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New California grasshoppers of the genus Melanoplus
(Orthoptera, Acrididae)
by
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New California grasshoppers of the genus *Melanoplus* (Orthoptera, Acrididae)

by

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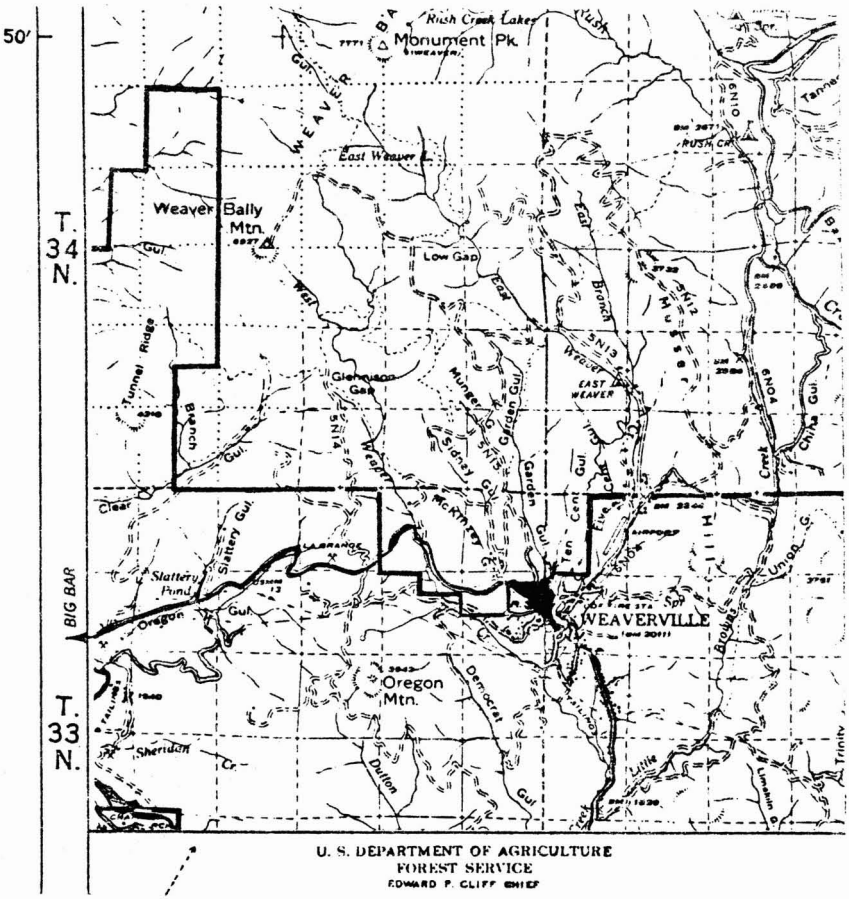
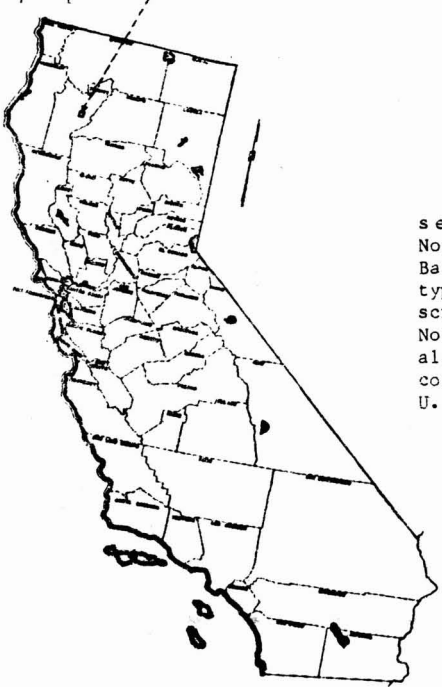




Outline map of California with enlarged section of a portion of Trinity County. Note Weaverville, lower right center; Weaver Bally and East Weaver Lake upper left center, type localities of the new species here described. Boonacris (Karokia) blanci Rehn, Notulae Naturae No.368, July 31, 1964, was also discovered on Weaver Bally during this collecting trip. Enlarged map, courtesy of U. S. Forest Service.

The two species of flightless grasshoppers here described are from the Weaver Bally area of northern Trinity County, California (see map).

One of the new species, collected at the summit of Weaver Bally, is a third member of the keiferi group 1/ of Melanoplus Stål. Its discovery is not surprising because collection which led to the finding of M.chimariki Gurney and Buxton and M.keiferi Gurney and Buxton, suggested the characteristic habitat of the group. Any bald, exposed hilltop, from 5,000' to 7,000' high, in the Coast Ranges of northern California may be expected to be an area suitable for members of this group. The vegetation of the exposed ridges, where the three known members of the group were collected, is sparse and dwarfed. It includes manzanita (Arctostaphylos), bitter cherry (Prunus emarginata (Douglas) Walpers), and buckthorn (Rhamnus). Late fall is the only time for effective collecting for adult members of this group. The ground is covered with serpentine, and little grass is evident. The bluish-gray grasshoppers, which tend to change to a brownish-gray after pinning, blend well with the ground.

Large populations of the keiferi group usually disperse widely near the exposed rocky areas. However, during late September and October, when the first storms can be expected, the populations tend to gather in the dull rocky patches and become extremely localized.

