

NEW ANT-LIONS FROM THE SOUTHWESTERN  
UNITED STATES

(NEUROPTERA: MYRMELEONTIDAE)<sup>1</sup>

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In the course of identifying material from the Southwest, the writer has encountered several new species and a new genus of Myrmeleontidae. Descriptions of these are given below, with a list and key to the species of the genus *Eremoleon* Banks. Sources of specimens are designated by the following abbreviations: CAS, California Academy of Sciences; CIS, California Insect Survey, University of California, Berkeley; UCD, University of California, Davis; UCR, University of California, Riverside; UCLA, University of California at Los Angeles; LAM, Los Angeles County Museum; MCZ, Museum of Comparative Zoology, Harvard. The kindness of the staffs of these institutions in lending material is gratefully acknowledged.

The terminology of the wing venation as used herein differs from the usual system (summarized by Markl)<sup>2</sup> in several fundamental aspects. Markl's study is an excellent and invaluable treatment of the comparative morphology of the wing of the ant-lions, but unfortunately his scope, a tribal revision, was so large as to have discouraged detailed investigation of venation in other families. The best clues to the homologies of the myrmeleontoid wing are to be found in the primitive myrmeleontoids—the Osmylidae and the Myiodactylidae. A thorough account of the reasons for the adoption of the present system will be given in a forthcoming paper, dealing with the venation of the order as a whole.

In both wings, MA has become coalesced with Rs; the "basal piece" (Figure 8, "b") is to be seen at the base of the fore wing between R and MP. In the hind wing the basal

<sup>1</sup>Published with the aid of a grant from the Museum of Comparative Zoology, Harvard College.

<sup>2</sup>Markl, W., 1954, Verh. d. Naturforschenden Ges. Basel 65:178-263.

part of MA is retained in the Osmylidae as a sinuate vein running between MP and Rs shortly after the latter has diverged from R; in the higher families this portion of the vein disappears. MA reappears, however, as the last branch from the "radial sector" (of previous authors, herein termed  $Rs+MA$ ), differing often in being strongly convex, and branching much more than do the true branches of Rs. Comstock has termed the triangular sector which results from this branching the "radial cuneate area". Since the "radial sector" is a complex vein, the cross veins which lie behind it, between the base of the wing and its divergence from R, cannot be termed "radial cross veins"; they are in reality median cross veins. Because they have been used so much as a source of taxonomic characters, confusion might result in referring to them as median cross veins, hence the writer has adopted the term *presectoral cross veins* (Figure 8, "ps").

There has been much controversy over the homology of the cubitus in the hind wing, Comstock holding that the convex forked vein which appears analogous to the cubitus in the fore wing is actually  $M_3+4$ . His system was based mostly on evidence from the tracheation and from the absence of the "oblique vein" ( $MP_3+4$ ) from the hind wing. This forked vein is homologous to what has been termed  $MP_3+4$  in the other superfamilies; but it is the belief of the writer that it is actually composed primarily of cubital elements. There is evidence which indicates that  $CuA_1$  has, in the hind wing of all the Neuroptera, coalesced with M, resulting in a condition similar to that found in the Mecoptera, so that  $CuA_1$  appears as the posterior branch of the vein which has been called MP. In this paper, the veins which Markl terms "A<sub>1</sub>" and "A<sub>2</sub>" are referred to as  $CuA_2$  and  $CuP+A_1$ , respectively. In the ant-lions,  $A_1$  is coalesced for a short distance with  $CuP$ ; the base of  $A_1$  although weak, is visible. Markl seems not to have noticed the double nature of this vein, although he shows the base of  $A_1$  correctly in his figure 45. In the Osmylidae this coalescence has not taken place. The term *inner cubital veinlets* as used herein is equivalent to "anal veinlets" of previous authors.

Few workers have made reference to the internal male

genitalia when doing taxonomic work on the Mymeleontiidae. The writer has found that the structure of the gonarcus, and especially of the parameres, furnishes most useful characters; accordingly these are illustrated for all the species treated below, when male material was available. Within a species, there seems to be little variation in their size and structure; unfortunately, it will sometimes be found that closely related species have almost identical internal genitalia. Tjeder's terminology<sup>3</sup> is used.

Dorsally, there is present an arched sclerite, the *gonarcus*, which bears at its apex a small hood-like structure, the *mediuncus*. Loosely articulated with the *mediuncus* are the *parameres*, which often are produced to form hooks. Ordinarily, these structures will be found to lie in a pouch between the bases of the *ectoprocts* ("male appendages"); occasionally, this pouch will be found everted (Figure 32). The genital opening is on the ventral side of this sac, its position being marked by a small sclerite (Figure 32, dotted lines). As eversion takes place, the spatial relationships of the sclerites change markedly. In some species (e. g. *Hesperoleon* and relatives) the parameres have a thin region near their middle, the *hinge*, where they may fold when the genital sac is inverted. Upon eversion, they straighten out, and the points of the hooks become more divergent.

The reader is cautioned that, because of this folding, it was not possible to draw all the figures from the same viewpoint, and that, as a result, several of the figures are distorted. The side view gives a much better impression of the shape of the parameres than does the rear view, for this reason. In *Eremoleon* the parts are fairly rigid.

For critical examination, it is necessary to remove the gonarcus and parameres from the abdomen; these can easily be teased out after boiling the tip of the abdomen in KOH. The genitalia are stored in glass vials containing glycerine, pinned beneath the specimen. If the corks are boiled in paraffine, there is less danger of the glycerine soaking through to corrode the pin. This can also be minimized by piercing the cork at a 45 degree angle, so that

<sup>3</sup>Tjeder, Bo, 1954, Ent. Medd. 27:23-40.

the glycerine will remain at the bottom of the vial whether the specimen is stored in a flat tray, or in a box placed vertically on a shelf.

Among the measurements given are the lengths of the pterothorax and the third abdominal tergite. These lengths can be measured easily and accurately; their ratio gives a value useful in describing the amount of abdominal elongation.

Although the size of the labial palpi varies considerably within a given species, the size and shape of the terminal segment tends to be quite characteristic. In this segment is a sense-organ,<sup>4</sup> to accomodate which it is swollen to a greater or lesser degree. In the male, the terminal segment is often smaller than in the female.

#### Genus *Eremoleon* Banks.

Banks, 1901, Trans. Am. Ent. Soc. 27:365; 1928, Bull. Mus. Comp. Zool. 68: 69-71; Proc. Calif. Acad. Sci. 4th Ser. 24: 143-144.

This genus is still too poorly represented in collections to enable a full-fledged revision; the following is simply a list of the described species, with a key and such figures as may be found helpful in identification.

#### Key to the Species of the Genus *Eremoleon*.

1. A very slender species, the antennae about  $1\frac{1}{2}$  times length of head and thorax together; third abdominal tergite 1.4 times length of pterothorax . . . . . *longior*  
— More robust, the antennae at most equal to length of head and thorax together; third abdominal tergite at most equal to length of pterothorax . . . . . 2
2. A deep black mark on base of fore wing, mesepimeral wing process black . . . . . *nigribasis*  
— No such mark, mesepimeral wing process brown or yellow . . . . . 3
3. CuP+A<sub>1</sub> in fore wing curved forward, margin curved outward, so that the space between is wider in middle than at ends; prothorax wider than long . . . *mexicana*

<sup>4</sup>Eisner, T., 1953, J. Morph. 93:109-122.

