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REVISION OF THE NORTH AMERICAN GRASSHOPPERS  
OF THE CONALCAEA COMPLEX

By ASHLEY B. GURNEY

GRASSHOPPERS of the *Conalcaea* complex inhabit much of Mexico and the States of Arizona and New Mexico. They are sometimes encountered in surveys by economic entomologists, and so it is important to clarify the problems of their identification, though these species themselves are not known to be injurious to cultivated plants. The grasshoppers here treated were formerly referred to the genus *Conalcaea* alone, but an additional genus is now recognized in an attempt to explain the relationship and distinguishing features of the species more clearly than has previously been done. As now understood, the complex comprises two genera and seven species, and one species includes two subspecies. Two species are described as new. The term "complex" is used primarily for convenience, rather than as a permanent group of nomenclatorial importance, since a presentation of related genera in anything like a final arrangement must await fuller reports on the Mexican forms.

Characters of the male genitalia, especially the aedeagus, which usually is concealed, have been found very useful, both as specific and generic criteria. Specimens with the aedeagus extracted and allowed to dry exposed at the end of the abdomen are useful and in certain species may give entirely adequate information on aedeagal characters. The most satisfactory preparations of the aedeagus, however, are those preserved in fluid, and for conven-

ience they may be kept in microvials of glycerol attached to the pins bearing the specimens from which they were extracted after relaxation. Study of the aedeagus has shown that material formerly referred to *Conalcaea humphreysii* (Thomas) contains two distinct species and also that United States records of *C. poecila* Hebard are in error. The considerable variability of the male cercus that occurs in *C. huachucana* Rehn was not previously recognized, and examination of large series now suggests that *C. coyoterae* Hebard, typical specimens of which seem quite distinct from *huachucana*, is in reality a subspecies of *huachucana*. Most of the diagnostic characters have been illustrated, thus permitting brief descriptions. To avoid repetition characters common to both genera treated are given only once.

James A. G. Rehn, Academy of Natural Sciences of Philadelphia; Dr. T. H. Hubbell, University of Michigan; Dr. Joseph Bequaert, Museum of Comparative Zoology; and Dr. R. H. Beamer, University of Kansas, were most cooperative in making their entire collections of these grasshoppers available for study. This material, supplementing that in the United States National Museum, has made it possible to examine all the existing<sup>1</sup> holotypes and lectotypes involved and to study the principal important series as well. The following individuals also contributed helpful specimens or field notes: Dr. Irving J. Cantrall, University of Michigan; Kenneth R. Hobbs, Pomona, Calif.; W. W. Jones, Douglas, Ariz.; Dr. E. R. Tinkham, Indio, Calif. To Mr. Rehn I am especially grateful for many helpful courtesies and for sending me numerous personal field notes. Dr. Hubbell and Dr. Cantrall generously placed at my disposal a new species, complete with notes on its distinguishing characters, which the latter had originally intended to describe. Dr. H. Radclyffe Roberts, of the Academy of Natural Sciences of Philadelphia, kindly advised me on generic relationships based on his extensive and largely unpublished studies of Mexican Melanoplinae. Finally, I am indebted to H. C. Wilcox, R. C. Bonde, and Bruce Denman, of the United States Department of Agriculture, for photographing specimens.

All the drawings are my own work.

Grasshoppers of the *Conalcaea* complex belong to the tribe Melanoplinae,<sup>2</sup> and the two genera treated have the following characters in common:

<sup>1</sup> The type of *Barytettix humphreysii* (Thomas) apparently no longer exists. Hebard (Proc. Acad. Nat. Sci. Philadelphia, vol. 79, pp. 1-11, 1927), who reviewed the types of species of Orthoptera described by Cyrus Thomas, reported that this type was missing.

<sup>2</sup> I have followed Roberts (Proc. Acad. Nat. Sci. Philadelphia, vol. 99, p. 202, 1947) in adopting the tribal name Melanoplinae instead of using the long-used group name Melanopli.

Vertex of head only moderately elevated above level of pronotal disk, produced in front of eyes, shallowly sulcate between eyes; eyes well separated; antennae filiform, extending about to middle of tegmina; pronotum without well-developed lateral carinae, median carina indicated but not elevated, posterior margin emarginate; tegmina lobate, extending about to or slightly beyond base of tergum 2,<sup>3</sup> apex rounded; prosternal spine well developed, straight or directed slightly posteriorly; mesosternal interspace quadrate to slightly elongate (male), weakly transverse to quadrate (female); metasternal interspace elongate; metasternal lobes nearly contiguous (male), well separated (female); legs of moderate size; hind femur extending about to or moderately beyond apex of abdomen; hind tibiae normally red, pinkish, purplish red, or yellowish buff. Male with furcula reduced to abbreviate lobes, or scarcely present; supra-anal plate triangular, middistal lateral prominences of dorsal surface present and of variable size; apex of subgenital plate conical; male cercus with apex directed ventrad, often decidedly so produced, apical third varying from scarcely wider than middle width to considerably enlarged and lobate dorsally.

*Melanoplus*, *Aeoloplus*, *Hypochlora*, *Agroecotettix*, and many other genera that include brachypterous species are at once distinguished from the present complex by not having the posterior margin of the pronotum emarginate.<sup>4</sup> *Phaedrotettix* shows definite relationship to *Conalcaea* but typically has green hind tibiae, the male cerci are of a different pattern, and the apex of the male subgenital plate is not conical. The Mexican genus *Sinaloa* is another close relative, and the resemblance to *Barytettix* is usually enhanced by orange-colored antennae, but the males have differently shaped cerci, the furcula is represented by long, slender, adjacent processes, and the aedeagus is of a different pattern from that of the present complex. The key by Ball et al. (1942, p. 322)<sup>5</sup> will be found helpful in recognizing the genera of United States specimens likely to be confused with *Conalcaea* and *Barytettix*. At present there is no adequate published key to the genera of Mexican *Melanoplini*.

The species of the *Conalcaea* complex have not been comprehensively treated since Scudder's original description of the gen-

<sup>3</sup> First large visible segment behind pronotum is metanotum.

<sup>4</sup> *Melanoplus gracilis* (Bruner), which does not inhabit the territory occupied by *Conalcaea* and *Barytettix*, has the posterior margin of the pronotum weakly emarginate. The apex of the subgenital plate in the male of *gracilis* is not cone-shaped, as in males of the *Conalcaea* complex, nor are general body coloration and details of the genitalia of either sex comparable.

<sup>5</sup> Unless given directly in the text or in footnotes, references to literature will be found in the citations under the genera and species treated.

era in 1897, and the most important subsequent papers have been those of Hebard and of Rehn, in which three new species were described and several synonyms and generic transfers were indicated. A very brief review of the Arizona species was made by Ball and his associates in 1942.

KEY TO THE GENERA OF THE CONALCAEA COMPLEX

Tegmen longitudinally divided in color; posterior half (actually dorsal half, since these tegmina are functionless and are never spread in life) with pale veins on dark ground color, costal half entirely dark (pl. 10, fig. 3; fig. 58, *g*); antennae brownish, male with dorsal valve of aedeagus enlarged and decidedly produced posteriorly when seen in lateral view (fig. 59).....*Conalcaea* Scudder

Tegmen of uniform color pattern, composed of blackish ground color with superimposed pale veins (pl. 10, fig. 1; fig. 58, *a*); antennae orange (in well-preserved specimens); dorsal valve of aedeagus with no pronounced posterior development seen in lateral view (fig. 64).....*Barytettix* Scudder

The structural pattern of the aedeagus and the general appearance of specimens indicate that two lines of development worthy of generic recognition occur, though external separating characters of a structural nature are somewhat vague. Tegminal color separates nearly all specimens at a glance, but some individuals of *C. miguelitana* do not show the bicolored condition clearly, though belonging in that category. As shown in the photographs (pls. 10, 11), the dark longitudinal bar on the lateral lobe of the pronotum is characteristically interrupted on the prozona by a diagonal pale mark in *Barytettix*, and the bar does not extend onto the metazona. Available specimens of *B. crassus* were originally immersed in alcohol and do not show the pale mark, though properly preserved specimens may do so. *Conalcaea* not only lacks this pale mark, but the dark bar extends across the metazona. Lateral pronotal carinae are indistinct in *Conalcaea*, absent in *Barytettix*. In most species of *Barytettix* the texture of the surface of the metazona is in noticeable contrast with that of the prozona but scarcely contrasted in *Conalcaea*. The dominant body color of *Conalcaea* is brown; in *Barytettix* there is a strong tendency toward green or greenish olivaceous.

Genus CONALCAEA Scudder

*Conalcaea* SCUDDER, Proc. Amer. Acad. Arts Sci., vol. 32, pp. 196, 204, 1897 (Jan.); Proc. U. S. Nat. Mus., vol. 20, pp. 9, 23-26, 1897 (Dec.).—BRUNER, Biologia Centrali-Americana, Orthoptera, vol. 1, pp. 218, 304-305, 1907-1908.—KIRBY, Synonymic catalogue of Orthoptera, vol. 3, p. 493, 1910.—HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, pp. 263-264, 1917; Trans. Amer. Ent. Soc., vol. 61, p. 300, 1935.—BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, pp. 323, 329-330, 1942.