During the trip when the new species of the keiferi group was collected, a series of M.chimariki, including the previously unknown female, was collected at its type locality, and a series of M.keiferi was taken at Telephone camp ground, Glenn County, California, near the type locality of the latter species.

The second new species, here described as the basis for a new species-group related to the occidentalis group, was found in a small patch (20 by 40 yards) of Boykinia major Gray (Saxifragaceae). The host plants, to which the species was restricted, were growing on a shelf near the southwest side of East Weaver Lake. The latter is a deep cirque of about one-half acre surface, at an altitude of about 6,200' located scarcely one air mile northeast of Weaver Bally, over a ridge from the mountain and down an extremely steep talus slope strewn with granite boulders.

We are indebted to Arthur D. Cushman, Entomology Research Division, U. S. Department of Agriculture, for drawing figures 6-13, 15-21, and 30. Figures 14,15, 22-29, and 31 are by Gurney, and the remaining drawings and the photograph are by Buxton. The names of colors used in the descriptions are from the Reinhold Color Atlas.

MELANOPLUS LITHOPHILUS, new species
Figs. 1-5 (C), 13, 24, 25, 27, 28

Holotype.--Male, Weaver Bally, Trinity County, California, 25-IX-1963, ex serpentine on summit, G.M.Buxton and F.L.Blanc, Collectors, Calif.Dept.Agr. No.63J11-12 [California Academy of Sciences].

Size medium for group; tegmina lanceolate, longer than in M. keiferi or M. chimariki (Fig. 5), reaching midway on supra-anal plate. Head in dorsal view with ratio of interocular distance to width of compound eye as 4:11; fastigium strongly declivent anteriorly and shallowly sulcate; frontal costa shallowly sulcate; pro-

1/ Ashley B.Gurney and George M.Buxton, 1963. New California Grasshoppers of the genera Melanoplus and Hypsalonia (Orthoptera, Acrididae). Bul. Brooklyn Ent. Soc., Vol. 58: 62-71, figs. 1-12.

notum with lateral carinae scarcely evident on metazona and indistinct on prozona; median carina on prozona weak, scarcely evident on posterior half, cut by two sulci; median carina of metazona distinct; entire surface of pronotum dull, with sparse but prominent short hairs, best seen in lateral view; principal sulcus perceptibly angled posteriorly (170°) where it cuts the median carina; median carina of prozona longer than metazona (as 9:8); posterior margin of metazonal disc broadly angled at about 120°; prosternal spine bluntly conical. Tegmina overlapping entire length, wings a little shorter than tegmina. Apical portion of abdomen moderately enlarged and strongly curved dorsally. Legs robust.

Supra-anal plate (Fig. 1) equilaterally triangulate, lateral margins elevated in basal two-thirds; two longitudinal submedian ridges moderately developed on basal half and converging posteriorly with depression between submedian and lateral ridges; slightly depressed on distal tip. Furcula minute. Cercus (Fig. 2) broadly attached, expanding slightly on basal one-fourth, then rapidly expanding mesally, distal width approaching twice the proximal width, slightly concave in center.

Concealed genitalia (extracted and preserved in glycerine in microvial attached to holotype) with main fleshy portion of aedeagus erect (Figs. 3 and 4); a membranous and transparent forked piece, broadly attached dorsally and laterally, rises from each half of main stem, providing loosely fitted sheath for dorsal valve, anterior and longest arm of fork almost equalling dorsal valve in height; dorsal valves darkly pigmented, long, slender, tapering, erect and gently curving anteriorly and slightly outward in central portion, then abruptly curving inward and upward at tip; ventral valves two-thirds height of dorsal valves, moderately pigmented and striated, curving gently and evenly anteriorly, blunt at apex; epiphallus (Fig. 24, 25, 27) with ancorae moderately sized and down-curved, lophi truncate, dorsal margins broadly rounded in dorsal and lateral views.

Coloration.-- Dorsal surface of head, thorax, tegmina, front and middle legs light grayish brown (Color 6D3), abdomen and ventral surface of body near orange-gray; hind femur pale, with three black transverse bars on lateral and dorsal surfaces, one at extreme base indistinct, genicular area also dark, meso-ventral surface lemon basally to reddish centrally to lemon in a small distal area, genicular area and transverse bar on apical third black on mesal surface; hind tibia grayish blue with black spines, outer proximal surface with brown mottling on basal fourth, inner apical spurs equal, with pale bases and black tips; tarsi pale.

Measurements (in millimeters).--Length of body, 16.9; pronotum, 3.9; hind femur, 9.7; front femur, 3.5; tegmen, 7.7. Greatest width of pronotum (posterior, including lateral lobes in perspective from above), 3.6; hind femur, 2.8; front femur, 0.8; tegmen, 2.0 2/.

Allotype.--Female, same data as holotype [California Academy of Sciences]. Head in dorsal view with ratio of interocular distance to width of compound eye as 8:17; eye less globose than in male; fasti-

2/ Tegmen length is measured from the distal extremity of the tubercle formed by the junction of the costal and subcostal veins to the apex of the tegmen. The pit just anterior to the tubercle is a convenient landmark (Fig. 7). A standard reference for structures often measured is V. M. Dirsh, 1953. Morphometrical studies on phases of the desert locust (Schistocerca gregaria Forskal). Anti-Locust Bull. 16: 1-34, 31 figs.

gium feebly sulcate; medium carina of prozona and metazona equal in length; posterior margin of pronotum with about 120° angulation; tegmina reaching to tergum 5, over little more than half the abdominal length. Cercus (Fig. 28) with ventral margin a little more convex than dorsal margin, apex bluntly rounded; dorsal ovipositor valve (fig. 13) with scoop broadly concave and ventral portion complementing dorsal portion of ventral valve as figured.

