

TAXONOMIC STUDY OF THE PLANTHOPPER
GENUS *OLIARUS* IN THE UNITED STATES
(HOMOPTERA: FULGOROIDEA: CIXIIDAE)¹

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ABSTRACT

The genus *Oliarus* in North America north of Mexico was studied with emphasis on the morphology of the male terminalia. The aedeagal complexes of 36 previously described species were illustrated for the first time. Six species proposed as new to science were described and illustrated. A change of status was proposed for one species, a new name given to another species, lectotypes were designated for two species, and three nominal species were relegated to synonymy. Fifty-one species in the study area were considered as valid, with each species receiving attention as to important features of the external morphology, male terminalia, diagnosis from similar species, location of type material, morphological variation, seasonal and geographical distribution, and other biological information when available. Remarks on relationships and a key to the species, based on male terminalia, were also included.

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INTRODUCTION

We have assembled a taxonomic treatment of all the described taxa of the genus *Oliarus* Stål (Homoptera: Fulgoroidea: Cixiidae) from North America, north of Mexico (1) to provide descriptions and illustrations of each species as interpreted from the habitus and genitalia of male specimens, (2) to note variation within species, (3) to record habitats, food plants, geographic and seasonal distribution, and other biological data, and (4) to present a key with which males may be identified to species.

The need for taxonomic revision became apparent when we realized that 18 species of North American *Oliarus* had been described (usually without illustrations) since the last revision by Ball (1934), which was admittedly preliminary in scope, lacked illustrations, and was based primarily on female color characters (which have proved unreliable).

MORPHOLOGY

The morphological terminology employed in this paper primarily follows that of R.G. Fennah (1944-1958). Characters of the head are often useful at the specific level, but color is variable, and length and width ratios of the vertex and frons exhibit infraspecific variation. Carinae may be more elevated in some specimens of a particular species than in others. The length of the rostrum varies infraspecifically but does so within limits and sometimes affords usefulness at the species group level.

The thorax has useful characters, but again the range of variation of these characters must be understood before much taxonomic reliance can be placed on them. The ground color and carinal color on the mesonotum not only can vary from specimen to specimen but also may be slightly asymmetrical on an individual. The generic character of five longitudinal carinae on the mesonotum holds true in nearly all specimens of *Oliarus*, but sometimes the intermediate pair of carinae is either barely existent or obsolete. Venation in the tegmina is erratic, less so in the wings, with frequent differences in venation in both of these between left and right appendages. Tubercles on the tegminal veins differ in size, pigmentation, and spacing, and sometimes are useful taxonomic characters. Spots, bands, stripes, and smoky areas of the membrane are useful characters in those species in which range of variation is understood. Several species normally have translucent or milky subhyaline veins, but occasionally specimens in the same species have vitreous or melanic subhyaline veins. Vein color is variable but is frequently consistent enough within a given species to be of use. The stigma usually is elongate and brownish, or pale or nearly so in a few species. The value of the stigma as a taxonomic character is limited by its variability in shape and color and sometimes by its lack of sharply defined boundaries. The legs usually are without reliable characters, but some species have banded front and middle tibiae instead of the usual solid brown tibiae. Each posterior tibia (metatibia) usually has three lateral spines, but the number and spacing of the spines are variable even from left side to right side on the same specimen. In the specimens examined, the number of apical spurs on each metatibia is always six. The number of apical spurs of each of the first and second tarsites of each metatarsus usually is seven, including the lateral pair of spurs. Specimens of the *Oliarus exoptatus* Van Duzee group and the *O. cinnamomeus* Provancher group not only have more than seven apical spurs, but each spur except those forming the lateral pair has a scalelike tooth at its apex. These scalelike teeth are discussed in detail by Fennah (1958).

The externally visible portions of the male genitalia consist of the 9th abdominal segment, commonly termed the pygofer; the 10th segment, commonly called the anal segment or anal tube; and the

11th segment, which has slight taxonomic usefulness. The concealed portions of the male genitalia consist of the aedeagal complex, connective, and styles. The connective is attached lateroventrally to the styles and dorsally to the aedeagal apodeme. It has hitherto been neglected as a taxonomic character in *Oliarus*. The connective appears to have its greatest value in providing additional evidence for discerning groups of species. The aedeagal complex and the styles have been used as taxonomic characters for several decades. The pygofer or genital capsule serves as a support for the male structures and provides a rigid medioventral process against which the styles hold the 1st and 2nd valvulae of the female ovipositor during copulation. This medioventral process is so distinctive in some species that specific determinations are sometimes possible by use of this character. The process also is valuable in helping to define groups of species. The dorsal bridge of the pygofer has slight taxonomic value but is important as the site of the principal attachments of the anal segment and of the perianthrium of the aedeagal complex. The lateral lobes of the pygofer have characteristic shapes and sometimes are so distinctive that specific identifications are sometimes possible by use of this character alone. The outline of the anal segment is useful from dorsal, lateral, and caudal views.

The aedeagal complex has the most valuable set of characters used in present systematic studies. These characters are best seen in ventral view, but most species have at least one dorsal process that should be examined from dorsal aspect. The aedeagal complex consists basally of the aedeagal apodeme extending to the aedeagal joint and enclosed throughout this extent by sheath-like material called the perianthrium. The distal part of the aedeagus (beyond the joint) is termed the flagellum and usually bears sclerotized processes, as does the perianthrium. The shapes, positions, and number of all of these processes are very important characters, especially at the specific level. The shape and direction of the flagellum proper (ignoring its processes) has taxonomic applications more at the species group level than at any other level.

ECOLOGY

Precise data on the ecology of *Oliarus* in North America are scarce. The available information indicates that the nymphs are subterranean and feed on the roots of plants. Nymphs of *O. quinquelineatus* (Say) were collected near roots of *Solidago* sp. at Vienna, Virginia, by J.C. Bridwell at various times in 1936-38. *O. cinnamomeus* (Provancher) apparently is characteristic of bog areas where sphagnum moss and species of *Vaccinium* are prevalent. *O. quinquelineatus* (Say) and *O. vicarius* (Walker) usually have been collected close to pine, *Pinus* spp. Possibly the nymphs and adults have different food habits, which phenomenon is not unusual in the Homoptera. In Florida, ecological requirements for several of the species seem to be quite exacting. *O. sablensis* Caldwell is common in a low, herbaceous, pine-flatwood zone downhill from a scrub oak habitat four miles east of Gainesville, but this is the only place in Florida where this species has been commonly collected. Collecting for *O. viequensis* Caldwell is usually not successful until a low, herbaceous swale rich in grasses has been located in a tidal flat area. *O. littoralis* Ball also is characteristic of grassy tidal flats. Mead has collected *O. viequensis* in greatest numbers on Big Pine Key, Florida where there are extensive tidal flats with a creeping wiry grass, *Monanthochloe littoralis* Englemann. In the western United States, *O. dondonius* Ball is typical on sea blite, *Dondia* (= *Sauda*) sp., of the arid alkali flats.

In North America the species of *Oliarus* are of unknown economic significance even though adults have been collected from a variety of vegetable and forage crops, fruits, and ornamentals. Some commercial plants from which *Oliarus* adults have been taken include, sugarcane, cotton, rice, tomatoes, potatoes, corn, soybeans, eggplant, carrots, beans, asparagus, yams, celery, papaya, apricot, plum, pecan, sunflower, alfalfa, and pasture grasses. Sein (1932, 1933) found nymphs of *Oliarus complectus* Ball [reported as *O. franciscanus* (Stål)] feeding on the roots of sugarcane and paragrass in Puerto Rico but found no economic damage to these host plants. His attempts to implicate *O. complectus* as a vector of sugarcane mosaic were negative. From elsewhere in the world, however, Dubovskiy (1965) listed *O.*

leporinus (Linnaeus) along with other Homoptera as known vectors of plant virus diseases. Boyce *et al.* (1951), in New Zealand, proved that *O. atkinsoni* Myers is a vector of the "virus" that causes yellow-leaf disease of *Phormium*, an indigenous plant exploited for the fiber industry. Damage by yellow-leaf disease was responsible in part for the deterioration and eventual disappearance of many thousands of acres of *Phormium*.

HISTORICAL REVIEW

The genus *Oliarus* was erected in 1862 by Stål. Distant (1906) designated a southeast Asian species, *walkeri* (Stål), as type of the genus. The catalog by Metcalf (1936) is the best compilation of the world's knowledge of *Oliarus* and other cixiids. Search through this catalog shows the first described *Oliarus* (a European species) to have been *leporina* by Linnaeus in 1761 in the genus *Cicada*. Fabricius described the first New World species in 1775. This was *Cicada villosa* from "America meridionali" (South America). However, the status of this species is in doubt partly because Stål (1869) wrote that "the true home of this species probably is southern Russia, from whence I have seen a specimen agreeing with that of Fabricius" (translated from the Latin by the late Prof. R.F. Hussey, University of Florida; furthermore, the type is a female in poor condition.

For the Canadian and United States portions of North America, the first descriptions were by Say (1830). These were *Oliarus* (= *Flata*) *humilis* and *quinquelineatus*. Walker (1851) described *vicarius* (in *Cixius*). Stål (1859) described *franciscanus* from specimens supposedly collected in California, and since then this name has been applied erroneously to specimens collected from many parts of North America (*O. franciscanus* is actually a South American species). Provancher (1889) described *cinnamomeus*, the first North American species described in the nominal genus *Oliarus*. Later, Ball (1902) described *aridus*, *complectus*, and *sementinus*. Of these, *complectus* has been involved in gross complications. The type series of 25 specimens included such far flung localities as Maryland, Kansas, Arizona, Colorado, and Haiti. Later, Ball (1934) realized his type series was mixed and restricted

the type locality to Port-au-Prince, Haiti. This was fortunate because his concept of *complectus* still included certain forms from Florida, southern Arizona, and adjacent Mexico that later were shown to involve three species, not just one. *O. complectus*, in a strict sense, is primarily a Caribbean species. Unfortunately, Metcalf concluded research on his 1936 catalog in 1934 without having seen Ball's paper. Metcalf followed the Van Duzee publications, giving *complectus* as a synonym of *franciscanus*; therefore, *franciscanus* in the sense of Metcalf (1936) was still a composite of at least eight or nine species according to present day knowledge.

Swezey (1904) included seven species of *Oliarus* in a catalog of fulgoroids of America north of Mexico. He summarized the references, distribution, habitat, and food plants of the species as they were understood at that time. Some of this information is erroneous; for example, the habitat information associated with *complectus* and *franciscanus* is incorrect.

Fowler (1904) described nine species of *Oliarus* from Central America and Mexico. Two of these species, *nigro-alutaceus* and *concinulus*, have been reported in the southwestern United States, but this is discounted as explained below. *O. concinulus* appears related to several Canadian, Mexican, and United States species, of later description, referred to hereinafter as the *concinulus* group. The description and illustration of *O. breviceps* Fowler from specimens collected at Juarez in northern Mexico agrees with *O. aridus* Ball; and Van Duzee (1916) apparently was correct in synonymizing *breviceps* with *aridus*. The other Fowler species of *Oliarus* probably are too different and too far removed geographically from the United States to be directly involved in this study. The Fowler types are in the British Museum and need a critical study before the nomenclature of Neotropical *Oliarus* can reach stability. This may be difficult because some of the species were based entirely on females, and because the type series is short and of poor quality in some of these species.

Kirkaldy (1907) added *pima*. Van Duzee (1908) not only described *hyalinus* as a new species but also prepared the first key to the species of *Oliarus* in Canada and the United States. However, of the 10 species listed, 3 were unknown to him; hence his key included only 7 species. His descriptions and notes on the various

species were well done and generally accurate except for some confusion regarding *complectus*. In 1912 Van Duzee published *slossoni* as a new name for *hyalinus* and added two new species, *placitus* and *difficilis*. Barber (1914) listed six species of *Oliarus* in Florida, but one of these, *complectus*, perpetuated an erroneous record first made by Van Duzee (1909). Van Duzee (1914) added *californicus* and *fidus*, synonymized *complectus* under *franciscanus* in 1916, and described *hesperius* and *exoptatus* in 1917a. He mentioned *hesperius* as the species he had formerly determined as *franciscanus* and noted that after a careful study he was convinced that "Stål's species [*franciscanus*] must be the *complectus* of Ball."

Van Duzee (1917b) prepared a catalog of Hemiptera that included references and geographic distribution for all 13 species of *Oliarus* reported at that time from Canada and the United States.

Metcalf (1923) prepared a profusely illustrated key to the North American fulgoroids ranging in the territory lying east of the foothills of the Rocky Mountains. He included descriptions of new species, four of which were in *Oliarus*. These were *montanus*, *vitreus*, *texanus*, and *vittatus*. Thirteen species of *Oliarus* were recognized in this key. There has been considerable confusion in the literature surrounding *texanus* and *vittatus*; however, we saw the type material and the holotype male of *texanus* is essentially correct as described and illustrated by Metcalf, and the two male paratypes are conspecific with the type. The paratype female of *texanus* is actually *difficilis* Van Duzee. The holotype male of *vittatus* is actually *difficilis*, and the allotype female is *texanus*. The drawings of *difficilis* in Metcalf are of the form described by Caldwell (1947b) as *O. eximus teximus*.

In 1923 Van Duzee prepared a key to the four species he recognized as occurring in Connecticut. He presented brief notes on morphology, range, and habitat. The reference to *franciscanus* (Stål) is erroneous and probably refers to *ecologus* and/or *sablensis*. Leonard (1928) listed five species of *Oliarus* in New York, and of these, *O. placitus* Van Duzee is listed erroneously as shown below.

Dozier (1928) prepared a key to nine species of *Oliarus* known or believed to occur in Mississippi, and added biosystematic data. Er-

roneous information included the listing of *slossoni* Van Duzee as abundant in Mississippi. The drawing and the comments actually refer to *aridus* Ball. Also incorrectly identified were *franciscanus* (Stål) and *humilis* (Say), which were *ecologus* Caldwell and *chuliotus* Ball, respectively. Van Duzee (1929) described his last *Oliarus*, *O. truncatus*.

In 1934 Ball published the most important single work on *Oliarus* in North America. He described 10 species as new, but one of them, *O. nogalanus*, was subsequently synonymized. He submitted a preliminary key, with distributional notes, to 31 species of *Oliarus*, but recognized only 28 as occurring north of the Mexican border. Ball disdained the dissection of male genitalia; therefore, his key characters were based on the easily seen external structures and colors of specimens. He was handicapped by not using characters of the aedeagal complex; thus, several of his couplets fail to separate two or three closely related species. Ball attempted to clarify the Fowler species and appears correct on some and incorrect on others. The task of fully delineating the Fowler species still remains. It is certain that Ball's action in synonymizing *texanus* Metcalf under *concinnulus* Fowler was incorrect. Fennah (1945b) published drawings by W.E. China of the male genitalia of the type of *concinnulus*, and this clearly established the wide difference between this species and *texanus* Metcalf. Ball correctly placed the female allotype of *vittatus* Metcalf as a female *texanus* Metcalf before mistakenly reducing *texanus* to synonymy under *concinnulus*. Ball also resurrected his *complectus*, listing *lacteipennis* Fowler, *humeralis* Fowler and *franciscanus* in the sense of Van Duzee as synonyms. His action on the Fowler species was based on study of the printed descriptions, not on the actual types. He correctly realized that the original type material of *complectus* was mixed but failed to realize there were two other species remaining in his new concept of *complectus*. Ball wisely decided to consider *franciscanus* Stål as an unknown until the type could be studied. He also realized that the holotype male of *vittatus* Metcalf must be the male of *difficilis* Van Duzee. In Ball's key, *pima* Kirkaldy should be changed to *sonoitus* Ball and *nogalanus* Ball should be corrected to *pima*, as will be shown below. The new species added by Ball in 1934 were, in page order: *chuliotus*,

papagonus, *nogalanus* (in error), *corvinus*, *yavapanus*, *coconinus*, *littoralis*, *apache*, *altanus*, and *dondonius*.

Metcalf published his catalog in 1936, but the preparation of the manuscript stopped in 1934 before Ball's important 1934 paper was available. In his catalog, Metcalf listed *lucidus* as a new name for *vitreus* Metcalf, which is treated as a synonym of *vicarius* (Walker) in our present revision.

Ball (1937) added *sonoitus* and *pygmaeus* and corrected a portion of his 1934 key after his subsequent study of Kirkaldy's mixed type series of *pima*. Ball stated that the new species *sonoitus* was the species he keyed out as *pima* Kirkaldy in his 1934 paper and that most of the *pima* type series was what he (Ball) had described as *nogalanus*. If we interpret Ball's remarks correctly, *nogalanus* Ball should be synonymized under *pima* Kirkaldy. We have seen the presumed type series of *pima* and the types of *nogalanus* and *sonoitus*. *O. sonoitus* is distinct, whereas *nogalanus* is the same as *pima*. Brimley (1938) listed 10 species of *Oliarus* in North Carolina, including *O. aridus* Ball as questionably present. Mead confirmed the presence of *aridus* in North Carolina during a collecting trip to Morrow Mountain State Park in 1959. The North Carolina records for *O. cinnamomeus* Provancher, *O. difficilis* Van Duzee, *O. franciscanus* Stål, and *O. slossoni* Van Duzee are in error.

Osborn (1938) included a key to the Ohio species of *Oliarus* as part of a larger work on Ohio fulgoroidea. Supplementing the key were illustrations, descriptive notes, and distributional data on five Ohio species and two more of possible occurrence. A number of discrepancies are involved in the drawings. The sexes are reversed in the captions of figures 13c and 13d. Drawings 14A, 14B, 14C, 14D and 14E of ventral views of the male genitalia exhibit mirror images of the aedeagal complex. The styles of *placitus* (figure 14B) are represented as symmetrical but actually are moderately asymmetrical. Figures of *franciscanus* (14C and c') are *ecologus* Caldwell, and the records listed for *franciscanus* apply to a mixture of *ecologus* and *sablensis*.

Caldwell (1938) added *nigravittus* and *lobatus*. The holotype male of *nigravittus* was studied by us, and it is now considered the same as *sonoitus* Ball, and the synonymy is made below.

Fennah (1945b) prepared a paper on the Cixiini of the Lesser Antilles. The full impact of this work on North American *Oliarus* has yet to be evaluated and involves regions and generic considerations mostly beyond the scope of the present revision. The one new species of *Oliarus* described by Fennah (1945b) was *campestris*. We agree with Caldwell (1952) that *campestris* is properly placed in synonymy under *complectus*.

Caldwell (1947a) described *acicus*, *ecologus*, and *zyxus*, then (1947b) added *eximus eximus*, *eximus teximus*, *forcipatus*, *catus*, *retentus*, *bispinus*, *uncatus*, and *sylvaticus* for the United States, plus other species from Mexico.

Beirne (1950) added *artemisiae* (a preoccupied name) and included a key, illustrations, distribution, and notes on *Oliarus* in Canada. He treated seven species. His illustrations of the male genitalia of *franciscanus* appear to have been made from *coconinus* Ball. The drawings labeled *ecologus* Caldwell are *sablensis* Caldwell.

Caldwell (1951) described *sablensis*, *gladensis*, and *altanatus*, and added a new name and a new species for Mexican forms not reaching the United States. *O. gladensis* Caldwell is placed in synonymy under *chuliotus*, below.

Caldwell and Martorell (1952) added *viequensis* Caldwell, illustrated and defined *complectus* Ball, and described *borinquensis* Caldwell as a new species from Puerto Rico. The last is identical with *slossoni* Van Duzee described from Florida and is synonymized in the present treatment.

Genus OLIIARUS Stål

Oliarus Stål 1862:306. Type-species *Cixius walkeri* Stål by subsequent designation of Distant 1906:256.

Melanoliarus Fennah 1945b:141. Type-species *Oliarus (Melanoliarus) maidis* Fennah by original designation [subgenus].

Total length of North American forms varying from 3.0 to 8.5 mm. Head somewhat narrower than thorax, angularly emarginate at the base, vertex concave, longer or shorter than width between the eyes, usually longer, lateral carinae diverging posteriorly, with or without a median carina extending forward from the base; vertex with an angulate or arcuate transverse carina near apex and a frontal carina at apex, the transverse and frontal carinae usually joined (sometimes feebly) by two longitudinal carinae, the four carinae thus forming two lateral foveae and a small

rectangular or square pit or compartment between; face with epistomal suture, arched dorsally, the frons and clypeus together broadest at about the midlength of face; frons and clypeus together elliptical in shape; base of anteclypeus marked by introrse termination of lateral facial carinae; a median carina traversing face from apex of anteclypeus to basal area of frons where a fork or thickening occurs, forming a small triangle which becomes obscure in species having tumid face; elevation of median carina varying from very conspicuous in some species to obsolete or nearly so for part its length in other species; median ocellus present and usually conspicuous at juncture of frons and postclypeus; rostrum varying in length from definitely not attaining caudal margin of posterior trochanters to surpassing trochanters by as much as most of length of terminal segment of rostrum.