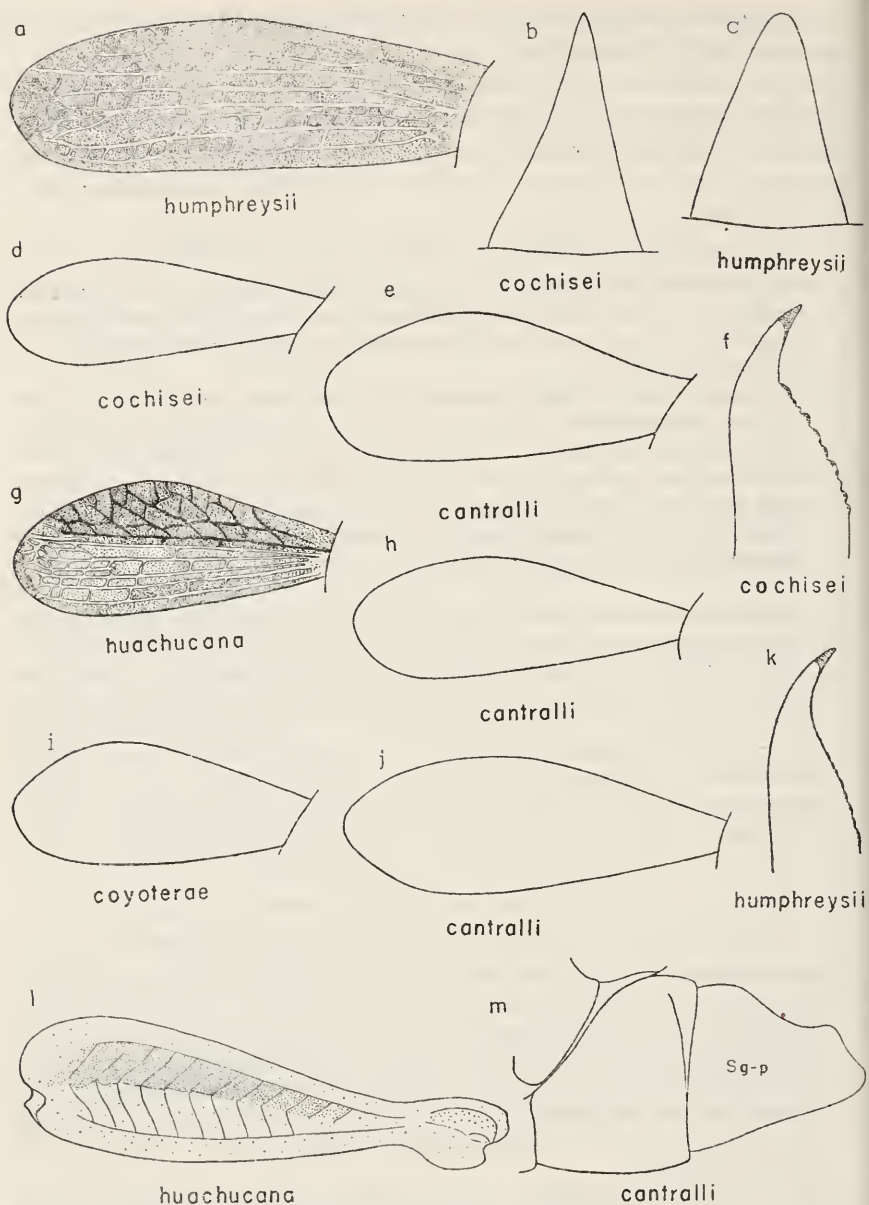


FIGURE 58.—Structural details of *Conalcaea* and *Barytettix*: a, *B. humphreysii* (Thomas), female, Ajo Mountains, Ariz., adaptation of left tegmen; b, *B. cochisei*, new species, female allotype, outline of right cercus; c, *B. humphreysii*, female, Ajo Mountains, Ariz., outline of right cercus; d, *B. cochisei*, holotype, outline of left tegmen; e, *C. cantralli*, female, allotype, outline of left tegmen; f, *B. cochisei*, female allotype, outline of right dorsal valve of ovipositor; g, *C. huachucana huachucana* Rehn, female, Douglas, Ariz., adaptation of left tegmen; h, *C. cantralli*, holotype, outline of left tegmen; i, *C. h. coyoterae* Hebard, female paratype, Prescott, Ariz., outline of left tegmen; j, *C. cantralli*, female paratype, outline of left tegmen; k, *B. humphreysii*, female, Ajo Mountains, Ariz., outline of right dorsal valve of ovipositor; l, *C. h. huachucana*, female, Douglas, Ariz., left hind femur; m, *C. cantralli*, holotype, outline of apical portion of abdomen, lateral view. (Sg-p, subgenital plate.)

simple, without basal flaps; epiphallus as drawn (fig. 63, *c*), with dorsal margin of lophi (L) oblique and broadly rounded, rather than projecting and narrowly rounded as in the subspecies of *huachucana*.<sup>6</sup>

Coloration: General color varying from pale brown to blackish gray; dark bar of lateral lobes of pronotum weakly developed in some specimens; longitudinal division of tegmen with respect to color evident but not always clear, poorer defined than in other species; hind femur lacks distinct longitudinal bar, partial one sometimes present, ventral margin of paginal area usually black.

Measurements (length in millimeters) of representative specimen: Body, 20; pronotum, 4.5; front femur, 4; hind femur, 12.5; tegmen, 3.5.

*Female*.—Differing from male only with respect to genital segments, and an increased robustness typical of the sex.

Measurements (length in millimeters) of representative specimen: Body, 25.5; pronotum, 5.5; front femur, 4.5; hind femur, 14.5; tegmen, 4.1.

The species superficially resembles *h. huachucana*, but the dorsal swelling in the apical third of the male cercus is less, the furcula and lateral prominences of the supra-anal plate are much more developed, and the dorsal longitudinal stripe on the external face of the hind femur is weak, in addition to different features of the aedeagus.

*Type*.—A male designated by Rehn and Hebard, 1912. Museum of Comparative Zoology, Cambridge, Mass.

*Type locality*.—Sierra de San Miguelito, San Luis Potosí, Mexico.

The lectotype and one male and two female lectoparatypes of Scudder's series have been examined. The male is now deposited in the U. S. National Museum (U.S.N.M. No. 58934). The only other specimens examined were taken by H. R. Roberts at the following localities: 18 miles west of San Luis Potosí, San Luis Potosí, Mexico, 7,500 feet, September 5, 1940 (1 ♂); between Zacapu and Zamora, Michoacán, Mexico, 7,500 feet, September 6, 1938 (23 ♂, 8 ♀); 5 miles south of Chilchota, on road to Urupan, Michoacán, Mexico, 6,000 to 7,000 feet, August 15, 1940 (11 ♂, 7 ♀).

The Arizona record of Bruner (1908) was probably based on material of *h. huachucana*. His record of *miguelitana* from Ciu-

<sup>6</sup> The anchorae, or anterior hooks of the epiphallus (A), appear different in figure 63, *a*, *b*, *c*, owing to the directions in which they point, but I have been unable to find constant differences in fundamental shape. The terminology of the male genitalia is largely that of Roberts (Proc. Acad. Nat. Sci. Philadelphia, vol. 93, pp. 201-246, 1941).

dad, Durango, has not been confirmed. Ciudad is about 75 miles northeast of Mazatlán.

The Roberts specimen from west of San Luis Potosí is almost a topotype, as the type locality is located 10 to 15 miles south and slightly west of that city.

Dr. Roberts informs me that all his specimens of *miguelitana* were collected under ecological conditions varying from open woodland to dry scrub country, none under desert conditions.

CONALCAEA CANTRALLI, new species

FIGURES 58, *c, h, j, m*; 59, *c, f*; 60, *e, f*; 62, 63, *a, d, g, h*; PLATE 10, FIGURE 3

*Male* (holotype).—Size medium to large for genus. Head slightly narrowed in front, basally subequal in width to anterior part of pronotum; pronotum gradually widening posteriorly, shaped as in fig. 63, *d*; tegmen barely extending onto abdominal tergum 2, shaped as in plate 10, figure 3; figure 58, *h*; supra-anal plate wider than long, deeply furrowed medially, the adjacent lateral ridges longitudinally wrinkled, lateral one-third of plate broadly concave on each side, toothlike prominences present, furcula not evident (fig. 63, *h*); cercus conspicuously lobate, the mesal surface excavate in apical third due to curvature, apex projecting somewhat ventrally and more noticeably mesally, exterior surface of apical third shallowly pitted as illustrated (fig. 60, *e*); subgenital plate bluntly conical (fig. 58, *m*); dorsal valves of aedeagus elongate, broadly and inconspicuously projecting anteriorly (fig. 59, *f*, A-m), posterior projection only moderately developed (fig. 59, *c*, pe), posterior surface of apical third darker and of a less membranous texture mesally (*m*) than laterally; ventral valves concave on inner surfaces (*c*), posterior exterior surfaces with small basal flap (*f*); epiphallus with ancorae acute, tapering, directed ventroanteriorly (less triangular in shape than appearing in figure 63, *a*, because of direction of that view), lophi tall, the dorsal margin broadly and evenly rounded.

Coloration: Essentially as in *coyoterae*; disk of pronotum Roman sepia; face and lower part of lateral lobes of pronotum pale brown; ventral surface and lower sides of abdomen straw yellow, also a mediolongitudinal band on terga 2 to 6; dark postocular bar indistinct on head, black and well defined on lateral lobe of prozona, grading into pale brown on ventral half of metazona; dark pattern on meso- and metepisterna typical of *coyoterae*, black on costal half of tegmen, on dorsal half of sides of terga 1 to 7 grading to dark chestnut; antennae pale brown; hind femur with blackish brown longitudinal bar much as in *h. huachucana*; hind tibia vermilion.

Measurements (length in millimeters): Body, 24; pronotum, 5.3; front femur, 4.5; hind femur, 13; tegmen, 4.3. Greatest width of pronotum (posterior, including lateral lobes in perspective from above), 4.3.

