Liriomyza will help in predicting population densities vital to developing effective pest management tactics.

LITERATURE CITED


A REVIEW OF FRANKLINIELLA BRUNERI WATSON AND DESCRIPTION OF F. KELLIAE, N. SP.
(THYSANOPTERA: THRIPIIDAE)

K. SAKIMURA
Bishop Museum, Honolulu, HI 96819

ABSTRACT

Frankliniella bruneri Watson, 1925 was rediscovered for the first time in the past 55 years to be a valid species, and is rediagnosed. Frankliniella pseudotritici Priesner, 1932 and inornata Moulton, 1936 are newly found synonyms. Frankliniella kelliae, n. sp., mounted together with the type series of bruneri, has otherwise long been confused with another well known species, F. difficilis. Both F. bruneri and kelliae are widely spread and common general flower feeders in the Caribbean area.

RESUMEN

Frankliniella bruneri Watson, 1925, fue descubierto de nuevo después de 55 años como una especie válida, y se diagnostica de nuevo. Frankliniella pseudotritici Priesner, 1932 y F. inornata Moulton, 1936 son sinónimos nuevos. Frankliniella kelliae n. sp. montada junta con la serie típica de F.
Bruneri, ha sido confundido por largo tiempo con otra especie bien conocida. F. difficilis. F. bruneri y F. kelliae se alimentan de las flores de diferentes especies y son comunes y distribuidas largamente en la región del Caribe.

Frankliniella bruneri Watson, 1925 from Cuba has remained completely obscure for the past 55 years because of its initial misplacement and insufficient specific description by Watson. Now it is rediscovered to be a valid species and furthermore found to be a widely spread and very common general flower feeder in the western Caribbean area. Frankliniella pseudotritici Priesner, 1932 from Mexico and F. inornata Moulton, 1938 from Cuba are newly found synonyms of the species. Another Frankliniella sp. mounted together with the type series of bruneri is another widely spread and very common general flower feeder in the central Caribbean area, and is described here as a new species. The type series of bruneri studied is a loan from the Florida State Arthropod Collection (FSAC).

Frankliniella bruneri Watson, REINSTATED, REVISED STATUS
(Fig. 1-4)

Frankliniella tritici: Watson 1924:46 (misidentification).
Frankliniella cephalica bruneri Watson, 1926:54; Moulton 1948:91.
Frankliniella gemina pseudotritici Priesner, 1932:179, NEW SYNONYM.
Frankliniella inornata Moulton, 1936:62; Moulton 1948:63, 94, fig.; Jacot-Guillarmod 1974:782, NEW SYNONYM.

No second collection of this species has been on record, and no subsequently so determined specimen remains in either USNM or CAS (California Academy of Sciences). Moulton (1948) who had apparently not seen the type series accepted the species as valid, but Jacot-Guillarmod (1974) summarily synonymized with F. cubensis, without seeing the type series. This synonymy has no merit.

Type Series: The type series designated for F. cephalica bruneri consists of a long series of specimens (30 ♂♂, 4 ♀♀) collected by S.C. Bruner at La Jaula on Peninsula de Duanaheacabices (2 slides) and Santiago de las Vegas (9 slides), Cuba from February to April, 1924 from various hosts: orange, avocado, Hibiscus rosasinensis, Phaseolus hvelvis, Moringa sp., and Rosa sp. Watson (1924) first determined these as F. tritici (Fitch), but 2 years later redetermined them as F. cephalica bruneri, n. sp. (1926). The presently remaining type series, which is probably in its entirety, in FSAC is 55 adults and 4 larvae mounted together on 9 slides with Watson’s inscription of “type and paratypes” or “paratypes”, and 2 other toptopic slides lacking the type status inscription but with same collection data and Watson’s writing of bruneri, n. sp. All the specimens on these slides are determined as shown in Table I.