Coloration.--Essentially as in holotype, but a little darker with colors less contrasting.

Measurements (in millimeters).--Length of body (including ovipositor), 23.0; pronotum, 4.7; hind femur, 11.5; front femur, 3.5; tegmen, 9.4. Width of pronotum, 4.5; hind femur, 3.0; front femur, 0.8; tegmen, 2.9.

Variation.--The paratypes are about the same size as the holotype and allotype. Five male and five female paratypes have measurements (in millimeters) as follows: Length of body of males, 15.5 - 17.0 (av. 15.9), of females, 22.0 - 23.6 (av. 22.8); of pronotum of males, 3.8 - 4.5 (av. 4.1), of females, 4.7 - 5.6 (av. 5.1); hind femur of males, 8.9 - 9.8 (av. 9.5), of females, 11.3 - 12.3 (av. 11.7); tegmen of males, 7.2 - 8.3 (av. 7.6), of femalea, 9.2 - 10.4 (av. 9.7).

In five of the paratypes examined, the aedeagus shows the mesal lobe of the specialized lateral piece approaching in height the anterior lobe; in all cases the membrane of the lateral piece is conspicuous. Otherwise the aedeagus is of uniform shape. There is no significant variation in color.

Specimens examined.--22 (13 males, 8 females, 1 juv., including holotype, allotype, paratypes). All with same data as holotype.

Because of the type of male cercus and the pattern of the aedeagus, there seems no question about the group placement of lithophilus. As Fig. 5 shows, the tegmina of the three species of the group are of the same type, differing only in length. When the dorsally turned abdomen of males is relaxed and set in a horizontal position the tegmina normally reach tergum 8 in lithophilus, tergum 5 in chimariki, and tergum 4 in keiferi. Although the wings of lithophilus approach flight capability, no flight was observed.

The name litho-rock and philus-lover refers to the habit of seeking rock-covered ground.

MELANOPLUS CHIMARIKI Gurney & Buxton
Fig. 5 (B)

Melanoplus chimariki was described in 1963 (see footnote 1) from a unique male collected on South Fork Mountain,"4 miles southwest of Hyampom,"3/Trinity County,California, 14 September 1960, Calif. Dept. Agric. No. 62J23-3, by T. Gallion of the California State Bureau of Entomology [U. S. National Museum, Type No. 66, 499]. A series of 15 males and 12 females was collected on the South Fork Ridge in 1963, ane the female is here described.

3/ Although the type locality of M. chimariki was reported in the original description as four miles southwest of the village of Hyampom, a more precise designation is five miles W. S. W. of Hyampom, where the series reported here was collected. This is on South Fork Mountain, near the U. S. Forest Service road to the Blake Mountain Lookout in the vicinity of the boundary between Trinity and Humboldt counties.

Allotype.--Female, South Fork Ridge, 5 mi. W. S. W. Hvampom, Trinity County, California, 26-IX-1963; ex serpentine on summit; collectors, F.L.Blanc and G.M. Buxton; Calif. Dept. Agric. 63J11-11 [U. S. National Museum].

Head in dorsal view with ratio of interocular distance to width of compound eye as 10:17; eye less globose than in male; fastigium shallowly sulcate; median carina of prozona scarcely longer than metazona (as 15:14); posterior margin of pronotum broadly rounded. Cercus with dorsal margin slightly concave for first 7/8, then rounded narrowly at apex, ventral margin of cercus broadly rounded entire length, lateral surface slightly concave.

Coloration: Head, pronotum, and tegmina dark gray (1F1); mesosternum and metasternum uniform dark brown; hind femur light brown with three faded but distinct transverse bars.

Measurements (in millimeters).--Length of body (including ovipositor), 22.6; pronotum, 5.5; hind femur, 12.2; front femur, 3.5; tegmen, 9.0. Width of pronotum, 5.7; hind femur, 3.6; front femur, 0.8; tegmen, 3.3.

Variation.--The allotype is slightly larger and darker than the rest of the series. Five male and six female paratypes have measurements as follows: Length of body of males, 15.5-17.5 (av. 16.6), of females, 18.9-23.4 (av. 21.3); of pronotum of males 4.25-4.5 (av. 4.4), of females, 5.0-6.0 (av. 5.6); hind femur of males, 9.25-11.0 (av. 10.1), of females, 10.1-12-9 (av. 11.8); of tegmen of males, 6.25-7.5 (av. 6.65), of females, 7.9-9.6 (av. 8.6).

Specimens examined.--19 (11 males, 7 females, 1 juvenile. Allotype and series).

MELANOPLUS HARPERI, new species
Figs. 6-8, 11, 12, 18-23, 26, 29, 30

Holotype.--Male, East Weaver Lake, Trinity County, California, 25-IX-1963, ex *Boykinia major*. G. M. Buxton and F. L. Blanc, collectors, Calif. Dept. Agric. No. 63J8-17 [California Department of Agriculture, Sacramento, California].