Thorax with pronotum short and tricarinate, posteriorly deeply and angulately emarginate in median area, curving laterally; mesonotum with five longitudinal ridges, intermediate pair sometimes nearly obsolete; tegmina at rest longer than the abdomen, each broadly rounded at the apex, veins Sc + R contiguous at base with M, fork of M_{1+2} nearer to fork of M than is the fork of M_{3+4} , setae confined to veins, not on membrane, usually with 10 to 12 apical cells and 5 or 6 anteapical cells; posterior legs with variable number of conspicuous lateral tibial spines, usually three, first and second tarsites normally with seven apical spurs, but some species with additional spurs having membranous scale teeth attached distally to all the spurs except the lateral pair.

Male terminalia with base of perianthium firmly articulated at two points on the dorsal bridge of the pygofer in most species, but fastened to upper lateral portions of pygofer in a few species, attachment to base of anal segment weak, non-sclerotized; anal segment firmly attached to and articulated with dorsal bridge of pygofer, shape of anal segment varying from narrow and flaplike to broad and hoodlike; often slightly asymmetrical; styles often asymmetrical, loosely connected with each other, capable of independent movement; medioventral process of pygofer greatly variable in shape and size; connective varying from long and slender to short and stout, sometimes asymmetrical, combined width of ventral arms varying from conspicuously greater than, to less than width of base in posterior view; aedeagal complex with perianthium well developed and having great variety of shapes and processes, aedeagus with conspicuous apodeme normally articulated posteriorly with flagellum, the latter directed at various angles to the left when viewed in the non-mating position from ventral view, flagellum usually having several processes. The genus is cosmopolitan and rich in species.

Diagnosis. In North America, males of *Oliarus* are set well apart from other genera by the combination of a comparatively broad vertex, angulate emargination of the posterior part of the head, five (rarely three) longitudinal carinae of the mesonotum, lack of setae or fuscous granules on the membrane of each tegmen, main attachment of perianthium to pygofer rather than to base of anal segment, and styles independently movable, with projections, and not flattened.

Notes. Curators and other persons desiring to separate *Oliarus* from other North American genera of Cixiidae are referred to the keys provided by Metcalf (1923, 1938). Not included in these keys is *Oliaronus* Ball (1934). This genus is very closely related to *Oliarus*, especially the *aridus* Ball group. The male ter-

minalia of *Oliaronus tontonus* Ball, type-species of the genus, are very similar to *Oliarus pima* Kirkaldy except for the presence of a very slender, moderately long, ventral process of the periandrium that is not present in *pima*. *Oliaronus* is the only North American cixiid genus that, like *Oliarus*, has the posterior margin of the vertex deeply angulate and parallel to the posterior margin of the angulate pronotum. All the other genera except *Oliaronus* have the posterior margin of the vertex broadly rounded (concave). *Oliaronus* is separated from *Oliarus* by its unusual tegmina in which much of the costal cell is thickened, darkened, and thickly beset with heavy setigerous tubercles. Species of *Oliarus* lack this thickened area and lack tubercles in the membranous areas between veins such as are found in the costal and outer discal cells of *Oliaronus*. Another striking characteristic of *Oliaronus* is the series of seven or eight long, narrow, oblique cells between the node and the radial sector. The available specimens of *Oliaronus* are all from the southeastern quarter of Arizona.

SPECIES GROUPS IN NORTH AMERICAN OLIARUS

Many North American species of *Oliarus* are sufficiently similar to certain other members of the genus to allow groupings of species. Other species seem too distantly related to permit assignment to a group.

The largest group is the *Oliarus aridus* group consisting of the following 15 species: *aridus* Ball, *hesperius* Van Duzee, *kieferi*, new species, *pima* Kirkaldy, *sonoitus* Ball, *californicus* Van Duzee, *sementinus* Ball, *canyonensis*, new species, *retentus* Caldwell, *truncatus* Van Duzee, *apache* Ball, *papagonus* Ball, *caldwelli*, new species, and *lobatus* Caldwell. These species are characterized by the extensive length and uniform curving of the flagellum, which apparently forms a loop as seen in ventral aspect. Most of the species in the *aridus* group are southwestern in distribution, *aridus* being the only one to range east of Texas, moreover, it is the most ubiquitous Nearctic *Oliarus*. On the west coast, only *aridus* and *hesperius* are known to extend as far north as Oregon. Some of the more important characteristics that separate species within the *aridus* group are presence or absence of a process on the inner margin of the flagellar loop, number of processes on the flagellum and the number of these that are apical, number of processes on the ventral periandrium, presence or absence of a process on the dorsal periandrium, whether or not the dextral periandrial process is forked, width of the vertex, type of spotting and banding of the tegmina, color of veins and size of the tubercles on the veins, shape of the macula, and width of the frons on the face, along with other characters.

The *Oliarus cinnamomeus* group consists of two closely related species, the other species being *habecorum*, new species. Several outstanding characteristics that set these two species apart from other Nearctic species are as follows: dextral process very long, extending not only caudad, but curving left and cephalad in an unusual manner for American species; sinistral process platelike, extending from ventral to dorsal surface; first and second tarsites of the metatarsi with more apical spurs than the usual number seven in most American forms, and each of these spurs except the

lateral pair with a membranous scalelike tooth on the distal portion. Members of the *cinnamomeus* group have uniformly colored light brown or dark brown tegmina. The styles are unusual in the way that the inner ridge of "process" arises abruptly from the shaft and does not terminate in a lobe or digitate process as in most species. These two species are comparatively rare and occur primarily in bogs or other damp places in the eastern and northeastern areas of the United States. If the political boundaries of North Carolina were enlarged by one or two counties, *habeckorum* could be considered endemic to North Carolina according to present evidence.

Although much different from the *Oliarus exoptatus* Van Duzee group, the *cinnamomeus* group may be closer to the *exoptatus* group than to any other in the Nearctic Region. Both groups are characterized by a broad vertex and by more than seven apical spurs on the first and second tarsites of the metatibiae.

Species in the *Oliarus exoptatus* group are *beirnei*, new name; *exoptatus* Van Duzee; and *fidus* Van Duzee, all western in distribution. These species are very closely related and need more study. As treated in the present paper, *beirnei* ranges from southwestern British Columbia southward to central California; *exoptatus* ranges in the northern half or two-thirds of California, the Lake Tahoe area of Nevada, and in isolated areas of the northern Rocky Mountain system in the United States; *fidus* seems confined to the southwestern corner of California. The *exoptatus* group is characterized by a high degree of asymmetry in the styles and by the attachments of the perianthium and anal segment to the pygofer. The anal segment is not attached to the median posterior margin of the dorsal bridge of the pygofer as is usual, but instead is off-center to the left. The base of the perianthium is so extremely broad that the points of attachments have evolved from the narrow dorsal bridge to the wider accommodation provided by attachment to the upper sides of the pygofer. The attachment to the left side of the pygofer is slightly more dorsad than on the right. The flagellum in the *exoptatus* group is characterized by three processes, none of which is apical, the most unusual process of the three being a long, slender, curving process arising ventrad at the base of the flagellum. One of the unusual characteristics of the perianthium is the spherical development on the right basal portion, which in ventral aspect appears as a convexity, and in dorsal aspect as a concavity. The anal segment in the *exoptatus* group is moderately asymmetrical in dorsal or caudal view. A distinguishing feature of the anal segment is the broad and deep subrectangular excavation of the apex, with the median portion directed ventrad in a truncate process. The connective in the *exoptatus* group has a characteristically different shape from that of other Nearctic species.

We have compared species of the *exoptatus* and *cinnamomeus* group with a few European specimens and with some of the illustrations of European *Oliarus*. Both the *exoptatus* and *cinnamomeus* groups seem closer to Palearctic than to other Nearctic species. There is a need for a more comprehensive comparison of Asiatic and European forms with those of the Nearctic region.

The *Oliarus placitus* group consists of *placitus* Van Duzee, *montanus* Metcalf, *eximus* Caldwell, and *teximus* Caldwell. The first two species have been collected in the eastern half of the United States, and the last two species are southwestern in distribution. One of the outstanding characteristics of males in this group is the

greatly expanded pygofer process. Other group characteristics include the short, stout connective having unusually long ventral arms, and often with the base of the connective tilted, that is, not at right angles to the long axis of the shaft; styles which usually are apically bilobed, asymmetrical, and long and arcuate *in situ*; flagellum and perianthrium so intimately fused that separation of the two structures is difficult; flagellum extending primarily caudad, and slightly curved to the left; and tegmina with veins intermixed pale and dark throughout.

Somewhat allied to the *Oliarus placitus* Van Duzee group is the closely related pair of species *quinquelineatus* (Say) and *vicarius* (Walker). These two species have neither the greatly expanded pygofer process nor unusual connectives or styles, but they do have the basic structure of the aedeagal complex much as in the *placitus* group. The great array of spines on the aedeagal complex of *quinquelineatus* and *vicarius* is distinctive and is one of the most peculiar and astonishing developments to be seen on any species of *Oliarus* in the world. *O. vicarius* is characteristic of the coastal plain from Florida to North Carolina; *O. quinquelineatus* ranges over much of the eastern United States, with *vicarius* mostly replacing *quinquelineatus* in the coastal plain but with some sympatry; however, the species maintain their close but distinctive characteristics. Both species seem to be associated with pine trees, but it is not known if this association is obligatory.

The *Oliarus yavapanus* group of species includes *forcipatus* Caldwell, *uncatus* Caldwell, and *yavapanus* Ball, all from the southwestern United States. The general appearance, styles, anal segments, and pygoferes are sufficiently similar among the three species that separation depends upon characters of the aedeagal complex. Group characteristics of the aedeagal complex include a perianthrium with moderately developed sinistral and dextral processes, a medioapical ventral process, a moderate-sized mediobasal dorsal process, and especially the short mediobasal process of the venter. The flagellum has a single apical process and a single caudopreapical process in the three species.

Subgenus *Melanoliarus* Fennah (1945b) includes *O. complectus* Ball, *viequensis* Caldwell, and *acicus* Caldwell. *O. complectus* and *viequensis* are Antillean species that extend into Florida. *O. acicus* ranges in northern Mexico and in the southwestern United States close to the Mexican border from Texas to California. The most obvious characteristic of this group is that the anal segment of the male has an acute apical tooth directed ventrally and somewhat anteriorly. Another important characteristic is the basal ring of the perianthrium that gives rise to two or three short processes ventrally and laterally. Species in this subgenus are small, have most parts of the head and thorax dark brown or black, and have tegmina nearly immaculate.

The *Oliarus chuliotus* group includes *bispinus* Caldwell, *sablensis* Caldwell, and *chuliotus* Ball. This group is characterized by the sclerotized medial area of the dorsal perianthrium being expanded into an unpaired biramous process, the ventral perianthrium having four conspicuous processes, and the flagellum with none to two processes. The other parts of the male terminalia are without usual shapes or appendages. *O. bispinus* is a rare species in southwestern Texas, whereas *O. sablensis* and *O. chuliotus* are very closely related eastern species. These two species exhibit considerable sympatry, but apparently they have not been discovered together in any

one habitat. Both species seem to be locally abundant but scarce generally. The habitat requirements apparently are rather specialized. Of the 67 counties in Florida, there are records of *O. chuliotus* in five, *O. sablensis* in seven, but in only two of these, Dade and Seminole Counties, are both species found. *O. chuliotus* has been taken in nine states plus the District of Columbia. *O. sablensis* has been taken in 20 states (in 6 of which *chuliotus* occurs), the District of Columbia, and Ontario and Nova Scotia in Canada. *O. sablensis* extends several hundred miles farther north and northeast than *chuliotus*; the latter, however, has a more south-westward distribution. In the *chuliotus* group is a tendency toward a clinal increase in the number of flagellar processes along a diagonal line from southwestern Texas to northeastern United States. *O. bispinus*, the Texas species, has no flagellar processes; *O. chuliotus*, next along the diagonal line, has one flagellar process; *O. sablensis*, which overlaps in range with *chuliotus* and becomes the only species on the northeastern part of the diagonal line, has two flagellar processes. The high concentration of records in the eastern United States suggests that the *chuliotus* group is a part of the Carolinian fauna, but derivation from the Mexican fauna cannot be discounted. As yet, no Mexican, Central American, or Antillean species have been observed that resemble the *chuliotus* group. *O. ecologus* Caldwell resembles members of the *chuliotus* groups but the aedeagal complex of *ecologus* is considerably different than that of the *chuliotus* group.

The last group recognized in this paper is the *Oliarus concinnulus* Fowler group. *O. concinnulus* apparently occurs only in Mexico but is closely related to six species whose ranges include parts of the United States. These are *altanatus* Caldwell, *corvinus* Ball, *dondonius* Ball, *littoralis* Ball, *sylvaticus* Caldwell, and *zyxus* Caldwell. They are all western and southwestern species except *littoralis*, which is endemic to Florida in tidal flat situations. We presume that geologic events were instrumental in isolating precursors of *littoralis* from other members of the group. One of the outstanding characteristics of the *concinnulus* group is the left-caudal enlargement of the sinistral process, often in the form of an "outside" pair of calipers. This structure is highly variable. This caliperlike process has been one of the principal structures used to separate species of this group. More work is needed to augment the somewhat inconclusive evidence provided by the variable caliperlike sinistral process. Other distinctive group characters include two apical processes and a smaller subapical process on the flagellum. Most of the species in this group have spicules on the sinistral process, *O. dondonius* and *altanatus* being the principal exceptions. *O. concinnulus*, itself, may have spicules. The dextral process varies infra- and interspecifically. *O. concinnulus* and *altanatus* are notable for the extremely slender dextral process. Most of the habitat information available on the *concinnulus* group shows the various species to be associated with alkaline areas.

Other species of *Oliarus* in this paper which have not been assigned to groups are: *altanus* Ball; *arizonensis*, new species; *catus* Caldwell; *coconinus* Ball; *difficilis* Van Duzee; *ecologus* Caldwell; *humilis* (Say); *pygmaeus* Ball; *slossonae* Van Duzee; and *texanus* Metcalf.

KEY TO UNITED STATES AND CANADIAN SPECIES
OF *OLIARUS* BASED ON MALES

1. Flagellum in ventral view forming a loop by curving left, then right to disappear behind dorsal surface of aedeagus (fig. 471) 39
 Flagellum in ventral view not completing full loop to disappear behind dorsal surface of aedeagus (fig. 166) 2
2. Flagellum in ventral view curving only slightly to the left in relation to body axis (fig. 350); pygofer process greatly expanded or not 34
 Flagellum in ventral view curving left nearly or more than 90 degrees for at least part of its length (fig. 166); pygofer process not greatly expanded 3
3. Pygofer process cylindrical in ventral view, extending posteriorly as far as apices of abbreviated lateral lobes, and with a preapical ventral transverse keel (figs. 320, 330, 339); styles with inner process highly developed and grossly asymmetrical (figs. 319, 329, 338); anal segment with medioapical portion broadly and deeply incised in dorsal view (figs. 316, 326, 335), the median portion directed nearly straight downward forming a broadly truncate ventral process as seen in caudal view (figs. 318, 328, 337) (*exoptatus* group) 32
 Pygofer process not extending posteriorly as far as apices of pygofer lobes (fig. 291), but if so, not cylindrical and without subapical ventral, transverse keel; styles various, without inner processes large and grossly asymmetrical (fig. 290); anal segment not with combination of broad and deep apical excavation (fig. 287) and truncate caudoventral process (fig. 289) 4
4. Anal segment forming a medioapical recurved spine or process directed ventrocephalad (figs. 288, 298) (subgenus *Melanoliarus*) 30
 Anal segment with posterior margin not developed as a prominent downward recurved spine 5
5. Dorsomedian area of periandrial mass occurring as two prongs or processes, one directed more or less to the right, the other more or less to the left (figs. 256, 266-267, 277) (*chuliotus* group) 28
 Dorsomedian area of periandrial mass various, but not occurring as above 6
6. Aedeagus ventrally with left side of periandrial mass (sinistral process) usually developed into a conspicuous, highly variable, caliperlike or cheliform process (figs. 184, 193, 202, 211, 220-242); dorsally with long process directed caudad from base of periandrium, and flagellum with three apical to subapical processes (fig. 185, 194, 203, 212, 243) (*concinulus* group) 22
 Aedeagus without the above combination of characters 7
7. Aedeagus with venter of periandrium having a short, basal process lying between well-developed processes of right and left side and with dorsal periandrium having a mediobasal, moderately long, slender process (figs. 148-149, 157-158, 166-167) (*yavapanus* group) 20

- Aedeagus without the combination of ventral mediobasal process and the dorsal process of the periandrium as described above (figs. 98-99) 8
8. Left side of periandrium developed into a platelike structure or process that extends from the ventral to the dorsal surface (figs. 126-127, 136-137) 19
- Left side of periandrium without the dorsoventral, vertical, platelike process 9
9. Dorsum of periandrium without processes (figs. 68, 108) (exclusive of right or left side processes that may curve dorsad, or of any basal, downcurving process of flagellum) 14
- Dorsum of periandrium with one or two processes (figs. 21, 30, 59) 10
10. Dorsum of periandrium with two long sinuate processes (fig. 21); apex of venter of periandrium with curving, hyaline process (fig. 20) (easily overlooked) *ecologus* Caldwell
- Dorsum of periandrium usually with only one process, but if with two, not with both processes long and sinuate; apex of venter of periandrium without a hyaline process 11
11. Style with mesal margin of shaft greatly swollen (fig. 34); apex of flagellum with a pair of subequal processes forming an inverted "V" (fig. 30) *difficilis* Van Duzee
- Style with mesal margin not greatly swollen (fig. 44); apex of flagellum with only one process (therefore, without inverted "V") although sometimes with subapical process slightly overlapping apical one (fig. 40) 12
12. Anal segment with a pair of short points at apex (fig. 41); dorsum of periandrium with stout process originating in mediobasal area, this process usually spathe-like (fig. 40) *cocconinus* Ball
- Anal segment regularly convex or concave, not forming pair of short points (fig. 51); dorsum of periandrium with mediobasal process narrow, not stout and spathe-like (figs. 50, 59) 13
13. Left basal lateral area of ventral periandrium poorly developed as a short protuberance and with its mesal apical portion giving rise to a large left-curving process as in fig. 49; dorsum of periandrium apically giving rise to a long, conspicuous curving process directed left-cephalad, and basally giving rise to a short, narrow process (fig. 50) *catus* Caldwell
- Left basal lateral area of ventral periandrium well developed and giving rise to a conspicuous process reflexed in its apical third and with its mesal apical portion giving rise to a long unevenly curved slender process (fig. 58); dorsum of periandrium without a long, curving process arising apically but basally giving rise to a long, slender process directed posteriorly (fig. 59) *humilis* (Say)
14. Styles asymmetrical, the left one either with a much longer inner process or with an extra process (figs. 72, 83) 15
- Styles essentially symmetrical 16

15. Left style with long, lobelike inner process attaining outer margin of style and without an extra toothlike process on expanded apical portion (fig. 72); aedeagal complex with prominent dextral processes (fig. 67) *slossonae* Van Duzee
 Left style with short inner process not nearly attaining outer margin of style and with an extra toothlike process on expanded apical portion (fig. 83); aedeagal complex without dextral process (fig. 76) *altanus* Ball
16. Periandrium with left, basiventral process irregularly serrate, broad and somewhat anvil-shaped (figs. 88-89); pygofer in ventral view with process extending as far posteriorly as lateral lobes, the process at base approximate width of a lateral lobe (fig. 94) *arizonensis*, n. sp.
 Periandrium without a left basiventral process as above; pygofer in ventral view with process not extending posteriorly as far as lateral lobes (fig. 104), but if near that length then obviously narrower than width of a lateral lobe (fig. 113) 17
17. Periandrium on the left with an asymmetrical, Y-shaped process, the outer ramus fairly straight and slender and directed approximately 45 degrees left-caudad, the inner ramus shorter, usually with a protuberance and directed to the right (figs. 98-99); style with basal mesal margin considerably expanded (fig. 103) *texanus* Metcalf
 Periandrium on the left not forking apically (fig. 117); style with basal mesal margin of shaft but little expanded (fig. 122) 18
18. Flagellum directed to the left, then cephalad for only a short distance, and with two subequal processes at apex (fig. 107); left apical portion of periandrium with two long processes directed cephaloventrad (figs. 107-108); total length unusually short (3.5 mm or less) *pygmaeus* Ball
 Flagellum directed left but curving considerably cephalad and slightly to the right thereby nearly forming a loop with one apical process (figs. 117-118), and having one preapical process about halfway around left margin of loop (fig. 118); total length 3.7 mm or more *papagonus* Ball
19. Aedeagus with a short, slender process arising at the left ventral subapical portion of the periandrium, the tip of this process ending near apex of the platelike process (figs. 126-127); remainder of aedeagus with four conspicuous pointed processes; anal segment nearly symmetrical in caudal view (fig. 130) *cinnamomeus* Provancher
 Aedeagus without a short, slender process at the left, ventral subapical portion of the periandrium (fig. 136); remainder of aedeagus with five conspicuous pointed processes; anal segment distinctly asymmetrical in caudal view (fig. 140) *habeckorum*, n. sp.
20. Flagellum with a total of three processes including a caudodorsal basal short process (fig. 149); left portion of periandrium with a large, non-bifid process pointing to the left and avicephaliform in profile (figs. 148-149) *yavapanus* Ball
 Flagellum with total of two processes and without a caudodorsal basal short process (fig. 167); left portion of periandrium bifid, not avicephaliform in profile (fig. 166) 21