Watson (1926) was deficient in describing the specific diagnostic characters, but then few points mentioned, such as yellowish orange ocular crescent, dimensions of antennal segments II-IV with diminutive dorsoapical
Fig. 1-8. 1-4, *Frankliniella bruneri* (specimens all from Jamaica): 1. Head and prothorax (♀); 2. Antenna, right (♀); 3. Tergite V (♀); 4. Tergite IX (♂). Fig. 5-8, *F. kelliae*: 5. Head and prothorax (paratype ♀); 6. Antenna, left (paratype ♀); 7. Pedicel of antennal III (paratype ♀); 8. Tergite IX (allotype ♂).

production on II and undilated pedicel ("narrow peduncle") of III make Watson’s *bruneri* fit only Sp. No. 1 (Table 1). Species No. 1 is also predominating in numbers among all the specimens mounted, and is uniformly represented on every one of the 11 slides, except one that is paired with the other slide of the same collection. Species Nos. 2 and 3 have bright red ocellar crescents, Nos. 2, 3 and 4 all have dilated pedicels, No. 4 has a slender antenna, and No. 5 has a dark body. Watson’s placement (1926) of
TABLE 1. SPECIES OF THRIPS MOUNTED TOGETHER WITH THE TYPE SERIES OF *Frankliniella bruneri*.

<table>
<thead>
<tr>
<th>Species</th>
<th>8 paratype and 2 topotypic slides</th>
<th>A slide with &quot;type and paratypes&quot; inscribed*</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>F. bruneri</em> Watson, 1926</td>
<td>14 ♀♀, 3 ♂♂</td>
<td>3 ♀♀</td>
<td>17 ♀♀, 3 ♂♂</td>
</tr>
<tr>
<td>2. <em>F. cubensis</em> Hood, 1925</td>
<td>5 ♀♀</td>
<td>1 ♀</td>
<td>6 ♀♀</td>
</tr>
<tr>
<td>3. <em>F. difficilis</em> Hood, 1925</td>
<td>2 ♀♀</td>
<td>1 ♀</td>
<td>1 ♀</td>
</tr>
<tr>
<td>4. <em>F. kelii</em>, n. sp.</td>
<td>2 ♀♀</td>
<td>1 ♀</td>
<td>2 ♀♀</td>
</tr>
<tr>
<td>5. <em>F. insularis</em> (Franklin, 1908)</td>
<td>2 ♀ ♂</td>
<td>3 ♀♀</td>
<td>2 ♀ ♂</td>
</tr>
<tr>
<td>6. <em>F. sp.</em> (damaged)</td>
<td>1 ♀</td>
<td>1 ♀</td>
<td>27 ♀ ♀, 8 ♂ ♂</td>
</tr>
</tbody>
</table>

*Collection data: La Jaula, orange and avocado, 6-IV-1924, S. C. Bruner.

This species in the cephalotea group was in error. This error was the primary cause for a long obscurity in which this species had remained until today.

**Holotype:** Among the 3 females of *bruneri* on the "type and paratypes" slide, the only one in dorsal mount is selected for the holotype, and a new label is additionally placed. The holotype is redescribed as follows: Color as is described in Diagnosis. Body 1610 (all measurements in micrometers; denotes length only unless otherwise stated; w. = width) (contracted to 950); head about 105, w. 150; interocellar seta 48, postocular seta iv 39. Antenna 268, length (width) of segments: 23 (26), 42 (24.5) (dorsocaudally elevated a little but hardly produced), 53 (21) (pedicel undilated), 43 (20), 34 (18), 45 (17), 6.5 (6.5), 10.5 (5). Pronotum 130, w. 189; setae: anteromarginal 64, anteroangular 62, posteroangular i 82, ii 71, posteromarginal ii 49; pterothorax 200; forewing 750, hind vein with 16 setae; hind tibia 170. Abdomen 1040; comb on tergite VIII indiscernible because of insufficient clearing (see Diagnosis); ovipositor 230; caudal setae: IXi 105, ii 109, III 115, XI 112, II 102.