Size medium for genus; tegmina lobate, reaching across basal fourth of tergum 2; abdomen strongly recurved dorsally. Head (Fig. 8) in dorsal view with ratio of interocular distance to width of compound eye as 11:19; fastigium shallowly sulcate, its lateral carinae only moderately prominent; frontal costa not sulcate. Pronotum with lateral carinae indistinct; median carina weak on prozona, faintly cut twice anterior to strong principal sulcus; ratio of prozona to metazona (length of median carina sections) 23:17; dorsal portion of posterior margin of metazonal disc broadly truncate, slightly notched medially; prosternal spine conical. Tegmina narrowly separated (by about 0.2 mm.) at midline. Legs average for genus.

Supra-anal plate (Fig. 12) equilaterally triangulate; basal half with prominent submedian ridges. Subgenital plate in lateral view briefly directed posteriorly near apex, a short dorsal knob weakly produced apically. Furcula with short but very distinct, blunt lobes. Cercus (Fig. 30) of *occidentalis* type, in general, tapering in apical half to a blunt rounded apex, surface shallowly concave.

Concealed genitalia (extracted and preserved in glycerine in microvial attached to type, following treatment with KOH) with main fleshy portion of aedeagus erect in lateral view, with apex of sclerotized lateral piece (Fig. 20, slp) attached to lobe of main stem visible; sclerotized piece joined to parchmentlike flap (Figs. 18, 21, pf) with sinuate mesal margin (best seen in dorsoposterior view); dorsal valves consisting of elongate rods, much widened ventrally, within body of main stem, terminating near apex of sclerotized piece, but distinct from latter, apex of valve with mesally directed hook (Fig. 18, h); ventral valves (Fig. 19, vv) thin, inconspicuous, with striated surface. Epiphallus (Figs. 22, 23, 26) with lophi erect and conspicuous, only moderately wide.

Coloration.--Dorsum of head and pronotum grayish brown (8D3), mottled with flecks of dark gray and yellowish white; front of head mainly pale orange, genae grading to mottled pale gray; eye brownish orange; black postocular bar distinct; lateral pronotal lobe dark brown, darker on upper three-fourths and very glossy on prozona; oblique episternal streak yellowish white, surrounded by black. Tegmina brown. Venter of thorax and abdomen mainly pale orange; blackish areas on side of abdomen conspicuous; dorsal surface pale orange, with some weak darker mottling; genital segments orange gray. Hind femur grayish orange externally, darker above and toward apex, ventral surface yellowish, traces of transverse dark bars on inner half of dorsal surface; hind tibia grayish yellow, a dark brown band near base, spines black.

Measurements (in millimeters).--Length of body, 17.0; pronotum, 4.0; hind femur, 9.5; front femur, 3.2; tegmen, 3.7. Greatest width of pronotum (including lateral lobes in perspective from above), 3.4; hind femur, 2.5; front femur, 1.0; tegmen, 2.2.

Allotype.---Female, same data as holotype. [California Department of Agriculture].

Head in dorsal view with ratio of interocular distance to width of compound eye as 7:10; eyes less globose than in male; frontal costa conspicuously sulcate at median ocellus and ventrad of it; median carina of prozona longer than that of metazona (as 28:23), not clearly cut by sulci on prozona; posterior margin of pronotum broadly produced, about 165 degrees angulation; dorsum dull, lateral lobes glossy, less so on metazona. Tegmina extending across half of tergum 2. Cercus (Fig.29) blunt; dorsal ovipositor valve (Fig.11) with "scoop" broadly concave near apex, margin slightly irregular toward base, transverse ridges of dorsal surface broken, indefinite.

Coloration.--Essentially as in holotype, but tegmina and lateral pronotal lobes not so dark, both parts light brown.

Measurements (in millimeters).--Length of body, 25.0; pronotum, 5.1; hind femur, 12.2; front femur, 3.5; tegmen, 5.0; width of pronotum, 4.7; hind femur, 3.2; front femur, 0.9; tegmen, 3.1.

Variation--The paratypes agree essentially with the holotype and allotype. Five male and five female paratypes have measurements as follows: Length of body of males, 17.1-18.0 (av. 17.5), of females 24.0-25.1 (av. 24.6); of pronotum of males, 4.0-4.2 (av. 4.1, of females, 4.9-5.3 (av. 5.1); hind femur of males, 9.5-10.0 (av. 9.9), of females, 11.1-12.8 (av. 11.8); of tegmen of males, 3.8-4.4 (av. 4.0), of females, 4.6-5.5 (av. 4.9).

The concealed genitalia of 14 male paratypes (8 dry, 6 in glycerine) have been examined, and no significant differences in aedeagus or epiphallus have been noted. However, the aedeagus of a freshly dissected specimen or a preparation treated with KOH usually has tumid, well-rounded fleshy lobes of the main stem (Fig. 19), but dry mounts attached to the body (Fig.18) and some of those preserved in glycerine without KOH treatment show much shrinkage of the fleshy lobes. In dry preparations the ventral valves are scarcely evident, but may be located in wet preparations by spreading the paired left and right structures. The darkly sclerotized and hooked apex of the dorsal valves often are visible in dry preparations, but usually are covered by the parchmentlike flap in wet preparations and must be probed with dissecting needles to be seen.

Some specimens show minor variation in color, and in some the pale oblique episternal streak is inconspicuous. In life the general body color of harperi was reddish brown (8D8), with the hind tibia light yellow to a darker yellow, almost black at base, but the red tinge of the body faded rapidly after death.

Certain variation is exhibited by additional specimens of harperi which were collected in September 1964 by Buxton, Gurney, and Richard M. Thompson at Grizzly Meadows, Trinity County, California. These specimens will be discussed in a later paper.