21. Flagellum with the non-apical process much wider in basal half; arising dorso-
cephalad and directed left-cephalad (fig. 158) *forcipatus* Caldwell
Flagellum with the non-apical process rather slender and short, arising caudad
and directed to the left (fig. 167) *uncatus* Caldwell
22. Periandrium with dextral process straight and extremely slender (fig. 175);
dorsum of periandrium with mediobasal process long, slender, directed
caudad then curving to the left (fig. 176) 23
Periandrium with dextral process straight or curved but not extremely slender
(figs. 184, 193); dorsum of periandrium with mediobasal process usually
straight, sometimes with apical third bending slightly to left (fig. 243)
. 24
23. Periandrium with sinistral process only slightly suggestive of a caliperlike
structure, the apical prong clavate, and making only slight curve to the
right; basal prong of caliper much weaker and more slender than apical
prong (Mexican species, no valid United States records; see fig. 56 in
Fennah (1945b) *concinulus* Fowler
Periandrium with sinistral process in the form of large, well-defined caliper-
like structure, the apical prong slender and making at least a 90 degree
curve to the right; basal prong of caliper only slightly shorter than apical
prong (fig. 175) *altanatus* Caldwell
24. Periandrium with sinistral process moderate-sized, asymmetrically bifid, not
in form of caliper but suggesting a concave anvil (fig. 184); medioventral
periandrial process somewhat variable but always unusually broad at base
of neck, curving to the left, avicephaliform (fig. 184) *corvinus* Ball
Periandrium with sinistral process large, usually expanding and curving
apically to the left and caudally, in form suggesting calipers (figs. 193,
202, 211); medioventral periandrial process variable, more slender and
curved to the left, seldom avicephaliform (figs. 193, 202, 211) 25
25. Sinistral process strongly convex between prongs of caliper and with basal
prong well developed (fig. 193); anal segment in caudal view with
ventral profile in form of a broad, somewhat rectangulate inverted "U"
(fig. 197) *littoralis* Ball
Sinistral process without strong convexity between prongs, although some-
times slightly convex with basal prong of caliper either present or absent
(figs. 220-241); anal segment in caudal view with ventral profile fairly
straight "U" (figs. 206, 215, 250) 26
26. Sinistral process elongate-platelike, introrsely uncinately distally, without basal
prong or subprocess, but with spicules (fig. 202); basidorsal process of
periandrium nearly attaining posterior margin of aedeagus (fig. 203)
. *sylvaticus* Caldwell
Sinistral process usually caliperlike, having basal prong with few exceptions,
and with or without spicules (figs. 220-242); basidorsal process of perian-
drium extended posteriorly but distinctly failing to attain proximity of
posterior margin of aedeagal complex (figs. 212, 243) 27

27. Flagellum with none of its three processes unusually short and directed primarily to the left from the left caudal margin (shortest of three flagellar processes moderately small, visible dorsally (fig. 212) but not ventrally (fig. 211), and directed cephalad); sinistral process with spicules, usually broadly and shallowly U-shaped with the breadth of opening usually but not always greater than depth of concavity when latter is present (figs. 220-241) *zyxus* Caldwell
 Flagellum with one of its three processes unusually short, arising on the left caudal margin, and directed left or left-caudad (fig. 243); sinistral process without spicules, usually deeply U-shaped, with the breadth of opening nearly always less than depth of concavity (figs. 242-247) *dondonius* Ball
28. Apex of flagellum with a conspicuous pointed process (figs. 255-256) *sablensis* Caldwell
 Apex of flagellum without a process (figs. 265, 276) 29
29. Flagellum with a fairly long, slender process originating in its basiventral area and directed to the left (fig. 265); dorsal periandrial mass with dextral prong or process extending posteriorly (figs. 266-267) *chuliotus* Ball
 Flagellum without a process arising in its basiventral area (fig. 276); dorsal periandrial mass with dextral prong or process not extending caudad (fig. 277) *bispinus* Caldwell
30. Aedeagus with a conspicuous corkscrew-shaped process spiraling around flagellum (fig. 285); flagellum initially directed to left, then curving caudad 90 degrees; flagellum without apical processes (figs. 285-286) *acicus* Caldwell
 Aedeagus without a large, corkscrew-shaped process spiraling around flagellum; flagellum directed left at right angle to long axis of aedeagus; flagellum with a pair of apical processes (figs. 295-296, 305-306) 31
31. Venter of periandrium with a pair of similar apical processes (fig. 295); dorsum of periandrium with an apical retrorse process directed cephalad primarily (fig. 296); flagellum apically with a pair of subequal processes not arising from a common area (fig. 296) *complexus* Ball
 Venter of periandrium with a single, apical process (fig. 305); dorsum of periandrium without an apical process (fig. 306); flagellum apically with an unequal pair of processes arising in a common area on the ventral surface (fig. 305) *viequensis* Caldwell
32. Left medioventral surface of periandrium giving rise to a moderately long acuminate process directed to the left (fig. 314); left style with caudal sublobe smoothly rounded and directed to left (fig. 319) *exoptatus* Van Duzee
 Left medioventral surface of periandrium not as above but shorter, often truncate or weakly bifid and often not directed straight left (figs. 324, 333); left style with caudal sublobe varied, produced posteriorly in some specimens (figs. 329, 338) 33

33. Left style with caudal sublobe produced posteriorly as a spinelike process (fig. 329); left venter of periandrium in ventral view giving rise to a semi-truncate process directed approximately 45 degrees left caudad (fig. 324) *fidus* Van Duzee
- Left style with caudal sublobe lobelike not developing into a spinelike process (fig. 338); left venter of periandrium in ventral view usually giving rise to a short, weakly bifid process directed approximately 90 degrees to the left (fig. 333) *beirnei*, n. n.
34. Aedeagus with the dominant process having many spiny subprocesses (fig. 342); pygofer process subtriangular in ventral aspect, not greatly expanded (figs. 347, 356-357) 35
- Aedeagus without any large process having many spiny subprocesses; pygofer process greatly expanded and rounded in ventral aspect (figs. 366, 375, 385, 396) 36
35. Pygofer process with apex somewhat rounded and attaining, or nearly attaining, level of apices of lateral lobes (fig. 347); left basal periandrial process with apical portion straight and with distal portion of large ventral process usually curving 90 degrees near apex (fig. 342); each style with inner process having short protuberance along caudal margin (fig. 343) *quinquelineatus* (Say)
- Pygofer process with apex acute or subacute and distinctly not attaining level of apices of lateral lobes (fig. 356-357); left basal periandrial process with apical portion recurved slightly more than 180 degrees, and with distal portion of large ventral process making little or no curve near apex (fig. 350); each style with inner process not having short protuberance along caudal margin (fig. 355) *vicarius* (Walker)
36. Aedeagus with long, very slender, lightly sclerotized process arising at apex of flagellum to the left (figs. 360-361, 369-370) 37
- Aedeagus without a long, very slender, apical process as above (figs. 379-380, 389-391) 38
37. Aedeagus with two massive processes, enlarged and bifid apically (figs. 360-361); styles with apices produced broadly (fig. 365); posterior margin of pygofer truncate in lateral view (fig. 367) *placitus* Van Duzee
- Aedeagal complex without two massive processes as above (figs. 369-370); styles with apices rounded (fig. 374); posterior margin of pygofer narrowly subtruncate or truncate in lateral view (figs. 376-377) *montanus* Metcalf
38. Aedeagus with three long processes extending caudad from basal areas (figs. 379-380); swollen part of pygofer process about as wide as long in ventral aspect (fig. 385) *eximus* Caldwell
- Aedeagus with four long processes extending caudad from basal areas (figs. 390-391); swollen part of pygofer process longer than wide in ventral aspect (fig. 396) *teximus* Caldwell
39. Flagellum with basal half or third of loop having a process developing from inner ring (figs. 472, 473, 502, 522) 46

- Flagellum with basal half of loop not giving rise to a process from inner margin (figs. 420-421, 429, 431, 440-441) 40
40. Venter of periandrium with the right apical area giving rise to a prominent retrorse process (figs. 400, 409); distal half of each style with massive lobe and stout hooklike inner process on basal margin of lobe (figs. 405, 414) 41
- Venter of periandrium with the right apical area not giving rise to a prominent retrorse process (figs. 440, 449); distal half of each style neither massive, nor with a stout hooklike inner process as above 42
41. Retrorse process of right apicoventral area of periandrium making approximately a 90 degree curve to the left near its distal third (fig. 400); periandrium with a total of five processes (fig. 400); anal segment with apex distinctly concave in dorsal view; forming a pair of points (fig. 402) *lobatus* Caldwell
- Retrorse process of right apicoventral area of periandrium recurved approximately 135 degrees to the right near its distal third (fig. 409) unciform; periandrium with a total of four processes (figs. 409-410); anal segment with apex convex in dorsal view (fig. 411) *caldwelli*, n. sp.
42. Periandrium with two processes visible in ventral view (fig. 420); dorsally with a retrorse process arising from the extreme right apical area at base of flagellum (fig. 421) *apache* Ball
- Periandrium with three or four processes visible in ventral view and dorsally without a retrorse process arising from the extreme right apical area at base of flagellum 43
43. Flagellum with two similar apical processes (figs. 431, 441); dorsal periandrium with a process in the left apical area (figs. 431, 441) 44
- Flagellum with one apical process (figs. 118, 450); dorsal periandrium without processes in the left apical area (figs. 118, 450) 45
44. Periandrial processes five; venter of periandrium with right basal process forked and left basal process short, toothlike (fig. 429) *knullorum*, n. sp.
- Periandrial processes three; venter of periandrium with right basal process unforked and left basal area swollen, developing caudad into a long recurved process (fig. 440) *retentus* Caldwell
45. Periandrium with right side not tumid and dextral process broad, serrately truncate and appearing broken or malformed (fig. 450); left basiventral portion of periandrium developing into two slender processes, the outer approximately half the length of the inner (fig. 449); inner processes of styles asymmetrical, the right process distinctly longer than the left (figs. 451, 455); anal segment gradually enlarged apically (fig. 453) *canyonensis*, n. sp.
- Periandrium with right side tumid near middle and dextral process slender, acute, curved to the left and dorsad, thus partially hidden in ventral view (fig. 117); left basiventral portion of periandrium developing into only one unusually long process (fig. 117); inner process of styles nearly symmetrical, shorter and slimmer than inner process of right style of species

- above (fig. 122); anal segment abruptly enlarged apically (fig. 120)
 *papagonus* Ball
46. Dorsal periandrium with one process (fig. 493) 48
 Dorsal periandrium with no process (figs. 462, 472) 47
47. Styles symmetrical, slender, subterete apically; lateral expansion of each style arising at right angle to shaft, far removed from apex, slender and slightly curved (thumblike) (fig. 466) *hesperius* Van Duzee
 Styles slightly asymmetrical with shafts moderately slender; lateral expansion of each style at apex, with broad expansion angularly recurved (fig. 479)
 *aridus* Ball
48. Periandrium with basiventral area having two or three short unforked processes; left apicoventral area of periandrium with an unusually long, partly curved, twisted process directed left-cephalad (fig. 483)
 *truncatus* Van Duzee
 Periandrium with basiventral area having but single unforked process (figs. 532, 533) or one to three processes, one of which is branched (figs. 492, 501, 511, 521); left apicoventral area of periandrium without process as above 49
49. Flagellum with five processes, including a short, pointed process directed left from base at the caudal extreme of aedeagus (fig. 493); periandrium with three processes, counting any forked process as one (figs. 492-493)
 *sementinus* Ball
 Flagellum with four processes and not having a short, pointed process directed left from base at caudal extreme of aedeagus (figs. 502, 512, 522, 534); periandrium with four or five processes, counting any forked process as one (figs. 501-502, 511-512, 521-522, 532-534) 50
50. Flagellum with inner process near middle of loop, short, stout, and with apex directed left (fig. 502); periandrium with total of four processes not counting lateral ramus of a fork (figs. 501-502) *pima* Kirkaldy
 Flagellum with inner process longer, more slender, apex directed right-cephalad; periandrium with total of five processes not counting lateral ramus of a fork (figs. 511-512, 521-522, 532-534) 51
51. Left lateral lobe of pygofer with posterior margin having a small, thumblike projection or sublobe (fig. 518); left basiventral area of periandrium in ventral view having a small process appearing to make two 90 degree curves (fig. 511); dextral process of periandrium long, forked in apical one-fourth or one-fifth (fig. 511); periandrium without an additional dextral process (figs. 511-512) *sonoitus* Ball
 Left lateral lobe of pygofer with posterior margin not having a small thumblike lobe or process (figs. 529, 540); left basiventral area of periandrium without a process as above; basal dextral process moderately long, unforked or forked; periandrium with an additional more distal dextral periandrial process (figs. 521, 532-533) 52

52. Periandrium ventrally with basal dextral process forked and with mediosubapical process short, straight, and directed right-caudad (fig. 521); styles with inner process arising in distal third (fig. 526) *kieferi*, n. sp.
 Periandrium ventrally with basal dextral process unforked and with medio-subapical process long, partially curved, and directed primarily to the left (fig. 532); styles with inner processes developing at middle portion (fig. 538) *californicus* Van Duzee

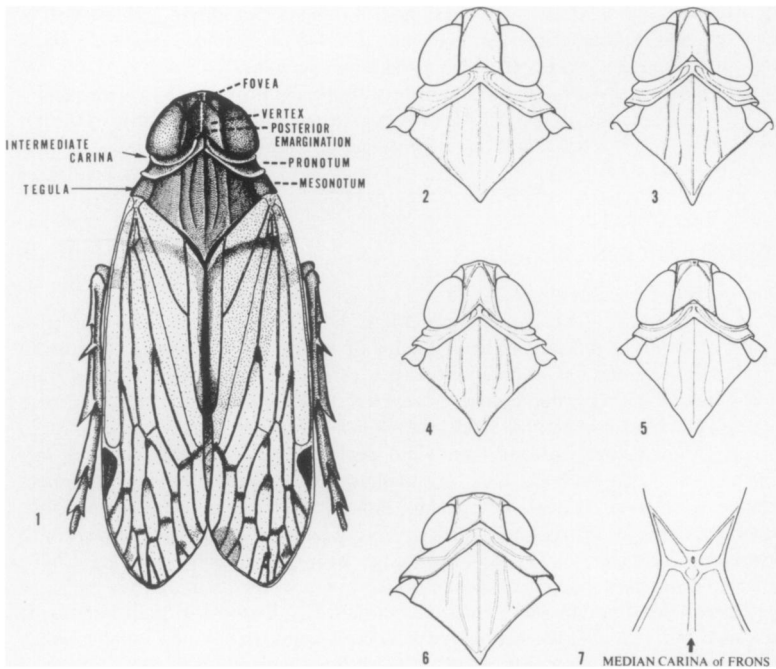
Oliarus ecologus Caldwell

Figs. 20-28

Oliarus ecologus Caldwell 1947a: 76.

Salient features. — Length of male 3.7 to 4.5 mm (based on 115 specimens); length of holotype 4.3 mm. Ground color of vertex and mesonotum piceous in most specimens, fuscous in other specimens; carinae of mesonotum varying from concolorous to partially dull orange (there is a distinct tendency for median carina to be orange), other four carinae black or dark brown. *Head:* Vertex narrow, length in middle line distinctly greater than width at apex of posterior emargination; median carina present in basal half. Face piceous or fuscous and with prominent carinae which are more heavily orange or yellow on the frons; maculae absent; frons wider than long in middle line. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually separate from pale border of posterior margin, but nearly tangential in some specimens. Mesonotum with all carinae prominent. Tegmina without large spots or bands but with suffusion around apical cross-veins; membrane usually with a slight dusky aspect, especially distally, but glossy clear in some specimens; veins mainly pale, becoming brown apically; tubercles not prominent; apical cells usually 11 and anteapical cells 5; stigma pale yellow or brownish; length less than twice width. Legs with all tibiae usually pale yellow, with brownish overtones in some specimens.

Male genitalia. — Aedeagal complex as in figs. 20 and 21; pointed processes eight. Periandrium ventrally with two straight, stout, pointed processes in the median subapical area and with two more processes in the left apical area, these processes curving left, then ventrocephalad apically, the thinner and more caudal of this latter pair hyaline and easily overlooked, the other process of this pair hyaline basally, becoming sclerotized in apical half, also becoming swollen in middle portion, apex becoming abruptly acuminate; dorsal periandrium with two processes, one originating basally on right and becoming long, slender, and sinuate, with apex extending caudad of base of flagellum; other dorsal process originating in the left apical area, curving right, then caudad, stoutest in this middle portion, recurved apically, with the apex approximately pointing toward the apex of the other dorsal process. Flagellum with two slender, moderately long processes originating in the caudoapical area, one dorsal, the other ventral, the latter extrorse at its apex, the dorsal process introrse at its apex. Styles as in fig. 25; symmetrical; apices broadened



FIGURES 1-7. 1. Dorsal view of *O. sonoitus* Ball. Head, pronotum, and mesonotum in dorsal view. 2. *O. chuliotus* Ball. 3. *O. dondonius* Ball. 4. *O. altanatus* Caldwell. 5. *O. texanus* Metcalf. 6. *O. canyonensis*, n. sp., from holotype. 7. Frontal view of anterior portion of crown and upper portion of frons of *O. texanus* Metcalf.

and evenly recurved; inner process very short, pointed. Connective as in fig. 28; long and slender with combined width of the ventral arms approximately equal to width of base of the shaft. Pygofer as in figs. 26 and 27; symmetrical; medioventral process triangular in ventral aspect, broadest at base, sides nearly straight, pointed or nearly so, greatest width approximately three-fourths the length; usually extending posteriorly approximately half the distance to the level of the apices of the pygofer lateral lobes; pygofer lateral lobes evenly produced and rounded. Anal segment as in figs. 22-24; width approximately $7/10$ the length in dorsal aspect; nearly symmetrical, right caudal margin slightly more produced than left side in some specimens; margin very slightly concave, ventral profile in caudal aspect slightly undulate but generally fairly straight.

Types. — The type series of *O. ecologus* consists of "male holotype, female allotype, and many paratypes of both sexes from Pickaway Co., 7-1-36; paratypes same locality, 6-16-34; 7-8-36; Ross Co., 7-3-38; Jackson Co., 7-22-38; Licking Co., 6-16-34; and Lawrence, 6-24-34, all in Ohio." J.S. Caldwell was the collector. The following type material is in the United States National Museum collection: holotype male, allotype female, and paratypes. The male paratype from Licking County is not *ecologus* but is *O. sablensis* Caldwell. The two paratypic females, having the same collection data as this male are also presumed to be *sablensis*. The males and presumably the females of the remainder of the type series are all *ecologus*.

Distributional records. — Male specimens were studied from Connecticut (Mt. Carmel), New Jersey, and Pennsylvania in the northeast, south through Maryland, the District of Columbia, Virginia, North Carolina (Morrow Mountain State Park and Raleigh), South Carolina (Clemson), Georgia (Griffin), Alabama (Prattsville), Mississippi (Vicksburg), and Arkansas (Marion County), north and west to Tennessee (several localities), Kentucky (Oldham County), Ohio, Illinois (Cave-in-Rock and Vienna), and Kansas (Douglas County, Lawrence, and Manhattan). (There are no authentic Canadian records for *ecologus* at this time.) Beirne (1950:95) misidentified *ecologus*; his illustrations of *ecologus* are actually *sablensis*.

Notes. — *O. ecologus* is the only species studied that has a sizeable hyaline process on the aedeagal complex. This process is located on the left apex of the ventral perianthrium, extends caudad, curves left and cephalad. It has been neglected in previous descriptions and illustrations. Another process, which is hyaline basally and lies adjacent to the hyaline process, is darker apically and broader, and has a shape and position seen only in *ecologus*. Other highly diagnostic processes include the sinuate right dorsal process and the thicker, more sharply curving, dorsal process that becomes the most caudal part of the aedeagal complex. This dorsal combination of processes is unique among the New World species examined. The two subapical processes of the flagellum are also distinctive.

O. ecologus does not appear to be very closely related to any other Nearctic species. The *O. chuliotus* group probably is closest to *ecologus*. Further studies may confirm that *ecologus* is an example of the Carolinian Fauna with center of origin in the southern Appalachian Mountains. The longest series of specimens studied was from the Great Smoky Mountain National Park and vicinity.