**Diagnosis:** A total of 36 ♀♀ and 11 ♂♂ from Cuba, Jamaica and Mexico were measured for this diagnosis. Specimens from Mexico are generally far larger than others. The male form has heretofore not been described. *Intona* group—*runneri* complex. **Female:** Yellow body without any gray shading or blotching (see next paragraph); antenna 1 pale, 11 grayish brown, basally pale (almost totally pale when teneral), III-V pale yellow, distal 1/3-1/2 of III, 3/4 of IV, 1/4-1/3 of V grayish brown, VI-VIII grayish brown; ocellar crescent brown to reddish brown; wing pale yellow; major setae dark brown to dark grayish brown; integumental sculpture inconspicuous everywhere. Body 1.41-1.86 mm (all distended). Head (Fig. 1) 105-122, broad and rather short (1.4-1.5 times as wide as long); mouth cone fairly long, straight and tapered; interocellar seta about 1/2 as long as head, between anterior and posterior ocelli, postocular seta iv about 2/3 of interocellar seta. Antenna (Fig. 2) 252-303, 2.4-2.6 times as long as head, II somewhat dorsocaudally elevated but not produced, III 2.4-2.6 times as long as wide, pedicel simple, style stout (VII+VIII/VII w. = 2.6-2.9). Pronotum (Fig. 1) 1.3-1.2 times as long as head, all major setae subequal, about
1/2 as long as pronotum, posteroangular setae i somewhat longer, postero-
marginal seta ii about subequal to intercellar seta, 4 minor setae between
anteromarginal setae. Forewing with 14-17 setae on hind vein. Abdomen:
stenidia and chaetotaxy of tergites normal for the genus; comb on tergite
VIII complete, teeth medium in length, sometimes shorter at middle, sparse;
tergites IX-X with all major setae nearly subequal to each other in length,
all longer than tergite X. Male: Pale than female, frail, antenna colored
as female but II often pale and VI sometimes weakly pale at base. Body
1.61-1.32 mm; head 87-105, about 1.4 times as wide as long; antenna 222-260,
2.5-2.6 times as long as head; sternites III-VIII with large subcircular gran-
dular area (30-45 μm across); tergite VIII with comb complete but teeth
very small; tergite IX (Fig. 4) with 2 pairs of thick major setae on dorsum,
outer pair 2.4-3.3 times as long as inner pair; 2 other major setae on side
and clasper of sternite in thick and long thorns, sometimes not quite thick-
ened when terminal.

Muscle Marks: Among many specimens examined, some females were
seen with an ill-defined, small, circular, faint, brown mark (Fig. 3) near
both anterolateral corners of tergites III-VII. These newly discovered marks
among Franklinsiella are not related to ordinary grayish brown blotchings
on tergites. These are always in the mesal area along antecosta. According
to the interpretation by B. Hening, the muscle marks are localized heavier
c sclerotization of the cuticle at the origins of some of the lateral abdominal
tergo-tergal muscles (Priesner 1926: 60; Hood 1932: 1-6). The muscle
marks of this species are usually very faint and discernible only on well
cleared specimens, but rarely become fairly conspicuous. The incidence
of markings was found persistently among every series from Cuba (but not
seen on the type series), Jamaica and Mexico. Similar muscle marks were
also found in F. kelliae and difficile. (See pages 489 and 490.)

RELATIONSHIPS: Franklinsiella bruni is one of the congeners of the
brunii complex of the intensa group. All congeners are common in possess-
ing a normal head shape, undilated antennal pedicle, and pale to yellow
body without any blotching on abdomen. They are all poorly characterized
from each other, and diagnostic characters are very limited in most of the
cases. A workable key to species is desperately needed. Franklinsiella bruni,
together with gossypiana Hood, belongs to a small group that is charac-
terized by fully developed postocular seta iv, anteromarginal pronotal seta
subequal to anteroangular seta, aerial style stout, and straight and
tapered mouthcone. Franklinsiella gossypiana differs by having a narrower
head (1.3 times as wide as long), larger comb of tergite VIII, and narrowly
spaced occipital striae. Another closely related species is F. gemina Bagnall,
a common general feeder from South America, that differs by having a
distally recurved and bulky mouthcone with its tip not extending beyond
the mentum in dorsal view.

