

REVIEW OF THE NEW WORLD LEAFHOPPER GENUS *EXCULTANUS* OMAN (HEMIPTERA: CICADELLIDAE: DELTOCEPHALINAE)

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Abstract.—The taxonomy of the New World genus *Excultanus* is reviewed. *Excultanus argillaceus* (Van Duzee) is placed under *E. excultus* (Uhler), **n. syn.** *Excultanus paraconus*, **n. sp.** is described from Costa Rica. The known southward limit of the genus is extended from Guatemala to Misiones, Argentina. A key to the 12 species is provided, as well as a checklist with critical synonymies and distribution summaries.

Key Words: taxonomy, vector, Athysanini, *Excultanus*

About 150 of the 350 genera of U.S. leafhoppers have species in Mexico, yet only about 200 species occur in both countries. Furthermore, the number of leafhoppers known from the U.S. (approximately 3,000) is more than double the number known from Mexico, despite its relatively large size and topographical complexity. The situation for Central America is similar: 80 genera but only 65 leafhopper species are shared with the U.S., and fewer than 900 Central American species have been described. These figures suggest two important generalizations: (1) the Mexican and Central American faunas must be taken into account to provide comprehensive identification tools for U.S. leafhopper genera; and (2) the Mexican and Central American faunas are poorly known and likely contain several thousand leafhopper species new to science, including many belonging to genera that also occur in the United States.

The genus *Excultanus* is one such genus. *Excultanus* occurs in the United States, Mexico, Central America, from which one new species is here described, and South America. While the genus includes a known

vector of potential importance to California celery crops [i.e., *E. incurvatus* (Osborn & Lathrop); Nielson 1968b], there have been no synopses of the whole genus.

Literature citations designated with key letters are consistent with the bibliographies by Metcalf (1964a) and Oman et al. (1990).

REVIEW OF LITERATURE

Oman (1949a) erected the new subgenus *Texananus* (*Excultanus*) for eight species having a broadly excavated sternum VII in the female and lacking a posterior extension of the connective in the male genitalia.

Crowder (1952a) provided a key to the four species that occur in the United States. Linnavuori (1959b) elevated *Excultanus* to generic status, the genus being distinguishable from other *Phlepsius*-like genera by the absence of a posterior projection of the connective below the aedeagus. When Linnavuori (1959b) elevated *Excultanus* to generic status, he treated only the Central American species but clearly intended it to include the Nearctic species also treated under the genus-group name, by citing Oman (1949a). Likewise, Nielson (1968b) explic-

itly accepted the generic rank of *Excultanus* but mentioned only *E. incurvatus*, the single species known to vector phytopathogens.

McKamey (2000) affirmed the placement of the three species already included in *Excultanus* and referred nine other species to the genus: six previously in *Texananus* (*Excultanus*) and three [*E. parrai* (DeLong), *E. plummeri* (DeLong) and *E. horridus* (DeLong)] from *Texananus* but previously unplaced to subgenus, bringing the total number of species to 12. One new species is described and one older species is placed in synonymy in this paper.

MATERIALS AND METHODS

Specimens for the study are from the National Museum of Natural History, Smithsonian Institution, Washington, DC (NMNH); the Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica (INBIO); the DeLong collection of Ohio State University, Department of Entomology, Columbus, Ohio, USA (OSUC); and the California Academy of Sciences, San Francisco, California (CASC).

The pygofer and genitalia were prepared by briefly boiling the abdomen in a weak potassium hydroxide (KOH) solution. KOH-treated parts were preserved in glycerin in polypropylene microvials beneath the specimens.

Digital images were captured at 400 dpi resolution by mounting a Sony DKC5000® digital camera on a Leica MZ-APO™ stereoscopic microscope (for the pygofer) or Leitz Diaplan™ compound microscope (for the aedeagus).

The ventral and dorsal margins of the male pygofer of some species [e.g., *E. conus* (DeLong)] are softer than surrounding areas of the pygofer and curl inwards if the abdomen remains in KOH too long. Hence, DeLong's (1939c, 1944h) description of the pygofer of *E. conus* being "curled inwardly on ventral side, appearing tapered to a pointed apex," while consistent with his illustration (1944h, fig. 3), is an artifact of

preparation. Brief treatment in KOH, such as the method used here, does not curl the pygofer margins.

RESULTS

Genus *Excultanus* Oman

Texananus (*Excultanus*) Oman 1949a: 142.