Caldwell in his original description correctly pointed out that the drawings of the male genitalia of "*O. franciscanus*" which he prepared for Osborn (1938:301), are actually those of *ecologus*. Also, as Caldwell pointed out, Figure 140 in Osborn (1938:301) is a mirror image of the true position.

The habitat labels on specimens of *ecologus* are: floodplain woods, prairie meadow, and "*Lespedeza sericea*" (Miq.) (= *L. cuneata* Don). The seasonal distribution of *ecologus* extends from May 5 to August 12. *O. ecologus* probably is a univoltine species.

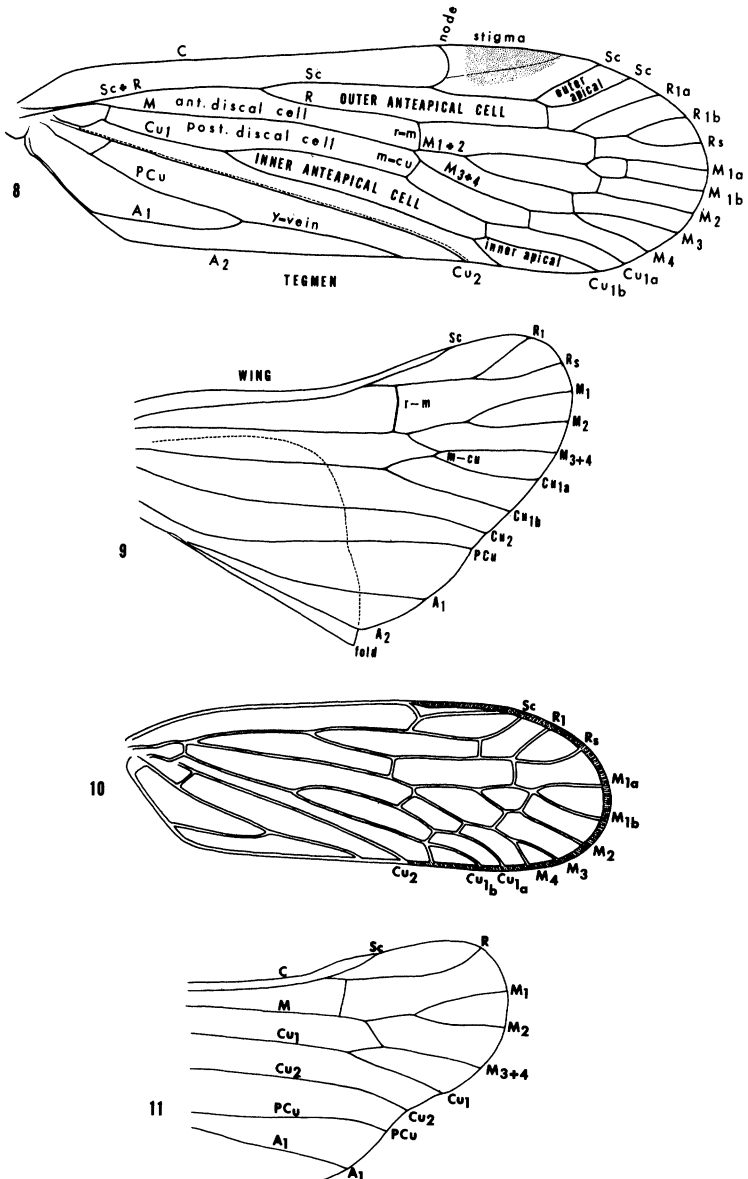
Oliarus difficilis Van Duzee

Figs. 29-38

Oliarus difficilis Van Duzee 1912:494.*Oliarus vittatus* Metcalf 1923:181. N. Syn.

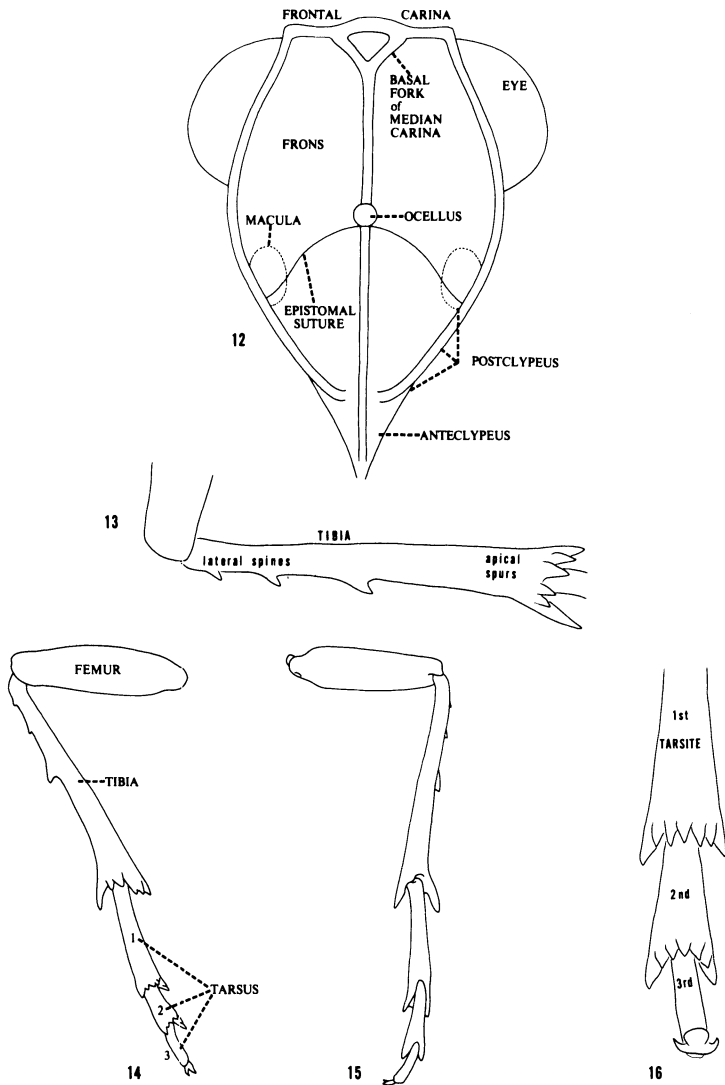
Salient features. — Length of male 4.5 to 5.0 mm (based on nine specimens). Ground color of vertex and mesonotum variable medium brown, mesonotal carinae concolorous. *Head:* Vertex moderately narrow, variable, length in middle line usually greater than width at apex of posterior emargination; median carina usually feebly developed (distinct basal half of disc in some specimens). Face with color somewhat variable, usually castaneous or ochraceous; median carina conspicuously elevated, yellowish throughout length and with unusually conspicuous fork at base; lateral carinae pale yellow and conspicuous; maculae not present in some specimens, feebly developed in other specimens; frons moderately narrow, width greater than length in middle line. Rostrum moderately long, usually slightly surpassing posterior trochanters. *Thorax:* Pronotum with intermediate carinae joining pale border of posterior margin. Mesonotum with intermediate carinae weaker, variable, almost obsolete in some specimens. Tegmina with membrane usually subhyaline, basal area smoky brown in some specimens; spots usually present at fork of Sc + R, fork of Cu., and on short length of M at level in line between forks just mentioned; crossveins usually with brownish suffusion; commissure fuscous basad of Y-vein juncture for approximately two-fifths length of commissure; tubercles brownish, moderately conspicuous because of contrast to pale veins; veins dingy pale yellow on most of tegmen, becoming fuscous at apex of tegmen; apical cells normally 11 and antepical cells 6; stigma a distinct brown patch, approximately twice as long as wide. Legs mostly light brown without bands.

Male genitalia. — Aedeagal complex as in figs. 29 and 30; total processes seven. Periandrium with five processes; ventrally with short, stout, acuminate dextral and sinistral processes; median area giving rise to prominent process directed caudally to level of flagellum, then curving left and recurving on itself to become directed to the right, terminating at level of aedeagal joint; left subbasal area giving rise to conspicuous process directed caudally initially then making scythelike curve to the left; dorsal periandrium with very short, stout process directed to the right from left apical area of periandrium. Flagellum curved to the left and bent anteriorly in its distal half, with the apex recurved right-dorsally with two slender, prominent, fairly straight apical processes, the dorsal one longer, terminating in the median, basal area of dorsal periandrium; these two processes forming an inverted "V" when viewed from left lateral aspect. Styles as in fig. 34; symmetrical or nearly so; shaft greatly swollen, especially basally; enlarged and recurved at slightly more than 90 degree angle when viewed in broadest aspect; inner processes moderately short, broad basally, rapidly becoming acute; *in situ* the styles stout, nearly straight and contiguous for most of length. Connective as in fig. 38; unusually long and slender; combined width of ventral arms distinctly greater than width of base of shaft in posterior aspect. Pygofer as in figs. 35-37; somewhat asymmetrical; medioventral process nearly an equilateral triangle in ventral aspect, extending posteriorly less than half distance to level of apices of pygofer lateral lobes; lateral



FIGURES 8-11. Wings. 8-9, *O. vicarius* (Walker). 10-11, *O. canyonensis*, n. sp., from holotype. 8, 10 forewings. 9, 11 hindwings.

PLANTHOPPER GENUS OLIARUS



FIGURES 12-16. Structural features. 12, Generalized face. 13, 15-16, *O. hesperius* Van Duzee. 14, *O. yavapanus* Ball. 13, metatibia. 14-15, metathoracic leg. 16, metatarsites.

lobes in lateral aspect with left lobe slightly more produced, somewhat rounded, subtruncate; right lateral lobe narrower, subacute. Anal segment as in figs. 31-33; slightly asymmetrical in dorsal view, right side more fully developed; longer than wide; medioapical margin approximately straight; ventral profile in caudal aspect slightly concave.

Types. — The type material of *O. difficilis* consists of two females taken at Belleair, Pinellas County, Florida, by Mrs. Annie Trumbull Slosson. These specimens are in the American Museum of Natural History. We have seen the one that has a yellow paratype label on it. Because no males were involved in the original description or type series, there has been a problem of determining which particular male form of *Oliarus* belongs with the *difficilis* females. We agree with Ball (1934:269) that the female specimens of the males and females he collected in central and southern Florida and at Brownsville, Texas, fit Van Duzee's description of *difficilis*, and that the males fit Metcalf's 1923 description of *O. vittatus* (holotype male) from Brownsville. The male illustrated here is from Dade Co., Florida.

Distributional records. — The known range of *O. difficilis* is quite restricted. The Texas specimens are all from Brownsville or Hidalgo County. In Florida the specimens seen are from Collier, Dade, Highlands, Lee, Palm Beach, Pinellas, and Seminole Counties. These counties are in central and southern Florida.

Notes. — *Oliarus difficilis* is an uncommon species of Neotropical affinities as yet found only in the southern half of Florida and the Lower Rio Grande Valley in the United States. The male genitalia are highly distinctive, and the species has no close relationship to the other members of the Nearctic fauna.

Collection data on specimens of *O. difficilis* include: "in pasture, S. Texas garden"; "*Mimosa borealis*" [Gray]; on *Celtis mississippiensis* [= *C. laevigata* Willdenow]; blacklight trap.

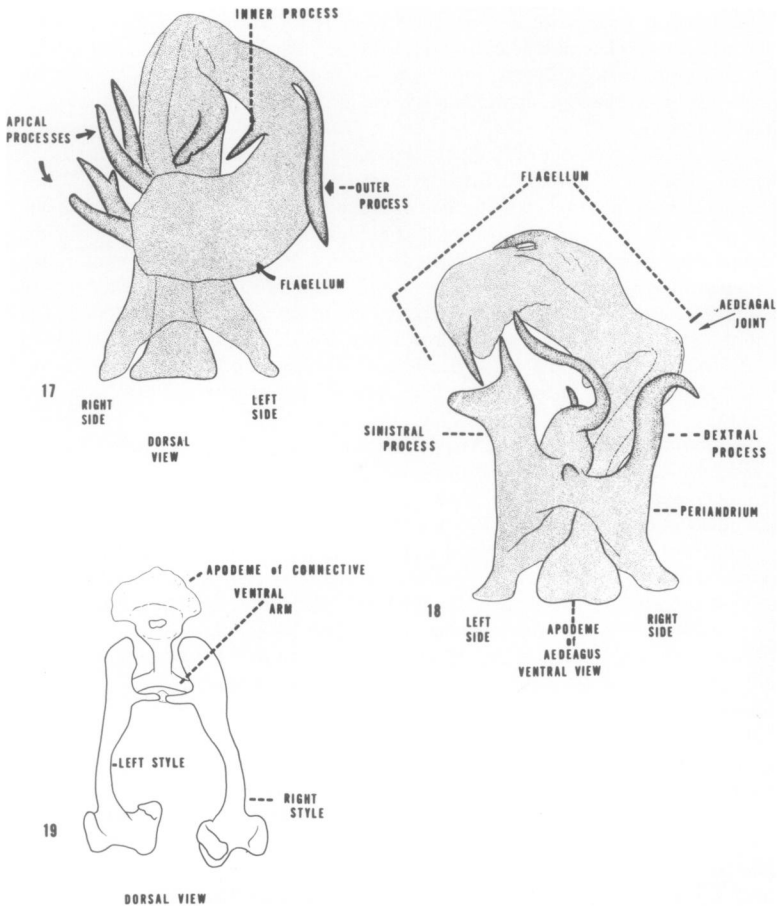
The seasonal distribution of *O. difficilis* extends from March 4 to December 11 but without any July or September records and only one for August. The majority of the records are in spring.

Oliarus coconinus Ball

Figs. 39-48

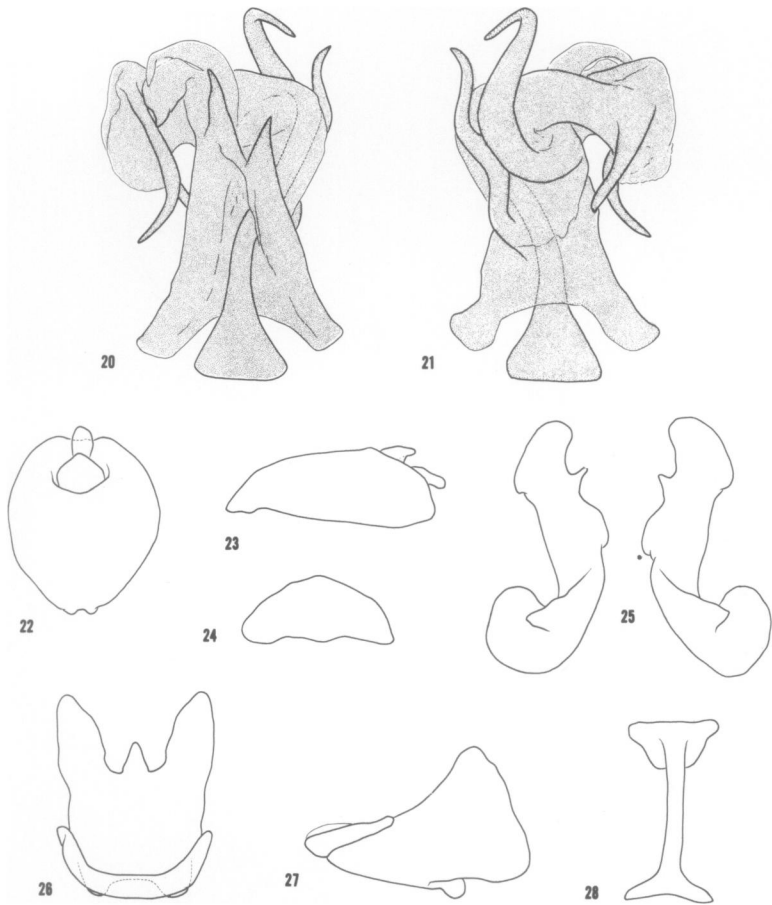
Oliarus coconinus Ball 1934:274.

Salient features. — Length of male 3.8 to 5.3 mm (based on 37 males). Ground color of vertex and mesonotum fuscous to piceous; mesonotal carinae usually orange, sometimes brownish. *Head:* Vertex in middle line distinctly longer than broad at apex of posterior emargination; median carina absent or very short. Face usually fuscous, but sometimes piceous; median carina distinctly orange and traversing entire face; basal fork of median carina short, highly calloused; lateral carinae orange to pale yellow with paleness tending to broaden near epistomal suture; frons moderately narrow, wider than long in middle line with length about four-fifths to five-sixths the width. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually not attaining pale band of posterior margin but occasionally tangential thereto. Mesonotum with

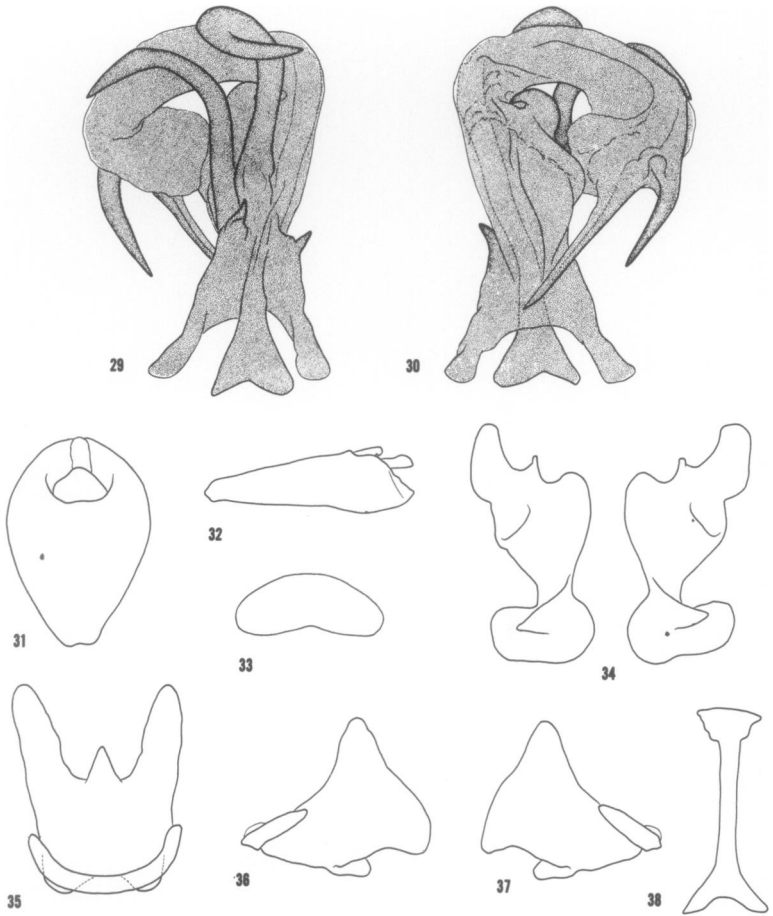


FIGURES 17-19. Male genitalia. 17, *O. kieferi*, n. sp. from holotype, aedeagal complex in dorsal view. 18, *O. uncatius* Caldwell, from holotype, aedeagal complex in ventral view. 19, *O. eximus* Caldwell, connective and styles in dorsal view.

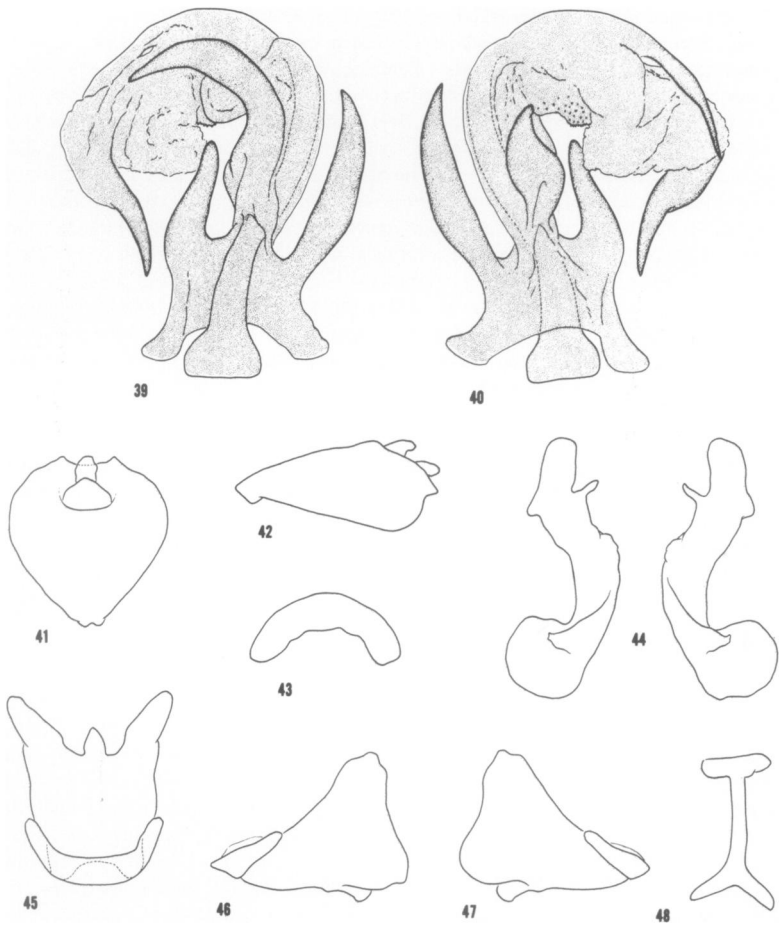
carinae of nearly equal prominence. Tegmina immaculate except for slight suffusion around apical crossveins; commissure with a brown portion immediately basad of union of Y-veins; tubercles moderate in size, concolorous with the veins which are a nearly uniform medium brown; normally with 11 apical and anteapical cells;



FIGURES 20-28. Male genitalia of *O. ecologus* Caldwell, from paratype, Lawrence Co., Ohio. 20, aedeagus in ventral view. 21, aedeagus in dorsal view. 22, anal segment in dorsal view. 23, anal segment in left lateral view. 24, anal segment in posterior view. 25, styles in broad inner aspect. 26, pygofer in ventral view. 27, pygofer in left lateral view. 28, connective in posterior view.



