronotum between posteroangular pair i; a seta (pair) of this series, numbered outwardly from the meson.  
 po; po-i, po-ii, etc. – (figs. 3, *n, p-q*; 4) the postocular series of setae visible in dorsal aspect; the mesal seta (pair) of this series, the submesal seta (pair), etc.  
 principal postocular – the postocular seta as previously known; the seta (pair) of the postocular series that is distinguished from the rest by its length or disposition or both.  
 s-i to s-iii – (figs. 11, *d*; 13, *b*) a seta (pair) of one of the secondary pairs, usually minor, on tergites IX and X. This term and its abbreviation supersede *accessory marginal setae* and *ami* to *amii* of Sakimura (1969).  
 subpostermarginal setae – (figs. 11, *d*; 13, *b*) the major setae of tergites IX and X, three pairs on IX and two on X; also caudal setae.

tangent - the anterior line tangent to the posterior ocelli, where not otherwise specified.  
 v, vi, etc. - setae, numbered from meson.  
 V, VI, etc. - pertaining to antennal or abdominal segments, numbered from base.

w. - width.

X - pertaining to abdominal segment 10.

Xi and XII - (fig. 11, d) the major or subpostero-marginal setae of female tergite X; the mesal and submesal (pairs of) long setae.

## SPECIES REMOVED FROM FRANKLINIELLA MINUTA GROUP

The following species usually have such long setae that they are placed in the *intonsa* group, although small specimens of each species fall within the limits of the *minuta* group as defined here.

### *Frankliniella adadusta* Moulton, n. status

*Frankliniella inutilis* f. *adadusta* Moulton, 1948: 74, 112. Lectotype ♀, here designated, USNM Type 58919, from Mexico.

Not *Frankliniella inutilis* Priesner, Jacot-Guillarmod, 1974: 793.

This nominal species is represented by two specimens from Orizaba, Veracruz, Mexico, I.1945, N. L. H. Krauss No. 14, lot 45-3805 (USNM). The female fits Moulton's indication, because the length of its antennal segment III is 53. Lacking the conspicuously banded legs and pale wing base of *inutilis*, this specimen is thought to be a distinct species. The paralecotype male is even more distinct from *inutilis*, having the body dark and seta IX-d nearly three times i, whereas the male of *inutilis* is pale and has these two setae subequal. Both *adadusta* type-specimens have setae much too long for the *minuta* group, because the interocellars are 40 or more and the anteromarginals about 50. The following key is not satisfactory for either specimen. The female runs to *serrata* Moulton, but has seta IVii normal; and the male runs to couplet 8, where the tilt of its head conceals the number of postocular setae. Moulton labeled the specimens "*Frankliniella inutilis* Pr. f. *adadusta* Mlt." holotype and allotype. He did not change the labels when he changed the name of the form to *adadusta* in the key and index in order to avoid the potential homonymy of which J. C. Crawford (pers. commun.) warned him. There is no holotype in CAS as stated by Jacot-Guillarmod (1974).

### *Frankliniella hawksworthi* O'Neill

*Frankliniella hawksworthi* O'Neill, 1970: 457, fig.; Jacot-Guillarmod, 1974: 781. Holotype ♀, USNM Type 70760, from Colorado.

This species is easily mistaken for *minuta* (Moulton) in mixed collections and runs to *curta* Hood in the following key. Its interocellar and postocular setae are each ca. 28, much longer than in *curta*.

### *Frankliniella inutilis* Priesner

*Frankliniella inutilis* Priesner, 1932: 183, fig.; Moulton, 1948: 74, 99; Jacot-Guillarmod, 1974: 793. Syntype ♀ in USNM from Mexico.

*Frankliniella varitibia* Moulton, 1948: 61, 94, fig.; Jacot-Guillarmod, 1974: 831. New synonymy. Holotype ♀, USNM Type 58914, from Mexico.

Although Moulton described *varitibia* in the *minuta* group, the unique holotype is merely a very small specimen of *inutilis*. This species normally has setae much too long to be confused with the *minuta* group. Unusually small specimens will run in the following key to *konoi*, new species; but *inutilis* has the postocular series with six setae, of which the principal postocular is iv, the middle and hind tibiae are dark banded as are the femora, and the wings are strongly washed with brown beyond the pale base and fading slightly toward the apex. The species is common in Mexico. The holotype is not in CAS as stated by Jacot-Guillarmod (1974).

### *Frankliniella maculipes* Hood

*Frankliniella maculipes* Hood, 1942: 659; Moulton, 1948: 62, 94; Jacot-Guillarmod, 1974: 795. Holotype ♀, USNM Type 72613, from Peru.

Although Hood compared this species with *oxyura* Bagnall and Moulton placed it in the *minuta* group, its interocellar and postocular setae are each ca. 27. These setae distinguish it from *floydandrei*, new species, to which it runs in the following key.

## KEYS TO SPECIES OF FRANKLINIELLA MINUTA GROUP

### FEMALE

1. Body entirely pale with yellowish-buff or yellowish-orange sub-  
tegumental pigment, or body with weakly gray-shaded areas, but  
tergites VIII-X never shaded; tergite X subequal to IX in length;  
six-seta postocular series (fig. 3, n) ----- 2
- Body dark or light brown, or at least tergites VIII-X strongly gray  
shaded in teneral specimens; tergite X subequal to or longer than  
IX; four-, five-, or six-seta postocular series (fig. 3, n, p, q) ----- 9
2. Antennal style one-jointed; Jamaica, Cuba ----- *jamaicensis*, new species
- Antennal style two-jointed ----- 3
3. Antennal segments II-VIII each uniformly dark except extreme  
base of III; interocellar seta well developed and colored, ca. 30;  
tergite IX with subpostermarginal seta iii 1.7-1.9 times as long  
as tergite X (fig. 11, i); Florida ----- *caudiseta*, new species
- Antennal segments III-V each pale at base and darker distally,  
sometimes entirely pale; VI pale at base or entirely dark; all  
cephalic setae reduced in size, usually much less than 20; tergite  
IX with subpostermarginal seta iii 0.9-1.6 times as long as  
tergite X ----- 4
4. Antenna VI pedicellate; posteroangular seta i decidedly smaller  
than ii; Brazil ----- *desantisi*, new species
- Antenna VI sessile; posteroangular seta i larger than ii ----- 5
5. Major setae dark grayish brown, contrasting sharply with pale  
body and pale fringe cilia and wings; posteromarginal seta ii  
usually less than 1.3 times as large as anteromarginal seta; two  
minor setae between anteromarginal setae; South America ----- 6
- Major setae light brown to pale, contrasting little with body and  
less with wings, almost concolorous with fringe cilia; posteromarginal  
seta ii more than 1.7 times as large as anteromarginal seta;  
four minor setae between anteromarginal setae; North  
America ----- 7
6. Anteromarginal and anteroangular setae and posteromarginal seta  
ii all reduced (fig. 4, f); wing setae little or no more than one-half  
wing width at middle; Brazil ----- *bertelsi* (De Santis)
- Those three pronotal setae well developed; wing setae two-thirds  
wing width at middle or longer; Brazil ----- *verbesinae* Sakimura
7. Antenna VI pale at base; abdomen not gray shaded, labium with  
small area weakly gray shaded; Arizona, California -----
- *deserticola*, new species
- Antenna VI uniformly dark; abdomen weakly but extensively  
gray shaded, labium extensively and strongly gray shaded ----- 8
8. Antenna II pale; tergite IX subequal to X; California -----
- *ewarti*, new species
- Antenna II dark; tergite IX slightly longer than X; Arizona -----
- *tuttlei*, new species

9. Middle and hind tibiae entirely or partly pale to pale brown, sometimes dark-brown tibiae broadly pale at both apical and basal ends or pale along inner margin, never uniformly dark brown; body bicolorous or brown ----- 10  
 Middle and hind tibiae uniformly brown and as dark as femora; body brown, ca. uniform when mature ----- 17

10. Tergite X longer than IX (1.4-1.7 times as long as IX) ----- 11  
 Tergite X subequal to IX ----- 12

11. Five-seta postocular series; extra widely spaced sculpture on pronotum, mesonotum, and metascutum (figs. 6, *j*; 7, *r*; 8, *g-h*); Brazil, Paraguay, Argentina ----- *oxyura* Bagnall  
 Six-seta postocular series; less widely spaced sculpture on pronotum, mesonotum, and metascutum (figs. 6, *p*; 7, *g*; 9, *h*); Peru ----- *trisetosa* Hood

12. Four-seta postocular series (fig. 3, *q*); posteromarginal seta *i* usually lacking (fig. 5, *b*); body strikingly bicolorous with prothorax palest, abdomen darkest; Brazil ----- *nakaharai*, new species  
 Five- or six-seta postocular series; posteromarginal seta *i* present; body not strikingly bicolorous ----- 13

13. Anteromarginal and anteroangular setae reduced, posteromarginal seta *ii* small, less than 15; metascutum with mesal reticulation almost equilateral and without pores (fig. 8, *a*); Brazil ----- *konoi*, new species  
 Anteromarginal and anteroangular setae reduced or well developed, posteromarginal seta *ii* well developed, usually more than 15; metascutum with mesal reticulation chiefly longitudinal and with pores (fig. 8, *k*) ----- 14

14. Anteromarginal seta well developed, as large as posteromarginal seta *ii* ----- 15  
 Anteromarginal seta reduced, smaller than posteromarginal seta *ii* ----- 16

15. Antennal segments III and IV basally yellow, distally brown washed; Panama ----- *floydandrei*, new species  
 Antennal segments III and IV uniformly grayish brown; Brazil ----- *fuscicornis* Moulton

16. All femora uniformly dark grayish brown; tergite IV with well-developed ctenidia and reduced seta pair *ii* (fig. 9, *k*); Peru, Colombia ----- *crawfordi*, new species  
 All femora light brown, partly gray washed; tergite IV with normal setae pair *ii* and ctenidia lacking or rudimentary and ending at seta pair *ii*; Brazil, Trinidad, Peru ----- *curta* Hood

17. Posteromarginal seta *iv* moderately developed, as large as *ii* or nearly so (fig. 3, *r*) ----- 18  
 Posteromarginal seta *iv* reduced, little or no larger than setae *iii* and *v* (fig. 3, *s*) ----- 19

18. Antennal segments III-IV and basal portion of V yellow; metascutum with pores; California, Colorado, Idaho, New Mexico, North Dakota ----- *davidsoni* (Moulton)  
 Antennal segments I-VIII uniformly dark brown, III sometimes lighter than rest but never yellow; metascutum without pores; western U.S.A., south to Peru; Hawaiian Islands; Midway atoll ----- *minuta* (Moulton)

19. Antenna VI pedicellate or with a slight neck at base (figs. 2, r; 2, a) .....	20
Antenna VI sessile, evenly rounded at base (figs. 2, q; 3, a) .....	21
20. Pronotum almost entirely smooth; metascutum with pores; tergite X 1.2-1.3 times as long as IX; antenna VI distinctly pedicellate (fig. 2, r); Mexico .....	<i>pestinae</i> , new species
Pronotum distinctly sculptured; metascutum without pores; tergite X 1.8-2.0 times as long as IX; antenna VI sometimes feebly pedicellate (fig. 2, a) .....	<i>achaeta</i> Hood (in part)
21. Tergite X subequal to IX in length; tergite IV with short ctenidia and reduced seta pair ii; Brazil .....	<i>serrata</i> Moulton
Tergite X longer than IX (1.4-2.0 times as long as IX); tergite IV with or without ctenidia, with seta pair ii normal .....	22
22. Five-seta postocular series (fig. 3, p); sternites III and IV with or without glandular area (fig. 9, m) .....	23
Six-seta postocular series (fig. 3, n); sternite III or sometimes III and IV each with one glandular area (fig. 9, m) .....	25
23. Pronotum with few faint striae along anterior margin (fig. 5, e); sternites III and sometimes IV each with glandular area; metascutum usually with pores; mouth cone directed ventrad; Chile .....	<i>magellanica</i> , new species
Pronotum with deep, anastomosing striae over entire area (figs. 5, i; 6, h); sternites without glandular areas; metascutum with or without pores; mouth cone directed ventrad or not .....	24
24. Metascutum without pores; mouth cone directed posteriad; mesonotum with striae more widely spaced (ca. 8) in transverse area (fig. 7, u); Colorado, Alberta, Saskatchewan .....	<i>achaeta</i> Hood (in part)
Metascutum with pores; mouth cone directed ventrad; mesonotum with striae more narrowly spaced (ca. 5) in transverse area (fig. 7, d); Colombia .....	<i>colombiana</i> Moulton
25. Metascutum without pores; antenna III 2.0-2.3 times as long as wide (fig. 3, h); major setae light brown; Peru .....	<i>tympanona</i> Hood
Metascutum with pores; antenna III 1.6-1.9 times as long as wide (fig. 2, s, t); major setae dark grayish brown; Chile .....	<i>valdiviana</i> , new species

MALE<sup>1</sup>

1. Body and legs pale with yellowish-buff or yellowish-orange subintegumental pigment; base of abdomen to tergite VII and middle and hind femora sometimes weakly gray shaded, but tergites VIII-X and forelegs pale or nearly pale; middle and hind tibiae sometimes partly gray shaded but never uniformly brown or dark brown .....	2
Body and legs dark or light brown; middle and hind tibiae uniformly brown and as dark as femora .....	6
2. Major setae light grayish to dark grayish brown, contrasting sharply with yellow body and wing .....	3
Major setae pale yellow to light brown, contrasting little with yellow body and wing .....	4

<sup>1</sup>Species not included are *caudiseta*, n. sp., *crawfordi*, n. sp., *curta* Hood, *dasantisi*, n. sp., *ewarti*, n. sp., *floydandrei*, n. sp., *fusicornis* Moulton, *jamaicensis*, n. sp., *konoi*, n. sp., *nakaharai*, n. sp., *pestinae*, n. sp., *serrata* Moulton, *trisetosa* Hood, and *verbesinae* Sakimura.

3. Posteromarginal seta ii reduced and subequal to anteroangular seta (fig. 4, *f*); six-seta postocular series; tergite IX with discal seta about twice as long as subposteromarginal seta i (fig. 13, *d*) \_\_\_\_\_ *bertelsi* (De Santis)  
 Posteromarginal seta ii developed and subequal to anteroangular seta (fig. 6, *i-j*); five-seta postocular series; tergite IX with discal seta subequal to subposteromarginal seta i (fig. 13, *a*) \_\_\_\_\_ *oxyura* Bagnall

4. Posteromarginal setae ii and iv well developed; five-seta postocular series; metascutum without pores (teneral specimens of dark-colored form; pale-brown body with distinctive caudal darkening) \_\_\_\_\_ pale-colored form, *minuta* (Moulton)  
 Posteromarginal seta ii well developed, iv reduced; six-seta postocular series; metascutum with pores \_\_\_\_\_ 5

5. Antennal segments II and VI each uniformly dark grayish brown; abdomen weakly but extensively gray shaded; sternites III, IV, and sometimes distal sternites as far as VII each with pair of small, circular, dotlike glandular areas (fig. 9, *p, q*) \_\_\_\_\_ *tuttlei*, new species  
 Antenna II yellowish buff, VI dark grayish brown with pale base; abdomen not gray shaded; sternites III-VIII each with single transverse, oblong glandular area (fig. 9, *n*) \_\_\_\_\_ *deserticola*, new species

6. Posteromarginal setae ii and iv both well developed, iv at least two-thirds of ii \_\_\_\_\_ 7  
 Posteromarginal seta ii only well developed, iv little or no larger than iii and v \_\_\_\_\_ 8

7. Antennal segments III-IV and basal portion of V yellow; metascutum with pores; six-seta postocular series or some postoculars missing \_\_\_\_\_ *davidsoni* (Moulton)  
 Antennal segments I-VIII each uniformly dark grayish brown, III sometimes lighter than rest but never yellow; metascutum without pores; five-seta postocular series \_\_\_\_\_ dark-colored form, *minuta* (Moulton)

8. Five-seta postocular series (fig. 3, *p*) \_\_\_\_\_ 9  
 Six-seta postocular series (fig. 3, *n*) \_\_\_\_\_ 11

9. Tergite IX with discal seta 1.7-2.3 times as long as subposteromarginal seta i, subposteromarginal seta iii very long, subequal to ii or longer (fig. 13, *b*); metascutum usually with pores, rarely without \_\_\_\_\_ *magellanica*, new species  
 Tergite IX with discal seta subequal to subposteromarginal seta i, subposteromarginal seta iii much shorter than ii (fig. 13, *e, k*); metascutum with or without pores \_\_\_\_\_ 10

10. Metascutum with pores; tergite IX with discal seta and subposteromarginal seta i each less than one-half as long as subposteromarginal seta ii (fig. 13, *k*) \_\_\_\_\_ *colombiana* Moulton  
 Metascutum without pores; tergite IX with discal seta and subposteromarginal seta i each more than one-half as long as subposteromarginal seta ii (fig. 13, *e*) \_\_\_\_\_ *achaeta* Hood

11. Metascutum with pores; antenna III 1.6-1.8 times as long as wide; antenna II yellowish brown; major setae dark grayish brown ----  
 ----- *valdiviana*, new species

Metascutum without pores; antenna III 2.1-2.4 times as long as wide; antenna II dark grayish brown; major setae light brown ----  
 ----- *tympanona* Hood

## SYSTEMATICS OF FRANKLINIELLA MINUTA GROUP SPECIES

### *Frankliniella achaeta* Hood

(Figs. 2, a; 6, g-h; 7, u; 8, p; 10, e; 13, e)

*Frankliniella achaeta* Hood, 1925: 81, fig.; Moulton, 1948: 60.

93, fig.; Jacot-Guillarmod, 1974: 761.

*Taeniothrips pearsalli* Moulton, 1927: 192, fig.

**Female.** — *Color*: Body dark grayish brown; antenna similar except III yellowish brown, IV base sometimes lighter; wing dark; legs similar to body except tarsi and anterior tibia lighter; major setae light brown. *Sculpture*: Occiput (fig. 6, g), one to two deep and four to five shallow, transverse striae; pronotum (fig. 6, h), mesonotum (fig. 7, u), and abdomen, deep, anastomosing, transverse striae, narrowly spaced on abdomen and widely spaced elsewhere (ca. 8 on mesonotum); metascutum, mesal area as in figure 8, p. *Measurements*: Body 1,300-1,700; head 90-120, w. 113-138; mouth cone 167-193; antenna 205-250, 2.1-2.4 times head; II 29-33, w. 24-26, ratio 1.2-1.4; III 35-41, w. 20-23, ratio 1.7-1.9; io 7-14, interval 13-22; po-iii 8-15; pronotum 125-138, w. 145-200; am 15-22; aa 10-13; pa-i 38-50, ii 33-43; pm-ii 28-37; forewing 700-900, w. at middle 54-65; setae at middle 35-45, 20-31, 25-34; hind tibia 125-163; tergite VIII comb 13-18; ovipositor 175-223; tergite IX 35-48; X 63-85; setae IXi 55-65, ii 85-108, iii 110-125; Xi 95-115, ii 85-105; ratio of tergites X/IX 1.8-2.0; setae IXi/iii 0.5-0.6; IXiii/tergite X 1.4-1.7.

Mouth cone posteriorly directed; antennal segment VI (fig. 2, a) often slightly constricted at base but not clearly pedicellate; io setae thin, on tangent; po 5 setae, iii thin; am and aa thin; pm except ii small, or iv a little longer than iii and v; metascutum (fig. 8, p) without pores; forewing setae numbering 22-27, 15-17, 8-12. Tergite III usually without, IV with vestigial ctenidia, both with setae ii normal; tergites VI-VII each with tiny, widely interrupted comb; tergite VIII comb with 11-14 teeth; tergite IX (fig. 10, e) about half

as long as X, its seta i about half as long as iii, and iii about half again as long as tergite X.

**Male.** — *Color and sculpture as in ♀. Measurements*: Body 1,250-1,280; head 93-95; antenna 198-214; pronotum 105-110; forewing 620-690; hind tibia 118-130; sternal glandular areas 10-15, w. 38-45; tergite VIII comb 10-12; tergite IX 45-55; X 43-55; setae IX-d 30-45, i 27-45, ii 58-80, iii 20-32; clasper 78-90.

Setae as in ♀ except at end of abdomen; sternites III-VII each with transverse oblong glandular area; tergite VIII comb pale, inconspicuous, with 12-15 teeth; tergite IX (fig. 13, e) with setae d and i subequal, more than half as long as ii; iii much shorter than ii.

**Material.** — U.S.A.: Colorado: Grant, sweeping, 21.VII.1916, L. O. Jackson (Hood 345), holotype (USNM Type 72600) and 3 paratype ♀♀ (USNM); Stillwater, elevation 2800 m, *Arnica cordifolia* Hooker, A. L. Pearsall (Moulton 986), holotype ♂ and allotype ♀ of *T. pearsalli* Moulton (CAS); Pingree Park, elevation 3000 m, *Solidago decumbens* Greene, 20.VIII.1926, C. P. Gillette (Moulton 1038a), 2 ♀♀ (CAS). CANADA: Alberta: Bellevue, E. of, sweeping dry prairie, 2.VIII.1969, B. S. Heming, 1 ♀, 1 ♂ (USNM). Saskatchewan: Indian Head, yarrow, 15.VII.1926, E. Hearle (Moulton 1571), 1 ♀ (CAS).

**Discussion.** — *F. achaeta* is characterized by frequently anastomosing, widely spaced striae on the pronotum; one pair only of developed postero-marginal setae; lack of metascutal pores; length of tergite X about twice that of tergite IX; length of seta IXi little or no greater than half that of seta IXiii; and length of IXiii about 1.5 times that of tergite X. This species is separable from *F. minuta* (Moulton) by the first two previous characters. The male holotype of *pearsalli* lacks one pair of postero-marginal setae. Moulton (1927, pp. 193, 202) based the measurement and illustration of seta d of tergite IX of this specimen on a

broken section of wing cilium near the seta. *F. achaeta* was collected at high elevations in Colorado and high latitudes in Alberta (B. S. Heming, pers. commun.) and Saskatchewan, and it appears to range the farthest north of any species in the *minuta* group.

***Frankliniella bertelsi* (De Santis),  
new combination**

(Figs. 2, b; 3, t; 4, f; 7, h; 8, i; 12, e; 13, d)

*Isochaetothrips bertelsi* De Santis, 1967: 2, fig.; Jacot-Guillarmod, 1974: 840.

**Female.**—**Color:** Body uniform pale yellow, integument not shaded; labium weakly brown shaded; antenna yellow with I hyaline, III-V apically brown washed, VI-VIII grayish brown except for basal one-third of VI; wing clear; legs yellow; ocellar crescents brownish red; major setae dark grayish brown. **Sculpture:** Occiput (fig. 4, f), six deep and two to three shallow, transverse striae; pronotum (fig. 4, f), shallow, narrowly spaced, partly anastomosing, transverse striae; mesonotum (fig. 7, h), seven to eight striae, same but not shallow; metascutum, mesal area as in figure 8, i; abdomen, striae same as on pronotum but less often anastomosing. **Measurements:** Body 1,200-1,350; head 95-110, w. 118-130; mouth cone 179-193; antenna 205-225, 2.0-2.3 times head; II 30-34, w. 21-24, ratio 1.3-1.5; III 35-40, w. 18-20, ratio 1.9-2.1; io 7-10, interval 19-27; po-iv 7-13; pronotum 100-118, w. 150-168; am 10; aa 7-13; pa-i 21-31, ii 15-25; pm-ii 8-13; other pm 7-9; forewing 540-670, w. at middle 40-50; setae at middle 23-28, 20-25, 25-30; hind tibia 108-145; tergite VIII comb 12-16; ovipositor 175-213; tergite IX 58-68; X 49-58; setae IXi 63-80, ii 68-83, iii 53-70; XI 68-80, ii 60-73; ratio of tergites X/IX 0.8-0.9; setae IXi/iii 1.1-1.2; IXiii/tergite X 1.0-1.3.

Antenna VI (fig. 2, b) not pedicellate; io (fig. 4, f) thin, on tangent; po 6 setae, iv thin, others minute; am (fig. 4, f) and aa thin; pa-ii (fig. 3, t) unusually short, sometimes nearly as short as but somewhat thicker than pm, subequal to aa; metascutum (fig. 8, i) with pores; forewing setae unusually short, numbering 22-26, 18-23, 12-16. Tergite VIII comb with 15-22 teeth; tergite IX (fig. 12, e) a little longer than X, its seta i a little longer than iii, and iii a little longer than tergite X; all caudal setae thick, thornlike, with bluntly

pointed tips.

**Male.**—Newly described. **Color and sculpture** as in ♀. **Measurements:** Body 1,030-1,150; head 83-88; antenna 203-210; pronotum 93-95; widths in same proportions as in ♀; forewing 530-570; hind tibia 118-124; sternal glandular areas each 6-8, w. 8-10; tergite VIII comb 15; tergite IX 48-50; X 48-50; setae IX-d 50-55, i 20-22, ii 57-60, iii 28-35; clasper 60-67.