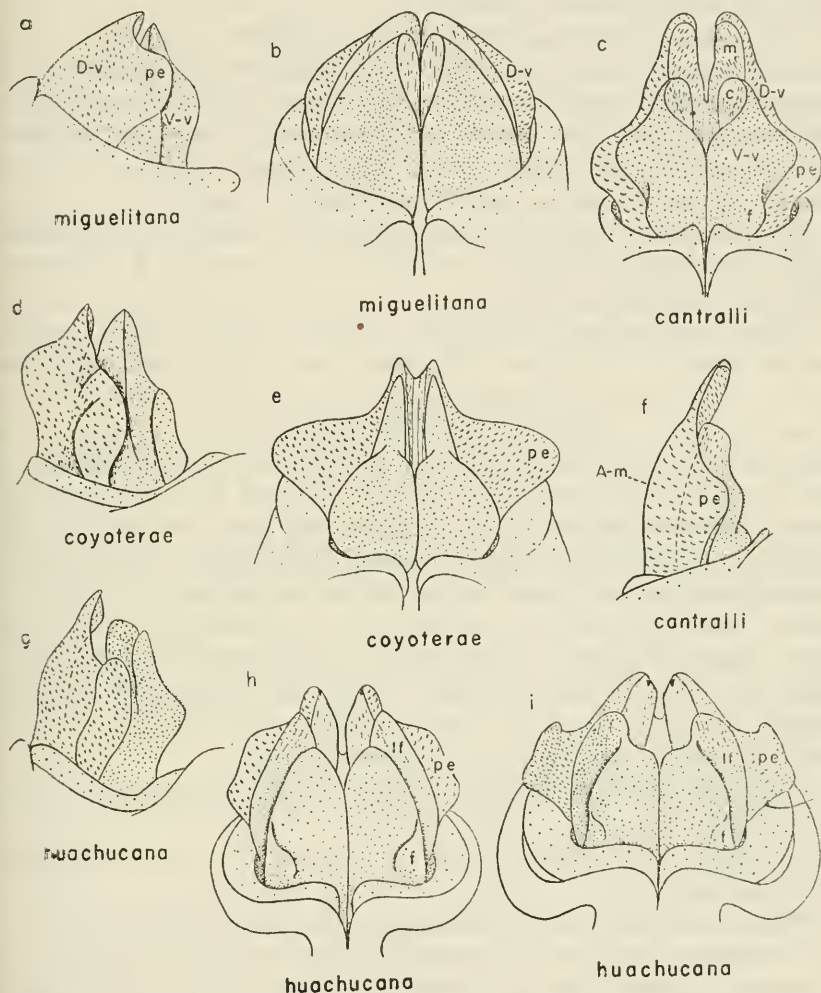


FIGURE 59.—Aedeagus of males of *Conalcaea*: a, *C. miguelitana* Scudder, lectoparatype, lateral view; b, *C. miguelitana*, lectoparatype, dorsoposterior view; c, *C. cantralli*, new species, holotype, dorsoposterior view; d, *C. huachuana coyoterae* Hebard, paratype, Prescott, Ariz., lateral view; e, *C. h. coyoterae*, paratype, dorsoposterior view; f, *C. cantralli*, holotype, lateral view; g, *C. huachuana huachuana* Rehn, Mule Mountains, Ariz., lateral view; h, *C. h. huachuana*, Santa Rita Mountains, Ariz., dorsoposterior view; i, *C. h. huachuana*, Mule Mountains, posterior view. (A-m, anterior margin of dorsal valve of aedeagus; c, concave mesal surface of ventral valve; D-v, dorsal valve; f, basal flap on posterior surface of ventral valve; m, posterior surface of dorsal valve; lf, lateral flap of ventral valve; pe, posterior extension of dorsal valve; V-v, ventral valve.)

*Female* (allotype).—General form as in male, larger and more robust; differing as follows: Face less retreating; eyes less globose; vertex as in figure 63, *g*; posterior emargination of pronotum broader; tegmen proportionally rather broader (fig. 58, *e*); genitalia essentially as in *coyoterae*.

**Coloration:** Differing from male as follows: Face and lower part of lateral lobes of pronotum Van Dyke brown; abdomen and ventral parts largely Roman sepia, terga darkened apically, a mediolongitudinal pale band barely suggested; dark bar on pronotum less sharply defined; dark longitudinal band on left hind femur occupying only anterior two-thirds of pagina.

**Measurements** (length in millimeters): Body, 30; pronotum, 6.5; front femur, 4.3; hind femur, 15.5; tegmen, 4.8. Greatest width of pronotum, 7.3.

There are five male paratypes, the pronotal length of which varies from 4.7 to 5.5 mm. The cerci are slightly variable, those of two specimens exhibiting more dorsal development of the apical lobe (fig. 60, *f*); there is a tendency for the apical margin to be irregular, but in some specimens it is smooth. The aedeagi of two paratypes are preserved in glycerol, and the outline of the dorsal valves in lateral view is less rounded anteriorly than in the holotype. Especially in the dry aedeagi, the extent of the posterior development of the dorsal valves is somewhat variable. The six female paratypes show no significant size variation. Two have more slender tegmina (fig. 58, *j*) than the allotype. The paratypes vary but little in color, beyond exhibiting moderately variable shades of brown on the dorsal surfaces. Two females have an obsolete mediolongitudinal pale abdominal bar.

*Type*.—Museum of Zoology, University of Michigan, Ann Arbor, Mich.

*Paratypes*.—U.S.N.M. No. 59154; Academy of Natural Sciences of Philadelphia.

*Type locality*.—"General Springs," Coconino County, Ariz.

The entire series of six males and seven females was taken at the type locality. The male holotype and five paratypes (1 male, 4 females) were collected on August 28, 1935, by Irving J. Cantrell, one female paratype by him on August 29, 1935. The allotype and five paratypes (4 males, 1 female) were collected August 28, 1935, by T. H. and Grace G. Hubbell.

"General Springs," a fire cabin and lookout station on the Coconino Plateau just at the edge of the Mogollon Rim, is about 12 miles northeast of Pine (Gila County) and about 10 miles east of Baker Butte (Coconino County). All specimens of *cantralli* were taken on the slopes below the rim, mainly along the lower

part of a trail running from the fire cabin (7,200 feet) past "The Tunnel," down to Pieper's Trout Farm. The upper slopes are precipitous, very rocky and with little soil. There are open stands of yellow pine and small white-oak shrubs. Below there are low dense thickets of manzanita, and the variety of trees, shrubs, and herbs increases. Alligator juniper, spruce, fir, and sumac occur there, in addition to oaks, and there is a layer of dead leaves and pine needles. Most of the specimens of *cantralli* occurred among the scrub oaks below "The Tunnel" and were caught with difficulty; some were found amid bracken ferns in a clearing at the edge of the forest.<sup>5</sup>

I am glad to give to this distinctive insect the name of my friend Irving J. Cantrall, who in 1943 published a masterly account of the ecology of the Orthoptera and Dermaptera of the George Reserve, Mich. (Misc. Publ. Mus. Zool. Univ. Michigan, No. 54, 182 pp., 10 pls).

#### CONALCAEA HUACHUCANA Rehn

Although further confirmatory evidence is desirable, I have concluded on the basis of material examined that there is intergradation of the characters separating *Conalcaea coyoteræ* from *C. huachucana* and that these forms represent subspecies. Figure 60, *g*, *h*, demonstrates the intergradation occurring in the shape of the male cercus. The shape of the dorsal valves of the aedeagus also shows intergradation. A series from Greenlee County, Ariz., is particularly intermediate in character. There is a progressive change in cercal shape, and specimens of *huachucana huachucana* from extreme southeastern Arizona have the ventrolateral extremity of the cercus more prolonged than specimens of the same subspecies from more northern localities. A single male of *h. huachucana* from near Gila Bend, Ariz., shows no intergradation with *coyoteræ*, and intergradation may prove to occur mainly in the eastern part of Arizona. Ball et al. (1942) record *coyoteræ* from the Pinal Mountains (near Globe, Ariz.), and this suggests that the northern form extends farthest south in eastern Arizona.

<sup>1</sup> "The Tunnel" is a historic point on the slope of the Mogollon escarpment, about a mile southeast of the General Springs forest-fire station and near the head of East Verde Creek. Here, in the winter of 1885-86, an abortive attempt was made to construct a railroad tunnel. In placing this and other Arizona localities, the reader is referred to "Arizona Place Names," by Will C. Barnes (Univ. Arizona Bull., vol. 6, No. 1, 503 pp., 1935). Also see Torre-Bueno's "Arizona Insect Localities" (Bull. Brooklyn Ent. Soc., vol. 32, pp. 187-194, 1937).

<sup>2</sup> As an aid to an understanding of the plants mentioned in this paper, readers are referred to Nichol's "The Natural Vegetation of Arizona" (Arizona Univ. Techn. Bull. 68, pp. 181-222, 22 pls., 1 map, 1943), to Benson and Darrow's "A Manual of Southwestern Desert Trees and Shrubs" (Univ. Arizona Bull., vol. 15, No. 2, 411 pp., 114 pls., 1944), and to Kearney and Peebles' "Flowering Plants and Ferns of Arizona" (U. S. Dept. Agr. Misc. Publ. 423, 1,069 pp., 29 pls., 1942).

## CONALCAEA HUACHUCANA HUACHUCANA Rehn

FIGURES 58, *g*, *l*; 59, *g-i*; 60, *g-l*; 62; PLATE 11, FIGURE 3

*Conalcaea huachucana* REHN, Proc. Acad. Nat. Sci. Philadelphia, vol. 59, pp. 48-50, figs. 6, 7, 1907.—SNOW, Trans. Kansas Acad. Sci., vol. 20, p. 163, 1907.—REHN and HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 60, p. 393, 1908; Proc. Acad. Nat. Sci. Philadelphia, vol. 64, p. 100, 1912.—KIRBY, Synonymic catalogue of Orthoptera, vol. 3, p. 493, 1910.—HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, p. 263, 1917; Trans. Amer. Ent. Soc., vol. 48, pp. 55-58, pl. 3, figs. 4, 5, 1922; vol. 61, p. 300, 1935.—BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, pp. 329-330, 1942.

*Male*.—General form as in plate 11, figure 3 (specimen illustrated has aedeagus extracted and apex of abdomen elevated more than in average specimens); tegmen usually about as in figure 58, *g*, sometimes more lanceolate; cercus usually as in figure 60, *i-l*, varying as in figure 60, *g*, *h*, in area of intergradation between *h. huachucana* and *h. coyoteræ*; supra-anal plate not so wide as long, usually intermediate in proportions between figure 63, *i* and *h*, of *miguelitana* and *cantralli*, furcula consisting of broadly rounded trigonal lobes not so conspicuous as in *miguelitana*, lateral prominences varying from elevated and with considerable lateral development to poorly developed; dorsal valves of aedeagus with only moderate and very broadly rounded swelling anteriorly when seen in lateral view, the posterior extensions conspicuous in posterior view and varying in appearance from knoblike shoulders to wide flaps (fig. 59, *h*, *i*, *pe*); ventral valves of aedeagus with basal flap (fig. 59, *h*, *i*, *f*), closely joined with a lateral flap (*lf*) of variable appearance; epiphallus essentially as in *h. coyoteræ* (fig. 63, *b*).

*Coloration*: General color varying from pale brown to dark gray; tegmen of variable color intensity, but longitudinal division normally very distinct, rarely only a few pale veins noticeable; postocular longitudinal blackish band shining, conspicuous.

*Measurements* (length in millimeters) of representative specimen: Body, 21; pronotum, 5; front femur, 4.2; hind femur, 12.5; tegmen, 3.5.

*Female*.—General form more robust than male; dorsal outline of fastigium and eyes as in fig. 63, *f*, of *coyoteræ*; dorsal valve of ovipositor scarcely curved in preapical third; cercus moderately acute, shorter than in *cantralli*.

*Measurements* (length in millimeters) of representative specimen: Body, 29; pronotum, 6.3; front femur, 4.5; hind femur, 15; tegmen, 5.

Variation and apparent intergradation with *h. coyoteræ* are further discussed under that subspecies.

*Type*.—A male designated by Rehn and Hebard (1912), in Academy of Natural Sciences of Philadelphia.

*Type locality*.—Carr Canyon,<sup>9</sup> Huachuca Mountains, Cochise County, Ariz.