FIGURES 29-38. Male genitalia of *O. difficilis* Van Duzee, specimen from Dade Co., Fla. 29, aedeagus in ventral view. 30, aedeagus in dorsal view. 31, anal segment in dorsal view. 32, anal segment in left lateral view. 33, anal segment in posterior view. 34, styles in broad inner aspect. 35, pygofer in ventral view. 36, pygofer in left lateral view. 37, pygofer in right lateral view. 38, connective in posterior view.



FIGURES 39-48. Male genitalia of *O. coconinus* Ball, from allotype. 39, aedeagus in ventral view. 40, aedeagus in dorsal view. 41, anal segment in dorsal view. 42, anal segment in posterior view. 43, anal segment in ventral view. 44, styles in broad inner aspect. 45, pygofer in ventral view. 46, pygofer in left lateral view. 47, pygofer in right lateral view. 48, connective in posterior view.

stigma brown, somewhat ovoid, approximately twice as long as wide. Legs brownish basally, yellowed distally.

Male genitalia. — Aedeagal complex as in figs. 39 and 40; total pointed processes six. Perianthium with four processes: dextral process moderately long, straight, and stout; in ventral aspect outside margin convex, inside (left) margin very slightly concave, in either ventral or dorsal aspect not overlapping other parts of aedeagal complex, extending caudad to or near level of aedeagal joint; sinistral process nearly always shorter than dextral process, widest at base, extending nearly straight caudad, occasionally curved at extreme apical area; the dextral and sinistral processes parallel to each other; perianthium with the one strictly ventral process conspicuous and originating in the median apical area, extending caudad initially then curving to left and falciform in appearance; dorsal perianthium with one process, inserted mediobasad, variable in shape and size, but usually stout, tending to be swollen in the middle, generally extending fairly straight caudad, apex straight or curved as much as 90 degrees to the left; shape of dorsal process in some specimens spatulate. Flagellum generally extending to the left and with two processes; apex of flagellum with a prominent, stout, acuminate process which usually is directed primarily anteriorly, but in some specimens directed at various angles posteriorly or to the left; a second flagellar process originating at posteriormost portion of complex, then extending along curvature of flagellum to the left and cephalad, the apical portion on some specimens concealed in ventral view, this process linear, finely tapered in apical portion; basidorsal cephalic side of flagellum spiculate, the sinistral process of perianthium usually ending a short distance from the spiculate area. Styles as in fig. 44; symmetrical; apex enlarged and evenly rounded, generally orbicular in broadest apex; *in situ*, with inner margins notched near medioventral process of pygofer; inner processes short, pointed. Connective as in fig. 48; slender and slightly twisted; combined width of ventral arms slightly exceeding width of base of shaft in posterior aspect. Pygofer as in figs. 45-47; medioventral process in ventral view triangulate, slightly longer than wide, broadest at base; short, the length slightly less than half the distance to level of apices of pygofer lateral lobes; lateral lobes moderately produced, in ventral aspect diverging at relatively wide angle; lobes nearly symmetrical, apices rounded or slightly pointed in lateral aspect with the apices considerably ventrad of midlength of posterior margin. Anal segment as in figs. 41-43; in dorsal aspect almost as wide as long; symmetrical; outline pyriform; medioapical area with a short, acute convexity on each side of a smoothly curved concavity; in caudal view, the ventroapical margin strongly concave from side to side, the complete profile of the anal segment approximately lunate.

Types. — The types as listed by Ball consist of: "Holotype female, allotype male, and one male paratype Williams July 13, 1929, a female Aug. 15, 1929, a female Flagstaff Aug. 7, 1929, and two males Huachuca Mts., Aug. 2, 1931, all taken by the writer [E.D. Ball] from the table lands or mountains in Arizona." All of the types are in the United States National Museum.

Distributional records. — Males were seen from: Arizona (Coconino, Navajo, Pima, and Santa Cruz Counties); Colorado (Ft. Collins, Larimer County); Nevada (Dixie National Forest, Lincoln County); Texas (Brewster and Jeff Davis Counties); Utah (Mantua, Cache County).

Notes. — *Oliarus coconinus* is a fairly common southwestern species that is superficially similar to numerous other species but is quite distinct from the standpoint of male terminalia. There are no other species close to it, but there is considerable intraspecific variation. The very broad anal segment with the twin apical points is diagnostic; the well developed and parallel dextral and sinistral processes are distinctive; the apical process of the flagellum, having a slight extrorse curve instead of the usual introrse curve, is diagnostic, and the group of spicules on the basidorsal part of the flagellum is unique. High magnification and proper lighting are needed to see these spicules clearly.

The specimens of *O. coconinus* examined have been without host or habitat labels. The locality labels all support Ball's contention that it is a species of tablelands and mountains.

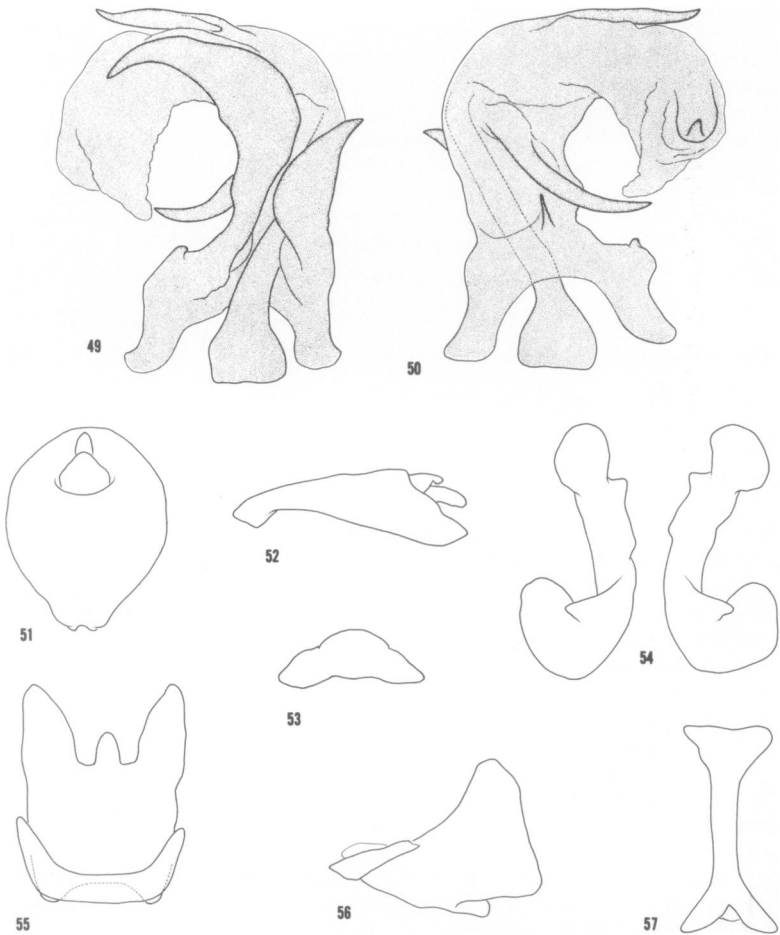
***Oliarus catus* Caldwell**

Figs. 49-57

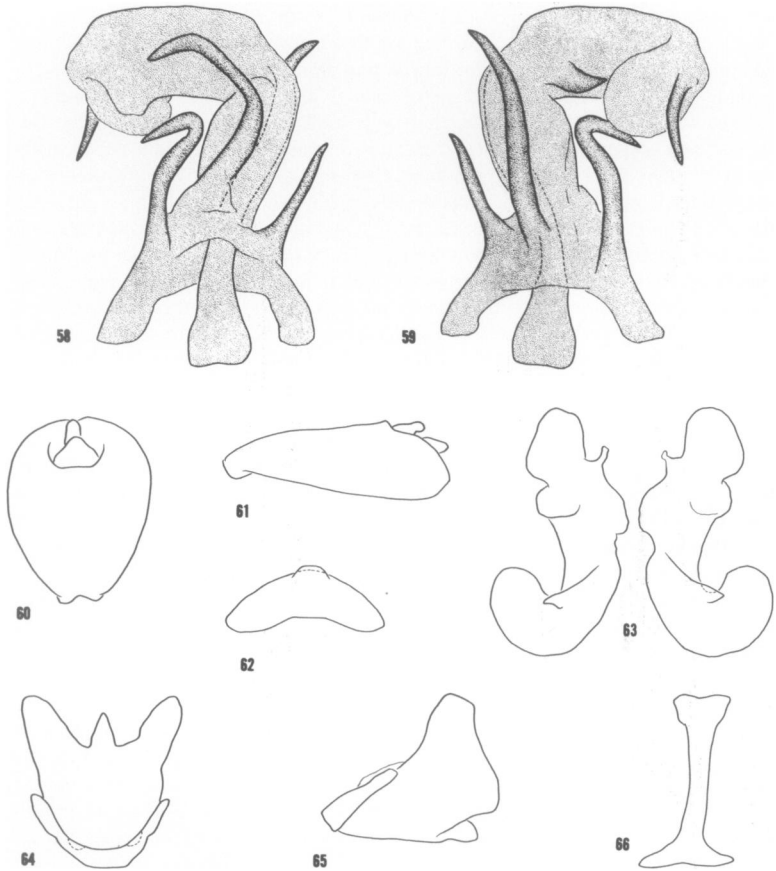
Oliarus catus Caldwell 1947b:147.

Salient features. — Length of male 4.5 to 5.2 mm (based on three males); holotype 5.2 mm. Ground color of vertex and mesonotum fuscous; mesonotal carinae varying from medium brown to orange. *Head:* Vertex moderately broad, length in middle line about equal to width at apex of posterior emargination; median carina absent. Face entirely fuscous except carinae which are yellowish orange to dull orange; median carina with basal fork short and broad, percurrent distally; all carinae unusually prominent; frons distinctly broader than long in middle line, the length usually three-fourths the width; rostrum almost or barely attaining caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae not reaching pale band of posterior margin, usually separated by dark pigment. Mesonotum with carinae equally prominent. Tegmina with spotting confined to small areas around apical crossveins; tubercles moderate in size, concolorous or nearly so; veins nearly uniform brown, and with commissure entirely brown basad of Y-veins juncture; apical cells varying from 9 to 11 in three specimens examined, antepical cells 5 to 6 in same individuals, holotype 11 and 6 respectively; stigma dark brown, length two to two and one-half times width. Legs mostly brownish, without banded pattern.

Male genitalia. — Aedeagal complex as in figs. 49 and 50; pointed processes usually seven, sometimes six or eight, depending on variation and interpretation. Periandrium usually with five processes; the dextral process primarily on ventral surface, reaching to joint of aedeagus, swollen in middle portion, acuminate apically and curving right-caudad, unforked in holotype and other specimen from Huachuca Mountains, Arizona, but with short, slender, pointed fork at midlength of right margin in specimen from Tumacacori Mountains, Arizona; sinistral process nearly obsolete, reduced to short, slender acuminate process directed ventrad primarily; a large falcate process originating in left-median basiventral area, directed caudad initially, expanding considerably in middle portion, curving to left and becoming acute at apex, somewhat sinuous basally, and with inner, left margin twice repand in holotype but regular in other two specimens studied; dorsal periandrium giving rise



FIGURES 49-57. Male genitalia of *O. catus* Caldwell, from holotype. 49, aedeagus in ventral view. 50, aedeagus in dorsal view. 51, anal segment in dorsal view. 52, anal segment in left lateral view. 53, anal segment in posterior view. 54, styles in broad inner aspect. 55, pygofer in ventral view. 56, pygofer in left lateral view. 57, connective in posterior view.



FIGURES 58-66. Male genitalia of *O. humilis* (Say), specimen from Pa. 58, aedeagus in ventral view. 59, aedeagus in dorsal view. 60, anal segment in dorsal view. 61, anal segment in left lateral view. 62, anal segment in posterior view. 63, styles in broad inner aspect. 64, pygofer in ventral view. 65, pygofer in left lateral view. 66, connective in posterior view.

to a long, slender process originating apically, directed left cephalad for much of length, gradually curving ventrad and caudad; median basidorsal area of holotype with small, slender process, obsolete or nearly so in other specimens examined. Flagellum directed left, then curving cephalad distally; with a medium-sized subapical process originating on dorsal side and primarily directed dorsocephalad; a second slender flagellar process along caudal margin, originating subbasally, directed left primarily, with apex curving partially dorsad. Styles as in fig. 54; slender, nearly symmetrical, moderately long, apically broadened and considerably recurved; inner processes short, pointed. Connective as in fig. 57; moderately long and slender; combined ventral arms slightly wider than base of shaft in posterior aspect. Pygofer as in figs. 55-56; bilaterally symmetrical or nearly so; medioventral process in ventral aspect moderate in size, sides nearly parallel in basal half, apex bluntly pointed, width two-thirds to three-fourths the length, the length slightly less than half the distance to tips of pygofer lateral lobes; lateral lobes well produced posteriorly, apices in lateral aspect varying from semi-rounded to acute and most strongly produced well ventrad of midlength of posterior margin. Anal segment as in figs. 51-53; distinctly longer than wide, the width three-fourths to four-fifths the length in dorsal view; apical medioventral margin truncate to convex in dorsal aspect, straight to slightly concave in caudal aspect.

Types. — The holotype male was collected in Carr Canyon, Huachuca Mountains, Arizona, June 23, 1932 by J.O. Martin. The allotype female was collected at Cave Creek, Chiracahua Mountains [Cochise County], Arizona, June 20, 1932 by J.O. Martin. These specimens are in the California Academy of Sciences collection and were examined; the holotype served for most of the illustrations.

Distributional records. — The range of *O. catus* is limited to Arizona; male specimens have been examined from the Huachuca Mts., Carr Canyon in the Huachuca Mts., and the Tumacacori Mts.

Notes. — *O. catus* is easily diagnosed by examination of the aedeagal complex. Otherwise it resembles several of the medium-sized, brownish species of the southwestern United States. The distinctive characteristics include the aborted sinistral process, the two large, diverging, centrally swollen processes of the ventral side, the long, curving, somewhat retrorse apical process of the dorsal periandrium, and the position of the two flagellar processes. There are no other species close to *catus* in these respects. *Oliarus catus* Caldwell seems to stand apart from other known species in the United States.

The three male specimens available for study exhibit minor variations in all features. Not previously mentioned is the variation of vein M in the tegmen. It has three branches reaching the apex in one individual, four branches in another, and five in the holotype.

The distribution of *O. catus* is restricted to two counties in the southeastern portion of Arizona; the earliest date of collection is June 20, the latest September 9.

Oliarus humilis (Say)

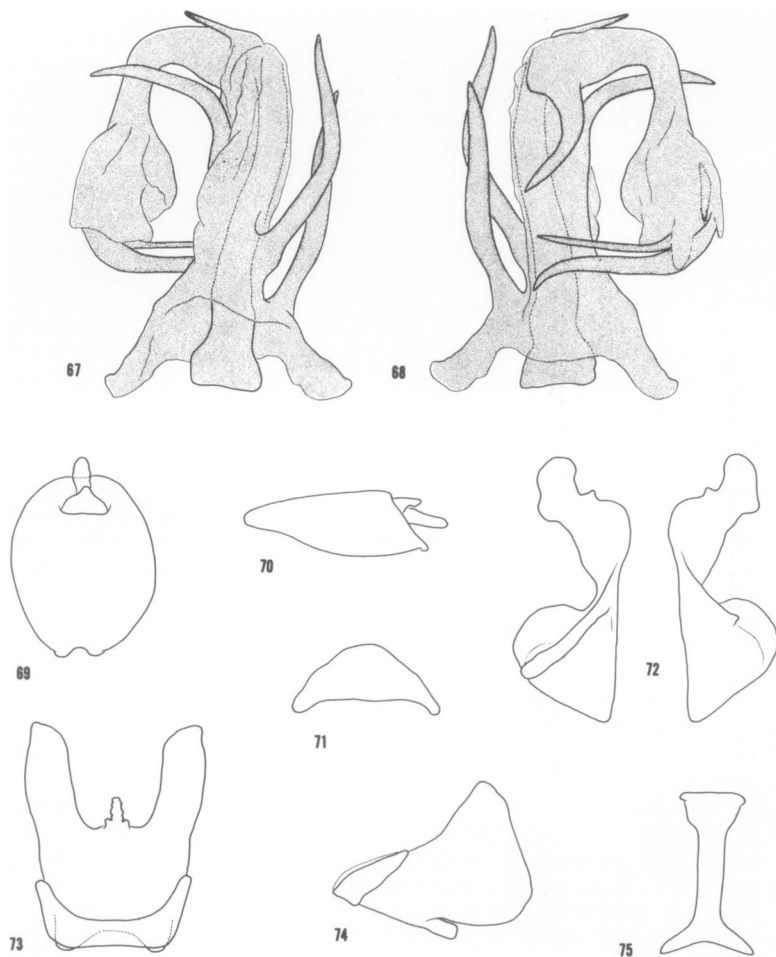
Figs. 58-66

Flata humilis Say 1830:240.

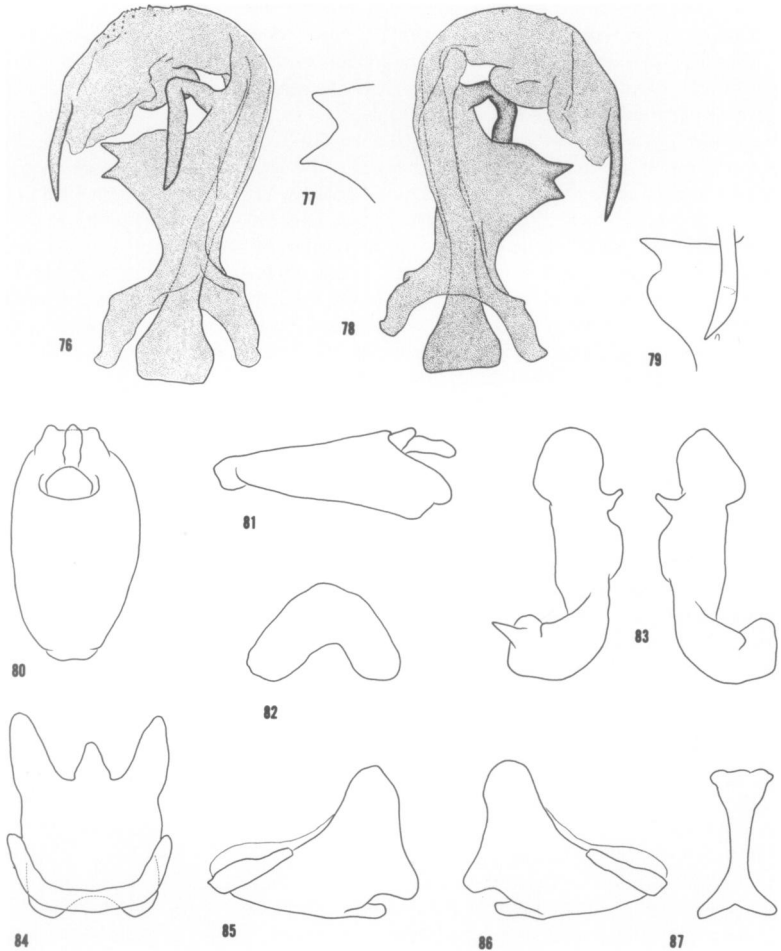
Salient features. — Length of male 4.1 to 5.0 mm (based on 80 specimens). Ground color of vertex and mesonotum dark brown or black; mesonotal carinae concolorous. *Head:* Vertex width variable but usually appearing broad and diverging basally, shorter in middle line than broad at apex of posterior emargination; median carina absent or very short. Face entirely fuscous except carinae varying from brown to dull orange; basal fork of median carina somewhat variable, usually broad as long; frons wide as long to 1.6 times wider than long in middle line. Rostrum with length variable, usually not attaining caudal margins of posterior trochanters but sometimes slightly exceeding them. *Thorax:* Pronotum with intermediate carinae not attaining pale band of posterior margin. Mesonotum with carinae uniformly conspicuous. Tegmina without spots, but membrane fumose with light to dark brown on apical third, usually fairly dark; basal portion of tegmen usually but not always lighter, in some specimens nearly clear, in others almost concolorous with apical portion; veins fairly uniform brown; tubercles not conspicuous; usually with 11 apical and 5 anteapical cells; stigma brown, short and broad. Legs generally brownish.