Cephalic, pronotal, and alar setae as in ♀; sternites III-VII each with very small, transversely oblong glandular area; tergite VIII comb with 15-17 teeth; tergite IX (fig. 13, d) with seta d more than twice as long as IXi.

**Material.**—BRAZIL: State of Rio Grande do Sul: Pelotas, 1962-1964, Ferreira col., 1 paratype ♀ (MLP). State of Santa Catarina: Nova Teutonia, *Morus nigra* L., sweeping, *Sambucus nigra* L., *Sapium* sp., XII.1948 to XII.1949, Fritz Plaumann (Hood 1784, 2016, 2055, 2076), 11♀, 2♂ (USNM).

**Discussion.**—*F. bertelsi* is characterized by the pale-yellow body with no gray shading but with dark grayish-brown, thick setae, short wing setae, very short posteromarginal seta ii, dense comb on tergite VIII, and thick, thornlike caudal setae.

***Frankliniella caudiseta* Sakimura and  
O'Neill, new species**

(Figs. 2, c; 4, a; 11, i)

**Female (holotype).**—**Color:** Body and legs orange yellow, integument of tergites I-VII but not VIII-X shaded very weak gray; labium slightly shaded; antenna I hyaline, II-VIII brownish gray, extreme base of III pale; thorax with orange-yellow subintegumental pigment; wing weak grayish brown; ocellar crescents red; major setae light brown to dark grayish brown. **Sculpture:** Weak; occiput (fig. 4, a) with three to four and anterior margin of pronotum (fig. 4, a) with few shallow, transverse striae; sculpture indiscernible on mesonotum and metanotum, barely discernible on abdomen. **Measurements** (paratype in parentheses): Body 1,200 (1,070); head 100 (90), w. ca. 135 (ca. 120); eye 63, w. 40, interval 53; cheek 38; occiput below eye 28; ocellar triangle w. 35, height 33; ocelli w. 10; mouth cone 180 (165); antenna 240 (215), 2.4 (2.4) times head; segments 20, w. 25; 33 (32), w. 23 (22), ratio 1.4 (1.5); 38 (34), w. 20 (18), ratio 1.9 (1.9); 38, w. 18; 30, w. 15; 46, w. 16; 11, w. 5; 14, w. 3; sense cone on VI 38 (30);

io 33 (30), interval 35; po-iv 15 (12); pronotum 100 (93), w. ca. 160 (ca. 145); am 15 (12); aa 18 (15); pa-i 58 (55), ii 34 (30); pm-ii 25 (22); pterothorax 150 (125), w. 200 (175); forewing 550 (500), w. at middle 42 (39); setae at middle 40 (35), 33 (30), 40 (34); hind tibia 140 (115); abdomen 740 (650), w. at IV 240 (200); tergite VIII comb 16; ovipositor 175 (175); tergite IX 50 (45); X 54 (50); setae IXi 90 (85), ii 95 (90), iii 95 (85); Xi 100 (100), ii 95 (90); ratio of tergites X/IX 1.1 (1.1); setae IXi/iii 0.9 (1.0); IXiii/tergite X 1.8 (1.7).

Antenna VI (fig. 2, c) sense cone unusually long; io setae (fig. 4, a) thick, longest in *minuta* group, on tangent; po 6 setae, iv thin; am thick; aa thin; pm setae except ii small; mesospinula and both furcae weak; metascutum with pores; forewing setae numbering 22 (19), 16 (15), 11 (11). Tergite VIII comb long, inconspicuous, with 12 teeth; tergites IX and X (fig. 11, i) subequal; their setae thornlike, long, and subequal to each other; seta IXiii longest in proportion to tergite X in *minuta* group.

**Male.**—Unknown.

**Material.**—Holotype ♀, U.S.A.: Florida: Marion Co.: Heather I., pine needles by Berlese funnel, 21.IV-18.V.1936, J. R. Watson (CAS Type 11087). Paratype: Florida: Cedar Keys [sic], 8 km E of, "scrub" [sic] leaves, mostly oak, by Berlese funnel, 6.X.1935, J. R. Watson, 1 ♀ (CAS).

**Discussion.**—*F. caudiseta* is characterized by the yellow body with brownish-gray antenna II-VIII, long interocellar seta, and very long caudal setae in proportion to tergite X. It is not known whether this species is native or introduced. The name is derived from the Latin *cauda* and *seta* and refers to these unusually long, strong setae.

### *Frankliniella colombiana* Moulton, new status

(Figs. 2, d; 5, i-j; 7, d; 9, e; 10, c; 13, k)

*Frankliniella minuta* f. *colombiana* Moulton, 1945: 93, 113; Bailey, 1949: 121; Arnaud and Lee, 1973: 32 [this spelling selected].

*Frankliniella minuta* f. *colombiensis* Moulton, 1948: 60. Not available; rejected original spelling.

Not *F. stylosa* var. *colombiensis* Moulton, 1948: 72, 99, 112.

*Frankliniella minuta* (Moulton); Jacot-Guillarmod, 1974: 796, in part.

**Female.**—*Color:* Body, antenna, legs, and major setae dark grayish brown (body except head of teneral specimens light grayish brown with abundant orange subintegumental pigment showing through); tarsi and sometimes antenna III and anterior tibia lighter brown; wing deep brown, scale darker at base. *Sculpture:* Occiput (fig. 5, i), 7-8 striae; pronotum (fig. 5, ii), widely spaced, anastomosing striae that form some reticles posteriorly; mesonotum (fig. 7, d), 9-10 narrowly spaced (ca. 5) anastomosing striae; metascutum, mesal area as in figure 9, e; abdomen, narrowly spaced striae; all striae deep and transverse. *Measurements* of lectotype (range among other specimens in parentheses): Body 1,420 (1,200-1,470); head 110 (only 7 specimens with head level, 95-125), w. 130 (118-132); mouth cone 183 (168-193); antenna 235 (225-240), 2.1 (1.9-2.4) times head; II 37 (32-38), w. 26 (24-26), ratio 1.4 (1.3-1.5); III 45 (40-45), w. 21 (20-22), ratio 2.1 (1.9-2.1); io 7 (7-9), interval (12-17); po-iii 7 (7-15); pronotum (7 specimens with pronotum level) 120 (113-128), w. 150 (143-163); am 15 (15-25); aa 35 (35-43); pa-i 48 (40-55), ii 35 (35-43); pm-ii 22 (22-28); forewing 770 (680-790), w. at middle 55 (53-55); setae at middle (33-45, 25-30, 33-35); hind tibia 150 (125-150); tergite VIII comb (13-20); ovipositor 220 (195-220); tergite IX 45 (43-55); X 75 (73-83); setae IXi 54 (48-55), ii 80 (69-80), iii 85 (73-90); Xi 98 (92-105), ii 93 (75-100); ratio of tergites X/IX 1.7 (1.6-1.9); setae IXi/iii 0.6 (0.6-0.7); IXiii/tergite X 0.9 (subequal).

Mouth cone not long but so directed ventrally that head and thorax usually tilt excessively in mounts (fig. 5, j) and ratio of antenna to head appears to vary widely; antenna (fig. 2, d) not pedicellate; io thin, slightly before tangent; po 5 setae, iii thin; am and aa (fig. 5, i) thick; pm except ii minor, subequal or iv a little larger than iii-v; metascutum (fig. 9, e) with pores; forewing setae numbering (23-26, 20-21, 16-18). Tergite III usually without ctenidia, rarely with vestiges on one or both sides; IV with short ctenidia and normal seta pair ii (as in fig. 9, j); tergite VIII comb with (12-15) teeth; tergite X (fig. 10, c) much longer than IX; IX with seta i two-thirds as long as iii, and the latter about as long as tergite X.

**Male.**—Newly described. *Color and sculpture* as in ♀; antenna I-II not paler than in ♀. *Measurements:* Body 1,000-1,180; head (only 6 specimens

with head level) 88-100, w. 115-125; antenna 210-225; pronotum (only 6 specimens with pronotum level) 100-115, w. 130-150; forewing 560-620; hind tibia 113-125; sternal glandular areas 10-15, w. 18-33; tergite IX 43-50; X 40-47; setae IX-d 17-22, i 20-25, ii 50-63, iii 22-38; clasper 63-75.

Io and po as in ♀; sternites III-VII each with small, transversely oblong glandular area; tergite VIII comb as in ♀; tergite IX (fig. 13, k) with setae d and i subequal or d often slightly shorter, each of these less than half as long as ii, and ii much longer than iii.

**Material.**—Lectotype, here designated, ♀, COLOMBIA: Department of Cundinamarca: Bogota, Compositae, 27.X.1944, E. J. Hambleton, No. 91 (lot 44-27724) (USNM Type 58912). Paralectotypes: Same data, 9♀♀, 9♂♂ (USNM, CAS). All type-specimens labeled "colombiensis" by Moulton. Topotypic series: Same data, 17♀♀, 6♂♂ (USNM).

**Discussion.**—When J. C. Crawford (pers. commun.), in helping Moulton with the manuscript for the 1948 paper warned him of the potential homonymy between the name of this form and *F. stylosa colombiensis*, Moulton replied that he planned to change this name to *colombiana*. Moulton made the change in the description and the index but not in the key or on the slides. Arnaud and Lee (1973), at the suggestion of the present authors, selected the name that Moulton intended to use. Bailey (1949) showed that he was aware of Moulton's intention by listing *colombiana* and not *colombiensis*, but he did not expressly select *colombiana*.

*F. colombiana* Moulton is characterized by the ventrally directed mouth cone, five-seta postocular series, metascutal pores, and length of tergite X, which is 1.6-1.9 that of IX. The ventrally directed mouth cone is rare among species of the *minuta* group, and this species has the most obvious one.

### *Frankliniella crawfordi* Sakimura and O'Neill, new species

(Figs. 3, a; 5, d; 7, n; 8, j; 9, k; 11, d)

**Female (holotype).**—**Color:** Body, antennal segments I-II and V-VIII, and femora dark grayish brown; antenna II distinctly darkest, III-IV yellowish brown, IV brown washed except at extreme base, and V pale at extreme base; pro-

thorax lightest and abdomen darkest of body; pterothorax with rich reddish-orange subintegumental pigment; wing deep brown except pale basal one-fourth; tibiae and tarsi uniformly yellow; ocellar crescents bright red; major setae brown to dark grayish brown. **Sculpture:** Occiput (fig. 5, d), two to three deep, three to four shallow, transverse striae; cheek conspicuously serrate; pronotum (fig. 5, d) smooth except one to two faint, transverse striae along anterior margin and a few deep, transverse striae along hind margin; mesonotum (fig. 7, n), deep, widely spaced, slightly anastomosing transverse striae; metascutum, mesal area as in figure 8, j; abdomen, deep, widely spaced, transverse striae. **Measurements** (paratype range in parentheses): Body 1,900 (1,840-2,000); head 123 (115-123), w. 158 (153-160); eye 74, w. 43, interval 71; occiput below eye 41; ocellar triangle w. 63, height 35; ocelli w. 16-17; mouth cone 207 (196-225); antenna 280 (280-293), 2.3 (2.3-2.4) times head; segments 25, w. 29; 41 (38-44), w. 25 (23-25), ratio 1.6 (1.6-1.8); 48 (48-51), w. 23 (23-25), ratio 2.1 (2.0-2.2); 45, w. 22; 35, w. 19; 45, w. 20; 8, w. 7; 13, w. 5; io 8 (8-13), interval 24 (20-25); po-iii 15 (10-18); pronotum 160 (155-163), w. 210 (205-220); am 14 (14-22); aa 26 (26-34); pa-i 51 (48-58), ii 53 (48-60); pm-ii 28 (28-34); pterothorax 240 (233-250), w. 285 (285-315); forewing 910 (910-1,000), w. at middle 68 (68-73); setae at middle (48-53, 43-48, 48-55); hind tibia 200 (193-208); abdomen 1,230 (1,190-1,320), w. at IV 270 (270-325); tergite VIII comb 16 (15-18); ovipositor 252 (250-268); tergite IX 75 (75-78); X 78 (70-78); setae IX-i 60 (58-65), ii 84 (79-93), iii 93 (90-97); Xi 101 (96-107), ii 88 (80-90); ratio of tergites X/IX 1.0 (1.0-1.1), setae IX-i/iii 0.6 (0.6-0.7); IX-iii/tergite X 1.2 (1.2-1.3).

Body large; antenna (fig. 3, a) II and III each with dorsal pair of setae black and conspicuous; io (fig. 5, d) thin, below tangent, within ocellar crescent; po 5 setae, iii thin; am (fig. 5, d) thin, distinctly smaller than pm-ii; aa moderately thick; pm except ii minor, subequal; mesospinula well developed; metascutum (fig. 8, j) with pores; forewing setae numbering (30-33, 22-28, 18-22); hind tibia with 1 thin yellow and 2 thick, spurlike, blackish, blunt-tipped terminal setae. Tergite III without ctenidia; IV (fig. 9, k) and V with identical full-sized ctenidia and reduced seta pair ii; VIII comb with 17 (15-21) teeth; tergite X (fig. 11, d) subequal to IX; setae IX-i-ii thornlike, i

two-thirds as long as iii, iii somewhat longer than tergite X, and Xi longest of caudal setae.

**Male.**—Unknown.

**Material.**—Holotype ♀, PERU: Department of Junin: Huasahuasi, puna (arid high plains), 3700 m, beating, 30.III-4.IV.1940, F. Woytkowski, B-34, (USNM Type 72602). Paratypes: Same data, 6 ♀♀; COLOMBIA: *Trachypogon* sp. root, 18.I.1974, F. R. Planer, 1 ♀ (USNM).

**Discussion.**—*F. crawfordi* is characterized by the uniformly dark grayish-brown femora and yellow tibiae; reduced interocellar, postocular iii, and pronotal anteromarginal setae; and normal ctenidium with reduced seta ii on tergite IV. The leg color is unique among the species of the *minuta* group, and the ctenidial pattern is shared with only two other species of the group, *serrata* Moulton from Brazil and *davidsoni* (Moulton) from North America. The nearest species to *crawfordi* is *serrata*, which differs only in the color of antennal segment IV and the tibiae. *F. crawfordi* also approaches *curta* Hood, which differs in the color of antennal segments III-IV and femora and the ctenidial pattern of tergite IV.

This species is named after the late J. C. Crawford, former thysanopterist for the U.S. Department of Agriculture, who contributed much to Moulton's 1948 paper. Crawford supplied material and information and reviewed and even drafted parts of the original version of the manuscript.

### *Frankliniella curta* Hood

(Figs. 2, e; 6, c-d; 7, q; 8, n; 9, i; 12, d)

*Isochaetothrips unicolor* Moulton, 1933: 128; not *Frankliniella unicolor* Morgan, 1925: 141. New synonymy.

*Frankliniella curta* Hood, 1942: 654; Moulton, 1948: 60, 93; Jacot-Guillarmod, 1974: 773.

*Frankliniella oxyura*: Sakimura, 1967a: 168; Jacot-Guillarmod, 1974: 803, in part; not Bagnall, 1919: 267. Misidentification.

**Female.**—**Color:** Body of teneral holotype light grayish brown with end of abdomen much darker, appearing bicolorous because of bright subintegumental pigment, orange yellow in pterothorax and buff elsewhere; mature specimens with abdomen darker but not as dark basally as apically; labium dark grayish brown; antenna grayish brown, darker than vertex, I pale to light grayish brown, II light grayish brown to brown, III pale yellow to yellowish brown, IV-V light

grayish brown to grayish brown, VI-VIII grayish brown to brown; wing pale brown to deep grayish brown, basal one-fourth somewhat lighter; legs pale with darker wash on outside of femora in middle to uniform light brown; ocellar crescents bright reddish orange; major setae light grayish brown to dark. **Sculpture** (weak or obscure in teneral specimens): Occiput (fig. 6, c), three to four deep, two to three shallow, transverse striae; pronotum (fig. 6, d), deep, widely spaced, anastomosing transverse striae; mesonotum (fig. 7, q), five to six partly anastomosing transverse striae; metascutum, mesal area as in figure 8, n; abdomen, shallow, widely spaced, transverse striae. **Measurements:** Body 1,040-1,360; head 88-94, w. 110-123; mouth cone 150-175; antenna 200-218, 2.2-2.3 times head; II 28-32, w. 21-23, ratio 1.3-1.4; III 35-41, w. 19-21, ratio 1.8-2.0; io 5-12, interval 15-18; po-iii 7-14; pronotum 92-110, w. 130-163; am 10-15; aa 10-15; pa-i 36-55, ii 30-48; pm-ii 17-30; forewing 530-620, w. at middle 42-52; setae at middle 25-38, 23-33, 25-35; hind tibia 113-140; tergite VIII comb 13-20; ovipositor 202-225; tergite IX 58-63; X 57-65; setae IXi 45-73, ii 59-75, iii 55-70; Xi 76-95, ii 60-70; ratio of tergites X/IX 1.0; setae IXi/iii 0.8-1.2.

Antenna VI (fig. 2, e) not pedicellate; io thin, on tangent; po 5 setae, iii thin; am and aa thin, smaller than pm-ii; pm except ii minor, subequal; metascutum (fig. 8, n) with pores; forewing setae numbering 21-23, 16-20, 13-15. Tergite IV (fig. 8, n) ctenidium wanting or vestigial, ending with seta ii, this seta usually normal; tergite VIII comb with 13-16 teeth; tergites IX (fig. 12, d) and X subequal; seta IXi from a little less than to a little more than iii, and seta Xi decidedly longer than IXi-iii.

**Male.**—Unknown.

**Material.**—TRINIDAD: Swept from low herbage in cacao grove, 30.III.1915, C. B. Williams (No. 630), holotype ♀ (USNM Type 72603). BRAZIL: State of Espírito Santo: Santa Teresa, *Verbesina glabrata* Hook. and Arn., 19.VI.1928, O. Conde (Moulton 3216), holotype ♀ of *I. unicolor* Moulton (CAS); same data but from *Achyrocline satureoides* Gardner (Moulton 3214), 1 paratype ♀ (CAS). PERU: Department of Huanuco: Tingo Maria, Compositae flowers, 8.IX.1944, E. J. Hambleton (vial No. 14) (lot 45-600), 5 ♀♀ (USNM).

**Discussion.**—*F. curta* is weakly characterized by the rather minute cephalic and pronotal anterior setae and the widely spaced, anastomosing pronotal sculpture. It is closely allied to but distinct from *F. oxyura* Bagnall. The difference in color is slight. Structurally every character is shared except the nature of the pronotal sculpture and the length ratio of tergites IX and X. The holotype of *curta*, from Trinidad, is a teneral specimen, and the difference in its color from that of *unicolor* Moulton is primarily due to its teneral condition. The Peruvian specimens, which are from the high Andes, differ slightly but are thought to be conspecific. The wide distribution of this species and its adaptation to various habitats are remarkable.

### *Frankliniella davisoni* (Moulton)

(Figs. 2, *f-g*; 3, *n, r*; 4, *b*; 7, *e-f*; 9, *f*; 10, *g*; 13, *h*)

*Isochaetothrips davisoni* Moulton, 1936: 64.

*Frankliniella watsoni* Moulton, 1948: 60, 93.

*Frankliniella davisoni*: Sakimura, 1967a: 168; Jacob-Guillarmod, 1974: 773.

**Female.**—*Color*: Body, antenna, and legs dark grayish brown, except antenna III-IV yellow, V yellowish brown and paler basally, tarsi and anterior tibia brownish yellow; wing deep brown with scale darker; major setae light brown to dark brown. *Sculpture*: Occiput (fig. 4, *b*), four to five deep, two to three shallow, transverse striae; pronotum (fig. 4, *b*) smooth except for few faint, widely spaced, transverse striae along anterior margin; mesonotum (fig. 7, *e-f*), eight to nine anastomosing transverse striae; metascutum, mesal area as in figure 9, *f*; abdomen, deep, narrowly spaced, transverse striae. *Measurements*: Body 1,360-1,670; head 103-118, w. 120-135; mouth cone 174-210; antenna 213-255, 1.8-2.1 times head; II 28-35, w. 23-25, ratio 1.2-1.4; III 38-45, w. 17-20, ratio 2.1-2.3; io 5-12, interval 18-27; principal *po* (usually *iv*, rarely *iii*) 8-15; pronotum 118-145, w. 155-190; *am* 13-19; *aa* 8-15; *pa-i* 34-50, *ii* 25-40; *pm-ii* 24-30, *iv* 15-25; forewing 680-830, w. at middle 48-63; setae at middle 32-47, 25-33, 30-40; hind tibia 118-150; tergite VII comb 5-8; VIII comb 14-21; ovipositor 185-225; tergite IX 42-56; X 70-85; setae IX *i* 53-63, *ii* 95-125, *iii* 95-125; *Xi* 86-110, *ii* 75-100; ratio of tergites X/IX 1.5-1.7; setae IX*ii*/*iii* 0.5-0.6; IX*iii*/tergite X 1.3-1.6.

Antenna III (fig. 2, *f-g*) pedicel unusually long;

*io* (fig. 4, *b*) thin, usually in front of posterior ocelli; *po* (fig. 3, *n*) usually 6 setae, often lacking 1 or both members of a pair, *iv* (or *iii*) thin; *am* (fig. 4, *b*) and *aa* thin; *pm-iv* (fig. 3, *r*) two-thirds to four-fifths as large as *ii*; other *pm* minor; metascutum (fig. 9, *f*) with pores; forewing setae numbering 24-27, 17-21, 13-14. Tergite IV ctenidial pattern somewhat variable, usually with short ctenidium and seta *ii* slightly or decidedly reduced but rarely lacking ctenidia and with one seta of pair reduced; tergites II-VII with very shallow scallops along hind margins and occasionally a few teeth at sides; VII with very short, complete comb; VIII, comb with 12-17 teeth; X (fig. 10, *g*) about half again as long as IX; IX with seta *i* little more than half as long as *iii*, latter a little longer than *Xi-ii*.

**Male.**—Newly described. *Color and sculpture* as in ♀. *Measurements*: Body 1,140-1,210; head 105-108, w. 115-121; antenna 198-210; pronotum 108, w. 145-148; forewing 600-670; hind tibia 123-130; sternal glandular areas 12-14, w. 12-20; tergite IX 48-50; X 48-52; setae IX-*d* 35, *i* 30, *ii* 60-65, *iii* 38-39; clasper 68-80.

Cephalic and pronotal setae as in ♀; sternites III-VII each with subcircular, slightly transverse glandular area; tergites VII-VIII combs as in ♀; tergite IX (fig. 13, *h*) setae *d* and *i* subequal.

**Material.**—U.S.A.: Idaho: Craters of the Moon, no host data, 22.VII.1928, V. G. Davidson (Moulton 3342), holotype ♀ (CAS). New Mexico: Eagle Nest, *Chrysanthus latisquamatus* (Gray) Greene, 22.VIII.1940, J. R. Watson (No. 2), lectotype (here designated) ♀ of *watsoni* (CAS Type 10773) and 8 ♀ paralectotypes (CAS); same data as lectotype, 1 ♀ topotype (USNM). California: Inyo Co.: Westgard Pass, *Chrysanthus* sp., 20.VIII.1960, E. Schlinger (UCR 60-287), 3 ♀, 3 ♂♂ (UCR, USNM, Sakimura); Onion Valley, 3.2 km E. of, *Chrysanthus* sp., 8.IX.1966, R. C. Dickson (UCR 66-251), 4 ♀ (UCR, USNM). Colorado: Axial, sage, 8.VIII.1950, F. Andre, 2 ♀ (BMNH). North Dakota: Elbowoods, *Symphoricarpos occidentalis* Hook., 22.VIII.1946, R. L. Post, J. A. Munro, and O. A. Stevens, 1 ♀ (CAS).

**Discussion.**—Sakimura (1967a) recognized that *Isochaetothrips davisoni* Moulton is a species of *Frankliniella* and *F. watsoni* is a synonym of it. *F. davisoni* is characterized by the quadrate head, light-yellow to brownish-yellow antenna III-V,

two pairs of relatively large pronotal postero-marginal setae, tergal comb or scallops on posterior margins of III-VIII, and usually short ctenidia and reduced seta pair ii on tergite IV. The postocular series of setae is unusual in being variable in number. Through possession of two pairs of large pronotal postero-marginal setae, this species approaches *minuta* (Moulton), but the latter has dark grayish-brown antennal segments IV-V. Tergite IV with ctenidia and reduced seta pair ii, which usually occurs in *davidsoni*, is unusual among *minuta* group species, occurring elsewhere in the group only in *crawfordi* and *colombiana*. The tergite has ctenidia in *minuta* and *colombiana*, but in these species seta pair ii is not reduced.

A single female specimen from North Dakota is peculiar in having on each of sternites III-VI a small glandular area, circular to transversely oblong, 12-15 in size. The only other anomaly found on this specimen is a lack of seta s-i on tergite IX. This specimen otherwise fits *davidsoni*. For the present, the specimen is considered to be an intersex (Mound, 1971), although the sternal glandular area in the female is not necessarily a sign of an intersex in every case. This area is often present in females of certain South American species of *Frankliniella*.