Specimens have been examined from the following localities, in addition to the type locality: NEW MEXICO: Hachita Grande Peak (also called Big Hatchet Peak), Hidalgo County; canyon west-northwest of Hachita Grande Peak. ARIZONA: Maricopa Mountains, 15 miles east of Gila Bend; Santa Catalina Mountains; Chiricahua Mountains; Mule Mountains, Cochise County; Reef;

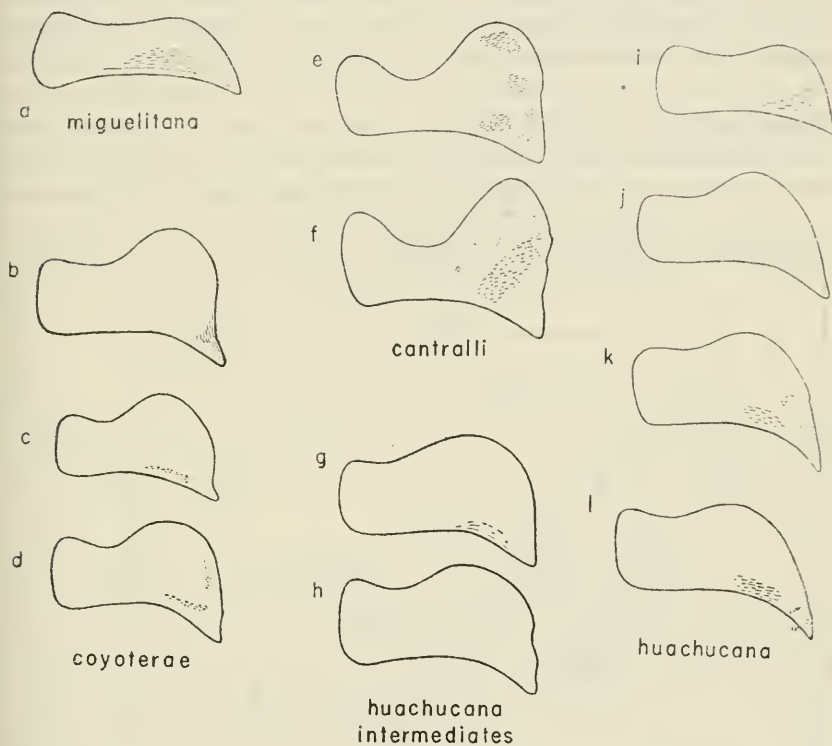


FIGURE 60.—Cerci of male specimens of *Conalcaea*: a, *C. miguelitana* Scudder, lecto-paratype; b, d, *C. huachucana coyoterae* Hebard, topotypes; c, *C. h. coyoterae*, a paratype from Prescott, Ariz.; e, *C. cantralli*, new species, holotype; f, *C. cantralli*, a paratype; g, h, *C. huachucana huachucana* Rehn, intermediates, Hot Air Canyon, Greenlee County, Ariz.; i, *C. h. huachucana*, Chiricahua Mountains, Ariz.; j, *C. h. huachucana*, Reef, Ariz.; k, *C. h. huachucana*, Santa Rita Mountains, Ariz.; l, *C. h. huachucana*, Huachuca Mountains, Ariz.

<sup>9</sup> Carr Canyon is about 5 miles southeast of Huachuca Peak, in the Coronado National Forest. Reef, sometimes known as Palmerlee, is located less than a mile away, and these names are known to entomologists chiefly through collections made there about 1905 by the late C. R. Biederman and the late Charles Schaeffer.

Huachuca Mountains (no detailed locality); Madera Canyon, Santa Rita Mountains; Santa Rita Mountains (no detailed locality); saddle at west base of Old Baldy, Santa Rita Mountains; Sycamore Canyon, Patagonia Mountains, Santa Cruz County; Sycamore Canyon, Baboquivari Mountains, Pima County; Douglas.

Additional published Arizona records are Palmerlee (Rehn and Hebard, 1908), Pinaleno Mountains, and Black River area of the Natanes Plateau (Ball et al., 1942). Specimens from the last-named area might show intergradation with *coyoterae*.

The principal environment occupied by *huachucana* is the open type of chaparral and oak woodland, evidently of the Upper Sonoran and Transition Zones. The following examples of conditions under which *huachucana* was found at a few localities are condensed from data selected by Mr. Rehn from field notes kept by himself and Mr. Hebard: NEW MEXICO: At Hachita Grande Peak a few specimens found on slopes covered with pinyon and having many precipices, up to 7,800 feet on highest peak. In canyon a



FIGURE 61.—Distribution of ■ *Baryttix crassus* Scudder, ● *B. poecilus* (Hebard), and ▲ *Conalcaea miguelitana* Scudder. All localities represented by material examined.

few found near small bushes and in fine grass, not below 5,500 feet; the canyon very extensive, with pebbles, boulders, oaks about 2 feet tall, and much *Nolina*, *Agave*, *Dasyilirion*, *Acacia*, and *Opuntia*. ARIZONA: In Mule Mountains found under and in grasses in forest of high scrub oaks at 6,038 to 7,350 feet; a few individuals on Mount Ballard in heavy wildflowers and grasses up to 6,300 feet. In Upper Madera Canyon, Santa Rita Mountains, found on the ground in dead leaves and among scant herbage under low oaks on canyon floor at 4,900 feet, also up to 5,700 feet; under oaks on slopes of mountain saddles, very few above 6,000 feet, highest at 7,500 feet. In Sycamore Canyon, Patagonia Mountains (at top of pass on only road crossing mountains), found scattered through glades among oaks; very scarce in dead leaves under oaks on way to summit of side peak, one male on bare ground of small opening at top (6,900 feet). In Sycamore Canyon, Baboquivari Mountains (in east face of range, almost due east of Baboquivari Peak), found near groves of mesquite and open stony benches with clumps of short grass.

Collecting dates of adults examined range from July 6 (Palmerlee, Ariz.) to October 9 (Baboquivari Mountains).

CONALCAEA HUACHUCANA COYOTERAE Hebard (new status)

FIGURES 58, *i*; 59, *d*, *e*; 60, *b-d*; 62; 63, *b*, *f*

*Conalcaea coyoterae*<sup>10</sup> HEBARD, Trans. Amer. Ent. Soc., vol. 48, p. 55, pl. 3, figs. 1-3, 1922; Trans. Amer. Ent. Soc., vol. 61, p. 300, 1935.—FRISON, Bull. Illinois, Nat. Hist. Surv., vol. 16, art. 4, p. 142, 1927.—BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, p. 329, 1942.

*Conalcaea neomexicana* SCUDDER, BRUNER, Biologia Centrali-Americana, Orthoptera, vol. 2, p. 305, 1908 (misidentification in part).

The most important feature distinguishing this subspecies is the shape of the male cercus, which in typical specimens is entirely diagnostic (fig. 60, *b-d*). When the aedeagus is examined in lateral view the dorsal valve is seen to be abruptly swollen anteriorly, not moderately and broadly produced as in *C. huachucana huachucana* (fig. 59, *d*). Particularly in dry preparations, the aedeagus varies sufficiently in different individuals to render untrustworthy as subspecific characters the features appearing in a posterior view. The majority of specimens of *coyoterae* from Prescott, Ariz., lack a longitudinal black bar on the dorsal half of the external pagina of the hind femur, such as occurs in *h. huachucana* (fig. 58, *l*). Hebard (1922) noted this, but reported the bar as well developed in a male from Bill Williams Mountain, Ariz., and he concluded that no color

<sup>10</sup> Spelled *coyotero* by Hebard (1935) and Ball et al (1942). The original spelling was correct, in addition to having priority.

feature could be depended upon to separate all specimens of the two forms. Specimens collected at Prescott since the original description was published show that in some individuals the dark bar is complete, in others partially or entirely lacking. The bar occurs in all specimens of *h. huachucana* that I have seen. The general coloration of *coyoteræ* is variable and encompasses the same range of shades as the typical subspecies.

Ball et al. (1942) indicate that *coyoteræ* is smaller than *h. huachucana*, but the series I have examined suggests that comparable extremes and variation in size occur in each subspecies. The pronotal length of *coyoteræ* males from Prescott varies from 4.3 to 5.1 mm., and that of *h. huachucana* varies from 4.2 to 5.2 mm. (extremes from Santa Rita Mountains, Ariz., and Hachita Grande Peak, N. Mex., respectively). Females studied are also comparable, those of *coyoteræ* examined ranging in pronotal length from 4.3 to 5.5 mm. (both from Prescott), and Hebard (1922) recorded female paratypes of which the pronotum measured 6.3 mm.

*Type*.—A male originally designated, in Academy of Natural Sciences of Philadelphia.

*Type locality*.—Prescott, Ariz., 5,400 feet elevation.

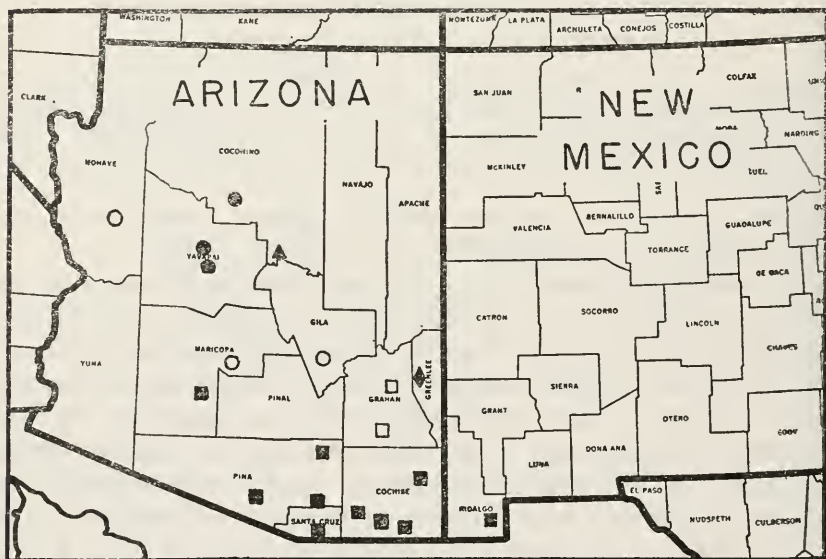
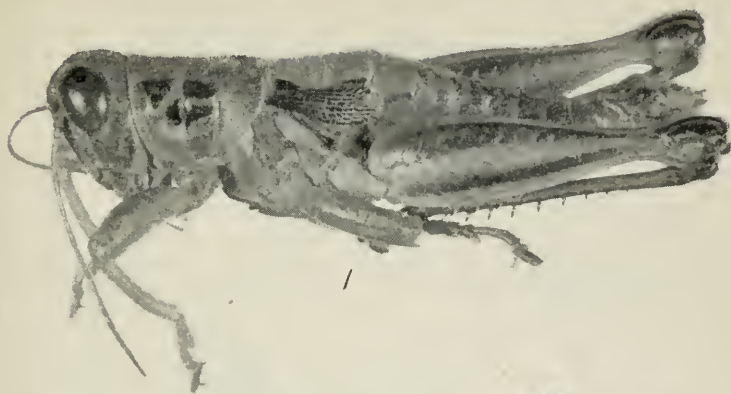


FIGURE 62.—Distribution of *Conalcaea huachucana huachucana* Rehn, *C. huachucana coyoteræ* Hebard, and *C. cantralli*, new species: ■ *C. h. huachucana*, material examined; □ *C. h. huachucana*, localities noted in literature from which I have not seen material; ● *C. h. coyoteræ*, material examined; ○ *C. h. coyoteræ*, localities noted in literature from which I have not seen material; ◆ *C. huachucana*, intermediates, material examined; ▲ *C. cantralli*, material examined.