Specimens examined.--34 (20 males, 14 females, including holotype, allotype, paratypes). All specimens were collected with the holotype.

We are glad to name this distinctive grasshopper in honor of Robert W. Harper, Chief of the Bureau of Entomology, formerly State Grasshopper Leader in California. His continued interest, following the 1952 publication of his "Grasshoppers of economic importance in California," has contributed to collecting activities which have added importantly to the knowledge of California Acridoidea.

Relationship of the harperi species-group

We regard M. harperi as representing a new species-group of Melanoplus, and anticipate the discovery of additional members of the group. Closest relationship appears to be in the occidentalis group, a little less close to the keiferi group.

From both of the related groups, harperi differs in the pattern of the appendages of the aedeagus, the nearly truncate rather than strongly produced posterior margin of the pronotum, and the lobate instead of lanceolate to fully developed tegmina. The male cercus is widened in part of the apical half in the keiferi group, not entirely tapering there as in harperi. Basic differences in the cercus between harperi and the occidentalis group are subtle, but the species of the latter group have a stronger development of smoothly rounded posterobasal curvature (Fig. 31, pbc). Although the furcula of harperi is small, it is decidedly larger than in the three members of the keiferi group. The typical color of the hind tibia in the latter is grayish blue, sometimes darkened to deep blue, but in harperi the color is grayish yellow.

Similarity of the basic pattern of the main stem of the aedeagus and its appendages appears to be a strong indicator of relationship in Melanoplus and allied genera. There seems no question but that the tall slender dorsal and ventral valves, associated with a mainly

parchmentlike piece from each lobe of the main stem, shows the cohesiveness of the keiferi group and the contrast with harperi. In the occidentalis group, illustrated by cuneatus Scudder, rugglesi Gurney, and occidentalis brevipennis Bruner (Figs. 14-17), the species agree in having the dorsal valve (Fig. 14, dv) elongate, tapering, with the apex differently specialized in the various species; the spirally twisted apex in rugglesi is noteworthy. The ventral valve and the specialized lateral piece of the aedeagus are of the same type in all the species and, at least for some of the species, the latter is distinctive in its apical section; in cuneatus there is scarcely any dorsal development (Fig. 16, slp). Thus, the aedeagal pattern is fundamentally different in the occidentalis, harperi, and keiferi groups.

In each species-group of Melanoplus, the posterior margin of the pronotum tends to be of a uniform type, such as emarginate, approximately truncate, or produced to a weak or strong degree. Although some Orthoptera are noted for changes in pronotal shape correlated with differences in wing length, the posterior pronotal margin of Melanoplus appears rather constant for a species even when both long- and short-winged individuals occur. This condition is demonstrated by series of M. marginatus (Scudder) and M. dawsoni (Scudder). The posteriorly produced pronotum of both the keiferi and occidentalis groups argues against the inclusion of harperi in either of them. Figures 8 and 9 show the contrast between harperi and rugglesi.

Insofar as we know, no species-group of Melanoplus contains species which have lobate tegmina as well as those with lanceolate or full-length tegmina. The short tegmina of species which occasionally are brachypterous (usually macropterous) seem invariably to be lanceolate or sharply pointed, and species or subspecies such as M. occidentalis brevipennis (Fig. 10), in groups which otherwise include fully winged members, regularly have lanceolate tegmina rather than lobate tegmina which may be rounded as in harperi (Fig.7) or truncate. In the viridipes group certain species have tegmina covering about half of the abdomen, and other species have the same basic tegminal shape although length is very much less. The photograph (Fig. 5) shows the great similarity of tegminal shape in the three members of the keiferi group, quite different from the lobate tegmina of harperi. Figures 7 and 10 contrast the tegmina of harperi and occidentalis brevipennis, the only brachypterous member of the occidentalis group.

In harperi, size and structure of the furcula, and color of hind legs do not differ much from the condition in the occidentalis group, but the characters previously discussed appear to amply justify the group distinctiveness of harperi. Of the members of the occidentalis group, rugglesi occurs closest geographically to harperi. There are records of the gregarious phase of rugglesi from the extreme eastern portion of both Modoc and Lassen counties, California, but the solitary phase is not known farther west than Arco, Idaho; Battle Mountain, Nevada; and the Panamint Range, California. It is uncertain whether rugglesi occurs permanently in northern California.

Figures 8 and 9 show that the fastigial carinae of rugglesi are more prominent and closer together than those of harperi, and that the compound eyes are more prominent, in addition to the pronounced difference in the posterior margin of the pronotum. These distinguishing characters of the two species supplement the diagnostic features of the aedeagus, as shown in Fig. 14 for rugglesi and Fig. 19 for harperi.

PLATE 1

Fig. 1. *Melanoplus lithophilus* n. sp., supra-anal plate, male paratype.

Fig. 2. *M. lithophilus* n. sp., cercus, paratype.

Fig. 3. *M. lithophilus* n. sp., posterior view of aedeagus (KOH preparation in glycerine), holotype.

Fig. 4. *M. lithophilus* n. sp., lateral view (from left side) of aedeagus, holotype.