Type species by original designation: *Jassus excultus* Uhler 1877.

Excultanus; Linnavuori 1959b: 197 [elev. status].

Diagnosis.—Differing from other Deltocephalinae in having head narrower than pronotum (Fig. 1); forewing with appendix well developed; pronotum and usually forewing with vermiculate pigment lines (pl. 39, fig. 1 of Oman 1949a); subgenital plates with setae; male with genital connective lacking posterior projection below aedeagus; female sternum VII deeply excavated [except *E. hebraeus* (Ball)] and often with portion of underlying membranes visible. Resembles *Texananus* and other *Phlepsius*-like genera in having forewing covered with ramose or vermiculate pigment lines (Fig. 1).

Notes.—Illustrations of the female sternum VII and male pygofer and genitalia for most species were provided by DeLong (1944h) and Crowder (1952a).

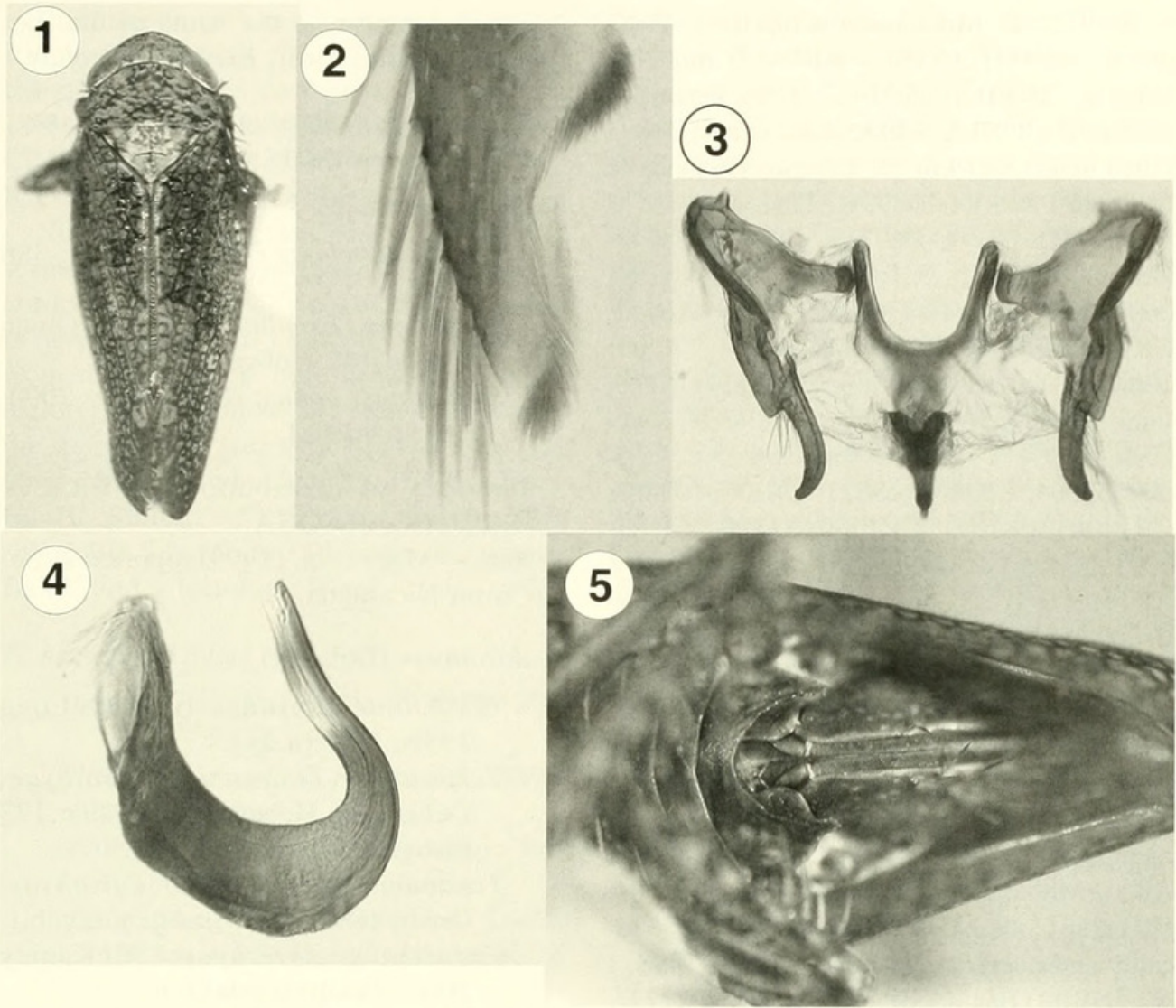
KEY TO SPECIES OF *EXCULTANUS*

- 1. Male pygofer less than or equal to length of subgenital plates; female sternum VII with portion of posterior underlying membranes visible, if excavated almost to base and with minute median projection (*E. conus*), then sternum VII length approximately $\frac{2}{3}$ its maximum width 2
- Male pygofer extending beyond subgenital plates; female sternum VII with portion of posterior underlying membranes not visible or, if visible (*E. dorothyae* and *E. eugeneus*), then triangular and attaining posterior margin of sternum VII or excavated almost to base, with minute median projection and sternum VII length approximately $\frac{1}{2}$ its maximum width 6
- 2. Male with anal segment X strongly produced ventrally, hanging within pygofer; female sternum VII deeply excavated, margins of excavation notched at mid length *plummeri*

- Male with anal segment X normal, ringlike, not produced ventrally; female sternum VII deeply excavated without notch at mid length along margins, or not excavated and with median notch 3
- 3. Male pygofer with conspicuous inner brushes of darkened bristles distally on dorsal and ventral margins; male pygofer length in lateral view about 1.5 × height; female sternum VII deeply excavated and underlying membranes not visible *horridus*
- Male pygofer without inner brushes of bristles on margins; male pygofer in lateral view about as long as tall; female sternum VII deeply excavated and underlying membranes visible or if membranes not visible (*E. hebraeus*), then not excavated and with median notch 4
- 4. Male pygofer apex bluntly rounded; female sternum VII with visible portion of posterior underlying membranes rectangular, extending from median excavation to lateral margin *dorothyae*
- Male pygofer apex truncate; female sternum VII underlying membranes either not visible or with visible portion oval and lying entirely within deep excavation (as in Fig. 5) 5
- 5. Male pygofer apex bilobed dorsoposteriorly; aedeagal shaft extending nearly to dorsal margin of pygofer; female sternum VII not excavated, with median notch, underlying membranes not visible *hebraeus*