### *Frankliniella desantisi* Sakimura and O'Neill, new species

(Figs. 3, b; 5, c; 7, c; 8, f; 12, b)

**Female (holotype).**—**Color:** Body yellow, without integumental shading, with yellow sub-integumental pigment; antenna yellow, I pale, distal one-half of VI and entire VII-VIII dark grayish brown, distal one-third to one-half of IV-V brown washed; wing yellow; major setae yellow to light brown except caudal setae dark grayish brown. **Sculpture:** Occiput (fig. 5, c), two deep and four to five shallow, transverse striae; pronotum (fig. 5, c), sides with peculiar concentric, curved striae along extreme lateral margins (prothorax thick with notum bulging along meson), disc with faint, normal, partly anastomosing, transverse striae about as in *konoii*, new species (fig. 4, i); mesonotum (fig. 7, c), six to seven widely spaced, anastomosing transverse striae; metascutum, mesal area as in figure 8, f; abdomen, shallow, transverse, narrowly

spaced striae. **Measurements** (paratype range in parentheses): Body 1,470 (1,300-1,510); head 100 (88-100), w. 120 (113-128); eye 63, w. 32, interval 56; occiput 33 below eye; ocellar triangle w. 50, height 32; ocelli w. 18; mouth cone 188 (188-207); antenna 240 (220-248), 2.4 (2.4-2.6) times head; segments 23, w. 25; 35 (34-39), w. 22 (21-24), ratio 1.6 (1.5-1.7); 40 (37-44), w. 17 (16-19), ratio 2.4 (2.2-2.4); 34, w. 17; 33, w. 16; 41, w. 20; 8, w. 7; 12, w. 4; io 10 (minute to 10), interval 14 (10-16); po-iv 12 (7-13); pronotum 135 (123-145), w. 150 (140-160); am 22 (11-22); aa 10 (minute to 10); pa-i 33 (15-33), ii 40 (35-45); pm-ii 13 (13-20); pterothorax 170 (150-193), w. 195 (188-215); forewing 590 (550-620), w. 48 (40-53) at middle; setae at middle (25-30, 15-20, 18-25); hind tibia 130 (120-135); abdomen 960 (855-995), w. at IV 200 (155-225); tergite VIII comb 13 (12-16); ovipositor 185 (173-210); tergite IX 58 (50-58); X 63 (50-63); setae IX-d 43 (41-55), i 78 (70-83), ii 80 (75-90), iii 83 (73-90), s-iii 33 (30-44); Xi 75 (70-84), ii 75 (73-80); ratio of IXiii/tergite X 1.3 (1.3-1.6).

Body slender; ocelli (fig. 5, c) large, possibly with very pale pinkish-yellow pigment; mouth cone long and broad; antenna III (fig. 3, b) with pedicel minutely angulate as in species of *tritici* group; VI pedicellate; io pale, on or rarely below tangent; po 6 setae, iv thin; pronotum (fig. 5, c) narrow; am thin, about half its length behind margin (in paratypes about one-third to nearly its full length behind margin), with 4 or rarely fewer minor setae on margin between am pair; pa-i decidedly shorter than ii; pm setae except ii minor, subequal; mesospinula and both furcae well developed; mesonotum (fig. 7, c) with seta i anterior to hind margin; metascutum (fig. 8, f) with pores; wing setae numbering (20-23, 15-17, 10-14), those on longitudinal veins unusually short. Abdomen slender; tergite VIII comb with 14 (12-15) teeth; tergite IX (fig. 12, b) subequal to X, its seta iii distinctly longer, its setae d and s-iii longer and more thornlike than in any other species of *minuta* group, and its s-i and ii minor; caudal setae subequal.

**Male.**—Unknown.

**Material.**—Holotype ♀, BRAZIL: State of Santa Catarina: Nova Teutonia, sweeping, 29.XII. 1948, Fritz Plaumann (Hood 2016), (USNM Type 72634). Paratypes: Same data, 16 ♀♀ (USNM); same data, except host Myrtaceae, 10/12.X.1949,

(Hood 2064), 1 ♀ (USNM).

**Discussion.**—*F. desantisi* is distinctively characterized by a series of unique or rare characters among the species of the *minuta* group. Such characters are the pedicellate antenna VI, minute pronotal anteroangular seta, decidedly shorter pronotal posteroangular seta i than seta ii, anterior position of mesonotal seta i, and fully developed discal seta (IX-d) and secondary seta iii (s-iii) on tergite IX.

This species is named after Luis De Santis in honor of his years of outstanding contributions to the taxonomy of South American Thysanoptera and also for his cooperation in lending material and helping in other ways.

### *Frankliniella deserticola* Sakimura and O'Neill, new species

(Figs. 2, h; 4, g; 7, y; 8, b; 9, n; 11, h; 13, c)

**Female (holotype).**—**Color:** Body entirely pale, nearly hyaline, with only weak shading at extreme tip of labium; subintegumental pigment yellow to yellowish buff; antenna I pale to hyaline, II yellow to yellowish buff as head, III-V yellow with weak brown wash on distal one-fourth or less on III and one-third to one-half on IV, V uniformly yellow (paratypes occasionally with III not washed or V narrowly washed at apex), VI-VIII dark brown with basal one-third to one-half of VI yellow; wing clear with pale yellow setae; legs yellow, femora weakly shaded with buff; ocellar crescents orange red; major setae pale yellow except caudal setae yellowish buff. **Sculpture:** Weak; striae transverse, shallow or faint; occiput (fig. 4, g), two to three striae and three to four very faint striae; pronotum (fig. 4, g), striae; mesonotum (fig. 7, y), five to six partly anastomosing striae; metascutum, mesal area as in figure 8, b; abdomen, striae widely spaced. **Measurements** (paratype range in parentheses): Body 1,300 (1,150-1,330); head 90 (80-98), w. 135 (125-140); eye 53, w. 35, interval 60; cheek 43; occiput below eye 35; ocellar triangle w. 51, height 38; ocelli w. 13; mouth cone 190 (185-210); antenna 230 (215-240), 2.6 (2.4-2.7) times head; segments 20, w. 23; 38 (33-38), w. 23 (22-24), ratio 1.7 (1.4-1.6); 38 (36-42), w. 17 (17-21), ratio 2.2 (1.9-2.2); 34, w. 18; 29, w. 16; 42, w. 17; 8, w. 8; 15, w. 4; io 13 (10-15), interval 19 (15-20); po-iv 8 (8-12); pronotum 103 (100-113), w. 175 (160-180);

am 12 (9-12); aa 8 (8-11); pa-i 33 (30-42), ii 28 (21-29); pm-ii 25 (21-29); pterothorax 163 (150-168), w. 210 (205-235); forewing 580 (550-620); setae at middle (26-32, 23-32, 28-38); hind tibia 148 (138-158), its longest terminal seta 21 (19-21), 0.14 (0.12-0.14) times tibia; abdomen 800 (759-830); tergite VIII comb 15 (11-15); ovipositor 208 (193-213); tergite IX (fig. 11, h) 55 (53-60); X 53 (53-60); setae IXi 68 (58-70), ii 76 (68-78), iii 61 (50-65); Xi 63 (58-70), ii 58 (55-60); ratio of setae IXi/iii 1.1 (1.1-1.3); IXiii/tergite X 1.2 (0.9-1.2).

Antenna VI (fig. 2, h) not pedicellate; io (fig. 4, g) thin, somewhat below tangent, rarely far below it; po 6 setae, iv thin; am (fig. 4, g) and aa thin, with 4 minor setae between am pair; pm except ii minor, subequal; metascutum (fig. 8, b) with pores; forewing setae numbering (21-23, 16-18, 11-13). Tergite VIII comb with (13-17) teeth; tergite X (fig. 11, h) subequal to IX; caudal setae rather short, IXi and iii subequal, and ii somewhat longer; Xi and ii subequal to IXiii.

**Male (allotype).**—**Color and sculpture** as in ♀ except caudal setae yellow. **Measurements** (paratype range in parentheses): Body 1,120 (950-1,130); head 88 (75-90), w. 123 (108-125); mouth cone 175 (158-175); antenna 218 (208-225); segments 18, w. 21; 30 (30-34), w. 22 (20-22), ratio 1.4 (1.4-1.6); 36 (33-37), w. 17 (16-18), ratio 2.1 (1.9-2.2); 30, w. 17; 28, w. 15; 38, w. 16; 8, w. 8; 14, w. 4; io and po-iv 10-13; pronotum 95 (83-98), w. 155 (135-155); pa-i 38 (24-38), ii 30 (15-30); pm-ii 27 (15-27); pterothorax 155 (140-158), w. 195 (175-200); forewing 550; hind tibia 133 (118-138), its longest terminal seta 15 (15-17); abdomen 620 (590-670); sternal glandular areas 13-15 (8-15), w. 38-45 (20-50); tergite IX 51 (45-51); X 40 (36-43); setae IX-d 34 (25-38), i 28 (15-33), ii 62 (42-65), iii 34 (26-36); clasper 75 (58-75).

Am-aa short as io and po; sternites III-VII each with transverse, rod-shaped glandular area (fig. 9, n); tergite VIII comb somewhat shorter than that of ♀; caudal setae (fig. 13, c) delicate, IX-d decidedly longer than i.

**Material.**—Holotype ♀, allotype ♂, U.S.A.: California: Riverside Co.: Highway 86 near Garnet (42 km W of Indio on Interstate Highway 10), *Malacothrix* sp., 25.III.1959, W. H. Ewart and O. L. Brawner (UCR 59-35) (UCR). Paratypes: Same data, 1 ♀; Palm Springs, *Dithyrea* sp.,

8.II.1958, Ewart (UCR 58-116), 1♀; Palm Desert, *Hymenoclea salsola* Torrey and Gray, 25.III. 1959, Ewart and Brawner (UCR 59-44), 1♂; San Bernardino Co.: Twentynine Palms, *Thamnosa* sp., 25.III.1959, Ewart and Brawner (UCR 59-37), 1♂ (UCR); Arizona: Yuma Co.: Dateland, *Dalea emoryi* Gray, 19.V.1964, D. M. Tuttle, 7♀♀, 13♂♂ (CDA, USNM).

**Discussion.**—*F. deserticola* belongs to a group of three poorly characterized species with entirely yellow body, yellow to brown major setae, anterior pronotal setae scarcely distinguishable from minor clothing setae, and four minor setae between the pronotal anteromarginal setae. The others in the group are *tuttlei*, new species, and *ewarti*, new species, from the same Mojave and Colorado Deserts. Each is distinguished from the others by minor characters. *F. deserticola* lacks the gray-shaded integument, grayish-brown major setae, and uniformly dark antennal segment VI of the other two species. The coefficients of difference (Mayr et al., 1953, p. 146) between *deserticola* and *tuttlei* in the ratios of the following lengths are far higher than the minimum required for significance: Tergite X vs. IX, longest terminal hind tibial seta vs. hind tibia, seta IXi vs. tergite X, and four other minor ratios. Little indication was found of intergradation between the two species. The male sternal glandular areas in *deserticola* (fig. 9, n) are transversely oblong, whereas in *tuttlei* they form pairs of tiny dots (fig. 9, p-q). The male of *ewarti* is still unknown.

### Frankliniella ewarti Sakimura and O'Neill, new species

(Figs. 3, c; 4, h; 7, k; 8, d; 12, a)

**Female (holotype).**—**Color:** Body yellow to brownish yellow; integument with weak grayish-brown shading, weaker on head and abdomen VIII-X than elsewhere; abdominal segments shaded only along anterior and lateral margins, sometimes almost without shading or with none mesally; subintegumental pigment yellow to brownish yellow, often more intense in thorax than elsewhere; antenna I pale to hyaline; II-V light brownish yellow, II sometimes darker than III but never as dark as VI; distal one-half of III, two-thirds of IV, one-fourth of V weakly washed grayish brown; VI-VIII dark grayish brown, VI always uniformly dark; legs yellow, outsides of femora and tibiae weakly shaded brown but not

darker than body; wing pale yellow or rarely clear; ocellar crescents brownish red; major setae yellowish brown to light grayish brown, lightest on wing and darkest at end of abdomen. **Sculpture:** Occiput, pronotum (fig. 4, h), and mesonotum (fig. 7, k) about as in *deserticola* and *tuttlei*, new species, but metascutum (fig. 8, d) with reticulate mesal area smaller than, and striae in lateral area about twice as dense as and more extensive than, these areas in *tuttlei*. **Measurements** (paratype range in parentheses): Body 1,500 (1,450-1,700); head ca. 97 (93-108), w. 135 (125-145); eye ca. 56, w. 38, interval 57; occiput 35 below eye; ocellar triangle w. 54; ocelli w. 15; mouth cone 208 (190-212); antenna 258 (243-265), ca. 2.7 (2.4-2.7) times head; segments 22, w. 25; 38 (36-40), w. 24 (23-25), ratio 1.6 (1.5-1.7); 43 (43-49), w. 20 (18-20), ratio 2.2 (2.2-2.5); 40, w. 18; 35, w. 17; 48, w. 17; 8, w. 8; 16, w. 4; io 10 (10-17), interval 16 (15-18); po-iv 8 (8-13); pronotum 115 (105-130), w. 170 (163-188); am 13 (8-15); aa 6 (6-13); pa-i 61 (45-61), ii 45 (35-45); pm-ii 25 (24-33); pterothorax 195 (183-200), w. 240 (238-275); forewing 730 (700-790), w. at middle 68 (58-68); setae at middle 43, 33, 43; hind tibia 170 (165-183), its longest terminal seta 18 (18-23), 0.11 (0.11-0.13) times tibia; abdomen 1,000 (900-1,100), w. at IV 260; tergite VIII comb (13-19); ovipositor 225 (218-235); tergite IX 60 (60-70); X 60 (60-70); setae IXi 78 (68-88), ii 95 (75-98), iii 80 (64-83); Xi 78 (58-80), ii 73 (53-75); ratio of IXiii/tergite X 1.3 (1.0-1.3).

Antenna VI (fig. 3, c) not pedicellate; io (fig. 4, h) thin, somewhat below tangent; po 6 setae, iv thin, remainder minute; am and aa (fig. 4, h) thin; 4 minor setae between am pair; pm except ii minor, subequal; metascutum (fig. 8, d) with pores; forewing setae numbering (25-28, 17-22, 13-17); longest terminal hind tibial seta shorter than that in *tuttlei*. Tergite VIII comb with (17-20) teeth; tergite X (fig. 12, a) subequal to IX; caudal setae as in *tuttlei* but longer than in *deserticola*; IXi and iii subequal, not as long as ii; Xi and ii subequal to IXiii; IXiii a little longer than tergite X.

**Male.**—Unknown.

**Material.**—Holotype ♀, U.S.A.: California: Imperial Co.: Desert Shores, 0.8 km NE of, *Hymenoclea salsola* Torrey and Gray, 8.II.1958, W. H. Ewart (UCR 58-4) (UCR). Paratypes: Same data,

3 ♀♀(UCR, USNM); Los Angeles Co.: Newhall, 22.4 km E of, same host and collector, 27.IV.1959 (UCR 59-73), 1♀; Riverside Co.: Palm Springs, 13 km NW of, *Dithyrea* sp., 3.IV.1955, Ewart (UCR 55-22), 3♀; same data except 8.II.1958 (UCR 58-116), 5♀; Travertine Rock, *Hymenoclea* sp., 15.II.1966, O. L. Brawner (UCR 66-18), 1♀; (UCR).

**Discussion.**—*F. ewarti* forms a group with *tuttlei* and *deserticola* and is weakly differentiated from them, particularly from the former. *F. ewarti* differs from *tuttlei* by the pale antenna II, denser metascutal sculpture, and subequal lengths of tergites X and IX. It differs from *deserticola* by the uniformly dark antenna VI, strongly shaded labium, and weakly but clearly shaded abdomen.

This species is named after W. H. Ewart in honor of his longstanding efforts and achievement in building a fine thrips collection from the Mojave and Colorado Deserts and also for his cooperation in lending us a part of his collection.

### *Frankliniella floydandrei* Sakimura and O'Neill, new species

(Figs. 2, i; 6, a; 7, w; 8, k; 11, g)

**Female (holotype).**—**Color:** Body brown; head and thorax yellowish brown with integument lightly gray shaded, darkest in metathorax; mouth cone shaded toward tip; antenna I-II grayish brown, I lighter than II, II dark as vertex, III-V brownish yellow with weak brown wash on distal one-fourth of IV and one-third of V, VI-VIII light grayish brown; thorax with orange-yellow subintegumental pigment; abdomen grayish brown, caudal segments somewhat darker; wing pale brown; legs yellow, shaded grayish brown on coxae, outer margin at middle of anterior femur, and entire middle of middle and hind femora; ocellar crescents bright red; major setae light grayish brown, caudal ones darker. **Sculpture:** Occiput (fig. 6, a), two to three of the six to eight striae very shallow; pronotum (fig. 6, a), striae widely spaced, along meson; mesonotum (fig. 7, w), five to six widely spaced, partly anastomosing striae; metascutum, mesal area as in figure 8, k, identical with that in *curta*; abdomen, striae widely spaced; all striae shallow and transverse. **Measurements:** Body 1,270; head 95, w. 135; eye 60, w. 39, interval 58; occiput below eye 38; ocellar triangle w. 50, height 30;

ocelli w. 14-15; mouth cone 185; antenna ca. 220, ca. 2.3 times head; segments 18, w. 26; tilted, estimated 33, w. 24, ratio ca. 1.4; 43, w. 20, ratio 2.1; 34, w. 17; 30, w. 16; 38, w. 17; 7, w. 7.5; 8, w. 5; io 10, interval 15; po-iii 15; pronotum 110, w. 163; am 28; aa 37; pa-i 50, ii 45; pm-ii 30; pterothorax 150, w. 210; forewing 560, w. at middle 48; setae at middle 38, 30, 35; hind tibia 125; abdomen 830, w. at IV 225; tergite VIII comb 15; ovipositor 210; tergite IX 60; X 58; setae IXi 65, ii 75, iii 73; Xi 88, ii 73; ratio of tergite X/IX 1.0; seta IXiii/tergite X 1.2.

Head (fig. 6, a) transverse; antenna VI (fig. 2, i) not pedicellate; io thin, on tangent; po 5 setae, iii thin; am and aa (fig. 6, a) fairly well developed; pm except ii minor, subequal; metascutum (fig. 8, k) with pores; forewing setae numbering 22, 15, 13. Tergite VIII comb with 13 teeth; tergite X (fig. 11, g) subequal to IX; caudal setae subequal except IXi shorter, Xi longer than the rest.

**Male.**—Unknown.

**Material.**—Holotype ♀, PANAMA: Canal Zone: Ancon, sweeping Bermuda grass, etc., 12. XI.1911, James Zetek, (USNM Type 72605).

**Discussion.**—The holotype of *floydandrei* is probably the specimen that Hood (1913) reported as "minuta."

*F. floydandrei* is characterized by fairly well-developed pronotal anterior setae, dull-yellow antenna III and IV, and transverse head. Few other species in the *minuta* group have fairly well-developed pronotal anterior setae and minute postocular iii and interocellar setae. This species, *fuscicornis* Moulton, and *curta* are similar in having a brown body with dark grayish-brown abdomen and yellow legs. However, *floydandrei* has dull-yellow antenna III and IV.

This species is named after the late Floyd Andre, our colleague for many years, who died unexpectedly in February 1972. Until his last day this remarkable man kept his interest in Thysanoptera by collecting extensively in far-away lands and generously helping his colleagues.

### *Frankliniella fuscicornis* Moulton

(Fig. 5, h)

*Frankliniella fulvicornis* Moulton, 1933: 124, fig. Not: *Frankliniella intonsa* f. *fulvicornis* (Uzel, 1895, p. 96); Priesner, 1925: 19.

*Frankliniella fuscicornis* Moulton, 1948: 60, 94; Jacot-Guillarmod, 1974: 779.

**Female.**—*Color*: Body orange yellow; integument weakly shaded grayish brown, last two segments darker; labium strongly shaded; antenna grayish brown, darker than head, II and V–VIII darkest; thorax and abdomen with orange subintegumental pigment; wing pale grayish yellow; legs pale brown, femora shaded weak grayish brown dorsally in middle; ocellar crescent reddish orange; major setae light grayish brown. *Sculpture*: Occiput (fig. 5, h), two to three deep, two to three shallow, transverse striae; pronotum (fig. 5, h), two or more shallow striae near anterior margin; remaining sculpture obscured. *Measurements*: Body ca. 1,230; head ca. 93, w. 125; mouth cone ca. 175; antenna ca. 220; II not measurable; III ca. 41, w. 23, ratio ca. 1.8; io 13, interval 16; po-iii 15; pronotum 108, w. 170; am 25; aa 42; pa-i 55, ii 51; pm-ii 29; forewing 620, w. at middle 48; setae at middle 39, 35, 42; hind tibia 140; tergite VIII comb 19, teeth 9 apart; ovipositor 220; tergite IX 60; X 65; setae IXi 58, ii 73, iii 80; Xi 80, ii 73; ratio of tergites X/IX 0.9; setae IXi/iii 0.7; IXiii/tergite X 1.2.

Io (fig. 5, h) thin, almost exactly on tangent; po 5 setae, iii thin; am and aa thick; am just less than pm-ii; pm except ii minor, subequal; metascutal pores present; wing setae numbering 25, 18, 13. Tergite VIII comb long, very sparse, with 12 teeth; tergite X subequal to IX; setae Xi and ii subequal to IXii and iii.

**Male.**—Unknown.

**Material.**—BRAZIL: State of Sao Paulo: Sao Paulo, lemon flowers, 1.IX.1929, D. Moulton (No. 3730), holotype ♀ (CAS).

**Discussion.**—*F. fuscicornis* is known only from the teneral holotype, which is poorly mounted. The mature body color of the species, several characters of the female, and the nature of the male are unknown. The species is near *curta* and is separable only by the moderately developed pronotal anterior setae, which in *curta* are minute.

### *Frankliniella jamaicensis* Sakimura and O'Neill, new species

(Figs. 2, j; 4, c; 11, b)

**Female (holotype).**—*Color*: Body and appendages yellow except head sometimes tinged brown; antenna I–II pale to yellow, III–VII grayish brown with bases of III–IV pale; ocellar crescent bright red; major setae grayish brown,

on teneral specimens sometimes dull yellow. *Sculpture*: Occiput (fig. 4, c), one shallow, two to three very shallow, transverse striae; pronotum (fig. 4, c), a few shallow, transverse striae along anterior and hind margins; sculpture of mesonotum, metascutum, and abdomen not discernible. *Measurements* (paratype range in parentheses): Body 1,290 (1,130–1,470); head (fig. 4, c) 95 (95–105), w. 125 (120–130); eye 55, w. 36, interval 54; occiput below eye 33; ocellar triangle w. 48, height 28; ocelli w. 12; mouth cone 162 (148–164); antenna 203 (203–209), 2.1 (about 2.0) times head; segments 20, w. 21; 32 (32–34), w. 22 (22–23), ratio 1.5 (1.4–1.5); 35 (34–36), w. 19 (18–20), ratio 1.8 (1.8–1.9); 34, w. 18; 23, w. 16; 30, w. 16; 12, w. 6; io interval 33 (30–36); po-iv 9 (8–13); pronotum 103 (95–118), w. 158 (143–158); am 19 (16–23); aa 22 (18–28); pa-i 38 (33–43), ii 33 (33–43); pm-ii 19 (16–21); pterothorax 143 (138–158), w. 193 (185–210); forewing 550 (520–580), w. at middle 43 (43–48); setae at middle (23–28, 20–25, 23–31); hind tibia 118 (113–125); abdomen 850 (740–850), w. 218 (175–218) at IV; tergite VIII comb (7–9); ovipositor 168 (163–188); tergite IX 48 (46–50); X 51 (48–55); setae IXi 44 (40–48), ii 46 (43–55), iii 50 (48–50); Xi 65 (63–74), ii 55 (55–60); ratio of tergites X/IX 1.1 (1.0–1.1); setae IXi/iii (0.8–0.9); Xi/IXiii 1.3 (1.3–1.5).

Antenna (fig. 2, j) 7-segmented, its style 1-jointed; io (fig. 4, c) minute, pale, on outer common tangent of anterior and posterior ocelli, contiguous to posterior ocellar crescent; po 6 setae, iv thin, pale; pm (fig. 4, c) setae except ii minor, subequal; mesospinula present and both furcae poorly developed; metascutum with pores; wing setae numbering (21–24, 17–21, 13–18), unusually short. Tergites I–VIII with ctenidial and setal patterns normal for *Frankliniella*; tergite VIII comb short, with (13–15) teeth; tergite X (fig. 11, b) subequal to IX; caudal setae unusually short, delicate; Xi longest.