SYNONYMS: While this species remained in obscurity, it was twice de-
scribed under different names, F. pseudotritici Priesner from Mexico (Fed-
eral District, Veracruz) and inornata Moulton from Cuba. The type series
of both species on loan from Senckenberg Museum (SMF) and CAS were
compared with that of bruni.

DISTRIBUTION AND BIOMORPHS: A long series from Jamaica (Sakimura)
and other long series from Cuba and Mexico (USNM, CAS) revealed that
bruneri is widely distributed on the islands of Cuba and Jamaica, and from southern Texas to southern Mexico along the Gulf coast, further south from Yucatan to Costa Rica (SMF), and probably also into Panama and Colombia. So far no specimen of this species from southern Florida has been seen. However, its distribution is very likely extended over southern Florida. This is a common and abundant general flower feeder with a very large host range including many ornamental, crop and uncultivated plants. This species has long been known to be common among cut flowers imported from Mexico to the U. S. All specimens were misidentified in the USNM Collection as *F. trehernei* Morgan by the late D. Moulton. Additional notes on its bionomics are being prepared by the author.

*Frankliniella kelliae* Sakimura, New Species
(Fig. 5-8)

This species had long been confused with *F. difficilis* Hood, 1925, and remained unstudied until quite recently. The earliest specimens discovered in the USNM Collection were collected in 1912 at Key West, Florida, and again in 1915 at Santiago de las Vegas, Cuba. The latter (Cardin 1918: 98) was submitted for determination to Hood who left them unnamed. Several other subsequent specimens (USNM, CAS) were found misidentified as *F. difficilis* or *tritici* (Pitch), or left undetermined. The first critical study was made by Kellie O’Neill in 1965 with the material collected by the present writer from Jamaica. Her conclusion was that they represented a closely related but separate species from *difficilis*. By a mere coincidence, 5 specimens of this species were found mounted together with the type series of *F. bruneri* collected in 1924 at La Jaula, Cuba (Table 1). A new species is designated here, and is named after Kellie O’Neill in appreciation of her broad knowledge on the vast numbers of the American species of *Frankliniella*. Measurements given in the following description are based on samples from 11 different populations (12♂♀, 3♂♂) from Jamaica and 2 others (4♂♀, 2♂♂) from Cuba.

**BRIEF DIAGNOSIS**: Tritici group—*difficilis* subgroup. Yellow body without any abdominal blotching; ocellar crescent brownish; antennal III with mushroom form pedicel, anteromarginal pronotal seta subequal to anterone marginal seta, comb of tergite VIII always complete but sometimes very short, caudal setae nearly subequal to each other, male with discal seta on tergite IX well developed and far larger than seta XI, without comb on tergite VIII. Easily confused with *F. difficilis* in female, but distinct in male.