- Male pygofer apex single-lobed; aedeagal shaft extending dorsally to about mid height of pygofer; female sternum VII deeply excavated and with small median projection, underlying membranes visible *eugeneus*
- 6. Male pygofer without distal brush of bristles on ventral margin or apex; male pygofer in lateral view with distal half forming an equilateral triangle; female sternum VII sinuously excavated and smoothly concave medially with underlying pair of membranes triangular *excultus*
- Male pygofer with conspicuous inner brush of darkened bristles distally (Fig. 2), though not always at apex; male pygofer in lateral view with distal half length greater than pygofer height, not forming an equilateral triangle; female sternum VII excavation either not sinuous or bearing acute notch medially, with underlying pair of membranes oval (Fig. 5) 7
- 7. Male pygofer with inner brushes of bristles on dorsal and ventral margins; female sternum VII excavated approximately halfway to base with acute, V-shaped median notch *parrai*
- Male pygofer with inner brushes of bristles on ventral margins or at apex, or both (Fig. 2), but not on dorsal margins; female sternum VII excavated at least ⅔ to base, excavation medially either smoothly concave or with small median projection 8
- 8. Male pygofer with inner brushes of bristles on ventral margins, sometimes continuing to apex; female sternum VII length at least ⅔ its maximum width, posterior angles acute (Fig. 5) or excavation with small median projection, or with both conditions 9
- Male pygofer with inner brushes of bristles at apex only; female sternum VII length approximately ½ its maximum width, posterior angles truncate or rounded, excavation without median projection 11
- 9. Male pygofer apex weakly sclerotized, without bristled fringe; female sternum VII with posterior angles rounded, excavated almost to base and with distinct median projection *paralus*
- Male pygofer with strong sclerotization and bristle-fringed ventral margins continuing to apex; female sternum VII with posterior angles acute, excavation depth variable, sometimes with minute median projection 10
- 10. Male pygofer with bristle-fringed ventral margins linear (whether curled inwardly in KOH-prepared specimens or not curled inwardly); female sternum VII excavated almost to base *conus*
- Male pygofer with bristle-fringed ventral margins sinuous (Fig. 2); female sternum VII excavated about ⅔ its length (Fig. 5) *paraconus*, n.sp.
- 11. Male subgenital plates triangular, connective anterior arms V-shaped, and style with preapical concavity U-shaped; length including wings in repose 5.7–6.2 mm; female sternum VII with visible portions of underlying membranes about as long as wide *incurvatus*
- Male subgenital plates subtriangular but weakly attenuate on lateral margins, connective anterior arms U-shaped, and style with preapical concavity V-shaped; length including wings in repose 7.0–8.0 mm; female sternum VII with visible portions of underlying membranes about twice as long as wide *neomexicanus*