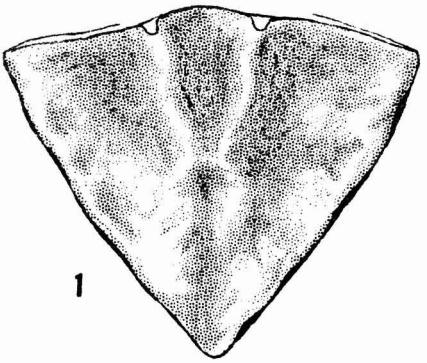
Fig. 5. Photo of typical male specimens of the three known members of the *Melanoplus kieferi* group showing comparative wing length.

A. *Melanoplus kieferi* G. & B., from Telephone Camp Ground, Glenn Co., Calif.

B. *M. chimariki* G. & B., from South Fork Ridge, Trinity Co., Calif.

C. *M. lithophilus* n. sp., paratype from Weaver Bally, Trinity Co., Calif.

Plate 1



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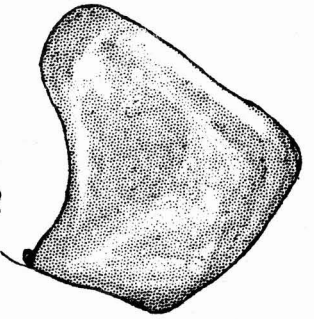

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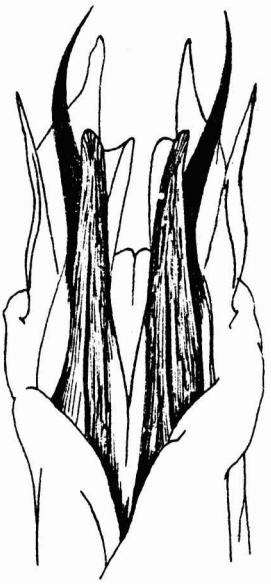

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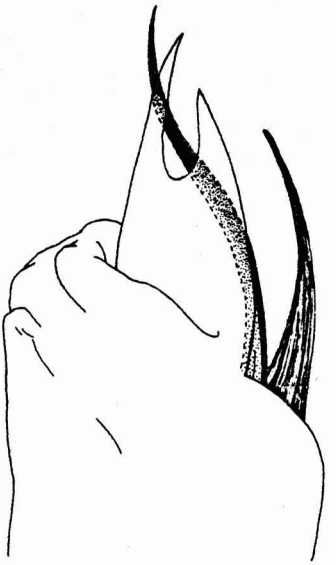

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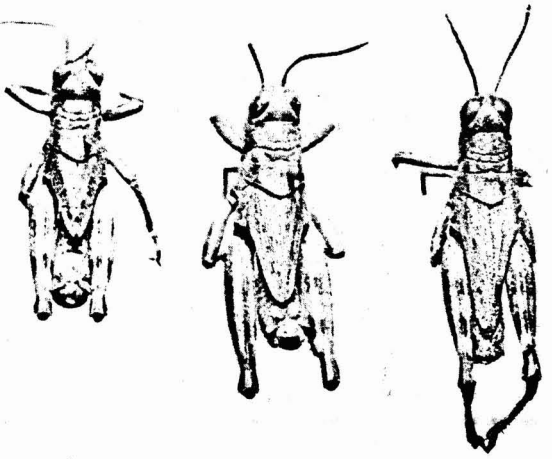

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A B C

PLATE 2

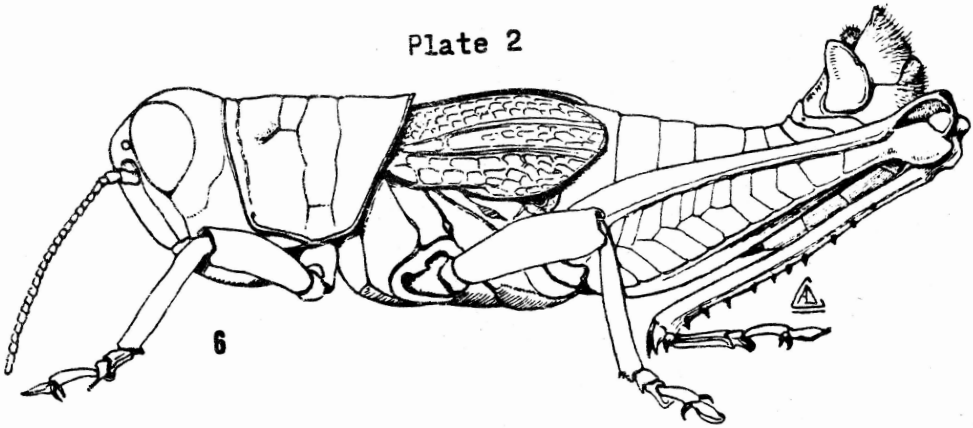
Fig. 6. Melanoplus harperi n. sp., habitus,paratype.
Fig. 7. M. harperi n. sp., left tegmen, paratype.
Fig. 8. M. harperi n. sp., dorsal view of head and pronotum, male paratype.
Fig.11. M. harperi n. sp., ovipositor, paratype.
Fig.12. M. harperi n. sp., supra-anal plate of male paratype.

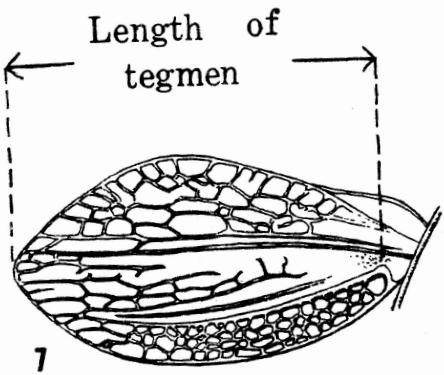
Fig. 9. Melanoplus rugglesi Gurney, dorsal view of head and pronotum, male of solitary phase from Border, Idaho.