- CuP+A<sub>1</sub> in fore wing straight or sinuate, the space between wider at base than middle; prothorax longer than wide . . . . . 4
- 4. Mesepimeral wing process dark umbraceous; 12-16 branches of CuP+A<sub>1</sub> in fore wing . . . . . *macer*
- Mesepimeral wing process yellow; 11 or less, usually 8-9, branches of CuP+A<sub>1</sub> in the fore wing . . . . . 5
- 5. Antennal segments longer than wide; antennae about as long as head and thorax together, the pedicel and scape black; wings heavily spotted . . . . . *gracile*
- Antennal segments wider than long; antennae shorter than head and thorax together, pedicel and scape pale; wings only weakly marked . . . . . 6
- 6. Large species (fore wing 30 mm., or longer); fore tibial spurs as long as 2 tarsomeres; all setae light brown . . . . . *insipidus*
- Smaller species (fore wing 28 mm., or less); fore tibial spurs as long as 3½ tarsomeres; most setae on legs, and many on thorax, black . . . . . *pallens*

*Eremoleon macer* (Hagen)

Figures 21, 30

*Myrmeleon macer* Hagen, 1861, Synopsis of N. Amer. Neur. :236

*Eremoleon macer* Banks, 1901, Trans. Amer. Ent. Soc. 27:365; 1928, Bull. Mus. Comp. Zool. 68:70; 1938, Carnegie Inst. Wash. Pub. 491:235

*Segura vitreus* Navas, 1914, Ent. Zeitung 28:18

In the Museum of Comparative Zoology there is a pair of specimens from Mexico (Apatzingan, Michoacan, 12,000 feet, Aug. 11. 1941, H. Hoogstral, and Jacala, Hidalgo, 4,500 feet, June 22, 1939, Ralph Haag) which are quite similar to *macer* in general characteristics, but which have more slender wings, with fewer presectoral cross veins in the fore wing (7 or 8, but about 10 in *macer*), and with more branches of CuP+A<sub>1</sub> in the fore wing; the vertex is dark pruinose, with two well-defined rows of spots in the Jacala specimen. The genitalia are like those of *macer*. Despite the differences from *macer*, it does not seem advisable to consider them distinct without more material

from this area. Should it then appear that they are distinct, the name *mexicana* Navas might be appropriate. The wing shape and markings are similar to those of *mexicana*; in the Apatzingan specimen the anal area in the fore wing is widened like Navas' figure (Figure 1b), but not to such a marked degree. The vertex and pronotal markings do not agree well with the figure.

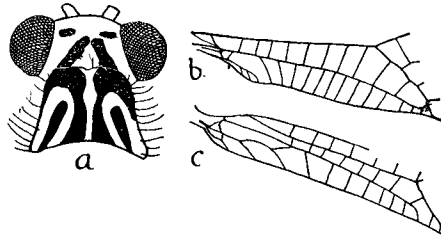


Figure 1. *Eremoleon mexicana* (Nav.) a. Head and prothorax, b. Axillary region of anterior wing, c. Axillary region of posterior wing (from Navas, 1925).

*Segura vitreus* has long been considered a synonym of *macer*; the description fits well except "Abdomen ♂ cercis manifestis, cylindricis," and "Abdomen longum, in ♂ alis longius . . .," characters which are not found in other species of *Eremoleon* or in related genera. Probably the type specimen, collected in 1871, has another abdomen affixed.

#### *Eremoleon mexicana* (Navas)

Figure 1 a, b, c

*Novulga mexicana* Navas, 1925, Mem. R. Acad. Ci. Artes Barcelona 19:189-190, fig. 17.

*Eremoleon macer* Banks, 1936, Carnegie Inst. Wash. Pub. 491:235

In all probability, this is *E. macer*; however, as mentioned above, the figure shows a differently shaped CuP+A<sub>1</sub> in the fore wing. According to the description, the wings are acute, and less prominently marked than in *macer*, there being only a small spot at the connection of CuP+A<sub>1</sub> and CuA<sub>2</sub>, at the rhegma, and at the hypostigmatic cell. The hind wing is immaculate.

**Eremoleon insipidus**, new species

Figures 19, 20, 28

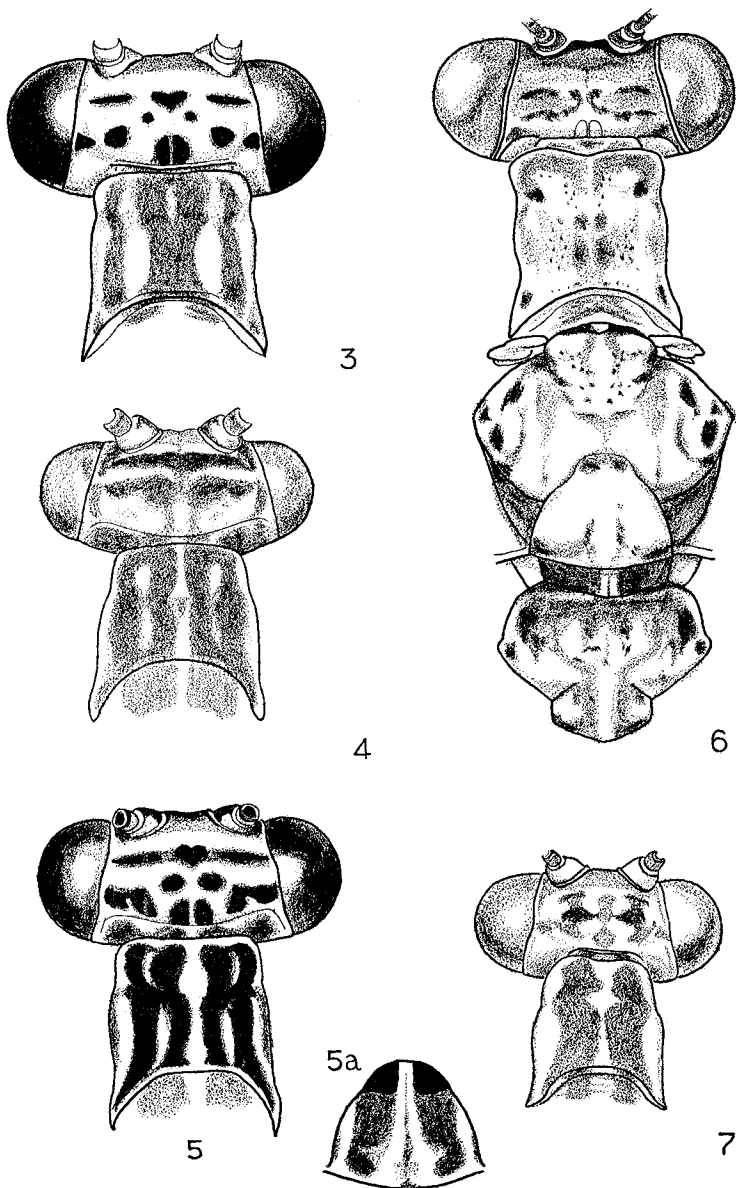
Head pale; a faint indication of an interantennal dark band; first row of vertex scars unpigmented — a dash on each side and double medial scar; behind is a pair of indistinct brown submedian spots; last segment of labial palpi large, strongly swollen (Figure 28); antennae pale, club infusate, flagellar segments all broader than long. Pronotum gray-brown, a pair of small submedian spots before furrow; behind furrow a pair of wide median brown bands, broadly separated by pale posteriorly; a short lateral dark stripe each side. Nota mostly infusate, a pair of broad brown stripes on mesoscutellum. Propleuron dark, mesanepisternum with a brown stripe below, rest of pleura pale; mesepimeral wing process light ochraceous. Coxae pale; a small basal brown spot; femora pale, very faintly spotted with brown; large apical brown spot on anterior side; tibiae lightly brown-dotted; tarsi pale. All setae, including long seta on fore femur, pale, darkest ones a light yellow brown in color. Fore tibial spurs only as long as 2 tarsomeres, hind spurs,  $1\frac{1}{2}$  tarsomeres.

First abdominal tergite pale, second dark with apical pale spot, third-sixth with small median pale spots at base and apex, and with large subbasal spot each side, broadly confluent medially and containing a dark spot each side. Apical tergites darker, with markings indistinct. Sternites pale to middle of 4th, beyond dark.

Venation largely pale; in fore wings most cross veins dark at ends; longitudinal veins dark where intersected by dark cross veins; each dark intersection surrounded by a small gray cloud in membrane; larger spots at apex of hypostigmatic cell, rhexma, and end of  $CuA_2$ . In hind wing venation paler, membrane scarcely marked, dark spots at apex of hypostigmatic cell and rhexma.