**Male.**—Unknown.

**Material.**—Holotype ♀, JAMAICA: Hanover Parish: Round Hill, Hill Top, *Eupatorium villosum* Swartz flowers, 25.XI.1964, K. Sakimura (Saki 4487d-5), (USNM Type 72606). Paratypes: Same data, 5 ♀♀ (USNM, Sakimura); CUBA: Havana, *Lantana camara* L. flowers, XII.1952, N. L. H. Krauss (2057; lot 52-1895), 1 ♀ (USNM).

**Discussion.**—*F. jamaicensis* is the first species of *Frankliniella* recognized with seven-segmented antennae. It is otherwise a typical *Frankliniella* species. In addition to the antennal style, the position of the interocellar seta and the shortness of the caudal setae are useful for diagnosis.

***Frankliniella konoi* Sakimura and O'Neill, new species**

(Figs. 2, k; 4, i; 7, b; 8, a; 11, j)

**Female (holotype).**—**Color:** Body dark grayish brown; pterothorax with orange subintegumental pigment; femora concolorous with body, tibiae lighter, with weak grayish-brown wash along outer margins, tarsi yellowish brown; antenna dark grayish brown, I and III lightest, II darkest; wing brown; ocellar crescents red; major setae dark brown, caudal ones dark grayish brown. **Sculpture:** Occiput (fig. 4, i), two deep, three to four shallow, transverse striae; pronotum (fig. 4, i), anastomosing striae; mesonotum (fig. 7, b), six to seven anastomosing striae; metascutum (fig. 8, a) deeply reticulate along meson, reticles more nearly equilateral than usual; abdomen, striae; pronotal and abdominal striae shallow, transverse, widely spaced. **Measurements:** Body 1,450; head (slightly tilted upward) ca. 115, w. 130; eye ca. 60, w. 38, interval 55; occiput below eye 42, ocellar triangle w. 49; ocelli w. 14; mouth cone 182; antenna 250, ca. 2.2 times head; segments 21, w. 28: 35, w. 26, ratio 1.3; 43, w. 21, ratio 2.0; 35, w. 21; 31, w. 19; 41, w. 18; 8, w. 7; 13, w. 5; io interval 24; po-iv 10; pronotum 115, w. 175; pa-i and ii 39-40; pm-ii 13; pterothorax 190, w. 240; forewing 670, w. at middle 53; setae at middle 30, 28, 33; hind tibia 140; abdomen 920, w. at IV 255; tergite VIII comb 15; ovipositor 205; tergite IX 53; X 59; setae IXi 68, ii 80, iii 85; Xi 88, ii 78; ratio of tergites IX/X 1.1; setae IXi/iii 0.8; IXiii/tergite X 1.4.

Antenna VI (fig. 2, k) not pedicellate; io (fig. 4, i) minute, slightly before tangent; po 6 setae, iv thin; pronotum transverse; am (fig. 4, i) and aa minute; pm-ii short; other pm minor, subequal; mesospinula and both furcae well developed; mesonotum (fig. 7, b) with seta i well before hind margin; metascutum (fig. 8, a) without pore; forewing setae numbering 25, 18, 15. Tergite VIII comb with 15 teeth; tergites IX (fig. 11, j) and X subequal; seta IXi thornlike, thicker and shorter

than ii and iii.

**Male.**—Unknown.

**Material.**—Holotype ♀, BRAZIL: State of Santa Catarina: Nova Teutonia, dead branches, XI.1955, Fritz Plaumann (Hood 1791) (USNM Type 72607).

**Discussion.**—*F. konoi* is characterized by the reduction of the pronotal anteroangular seta, the anterior position of mesonotal seta i, and the nature of the reticulation on the mesal area of the metascutum. It resembles *curta* and *bertelsi* in having minute anteroangulars, but the latter species have metanotal seta i in the normal position and different metascutal sculpture. It is named after Tokuwo Kono, thysanopterist with the California Department of Agriculture, who furnished material for this study and for deposit in the USNM.

***Frankliniella magellanica* Sakimura and O'Neill, new species**

(Figs. 3, d, m; 5, e-g; 7, m; 9, a, m; 10, h; 13, b)

**Female (holotype).**—**Color:** Body grayish brown, darkest in abdomen IX-X; head and thorax darker at sides; antenna colored as head, V-VIII darker than rest, III and basal one-third of IV yellowish brown (III pale in some paratypes); wing uniform pale brown; legs darker than body except tarsi and anterior tibia yellowish brown; major setae light brown except caudal setae darker. **Sculpture:** Occiput (fig. 5, e), three to four deep, two to three shallow striae; pronotum (fig. 5, e), four to five faint striae along anterior margin; mesonotum (fig. 7, m), six to seven shallow, partly anastomosing striae; metascutum, mesal area as in figure 9, a; abdomen, deep striae; striae transverse and on pronotum, mesonotum, and abdomen widely spaced. **Measurements (paratype range in parentheses):**

Body 1,480 (1,480-1,560); head ca. 90 (90-100), w. 110 (110); eye ca. 52, w. 30, interval 48; occiput below eye ca. 30; ocellar triangle w. 45, height ca. 32; ocelli w. 11-12; mouth cone 180 (178-183); antenna 220 (220-230), ca. 2.4 (2.3-2.4) times head; segments 17, w. 23; 30 (30-34), w. 23 (23-25), ratio 1.3 (1.3-1.4); 38 (38-40), w. 18 (18), ratio 2.1 (2.1); 34, w. 19; 26, w. 17; 40, w. 19; 7, w. 7; 13, w. 4; io 20 (15-20), interval 13 (11-13); po-iii 12 (10-15); pronotum ca. 116 (116-135), w. 143

(143-145); am 10 (10-15); aa 16 (16-23); pa-i 40 (40-45), ii 35 (35-38); pm-ii 25 (23-25); pterothorax 160 (160-175), w. 200 (200-215); forewing 590 (590-630), w. at middle 43 (43-50); setae at middle (33-38, 25-30, 30-35); hind tibia 125 (120-133); abdomen 1,000 (1,000-1,100), w. at IV 195 (195-215); sternite III glandular area 13 (8-15), w. 18 (15-23); IV glandular area 6, w. 6; tergite VIII comb 9 (9-13); ovipositor 205 (195-210); tergite IX 45 (45-50); X 65 (65-78); setae IXi 70 (67-73), ii 85 (83-93), iii 90 (90-98); Xi 95 (93-100), ii 80 (80-88); ratio of tergites X/IX 1.4 (1.4-1.6); setae IXi/iii 0.8 (0.7-0.8); IXii/tergite X 1.4 (1.3-1.4).

Mouth cone (fig. 5, e-g) long, broad, heavy, directed ventrad, causing head and prothorax to tilt strongly forward (fig. 5, g) unless specimen is mounted in sufficient medium to float free (fig. 5, e); antenna VI (fig. 3, d) short, not pedicellate; io (fig. 3, m) thin, below tangent; po (fig. 5, e) 5 setae, iii thin; am (fig. 5, e) and aa thin; pm except ii minor, subequal; mesospinula and both furcae well developed; metascutum (fig. 9, a) without pores in holotype, but with 1 or usually pair in allotype and 2♀ and 7♂ paratypes; forewing setae numbering (20-21, 16-17, 11-12); legs short. Sternite III (fig. 9, m) with 1 small, transversely oblong glandular area; sternite IV with 1 very small, circular glandular area (wanting in the 2♀ paratypes); details of tergites III and IV indiscernible, but at least 1 paratype with rudimentary ctenidia ending at normal sized setae ii on these tergites; tergite VIII comb very short but complete, with 11-14 teeth; tergite X (fig. 10, h) almost half again as long as IX; setae Xi-ii subequal to IXii-iii.

**Male (allotype).**—Color and sculpture as in ♀, but color somewhat lighter and anterior tibia with more yellow. Measurements (paratype range in parentheses): Body 1,270 (1,170-1,300); head ca. 95 (90-100), w. 110 (105-115); mouth cone 183 (173-185); antenna 226 (210-236); segments 20, w. 25; 30 (29-33), w. 23 (22-24), ratio 1.3 (1.3-1.4); 38 (35-41), w. 18 (17-18), ratio 2.1 (2.1-2.3); 30, w. 18; 28, w. 16; 43, w. 18; 8, w. 8; 14, w. 5; io 22 (18-25); po-iii 15 (10-15); pronotum ca. 120 (108-120), w. 150 (140-150); am 25 (20-35); aa 30 (30-43); pa-i 40 (37-44), ii 35 (32-35); pm-ii 35 (20-35); pterothorax 150 (150-158), w. 193 (185-200); forewing 550 (530-590), w. at middle 48 (43-49); setae at middle (33-40, 25-30, 28-35);

hind tibia 120 (115-133); abdomen 820 (770-830), w. at IV 180 (150-180); sternal glandular areas (10-18), w. (15-33); tergite VIII comb (5-7); tergite IX 55 (50-55), X 45 (40-48); setae IX-d 64 (45-64), i 29 (24-33), ii 80 (58-88), iii 80 (73-80); clasper 88 (70-88); ratio of setae IX-d/i 2.2 (1.7-2.3).

Am and aa moderately thick, longer than in ♀; forewing setae numbering (19-22, 16-18, 11-12). Sternites III-VII each with transversely oblong glandular area; tergite IV with normal seta pair ii and weakly developed short ctenidia; ctenidia present on tergites IV or III-IV in some paratypes; tergite VIII comb shorter than in ♀, with (11-15) teeth; setae IXiii (fig. 13, b) longer and IX-d longer compared with IXi than usual in *minuta* group; clasper very thick.

**Material.**—Holotype ♀ and allotype ♂, CHILE: Province of Magallanes: San Gregorio, 15.2 km NE of, elev. 5 m, coastal dune association, 27.XI. 1966, E. Schlinger and M. Irwin (UCR 66-374) (UCR). Paratypes: Same data, 2♀, 7♂ (UCR, USNM).

**Discussion.**—*F. magellanica* is characterized by the long, broad, heavy mouth cone directed ventrad, five-seta postocular series, slender antenna III, and glandular areas on ♀ sternites III and sometimes IV. The metascutal pores of this species are apparently variable, 1 of the 11 specimens lacking both pores and others lacking 1 pore. This variation is unusual among species of the *minuta* group, occurring only in this species and *oxyura* Bagnall. Ordinarily the metascutal pores are fairly constant in *Frankliniella* species.

*F. magellanica* is one of three South American species of the *minuta* group with glandular areas on female sternites. Others are *tympanona* Hood and *valdiviana*, new species. Among these species such areas occur regularly on sternite III and occasionally on IV. No specimens were found without such areas. Glandular areas also often occur on female sternites in two species of the *intonsa* group, *australis* Morgan and *cestrum* Moulton, which occur in Argentina, Chile, and Bolivia. Mound (1971) reported a series of specimens intermediate between these two species in which several specimens lacked one or both glandular areas of the pair. The possibility of a similar lack in the species of the *minuta* group limits the taxonomic value of the glandular area on female sternites in this group also.

The male of this species is unusual in having seta pair iii fully developed and the discal seta pair on tergite IX elongated.

**Frankliniella minuta (Moulton)**

(Figs. 2, *m-n*; 3, *j, p*; 4, *d*; 7, *s*; 9, *c-d, j*; 10, *i-j*; 13, *j*)

*Euthrips minutus* Moulton, 1907: 56, fig.; Crawford, 1910: 149.

*Euthrips minutus* var. *setosus* Crawford, 1909: 105, fig.

*Frankliniella minuta*: Karny, 1912: 335; Priesner, 1933: 50; Moulton, 1948: 60, 93, fig.; Bryan and Smith, 1956: 389, 408; Bailey, 1957: 175; O'Neill, 1970: 454; Jacot-Guillarmod, 1974: 795, in part.

Not *Frankliniella ?minuta*: Watson, 1922: 35; Jacot-Guillarmod, 1974: 795, in part. Misidentification.

*Frankliniella minuta* f. *luminosa* Moulton, 1948: 60, 93.

**Female.**—*Color*: Body and appendages dark grayish brown except antenna III sometimes lighter, tarsi and anterior tibia yellowish brown to light brown; major setae light brown to dark grayish brown. *Sculpture*: Occiput (fig. 4, *d*), one to two deep, three to four faint, transverse striae; pronotum (fig. 4, *d*), several extra widely spaced, shallow, transverse striae in anteromesal triangle; mesonotum (fig. 7, *s*), deep, widely spaced, partly anastomosing transverse striae; metascutum, mesal area as in figure 9, *c-d*; abdomen, deep, widely spaced, transverse striae. *Measurements* of holotype (other specimens in parentheses): Body 1,300, telescoped to 820 (1,050-1,700); head 95 (80-125), w. (108-148); mouth cone 168 (143-197); antenna ca. 220 (190-265), ca. 2.3 (2.0-2.4) times head; segments 17; ca. 26 (28-36), w. (20-26), ratio (1.3-1.5); 36 (32-47), w. (18-23), ratio ca. 1.7 (1.7-2.2); 35; 29; 40; 6; 13; io 13 (10-31), interval 25 (23-36); po-iii 13 (9-20); pronotum 110 (93-140), w. (145-195); interval between striae (10-12); am 25 (12-37); aa 30 (15-42); pa-i 40 (24-55), ii 40 (30-58); pm-ii and iv 23 (18-40); mesonotal striae, interval (5-6); forewing 620 (540-830), w. at middle (36-60); setae at middle 28 (24-41), 23 (20-36), 25 (24-39); hind tibia 128 (97-173); tergite VIII comb 15 (13-26); ovipositor 175 (130-210); tergite IX 43 (37-61); X 63 (48-80); setae IX-i 46 (36-63), ii 88 (70-116), iii 80 (65-116); Xi 78 (65-111), ii 73 (63-107); ratio of tergites X/IX 1.5 (1.3-1.6); setae IX-i/iii 0.6 (0.5-0.6); IX-iii/tergite X 1.3 (1.2-1.5).

Antenna VI (fig. 2, *m-n*) sometimes narrowed at base but not pedicellate; io (fig. 3, *j*) thin to

moderately thick, in front of posterior ocelli; po (fig. 3, *p*) 5 setae, iii thin; am (fig. 4, *d*) and aa thin or thick; pm-ii and iv large, iv subequal to ii; other pm much smaller; metascutum (fig. 9, *c-d*) without pores; forewing setae numbering 24 (21-30), 18 (17-23), 12 (11-17). Tergite IV (fig. 9, *j*) usually with short ctenidium ending at normal seta ii, unlike *davidsoni*, in which the ctenidium is present and seta ii is reduced; several tergites before VIII with shallow scallops along hind margin; VIII with comb long, teeth numbering 14 (11-15); X (fig. 10, *i-j*) decidedly longer than IX, not as long as seta IX-iii; setae Xi and ii about equal to IX-ii and iii.

**Holotype Female.**—Badly contracted and partly damaged specimen; no width measurements available; io and po-iii thin; am and aa moderately thick; tergite X half again as long as IX; seta IX-i three-fifths as long as iii and the latter distinctly longer than tergite X.

**Male.**—*Color*: Dark forms as in ♀, not as dark when teneral but always with caudal end darkest; antenna except sometimes III dark; pale forms, body yellow to orange with very weak brown shading in integument; subintegumental pigment yellow to orange; last two abdominal segments darker than rest; antenna I-II yellowish brown, II darker, I sometimes nearly pale; III-IV brown, sometimes both lighter basally; V-VIII grayish brown, sometimes V-VI lighter basally; wing yellow; legs yellow, with weak brown shading along outer margins of femora and tibiae at middle; major setae light brown. *Sculpture* as in ♀ but weaker in pale forms. *Measurements*: Body 840-1,190; head 78-100, w. 100-125; antenna 180-240; pronotum 85-105, w. 120-158; forewing 480-600; sternal glandular areas each 9-18, w. 20-40; tergite VIII comb 11-18; tergite IX 33-44; X 32-42; setae IX-d 20-30, i 18-35, ii 43-76, iii 20-32; clasper 50-70.

Sternites III-VII each with transversely oblong glandular area; tergite VIII comb with 11-14 teeth; setae IX-d (fig. 13, *j*) and i subequal; ii about twice i.

**Type-Specimens.**—U.S.A.: California: Berkeley, grass, 1.III.1906 ("3-1-'06"), D. Moulton, holotype ♀ (CAS No. 10729), labeled "Frankliniella minuta M." in Moulton's handwriting and "holotype" in unknown handwriting. Claremont, Compositae, D. L. Crawford, lectotype ♀, here designated, of *Euthrips minutus* var.

*setosus* D. L. Crawford, dorsally mounted specimen nearest upper left corner and with wings folded but not crossing body; accompanied by 6 ♀ paralecto-types and a ♀ each of *Frankliniella occidentalis* (Pergande) and *Thrips tabaci* Lindeman (CNC); both labels in R. C. Treherne's handwriting; right label with "FRANKLINIELLA MINUTUS var SETOSUS Crawford Type 369 Det. D. L. Crawford," and "Type No. 369" on a superimposed small red label. MEXICO: State of Morelos: Zampoala, 25.XII.1944, N. L. H. Krauss No. 18 (lot 45-3805), lectotype ♂, here designated, of *Frankliniella minuta* f. *luminosa* Moulton (USNM Type 58913); left label with "clara" in Moulton's handwriting crossed out and replaced by "luminosa HOLO" in J. C. Crawford's handwriting.

**Other Material.**—About 580 ♀♀ and 89 ♂♂ were examined for this study. Of these, 255 ♀♀ and 28 ♂♂ were measured.

**Distribution.**—U.S.A.: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, and Wyoming; particularly common in Arizona and California. MEXICO: Distrito Federal, States of Durango, Michoacan, Morelos, Nayarit, Nuevo Leon, Sonora, Tamaulipas, and Veracruz. GUATEMALA: Departments of Chimaltenango and Sacatepequez. PANAMA: Provinces of Chiriquí and Panama. PERU: Departments of Amazonas and Lima. HAWAIIAN ISLANDS, including Midway atoll.

**Host Plants.**—The following names of plants, about half of which belong to Compositae, appear on the slides: *Acacia* spp., *Achillea* spp., *Aconitum* sp., *Adenostoma* sp., alfalfa, almond, apricot, *Arenaria* sp., *Arnica* sp., *Asclepias* sp., *Aster* sp., *Baileya multiradiata* Harvey and Gray, *Berberis* sp., *Bidens pilosa* var. *radiata* Sch. Bip., *Brassica* spp., "bromeliads," cactus, *calendula*, carnation, cherry, *chrysanthemum*, *Chrysanthemum parthenium* (L.) Bernhardi, *Chrysanthemus parryi* (Gray) Greene, *Cleome lutea* Hooker, "composite," *Crepis acuminata* Nuttall, daisies, *Dybautia* spp., *Encelia farinosa* Gray, *Eschscholzia californica* Cham., *Eupatorium* spp., *Gaillardia* spp., gardenia, *Geraea canescens* Torrey and Gray, *Gilia aggregata* (Pursh) Spreng., "grasses," *Gutierrezia dracunculoides* (D. C.) Blake, *Haplопappus heterophyllus* (Gray) Blake, *H. spinulosus* (Pursh) D. C., *Helianthus*

spp., *Hymenoxyd odorata* D. C., *Juniperus* sp., *Larrea divaricata* Cav., *Lepidospartum squamatum* (Gray) Gray, lettuce, lilac, *Lithospermum* sp., *Malva* sp., marigold, *Mimosa borealis* Gray, narcissus, oleander, orange, "orchids," *Oxalis* sp., *Palafoxia rosea* (Bush) Cory, *Parthenium argentatum* Gray, peach, pear, *Petalonix thurberi* Gray, *Pinus* spp., plum, *Prosopis pallida* (Willd.) H., B., and K., *Quercus lobata* Nee, rose, *Salix* sp., *Senecio* spp., Shasta daisy, *Sideranthus spinulosus* (Pursh) Sweet, *Silphium* sp., *Solidago* spp., *Sorghum halepense* (L.) Persoon, *Sphaeralcea grossulariaefolia* (Hook. and Arn.) Rydberg, *Stanleya pinnata* (Pursh) Britton, *Tagetes* sp., *Taraxacum* spp., *Tillandsia* sp., *Tithonia* sp., *Verbesina encelioides* (Cav.) Benth. and Hook., *Xanthocephalum gymnospermooides* (Gray) Rothr., *Yucca* spp., and *Zinnia* sp.

**Discussion.**—Moulton (1907) originally described *minuta* as a species of *Euthrips*. D. L. Crawford (1909) described and he (1910) synonymized a variety *setosus* before Karny (1912) placed *minuta* in his new genus *Frankliniella*. His illustrations are somewhat diagrammatic, but they appear to have been made from more than one specimen, for no single specimen seen had all the illustrated characteristics visible. Jacot-Guillarmod (1974) synonymized Moulton's (1948) form *luminosa*. Moulton (pers. commun. with J. C. Crawford) changed the name of the form *luminosa* from *clara* in the manuscript of his 1948 paper when Crawford pointed out the potential homonymy with forms of two other species that were to be named *clara*. Advised by Moulton of the change, Crawford penciled out "clara" and wrote "luminosa" on the label of the unique type-specimen. The CAS collection contains two females collected by Moulton in Argentina that he labeled as holotype and paratype of "luminosa." Whether these specimens were intended as replacements for the male described as *luminosa* or represent a further manuscript name is not known; they do not belong to the *minuta* group.

*F. minuta* is characterized by the interocellar setae before the posterior ocelli, five-seta series of postocular setae, extra widely spaced pronotal striae, two pairs of large posterom marginal pronotal setae, metanotum without pores, and subposterom marginal seta i of tergite IX a little or no more than half as long as seta iii. Males of this species apparently may be yellow or dark.

The *minuta* specimen that Hood (1913, p. 120) reported from the Canal Zone, Panama, cannot be found. It is probably, but not certainly, the holotype of *flydandrei*, which Hood left with no indication of specific identity. Watson's (1922) doubtful record of *minuta* in Georgia, presumably the source of Jacot-Guillarmod's (1974) record for this State, was based on a female macroptera of *fusca* (Hinds). *F. minuta* was a recent immigrant to Hawaii, where it was first discovered in 1947 (Sakimura, 1948). It was first discovered at Midway atoll in the late 1950's (Suehiro, 1960). No specimens could be found to substantiate Moulton's (1948, p. 93) record of this species in western Canada. Ortiz-P. (1973, p. 112) reported a recent collection of *minuta* in the Department of Lima, Peru. This locality is represented in the USNM by a misidentified paratype of *tympanona* Hood collected in 1913 and another specimen collected in 1936. Specimens of *minuta* are frequently intercepted in quarantine in Florida, but so far no sign has been found of its naturalizing in this State.

***Frankliniella nakaharai* Sakimura and O'Neill, new species**

(Figs. 2, *p*; 3, *q*; 5, *b*; 7, *i*; 9, *g*; 11, *e*)

**Female (holotype).**—*Color*: Body bicolorous; head and pterothorax brown; vertex, cheek, metascutum, and scutellum weakly shaded grayish brown; anterior angle and side of pterothorax, metasternum, and middle and hind coxae strongly shaded; mouth cone and prothorax yellow to yellowish brown; shading on tip of mouth cone strong, on anterior coxa weak; thorax sometimes with yellowish-brown subintegumental pigment; abdomen dark grayish brown with distal segments darker; antenna I pale; II and V–VIII light brown and lighter than vertex except V lighter at base; III–IV yellowish brown; IV distally brown washed; wing pale yellow to pale brown; legs light yellowish brown with weak grayish-brown shading along narrow outer margin of anterior femur, across middle of each middle and hind femur, and along middle of narrow outer margins of middle and hind tibiae; ocellar crescents red; major setae grayish brown and darker on abdomen IX–X. *Sculpture*: Occiput (fig. 5, *b*), one deep, four to five shallow, transverse striae; pronotum (fig. 5, *b*), widely spaced, shallow, transverse striae in anteromesal

triangle and along hind margin; mesonotum (fig. 7, *i*), six to seven shallow transverse striae; metascutum, mesal area as in figure 9, *g*; abdomen, deep, widely spaced, transverse striae. *Measurements* (paratype range in parentheses): Body 1,150 (1,110–1,150); head 90 (90), w. 110 (110); eye 50, w. 30, interval 50; occiput below eye 28; ocellar triangle w. 44, height 28; ocelli w. 10–12; mouth cone 160 (160–163); antenna 200 (198–210), 2.2 (2.2–2.3) times head; segments 19, w. 22; 33 (32–33), w. 21 (20–21), ratio 1.6 (1.6); 33 (33–35), w. 17 (17–18), ratio 1.9 (1.9); 27, w. 16; 22, w. 16; 36, w. 18; 6, w. 6; 12, w. 4; io 18 (18–20), interval 13 (13); po-ii 11 (11–13); pronotum 100 (95–100), w. 135 (135); am 13 (11–13); aa 5 (5–8); pa-i 35 (34–40), ii 33 (33–35); pm-ii 19 (19–20); pterothorax 140 (138–140), w. 180 (180–183); hind tibia 113 (110–113); forewing 480 (470–490), w. at middle 40 (40); setae at middle (28–33, 24–33, 30–35); abdomen 730 (680–730), w. at IV 190 (190–203); tergite VIII comb 13 (12–13); ovipositor 193 (193–198); tergite IX 60 (53–60); X 58 (50–58); setae IXi 68 (66–68), ii 70 (67–70), iii 60 (59–60); Xi 68 (65–69), ii 60 (60); ratio of tergites X/IX 1.0 (0.9–1.0); setae IXi/iii 1.1 (1.1); IXiii/tergite X 1.0 (1.0–1.2).