Male genitalia. — Aedeagal complex as in figs. 58 and 59; total pointed processes six. Periandrium with four processes; the dextral process appearing fairly straight and slender in ventral view but arcuate in lateral aspect, tip curving ventrad; sinistral process longer and reflexed subapically, the apical portion directed left-ventrocephalad; median basiventral process long, slender, scythelike, usually directed caudad, then curving to the left in ventral aspect; dorsal process originating mediobasally, directed caudad, gently sinuate, long, slender, and pointed, approximately reaching apex of complex. Flagellum with two processes, a slender one in the apical region directed cephalad and only partially visible in ventral aspect, the second process basidorsal, short, stout, directed to the left. Styles as in fig. 63, rather stout, swollen basally, rounded and recurved apically; inner process short, pointed, nearly symmetrical. Connective as in fig. 66; moderately long and slender; combined ventral arms distinctly wider than base of shaft. Pygofer as in figs. 64 and 65; medioventral process triangular, broadest at base, slightly longer than wide, extending posteriorly half or slightly less than half as far as left lateral lobe in ventral aspect; lobes well produced, nearly symmetrical, somewhat variable in degree of convexity at apices, diverging distally in ventral aspect, and in lateral aspect most strongly produced slightly below midlength of posterior margin; apodemes weakly developed. Anal segment as in figs. 60-62; in dorsal view nearly symmetrical, slightly broader on left side; longer than wide; apical medioventral margin truncate to slightly concave in dorsal view, concave and moderately hoodlike in caudal profile.

Types. — The type of *O. humilis* is assumed to be lost with other Say material. The original description fits several species; the concept of *humilis* followed here is that of Van Duzee (1908, 1923), Metcalf (1923), Osborn (1938), and Beirne (1950). The specimen illustrated belongs to the United States National Museum and is from Pennsylvania, the only state mentioned in the original description.



FIGURES 67-75. Male genitalia of *O. slossonae* Van Duzee, specimen from Coral Gables, Fla. 67, aedeagus in ventral view. 68, aedeagus in dorsal view. 68, aedeagus in dorsal view. 69, anal segment in dorsal view. 70, anal segment in left lateral view. 71, anal segment in posterior view. 72, styles in broad inner aspect. 73, pygofer in ventral view. 74, pygofer in lateral view. 75, connective in posterior view.



FIGURES 76-87. Male genitalia of *O. altanus* Ball, from allotype. 76, aedeagus in ventral view. 77, apex of sinistral process in ventral view. 78, aedeagus in dorsal view. 79, apex of sinistral process in ventral view. 80, anal segment in dorsal view. 81, anal segment in left lateral view. 82, anal segment in posterior view. 83, styles in broad inner aspect. 84, pygofer in ventral view. 85, pygofer in lateral view. 86, pygofer in right lateral view. 87, connective in posterior view.

Distributional records. — Specimens were examined from New Hampshire (Durham), Massachusetts (Woods Hole), Connecticut, New York, New Jersey, and Pennsylvania westward to Ohio, Michigan, Illinois, Wisconsin, Iowa, Minnesota, "Dacota," Kansas, Arizona (Flagstaff), New Mexico (Albuquerque), Utah (Ephraim), Nevada (Humboldt and Lyon Counties), Montana, and Oregon (Corvallis and Salem). Males were also seen from Quebec, Ontario, Saskatchewan, and British Columbia in Canada.

Notes. — *Oliarus humilis* is one of the most distinctive North American species. Characters of the male terminalia, especially the aedeagal complex, are amply diagnostic for *humilis*. Additionally, *humilis* usually can be identified in either sex by the brownish apical third of the tegmen that contrasts with the paler basal portion; however, variation in the degree and contrast of brownish suffusion in the tegmina sometimes leads to confusion with a few other species. In these instances the dark carinae and tablet of the mesonotum, the dark vertex, face, and frontal carinae of *humilis* are usually sufficient to separate it from other Nearctic species.

Oliarus humilis ranges from coast to coast in a broad belt including most of the northern half of the United States and southern Canada. It is the most common northern species of the genus in North America. The primary source of habitat data for *humilis* is the Illinois Natural History Survey collection. The following data are all from Illinois locations: low pasture, tamarack bog, on juniper, on prairie, cat-tail bog, along river, on rye, swamp, at light, and *Poa pratensis* Linnaeus. Elsewhere the following data are available: on hickory [*Carya*], on *Asimina* in Ohio; on alfalfa [*Medicago sativa* Linnaeus] at Wheatly, Ontario, and in Dane and Brown Counties, Wisconsin; at fish hatchery, sand areas in Le Sueur, Nicollet, and Scott Counties, Minnesota. These data show that *humilis* predominates in damp habitats of cooler climates. The seasonal distribution of adult captures among all the states and provinces is primarily in July and August, but the earliest date is June 20 (Ill.) and the latest 12 September (Ohio).

***Oliarus slossonae* Van Duzee, emended name**

Figs. 67-75

Oliarus hyalinus Van Duzee 1908:487. Preoccupied name.

Oliarus slossoni Van Duzee 1912:494. New name for *O. hyalinus* Van Duzee, not Fieber.

Oliarus borinquensis Caldwell 1952:137. N. Syn.

Salient features. — Length of male 6.1 to 7.4 mm (based on 31 specimens). Ground color of vertex fuscous; mesonotum lighter, castaneous to yellow-brown; carinae of mesonotum usually concolorous. *Head:* Vertex unusually narrow, length in middle line substantially greater than width at apex of posterior emargination; median carina variable, usually present in basal half. Face variable in color from fuscous to yellowish brown, clypeus usually darker than frons, with pair of large maculae at lateral margins of epistomal suture, usually with most of the pale area in the frons; median carina broadly prominent, but little elevated, basal fork confluent, usually nearly obsolete. Rostrum unusually long, typically surpassing caudal margin of posterior trochanters by one-half to three-fifths the length of its terminal segment. *Thorax:* Pronotum with intermediate carinae either joining with

or tangential to pale border of posterior margin. Mesonotum with all carinae weak, especially the anterior portion of the intermediate pair which are sometimes obsolete or nearly so. Tegmina vitreous in some specimens, milky subhyaline in others, usually darker along most of commissure, slightly infuscated at apical crossveins, and some specimens with transverse dark band at base of clavus and extending slightly into corium; tubercles weakly developed, veins variable in color, mostly pale yellow basal half, brown apical half; apical cells normally 12 and anteapical cells 6; stigma a distinct brown patch, its length approximately two and one-half times width. Legs with femora and tibiae usually pale yellow, varying somewhat to yellowish brown.

Male genitalia. — Aedeagal complex nearly as in figures 67 and 68 (the two processes appearing to be attached to the base of flagellum actually belong to the periandrium); total pointed processes eight, one of which on the dorsoapical flagellum is very short in some specimens. Periandrium with five processes, one of which is dorsal; in ventral aspect with two long, slender, slightly curved processes originating basally and subbasally on the right side; left side without a basal process but with a conspicuous subapical process directed primarily to the left; extreme apical area adjacent base of flagellum with a short, slender process directed primarily to the left; dorsal periandrium with a prominent retrorse process rising apically, initially directed cephalad, distally curving right-cephalad. Flagellum initially directed left, then making a 90 degree curve cephalad, becoming enlarged apically; with three processes in the apical region, length of processes variable but usually with the shortest closely appressed to the subapical dorsal area of the flagellum, in some specimens barely emerging from the flagellar tissue, longer and more conspicuous in other specimens; apex (with rare exceptions) either with a pair of processes of equal length or with one approximately twice as long as the other. Styles as in fig. 72; with small apodemes, shafts swollen basally, narrowed at midlength, greatly expanded apically, angulately recurved but apex of recurved portion broadly rounded; inner processes conspicuously asymmetrical, with left inner process long, lobelike, reaching or slightly surpassing margin or recurved portion, slender, tending to be clavate; right inner process very short, not lobelike. Connective as in fig. 75; moderately long and stout; combined width of ventral arms distinctly greater than width of base of shaft in posterior aspect. Pygofer as in figs. 73-74; symmetrical or nearly so; medioventral process in ventral aspect unusually small and with two distinct widths, basally pedestallike and approximately twice as broad as the longer, cylindrical, distal portion; total length of process substantially less than one-half distance to apices of pygofer lateral lobes; lateral lobes in lateral aspect well produced, rounded. Anal segment as in figs. 69-71; slightly asymmetrical in dorsal aspect, longer than wide, medioapical margin straight or slightly concave; in caudal aspect hoodlike, middle portion of ventral profile nearly straight.

Types. — The type of *O. slossonae* is a male taken by Mrs. Annie Trumbull Slosson at Biscayne Bay, Dade County, Florida. This type is at the American Museum of Natural History, and it has been studied. Caldwell in Caldwell and Martorell (1952:137) described *Oliarus borinquensis* from Puerto Rico. Examination of the holotype in the U.S. National Museum showed it to be conspecific with *slossonae*.

Distributional records. — Specimens examined range in the three counties of the southern tip area of Florida (Collier, Dade, and Monroe Counties, including the Florida Keys): Perico and Central Mercedes, Matanzas Province, Cuba; Camaguay, Camaguay Province, Cuba; Puerto Rico; and St. Thomas, Virgin Islands.

Notes. — Perhaps the best diagnostic character for either sex of *slossonae* is the unusually narrow, troughlike disc of the vertex, which is nearly always definitive, especially in conjunction with large overall size. Males can be diagnosed immediately by the very small, narrow, terete medioventral pygofer process which is inserted on a pedestal. The illustration, locality records, hosts, and other comments by Dozier (1928) for *slossonae* in Mississippi and Texas are in error and actually refer to *aridus* Ball.

The most puzzling variation in males of *Oliarus slossonae* has been between the apical processes of the flagellum. It is common to find specimens with a pair of long, slender processes of equal or nearly equal length, with the outer process nearly always thicker than the inner one. It also is common to find specimens with the more slender, inner process about half the length of the outer process. Examination of many south Florida specimens showed no geographic correlation for this difference; however, the following facts are relevant. Under high magnification the shorter member of the pair does not taper to a point but remains something like the open end of a slightly tapered pipette. Also, in specimens where both processes are long, the thin one is slightly constricted at that point in its length which corresponds to the end of the process in the other form. We concluded that this thin process is structurally weak at this constricted part of the process, and that the process may break off at this point. This explains the shorter process abruptly terminating at the same relative position in the specimens having this condition; also with the apex of the short process being approximately round in end view instead of pointed. Possibly the process breaks when specimens are roughly handled in the collecting process, but it may be that this process breaks during copulation.

Oliarus slossonae Van Duzee is a tropical species found only in southern Florida in the United States. It is also known from Cuba and Puerto Rico in the West Indies.

Habitat or host labels on specimens of *O. slossonae* include century plant at St. Thomas, Virgin Islands; on red mangrove, *Rhizophora mangle* Linnaeus (in Puerto Rico); in Guanica Insular Forest in Puerto Rico; taken on *Tabebuia* in Cuba; in light trap; *Trema micranthus* (L.) Blume; at blooms of *Sabal etonia* Swingle; in Steiner trap; blacklight trap, on calamondin [*Citrus mitis* Blanco]; Steiner trap in mango tree, on *Lucuma roxburgii*; on *Flaveria linearis* Lagasca, all in Florida.

Specimens of *O. slossonae* have been collected every month of the year in Florida.

The species name is emended to have a feminine ending to agree as a patronym for Mrs. Annie T. Slosson, collector of the holotype.

***Oliarus altanus* Ball**

Figs. 76-87

Oliarus altanus Ball 1934:276.

Salient features. — Length of male 4.7 mm (based on three males of type series).

Ground color of vertex and mesonotum fuscous; mesonotal carinae concolorous. *Head*: Vertex fairly narrow, with length in middle line distinctly greater than width at apex of posterior emargination; median carina absent or nearly so. Face fuscous; median and lateral carinae strongly elevated on frons, less so on clypeus; median carina yellowish on frons except brown at basal fork; fork indistinct; lateral carinae broadly stramineous at widest portion of frons, color narrowing and becoming brownish basally; carinae of postclypeus dull orange to fuscous; face without maculae; frons narrow, length in middle line approximately three-fourths the width. Rostrum not attaining caudal margins of posterior trochanters. *Thorax*: Pronotum with intermediate carinae not joining pale band of posterior margin. Mesonotum with carinae weakly to moderately prominent, intermediate pair little, if at all, weaker than the other three carinae. Tegmina nearly immaculate, usually with small, indistinct brown spot at fork of Cu, and with slight embrowning around apical crossveins; tubercles prominent and abundant, usually a contrasting light brown against pale veins on basal half of tegmen, concolorous brown apically; costa entirely pale; apical margin of tegmen pale instead of usual brownish color of most other species of *Oliarus*; commissure with short brownish portion immediately basad of union with Y-veins; forking of veins near apex variable, apical cells usually 9 or 10 and anteapical cells 6; stigma white, long and narrow, length four to four and one-half times the width. Wings with R not forked, M with one fork (only two branches reaching apex instead of usual three of most species of *Oliarus*). Legs with femora fuscous, tibiae mostly pale, apices of tarsi brown.

Male genitalia. — Aedeagal complex as in figs. 76-79; total pointed processes fundamentally only three but subject to variation and interpretation. Periandrium with two conspicuous processes, one of which becomes lobed or forked; no dorsal processes and no dextral or sinistral process in usual basilateral areas; a left process arising from broad base in midregion and extending some distance straight left, forked near apex in two specimens, but in third specimen distinctly asymmetrical, with apex divided into a broad lobe and an acuminate process; ventral left apical area giving rise to prominent retrorse process which is directed ventrad for a short distance before curving cephalad for most its length. Flagellum extending left and curving somewhat cephalad distally; with single, slender, apical process directed cephalad; ventrocaudal portion of flagellum having several spicules (difficult to see at low to medium power of stereoscopic microscope). Styles as in fig. 83; asymmetrical; left style with unusual acuminate tooth or process originating on inner face near apex of recurved portion and extending beyond this apex; right style not having this special process; inner process symmetrical, weakly developed, ridgelike, terminating abruptly with 90 degree return to expanded apex of shaft; basal portion of shaft swollen. Connective as in fig. 87; shaft comparatively short and stout; combined width of ventral arms a little wider than base of shaft in posterior aspect. Pygofer as in figs. 84-86; medioventral process in ventral aspect triangular, broadest at base (not constricted near union), its apex bluntly pointed, its length slightly greater than width (ratio width to length 8.0-8.8:10), extending posteriorly slightly more than half the distance to level of apices of pygofer lateral lobes; lateral lobes of pygofer in ventral aspect with main axis of each lobe directed nearly straight caudad;

lobes in lateral aspect well produced, comparatively slender and pointed, each with another lobe developing below midlength of posterior margin and directed ventrocaudad at approximate 45 degree angle. Anal segment as in figs. 80-82; in dorsal view rather long, with width but little more than half the length (5.6:10); fairly symmetrical, left side somewhat more expanded than right side; moderately concave at medioapical margin, apex ending in pair of sublateral protuberances; in caudal view, ventral profile conspicuously concave.

Types. — The holotype female, allotype male, and two paratype males are located in the United States National Museum. All were examined. All three males were glued to one point and no reference was found as to which one was the allotype. They were remounted on three separate points. The specimen originally in the middle retains the original label of "Tinajas Altas, Ar., 3-19-32, E.D. Ball" and the original allotype label. Most of the drawings were made from the allotype.

Distributional records. — *Oliarus altanus* is known only from the type locality, Tinajas Altas, Arizona. This locality has been neglected by collectors more than many other parts of Arizona. Tinajas Altas is in Yuma County close to the Mexican border, longitude 114 degrees W; altitude 1000 to 1700 feet.

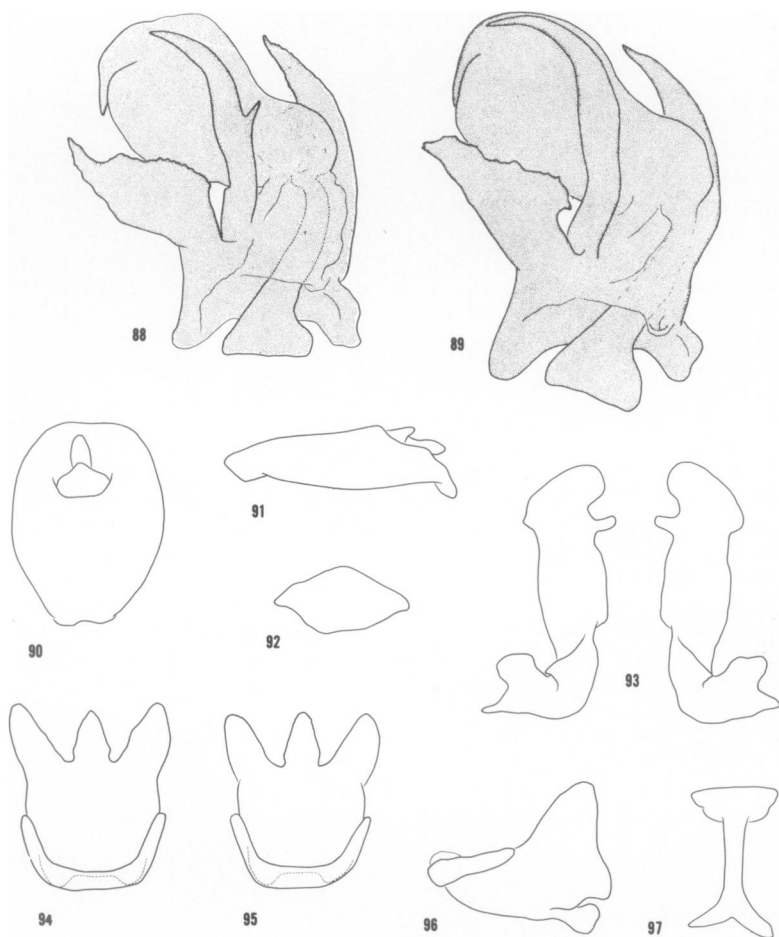
Notes. — *Oliarus altanus* apparently is one of the rarest species in the Nearctic fauna. It is known only from the type series of four specimens, all in the same lot, from Tinajas Altas, Arizona. It is a distinctive species easily diagnosed by the male genitalia. The male genitalia are unusual in several ways. The toothlike process on the left style (absent on right style) is diagnostic; the very low number of processes (three, or four if fork is counted) is diagnostic; the presence of spicules on the left ventrocaudal part of the flagellum is highly unusual. There are no right-lateral or dorsal processes of any kind. Another diagnostic structure is the broadly based process extending left from the left ventromedian area of the periandrium. It tapers somewhat, then bifurcates apically into similar subprocesses (fig. 76) or ends in one pointed process and a broad lobe (fig. 79).

It is very difficult to place *O. altanus*. Possibly it is closest to *O. pygmaeus* Ball, another Arizona species. *O. pygmaeus* has more and differently shaped processes but does agree with *O. altanus* in lacking the basal sinistral and dextral processes. Furthermore, the pygofer is similar in appearance, especially in the shape of the lateral lobes. The anal segment is similar in having the deep median concavity of the caudoventral profile.