## EXPLANATION OF PLATE 3

Figures 3-7. Fig 3. *Hesperoleon minutus*, ♀, head and pronotum (Cathedral City, Calif.). Fig 4. *H. infuscatus*, ♂, head and pronotum (Antioch, Calif.). Fig 5. *H. fidelitas*, allotype, head and pronotum. Fig 5a. *H. fidelitas*, mesoscutellum. Fig 6. *Eremoleon gracile*, holotype, ♀, head and thorax. Fig 7. *Tyttholeon puerilis*, holotype, head and pronotum.



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Fore wing: broad, 5-7 presectoral cross veins, the last usually connected to first cross vein from RS+MA; 9-11 branches of RS+MA; 9-10 cross veins between CuA and CuP+A<sub>1</sub>; 8-10 cross veins between CuP+A<sub>1</sub> and wing margin. Hind wing: cubital area broad, with four rows of cross veins.

Parameres (Figure 19) similar to those of *macer*, but the plates much farther apart, the inner margin strongly concave.

Body length, 24.-27.5 mm.; fore wing, length 30.5-35. mm., width 7.6-9.6 mm.; hind wing, length, 28.5-32. mm.; width 7.1-7.6 mm.; labial palpus, length 0.78-0.88 mm.; width 0.20-0.25 mm.; antenna 5.7-6.7 mm.

Holotype ♂: 5 mi. S. of San Miguel, L. Cal. VII-20-38, Michelbacher and Ross, in the Museum of Comparative Zoology. Paratypes: Riggs, Calif. 5-9-34 ♀, Sperry (MCZ); Borego Valley, Calif., VI-6-40, C. D. Michener (CIS); El Mayor, L. Calif., IV-19-39, 1 ♂ 1 ♀, E. S. Ross (CAS); Mejia Is., Angel de la Guardia I., Gulf of Calif.; VI-28-21, ♂, E. P. Van Duzee (CAS).

These specimens are an insipid pale brown in color, with few really distinct markings on head or thorax; nowhere is there any structure which is strongly pigmented — black is absent. The large, heavily swollen labial palpi (Figure 28) are characteristic. The holotype and the Mejia Isd. specimens are paratypes of *affine* Banks.

#### **Eremoleon gracile**, new species

Figures 3, 17, 29

Face pale; shiny dark interantennal band present, widely separated from first vertex row. First vertex row with a curved, dull black dash each side, and a pair of indistinct submedian brown dots; second row similar but fainter; behind a shiny black spot each side near eye, and an indistinct brown median mark. Labial palpi short, pale. Scape and pedicel shiny-black, flagellum slender, the segments slightly longer than wide, reddish brown, the tip strongly swollen, much darker.

Thorax mostly pale, notum marked as in Figure 3; meso- and metepisterna largely infuscate, epimera largely pale; expansion of mesepimeral wing process light yellow. Fore

coxa pale with small basal fuscous spot; mid and hind coxae infuscate laterally; femora pale, very faintly dotted at base of some setae, apical shiny black bands; tibiae dotted with dark, bearing postbasal and apical black bands. Tarsi pale, 5th tarsomere narrowly dark-tipped. Fore spurs equal three tarsomeres, hind spurs two; setae mostly black, many white on femora.

First abdominal tergite pale with small dark preapical dot; second with pale basal band and apical dot; third-seventh dark-fuscous, a large pale spot each side, broadly connected medially, apical segments pale. First sternite with a black spot each side, second, third and base of fourth pale, apex of fourth, fifth, sixth and seventh fuscous.

Wings: venation as in Figure 17. Base of wing pale, venation largely pale, many cross veins dark wholly or at ends; longitudinal veins interrupted with dark at intersections of many cross veins; dark spots as indicated on figure.

Measurements (mm.): body length 21; abdomen 15; head and thorax 6.3; pterothorax 4.0; third abdominal tergite 3.4; antenna 6.8; fore wing 25.5 long, 6.6 wide; hind wing 24.0 long 5.5 wide; third segment, labial palpus 0.48 long, 0.12 wide.

Holotype ♀: Riverside, California, August 31, 1939, Paul De Bock (UCR): Deposited in the California Academy of Sciences.

*Eremoleon nigribasis* Banks

Figures 24, 27

*Eremoleon nigribasis* Banks, 1920, Bull. Mus. Comp. Zool. 64:329; 1928, *ibid.* 68:71; Proc. Calif. Acad. Sci., 4th Ser. 24:143

*Eremoleon affine* Banks, 1942, Proc. Calif. Acad. Sci., 4th Ser. 24:144, **new synonymy**  
Utah, New Mexico, Arizona, Baja California.

The type of *E. affine* Banks, as well as the paratypes from 5 mi. S. of San Miguel and Venancio, Baja Calif., are pale individuals of this species in which the black mark on the wing base is indistinct or absent.

*Eremoleon pallens* Banks

Figures 18, 26

*Eremoleon pallens* Banks, 1941, Psyche 48: 101-102

The type series was collected from a mine shaft on Pichaco Peak, Arizona.

*Eremoleon longior* Banks

Figures 22, 23, 25

*Eremoleon longior* Banks, 1938, Carnegie Inst. Wash. Pub. 491: 235

A cave-dwelling species from Yucatan, Mexico. Its slenderness is combined with great fragility.

*Hesperoleon texanus* Banks

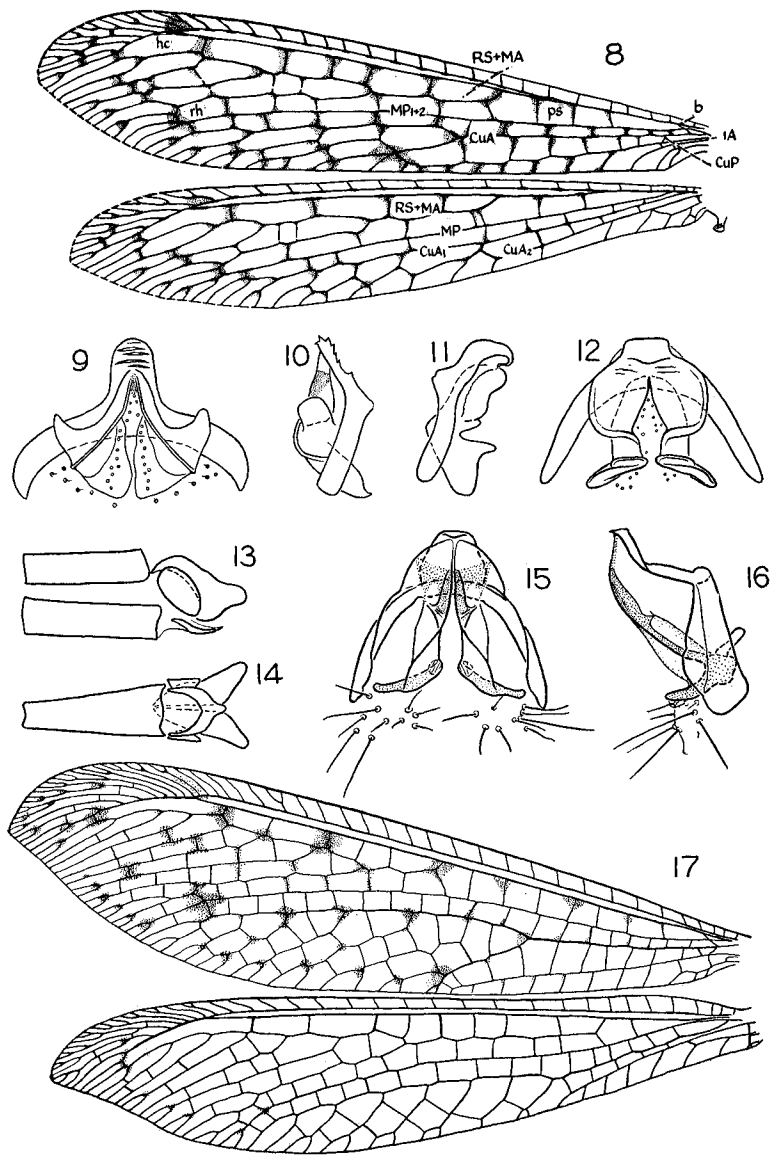
Figures 42, 43

*Hesperoleon texanus* Banks, 1903, Proc. Ent. Soc. Wash. 5:175

This species has not previously been recorded from California. California specimens are larger than more eastern specimens, with longer antennae. Oklahoma specimens have the third abdominal tergite 1.5 times the length of the pterothorax, while in the California males this ratio was 1.7 and 1.9. The difference in color is striking, the Southern California specimens being much darker. Material from Riverside shows a gradation in size down to that of typical *texanus*, and a ♀ from Olanche, California (MCZ), is intermediate in its coloration between the paler *texanus* and the darker southern specimens. Some means of measurements of the California specimens follow (in mm.):