Body small; antenna VI (fig. 2, *p*) not pedicellate; io between posterior ocelli; po (fig. 3, *q*) 4 setae, ii thin; am (fig. 5, *b*) thin; aa minute; pm-i pair lacking in holotype and 1 paratype, 1 seta lacking in remaining paratype (fig. 5, *b*); pm-ii well developed; other pm minor, subequal; mesospinula nearly interrupted at middle; both furcae weakly developed; metascutum (fig. 9, *g*) with pores, these sometimes close together; forewing unusually short, abruptly pointed at tip, its anterior marginal fringe thick, dark grayish brown, and difficult to distinguish from costal setae, in contrast to thin, yellowish-hyaline hind marginal cilia; setae numbering (17–18, 13–15, 8–9). Tergite VIII comb with 15 (13–16) broad-based teeth; tergite X (fig. 11, *e*) subequal to IX; IX setae thornlike, subequal except iii a little shorter; Xi thornlike and subequal to IXi–ii.

**Male.**—Unknown.

**Material.**—Holotype ♀. BRAZIL: State of Santa Catarina: Nova Teutonia, 15.XI.1949, Fritz Plaumann (Hood 2017A) (USNM Type 72608). Paratypes: Same data, 1 ♀; same data except *Morus nigra* L., 5. XI.1949 (Hood 1784), 1 ♀ (USNM).

**Discussion.**—*F. nakaharai* is distinctive because of its bicolorous body and four-seta postocular series with ii the principal postocular. The yellow to light-brown anterior body with dark grayish-brown abdomen is unusual among species of the *minuta* group, and the thick, dark grayish-brown fringe on the anterior margin of the forewing is unique. The reduced number of setae is conspicuous with the postocular series lacking two setae and the posterior pronotal margin lacking the mesal pair. The latter is unique and the former nearly so; *pestinae*, new species, also has a four-seta postocular series but with iii the principal seta.

This species is named after Sueo Nakahara, thysanopterist with the Animal and Plant Health Inspection Service, U.S. Department of Agriculture, who cooperated in providing material for this study.

### *Frankliniella oxyura* Bagnall

(Figs. 2, q; 6, i-j; 7, r; 8, g-h; 10, d; 13, a)

*Frankliniella oxyura* Bagnall, 1919: 267; 1923: 628; Moulton, 1948: 60, 93; De Santis, 1966: 12; Mound, 1968: 38; Jacot-Guillarmod, 1974: 803.

*Frankliniella minuta* var. *paraguayensis* Priesner, 1921: 189, fig.

*Frankliniella minuta* var. *paraguayensis* ab. *adusta* Priesner, 1921: 189.

*Frankliniella oxyura* f. *adusta* (Priesner), Priesner, 1925: 19; Moulton, 1948: 60, 93.

Not *Frankliniella oxyura*: Sakimura, 1967a: 168. Misidentification.

Not *Isochaetothrips unicolor*: Sakimura, 1967a: 168.

**Female.**—*Color*: Body brownish yellow with integument shaded brown to uniformly dark grayish brown; abdomen or end of abdomen sometimes darker; antenna brown to dark grayish brown; II darkest, with conspicuous pale area around and especially before areola; III light yellowish brown to light brown; IV yellowish brown to light brown; V lighter at base than elsewhere; wing light brown, lighter in basal one-fourth; legs unevenly colored; femora yellow with slight to extensive brown wash beginning in middle of outer margin, to dark grayish brown; anterior femur usually lighter along inner margin and at apex; tibiae yellow or brownish yellow with weak grayish-brown wash along outer margin at middle, to light brown; anterior tibia often lighter; tarsi yellow to brownish yellow; ocellar crescents brownish red; major setae light

brown to dark grayish brown. *Sculpture*: Occiput (fig. 6, i), four to five deep, one to two shallow, transverse striae; pronotum (fig. 6, j), several extra widely spaced, faint, transverse striae in anteromesal triangle, as in *minuta*; mesonotum (fig. 7, r), five to six partly anastomosing transverse striae; metascutum, mesal area as in figure 8, g-h; abdomen, shallow, widely spaced, transverse striae. *Measurements*: Body 1,220-1,480; head 88-105, w. 120-130; mouth cone 150-178; antenna 213-235, 2.2-2.4 times head; II 30-34, w. 22-24, ratio 1.3-1.5; III 40-43, w. 20-23, ratio 1.8-2.0; io 9-18, interval 15-20; po-iii 10-15; pronotum 102-120, w. 133-168; am 16-25; aa 22-39; pa-i 38-51, ii 30-44; pm-ii 20-31; pterothorax 155-175, w. 200-240; forewing 590-690, w. at middle 45-50; setae at middle 28-38, 25-33, 30-40; hind tibia 118-140; abdomen 850-970, w. at IV 195-243; tergite VIII comb 13-20; ovipositor 215-243; tergite IX 48-55; X 70-86; setae IXi 47-60, ii 59-80, iii 63-80; Xi 75-93, ii 65-80; ratio of tergites X/IX 1.4-1.7; setae IXi/iii 0.7-0.9; IXiii/tergite X 0.8-1.0.

Antenna (fig. 2, q) not pedicellate; io thin, on tangent; po 5 setae, iii thin; pm except ii fairly minute, ii subequal to aa; metascutum (fig. 8, g-h) usually with pores; forewing setae numbering 22-27, 17-21, 12-16. Tergite IV with short ctenidium and normal seta ii; tergite VIII comb long, sparse, with 11-14 teeth; tergite X (fig. 10, d) about half again as long as IX; seta i of IX not quite as long as iii, and latter about as long as tergite X; seta i of tergite X longest of caudal setae.

**Male.**—Newly described. *Color*: Body pale brownish yellow; head along anterior margin weakly washed with brown; antenna I pale; II-IV yellowish brown and darker distally; V-VIII brown except basal one-third to one-half of V lighter; wing pale brownish yellow; legs same as body, with femora weakly washed with brown; major setae light grayish brown, contrasting with body and wing. *Sculpture* as in ♀. *Measurements*: Body 960-1,010; head 82-93, w. 110-120; eye 50-52, w. 32-33; cheek 48-50; mouth cone 146-158; antenna 190-198; III 36-38, w. 17-19, ratio 2.0-2.1; io 13-17; po-iii 10-20; pronotum 83-103, w. 130-158; am 16-30; aa 26-30; pa-i 38-45, ii 28-35; pm-ii 22-30; pterothorax 138-145, w. 160-180; forewing 460-510, w. at

middle 37-40; hind tibia 105-110; abdomen 560-640, w. 130-160 at IV; sternal glandular areas 10-13, w. 20-30; tergite IX 42-43; X 39-40; setae IX-d 22-38, i 18-25, ii 38-53, iii 25-28; clasper 63-73.

Io and po-iii thin; sternites III-VII each with transversely oblong glandular area; seta IX-d (fig. 13, a) about as long as or a little longer than i.

**Material.**—PARAGUAY: Department of Concepcion: Puerto Max, no host data, 1905, Vezenyi (Bagnall 373), 2 ♀ paralectotypes (CAS, USNM). No specific locality, *Vernonia* sp., 1904-1905, K. Fiebrig (Preisner 56), 3 ♀ syntypes of *F. minuta* var. *paraguayensis* Priesner (USNM). BRAZIL: State of Espírito Santo: Santa Teresa, *Ageratum conyzoides* L., *Agave* sp. flowers, violet, rose, *Inga marginata* H. B. and K., *Verbesina glabrata* Hook. and Arn., sweeping, unknown host, 9.VI-7.VIII.1928, O. Conde (Moulton 3206, 3208, 3210, 3212, 3213, 3216, 3223, 3231), 14 ♀, 3 ♂♂ (CAS, USNM); Santa Leopoldina (=Colonia Rio Bonito), *Vernonia polyanthes* Lessing, 22.VI.1928, Conde (Moulton 3219), 1 ♂ (CAS). State of Minas Gerais, blossoms of "composite Uricaceae," unknown composite flowers, unknown flowers, 6.IV-4.VIII.1933, E. J. Hambleton (Moulton 5236, 5241, 5259), 9 ♀♀ (CAS, BMNH). State of Rio de Janeiro: Itatiaia, *Eupatorium* sp., IX.1929, Dario Mendes (Moulton 3799), 1 ♀ (CAS). State of Santa Catarina: Nova Teutonia, grass, I.1954, Fritz Plaumann (Hood 2114), 11 ♀♀ (USNM).

**Discussion.**—Bagnall (1923) synonymized *paraguayensis* Priesner (1921) with his *oxyura*, but *adusta* Priesner (1921) stood until Jacot-Guillarmod (1974) synonymized it.

*F. oxyura* is characterized by the extra widely spaced pronotal striae, dull yellow middle and hind tibiae, and five-seta postocular series. The occasional absence of metascutal pores in this species and *magellanica* is unusual. *F. oxyura* resembles *trisetosa* Hood in the yellow antenna III-IV and variegated femora and tibiae, but *oxyura* differs in the five-seta postocular series and more widely spaced pronotal striae. *F. oxyura* appears to be common in the east-central region of South America. De Santis (1966, p. 12) recorded it from the Provinces of Cordoba and Tucuman, Argentina.

### *Frankliniella pestinae* Sakimura and O'Neill, new species

(Figs. 2, r; 4, e; 7, j; 9, b; 11, f)

**Female (holotype).**—**Color.** Body, antenna, and legs grayish brown to dark grayish brown; antenna III, tarsi, and anterior tibia lighter; antenna II with pale area around and before areola; wing deep brown, extreme tip and scale darker; ocellar crescents brownish red; major setae light brown except caudal setae medium brown. **Sculpture.** Occiput (fig. 4, e), one deep, two to three shallow, transverse striae; pronotum (fig. 4, e) with only few transverse striae along hind margin; mesonotum (fig. 7, j), six to seven shallow, widely spaced, partly anastomosing transverse striae; metascutum, mesal area as in figure 9, b; abdomen, shallow, narrowly spaced, transverse striae. **Measurements** (paratype range in parentheses): Body 1,460 (1,440-1,530); head ca. 90 (ca. 88-95), w. 120 (ca. 120-136); eye and ocellar triangle not measurable; mouth cone 178 (168-181); antenna of paratype (holotype too badly tilted, except for w. II and III) 243 (230-243), (2.5-2.6) times head; segments 20, w. 23; 39 (36-39), w. 19 (18-20), ratio (1.9-2.1); 38 (36-39), w. 18 (18-20), ratio (1.9-2.1); 35, w. 19; 32, w. 16; 44, w. 17; 8, w. 7; 12, w. 5; (remaining measurements as usual); io 16 (minute to 16), interval 20 (17-20); pronotum 120 (120-125), w. 158 (ca. 158-165); am 24 (24-25); aa 26 (26-28); pa-i 40 (40-48), ii 44 (41-45); pm-ii 26 (26-30); pterothorax 183 (175-183); forewing 750 (740-750), w. at middle 60 (55-60); setae at middle (35-43), (30-33), (35-37); hind tibia 133 (133-140); abdomen 960 (960-980), w. at IV 240 (240); tergite VIII comb 20-22; ovipositor 235 (225-235); tergite IX (fig. 11, f) 60 (58-60); X 76 (72-76); setae IXi 73 (73-98), ii 110 (110-125), iii 95 (95-105); Xi 105 (104-108), ii 95 (95-100); ratio of tergite X/IX 1.3 (1.2-1.3); setae IXi/iii 0.8 (0.8-1.0); IXiii/tergite X 1.3 (1.2-1.3).

Occiput (fig. 4, e) dorsally bulging (eye and ocellar triangle not measurable); antenna VI (fig. 2, r) clearly pedicellate; io in front of posterior ocelli; po 4 setae, iii minute; pm setae (fig. 4, e) except ii minute; mesospinula and both furcae well developed; metascutum (fig. 9, b) with pores; forewing setae numbering (24-26, 18-20, 14-16). Tergite VIII comb long, with (15-18) teeth; tergite X (fig. 11, f) a little longer than IX; seta i of IX about as long as iii or a little shorter; seta iii of IX a little longer than tergite X; and setae i and ii of X about equal to seta iii of IX.

**Male.**—Unknown.

**Material.**—Holotype ♀, MEXICO: State of Jalisco: Guadalajara, intercepted at Calexico, Calif., *Tillandsia usneoides* (L.), 6.III.1967, W. D. Gardner (Calexico 7545) (USNM Type 72609). Paratypes: MEXICO, intercepted at Nogales, Ariz., orchid debris, 9.V.1966, C. H. Spitzer (Nogales 92083), 1 ♀ (USNM); State of Jalisco: Guadalajara, intercepted at Nogales, Ariz., *Tillandsia* sp. and grass packing, 27.II.1968, D. Schwenke (Nogales 97532), 1 ♀ (USNM).

**Discussion.**—*F. pestinae* is characterized by the clearly pedicellate antenna VI, four-seta postocular series with the principal postocular iii, pronotum virtually free of striae and with one pair only of large posteromarginal setae, and subpostermarginal seta i of tergite IX (IXi) nearly equal to seta iii (IXiii). This species closely approaches *minuta* in color, but *pestinae* is separable by the characters previously named. *F. pestinae* may be a specific feeder on Spanish-moss (*Tillandsia usneoides*), which is used to pack plant material for shipping.

The specimens of the type-series have the head tilted, and the second paratype has the body broken at the thorax, so that the head could not be satisfactorily measured or drawn.

This specific name is formed as a Latinized genitive of Pestina, the copyrighted name of the official symbol of the former Plant Quarantine Division, now part of Plant Protection and Quarantine Programs, USDA Animal and Plant Health Inspection Service. The specific name honors plant quarantine inspectors of the Service for their work in defense of agriculture and their readiness to help with entomological research.

### *Frankliniella serrata* Moulton

(Figs. 3, e; 6, k-m; 7, a; 8, e; 11, a)

*Frankliniella serrata* Moulton, 1933: 125; 1948: 62, 94; Jacot-Guillarmod, 1974: 815.

**Female.**—**Color.** Body, antenna, and legs dark grayish brown, except antenna III yellowish brown, tarsi and anterior tibia light brown; antenna II darkest, with pale area around and before areola; wing deep brown, slightly lighter in basal fourth; major setae dark grayish brown. **Sculpture.** Occiput (fig. 6, k), three to four deep, three to four shallow, transverse striae; pronotum (fig. 6, m), few deep, widely spaced, transverse striae along anterior margin; mesonotum (fig. 7, a),

seven to eight deep, transverse striae forming scallops; metascutum, mesal area as in figure 8, e; abdomen, deep, narrowly spaced, transverse striae. **Measurements:** Body 1,630-1,820; head 120-135, w. 148-170; mouth cone 186-208; antenna 263-295, 2.2-2.3 times head; II 39-43, w. 25-29, ratio 1.4-1.6; III 48-54, w. 23-26, ratio 2.0-2.2; io 7-16, interval 20-24; po-iii 7-14; pronotum 133-155, w. 190-220; am 15-28; aa 17-33; pa-i 50-70, ii 45-55; pm-ii 23-33; forewing 760-900, w. at middle 59-72; setae at middle 38-48, 35-43, 38-48; hind tibia 154-185; tergite VIII comb 10-16; ovipositor 210-240; tergite IX 65-70; X 73-80; setae IXi 63-73, ii 75-90, iii 73-83; Xi 80-108, ii 88-105; ratio of tergites X/IX 1.0-1.2; setae IXi/iii 0.8-0.9; IXiii/tergite X 0.9-1.1.

Body large, coarse; head (fig. 6, k) transverse; antenna VI (fig. 3, e) not pedicellate; io thin, below tangent; po 5 setae, iii thin; am and aa thick; pm except ii minor and subequal or iv a little longer than others; metascutum (fig. 8, e) with pores; forewing unusually large and dark for the group, with dense rows of long, dark setae, which number 25-30, 21-25, 15-21. Tergite IV with short ctenidium and reduced seta ii; tergite VIII comb sparse, with 13-17 unusually short teeth with broad bases, giving the serrate appearance the specific name alludes to; tergites IX (fig. 11, a) and X subequal.

**Male.**—Unknown.

**Material.**—BRAZIL: State of Espirito Santo: Santa Teresa, no host data, 7.VIII.1928, O. Conde (Moulton 3231), 2 ♀♀ holotype and paratype (CAS); Rhono Claudio, *Sagittaria montevidensis* Cham. and Schlecht., 5.X.1928, Conde (Moulton 3236), 1 ♀ (CAS). State of Rio de Janeiro: Itatiaia Mt., *Eupatorium* sp., IX.1929, Dario Mendes (Moulton 3794), 6 ♀♀ (CAS, USNM); State of Santa Catarina: Nova Teutonia, *Sambucus nigra* L., 4.IX.1949, Fritz Plaumann (Hood 2055), 2 ♀♀ (USNM).

**Discussion.**—*F. serrata* is characterized by the large body with transverse head, dense wing setae, slender antenna III, five-seta postocular series, metascutal pores, subreticulate mesal area of metascutum, and short sawlike comb of tergite VIII. It is one of the few species with tergal seta IV-ii reduced to accompany a rudimentary ctenidium. Specimens with Moulton's numbers 3236 and 3794, although labeled as paratypes, do

not belong to the type-series, which comprises three ♀♀ with his number 3231.

### *Frankliniella trisetosa* Hood

(Figs. 3, f, k, s; 6, n-p; 7, g; 9, h; 10, a)

*Frankliniella trisetosa* Hood, 1942: 656; Moulton, 1948: 62, 94; Jacot-Guillarmod, 1974: 824.

**Female.—Color:** Body and antenna dark grayish brown except antenna III and sometimes base or all of IV yellowish brown, V pale at extreme base; wing pale brown with basal fourth slightly lighter; legs dark brown except tarsi, most of anterior tibia, both ends of middle and hind tibiae, and usually both ends of femora yellowish brown; major setae dark grayish brown. **Sculpture:** Occiput (fig. 6, n), 2-3 deep, 4-5 shallow, transverse striae; pronotum (fig. 6, p), deep, widely spaced, partly anastomosing, transverse striae; mesonotum (fig. 7, g), 9-10 deep, partly anastomosing transverse striae; metascutum with mesal area as in figure 9, h; abdomen, shallow, narrowly spaced, transverse striae. **Measurements:** Body 1,300-1,540; head 103-122, w. 125-139; mouth cone 156-193; antenna 230-255, 2.1-2.3 times head; II 34-38, w. 22-26, ratio 1.4-1.6; III 41-47, w. 21-23, ratio 1.9-2.1; io 15-20, interval 15-22; po-iv 18-25; pronotum 108-125, w. 145-175; am 20-33; aa 30-38; pa-i 40-58, ii 30-55; pm-ii 22-33; forewing 700-800, w. at middle 50-58; setae at middle 24-38, 30-35, 35-40; hind tibia 135-158; tergite VIII comb 18-23; ovipositor 196-230; tergite IX 43-50; X 70-81; setae IXi 45-58, ii 63-74, iii 78-81; Xi 75-103, ii 70-90; ratio of tergites X/IX 1.5-1.7; setae IXi/iii 0.6-0.8.

Antenna VI (fig. 3, f) narrow at base but not pedicellate; io (fig. 3, k) thin, on tangent; po 6 setae, iv thin; pm (fig. 3, s) except ii minor, subequal; wing setae numbering 25-28, 19-23, 15-19; metascutum (fig. 9, h) with pores. Tergite VIII comb sparse, with 13-15 long teeth; tergite X (fig. 10, a) half again as long as IX or longer; IX seta i only two-thirds of iii, which is longer than ii and subequal to tergite X; Xi longest of caudal setae.

**Male.—Unknown.**

**Material.—PERU:** Department of Cajamarca: Celendin, vicinity of, *Liabum verbascifolia* Lessing flowers, 29.V.1936, Felix Woytkowski (Hood 1184), ♀ holotype (USNM Type 72610) and 9 ♀

paratypes (USNM); same locality and collector, *Pappobolus macranthus* Blake flowers, beating bush, *Senecio* sp. flowers, composite flower, *Helianthus jelskii* Hieronymus flowers, 25.V to 6.VI.1936, (Hood 1175, 1187, 1190, 1194, 1198), 15 ♀ paratypes and 3 ♀♀ (USNM). Department of Amazonas: Chachapoyas, 2000 m, *Spartium junceum* L. flowers, 19.XII.1936, Woytkowski (Hood 1145), 1 ♀ (USNM).

**Discussion.**—*F. trisetosa* is weakly characterized by the variegated middle and hind tibiae, yellow antenna III-IV, moderately developed anterior pronotal setae, and long tergite X. *F. oxyura* resembles this species in coloration, but *oxyura* lacks the six-seta postocular series and density of sculpture on the pronotum, mesonotum, and metascutum of *trisetosa*.

### *Frankliniella tuttlei* Sakimura and O'Neill, new species

(Figs. 3, g; 5, a; 7, v; 8, c; 9, p-q; 12, c; 13, i)

**Female (holotype).—Color:** Body yellow to orange with integument weakly shaded grayish brown, especially on abdomen before VIII; labium extensively and strongly shaded; yellow to orange subintegumental pigment abundant, especially in thorax; antenna I pale; II-VIII dark grayish brown except for brownish yellow basal two-thirds or less of III-IV and one-third or less of V and narrow pale subbasal ring on III-V; wing pale brown to nearly clear, veins slightly darker; legs yellow, femora weakly shaded brown mesally; ocellar crescents brownish red; major setae yellowish brown to light grayish brown, lightest on wing and darkest at end of abdomen. **Sculpture** (figs. 5, a; 7, v; 8, c) about as in *deserticola*. **Measurements** (paratype range in parentheses): Body 1,520 (1,350-1,600); head 100 (93-113), w. 143 (138-160); eye 58, w. 41, interval 60; cheek 53; occiput below eye 43; ocellar triangle w. 55, height 39; ocelli w. 15; mouth cone 205 (195-230); antenna 260 (237-275), 2.6 (2.3-2.6) times head; segments 23, w. 27; 40 (36-42), w. 25 (24-26), ratio 1.6 (1.4-1.6); 48 (42-50), w. 21 (20-23), ratio 2.3 (2.0-2.3); 39, w. 19; 34, w. 19; 43, w. 18; 8, w. 9; 16, w. 6; io 13 (12-18), interval 13 (13-20); po-iv 10 (10-14); pronotum 120 (113-133), w. 195 (175-218); am 15 (13-17); aa 14 (12-15); pa-i 50 (30-60), ii 33 (20-49); pm-ii 30 (22-41); pterothorax 200

(160-210), w. 260 (240-310); forewing 730 (590-740), w. at middle 58; setae at middle 40, 30, 38; hind tibia 163 (143-178), its longest terminal seta 24 (22-27), 0.15 (0.14-0.17) times tibia; abdomen 910 (850-1,030), w. at IV 320; tergite VIII comb (18-16); ovipositor 240 (213-253); tergite IX 78 (65-78); X 66 (60-70); setae IX<sub>i</sub> 85 (78-100), ii 93 (78-108), iii 88 (73-98); XI 75 (69-90), ii 70 (68-88); ratio of tergites X/IX 0.8 (0.8-0.9); seta IX<sub>iii</sub>/tergite X 1.3 (1.3-1.5).

Antenna VI (fig. 3, g) not pedicellate; io (fig. 5, a) thin, somewhat below tangent; po 6 setae, iv thin, others minute; am (fig. 5, a) thin, with 4 minor setae between am pair; aa thin; pm except ii minute; metascutum (fig. 8, c) with pores; forewing setae numbering (20-27, 16-19, 11-15). Tergite VIII comb with (15-20) teeth; tergite X (fig. 12, c) shorter than IX; caudal setae as in *ewarti*, longer than in *deserticola*; setae i and iii of tergite IX subequal, shorter than ii, a third to a half again as long as tergite X; setae of X shorter than IX<sub>iii</sub>.