1

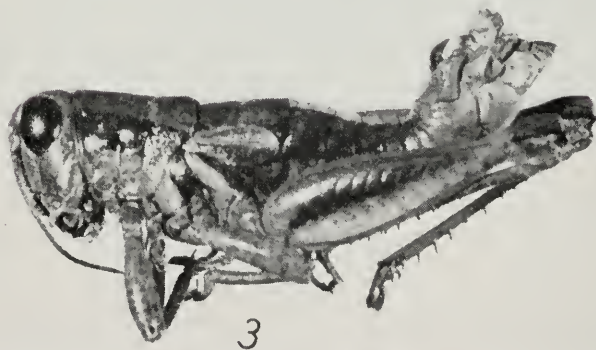


2



3

- 1, *Barytettix poecilus* (Hebard): Male paratype from Venvidio, Sinaloa, Mexico.
- 2, *Conalcaea miguelitana* Scudder: Male from 18 miles west of San Luis Potosí, San Luis Potosí, Mexico.
- 3, *Conalcaea cantralli*, new species: Male holotype.



- 1, *Barytettix humphreysii* (Thomas): Female from foothills of the Huachuca Mountains, Ariz.  
2, *Barytettix cochisei*, new species: Male paratype from Douglas, Ariz.  
3, *Conalcaea huachucana huachucana* Rehn: Male from Reef, Ariz.

I have examined a male from Bill Williams Mountain (near Williams), Coconino County, Ariz., in addition to many specimens from Prescott. The intergrades include five males and four females from Hot Air Canyon, Greenlee County, Ariz., taken from a wild turkey by L. L. Hargrave, October 25, 1939. Hebard's original series, which I have seen, also included specimens from Senator, Yavapai County, Ariz., and two localities in the environs of Prescott: Mount Union and Granite Peak. Hebard (1935) says that Phoenix, Ariz., material recorded by Bruner (1908) as *C. neomexicana* is in reality *coyoterae*.

Other localities given by Ball et al. (1942) are the Pinal and Hualapai Mountains. I suspect that the Pinal Mountain material may show intergrading characters comparable to those of the Hot Air Canyon series.

Adults of typical *coyoterae* collected from July 13 to September 14 have been seen. Ball et al. note adults as late as October 3 and say that overwintering occurs in the egg stage. A series taken at Prescott, July 29, 1933, by Dr. Beamer shows that adults were numerous but that some nymphs could still be found.

This subspecies is an inhabitant of the chaparral and oak zone of the Upper Sonoran Zone, the entire original series having been taken at an elevation of from 5,400 to 6,500 feet. Hebard (1922) says it is probably strictly geophilous, and Ball et al. say it feeds on low plants such as *Eriogonum* and *Lactuca*.

#### Genus BARYTETTIX<sup>11</sup> Scudder

*Barytettix* SCUDDER, Proc. Amer. Acad. Arts and Sci., vol. 32, pp. 197, 204, 1897 (January); Proc. U. S. Nat. Mus., vol. 20, pp. 10, 27-29, 1897 (December).—BRUNER, Biologia Centrali-Americana, Orthoptera, vol. 2, pp. 218, 305, pl. 4, figs. 8, 8a, 8b, 9, 1907-1909.—KIRBY, Synonymic catalogue of Orthoptera, vol. 3, pp. 494, 585, 1910.—HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, pp. 263-264, 1917; Trans. Amer. Ent. Soc., vol. 61, pp. 300, 303, 1935.

*Genotype*.—*Barytettix crassus* Scudder, 1897, by designation of Scudder (1897, December).

The genus *Barytettix* has characters noted for the complex and for separating it from *Conalcaea*. In 1917 Hebard placed *Barytettix* as a synonym of *Conalcaea*, but the aedeagus had not then been investigated. It shows that two cohesive groups of species are actually represented, supporting the separation suggested by general habitus and color. It is true, however, that the character used by Scudder (shape of mesosternal interspace) to separate the two genera is not dependable. Furthermore, Scudder placed his *Conalcaea neomexicana*, the type of which I have seen, in the

<sup>11</sup> Not to be confused with *Barytettix* Günther, 1939, the preoccupied name of a genus of grouse locusts for which Rehn (Ent. News, vol. 59, p. 155, 1948) has proposed a substitute.

wrong genus. It is actually a synonym of *B. humphreysii* (Thomas), and Hebard (1935) has explained that Scudder was confused additionally by mistakenly assuming *B. humphreysii* to be the species now known as *Melanoplus aridus* (Scudder).

A second species that Scudder placed in *Barytettix* has since been transferred by Hebard (Trans. Amer. Ent. Soc., vol. 51, p. 288, 1925) to still another of Scudder's genera, where it is known as *Sinaloa peninsulæ* (Scudder). The four species of *Barytettix* now recognized may be separated as follows:

KEY TO SPECIES OF BARYTETTIX

1. Basal lobe of aedeagus enlarged, extending far up on ventral valves (fig. 64, *a-d*) (New Mexico, Arizona, Sonora)..... 2
- Basal lobe of aedeagus small, extending but little up ventral valves (fig. 64, *e-h*) (Baja California, Sinaloa, Nayarit)..... 3
2. Male with apices of ventral valves of aedeagus erect and close together in posterior view (fig. 64, *b*); reddish color of hind tibiae, knees of hind femora, and of external male terminalia often conspicuously developed.  
*cochisei*, new species
- Male with apices of ventral valves of aedeagus broadly curved and widely separated in posterior view (fig. 64, *d*); reddish color inconspicuous on external male terminalia, present or absent on hind tibiae and knees.  
*humphreysii* (Thomas)
3. Cercus of male almost rectangular, apex scarcely prolonged (fig. 64, *l*); dorsal valves of aedeagus widely separated apically (fig. 64, *h*) (Sinaloa, Nayarit).....*poecilus* (Hebard)
- Cercus of male with apex considerably prolonged (fig. 64, *k*); dorsal valves of aedeagus contiguous (fig. 64, *f*) (Baja California).....*crassus* Scudder

BARYTETTIX COCHISEI,<sup>22</sup> new species

FIGURES 58, *b, d, f*; 64, *a, b, i, m*; 65; PLATE 11, FIGURE 2

*Conalcaea humphreysii poecila* Hebard, BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, pp. 329-330, 1942 (misidentification, in part).—TINKHAM, Amer. Midl. Nat., vol. 38, pp. 145-146, 1947 (misidentification, in part).

*Male*. (holotype).—Size medium for genus; general form as in plate 11, figure 2. Pronotum subcylindrical, prozona of uniform width, metazona flaring, posterior margin broadly emarginate; tegmen extending to base of tergum 1, shape as in figure 58, *d*; cercus decidedly concave mesally, outline of exterior surface essentially as in figure 64, *i*, less concave on ventral margin; subgenital plate bluntly conical; supra-anal plate broadly triangular, furcula represented by broadly rounded lobes, lateral prominences tiny but sharp; dorsal valves of aedeagus much shorter than ventral valves, both tapering and apically acute, the latter with

<sup>22</sup> Cochise was a chief of Chiricahua Apache Indians, who died in 1874 after leading attacks against white men for 10 years, 1861-1871. His name was given to the most southeasterly county of Arizona, which is an area typical of that occupied by this species.