## EXPLANATION OF PLATE 4

Figures 8-17. Fig. 8. *Tyttholeon puerilis*, ♂, wings: b— basal piece of MA, ps— presectoral cross veins, hc— hypostigmatic cell, rh— rhexema (San Felipe Can., Calif.). Fig. 9. *Maracandula bellula*, gonarcus and parameres, posterior view (Skyforest, San Bernardino Co., Calif.). Fig. 10. Same, lateral view. Fig. 11. *Tyttholeon puerilis*, gonarcus and parameres, lateral view (San Felipe Canyon). Fig. 12. Same, posterior view. Fig. 13. *Hesperoleon minutus*, holotype, apex of abdomen, lateral view. Fig. 14. Same, ventral view. Fig. 15. *H. minutus*, gonarcus and parameres, posterior view. Fig. 16. Same, lateral view. Fig. 17. *Eremoleon gracile*, holotype, wings.



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Body length, ♂ 37, ♀ 24; abdomen ♂ 30.2, ♀ 17.2; pterothorax ♂ 3.9, ♀ 3.7; fore wing, length ♂ 25.3, ♀ 24.2. width ♂ 6.6, ♀ 6.1; labial palpi (terminal segment) 0.76 long, 0.20 wide; antennae ♂ 7.25, ♀ 4.8; third abdominal tergite ♂ 7.2, ♀ 5.1.

In California, *texanus* is most likely to be confused with *H. niger* Currie, from which it can be separated by the dots on the mesoscutellum, and by the markings of the coxae (banded with pale in *texanus*, mostly black in *niger*). The gonarcus and parameres of these species are shown for comparison; *niger* (Figures 36, 37) has a conspicuously longer mediuncus, and lacks bristles on the lateral margin of the paramere between the hook and the hinge.

Calif. specimens examined: *Inyo Co.*: Olanche, ♀, F. A. Eddy (MCZ). *San Bernardino Co.*: Mill Creek, 6,000 ft., VII-23-29, ♂, P. H. Timberlake (UCR). *Riverside Co.*: Riverside IX-27, X-7, 8, 1948, 3 ♀♀, P. H. Timberlake (UCR); Keen Camp, San Jacinto Mts., IX-2-1950, ♀ (UCLA). *Los Angeles Co.*: IX-20-54, ♂, R. X. Schick (UCLA).

### ***Hesperoleon fidelitas*, new species**

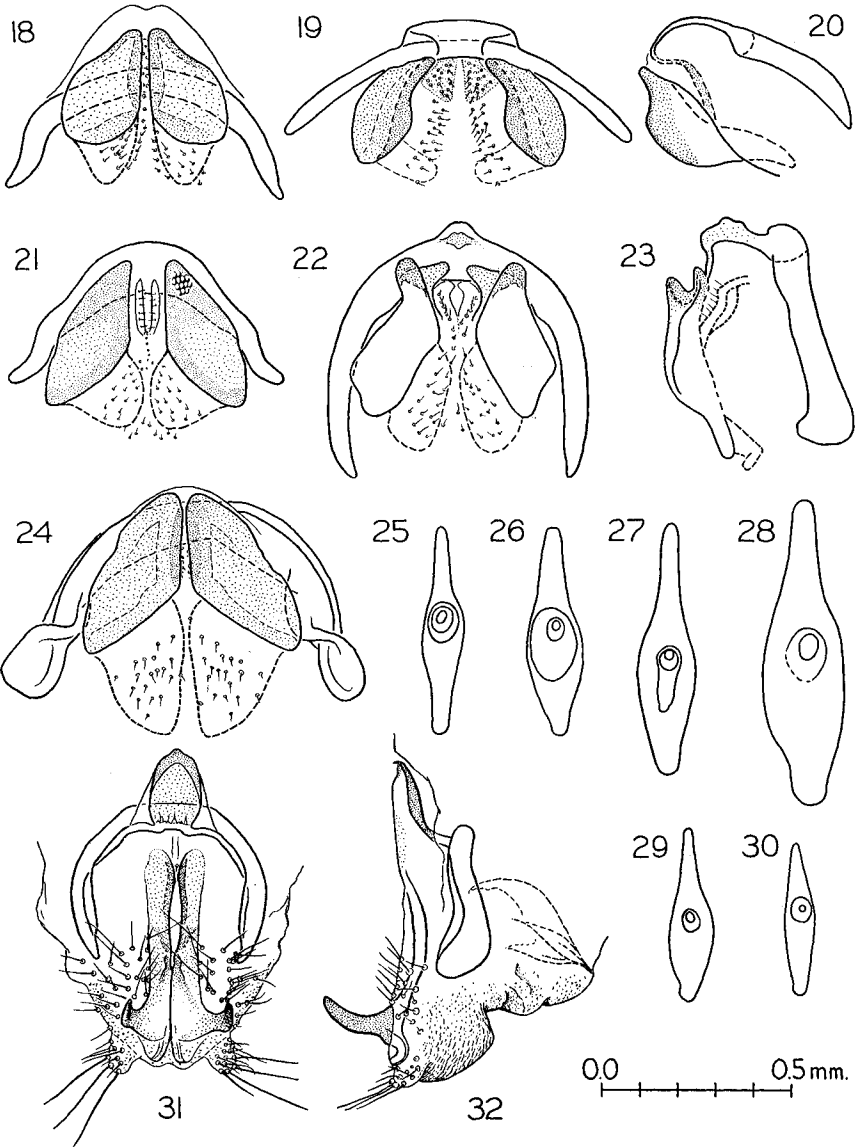
Figures 5, 5a, 33, 34

Face pale, occasionally a pair of dark dots on lateral mar-

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#### EXPLANATION OF PLATE 5

Figures 18-32. Fig. 18. *Eremoleon pallens*, paratype, gonarcus and parameres, posterior view (Pichaco Peak, Ariz.). Fig. 19. *E. insipidus* holotype, gonarcus and parameres, posterior view. Fig. 20. Same, lateral view. Fig. 21. *E. macer*, gonarcus and parameres, posterior view (Cuernavaca, Mexico). On the right is shown a portion of the characteristic cobblestone sculpture on the surface of these plates in *Eremoleon*. Fig. 22. *E. longior*, paratype, gonarcus and parameres, posterior view (Xtoloc Cenote Cave, Chitzen Itza, Yucatan). Fig. 23. Same, lateral view. Fig. 24. *E. nigribasis*, gonarcus and parameres, posterior view (Tucson, Ariz.). Fig. 25. *E. longior*, tip of right labial palpus (same specimen as Fig. 22). Fig. 26. *E. pallens*, paratype, ♂, tip of right labial palpus. Fig. 27. *E. nigribasis*, ♂, tip of right labial palpus (Douglas, Ariz.). Fig. 28. *E. insipidus*, tip of right labial palpus, holotype. Fig. 29. *E. gracile*, holotype, tip of right labial palpus. Fig. 30. *E. macer*, ♂, tip of right labial palpus (same specimen as Fig. 21). Fig. 31. *Hesperoleon deflexus*, holotype, gonarcus and parameres (everted), dorsal view. Fig. 32. Same, lateral view.