Excultanus paraconus McKamey,
new species
(Figs. 1–5)

Diagnosis.—Male pygofer with ventral margins sinuous and bearing a brush of dense bristles; female sternum VII with posterior angles acute, excavated posteriorly for about ⅔ of its length.



Figs. 1–5. *Excultanus paraconus*. 1, Male, dorsal view. 2, Male pygofer, right portion of ventral margin, ventral view, showing bristle-fringed, sinuous ventral margin. 3, Aedeagus, connective, and styles, dorsal view. 4, Aedeagus, lateral view. 5, Female sterna, ventral view, showing excavated sternum VII with visible ovoid portions of underlying membranes.

Description.—Measurements (mm). Length: male 6.6–7.0; female 7.0–7.6. Width across eyes: male 1.9, female 1.9–2.0.

Male and female similar externally. Frontoclypeus and pronotum darkly mottled fuscous, vertex and scutellum paler, forewing covered throughout with vermiculate infusate marks (Fig. 1). *Abdomen*: Male. Pygofer heavily sclerotized throughout, triangular in lateral view, covered with macrosetae, ventral margins (Fig. 2) sinuous in ventral view, with dense fringe of dark bristles, which are longest at convexities, almost absent at concavity, pygofer length

exceeding subgenital plates by half length of their mesal margins; subgenital plates triangular, lateral margins straight. Connective (Fig. 3) Y-shaped, anterior arms subparallel and separated from each other by approximately their length. Aedeagus (Fig. 4) articulated to connective, U-shaped, gradually tapering from base to apex; style (Fig. 3) with broad base quickly tapered, at mid length abruptly narrowed to slender distal $\frac{1}{3}$. Female sternum VII (Fig. 5) with posterior angles acute, excavated posteriorly for about $\frac{2}{3}$ its length.

Types.—Holotype ♂ [USNM] COSTA RICA: Puntarenas Prov., Puntarenas, 12-

VIII-1972, J. Maldonado C[apriles]. Paratypes [USNM]: COSTA RICA: 9 mi. NW Esparta, 22-VII-1965, 1 ♂, 1 ♀. Paratypes [INBIO]: COSTA RICA: Guanacaste Prov., Finca Jenny, 30 km N. Liberia, Guanacaste National Park, IX-1989, R. Espinoza, 8 ♂ 3 ♀, INBIO Bar Code No. CRI000025028, CRI000025546, CRI000152442, CRI000476339, CRI000476749, CRI000476741, CRI000025219, CRI000476734, CRI000476733, CRI000025606, CRI000476725; same locality, X-1989, E. Araya & R. Espinoza, 3 ♂ 4 ♀, INBIO Bar Code No. CRI000081664, CRI000108821, CRI000109428, CRI000130815, CRI000131397, CRI000130888, CRI000131051; same locality, XI-1989, 1 ♂, E. Araya & R. Espinoza, INBIO Bar Code No. CRI000138115; Estación Palo Verde, elev. 10 m, 12-23-XI-1991, R. U. Chavarria & D. Acevedo, Malaise 1 ♀, INBIO Bar Code No. CRI002800906, same locality 12 VIII-12 IX-1991, 1 ♀, INBIO Bar Code No. CRI002800983; Estación Experimental E. Jimenez Nuñez, 30-VII-1993, G. Allen, Malaise 6:00 pm–8:00 am, 1 ♀, INBIO Bar Code No. CRI002088831; same locality and nocturnal Malaise, 12-VIII-1993, 1 ♀, INBIO Bar Code No. CRI002072231; same locality and nocturnal Malaise, 15-VIII-1993, 2 ♂, 2 ♀, INBIO Bar Code No. CRI002088173, CRI001951879, CRI002072694 and CRI002072719; Parque Nacional Barra Honda, elev. 100 m, VIII 1994, M. Reyes, 1 ♀, CRI002005809.