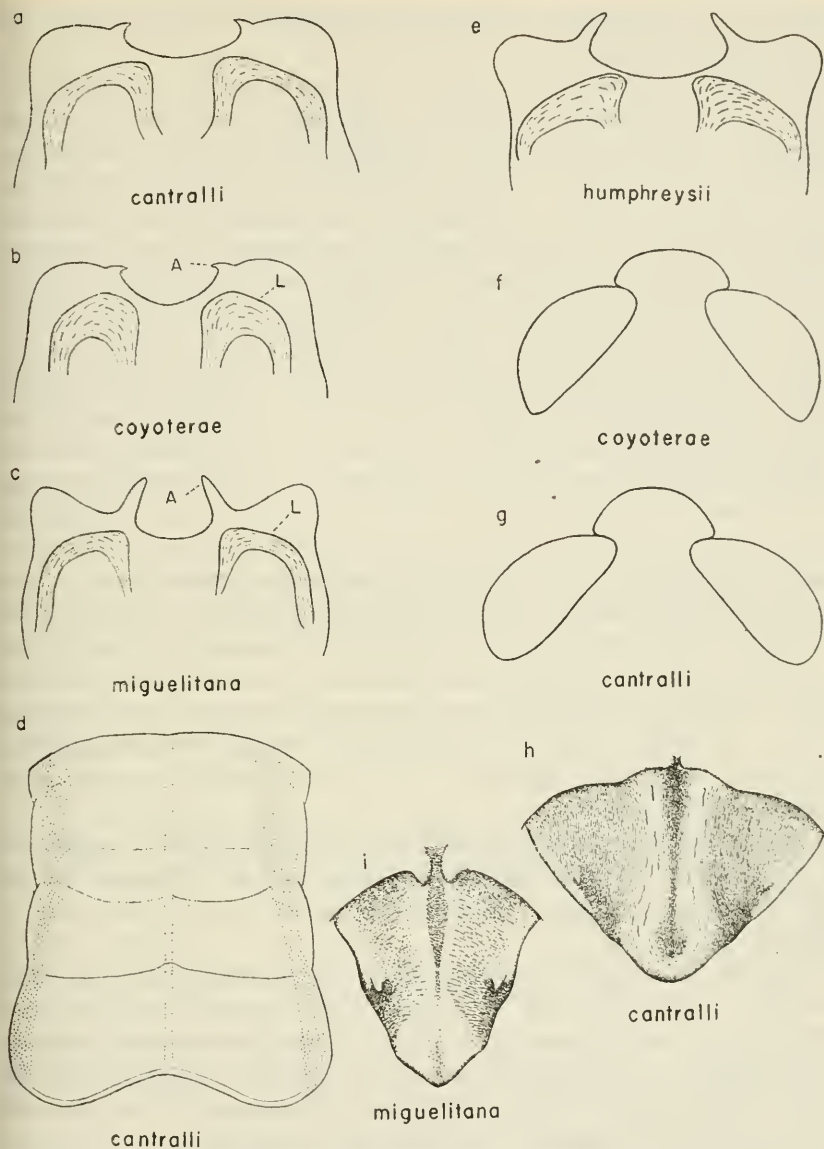


FIGURE 63.—Structural details of *Conalcaea* and *Baryttettix*: a, *Conalcaea cantralli*, new species, holotype, dorsoposterior view of epiphallus; b, *C. huachucana coyoterae* Hebard, paratype, Prescott, Ariz., dorsoposterior view of epiphallus; c, *C. miguelitana* Scudder, lectoparatype, dorsoposterior view of epiphallus; d, *C. cantralli*, holotype, dorsal view of pronotum, lateral lobes shown in perspective; e, *B. humphreysii* (Thomas), Santa Catalina Mountains, Ariz., dorsoposterior view of epiphallus; f, *C. huachucana coyoterae*, female paratype, Prescott, Ariz., dorsal view of vertex and eyes; g, *C. cantralli*, allotype, dorsal view of vertex and eyes; h, *C. cantralli*, holotype, supra-anal plate; i, *C. miguelitana*, male lectoparatype, supra-anal plate. (A, ancora; L, lophus.)

apices close together; epiphallus essentially as illustrated for *humphreysii* (fig. 63, e).

Coloration: General coloration olivaceous-green, marked with yellow and vermilion, shading to pale brown on apical third of abdomen. Head gray, paler on mouth parts, a narrow postocular yellow stripe ventrally edged with black on each side of vertex; eyes pale brown; basal two antennal segments greenish ash; basal half of flagellum vermilion, gradually darkening to brown at apex; disk of prozona of pronotum brownish green, bordered by slightly inbowed shiny yellow longitudinal stripes in the position of lateral carinae; lateral lobes of prozona shining black above, grading to brownish green at ventral margins, marked with bright yellow as in plate 11, figure 2, plus a poorly developed additional horizontal yellow bar through the posterior black area; metazona olivaceous-green, posteriorly margined with pale green; tegmen with blackish ground color, the veins pale yellow and duller near costal margin in basal half; front and middle legs olivaceous, paler beneath and on tarsi; hind femur yellow, pinkish on genicular lobe, brown above and on dorsal half of pagina, dorsal carinae blackish brown, ventral margin of pagina dark green; hind tibiae vermilion, tarsi pale pink, apical half of claws, spurs, and spines black; abdomen varying from brownish green at base to pale brown in apical third, a narrow pale brown mediolongitudinal stripe inconspicuous; supra-anal plate, cerci, and subgenital plate tinged with pinkish.

Measurements (length in millimeters): Body, 25.5; pronotum, 5; front femur, 4; hind femur, 12.5; tegmen, 4.3. Greatest width of pronotum (posterior, including lateral lobes in perspective from above), 4.7.

*Female* (allotype).—General form more robust than in male and face less retreating in lateral view, much as in illustrated specimen of *humphreysii* (pl. 11, fig. 1) but more elongate owing to extension of abdominal segments. Cercus elongate, apically very acute (fig. 58, b); ovipositor with dorsal valve scarcely curved on dorsal margin in apical fourth (fig. 58, f).

Coloration: As in male, except that head and thorax are more brownish than olivaceous-green, and yellow markings are less bright.

Measurements (length in millimeters): Body, 32.5; pronotum, 6.7; front femur, 4.6; hind femur, 16.7; tegmen, 5.7. Greatest width of pronotum, 6.7.

There are 12 male paratypes, varying in pronotal length from 5.1 to 6 mm. and in body length from 24 to 26 mm. The largest males are from Don Luis. No important variation of the cercus

has been noted, the slight differences observed being mainly due to warping in drying. The supra-anal plate (fig. 64, *m*) has the height of lateral prominences slightly variable. When the aedeagus is extracted and allowed to dry in situ, the basal lobe is likely to curl, so that the resulting lateral view does not agree with the wet condition (fig. 64, *a*). The posterior view demonstrates entirely diagnostic characters, however, in either wet or dry preparations. The four female paratypes vary in pronotal length from 6.3 to 7 mm. and in body length from 29 to 31 mm. In two of the females the cercus is less acute than in the allotype (fig. 58, *b*), though still sharply triangular. The subapical portion of the dorsal valve of the ovipositor is scarcely curved, showing some difference from *humphreysii* in this respect (fig. 58, *f, k*). I have not found the shape of cercus and ovipositor sufficiently helpful as separating characters, however, to include them in the key to species.

In general coloration there is a variable intensity of the olivaceous-green, a few specimens being more brownish, with yellow thoracic markings nearly the same shade as the background color. About half of the series has the lateral pronotal lobe as in plate 11, figure 2, the other having an additional yellow mark as in the holotype. In some it is indistinct, showing the feature to be variable. The lower half of the pagina on the exterior face of the hind femur is dull straw color, rather than a distinct yellow, in all the female paratypes, and in two of the males that area is greenish yellow and blends gradually with dark greenish brown on the dorsal half of the pagina. Nine of the males are decidedly reddish on the genital segments; the other three are inconspicuously tinged with pink. The ovipositor valves of the females vary from pale brown to pinkish yellow; the female supra-anal plate is brown.

*Type*.—U.S.N.M. No. 59155.

*Paratypes*.—In Museum of Zoology, University of Michigan, Ann Arbor, Mich.; Academy of Natural Sciences of Philadelphia; Museum of Comparative Zoology, Cambridge; University of Kansas, Lawrence; California Academy of Sciences, San Francisco; collection of W. W. Jones, Douglas, Ariz.

*Type locality*.—Douglas, Cochise County, Ariz.

The male type, allotype, and two male paratypes were taken at the type locality by W. W. Jones, September 10, 1944. Other paratypes taken at Douglas by Mr. Jones include one male and two females, October 22, 1944; one female, October 23, 1932; one female, August 20, 1933; one male, September 20, 1924; one male, October 10, 1943; one male (no date). Two paratypic males are from Don Luis, Cochise County Ariz., September 24, 1922 (Rehn

and Hebard); one is from Madera Canyon, Santa Rita Mountains, Ariz., September 10, 1931 (E. R. Tinkham); and three are from 2 miles southwest of Chiracahua, San Bernardino Valley, Cochise County, Ariz., 4,650 feet elevation, August 27, 1937 (Rehn, Pate, and Rehn). One female taken at Douglas, Ariz., August 25, 1944, by K. R. Hobbs, is not considered paratypic because lack of association with males and uncertainty over its characters make its identity somewhat doubtful.

Certain of the Arizonan and Sonoran specimens referred to *Conalcaea humphreysii poecila* by Ball et al. (1942) and Tinkham (1947) probably represent *cochisei*, and possibly those from Copete Mine, Sonora, also referred to *humphreysii* by Hebard (Trans. Amer. Ent. Soc., vol. 51, p. 291, 1925). The reader is referred to my comments on this subject under *Barytettix humphreysii* and *B. poecilus*.

Douglas, the type locality, is just north of the Mexican boundary in a small area of the southern desert characterized by the creosotebush and the saltbush. Don Luis is located at the south base of the Mule Mountains, about 3 miles southwest of the town of Bisbee. The Don Luis specimens were taken on "low easy slopes, open with short grass and a scattering of other desertland vegetation, such as ocotillo (*Fouquieria*), creosotebush, etc."

BARYTETTIX HUMPHREYSII (Thomas)

FIGURES 58, a, c, k; 63, e; 64, c, d, j; 65; PLATE 11, FIGURE 1

- Pezotettix humphreysii* THOMAS, Report of geographical and geological explorations west of the one-hundredth meridian, vol. 5, pp. 890-892, pl. 45, figs. 1, 2, 1875.—CAUDELL, Ent. News, vol. 22, p. 165, 1911.
- Conalcaea neomexicana* SCUDDER, Proc. U. S. Nat. Mus., vol. 20, pp. 24, 26, pl. 2, fig. 9, 1897; Catalogue of the Orthoptera of the United States and Canada, Proc. Davenport Acad. Nat. Sci., vol. 8, p. 48, 1899.—BRUNER, Biologia Centrali-Americana, Orthoptera, vol. 2, p. 305, 1908.—SCUDDER and COCKERELL, Proc. Davenport Acad. Nat. Sci., vol. 9, p. 40, 1902.—CAUDELL, Proc. U. S. Nat. Mus., vol. 28, p. 476, 1905.—REHN, Proc. Acad. Nat. Sci. Philadelphia, vol. 59, p. 47, 1907.—KIRBY, Synonymic catalogue of Orthoptera, vol. 3, p. 493, 1910.—REHN and HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 64, p. 74, 1912.—HEBAR, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, pp. 264, 275, 1917.
- Barytettix borealis* CAUDELL, Proc. Ent. Soc. Washington, vol. 9, pp. 69-70, 1908.—KIRBY, Synonymic catalogue of Orthoptera, vol. 3, 585, 1910.—CAUDELL and HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 64, p. 162, 1912.
- Barytettix neomexicana* SCUDDER, PIERCE, and MORRILL, Proc. Ent. Soc. Washington, vol. 16, p. 22, 1914.
- Conalcaea humphreysii* THOMAS, KIRBY, Synonymic catalogue of Orthoptera, vol. 3, p. 493, 1910.—HEBAR, Trans. Amer. Ent. Soc., vol. 51, pp. 290-291, 1925; Trans. Amer. Ent. Soc., vol. 61, p. 300, 1935.—BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, pp. 329-330, 1942.—TINKHAM, Amer. Midl. Nat., vol. 38, pp. 145-146, 1947.

*Conalcaea humphreysii poecila* Hebard, BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, pp. 329-330, 1942 (in part).

*Male*.—Essentially like *cochisei* except in key characters noted; averaging more robust. Cercus (fig. 64, *j*) with ventroapical angle averaging more acute than in *cochisei* but not sufficiently different to serve as a separating character; furcula, supra-anal plate and subgenital plate about as in *cochisei*; ventral valves of aedeagus with apices widely separated and incurved (fig. 64, *d*).