gins of clypeus; dark antennal band notched below, with prominent median extension, above widely separated from first vertex row. First vertex row a median triangle and a dash each side, often connected; second a pair of submedian spots and a dash each side; posterior to these spots a dark triangle, with apex anterior. Scape dark ventrally, pedicel dark laterally, flagellar segments dark with narrow apical pale bands. Maxillary palpi usually infuscated, labial palpi pale, the third segment dark, moderately swollen. Median pronotal stripes converge at furrow, then diverge and recurve; lateral stripes curve out at furrow then back toward, and sometimes touch, median stripe; a short sub-marginal stripe usually present. Mesoscutellum with a dark stripe and posterior dot each side, sometimes connected; metascutellum with a single dark mark. Pleurae mostly dark. Coxae dark with pale band; fore femora pale, dark posterior stripe; mid and hind femora dark with pale basal and preapical rings; mid femora with pale dorsal and posterior stripes. Tibiae pale, dark postbasal, preapical (except hind femur) and apical bands; a thin dark stripe on ventral sides of mid and hind femora; tarsal segments 1, 2, 3, and 5 pale, with dark apical bands, 4 sometimes wholly dark. Hind tibial spurs a little longer than first tarsal segment. Femoral setae mostly white, tibiae about equally black and white; on pleurae and nota white except one or two dark on marginal pronotal stripe; on abdomen mostly white, in the male shorter and with much greater number dark on segments 6-9 than in the female.

Abdomen (♂): dark, tergites 1-8 with a pale stripe on each side, which is widened at the middle and end of each segment, becoming obscure on the apical segments. Ventral median pale stripe at apex of 3rd and 4th segments, and at base of 4th and 5th segments. Length of segment 8 approximately three times width at base; ectoprocts slender, straight, slightly divergent, and bluntly rounded, greatest length approximately 2/3 that of segment 8. Gonarcus and parameres: gonarcus arms widely divergent; mediuncus short.

(♀): dark, tergite 2 pale at base and apex, tergites 3-7

with paired pale spots at base (except on 3rd), middle, and apex; sternites dark.

Wings: Fore wing: costa pale, other longitudinal veins alternately dark and pale; cross veins irregularly dark and pale; many of the dark sections surrounded by dark-suffused areas in the membrane, especially around  $MP_{3+4}$  ( $M_2$  of Markl, *et al.*), a spot between  $MP_{1+2}$  and  $MP_{3+4}+CuA_1$  between  $MP_{3+4}$  and rhexma, a line of cross veins up from rhexma toward the wing apex, and a line up from the end of  $CuA_2$ . In some specimens the wing is heavily spotted, in others only slightly so. Hind wing: unmarked except for dark spot on basal side of stigma; veins mostly dark, the longitudinals interrupted with pale.

Fore wing: 3 presectorals (rarely 4), 10-13 branches of  $Rs+MA$ , 11-14 basal cubital cross veins, usually 3-4 connected, 9 or 10 branches of  $CuP+A_1$ , 1-5 (usually 2-3) connected. Hind wing: 2 presectorals; 9-14 (usually 11) branches of  $Rs+MA$ ; 6 or 7 inner cubital veinlets.

Measurements (mm., means in parentheses) : body length ♂ 29.5-35.0 (33.0), ♀ 21.0-27.0 (24.2); abdomen ♂ 26.5-29.0 (27.0), ♀ 15.5-21.0 (18.4); fore wing, length ♂ 19.5-22.0 (20.8), ♀ 21.5-24.0 (23.5), width ♂ 4.6-5.6 (5.4), ♀ 5.8-6.5 (6.2); antennae ♂ 5.4-6.9 (6.2), ♀ 4.7-6.7 (5.7); terminal segment, labial palpi, length ♂ 0.62-0.69 (0.67), ♀ 0.67-0.92 (0.71), width ♂ 0.14-0.20 (0.17), ♀ 0.19-0.25 (0.19); third abdominal tergite ♂ 5.2-6.7 (5.9), ♀ 4.1-5.0 (4.4).

*Sonora*: Nogales, ♂ (MCZ).

*Arizona*: *Cochise Co.*: near Douglas, VIII-19-40, 4 ♂ 1 ♀, E. C. Van Dyke (CAS); San Pedro River, Fairbank, Sept. 6, 1927, ♀, J. A. Kusche (CAS); Huachuca Canyon, Sept. 3, 1950, ♂, R. Langston (LAM); *Santa Cruz Co.*: Madera Canyon, Aug. 16-20, 1949, 3 ♂ 2 ♀, P. Adams, col.; Box Canyon, Santa Rita Mts., Ariz., Aug. 21, 1949, ♂ (*holotype*), Aug. 25, 1949, ♀ (*allotype*, both in the Museum of Comparative Zoology), Aug. 25, 1 ♀, 2 ♂, Aug. 21, 2 ♂, P. Adams, col.; *Pima Co.*: Tucson, 16 mi. S., Aug. 11, 1924, ♂, E. P. Van Duzee (CAS); Tucson, 15 mi. E., 2600 ft., VIII-18-50, ♂, Cazier *et al.* (AMNH); Tucson, VIII-27-38, ♀, D. J. + J. N. Knull (MCZ), X-15-22, 1935, 4 ♂, 2 ♀,



Bryant (MCZ); Baboquivari Mts., VIII-15-22, ♀, D. C. Poling (CAS); *Maricopa Co.*: Wickenburg, VII-20-38, ♂, D. J. + J. N. Knull (MCZ); *Yavapai Co.*: 9-20-40, ♀, G. Willett (LAM).

*California: Riverside Co.*: Morongo, Sept. 28, 1944, at light, 2 ♀, Timberlake (UCR); *San Diego Co.*: San Felipe Creek, Sept. 10, 1938, 3 ♀, Timberlake (UCR); *San Bernardino Co.*: 10-15-38, ♂, K. E. Stager (UCLA); Yermo, 10-4-49, at light 2 ♀, J. M. Stern; Providence Mts., 10-7-40, ♂, C. Henne (LAM); *Inyo Co.*: Aberdeen, Owens Valley, 4125 ft., VIII-2-1937, 3 ♂ 2 ♀, Rehn, Pate, and Rehn (MCZ); Independence, VIII-23-52, 3 ♀ (UCLA).

This species is very close to *H. texanus*, and appears to replace it over the south center of its range. It may be differentiated from *texanus* by the markings of the legs, which are always evenly and prominently infuscated (dotted in *texanus*), and by the short mediuncus in the male. The pattern on the thorax is about the same as *texanus*, except for the submarginal pronotal stripes, seldom present in *texanus*. The vertex pattern is the same, but the spots are more sharply delineated than in most specimens of *texanus*.

In the past, specimens of *fidelitas* have mostly been confused with *intermedius*, which has no dots on the mesoscutellum, and a single dark band across the vertex (the anterior vertex row has become fused with the antennal band).

### **Hesperoleon deflexus**, new species

Figures 2, 31, 32, 41

Head capsule and mouthparts largely pale; a dark interantennal mark, which below is confined to area between antennal bases, with an anterior dark median line, and above fades out near anterior vertex scars; vertex scars usually not pigmented, consist of anterior transverse line, followed by a pair of spots (unpigmented in holo- and allotype, brown in Yermo specimens) and a posterior row of a median triangle and a transverse line each side. Labial palpi (Figure 41) extremely long and slender, apical half of terminal segment distended, area surrounding sensory

orifice infuscate. Antennae short, pale brown apically. Pronotum pale, a faint pair of convergent narrow median stripes behind furrow, and a pair of lateral black dots on furrow. A pair of short basal stripes on scutella, fused on metascutellum. Pleura mostly pale; legs pale, apical dark bands on third, fourth, and fifth tarsal segments. Hind spurs as long as  $1\frac{1}{2}$  tarsal segments. Femoral chaetae white (some black on hind femora); tibial chaetae black.