Note.—One difference between *E. paraconus* and *E. conus* may be the strong curvature of the aedeagus in the latter. The variation of aedeagal curvature observed elsewhere in the genus when there are more specimens, for example in *E. excultus*, suggests that this is not as reliable a feature to distinguish the species. The distinctive ventral margin of the male pygofer in *E. paraconus*, on the other hand, appears consistent and can usually be observed in undissected specimens.

Etymology.—The specific epithet (adjective) is formed by adding the Greek prefix

“para-,” for near, to the name of the species it resembles most, *Excultanus conus*.

CHECKLIST AND DISTRIBUTION SUMMARY FOR OTHER SPECIES OF *EXCULTANUS*

E. conus (DeLong)

Texananus conus DeLong 1939c: 386 [n.sp.].

Texananus (Excultanus) conus; Oman 1949a: 142 [subgen. comb.].

Excultanus conus; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Chiapas. NICARAGUA.

Note.—Maes et al. (1999) reported *E. conus* from Nicaragua.

E. dorotheae (DeLong)

Texananus dorothei [sic] DeLong 1939c: 387 [n.sp.].

Texananus (Texananus) dorotheae; DeLong & Hershberger 1949a: 173 [subgen. comb.].

Texananus (Excultanus) dorotheae; Oman 1949a: 142 [subgen. comb.].

Excultanus dorotheae; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Guerrero, Nuevo León, Puebla, Morelos, San Luis Potosí. UNITED STATES: Arizona, New Mexico, Texas.

Note.—In the original description, the species was explicitly dedicated to Dorothy Johnson Knull, so the correct spelling of the name is as used by DeLong & Hershberger (1949a) and others, including this work.

E. eugeneus (Ball)

Phlepsius (Texananus) eugeneus Ball 1918b: 384 [n.sp.]. Lectotype ♂ USNM.

Texananus eugeneus; DeLong & Caldwell 1937c: 43 [n.comb.].

Texananus (Excultanus) eugeneus; Oman 1949a: 142 [subgen. comb.].

Excultanus eugeneus; McKamey 2000: 214 [n.comb.].

Summary of distribution.—COSTA RICA: Guanacaste, Finca Jenny, 30 km N. Liberia, Guanacaste National Park, IX-1989, R. Espinoza, INBIO Bar Code No. CRI000024958 and CRI000025105. MEXICO: Guerrero, Jalisco, Morelos.

Notes.—This species was originally described from 12 syntypes. Previously recorded only from Mexico, the known range is here extended to Costa Rica. A syntype from the USNM is here designated as the lectotype to stabilize the nomenclature of the species. The lectotype has the following label data: “Amula/Guerrero,/6000 ft./Sept. H. H. Smith,” “TYPE,” “Cotype No./[blank]/U.S.N.M.,” “Phlepsius/eugeneus/Ball,” and a lectotype label.

E. excultus (Uhler)

Jassus excultus Uhler 1877a: 467 [n.sp.].

Phlepsius excultus; Southwick 1892a: 288 [n.comb.].

Phlepsius (Texananus) excultus; Ball 1918b: 386 [subgen. comb.].

Phlepsius argillaceus Van Duzee 1923a: 185 [n.sp.; holotype ♂ CASC], **new synonymy**.

Texananus agrillaceus [sic]; DeLong & Caldwell 1937c: 43 [n.comb.].

Texananus excultus; DeLong & Caldwell 1937c: 43 [n.comb.].

Texananus (Texananus) excultus; DeLong & Hershberger 1949a: 176.

Texananus (Excultanus) agrillaceus [sic]; Oman 1949a: 142 [subgen. comb.].

Texananus (Excultanus) excultus; Oman 1949a: 142 [subgen. comb.].

Excultanus excultus; Linnavuori 1959b: 198 [n.comb.].

Excultanus agrillaceus [sic]; McKamey 2000: 214 [n.comb.].

Summary of distribution.—ARGENTINA: Misiones. BAHAMAS. BELIZE. EL SALVADOR. GUATEMALA: San José. MEXICO: Baja California, Chiapas, Jalisco, Sonora, Veracruz. UNITED STATES:

Alabama, Arizona, California, Florida, Georgia, Louisiana, New Mexico, North Carolina, South Carolina, Texas.