Coloration: Pattern as in *cochisei*, but general tone brownish rather than greenish olivaceous; hind tibia usually yellowish buff but occasionally bright red; abdomen usually pale brown, averaging lighter than in *cochisei* and with scarcely any pinkish tinge on external genitalia.

Measurements (length in millimeters) of representative specimen: Body, 27; pronotum, 6.1; front femur, 4.8; hind femur, 14.5; tegmen, 4.2.

*Female*.—General form as in plate 11, figure 1, not separable with certainty from *cochisei* except by association with male; tegmen variable, usually narrower at base than in figure 58, *a*; dorsal valve of ovipositor decidedly upturned at apex (fig. 58, *k*); cercus blunt to moderately acute.

Coloration: As in male.

Measurements (length in millimeters) of representative specimen: Body, 31; pronotum, 6.6; front femur, 4.7; hind femur, 16.5; tegmen, 5.7.

Males examined vary in pronotal length from 4.8 mm. (Santa Rita Mountains) to 7.5 mm. (Baboquivari Mountains), and from 21.5 to 32 mm. in body length. Females vary in pronotal length from 5.7 mm. (Huachuca Mountains) to 8.3 mm. (Ajo Mountains), and from 19.5 to 36 mm. in body length.

The only dependable character I have found for separating *humphreysii* from *cochisei* is the aedeagus, although freshly collected or well-preserved specimens of *cochisei* are usually more greenish olivaceous than *humphreysii*, and there is more red on the hind legs and external genitalia. Ball et al. (1942) and Tinkham (1947) probably did not study the aedeagus, and certain specimens with considerable red were referred to *poecila*, as demonstrated by material of *humphreysii* here recorded from the Ajo Mountains, which was sent to me by Dr. Tinkham as representative of *humphreysii poecila*. It is now known that those authors were quite correct in realizing that a form related to typical *humphreysii* occurs in southern Arizona and Sonora, and without studying the aedeagus it was natural to assume that the additional form might be a subspecies of *humphreysii*. My examination of the type of *poecila* shows that the identification was incorrect.

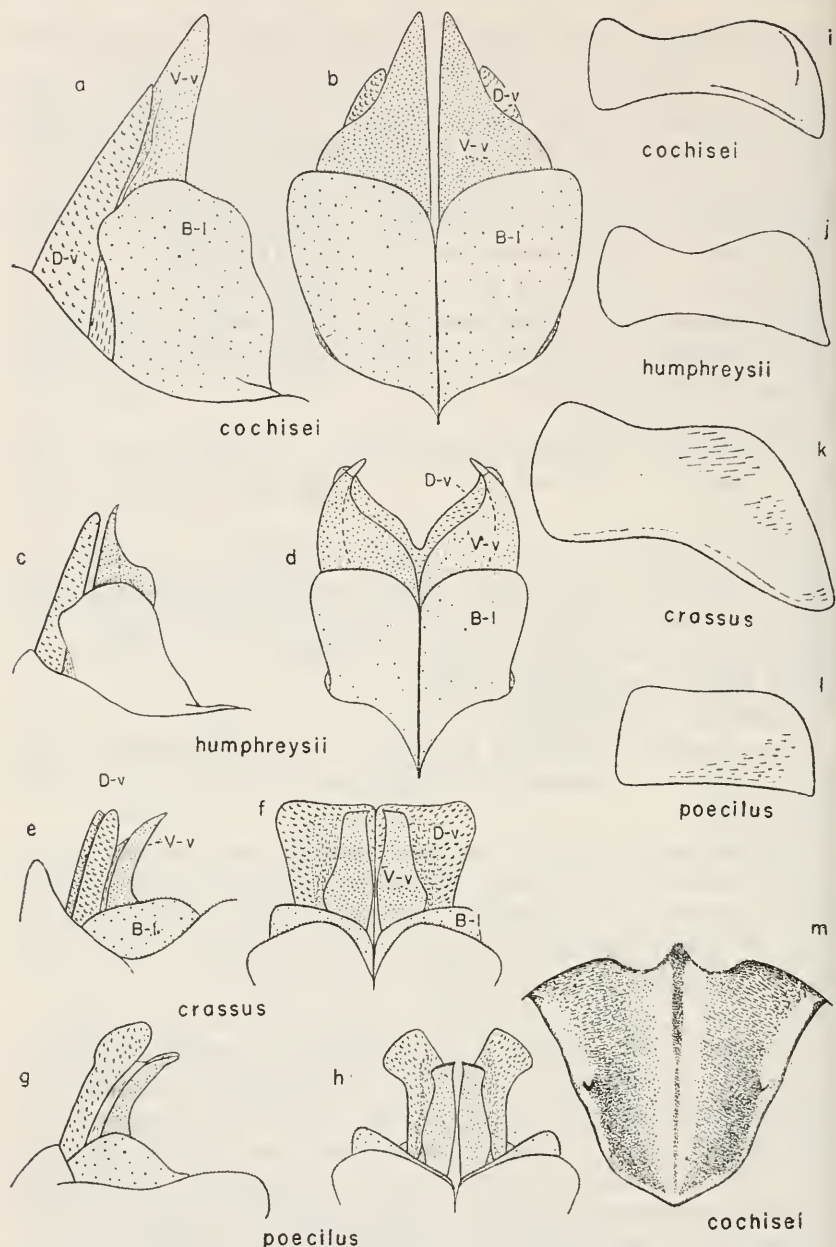


FIGURE 64.—Structural details of male specimens of *Baryttettix*: a, *B. cochisei*, new species, holotype, lateral view of aedeagus; b, *B. cochisei*, dorsoposterior view of aedeagus; c, *B. humphreysii* (Thomas), Santa Catalina Mountains, Ariz., lateral view of aedeagus; d, *B. humphreysii*, Santa Catalina Mountains, Ariz., dorsoposterior view of aedeagus; e, *B. crassus* Scudder, topotype, lateral view of aedeagus; f, *B. crassus*, dorsoposterior view of aedeagus; g, *B. poecilus* (Hebard), paratype, Villa Union, Sinaloa, Mexico, lateral view of aedeagus; h, *B. poecilus*, paratype, Villa Union, Sinaloa, Mexico, dorsoposterior view of aedeagus; i, *B. cochisei*, paratype, Douglas, Ariz., cercus; j, *B. humphreysii*, Santa Catalina Mountains, Ariz., cercus; k, *B. crassus*, topotype, cercus; l, *B. poecilus*, paratype, Villa Unión, Mex., cercus; m, *B. cochisei*, paratype, Don Luis, Ariz., supra-anal plate. (B-l, basal lobe of aedeagus; D-v, dorsal valve; V-v, ventral valve.)

however, and aedeagal characters give no indication of subspecific intergradation.

*Type*.—Apparently not in existence.

*Type locality*.—Southern Arizona.

In the absence of a type, it is impossible to determine whether the name *humphreysii* applies to the species here so called or to the one described as *cochisei*. The former has been collected much oftener, is more widely distributed, and in a sense the usage of earlier workers has been that of earlier revisers. Thomas' original illustrations clearly show that *humphreysii* belongs to *Baryttettix* rather than to *Conalcaea*, and I am adopting the view that the more common species was the one first discovered.

The synonymy of *Conalcaea neomexicana* Scudder and *Baryttettix borealis* Caudell, indicated by Hebard (1935), is fully borne out by my examination of the types. The type of *neomexicana*, now in the Academy of Natural Sciences of Philadelphia, is a unique male from Silver City, Grant County, N. Mex. Caudell (1908) described *borealis* from two males taken at the base of the Santa Catalina Mountains, Ariz., and one female without data. A male lectotype, U.S.N.M. No. 1041, was selected by Caudell and Hebard (1912).

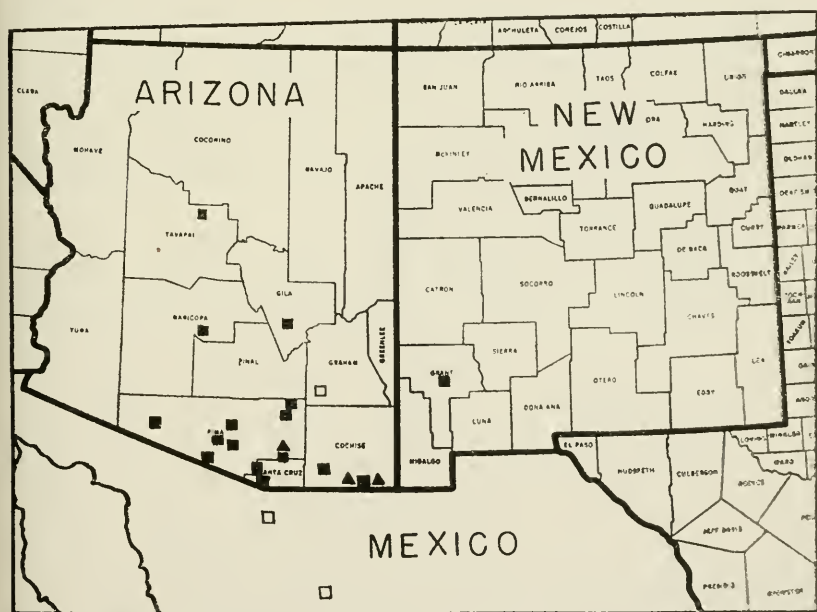


FIGURE 65.—Distribution of *Baryttettix humphreysii* (Thomas) and *B. cochisei*, new species: ■ *B. humphreysii*, material examined; □ *B. humphreysii*, localities noted in literature from which I have not seen material; ▲ *B. cochisei*, material examined.

Specimens of *humphreysii* from the following localities have been examined. NEW MEXICO: Silver City, Grant County. ARIZONA: Verde Valley, directly north of Clarksdale; Clarksdale; Globe; Phoenix; Sabino Basin, Santa Catalina Mountains; Pima Canyon, Santa Catalina Mountains; Santa Catalina Mountains (2 lots, no detailed locality); Douglas; Madera Canyon, Santa Rita Mountains; Stone Cabin Canyon, Santa Rita Mountains; 2 miles north of Oro Blanco, Tumacacori foothills, Santa Cruz County; Atascosa Mountain, Pajaritos Mountains, Santa Cruz County; Nogales; Coyote Mountains, at north end of Baboquivari range; Sycamore Canyon, Baboquivari Mountains, almost due east of Baboquivari Peak; Schaeffer Canyon, Baboquivari Mountains, at north base of Mount Mildred on east face of Baboquivari range; Baboquivari Mountains (no detailed locality); Fortification Rock, Baboquivari Valley, east-southeast of San Miguel; Fresno; Alamo Canyon, Ajo Mountains, about 30 to 40 miles southeast of Ajo.