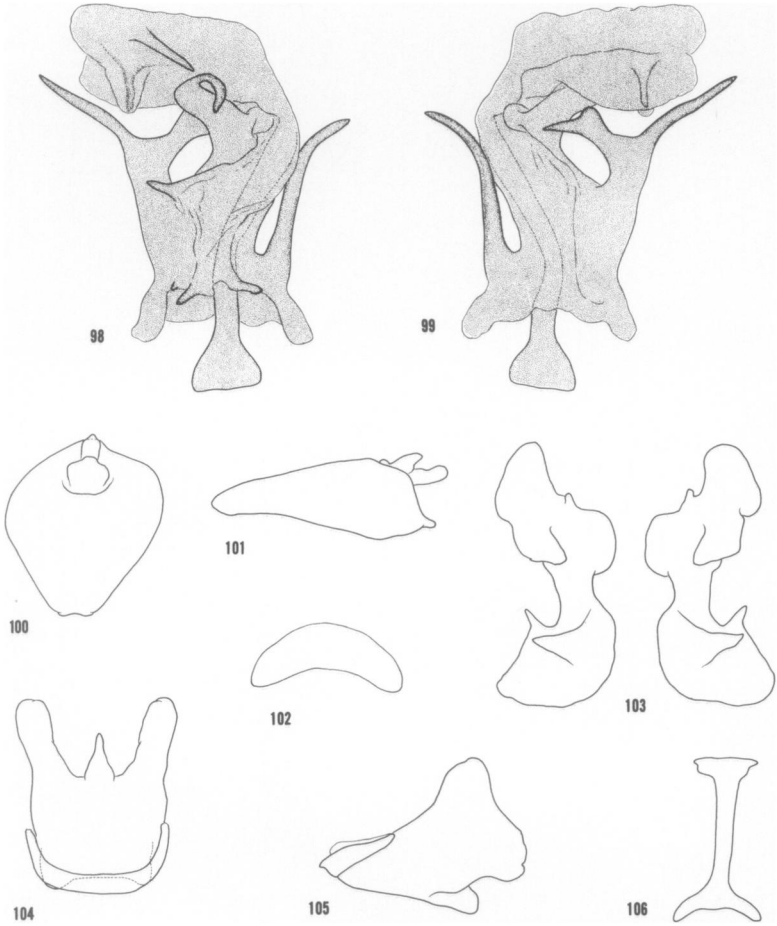
***Oliarus arizonensis*, n. sp.**

Figs. 88-97

Salient features. — Length of male 3.3 to 4.0 mm (based on 31 specimens); holotype male 3.5 mm. Ground color of vertex and mesonotum fuscous; mesonotal carinae with intermediate pair usually concolorous, median carina orange, and lateral carinae mostly dull orange. *Holotype head:* Vertex moderately narrow, in middle line longer than broad at apex of posterior emargination (1.4:1); median longitudinal carina short; foveae moderately broad, length two and one-half to three times the width; apical cell narrow, not prominent; frontal carina dull orange, arcuate, and indistinct at midlength. Face fuscocastaneous; median carina with basal



FIGURES 88-97. Male genitalia of *O. arizonensis*, n. sp., from holotype except as noted. 88, aedeagus in ventral view, paratype from Tubac, Ariz. 89, aedeagus in ventral view. 90, anal segment in dorsal view. 91, anal segment in left lateral view. 92, anal segment in posterior view, paratype from Tucson, Ariz. 93, styles in broad inner aspect, paratype from La Osa River, Ariz. 94, pygofer in ventral view. 95, pygofer in lateral view, paratype from La Osa River, Ariz. 96, pygofer in left lateral view. 97, connective in posterior view.



FIGURES 98-106. Male genitalia of *O. texanus* Metcalf, from holotype. 98, aedeagus in ventral view. 99, aedeagus in dorsal view. 100, anal segment in dorsal view. 101, anal segment in left lateral view. 102, anal segment in posterior view. 103, styles in broad inner aspect. 104, pygofer in ventral view. 105, pygofer in lateral view. 106, connective in posterior view.

fork short, broader than long, without distinct pit, carina percurrent, bright orange on frons, nearly concolorous with most of clypeus; lateral carinae distinct pale yellow or orange yellow bordering frons and postclypeus; frons wider than long in middle line (1.28:1); combined length of frons and postclypeus one and seven-tenths times width of frons; without maculae; rostrum short, distinctly failing to attain caudal margin of posterior trochanters. *Thorax*: Pronotum with intermediate carinae neither joining pale band of posterior margin, nor becoming joined laterally by longitudinal carina in vicinity of tegula. Tegula generally pale, slightly brownish in middle area. Mesonotum with carinae prominent, intermediate pair weaker, arcuate, becoming obsolete anteriorly. Tegmina evenly smoky brown, no spots or bands; veins uniformly brown; tubercles brownish, unusually large and abundant, giving rise to prominent pale setae; left tegmen with 10 apical and 6 anteapical cells, right tegmen with 11 apical and 6 anteapical cells; stigma not prominent, nearly concolorous brown, length approximately two and one-half times the width. Wings light smoky brown; left wing with triangles formed by apical forks of R and M about equal; right wing with triangle of M longer than triangle of R. Legs with only two lateral spines on each posterior tibia.

Male genitalia. — Aedeagal complex as in figs. 88 and 89; total pointed processes four. Periandrium with three processes; dextral process originating in a right laterodorsal position, extending caudad, then smoothly curving left-dorsad; sinistral process developing into a broad, irregularly serrate, globose-platformlike or anvil-like process; ventral left-median area of periandrium with long, fairly stout process directed caudad initially, curving to left and becoming slender apically, ending in fine point. Flagellum directed left, expanding into a rounded, sclerotized, platelike structure in ventral aspect; apical area with a moderately small, slender process directed cephalad primarily; this process with its apex barely hidden by flagellum when viewed ventrally. Styles as in fig. 93; nearly symmetrical; apex of each style curved 90 degrees from main axis of shaft, the apex of recurved portion bifid, the caudal branch of the fork slender and acuminate; the cephalic branch of the fork broader, irregularly lobate; inner process short, pointed; each shaft broadest at midlength, generally a little broader in basal half. Connective as in fig. 97; rather short and slender; combined ventral arms same width as base of shaft in posterior aspect. Pygofer as in figs. 94-96; medioventral process comparatively large, its width in ventral aspect approximately seven-tenths the length, broadest subbasally, generally triangular in outline, extending posteriorly almost to level of apices of pygofer lateral lobes; in lateral aspect process expanded apically; lateral lobes of pygofer in lateral view moderately produced ventrad of midlength of posterior margin; in ventral aspect lateral lobes diverging; apodemes moderately developed, about even with anterior margin of eighth sternite. Anal segment as in figs. 90-92; in dorsal view distinctly longer than wide (width to length 7.3:10); slightly asymmetrical, left side expanded a little more than right side; medioapical margin straight or nearly so; in caudal view ventral profile slightly asymmetrical, primarily convex.

Types. — *Oliarus arizonensis* is described from the male holotype, female allotype, 13 male paratypes and 10 female paratypes from the Santa Rita Moun-

tains, Arizona, July 18, 1931 (E.D. Ball), all in the United States National Museum, plus other paratypes in this and other museums. The holotype is one of three specimens on the same cardboard point. It is on the tip of the point. The female allotype is next to the pin on the same point. A male paratype is in the middle. The top label reads "San Rita Mt., Ar." and "E.D. Ball" machine printed, "7-18-31" in black India ink. Holotype, allotype and paratype labels are also affixed to the pin. Additional United States National Museum paratypes are as follows: one male, three females from "La Osa R., Ar., 9-7-35, E.D. Ball"; one male, one female from "Babo q. v. Mts., Ar., 8-6-34, E.D. Ball"; six males, two females from "Sabino Can., Ar., 8-10-32, E.D. Ball"; two males from "San Cata Mt., Ar., 7-17-30, E.D. Ball"; four males, three females from "Sta. Cruz Rv., Ar., 8-6-32, E.D. Ball." The following paratypes are from the Ohio State University: one male, "Tucson (sic), Ariz., VIII-16-36, J.M. Knull"; one male, "Tucson, Ar., VIII-16-40; (D.J. and J.N. Knull)"; one female, "Santa Rita M., Ar., VIII-11-36, J.N. Knull." From the University of Kansas collection: one male, "Tubac, Ariz., August 21, 1935, R.H. Beamer"; one male, "Baboquivari Mts., VII-24-41; R.H. Beamer"; one male, "Arivaca, Ariz., VII-26-41; E.L. Todd."

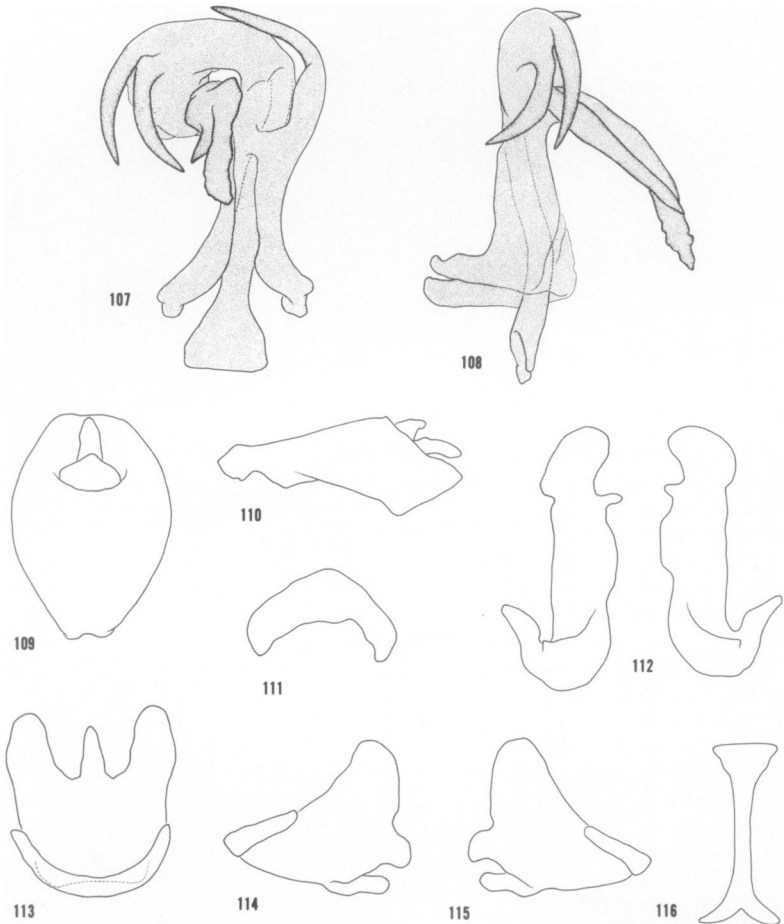
Distributional records. — The known range of *O. arizonensis* is restricted to certain areas of southeastern Arizona. No specimens are known from Cochise County, Arizona, and the Pima County records are all in the eastern half of that county. The type locality of "Santa Rita Mountains" leaves some doubt about the county in which the specimens were collected, because about half of this mountain range lies in northern Santa Cruz County, and the other half in southeastern Pima County.

Notes. — *Oliarus arizonensis* is one of the most distinctive North American species. The uniformly brown tegmina, small size, and restricted range separate it easily from most forms except *O. humilis* (Say) and certain brown forms of *O. zyxus* Caldwell. However, the male terminalia provide conclusive diagnosis for *arizonensis*. The most distinctive feature of *arizonensis* is the serrate, platformlike, left-ventral (sinistral) process. The total of four processes in the aedeagal complex is unusually low. Another diagnostic character is the large medioventral process of the pygofer, which in ventral aspect is almost as long as the lateral lobes of the pygofer and almost as broad as one of these lobes. The styles of *arizonensis* are unusual in the bifid character of the apex of the recurved portion.

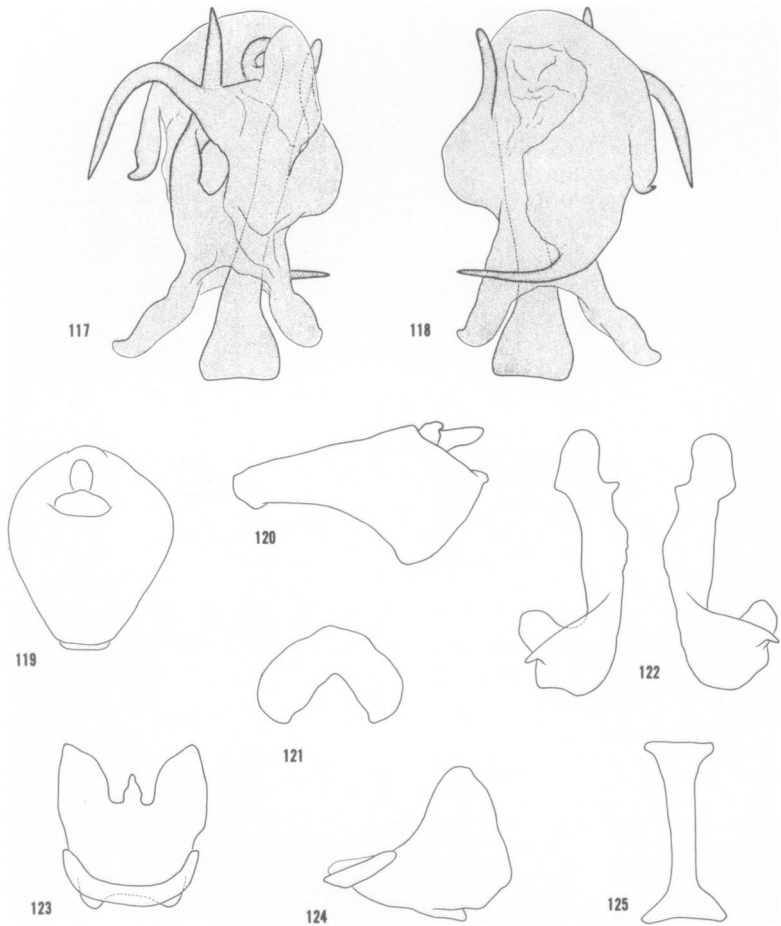
Variations include slight differences in shape and serrations of the anvil-like sinistral process of the periandrium and presence or absence of a spine or minute fork midlength on the right side of the median ventral process of the periandrium. Fig. 88 shows this subprocess. The tegmina and wings are subject to usual variation; apex of each tegmen usually with branching as follows: Sc two, R two, M five, Cu₁ two.

O. arizonensis does not appear to be closely related to any of the other species included here.

The seasonal distribution shows the earliest date as July 13, the latest September 7. This suggests the species is univoltine.



FIGURES 107-116. Male genitalia of *O. pygmaeus* Ball, specimen with same data as holotype. 107, aedeagus in ventral view. 108, aedeagus in left lateral view. 109, anal segment in dorsal view. 110, anal segment in left lateral view. 111, anal segment in posterior view. 112, styles in broad inner aspect. 113, pygofer in ventral view. 114, pygofer in left lateral view. 115, pygofer in right lateral view. 116, connective in posterior view.



FIGURES 117-125. Male genitalia of *O. papagonus* Ball, from paratype Eloy, Ariz. 117, aedeagus in ventral view. 118, aedeagus in dorsal view. 119, anal segment in dorsal view. 120, anal segment in left lateral view. 121, anal segment in posterior view. 122, styles in broad inner aspect. 123, pygofer in ventral view. 124, pygofer in left lateral view. 125, connective in posterior view.

Oliarus texanus Metcalf

Figs. 98-106

Oliarus texanus Metcalf 1923:181.

Salient features. — Length of male 3.7 to 4.4 mm (based on 51 specimens); holotype male 4.0 mm. Ground color of vertex and disc of mesonotum medium brown, lateral areas of mesonotum usually fuscous; mesonotal carinae concolorous or a lighter brown. *Head:* Vertex moderately broad, sides subparallel, length in middle line equal to width at apex of posterior emargination; median carina varying from short and feebly elevated to approximately half the length of the disc and moderately elevated. Face fuscous to castaneous; carina prominent varying from brownish orange to pale yellow; median carina yellowish and percurrent; lateral carinae pale along frons and postclypeus, slightly more distinct on frons; maculae not present in usual sense, but lateral carinae usually slightly widened at epistomal suture; frons moderately broad, distinctly wider than length in middle line. Rostrum of moderate length, attaining caudal margin of posterior trochanters or not.

Thorax: Pronotum with intermediate carinae usually narrowly separated from pale border of posterior margin. Mesonotum with carinae moderately and equally prominent, except intermediate pair which usually becomes weaker or evanescent cephalad. Tegmina usually lightly spotted at crossveins and forks of Cu, and Y-vein, occasionally immaculate in basal half; tubercles prominent, veins generally pale yellow to light brown, usually darker at apex; apical cells normally 11 and anteapical cells 6; stigma moderately narrow, usually light brown. Legs brownish basally, becoming lighter distally, lacking alternate pale and dark bands.

Male genitalia. — Aedeagal complex as in figures 98 and 99; total pointed processes usually eight or nine, somewhat subject to interpretation. Periandrium with eight processes, including three very short basiventral processes; dextral process long, slender, directed caudad primarily, but also somewhat to the right, more so apically, reaching level of aedeagal joint; sinistral process stout basally, unequally forked apically into two prominent rami, the outer ramus nearly straight and directed left-caudad approximately 45 degrees as viewed ventrally; inner ramus of sinistral process angling somewhat dorsad and nearly straight to the right, having caudal hump which gives it an avicephaliform appearance; periandrium ventrally with apical process directed left-caudad initially, then recurving and changing to right-ventrocephalad direction apically, much stouter basally; ventral left side at midlength with short, slender process directed primarily left ventrad. Flagellum directed to the left, failing to complete 90 degree curve in relation to long axis of periandrium but curving through 90 degrees in relation to aedeagal apodeme; flagellum with a short, ventral, subapical process directed right-cephalad, usually entire, but bifid apically in one of the paratypes; membranous lobe near ventral apex directed cephalad and containing internal strut or process (this might be counted as an "external" process of the flagellum if care is not taken to observe hyaline covering). Styles as in fig. 103; nearly symmetrical; each shaft short, with prominent hump or swelling basally, apically enlarged and recurved, angulate at apex of recurved portion and with a short, acute process near curvature and junction with shaft; inner processes prominent, triangular, longer than broad. Connective as in fig. 106; moderately long and slender; combined width of ventral arms substantially

greater than width of base of shaft in posterior aspect. Pygofer as in fig. 104-105; symmetrical or nearly so; medioventral process in ventral aspect triangular, longer than wide, slightly longer than half the distance between its base and level of apices of pygofer lateral lobes; lateral lobes in ventral aspect rather stout, subcylindrical, tending to be slightly enlarged near or at apex; in lateral aspect lobes well but unevenly produced, left lobe tending to have slight concavity near apex. Anal segment as in figs. 100-102; somewhat asymmetrical in dorsal view, almost as wide as long; caudoapical margin usually slightly convex; ventral profile in caudal aspect slightly concave.

Types. — The type material of *O. texanus* is located in the collection of the Illinois Natural History Survey. The type was examined, and drawings included here were made from it. The holotype male is from Brownsville, Texas, November 21, 1911, palm jungle sweepings; allotype female same data; paratypes: male, Brownsville, Texas, December 9, 1911, sweepings; male Brownsville, Texas, November 19, 1911, in pasture, South Texas Garden; female, Brownsville, Texas, November 23, 1911, in pasture, South Texas Garden. The female paratype is *O. difficilis* Van Duzee, not *texanus*. The allotype female of *O. vittatus* Metcalf, in the Natural History Survey collection, is *texanus*.

Distributional records. — Specimens were examined from UNITED STATES: numerous males and females from the following Texas counties: Bee, Bexar, Cameron, Dimmit, Eastland, Gillespie, Hidalgo Jeff Davis (Davis Mountains), LaSalle, Lavaca, McLennan, San Patricio (Corpus Christie Lake), Uvalde, Victoria, and Webb. The great majority of the specimens were collected in the Lower Rio Grande Valley. MEXICO: Chiapas: one male, five miles East of Cintalapa, 3-IV-1953; Michoacan: three males from Morelia, 9-30-45; Veracruz: one male, Cotaxtla Experiment Station, Cotaxtla, VI-23-62.

Notes. — *Oliarus texanus* is a common species in southern Texas and has been taken in southern Mexico. In external appearance it most closely resembles *O. difficilis* Van Duzee, under which distinguishing characters are treated. Ball (1934:275), not having seen the type of *O. concinnulus* Fowler and relying on the original description, mistakenly synonymized *texanus* under *concinnulus*. The male terminalia of *texanus* are vastly different from the terminalia of *concinnulus*. The male genitalia of the holotype *concinnulus* were illustrated in Fennah (1945b:146).

Data labels on specimens of *Oliarus texanus* Metcalf include: "at light," "cotton" [*Gossypium* sp.], "*Monarda citriodora*" [*Cervantes*], "on *Ratibida colummaris*" [David Don], "on peach foliage" [*Prunus* sp.], and the type data.

Specimens of *Oliarus texanus* Metcalf have been collected in all months of the year.

***Oliarus pygmaeus* Ball**

Figs. 107-116

Oliarus pygmaeus Ball 1937:180.

Salient features. — Length of male 3.0 to 3.4 mm (based on 17 specimens). Ground color of vertex and mesonotum varying from fuscous to ochre; carinae of mesonotum orange. *Head:* Vertex unusually narrow, length in middle line approx-

imately 1.8 X the width at apex of posterior emargination; median carina varying from nearly absent to almost as long as disc; foveae moderately narrow, length approximately three times width. Face brown, frons lighter brown than clypeus of some specimens; carinae of frons pale yellow and unusually prominent, the expanding carinae and pale color stopping abruptly at the epistomal suture, lateral carinae of postclypeus dull orange and moderately developed; median carina of postclypeus mostly obsolete, appearing again and dull orange at anteclypeus; maculae absent; frons width greater than length in middle line, its length slightly more than two-thirds width. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax*: Pronotum with intermediate carinae interrupted by a darkly pigmented short gap near hindmost part of curve, and narrowly separated from the pale border of posterior margin, except in some specimens where they are tangential. Mesonotum with carinae moderately prominent, intermediate pair closer to median carina posteriorly, closer to lateral pair of carinae anteriorly, and weaker, barely raised above surface. Tegmina pale with numerous small brown spots usually on crossveins, union of Y-veins, and immediately basad of stigma; veins pale throughout except very near apex; tubercles large, numerous, and especially prominent because of their brown color imposed on pale veins; apical cells seven or eight and anteapical cells four or five, branches of veins normally reaching apex: Sc one, R two, M three or four, Cu₁ one, the latter with Cu_{1b} confluent with Cu_{1a} a short distance before apex; stigma yellowish white to light brown, narrowly triangulate. Legs much paler than in most species of *Oliarus*.