Abdomen ( $\delta$ ): much longer than wings; third and fourth segments strongly curved downward. Basal half pale, apical half brownish with a faint dorsal pale stripe each side. Ectoprocts produced, upcurved, forcipate. Paramere hooks viewed from below spread at right angle basally; tips recurved, parallel; hooks flattened laterally, blunt. Many setae on membrane beside parameres up to level of

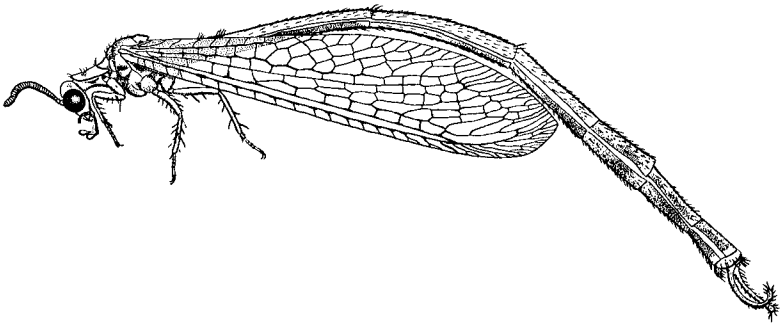


Figure 2. *Hesperoleon deflexus*, holotype. male.

hinge. Female abdomen short; a pale dorsal stripe each side, wider at base, middle and apex of tergites. Venation mostly pale, longitudinal veins often interrupted with black at intersections with cross veins; in fore wings a dark spot at base of creamy stigma, outer end of hypostigmatic cell, a few along CuA before fork, one at  $MP_{3+4}$ , halfway between  $MP_{3+4}$  and rhexma, and at rhexma. Hind wing: stigma creamy, longitudinal veins less marked with dark than fore wing, no spots.

Fore wing: 3 presectorals; 8 or 9 branches of  $Rs+MA$ ; 8-10 cubital cross veins, sometimes 1 or 2 connected; 7 or 8 anal veinlets, none connected. Hind wing: 2 (rarely 3)

presectorals, 6-8 branches of Rs+MA, 5 (rarely 4) inner cubital vienlets.

Measurements (mm., in order: ♂ holotype, ♂ paratype, ♀ allotype, ♀ paratype): body length 31.7, —, 20.5, 20.0; length of abdomen 27.2, —, 15.5, 20.0; fore wing length 17.0, 18.5, 18.5, 21.0; width 3.8, 4.6, 5.3, 5.6; third segment, labial palpus, length 1.08, 1.16, 1.27, —; width 0.24, 0.23, 0.31, —; antennal length 3.25, —, 3.5, —; length of pterothorax 2.76, 2.95, 3.04, 3.2; length of third abdominal tergite ♂ 5.9, 5.9.

Holotype ♂ and allotype ♀: Baker, San Bernardino Co., Calif., Aug. 23, 1952 (UCLA). Type deposited in the California Academy of Sciences, allotype in the UCLA Collection. Paratypes: Yermo, San Bernardino Co., Calif., 10-4-49, 1 ♂ 1 ♀, J. M. Stern (Adams Collection).

This is a pale yellow species, somewhat resembling *H. pallidus* in color. The elongate labial palpi immediately distinguish it from all other species of *Hesperoleon* save *longipalpis* (Hagen).<sup>5</sup> In *longipalpis*, the vertex marks are well pigmented, even in pale specimens; the antennal band on pale specimens consists of a spot under, and one lateral to, each antennal base. The ventral spots become confluent medially on darker specimens. In *deflexus*, the antennal band does not extend below the antennal bases, and the lateral spot is weak, connected to the antennal band above. In *longipalpis*, the male has short ectoprocts, long in *deflexus*. The internal genitalia are similar, *longipalpis* having somewhat longer and sharper paramere hooks.

### ***Hesperoleon minutus*, new species**

#### Figures 6, 13-16

Face pale, interantennal band straight-margined above, below emarginate, often with median extension toward clypeus. First vertex row a short band each side, and median wide cordate mark. Behind is a pair of submedian dots, then a pair of lateral dots on each side; posteriorly a triangular dark mark. Labial palpi about 1.5 times the length

<sup>5</sup>*Hesperoleon longipalpis* (Hagen) 1888 **nov. comb.** Banks made this species the type of his genus *Scotoleon*; it is merely a *Hesperoleon* with long labial palpi.

of fore tarsus, the terminal segment dark, strongly swollen; maxillary palpi pale; scape pale, dark below; pedicel infuscated dorsally; flagellar segments dark with wide apical pale bands.

Median pronotal stripes united behind furrow; before furrow divergent, usually separated by pale. Lateral stripes well separated from medians, narrow, anterior ends curved mesad. Marginal stripes absent. Mesoscutellum with two stripes, narrow anteriorly, well separated. Metascutellar stripes fused for about  $\frac{1}{2}$  their length.

Fore coxae pale with basal and apical dark areas on lateral surface. Mid and hind coxae dark basally, grading to pale apically. Femora dotted with dark, the dots often confluent, particularly on posterior side of fore femur, anterior side of mid femur, and on hind femur; tibiae with dark subbasal (faint on hind leg), preapical (absent on hind leg), and apical bands; fore and mid tibiae dotted with dark. Tarsomeres pale with apical dark bands, third and fourth often wholly dark.

Abdomen ( $\delta$ ): dark, second tergite with basal and apical pale spots; third, fourth, and fifth with a pale band each side, wider at base, middle, and apex of segments; sixth, seventh, and eighth tergites with pale basal, intermediate, and apical pale spots each side. Ectoprocts short, conical, divergent. Posterior margin of ninth sternite with tooth-like projection. Gonarcus and parameres (Figures 15, 16): mediuncus long; inner margin of parameres curves outward at hinge to form a high, thin strut, bracing hook. ( $\varphi$ ): dark, second tergite pale basally and apically, third to seventh tergites with pale basal, intermediate, and apical spots each side, third and fourth sternites pale apically.

Setae on legs mostly white, on thorax white, on abdomen short, white, a few dark on apical segments. Hind spurs as long as  $1\frac{1}{2}$  tarsomeres.

Wings: venation pale, interrupted with dark at intersections of cross veins; most cross veins dark. Dark marks at base of stigma, both ends of hypostigmatic cell, along CuA, in a line from rhexma toward tip of wing, and at end of CuA<sub>2</sub>. On hind wing a dark spot at base of stigma, otherwise unmarked.

In fore wing 3 presectoral cross veins (rarely 2), 6-9 branches of Rs+MA, CuF at or before origin of RS+MA; 8-10 cubital cross veins, not anastomosed; 8 or 9 anal veinlets, not anastomosed. Hind wing; 1-3, usually 2, presectorals, 5-8 branches of Rs+MA, CuF before origin of Rs+MA.

Measurements (means, in mm.): body length ♂ 17.6, ♀ 16.7; abdomen ♂ 13.7, ♀ 12.0; fore wing, length ♂ 13.5, ♀ 13., width ♂ 3.5, ♀ 4.3; pterothorax ♂ 2.3, ♀ 2.7; third abdominal tergite ♂ 3.2, ♀ 3.2; antennae ♂ 3.6, ♀ 3.7; third segment, labial palpi, length ♂ 0.68, ♀ 0.83, width ♂ 0.19, ♀ 0.21.

*California: Riverside Co.:* Cathedral City, VII-24-50, ♂, L. W. Isaak (UCD) (*holotype*, deposited in the California Academy of Sciences), VII-21-52, ♀, B. W. Tinglof (UCLA); Indian Wells, VI-17-52, ♀, VII-11-52, ♀ (UCLA); Blythe, 17 mi. NW, VII-26-46, P. D. Hurd and W. F. Barr (CIS); Palm Springs, VIII-8-56, ♂, L. A. Stange (Stange Coll.). *Imperial Co.:* Fort Yuma, 6-15-48, ♂, 6-13-48, ♀, W. B. Andahl (MCZ), June 1948, ♀, R. Coleman (CIS).