Hebard (1925) reported one male and nine females of *humphreysii* from the Copete mine, 30 miles east of Carbo, Sonora. He commented on the fact that the majority of that series differed from Arizona material in having redder hind tibiae. Without examining the male, it cannot be known whether *humphreysii* or *cochisei* was represented. Other localities mentioned in literature, from which I have not seen material, are the northern area of Sonora cited by Tinkham (1947) and the Galiuro Mountains and Chiricahua Mountains of Arizona (Ball et al., 1942). Hebard (1917) noted that Kirby (1910) incorrectly recorded *neomexicana* from Mexico, there then being no authentic record from that country of *humphreysii* or its synonyms.

*Barytettix humphreysii* is found from the northern part of the Lower Sonoran Zone through the Upper Sonoran. Tinkham (1947) considers it "one of the characteristic and dominant species" of what he calls "the Sonoran Live Oak Zone of the Upper Sonoran." In several instances, as in Schaeffer Canyon and in the Coyote Mountains, Mr. Rehn's notes record finding *humphreysii* lower on the desert foothills than the zones occupied by oaks, but in other places (Sabino Basin; Atascosa Mountain) it occurred in both strong and scattered stands of oaks. Sahuaro (*Carnegiea gigantea* Britton and Rose), paloverde (*Cercidium* or *Parkinsonia*), cholla (*Opuntia*) and sotol (*Dasylirion*) were dominant plants often characteristic of the habitats. In the Coyote Mountains, *humphreysii* was found in "pockets" of such plants between great boulders on very steep, rugged south slopes of a canyon. Again, groves of oaks and acacia, interspersed with clumps of fine grasses, were typical surroundings. In Sycamore

Canyon of the Baboquivari Mountains, it occurred on grassy benches along the sides of a canyon. In both the Santa Rita and the Santa Catalina Mountains, *humphreysii* has been found on desert cotton (*Gossypium thurberi* Todaro), but it is not precisely known to be a host plant.<sup>13</sup>

Adults examined were collected as early as the month of April and as late as November 15 (both extremes in the Baboquivari Mountains of Arizona), though most collections have been made from July to late October.<sup>14</sup>

Altitudes at which *humphreysii* occurs have been recorded above 6,000 feet, but most records are from 3,000 to 5,000 feet, and it appears that this is typically a species of lower altitudes than those preferred by *Conalcaea huachucana*.

BARYTETTIX POECILUS (Hebard), new combination

FIGURES 61; 64, *g, h, l*; PLATE 10, FIGURE 1

*Conalcaea poecila* HEBARD, Trans. Amer. Ent. Soc., vol. 51, pp. 267, 290-292, pl. 7, fig. 7, pl. 8, fig. 4, 1925.

*Conalcaea humphreysii poecila* Hebard, BALL, TINKHAM, FLOCK, and VORHIES, Arizona Agr. Exp. Stat. Techn. Bull. 93, pp. 329-330, 1942 (in part).—TINKHAM, Amer. Midl. Nat., vol. 38, pp. 145-146, 1947 (in part).

**Male.**—General form as in plate 10, figure 1; cercus scarcely curved mesally when seen from above, the apex broadly rounded, ventral margin weakly curved, the ventroapical angle little produced (fig. 64, *l*); furcula about as in *cochisei* (fig. 64, *m*), the lobes a little smaller and more abruptly demarked laterally; supra-anal plate shaped about as in *Conalcaea miguelitana* (fig. 63, *i*), the dorsolateral prominences varying from minute, as in the figure of *cochisei*, to about twice the size of those illustrated in *C. miguelitana*; epiphallus much as in *humphreysii* (fig. 63, *e*), the apical margin of lophi more roundly and evenly curved, the ancorae somewhat larger; dorsal valves of aedeagus slender, narrowed basally, divergent apically (fig. 64, *h*).

**Coloration:** General color varying from pale yellowish green to dark olive-green. Antennae reddish orange, darker in apical fourth; eyes russet; black pattern, edged with yellow, on lateral lobes of pronotum; hind femur varying from solid green, with darkened carinae and knees, to yellowish, with green on carinae and dorsal half of pagina, dark area of knees usually brownish purple; hind tibia purple, the spines and spurs black apically; hind tarsus pale purple to brown; supra-anal plate and cerci often reddish brown.

<sup>13</sup> Pierce and Morrill (Proc. Ent. Soc. Washington, vol. 16, p. 22, 1914).

<sup>14</sup> Hebard (Ent. News, vol. 44, pp. 231-235, 1933) has noted a few winter and early spring Orthoptera in the vicinity of Tucson, Ariz., but does not mention *Conalcaea* or *Barytettix*.

Measurements (length in millimeters) of representative specimen: Body, 29; pronotum, 5.9; front femur, 5.5; hind femur, 16; tegmen, 5.

*Female*.—Very much like *humphreysii* except in color, which agrees with that of the male.

Measurements (length in millimeters) of a paratype: Body, 33; pronotum, 7; front femur, 5.5; hind femur, 19.3; tegmen, 6.

Pronotal length of males varies from 5.7 (Venvidio) to 6.5 mm. (Villa Union), body length from 25.5 (Compostela) to 29.5 mm. (Villa Union). Females are recorded by Hebard (1925) as ranging from 6.7 (Venvidio) to 8 mm. (Villa Unión) in pronotal length, from 28.3 to 37.2 mm. in body length.

*Type*.—A male in the Academy of Natural Sciences of Philadelphia, collected August 28, 1918, by J. A. Kusche, and designated in the original description.

*Type locality*.—Venvidio, Sinaloa, Mexico (Venvidio is evidently near Los Mochis).

In addition to the type locality, the species is known from only two localities, from both of which I have seen material: Villa Union (about 15 miles southeast of Mazatlán), Sinaloa, Mexico. Vicinity of Compostela (about 25 miles south of Tepic), Nayarit, Mexico.

The male from Compostela is the only specimen that has not been recorded previously.

Records of *poecilus* from Arizona, and probably all those from Sonora by Ball et al. (1942) and Tinkham (1947) are in error, these applying to either *humphreysii* or *cochisei*.

Adult collection dates range from July 30 (Compostela) to September 27 (Villa Unión). No detailed information on habitats is available. The coastal region of Sinaloa and Nayarit belongs to the Tropical Zone, and the conspicuous native vegetation is largely of a scrub nature, chiefly mesquite, yucca, agave, cactus, and other plants.

#### BARYTETTIX CRASSUS Scudder

FIGURES 61; 64, e, f, k

*Barytettix crassus* SCUDDER, Proc. U. S. Nat. Mus., vol. 20, pp. 27-28, pl. 2, fig. 10, 1897; Index North American Orthoptera, p. 37, 1901.—BRUNER, Biologia Centrali-Americana, orthoptera, vol. 2, p. 305, pl. 4, figs. 8, 8a, 8b, 9, 1908-1909.—KIRBY, Synonymic catalogue of Orthoptera, vol. 3, p. 494, 1910.—REHN and HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 64, p. 74, 1912.

*Conalcaea crassa* (Scudder) HEBARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, pp. 264, 274, 1917; Trans. Amer. Ent. Soc., vol. 51, p. 290, 1925.

*Melanoplus nitidus* SCUDDER, Proc. U. S. Nat. Mus., vol. 20, pp. 207-208, 1897 (in part).

*Male*.—General form as in *humphreysii*; hind femur clearly more robust than in *poecilus* and slightly more so than in *humphreysii*; cercus (fig. 64, *k*) broadly produced ventroapically, moderately concave mesally; furcula and supra-anal plate about as in figure 64, *m*, of *cochisei*; epiphallus as in *poecilus*; dorsal valves of aedeagus broad, narrowing but little at base, contiguous apically (fig. 64, *f*).

*Coloration*: All the material examined was originally preserved in alcohol, so that discoloration has occurred. The pattern is the same as that of related species, except that the postocular black bar is unbroken on the prozona of the lateral lobes of the pronotum, and there is a trace of the bar on the metazona. A diffusion of dark pigment may have occurred while immersed in fluid, and these distinctions may not be typical of fresh specimens.

*Measurements* (length in millimeters) of a topotype: Body, 26.5; pronotum, 6.3; front femur, 5.7; hind femur, 16.8.

*Female*.—As in male except for genital features and greater robustness.

*Measurements* (length in millimeters) of a topotype: Body, 30; pronotum, 7.5; front femur, 5.5; hind femur, 19.5; tegmen, 5.8. Body length of females examined varies from 30 to 40 mm., pronotal length from 7.5 to 8.5.

*Type*.—A unique male noted by Scudder (1897); also by Rehn and Hebard (1912). In Academy of Natural Sciences of Philadelphia.

*Type locality*.—San José del Cabo, Baja California.

In addition to the type, I have examined two males and two females labeled as topotypes and marked "taken with type." Like the type, they bear the locality label "San José del Cabo, Baja California. G. Eisen Coll." The type also bears a "drawn" label, showing that it was illustrated by Scudder. One additional male, three females, and three nymphs bear identical locality labels but are not marked as topotypes. The topotype labels were probably affixed in recent years by Mr. Hebard, and probably the whole series is equally deserving of topotypic designation. Although no collecting date is carried by these specimens, it is known that Gustavus A. Eisen collected in Baja California during the years 1892-'94.

Also preserved in the Academy of Natural Sciences of Philadelphia is the female allotype of *Melanoplus nitidus* Scudder, collected by John Xantus at Cape St. Lucas, Baja California. That species has been referred to *Sinaloa* by Hebard (1917), but he found that the type and allotype were not congeneric, even as Scudder himself had suspected. The entire available series of *crassus* was originally preserved in alcohol.

It is possible that *crassus* is rather localized, and perhaps seldom abundant as well, because a collection of Orthoptera from Baja California made in 1938 by E. S. Ross, of the California Academy of Sciences, does not contain it. Neither is it mentioned by Hebard (Proc. California Acad. Sci., ser. 4, vol. 12, pp. 319-340, 1923; Trans. Amer. Ent. Soc., vol. 57, pp. 113-127, 1931) in reporting two other collections from Baja California.

The southern tip of Baja California is characterized by scrub vegetation and belongs to the Tropical Zone. Readers are referred to Nelson (Mem. Nat. Acad. Sci., vol. 16, 194 pp., 35 pls., 1921) for a detailed scientific report on the biological characteristics of Baja California. A popular account is by Gardner (Holiday, vol. 3, No. 4, p. 62 and various subsequent pages, 1948).