**DESCRIPTION**: Female including holotype: Pale yellow body without any brown blotching on abdomen, muscle marks on tergites III-VII as in *F. bruneri* (Fig. 3), clearly visible but rarely not; antennal I pale, II-V yellow, distal 2/3 of II grayish brown washed, distal 1/3 of III and extreme of V brown washed, distal 3/4 of IV dark grayish brown, VI-VIII dark grayish brown; ocellar crescent brownish; wings pale yellow; major setae brown to dark grayish brown; integumental sculpture inconspicuous except at sides of tergites and laterotergites. Body 1370-1660 (1610) (measurement in parentheses following the range denotes holotype or allotype); head (Fig. 5) 97-112 (112), w. 140-158 (156), 1.4-1.5 times as wide as long; mouth
cone rather short, straight and tapered; intercellar 39-54 (43), 0.3-0.5 of head, variable, near the outer common tangent of anterior and posterior ocelli; postocular iv 28-39 (39), 0.6-0.9 of intercellar, variable. Antenna (Fig. 6) 250-292 (292), 2.5-2.6 times as long as head; II 37-41 (41), w. 22-24 (24), 1.6-1.8 times as long as wide, dorsoapically somewhat elevated but hardly produced; III 49-59 (56), w. 18-21 (20), 2.6-3.0 (2.8) times as long as wide, pedicel (Fig. 7) in regular mushroom form; style stout (VII + VIII / VII w. = 2.6-2.9); length (width) of all segments of holotype: 28 (28), 41 (21), 56 (20), 50 (18.5), 38 (18.5), 49 (17), 7 (7), 10 (5.5). Pronotum (Fig. 5) 117-133 (133), w. 153-191 (186), 1.4-1.5 times as wide as long, 1.1-1.2 of head; anteroangular 51-64 (64), 0.4-0.5 of pronotum, anteromarginal 44-59 (59), 0.8-1.0 of anteroangular, usually subequal but rarely a little smaller, somewhat variable, 4 minor setae between anteromarginals; posteromarginal i 60-79 (76), ii 51-68 (68), subequal, 0.4-0.6 of pronotum, posteromarginal ii 33-50 (50), 0.3-0.4 of pronotum. Pterothorax 184-212 (204); forewing 600-790 (750), with 14-18 setae but usually 15-16 on hind vein; hind tibia 153-179 (179). Abdomen 870-1070 (1070), ctenidia and discal setae on tergites normal for the genus, comb on tergite VIII always complete but variable in length (5-12), ovipositor 198-225 (222); caudal setae: IXi 77-102 (91), ii 90-120 (105), iii 89-115 (100), Xi 99-113 (111), ii 84-105 (102), subequal each other.

Male including allotype: Body paler than ♀, antennal I pale, II-III and V yellow, nearly without brown or gray wash at all, IV yellow with distal 1/2 grayish brown, VI-VIII grayish brown, VI sometimes lighter at extreme base; without muscle marks. Body 920-1180 (1180), head 101-106 (106), w. 130-138 (138), 1.3 times as wide as long, intercellar 36-40 (39), postocular iv 24-33 (29), antenna 288-292 (292), both II-III similar in length / width to ♀. Pronotum 145-155 (153), w. 105-111 (111), 1.4 times as wide as long, anteroangular 40-49 (45), anteromarginal 41-44 (48). Comb on tergite VIII absent, glandular areas on sternites III-VII large, transverse, oblong; genitalia about 93. Caudal setae (Fig. 8): IXi 15-19 (19), discal 54-60 (54), IXii 45-53 (55), iii 39-46 (43), clasper 62-73 (73), the first 2 in thick seta form with discal far larger than 1, the last 3 in blackish thorn form and thickness somewhat variable among specimens.

Type: Holotype ♀, allotype δ, Jamaica, Kingston, Hope Garden, Tithonia diversifolia fl., 15-XI-1964, K. Sakimura (Saki 4408-1 ♀, —3 δ) USNM Type 100069. Paratypes: same data, 1 ♀, 2 δ ♀; same locality and date, Blighia sapida fl., Bauhinia triandra fl., Calophyllum inophyllum fl., and Caesalpinia coriaria fl., 16 ♀ ♀; Bryan Castle, Eupatorium odoratum fl., 1 ♀; Bengal, Lantana camara fl., 1 ♀; Falmouth, Canavalia rosea fl., 3 ♀ ♀; Round Hill, Barnett, Bengal, and Woodstock, all from Cocos nucifera male fl., 7 ♀ ♀; Hope Garden, Cassia siamea fl., 3 ♀ ♀; all these 32 ♀ ♀, 2 δ ♀ paratypes: 15 XI-8-XII-1964, Sakimura (Saki 4404a, 4408, 4416c, 44411, 4449c, 4454a, 4455a, 4476, 4477, 4520a, 4530a), R. Latta (Saki 4494) (Sakimura).


DISTRIBUTION AND BIONOMICS: The above data indicate that collections were made from Florida, Bahamas, Cuba, Jamaica, Dominican Republic, and Puerto Rico. The species is apparently distributed widely in the central Caribbean area, and is a very common general flower feeder. Additional notes on its bionomics are being prepared by the author.