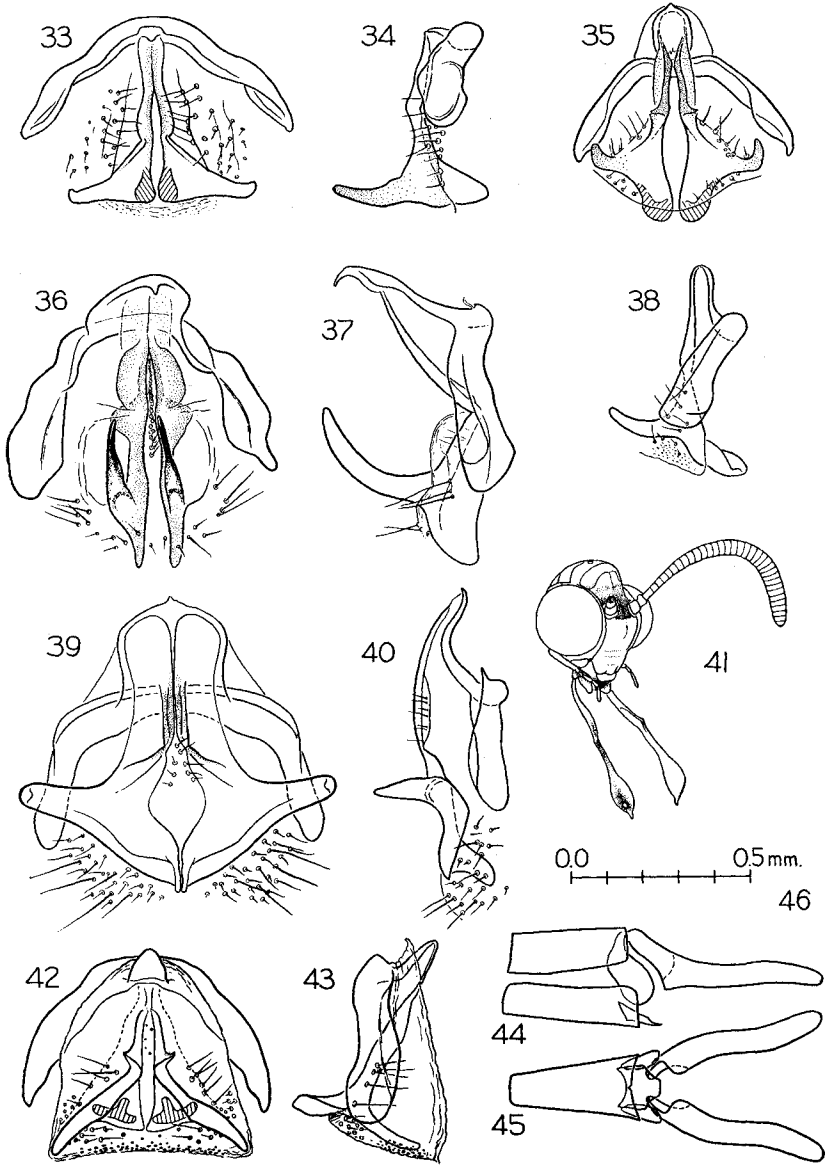
*Arizona: Yuma Co.:* Welton, VI-28-50, 2 ♂, 1 ♀, R. F. Smith (AMNH).

*Baja California:* San Felipe, VI-18-39, Michelbacher and Ross (CAS).

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#### EXPLANATION OF PLATE 6

Figures 33-46. Fig. 33. *Hesperoleon fidelitas*, holotype, gonarcus and parameres, posterior view. Fig. 34. Same, lateral view. Fig. 35. *H. minusculus*, gonarcus and parameres, posterior view (Whitewater, Riverside Co., Calif.). Fig. 36. *H. niger*, gonarcus and parameres, posterior view (3 mi. N. of Payson, Gila Co., Ariz.). Fig. 37. Same, lateral view. Fig. 38. *H. minusculus*, gonarcus and parameres, lateral view. Fig. 39. *H. infuscatus*, gonarcus and parameres, posterior view (Antioch, Calif.). Fig. 40. Same, side view. Fig. 41. *H. deflexus*, allotype, head. Fig. 42. *H. texanus*, gonarcus and parameres, posterior view (sac inverted). (Mill Creek, San Bernardino Mts., Calif., 6000 ft.). Fig. 43. Same, lateral view. Fig. 44. *H. infuscatus*, apex of abdomen, lateral view (Cajon Pass, San Bernardino Co., Calif.). Fig. 45. Same, ventral view. Fig. 46. Scale for gonarcus and parameres only.



A little smaller than *H. apache* Banks, and not closely resembling any other species of *Hesperoleon*.

***Hesperoleon infuscatus*, new species**

Figures 4, 39, 40, 44, 45

Face pale, antennal band straight-margined below, with a thin line extending toward clypeus. First vertex row far forward, a strongly curved band, separated medially from antennal band by a pale spot; in most specimens the ends fused with antennal band. Second vertex row often connected medially with first, consists of an irregular, medially thickened band each side, often connected. Labial palpi slender, the apical segment slender, pointed, shiny-fuscous; maxillary palpi dark. Scape dark below, pale above; pedicel dark, flagellum dark, last ten (more or less) segments with broad apical pale bands on ventral side. Pronotum distinctly broader than length at center, submedian stripes fairly straight; laterals very wide behind furrow, narrowly separated from medians by pale, before furrow narrow and curving to fuse with medians at anterior margin. Space between bands suffused with fuscous at, and sometimes behind, furrow. Submarginal stripe a thin line curving back from furrow, often absent. Mesoscutellum with two long, well-separated dark stripes, metascutellar stripes fused for about two-thirds their length. Coxae pale medially, dark laterally; fore femur dark-striped posteriodorsally, mid and hind femora wholly dark but for ventral pale stripe. Fore tibia infuscated posteriorly, with dark subbasal and apical bands; mid tibia with dark basal, subbasal, preapical, and apical bands; hind tibia with subbasal and apical bands, and a thin ventral dark line. Tarsal segments pale, dark-banded apically, segments three and four more so than others.

Abdomen ( $\delta$ ): dark, with dorsal pale stripe each side extending to sixth segment. Ectoprocts long: (about  $1\frac{1}{2}$  times as long as 8th abdominal tergite, which is short, 1.3 times as long as high) extend straight back, viewed from side; from above, bent into lyriform curve. Mediuncus arms spread widely; parameres form a flat plate from the lateral margins of which the hooks emerge and bend

straight back. (♀): the pale stripes thinner, may extend to tip of abdomen, or be absent.

Setae on legs mostly black (some white on coxae); on thorax mostly white, stiff, short; on abdomen mostly white, short, male with many long black setae on apical segments. Hind spurs as long as 1 ½ tarsal segments.

Wings: venation of fore and hind wings mostly dark, the longitudinal and some cross veins interrupted with pale; membrane narrowly brown-fuscous bordering dark veins; dark spots at inner side of stigma, along R at intersections of cross veins, along CuA, at rhexma, in apical field, and at end of CuA<sub>2</sub>. Hind wing similarly marked, but not so heavily.

Fore wing: 3 presectoral cross veins (rarely 4 or 5), usually the outer one connected to first cross vein beyond origin of Rs+MA; Rs+MA 8-11 branched; 11-15 basal cubital cross veins, 3-10 (usually 5 or 6) connected; 9-12 (usually 10 or 11) anal veinlets. Hind wing: 2 or 3 presectorals; Rs+MA 8-11 (usually 9 or 10) branched; 5-7 inner cubital veinlets.

Measurements (means, in mm.): body length ♂ 35.8, ♀ 26.7; abdomen ♂ 29.5, ♀ 20.2; fore wing ♂ 25.4, ♀ 26.9, width ♂ 6.3, ♀ 6.9; antennae ♂ 7.0, ♀ 5.7; third segment, labial palpus, ♂ 0.77, ♀ 0.85, width ♂ 0.17, ♀ 0.21; pronotum, length at center, ♂ 1.12, ♀ 1.19, width ♂ 1.81, ♀ 1.81; pterothorax ♂ 4.0, ♀ 4.4; third abdominal tergite ♂ 6.5, ♀ 6.2.