**Male (allotype).**—Color about as in ♀ but with integument often less shaded; antenna III-IV with dark grayish-brown area somewhat more extensive than in ♀; abdomen rarely but legs never without shading; setae pale yellow to light brown, caudal ones brown. Sculpture as in ♀. Measurements (paratype range in parentheses): Body 1,200 (1,080-1,260); head 88 (83-95), w. 130 (125-143); mouth cone 190 (165-200); antenna 230 (205-243); segments 20, w. 25: 35, w. 23: 43, w. 18: 34, w. 17: 29, w. 17: 39, w. 17: 7, w. 8: 14, w. 5: pronotum 103 (95-108), w. 173 (145-183); pa-i 43 (34-45), ii 28 (18-33); pm-ii 28 (20-28); pterothorax 158 (138-180), w. 227 (188-250); forewing 560 (490-600); hind tibia 130 (125-140), its longest terminal seta 19 (19-23), 0.15 (0.14-0.17) times tibia; abdomen 780 (700-820), w. at IV 250; paired glandular areas each w. 3-10, interval 18-20; tergite IX 5<sub>c</sub> (40-58); X 55 (43-58); setae IX-d 43 (25-45), i 26 (21-33), ii 60 (51-65), iii 38 (33-45); clasper 73 (65-83).

Sternites III-VII (fig. 9, p-q) each with pair of small, dotlike glandular areas, or distal segments lacking such areas; tergite VIII comb with fewer teeth than in ♀; caudal setae delicate; tergite IX with seta d variable but usually much longer than i, with s-i small and s-ii small to fairly long, often differing on the two sides of the tergite.

**Material.**—Holotype ♀, U.S.A.: Arizona: Yuma

Co.: Dome Valley, *Aster exilis* Elliott, 8.I.1963, D. M. Tuttle (USNM Type 72612); allotype ♂, same data (USNM). Paratypes: Same data, 2♀, 11♂♂ (CDA, USNM); Yuma Co.: Dateland, *Palafoxia linearis* (Cav.) Lag., 18.V.1964, Tuttle, 4♀, 4♂♂ (CDA); Yuma, *P. linearis*, 16.XII.1959, Tuttle (63A10-47), 10♀♀, 8♂♂ (CDA, UCR, USNM).

**Discussion.**—*F. tuttlei* forms a group with *ewarti* and *deserticola* and differs very little from either, particularly the former. *F. tuttlei* differs from *ewarti* by the dark antenna II, coarser metascutal sculpture, and clearly shorter tergite X than IX. It differs from *deserticola* by the uniformly dark antenna VI, strongly shaded labium, weakly but definitely shaded abdomen, clearly shorter tergite X than IX, and paired glandular areas on male sternites. For further remarks, see the discussion of *deserticola*.

This species is named after D. M. Tuttle, University of Arizona Experiment Station, Yuma, the collector of this and other species described in this bulletin.

### *Frankliniella tympanona* Hood

(Figs. 3, h; 6, q-r; 7, t; 8, q; 10, b; 13, f)

*Frankliniella tympanona* Hood, 1915: 21; Moulton, 1948: 60, 93; De Santis, 1966: 12; Ortiz-P., 1972: 86, fig.; Jacot-Guillarmod, 1974: 829.

**Female.**—Color: Body light grayish brown to dark grayish brown; antenna dark grayish brown except III brownish yellow and IV light at base; wing deep brown, scale darker at base; legs dark grayish brown with tarsi yellowish brown and anterior tibia lighter than others; major setae light brown, caudal ones darker. Sculpture: Occiput (fig. 6, q), one to two deep, three to four shallow or sometimes deep, transverse striae; pronotum (fig. 6, r), several faint, extra widely spaced, partly anastomosing, transverse striae in anteromesal triangle, as in *minuta*; mesonotum (fig. 7, t), five to six deep, widely spaced, partly anastomosing transverse striae; metascutum, mesal area as in figure 8, q; abdomen, deep, widely spaced, transverse striae. Measurements: Body 1,260-1,600; head 88-110, w. 113-135; mouth cone 155-208; antenna 213-265, 2.3-2.5 times head; 11.29-34, w. 21-24, ratio 1.3-1.5; III 38-48, w. 18-21, ratio 2.0-2.3; io 12-25, interval 10-17; po-iv 10-16; pronotum 100-128, w. 135-178; am 10-33; aa 22-45; pa-i 38-58, ii 35-50; pm-ii 18-33;

forewing 600-800, w. at middle 43-54, setae at middle 23-43, 18-38, 20-38; hind tibia 118-158; sternal glandular area 8-13, w. 10-18; tergite VIII comb 13-22; ovipositor 190-258; tergite IX 36-56; X 63-85; setae IXi 36-53, ii 60-80, iii 76-98; Xi 80-105, ii 73-98; ratio of tergites X/IX 1.7-2.0; setae IXi/iii 0.4-0.6; IXiii/tergite X 1.1-1.3.

Antenna III (fig. 3, h) normal for the group in width and shape; VI rounded at base, not pedicellate; io thin, on tangent; po 6 setae, iv thin; am and aa thin or thick; pm except ii minute; metascutum (fig. 8, q) without pores; forewing setae numbering 25-30, 18-22, 12-19. Abdominal sternite III (in 49♀ available) with small, oblong to circular glandular area; sternite IV in 1♀ also with glandular area; tergite IV with short ctenidia ending at normal seta pair ii; tergite VIII comb sparse, with 11-15 teeth, long; tergite X (fig. 10, b) nearly to fully twice as long as IX; seta IXiii longer than ii, a little longer than tergite X, and subequal to its setae.

**Male.**—*Color and sculpture as in ♀. Measurements:* Body 1,010-1,200; head 88-108, w. 109-129; antenna 200-240; pronotum 90-105, w. 135-158; hind tibia 110-125; sternal glandular areas 10-15, w. 13-20; tergite IX 43-48; X 38-43; setae IX-d 28-33, i 25-29, ii 55-65, iii 30-34; clasper 70-78.

Io, po, and pronotal setae as in ♀; sternites III-VIII each with one small, circular to oblong glandular area; tergite IX (fig. 13, f) setae d and i subequal.

**Material.**—PERU: Department of Lima: Chosica, flowers of a composite, 17.IV.1913, E. W. Rust (Hood A3159), ♀ holotype (USNM Type 72611) and 48♀, 5♂ paratypes (USNM, CAS).

**Discussion.**—*F. tympanona* is characterized by the six-seta postocular series, extra widely spaced striae on the pronotum, lack of metascutal pores, and a small glandular area on sternite III of the female. The glandular area is a conspicuous diagnostic character, but it has limited taxonomic value (see discussion of *magellanica*). *F. tympanona* reported from Territorio de Neuquen, Argentina (De Santis, 1966, p. 12) is possibly another species (see note under *valdiviana*, new species). Ortiz-P. (1972, p. 86) reported several recent collections of *tympanona* in the Department of Lima, Peru.

### *Frankliniella valdiviana* Sakimura and O'Neill, new species

(Figs. 2, s-t; 6, b; 7, p; 8, r; 10, f; 13, g)

**Female (holotype).**—*Color:* Body, antenna, and legs dark grayish brown, head and abdomen IX-X somewhat darker, and antenna III, basal part of IV, tarsi, and anterior tibia yellowish brown; wing uniform light grayish brown, scale darker; ocellar crescents red; major setae dark grayish brown, darker than in *tympanona*. *Sculpture:* Occiput (fig. 7, p), three to four deep, two to three shallow, transverse striae; pronotum (fig. 6, b), four to five shallow, extra widely spaced, transverse striae in anteromesal triangle, as in *minuta*; mesonotum (fig. 7, p), seven to eight shallow, widely spaced, partly anastomosing transverse striae; metascutum, mesal area as in figure 8, r; abdomen, deep, widely spaced, transverse striae. *Measurements* (paratype range in parentheses): Body 1,350 (1,250-1,680); head 93 (80-103), w. 110 (100-123); eye 56, w. 30, interval 50; occiput below eye 30; ocellar triangle w. 45, height 32; ocelli w. 12; mouth cone 163 (151-185); antenna 215 (195-238), 2.3 (2.2-2.5) times head; segments 18, w. 23; 29 (28-33), w. 23 (21-25), ratio 1.3 (1.3-1.5); 31 (31-40), w. 20 (19-23), ratio 1.6 (1.6-1.9); 33, w. 20; 27, w. 16; 40, w. 16; 7, w. 6; 16, w. 4; io 15 (7-22), interval 13 (11-22); po-iv 7 (7-14); pronotum 108 (105-125), w. 148 (135-163); am 13 (7-20); aa 15 (10-25); pa-i 43 (30-48), ii 33 (28-43); pm-ii 22 (18-30); pterothorax 150 (150-190), w. 205; forewing 610 (570-770), w. 45 (45-63) at middle; setae at middle (25-38, 23-33, 28-40); hind tibia 108 (108-145); abdomen 820 (810-1,020), w. 220 (185-270) at IV; sternal glandular area (10-13), w. (18-30); tergite VIII comb (10-16); ovipositor 205 (190-233); tergite IX 43 (38-45); X 70 (65-83); setae IXi 58 (35-58), ii 73 (50-73), iii 78 (65-93); Xi 75 (70-93), ii 73 (68-90); ratio of tergites X/IX 1.6 (1.6-2.0); setae IXi/iii 0.7 (0.5-0.7); IXiii/tergite X 1.1 (0.9-1.2).

Mouth cone normal; antenna III (fig. 2, s-t) variable in stoutness but decidedly stouter than in *tympanona*, its 2 dorsal setae large and dark; VI not pedicellate; io (fig. 6, b) thin to moderately thick, below tangent; po 6 setae, iv thin; am (fig. 6, b) thin; aa thin to moderately thick; pm setae except ii minor; mesospinula and both furcae well developed; metascutum (fig. 8, r) with pores; forewing setae numbering (23-30, 17-22, 12-16);

legs short. Sternite III in 45 available ♀♀ with small, oblong glandular area, other sternites without; tergite IV usually with distinct ctenidia ending at setae ii; these setae not reduced; tergite VIII comb with 11–15 teeth; tergite X (fig. 10, f) half again to twice as long as IX; its setae subequal to IXiii, the latter longer than IXii and about as long as tergite X.

**Male (allotype).**—*Color:* Body, wing, and major setae as in ♀; other appendages similar except antenna I decidedly lighter than head, II–IV yellowish brown, IV only weakly washed with gray at extreme end; anterior femur often pale at extreme apex. *Sculpture* as in ♀ but generally weaker. *Measurements* (paratype range in parentheses): Body 1,100 (900–1,200); head 90 (90–98), w. 113 (105–115); mouth cone 145 (135–157); antenna 190 (190–215); segments 16, w. 22; 29 (27–29), w. 21 (21–23), ratio 1.4 (1.2–1.4); 33 (31–34), w. 20 (18–20), ratio 1.7 (1.6–1.8); 29, w. 18; 22, w. 16; 34, w. 17; 6, w. 7; 15, w. 4; io 10 (7–15); po-iv 8 (6–10); pronotum 98 (90–123), w. 133 (123–143); am (12–22); aa (13–33); pa-i (23–31), ii (25–40); pm-ii 25 (16–25); pterothorax 143 (138–158); forewing 560 (510–600); hind tibia 108 (103–118); abdomen 660 (600–680); tergite VIII comb (5–9); sternal glandular areas (10–15), w. (12–42); tergite IX 40 (40–48); X ca. 34 (34–40); setae IX-d (24–33), i 17 (16–28), ii 49 (44–63), iii 29 (25–33); clasper 60 (60–78).

Tergite VIII comb very short, with 13–15 teeth; sternites III–VII each with transversely oblong glandular area; seta IX-d (fig. 13, g) somewhat longer than i but variable.

**Material.**—Holotype ♀, allotype ♂, CHILE: Province of Valdivia: Valdivia, 24 km S of, no host data, 3.II.1967, E. Schlinger (UCR 66-281) (UCR). Paratypes, same data, 3♀♀, 3♂♂ (UCR, USNM); Province of Malleco: Parque Nacional de Nahuelbuta, 1450 m, no host data, 24.I.1967, M. Irwin (UCR 66-304), 10♀♀, 4♂♂; Province of Aconcagua: Quebrada El Tigre, no host data, 12.VIII.1966, Schlinger and Irwin (UCR 66-277), 1♀; Province of Coquimbo: Cuesta Buenos Aires, composite flowers, 17.VIII.1966, Schlinger and Irwin (UCR 66-301), 5♀♀; same data but host shrub (UCR 66-293), 1♀; Quiliimari, dunes behind coast, 25.VIII.1966, Schlinger and Irwin (UCR 66-310), 5♀♀; Los Vilos, no host data, 22.VIII. 1966, Schlinger and Irwin (UCR 66-311), 6♀♀; same data but 25.VIII.1966 (UCR 66-299), 2♀♀.

**Discussion.**—*F. valdiviana* appears to be a southern isolate from *tympanona* in Peru. The structural differences are the presence of metascutal pores and the stouter antenna III in *valdiviana*. However, the color differs sharply, particularly in the male. In *valdiviana* the setae are dark grayish brown and male antenna II is yellowish brown, but in *tympanona* the setae are light brown and male antenna II is dark grayish brown. *F. magellanica* resembles *valdiviana* in the glandular area of female sternite III, but its mouth cone is broad and heavy and that in *valdiviana* is slender and normal. De Santis (1966, p. 12) reported a collection of *tympanona* from Territorio de Neuquen, Argentina. Since Neuquen is contiguous to Malleco and Valdivia, Chile, on the opposite slope of the Andes, the specimens from Neuquen might be *valdiviana*.

### *Frankliniella verbesinae* Sakimura

(Figs. 3, i; 6, e–f; 8, m; 11, c)

*Isochaetothrips varicornis* Moulton, 1933: 127; Sakimura, 1967a: 168.

Not: *Frankliniella varicornis* Bagnall, 1919: 268.

*Frankliniella verbesinae* Sakimura, 1967a: 168; Jacot-Guillarmod, 1974: 831.

**Female.**—*Color:* Body orange yellow with integument very weakly shaded gray, not darker caudally; labium extensively and strongly shaded; subintegumental pigment orange yellow; antenna yellow; I pale; III–V apically and VI–VIII entirely grayish brown; wings and legs yellow; major setae dark grayish brown. *Sculpture:* Occiput (fig. 6, e), two deep, four to five shallow, transverse striae; pronotum (fig. 6, f), shallow, widely spaced, partly anastomosing, transverse striae; mesonotum, five to six faint transverse striae; metascutum, mesal area as in figure 8, m; abdomen, shallow, narrowly spaced, transverse striae. *Measurements:* Body 1,410–1,520; head 105–110, w. 138–145; mouth cone 210–215; antenna 245–260, 2.3–2.4 times head; II 36–37, w. 24, ratio 1.5; III 44–45, w. 20–21, ratio 2.1–2.2; io 15–17, interval 18–20; po-iv 15–17; pronotum 118–120, w. 165–175; am 21–23; aa 20–22; pa-i 58, ii 48–50; pm-ii 25–30; pterothorax 160–168, w. 205–210; forewing 620–680, w. at middle 50–53; setae at middle 40–43, 35, 38–43; hind tibia 151–160; abdomen 920–1,000, w. at IV 225–258; tergite VIII comb 17–19; ovipositor 220–233; tergite IX 68; X

72-73; setae IXi 80-83, ii 94-98, iii 88-90; Xi 98-108, ii 85-93; ratio of tergites X/IX 0.9; seta IXiii/tergite X 1.2.

Io thin, on tangent; po 6 setae, iv thin; antenna VI (fig. 3, i) not pedicellate; am almost as long as pm-ii, with 2 minor setae between am pair; pm except ii minor, subequal; metascutum (fig. 8, m) with pores; forewing setae numbering 23, 19-20, 17; hind tibia with 2 terminal setae dark, spurlike. Tergite VIII comb with 15-16 teeth; tergite X (fig. 11, c) subequal to IX; caudal setae thornlike but not short; IXi somewhat shorter than iii, the

latter a little longer than tergite X, and Xi and ii subequal to IXii and iii.

**Male.**—Unknown.

**Material.**—BRAZIL: State of Espirito Santo: Santa Teresa, *Verbesina glabrata* Hook. and Arn., 19.VI.1928, O. Conde (Moulton 3216), 2 ♀ ♀ holotype and paratype (CAS).

**Discussion.**—*F. verbesinæ* is characterized by the yellow body with variegated antenna III-V, dark grayish-brown setae, and tergite X subequal to tergite IX in length.

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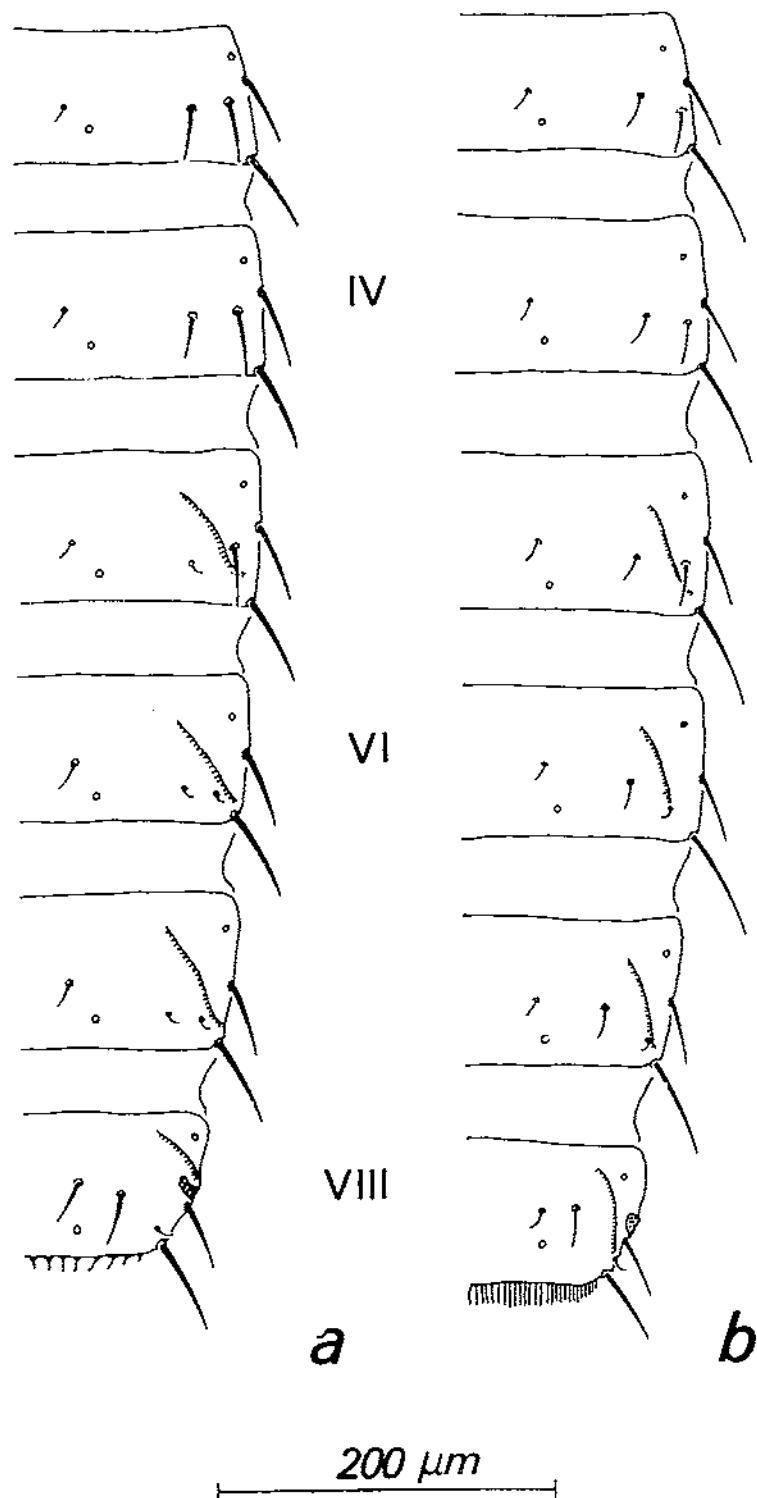


FIGURE 1.—Chaetotaxy and etenidia of tergites III-VIII, ♀; *a*, *Frankliniella untonsa* (Trybom); *b*, *Isochaetothrips setipennis* (Bagnall).

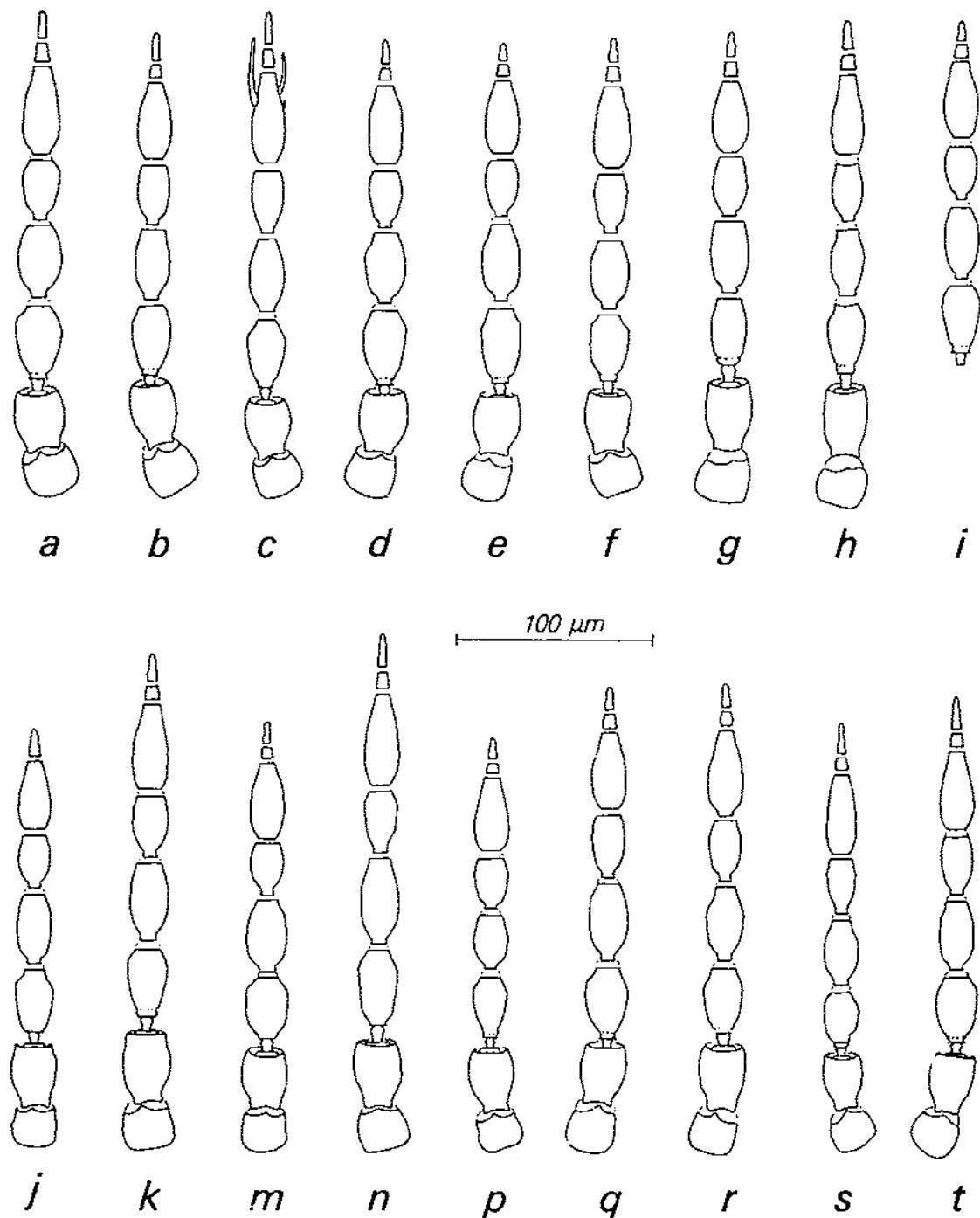


FIGURE 2.—*Frankliniella* species. Antenna, ♀: *a*, *achaeta* Hood, paratype; *b*, *bertelsi* (De Santis), from Santa Catarina, Brazil; *c*, *caudiseta*, n. sp., holotype, sense cones on VI shown; *d*, *colombiana* Moulton, paralectotype; *e*, *curta* Hood, from Peru; *davidsoni* (Moulton); *f*, Paralectotype of *watsoni* Moulton; *g*, from North Dakota; *h*, *deserticola*, n. sp., paratype, from Arizona; *i*, *floyd-andrei*, n. sp., holotype; *j*, *jamaicensis*, n. sp., paratype, from Jamaica; *k*, *konoi*, n. sp., holotype; *minuta* (Moulton); *m*, From Hawaii; *n*, from Utah, apex slender; *p*, *nakaharai*, n. sp., paratype; *q*, *oxyura* Bagnall, from Espírito Santo, Brazil; *r*, *pestinæ*, n. sp., paratype; *valdiviana*, n. sp.; *s*, Holotype; *t*, paratype.