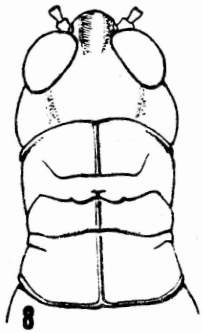
Fig.10. Melanoplus occidentalis brevipennis Bruner, left tegmen, from Palisades, Colorado.

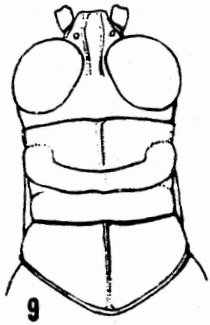
Fig.13. Melanoplus lithophilus n. sp., ovipositor of paratype.

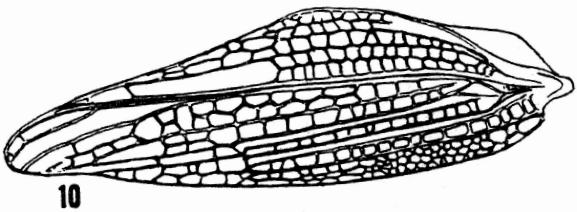
Plate 2

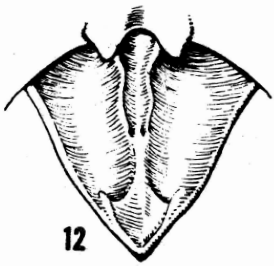












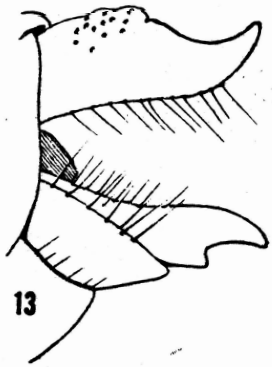


PLATE 3

Fig. 14. Melanoplus rugglesi Gurney, dorsoposterior view of aedeagus, gregarious (migratory) male specimen from Craine Creek, Humboldt Co., Nevada.

Fig. 17. M. rugglesi Gurney, dorsolateral view of aedeagus, same specimen as Fig. 14.

Fig. 15. Melanoplus occidentalis brevipennis Bruner, dorsoposterior view of aedeagus, right half only, specimen from Palisades, Colorado.

Fig. 16. Melanoplus cuneatus Scudder, dorsoposterior view of aedeagus, right half only, specimen from Sunset, Arizona.

Fig. 18. Melanoplus harperi n. sp., dorsoposterior view of aedeagus, dry preparation from paratype.

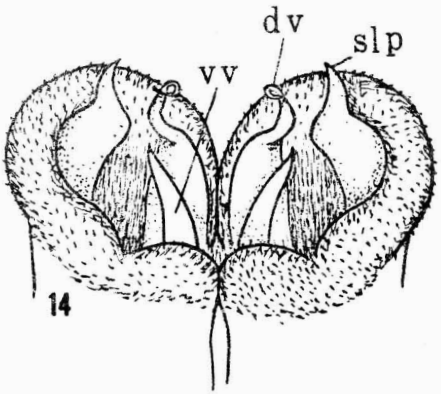
Fig. 19. M. harperi n. sp., dorsoposterior view of aedeagus, KOH preparation in glycerine from paratype.

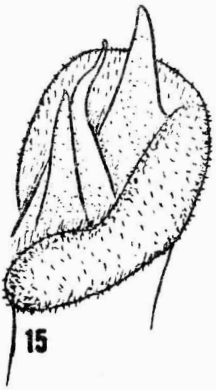
Fig. 20. M. harperi n. sp., lateral view of aedeagus, same specimen as in Fig. 19.

Fig. 21. M. harperi n. sp., dorsolateral view of aedeagus, same specimen as in Fig. 19.

Explanation of symbols: dv-dorsal valve; flms - fleshy lobe of main stem; h-hook of dorsal valve; pf-parchmentlike flap of specialized lateral piece; vv-ventral valve.