*California: Contra Costa Co.:* Antioch, V-24-49, 2 ♂ (one the *holotype*), 1 ♀ (*allotype*), J. W. Mac Swain (CAS); V-24-49, ♂, P. D. Hurd (CIS), VI-4-42, 1 ♀, 2 ♀, E. C. Van Dyke (CAS); VI-20-37, ♀, E. S. Ross (CAS); V-27-50, ♀, S. F. Bailey and R. M. Bohart (UCD); VI-8-39, 4 ♀, R. M. Bohart (CIS); VI-2-40, ♀, B. Brockman (CIS); V-20-33, ♀, E. O. Essig (CIS). *San Bernardino Co.:* Cajon Pass, VI-16-46, 3 ♂, 3 ♀, E. G. Linsley (CIS).

This species has a dark brown facies, similar to that of *H. curriei* Banks, from which it may be distinguished by the short 8th abdominal segment in the male, which is



longer than the ectoprocts in *curriei*, by the parameres, which are not formed as hooks, like those of *curriei*, and by the evenly infuscated femora — dotted in *curriei*. It is much more robust than *brunneus*, the ectoprocts of which have a preapical lobe on the median side, and the femora of which are dotted.

**Tyttholeon**, new genus

Figures 7, 8, 11, 12

Belongs to the Brachynemurini.

Labial palpi short, apical segment not swollen; antennae stout, strongly clavate. Legs fairly stout, tibial spurs absent, first tarsal segment two-thirds length of next three together. Abdomen much shorter than wings, of same length in male as in female. Many long white setae present on femora, coxae, and thorax (except metanotum).

Fore wing: costal area narrow, the cells more than twice as long as high; Rs+MA originates only slightly proximal to cubital fork; cubital fork acute. A<sub>1</sub> straight, connected to CuA<sub>2</sub> by one or two cross veins; A<sub>2</sub> unbranched; A<sub>3</sub> forked near margin. Banksian lines absent. Hind wing: costal area narrow; only one row of cross veins between cubital veinlets; CuA<sub>2</sub> reaches margin before CuF; at most one cross vein between CuA<sub>1</sub> and CuA<sub>2</sub> beyond fork. Banksian lines absent. Pilula axillaris present in male.

*Tyttholeon* is most likely to be confused with *Maracandula* Currie, since both of these genera lack spurs. In *Maracandula*, the first tarsomere is longer than the following three together. The venation is much less dense in *Tyttholeon*, and Rs+MA originates farther out on the wing; in *Maracandula* the costal cells are higher than long. The white setae on legs and thorax are not nearly so long as the macrochetæ of *Maracandula*. There is no similarity between the internal genitalia. *Maracandula* (Figures 9, 10) has on the paramere a lateral, heavily sclerotized ligulate lobe, and a sharp ridge on the posterior face. In *T. puerilis* the parameres are folded in a complex manner, but have no conspicuous heavily sclerotized hooks or lobes.

Generotype the following species:

**Tyttholeon puerilis**, new species

Figures 7, 8, 11, 12

Face pale, brown spot above posterior articulation of mandible and at joint of cardo and stipes; brown band between bases of antennae, emarginate below; vertex with an anterior row of three brown spots, middle row of two black marks connected by a line, and a posterior row of three brown spots. Last segment of labial palpi short, slender, curved, fuscous. Antennae short, heavily clavate; scape pale with apical fuscous ring; pedicel dark; flagellum 23-24 segmented, the first two or three segments more or less fused, shiny-fuscous basally, reddish brown in middle; a dark band at base of club, club yellow-buff.

Pronotum pale, a single dark band each side, narrower in front of furrow, often interrupted at furrow. Scutelli pale with bilobed anterior brown spot and thin median posterior black line. Coxae with basal and preapical brown spots, connected on mid and hind coxae. Femora pale, an apical dark stripe on posterior side of fore-femur, anterior side of mid and hind femora. Fore and mid tibiae with sub-basal and preapical dark bands, hind tibiae pale. Tarsomeres pale with narrow apical dark bands.

Abdomen ( $\delta$ ): brown, first tergite dark, second with narrow pale band and a pair of large posterior pale spots, third and fourth tergites with paired basal, intermediate, and apical spots, remaining segments with basal and apical spots only. Gonarcus and parameres (Figures 11, 12). Ectoprocts short, slightly produced posteriad below. ( $\varphi$ ): tergites dark with a pair of apical pale spots on each.

Many prominent setae on thorax, coxae, and femora. Most tibial setae black. Abdominal setae white, black on ectoprocts and terminal segments of female.

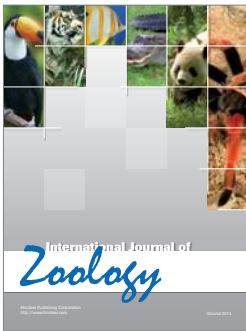
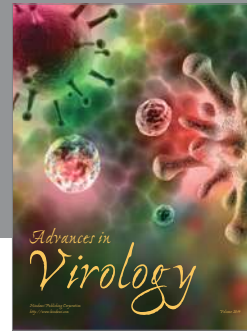
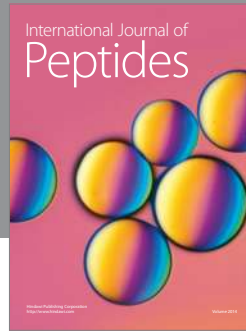
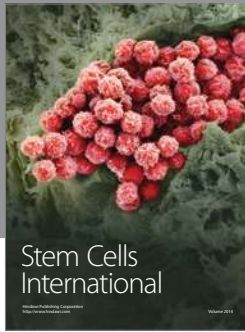
Wings: longitudinal veins pale, interrupted with dark at intersections of cross veins. Cross veins almost all dark, the membrane beside them bordered with dark, giving an effect of uniformly distributed short transverse brown dashes over wing; somewhat paler on hind wing.

Fore wing: 3 presectorals, Rs+MA 4-6 branched; 6-9 basal cubital cross veins; 6-10 anal veinlets. Hind wing: 1 or 2 presectoral cross veins; Rs+MA 4-6 branched; CuA<sub>1</sub> 5-8 branched; 4-7 basal cubital cross veins; 3-5 inner cubital veinlets.

Measurements (mm. means in parentheses): body length 10.2-14.5 (12.0); abdomen 6.8-10.0 (8.2); fore wing, length 13.0-17.7 (14.4). width ♂ 2.8-3.9 (3.24), ♀ 3.1-4.8 (3.6); last segment, labial palpus 0.23-0.34 (♂ 0.30, ♀ 0.25); antennae 2.3-2.8 (2.6); pterothorax 1.9-2.8 (2.27); third abdominal tergite 1.5-2.5 (♂ 2.02, ♀ 1.84); pronotum, length at middle 0.56-0.85 (0.69), width 0.75-1.14 (0.95).

*California: Mono Co.:* Near Topaz, 7-15-37, ♂, J. A. Comstock (LAM); *Inyo Co.:* Furnace Creek, Death Valley IV-18-49, 2 ♂, 1 ♀, O. Bryant (CAS); Death Valley, IV 1920, ♀, J. D. Gander (CAS). *San Bernardino Co.:* Providence Mts., VI-1-37, ♂, R. H. Andrews (LAM); Needles, V-8-39, Van Duzee (CAS). *Riverside Co.:* Palm Springs, VI-27-39, 2 ♂, 4 ♀, E. G. Linsley (CIS) (*type* ♂ and *allotype* ♀ in the Calif. Acad. of Sciences). *San Diego Co.:* Borego, IV-9-40, 1 ♂ 1 ♀, Sperry (MCZ); San Felipe Canyon, IV-18-25, ♂, at light Timberlake (UCR).

*Arizona: Yuma Co.:* Mohawk, IV-10-47, 2 ♂ 2 ♀; Sperry (MCZ); Aztec, VI-16-54, 1 ♂ 5 ♀, Stange & Menke (Stange Coll.).



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