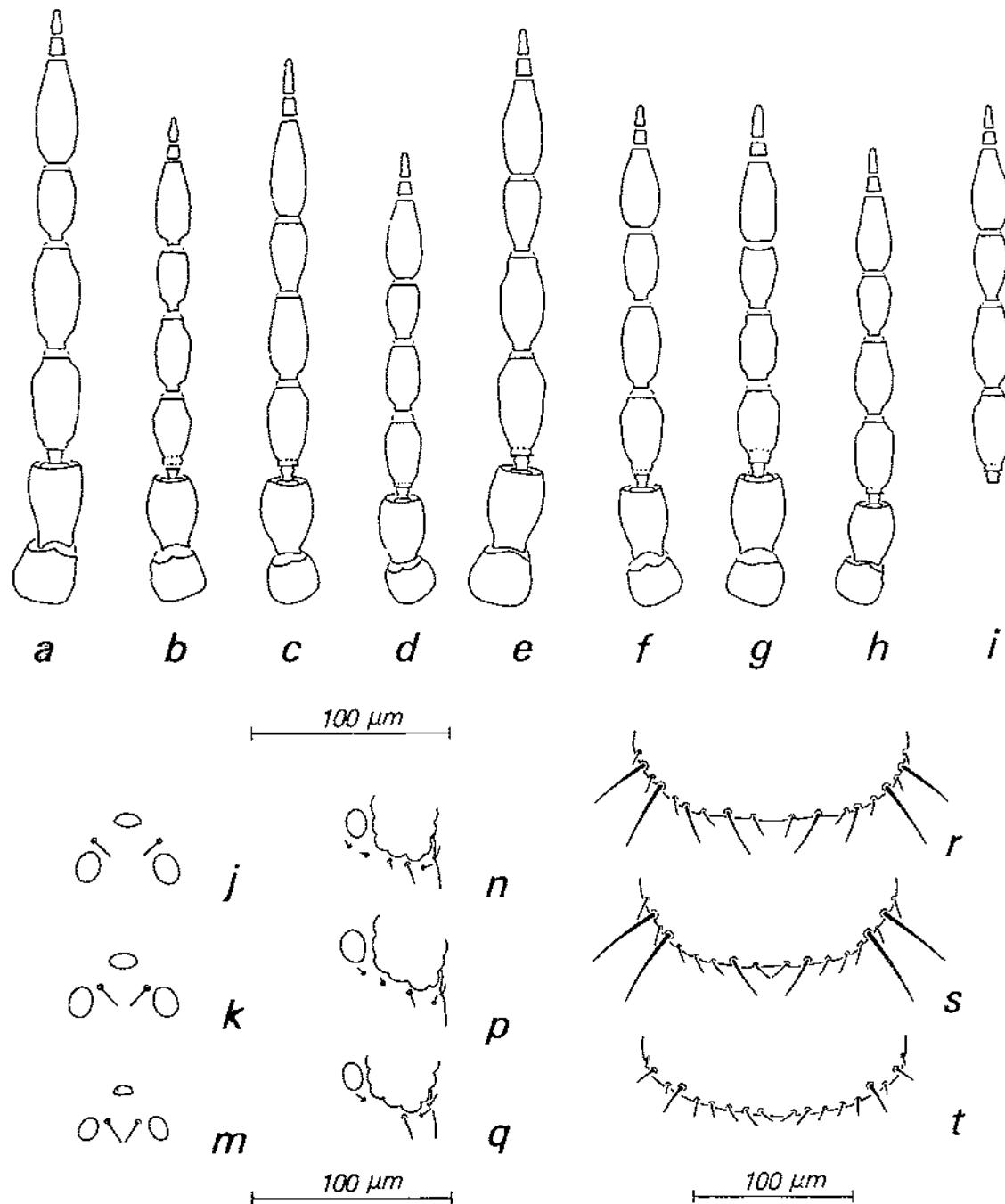


FIGURE 3.—*Frankliniella* species. Antenna, ♀: a, *craufordi*, n. sp., paratype; b, *desantisi*, n. sp., paratype; c, *ewarti*, n. sp., holotype; d, *magellanica*, n. sp., holotype; e, *serrata* Moulton, from Rio de Janeiro, Brazil; f, *trisetosa* Hood, paratype; g, *tuttlei*, n. sp., paratype; h, *typanoma* Hood, paratype; i, *verbesinae* Sakimura, holotype. Position of interocellar setae: j, *minuta* (Moulton), in front of posterior ocelli; k, *trisetosa*, on common tangent of posterior ocelli; m, *magellanica*, below common tangent of or between posterior ocelli. Postocular seta series: n, *davidsoni* (Moulton), six-seta series, iv principal seta; p, *minuta*, five-seta series, iii principal seta; q, *nakaharai*, n. sp., four-seta series, ii principal seta. Pronotal posteromarginal seta series: r, *davidsoni*, setae ii and iv developed; s, *trisetosa*, seta ii developed; t, *bertelsi* (De Santis), seta ii almost undeveloped.

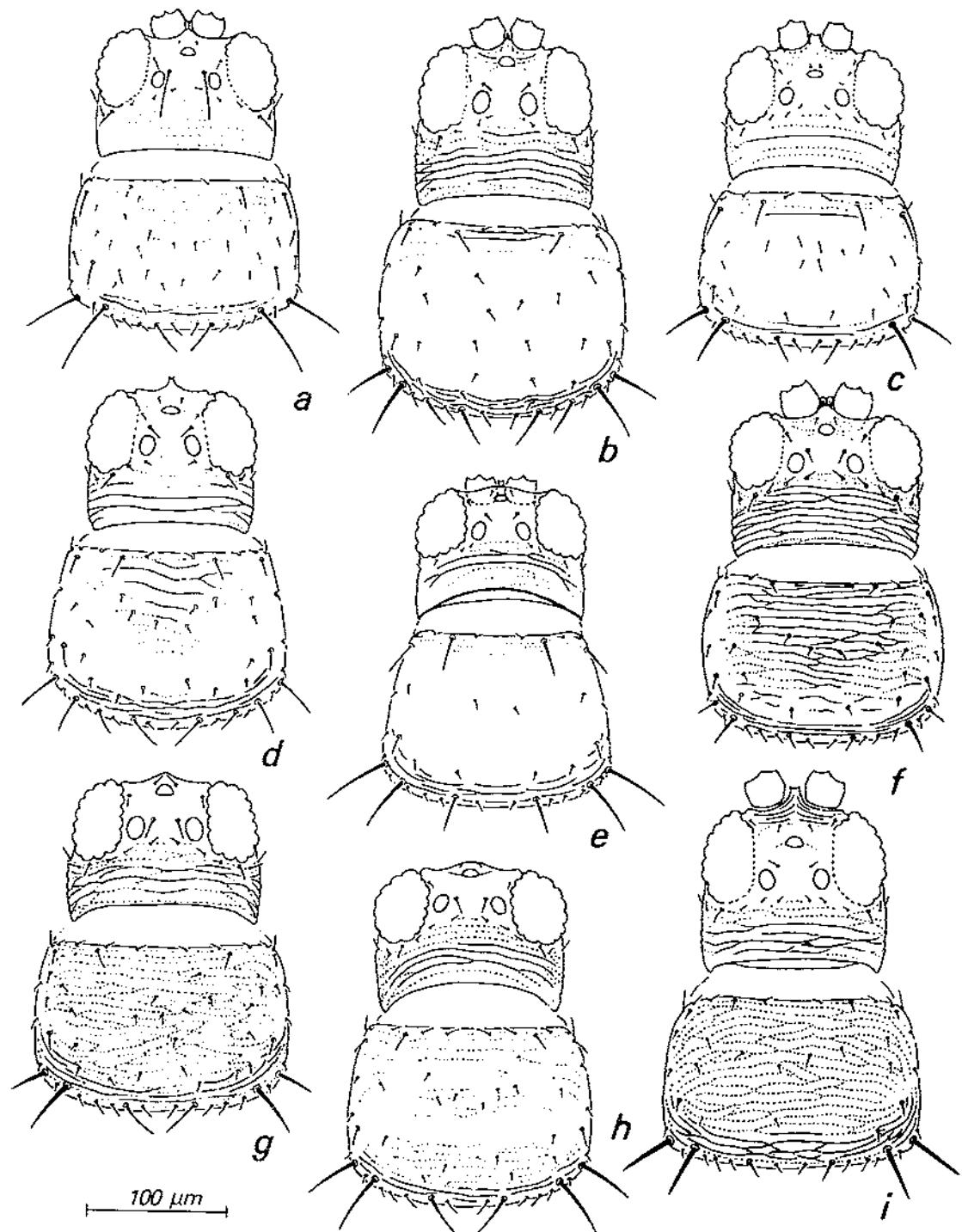


FIGURE 4.—*Frankliniella* species. Head and pronotum, ♀: a, *caudiseta*, n. sp., holotype; b, *davidsoni* (Moulton), paralectotype of *watsoni* Moulton; c, *jamaicensis*, n. sp., holotype; d, *minuta* (Moulton), from Morelos, Mexico; e, *pestinae*, n. sp., head of paratype and pronotum of holotype, head tilted forward; f, *bertelsi* (De Santis), from Santa Catarina, Brazil; g, *deserticola*, n. sp., paratype, from Arizona; h, *ewarti*, n. sp., paratype, head tilted forward; i, *konoi*, n. sp., holotype.

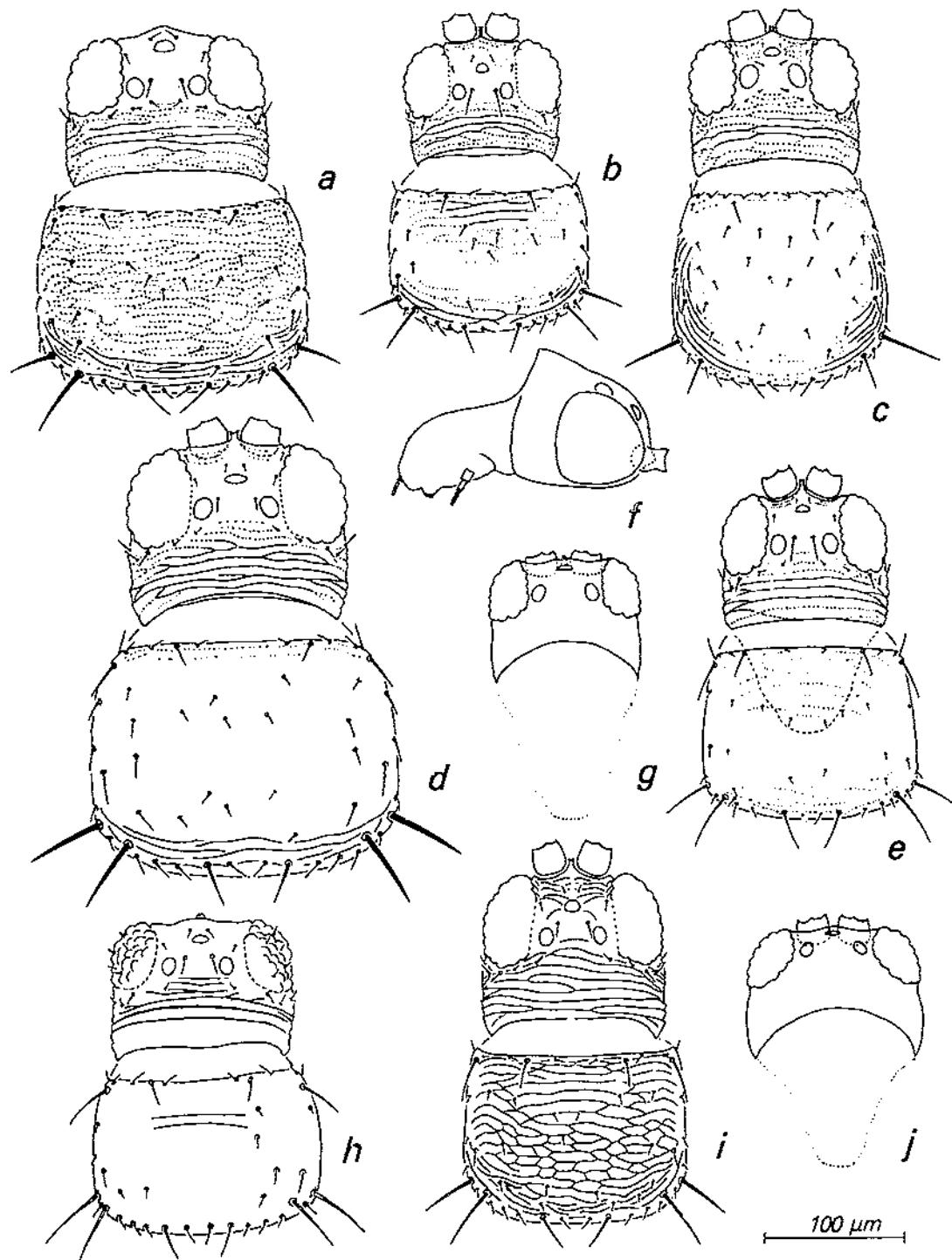


FIGURE 5.—*Frankliniella* species. Head and pronotum, ♀: a, *tuttlei*, n. sp., paratype; b, *nakaharai*, n. sp., head of holotype and pronotum of paratype; c, *desantisi*, n. sp., paratype; d, *crawfordi*, n. sp., paratype. Head and pronotum, ♂: e, *magellanica*, n. sp., allotype. Head and mouth cone, *magellanica*: f, Lateral view, labium bulging, paratype ♂; g, dorsal view, head tilted forward, mouth cone broad and heavy, holotype ♀. Head and pronotum, ♀: h, *fuscicornis* Moulton, holotype; i, *colombiana* Moulton, topotype. Head and mouth cone: j, *colombiana*, dorsal view, head tilted forward, paralectotype ♀.

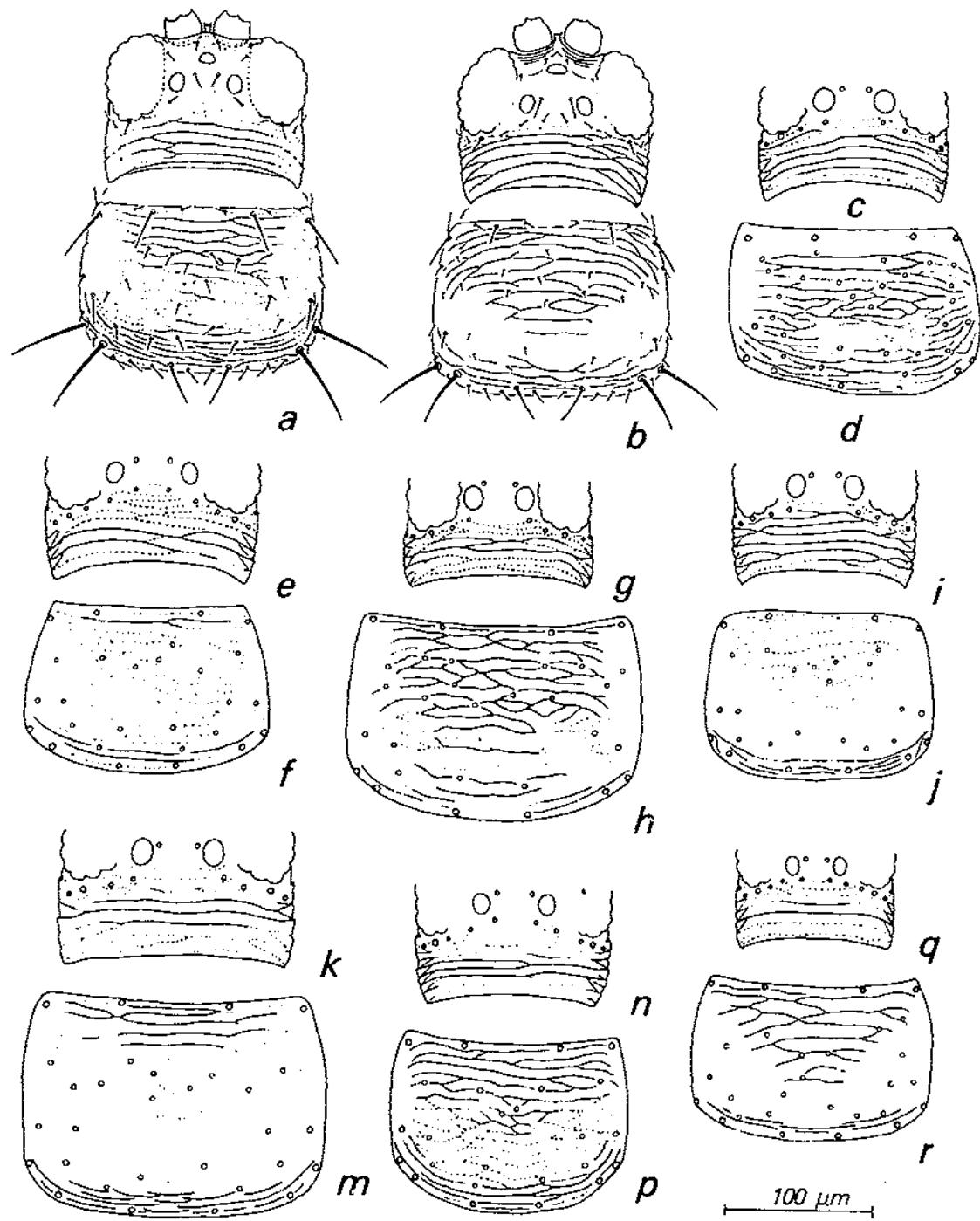


FIGURE 6.—*Frankliniella* species. Head and pronotum, ♀: a, *floydandrei*, n. sp., holotype; b, *coldiviana*, n. sp., paratype, from Coquimbo, Chile. Occipital area and pronotum, showing sculpture and positions of some setae, ♀: c—d, *curta* Hood, holotype of *Isochaetothrips unicolor* Moulton, pronotum rolled to right; *verbesinae* Sakimura; e, Paratype of *Isochaetothrips varicornis* Moulton; f, holotype of same; *achaeta* Hood; g, From Colorado; h, paratype; i—j, *oxyura* Bagnall, from Minas Gerais, Brazil; *serrata* Moulton; k, Paratype; m, holotype; n, p, *trisetosa* Hood, paratype; q—r, *lympanona* Hood, paratype.

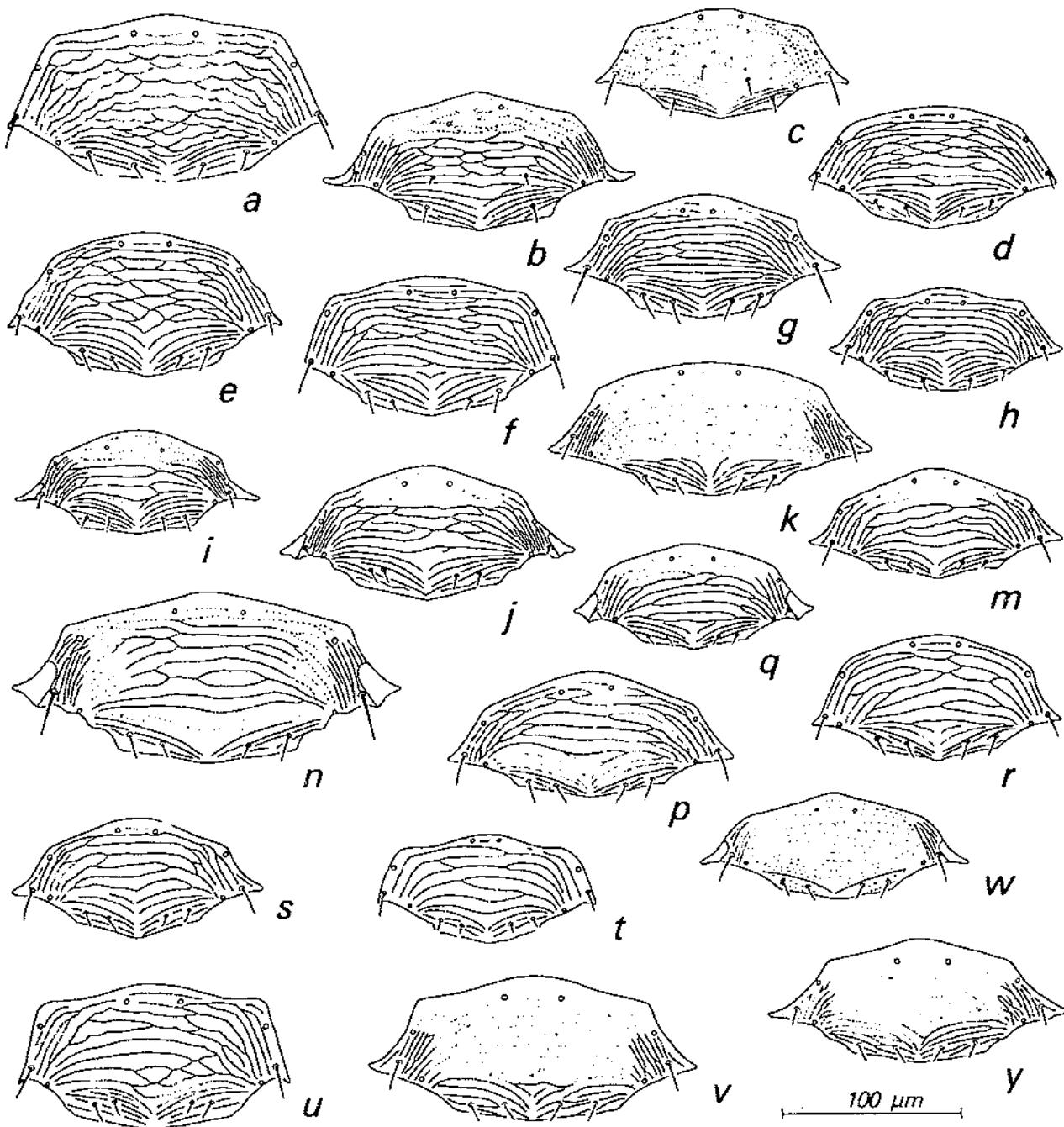


FIGURE 7.—*Frankliniella* species. Mesonotum, ♀: *a*, *serrata* Moulton, holotype; *b*, *konoi*, n. sp., holotype; *c*, *desantisi*, n. sp., paratype; *d*, *colombiana* Moulton, paratype; *davidsoni* (Moulton); *e*, From California; *f*, paratype of *watsoni* Moulton; *g*, *trisetosa* Hood, paratype; *h*, *bertelsi* (De Santis), from Santa Catarina, Brazil; *i*, *nahaharai*, n. sp., holotype; *j*, *pestinae*, n. sp., holotype; *k*, *ewarti*, n. sp., paratype; *m*, *magellanica*, n. sp., holotype; *n*, *crawfordi*, n. sp., paratype; *p*, *valdiviana*, n. sp., paratype, from Coquimbo, Chile; *q*, *curta* Hood, from Peru; *r*, *oxyura* Bagnall, from Espírito Santo, Brazil; *s*, *minuta* (Moulton), from Arizona; *t*, *tympanona* Hood, paratype; *u*, *achuceta* Hood, holotype; *v*, *tuttlei*, n. sp., paratype; *w*, *floydandrei*, n. sp., holotype; *y*, *deserticola*, n. sp., paratype, from Arizona.