Plate 3


dv
slp
vv
14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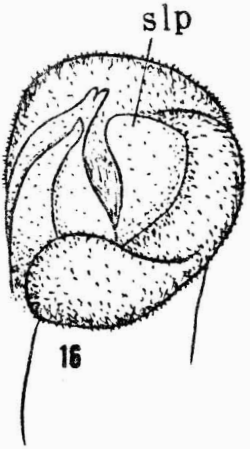
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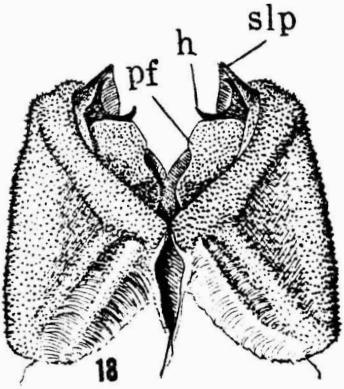
slp
h
pf
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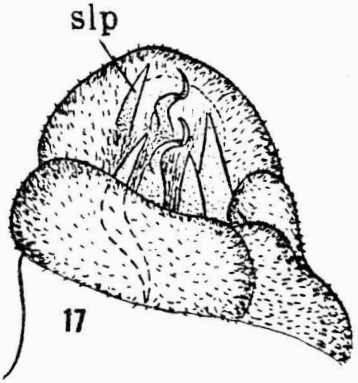
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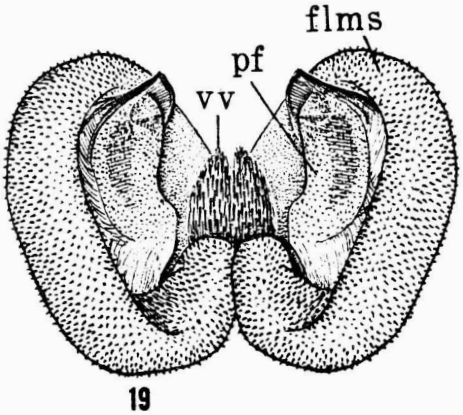
flms
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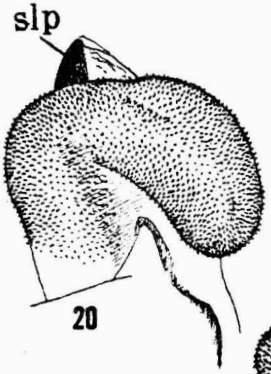
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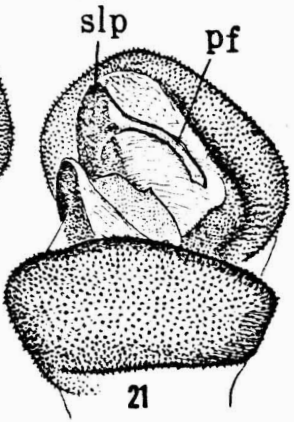
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21

PLATE 4

Fig. 22. Melanoplus harperi n. sp., dorsal view of epiphallus, KOH preparation in glycerine, from holotype.

Fig. 23. M. harperi n. sp., anterior view of epiphallus, from holotype.

Fig. 26. M. harperi n. sp., lateral view of ancora and lophus, from holotype.

Fig. 29. M. harperi n. sp., cercus of allotype.

Fig. 30. M. harperi n. sp., cercus of male paratype.

Fig. 24. Melanoplus lithophilus n. sp., dorsal view of epiphallus, from holotype.

Fig. 25. M. lithophilus n. sp., anterior view of epiphallus, from holotype.

Fig. 27. M. lithophilus n. sp., lateral view of ancora and lophus, from holotype.

Fig. 28. M. lithophilus n. sp., cercus of allotype.

Fig. 31. Melanoplus rugglesi Gurney, cercus of gregarious male, from Craine Creek, Humboldt Co., Nevada.

Explanation of symbols: lo-lophus; pbc-posterobasal curvature of cercus.
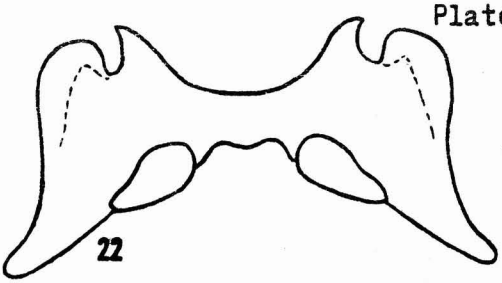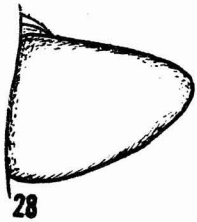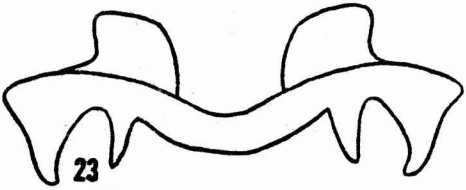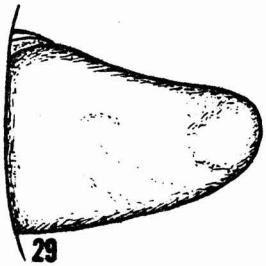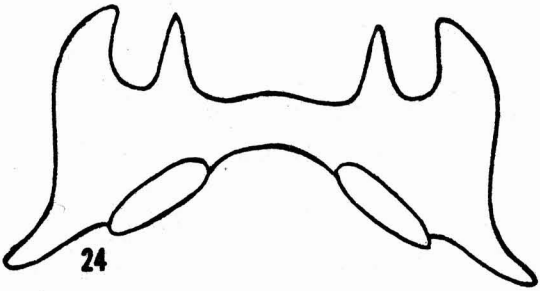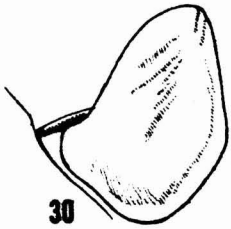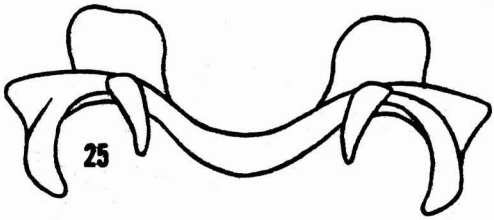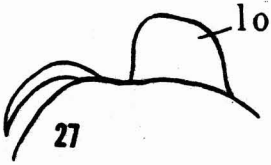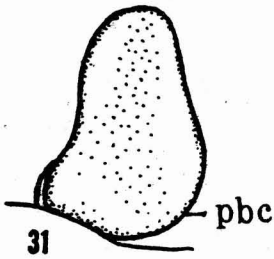
Plate 4