Notes.—The specimens from Argentina are identical with respect to all features except the aedeagal apex is almost in contact with the base, i.e., they are the closest to the 0-shape in the U- to 0-shape variation in this species. Also, although the species was already the most widespread, it is even more dispersed than previously thought, from the United States and Bahamas to Argentina (USNM specimen). The holotype of *argillaceus* was examined and dissected; the aedeagus is U-shaped with a weakly deflexed apex, also falling within the variation of *E. excultus*. The type locality of *argillaceus*, Baja California, is consistent with the other records of *excultus* in northern Mexico.

E. hebraeus (Ball)

Phlepsius (Iowanus) hebraeus Ball 1918b: 383 [n.sp.].

Texananus hebraeus; DeLong & Caldwell 1937c: 44 [n.comb.].

Iowanus hebraeus; DeLong & Hershberger 1948d: 115 [n.comb.].

Excultanus hebraeus; Linnavuori 1959b: 198 [n.comb.].

Summary of distribution.—GUATEMALA: Guatemala City. MEXICO: Chiapas, Guerrero.

Note.—This species was described from eight females, including one from the Vienna Museum that was not examined in this study. A syntype from the USNM is here designated as the lectotype to stabilize the nomenclature of the species. The lectotype has the following label data: “Amula/Guerrero,/6000 ft./Sept. H. H. Smith,” “TYPE,” “Cotype No./[blank]/U.S.N.M.,” “Phlepsius/hebraeus/Ball,” and a lectotype label.

E. horridus (DeLong)

Texananus horridus DeLong 1944h: 234 [n.sp.].

Excultanus horridus; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Guerrero, Oaxaca.

E. incurvatus (Osborn & Lathrop)

Phlepsius (Iowanus) incurvatus Osborn & Lathrop 1923a: 346 [n.sp.].

Texananus incurvatus; DeLong & Caldwell 1937c: 44 [n.comb.].

Texananus (Texananus) incurvatus; DeLong & Hershberger 1949a: 178 [subgen. comb.].

Texananus (Excultanus) incurvatus; Oman 1949a: 142 [subgen. comb.].

Excultanus incurvatus; Nielson 1968b: 285 [n.comb.].

Summary of distribution.—MEXICO: Jalisco, Sonora. UNITED STATES: Arizona, California, Georgia, New Mexico.

Note.—This species, a vector of western strain of North American aster yellows virus, is potentially important in the spread of this disease in celery in California.

E. neomexicanus (Baker)

Phlepsius neomexicanus Baker 1895b: 13 [n.sp.; holotype ♂ USNM].

Phlepsius (Iowanus) neomexicanus; Osborn & Lathrop 1923a: 346 [subgen. comb.].

Phlepsius (Texananus) neomexicanus; Ball 1931g: 85 [subgen. comb.].

Texananus neomexicanus; DeLong & Caldwell 1937c: 44 [n.comb.].

Texananus (Texananus) neomexicanus; DeLong & Hershberger 1949a: 176.

Texananus (Excultanus) neomexicanus; Oman 1949a: 142 [subgen. comb.].

Excultanus neomexicanus; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Sinaloa. UNITED STATES: Arizona, New Mexico, Texas.

E. paralus (DeLong)

Texananus paralus DeLong 1939c: 385 [n.sp.].

Texananus (Excultanus) paralus; Oman 1949a: 142 [subgen. comb.].

Excultanus paralus; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Chiapas, Guerrero, Michoacán, Morelos.

E. parrai (DeLong)

Phlepsius parrai DeLong 1939c: 382 [n.sp.; holotype ♂ OSUC].

Texananus parrai; DeLong 1944h: 234 [n.comb.].

Excultanus parrai; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Guerrero.

E. plummeri (DeLong)

Texananus plummeri DeLong 1939c: 385 [n.sp.; holotype ♂ OSUC].

Texananus cassus DeLong 1939c: 385 [n.sp.; holotype ♂ OSUC]. Synonymy by DeLong 1944h: 233.

Excultanus plummeri; McKamey 2000: 214 [n.comb.].

Summary of distribution.—MEXICO: Chiapas, Guerrero, Michoacán, Morelos.

Note.—*Excultanus plummeri* and its synonym *Texananus cassus* represent opposite sexes of the same species, of which a mixed series (males of females) was later collected.

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