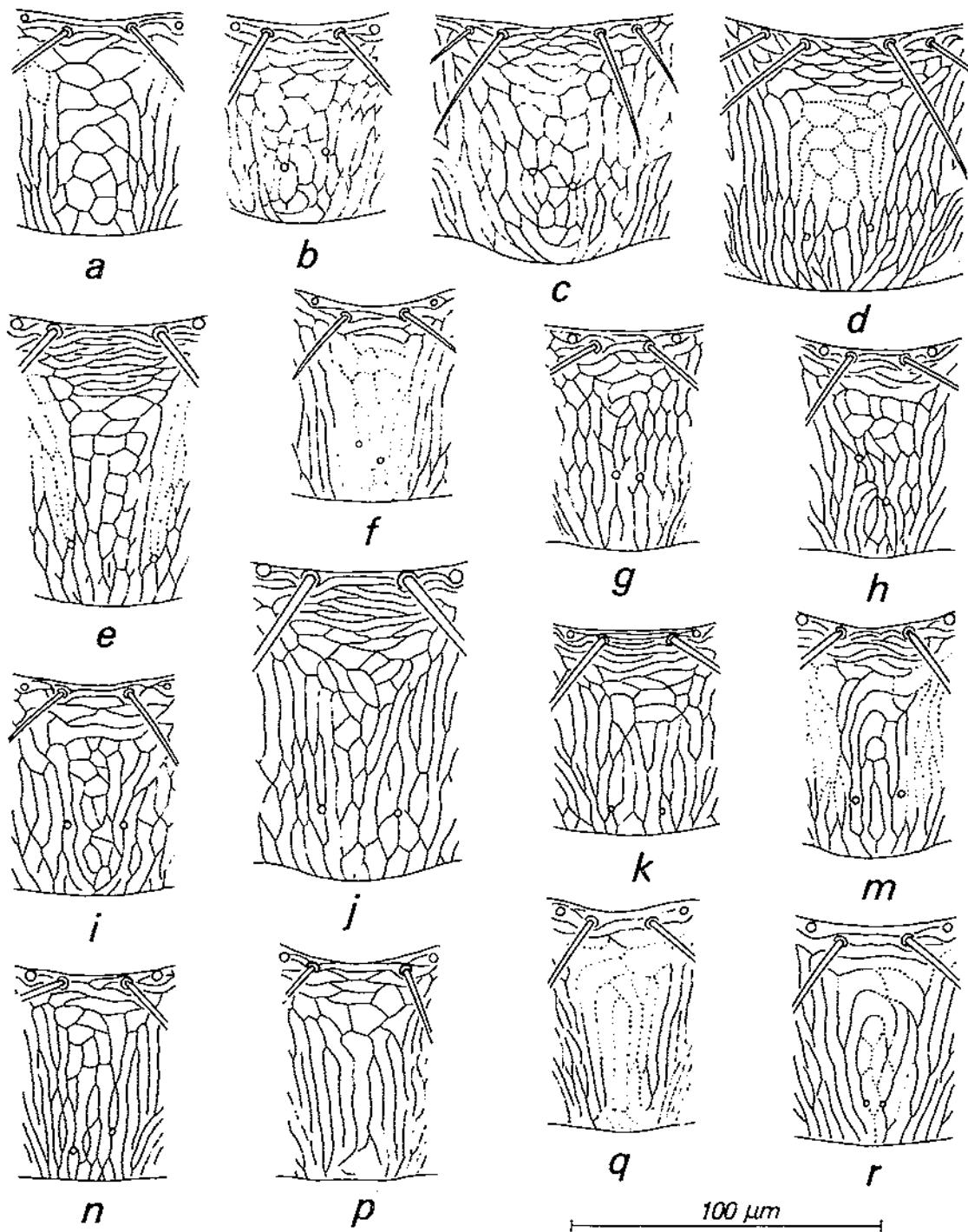


FIGURE 8.—*Frankliniella* species. Metascutum, mesal area, seta ii shown by only its socket, ♀: a, *konoi*, n. sp., holotype; b, *deserticola*, n. sp., paratype, from Arizona; c, *tuttlei*, n. sp., paratype; d, *ewarti*, n. sp., paratype; e, *serrata* Moulton, holotype; f, *desantisii*, n. sp., paratype; g, from Espírito Santo, Brazil; h, paralectotype; i, *bertelsi* (De Santis), from Santa Catarina, Brazil; j, *crawfordi*, n. sp., paratype; k, *floydandrei*, n. sp., holotype; m, *verbesinae* Sakimura, paratype; n, *curta* Hood, holotype of *Isochaetothrips unicolor* Moulton; p, *achaeta* Hood, from Colorado; q, *tympanona* Hood, paratype; r, *valdiviana*, n. sp., paratype, from Coquimbo, Chile.

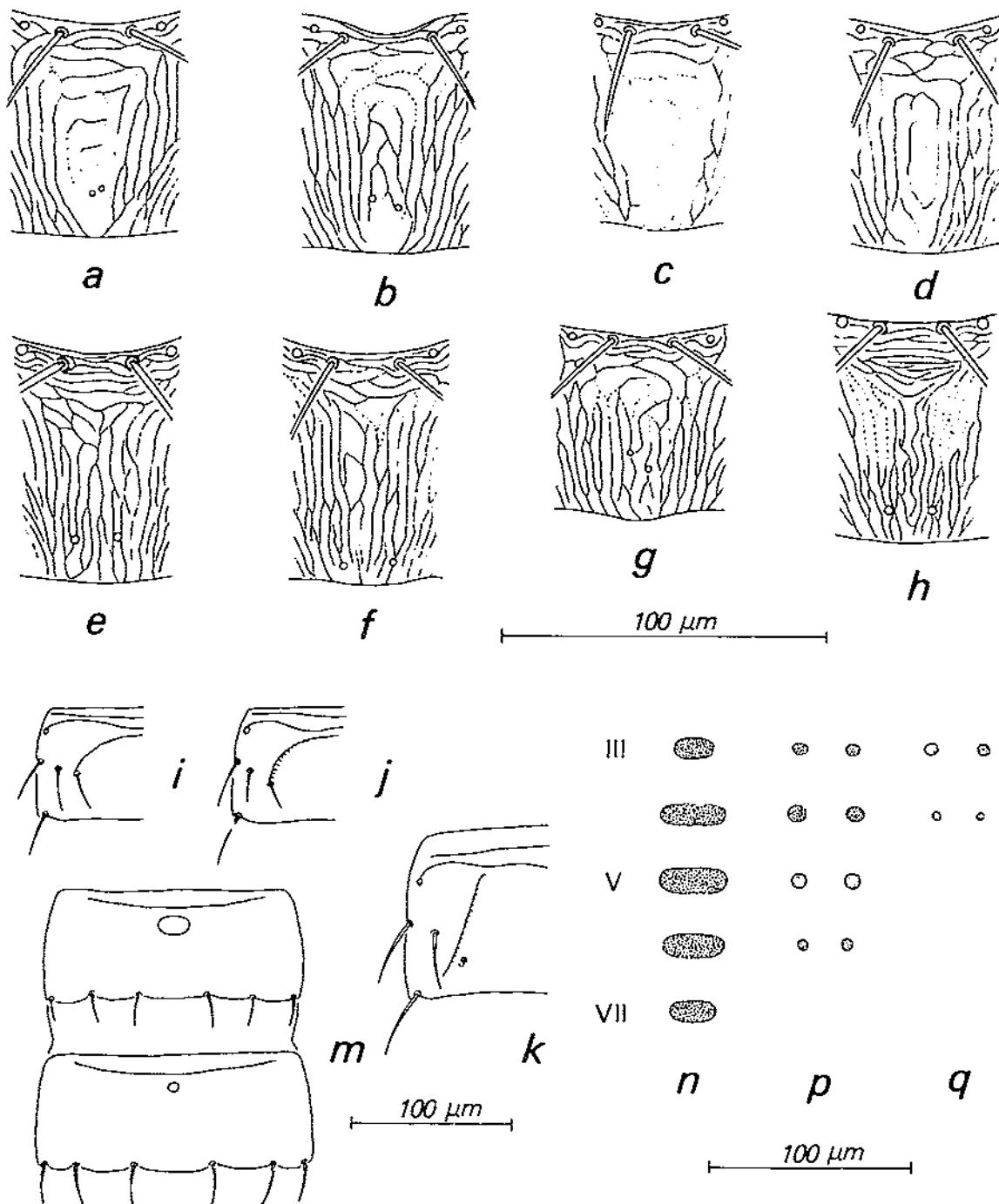


FIGURE 9.—*Frankliniella* species. Metascutum, mesal area, seta ii shown by only its socket, ♀: a, *magellanica*, n. sp., paratype; b, *pestinæ*, n. sp., holotype; c-d, *minuta* (Moulton), from Morelos, Mexico; e, *colombiana* Moulton, paralectotype; f, *davidsoni* (Moulton), paralectotype of *watsoni* Moulton; g, *nakuharai*, n. sp., paratype; h, *trisetosa* Hood, paratype. Tergite IV, chaetotaxy and ctenidia, ♀: i, *curta* Hood, seta ii normal and ctenidium absent, usual combination; j, *minuta*, seta ii normal but short ctenidium present; k, *cratfordi*, n. sp., seta ii reduced and short ctenidium present. Sternites III-IV of ♀ with glandular areas: m, *magellanica*. Glandular areas of ♂: n, *deserticola*, n. sp., on sternites III-VII; p-q, *tuttlei*, n. sp., often wanting on distal sternites.

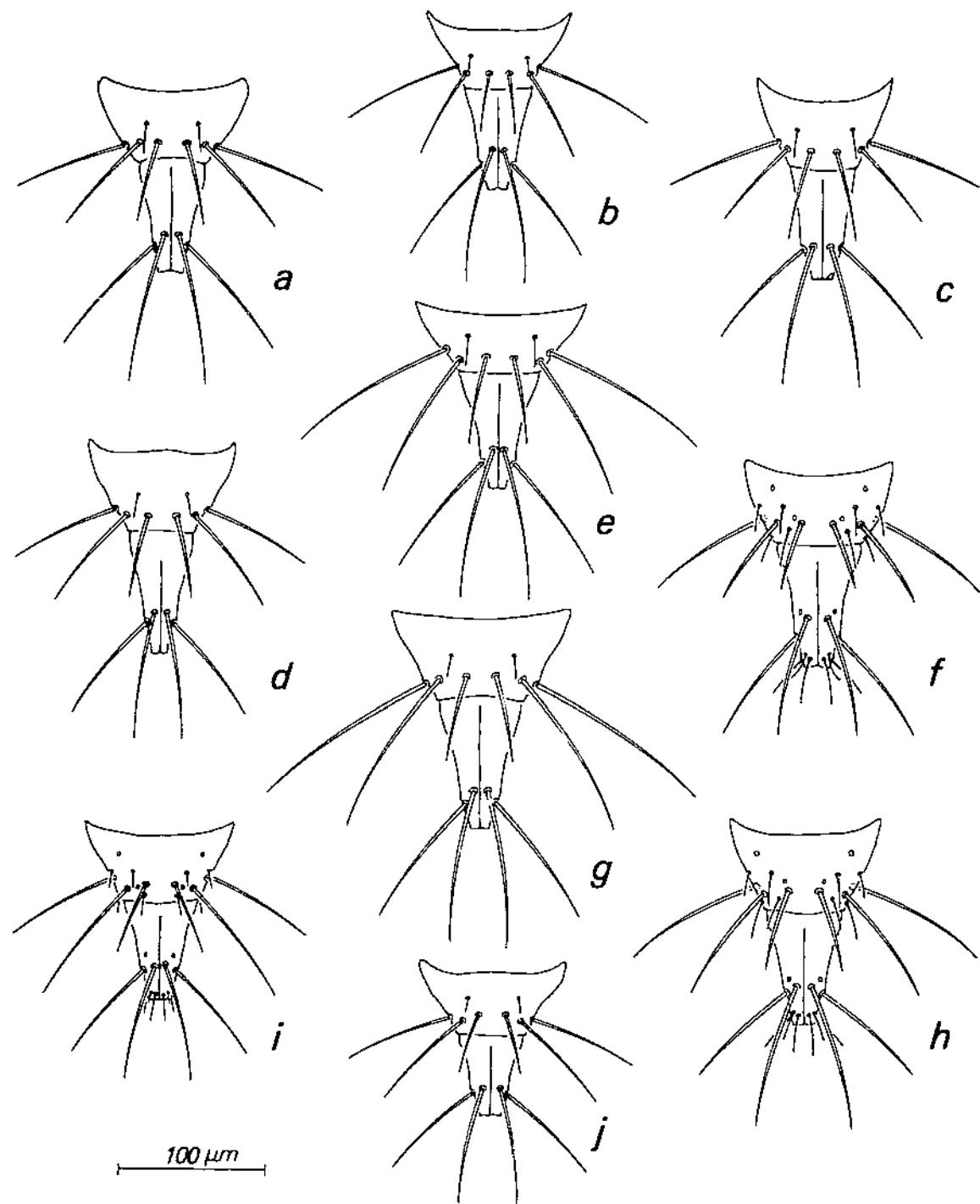


FIGURE 10.—*Frankliniella* species. Caudal segments IX–X, ♀, minor setae shown or not shown: *a*, *trisetosa* Hood, paratype; *b*, *tympanona* Hood, paratype; *c*, *colombiana* Moulton, paralectotype; *d*, *oxyura* Bagnall, paralectotype; *e*, *achaeta* Hood, allotype of *Taeniothrips pearsalli* Moulton; *f*, *valdiviana*, n. sp., paratype, from Coquimbo, Chile; *g*, *davidsoni* (Moulton), holotype; *h*, *magellanica*, n. sp., paratype; *minuta* (Moulton); *i*, Holotype; *j*, from Morelos, Mexico, segment X variable in length.

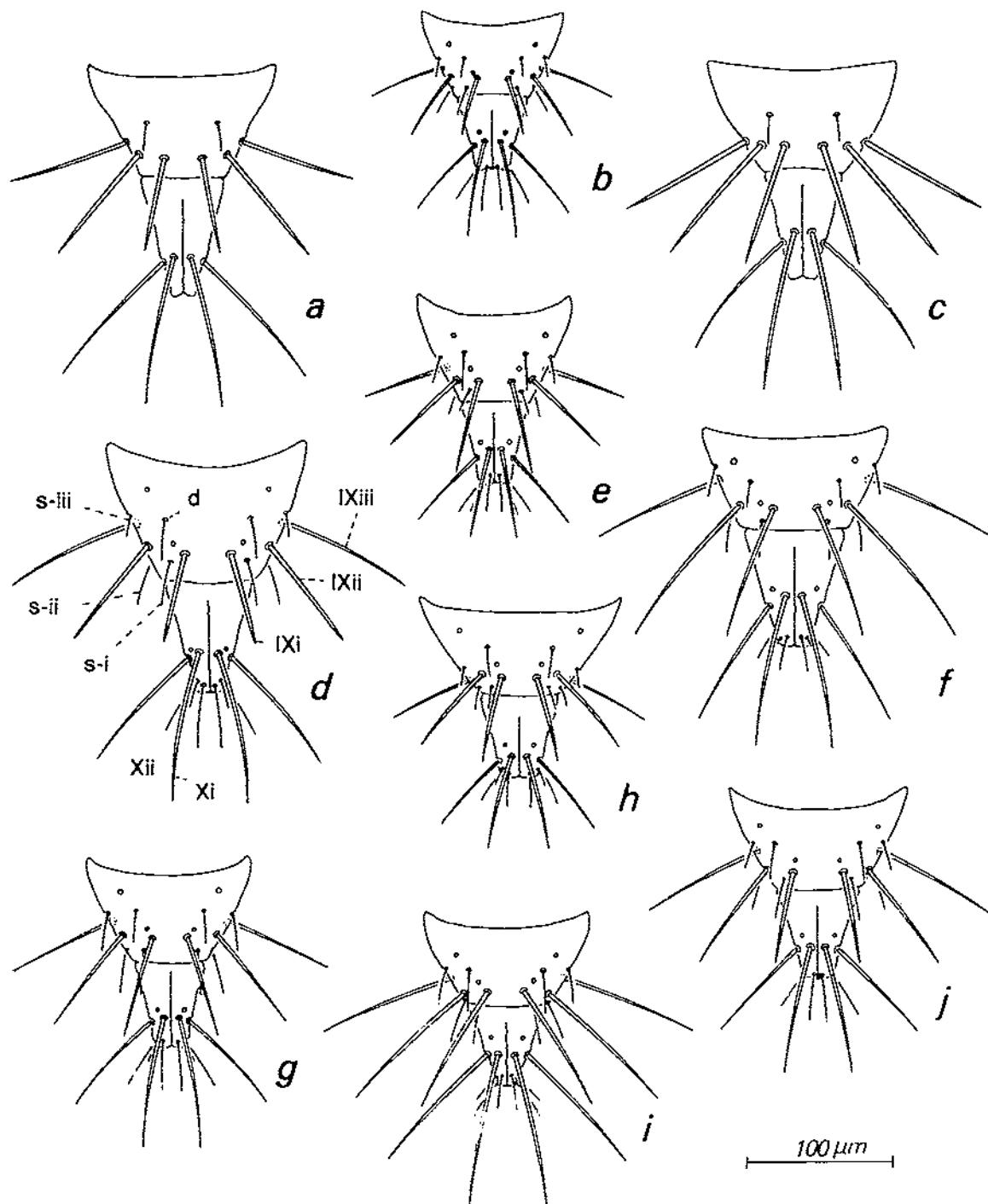


FIGURE 11.—*Frankliniella* species. Caudal segments IX-X, ♀, minor setae shown or not shown: *a*, *serrata* Moulton, holotype; *b*, *jamaicensis*, n. sp., holotype; *c*, *verbesinae* Sakimura, paratype; *d*, *crawfordi*, n. sp., paratype (for explanation of letters, see "Abbreviations and Definitions"); *e*, *nakaharai*, n. sp., paratype; *f*, *pestinae*, n. sp., paratype; *g*, *floydandrei*, n. sp., holotype; *h*, *deserticola*, n. sp., paratype, from Arizona; *i*, *caudiseta*, n. sp., holotype; *j*, *konoi*, n. sp.

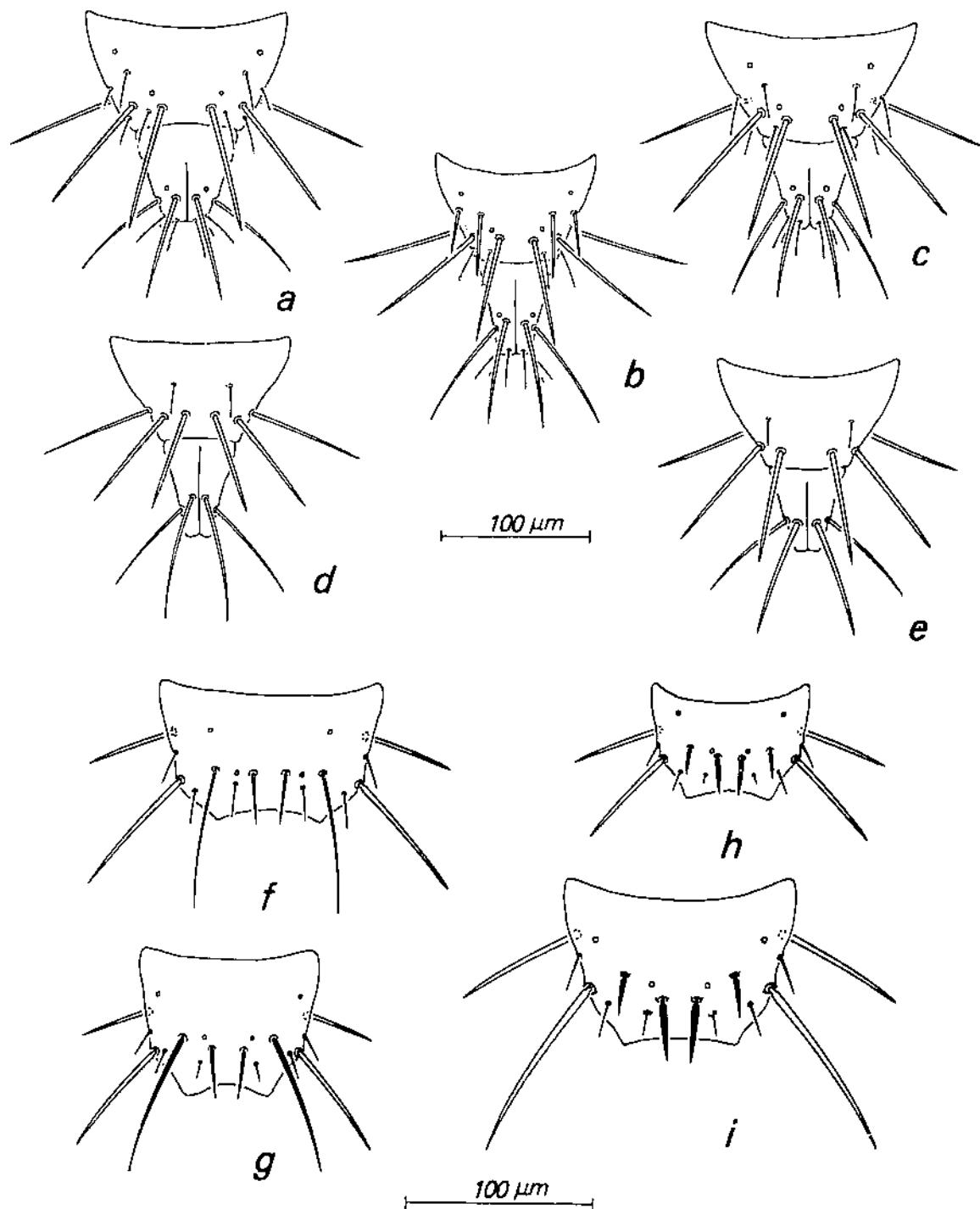


FIGURE 12.—*Frankliniella* species. Caudal segments IX-X, ♀, minor setae shown or not shown: a, *ewarti*, n. sp., paratype; b, *desantisii*, n. sp., paratype; c, *tuttlei*, n. sp., paratype; d, *curta* Hood, holotype of *Isochaetothrips unicolor* Moulton; e, *bertelsi* (De Santis), paratype. Chaetotaxy of tergite IX, ♂, examples of *intonsa* group: f, *intonsa* (Trybom); g, *insularis* (Franklin); h, species near *sulfuripes* Hood; example of *tritici* group: i.

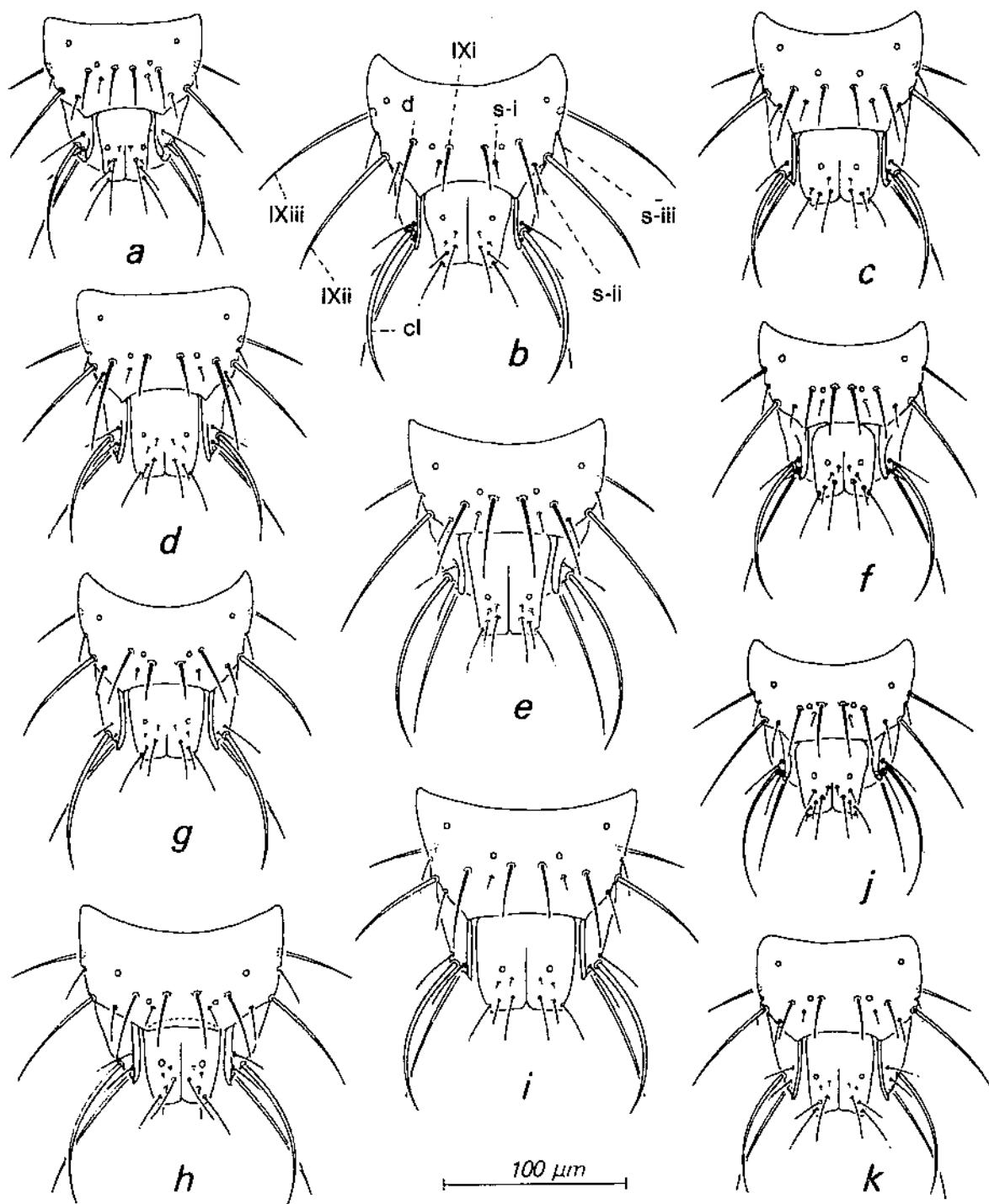


FIGURE 13.—*Frankliniella* species. Caudal segments of IX – X, ♂: a, *oxyura* Bagnall, from Espírito Santo, Brazil; b, *magellanica*, n. sp., paratype (for explanation of letters, see "Abbreviations and Definitions"); c, *deserticola*, n. sp., paratype, from Arizona; d, *bertelsi* (De Santis), from Santa Catarina, Brazil; e, *achaeta* Hood, holotype of *Taeniothrips pearsalli* Moulton; f, *tympanona* Hood, paratype; g, *valdiviana*, n. sp., paratype, from Valdivia, Chile; h, *davidsoni* (Moulton), from California; i, *tuttlei*, n. sp., paratype; j, *minuta* (Moulton), from Morelos, Mexico; k, *colombiana* Moulton, paralectotype.

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