RELATIONSHIPS: Frankliniella kelliiae and difficilis are closely related and have only a few distinguishing features such as color of the ocellar crescent and, in the male, the comb of tergite VIII and chaetotaxy of tergite IX. Muscle marks are present in both species but apparently are less common in difficilis. When the male is not collected together with the female and the ocellar crescent is faded on the mounted specimens, there has been and will be no way to make a reliable separation between them. Frankliniella difficilis differs from kelliiae by having a red ocellar crescent, and, in the male, by having a short but complete comb with both IXi and discal setae being in a thorn form of subequal lengths (about 25-30 μm long).

Another allied species is F. tritici that is often lacking the brown abdominal blotchings of the pale form in the Caribbean area. It differs from kelliiae by having shorter anteromarginal pronotal seta than anteroangular seta, and incomplete comb on tergite VIII.

ACKNOWLEDGMENTS

Acknowledgments are gratefully made to H. A. Denmark, Florida Department of Agriculture and Consumer Services, Gainesville; Steve Nakahara and Kelli O’Neill, Systematic Entomology Laboratory, U. S. Department of Agriculture, Beltsville, MD; Richard zur Strassen, Senckenberg Museum, Frankfurt a. M., Germany; D. H. Kavanaugh and P. H. Arnaud, Jr., California Academy of Sciences, San Francisco; and B. Heming, University of Alberta, Edmonton, Canada for cooperation in allowing loans of type material, providing advice and information upon inquiries, or extending generous cordiality and assistance while I was visiting the collections.

LITERATURE CITED


———. 1948. The genus Frankliniella Karny, with keys for the determination of species (Thysanoptera). Rev. Ent. (Rio de Janeiro) 19: 55-
BIONOMICS OF THE BROMELIAD-INHABITING MOSQUITO WYEOMYIA VANDUZEII AND ITS NURSERY PLANT TILLANDSIA UTRICULATA

J. H. FRANK and G. A. CURTIS

ABSTRACT

Aquatic stages of the mosquito Wyeomyia vanduzeii Dyar & Knab inhabit leaf axils of the epiphytic bromeliad Tillandsia utriculata L. in southern Florida.

Rough-barked trees provide a substrate for T. utriculata and a habitat for W. vanduzei. The volumetric capacity of T. utriculata leaf axils can be estimated from length of longest leaf (volumetric capacity in ml = 0.003251 x leaf length in cm$^{2.7799}$). In each plant, older, larger axils provide most of the volumetric capacity, but the outermost axils lose their ability to retain water. Water entering bromeliad axils is throughfall, i.e. rainfall reduced in volume but enriched with nutrients as it penetrates the tree canopy (throughfall mm = −0.2715 + (0.8825 x rainfall mm) in a high marsh study area). Organic debris from the tree canopy (estimated annual mean 2.4 g/m$^2$/day in a high marsh study area), trapped and decomposed in the bromeliad axils, also provides nutrients for aquatic organisms and for the bromeliad. The perennial bromeliad provides a stable habitat for mosquito larvae.

The number of mosquito eggs laid in axils is influenced by the size, water content, senescence and flower production of the bromeliad; as many are laid in the smaller, inner axils as in the larger, outer axils. At 27°C, most floating eggs hatched within 48 and 96 h. Eggs stranded out of water suffered loss in numbers and in viability, with combined loss at 10 days of 49%, at 20 days of 77%, and at 30 days of 95%

RESUMEN

En el sur de la Florida (EUA), los estadios acuáticos del mosquito Wyeomyia vanduzeii Dyar & Knab habitan en las axilas de las hojas de la bromelía epífita Tillandsia utriculata L.

Árboles con la corteza rugosa proveen un substrato para T. utriculata y un hábitat para W. vanduzei. La capacidad volumétrica de las axilas de las hojas de T. utriculata puede ser estimada del largo de la hoja más larga (capacidad volumétrica en ml = 0.003251 x largo de la hoja en cm$^{2.7799}$). En