Male genitalia. — Aedeagal complex as in figs. 107 and 108; total pointed processes five. Periandrium with three processes, none dorsal, without dextral or sinistral processes in the sense of processes originating basilaterally; right lateroapical area giving rise to a prominent rather slender process directed caudad for basal half, then curving approximate 90 degrees to left, becoming fairly straight, curving slightly ventrad, and ending near mediocaudal margin of flagellum; left-ventroapical area of periandrium giving rise to two long processes, both directed ventrocephalad; the shorter of these two processes straighter than the longer one which curves more cephalad and is somewhat crenulate. Flagellum directed left and with two subequal, tusklike, moderate-sized processes in the ventroapical area; both processes regularly curving, the apices pointing right-dorsocephalad. Styles as in fig. 112; nearly symmetrical; apices rounded, strongly recurved, becoming slender, subacuminate, apex of recurved portion diverging from shaft; inner processes short, little more than an aborted ridge. Connective as in fig. 116; rather long and slender; combined width of ventral arms distinctly greater than width of base in posterior aspect. Pygofer as in figs. 113-115; medioventral process in ventral aspect elongate-triangular, length slightly more than twice the width, broadest at or near base, extending posteriorly approximately three-fourths the distance to level of apices of pygofer lateral lobes; lateral lobes in ventral aspect directed nearly straight caudad, rather thick, bluntly rounded at apices; lobes in lateral aspect symmetrical, produced in a peculiar, comparatively narrow, somewhat beaklike shape. Anal segment as in figs. 109-111; in dorsal view longer than wide, nearly symmetrical, medioapical margin truncate; in caudal view ventral profile deeply concave, asymmetrical, general appearance hoodlike.

Types. — The holotype female, allotype male, and 14 paratypes were collected by E.D. Ball at Willcox, Arizona, August 9, 1937. These and additional specimens with the same data are in the United States National Museum.

Distributional records. — *O. pygmaeus* is known only from the type series taken at Willcox, Arizona.

Notes. — *Oliarus pygmaeus* is the smallest Nearctic species and one of the rarest. The small size, pale coloration, and heavy punctures on the veins of *pygmaeus* are distinctive; the brown spot immediately basad of the stigma is highly unusual; the reduced venation of the tegmina, especially the consistent, apical, confluence of Cu_{1a} with Cu_{1b} , is diagnostic; the male terminalia, especially the aedeagal complex, are diagnostic without recourse to other characters. The host label on the type series is "*Dondia*". *Dondia* is a genus of plants whose members are characteristic of the alkaline areas of western North America.

***Oliarus papagonus* Ball**

Figs. 117-125

Oliarus papagonus Ball 1934:272.

Salient features. — Length of male 3.7 to 4.2 mm (based on 30 specimens); allotype male nearly 4.2 mm. Ground color of vertex and mesonotum usually piceous, shading to fuscous in some specimens; mesonotal carinae concolorous. *Head*: Vertex width moderate, sides parallel or nearly so, length in middle line slightly greater than width at apex of posterior emargination; median carina short or absent. Face brown, unusually shiny, evenly convex; median carina obsolete at basal fork and postclypeus, weakly elevated on frons and anteclypeus, almost concolorous with face in some specimens, dull orange or orange-brown in others; lateral carina narrowly but distinctly yellowish or orange on frons, very narrow, faint orange on postclypeus; maculae absent; frons broad, with width greatly exceeding length in middle line. Rostrum of median length, varying from not quite attaining caudal margin of posterior trochanters to slightly surpassing them. *Thorax*: Pronotum with stramineous intermediate carinae joining pale band of posterior margin. Mesonotum broad, tumid, shiny, and with all carinae obscure. Tegmina translucent and with three transverse brown bands in the better marked specimens, but usually with a basal band only; basal band extending narrowly and evenly from costa to costa at level of posterior margin of mesonotum; middle band poorly developed in males, extending on dorsum between forks of Cu_1 , brownest at commissure; apical area with membranous areas narrowly embrowned adjacent to the crossveins only, but females usually with whole apical third smoky; tubercles moderately prominent, concolorous with brownish veins; apical cells normally 11 and anteapical 6; stigma with length usually 2-2.5 X width, pale area at node extending farther distad than in most species of *Oliarus*. Legs with femora brown, tibiae and tarsi yellowish.

Male genitalia. — Aedeagal complex as in figs. 117 and 118; total pointed processes five. Periandrium with three processes; dextral process prominent, swollen in basal half, abruptly reduced and slender in distal half with slender portion initially

curving dorsad and slightly to the left, apically curving ventrad, terminating close to aedeagal joint, distal half partially hidden from ventral view; sinistral process (left basiventral process) long and straight in ventral aspect, swollen in basal half, slender distally, tapering to a point, terminating at a level approximately even with most posterior development of aedeagus complex; left ventroapical area of perianthrium with a prominent process that is directed left-caudad in the basal half, thence curving more than 90 degrees to extend primarily in a cephalic direction; no processes developing on the dorsal perianthrium. Flagellum making a narrow, somewhat abbreviated loop left, then right-cephalad, apex of flagellum with moderately long, slender process, curving right-ventrad; outer midlength of flagellum with an acute process directed ventrocephalad primarily but with apex curving to the left. Styles as in fig. 122; symmetrical or nearly so; each shaft fairly straight, moderately long and slender; apex unevenly expanded and recurved; inner processes with long ridge but apex short and slender. Connective as in fig. 125; moderately proportioned; combined width of ventral arms greater than width of base in posterior aspect. Pygofer as in figs. 123-124; symmetrical or nearly so; medioventral process in ventral aspect longer than wide, the basal two-fifths cylindrical, distally abruptly narrowed and tapering to subacute apex; process extending posteriorly half the distance to level of apices of pygofer lateral lobes; lateral lobes appearing stout in ventral aspect, moderately and unevenly produced in lateral aspect, most posterior portion of caudal margin slightly ventrad of midlength. Anal segment as in figs. 119-121; in dorsal view somewhat pyriform, left side expanded slightly more than the right side, ventroapical margin convex; in caudal view extremely hoodlike; ventral profile with middle portion a huge inverted "V".

Types. — Ball listed the type series of *Oliarus papagonus* as holotype female, allotype male, and 13 paratypes from Eloy, Arizona (Pinal County). They were collected June 3, 1933, by Ball, on mesquite trees [*Prosopis juliflora* (Swartz) D.C.] growing in an area where *Lycium* sp. was abundant.

Distributional records. — Specimens of both sexes have been seen from the Arizona counties of Cochise, Maricopa, Pima, Pinal, Santa Cruz, and Yavapai.

Notes. — *Oliarus papagonus* is a very distinctive species with a sufficient resemblance to species of the *O. aridus* group to merit tentative assignment to this group. It is the only member of this group that has only two processes on the flagellum, the other species having three to five. The anal segment alone is sufficient to identify *papagonus*. This structure being extremely hoodlike or tectiform subapically, the medioventral profile in caudal view being a large inverted "V". *O. papagonus* is one of the species that can be identified readily in either sex without recourse to dissections. The combination of obscure carina, broad, dark, shiny tumid mesonotum and face, together with small size and transversely banded tegmina, make the species unusually distinctive. Morphological variation is minor in the specimens examined.

In addition to the plant associations noted with the type series above, some specimens were taken on *Condalia* sp. This genus includes spiny shrubs commonly found in hot sandy washes and narrow gullies in Arizona.

Collecting dates extend from June 3 to August 20.

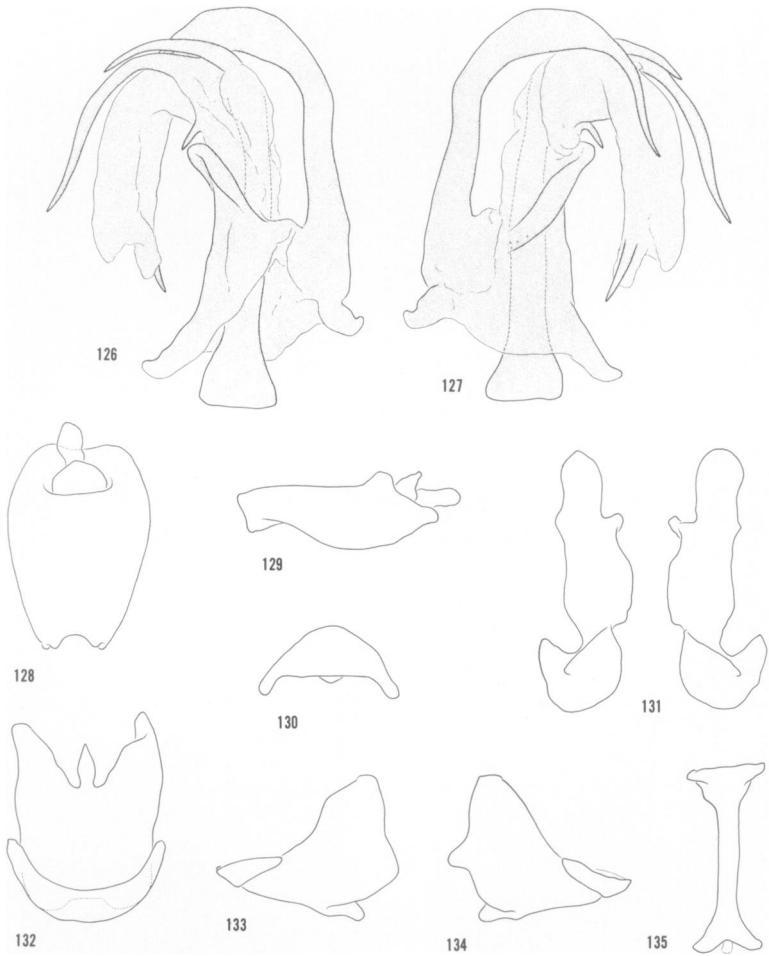
Oliarus cinnamomeus Provancher

Figs. 126-135

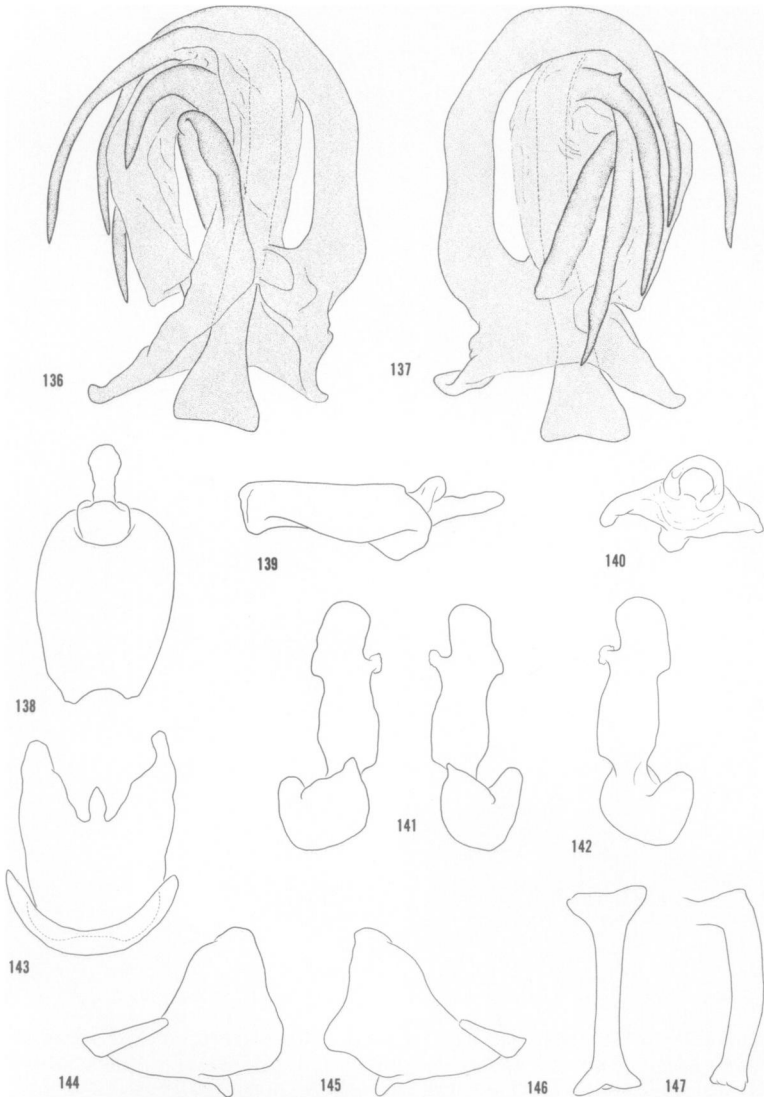
Oliarus cinnamomeus Provancher 1889:223.

Salient features. — Length of male 5.7 to 5.9 mm (based on 12 specimens). Ground color of vertex and mesonotum fuscous, carinae of mesonotum usually concolorous, occasionally a contrasting light brown. *Head:* Vertex unusually broad, length in middle line less than width at apex of posterior emargination (1:1.1-1.3); median carina variable, feebly developed in some specimens, extending anteriorly as much as half length of disc in other specimens. Face fuscopiceous, carinae prominent, lighter brown to dull orange; median carina percurrent, lighter color entire length distad of basal fork; frons wider than length in middle line (1.2-1.4:1). Rostrum usually not quite attaining caudal margin of posterior trochanters, apex approximately even with caudal margin in some specimens. *Thorax:* Pronotum with intermediate carinae not joining pale border of posterior margin. Mesonotum with all five carinae strongly prominent, lateral carinae tending to be slightly less conspicuous than the middle three. Tegmina entirely smoky brown except for pale costa and stigma; tubercles comparatively large but inconspicuously concolorous with brown veins; venation subject to usual variation in branching but tegmina usually with 11 apical and 6 anteapical cells; stigma pale, triangular, length 3.25 X the width. Legs with tibiae and tarsi lighter than basal segments; first and second metatarsites having unusual number of apical spurs, with basal tarsite of each metatarsus usually having 12 apical spurs, including lateral pair, but each one of the 10 spurs between lateral pair having a small membranous scalelike tooth attached distally, the variation in number of spur-scale combinations ranging from 8 to 11; second tarsite of each metatarsus having 9 to 11 apical spurs, including lateral pair, with 7 to 9, usually 8 or 9 spur-scale combinations present between lateral pair.

Male genitalia. — Aedeagal complex as in figures 126 and 127; total pointed processes five, plus a platelike sinistral process. Periandrium with one pointed process and a platelike process; dextral process unusually long and curved, extending straight caudad to level of aedeagal joint, then slightly enlarging and making falciform curve to the left, becoming slender, terminating dorsad of flagellum, and pointing left-cephalad; sinistral process platelike, extending dorsoventrally, and in some specimens with a few spicules. Flagellum curving left only a short distance before turning and extending fairly straight in cephalic direction; with four pointed processes; apically with a short, slender, acute process, wholly visible only in dorsal aspect; basiventral area of flagellum giving rise to three processes, all pointing or curving left-cephalad, the middle process longest, the shortest and straightest process closest to the posterior margin of the platelike process. Styles as in fig. 131; symmetrical or nearly so; shafts stout, each apex rounded and recurved but the recurved portion becoming pointed at apex; inner process ridgelike, without apical digitate extension. Connective as in fig. 135; moderately long and slender; combined width of ventral arms slightly less broad than base of shaft in posterior aspect. Pygofer as in figs. 132-134; medioventral process in ventral aspect fairly long and slender, length approximately three times width, middle portion swollen; extending posteriorly two-thirds to three-fourths the distance to level of apex of left pygofer



FIGURES 126-135. Male genitalia of *O. cinnamomeus* Provancher, specimen from El Dorado, Ont. 126, aedeagus in ventral view. 127, aedeagus in dorsal view. 128, anal segment in dorsal view. 129, anal segment in left lateral view. 130, anal segment in posterior view. 131, styles in broad inner aspect. 132, pygofer in ventral view. 133, pygofer in left lateral view. 134, pygofer in right lateral view. 135, connective in posterior view.



FIGURES 136-147. Male genitalia of *O. habeckorum* n. sp., from holotype. 136, aedeagus in ventral view. 137, aedeagus in dorsal view. 138, anal segment in dorsal view. 139, anal segment in left lateral view. 140, anal segment in posterior view. 141, styles in broad inner aspect. 142, left style in outer aspect. 143, pygofer in ventral view. 144, pygofer in left lateral view. 145, pygofer in right lateral view. 146, connective in posterior view. 147, connective in left lateral view.

lobe; pygofer lobes asymmetrical in ventral or lateral aspect, moderately produced; left pygofer lobe broadly produced, but right lobe produced into a thumblike lobe at midlength of posterior margin. Anal segment as in fig. 128-130; symmetrical or nearly so; in dorsal aspect conspicuously longer than broad; medioapical margin slightly concave; in caudal aspect ventral profile broadly concave but straight between lateral ventral extensions; hoodlike.

Types. — The type of *Oliarus cinnamomeus* Provancher was collected at Vancouver [British Columbia, Canada] by Rev. G. Taylor. The specimen is in the Musée du Québec, Quebec, Canada and was examined by Mr. René Bélique. He wrote "it is still in excellent condition apart from some discoloration. But, still as in the description, the very characteristic whitish costa and stigma are quite striking."

Distributional records. — Specimens were examined from CANADA: Ontario, Eldorado. UNITED STATES: Connecticut: Colebrook; Maine: Hooper, Norway, Whitneyville; Massachusetts: Sharon, Wincheldon; New Hampshire: Mount Washington; New Jersey: Ramsey; New York: Cold Spring Harbor, Long Island; Pennsylvania: "266:66 Belfrage" [G.S. Belfrage, collector; specimen in Riksmuseum Stockholm].

Notes. — *Oliarus cinnamomeus*, a somewhat rare and local northern form, is closest to *O. habeckorum*, new species. Means of distinguishing *cinnamomeus* and *habeckorum* are discussed under the latter species. *O. cinnamomeus* is readily diagnosed by the whitish slender costa and stigma contrasting with the fuscous tegmina. The male terminalia are definitive. Another very useful character is the set of scalelike teeth on the apices of the posterior basal and middle tarsites.

The known range of *O. cinnamomeus* is in the northeastern United States except for the type locality of Vancouver in British Columbia and one locality in Ontario.

Van Duzee (1923) wrote that he collected *Oliarus cinnamomeus* only on bogs where huckleberries [*Vaccinium* sp.] grow. Osborn (1938) referred to *O. cinnamomeus* as a northeastern [U.S.] species "said to occur in bogs where blueberries grow and may be looked for in blueberry association." The Eldorado, Ontario, specimen was collected in a sphagnum bog by G.S. Whalley, July 13, 1944. This specimen is used in the illustrations. A specimen from Maine has "cherry field" on the habitat label. Possibly this is local vernacular for a cranberry bog.

The known seasonal distribution of *O. cinnamomeus* is from June 25 to August 16.

***Oliarus habeckorum* n. sp.**

Figs. 136-147

Salient features. — Length of male 6.7 to 7.2 mm (based on 12 specimens); holotype male 6.9 mm. The following description is of the holotype. Ground color of vertex and mesonotum varying from stramineous to testaceous; mesonotal carinae with lateral pair mostly fuscous, intermediate pair yellowish, and the median carina mostly orange. *Head:* Vertex very broad, length in middle line much less than width at apex of posterior emargination (1:1.4); median carina of disc not present as a distinct ridge but as a broad, indistinct, slightly raised portion. Face

fuscous, concave between elevated carinae; median carina conspicuously forked at base, percurrent, and yellowish from apex of fork through anteclypeus, lateral carinae stramineous entire length, with pale color widened at and somewhat basad of epistomal suture, forming what could be interpreted as long and narrow maculae; frons moderately narrow, ratio of width to length in middle line 50:41. Rostrum light yellowish brown, except fuscous at apex of terminal segment; length moderately long, not attaining caudal margin of posterior trochanters but slightly surpassing posterior coxae. *Thorax*: Pronotum with pale yellow intermediate carinae not joining broad, pale yellow border of posterior margin. Mesonotum with all carinae conspicuous. Tegmina with all membranous areas light to medium brown, costal and apical cell areas darker brown; costa and stigma whitish to stramineous; tubercles concolorous, not conspicuous, but comparatively large; veins generally brownish, lighter brown in middle and basal areas; left tegmen at apex with Sc two-branched, R two-branched, M six-branched, and Cu₁ two-branched; apical cells 12 and anteapical cells 6; right tegmen at apex with Sc two-branched, R two-branched, M five-branched, and Cu₁ two-branched; apical cells 11 and anteapical cells 6; stigma length two and one-half to three times width, interior border of stigma somewhat indistinct. Wings with dusky membranes, R with two branches reaching apex, M with three branches reaching apex, triangle formed by veins of R shorter than triangle formed by anterior veins of M. Legs with front and middle femora and tibiae mixed fuscous and testaceous but not banded; posterior femora mostly brownish, posterior tibiae and tarsi testaceous to stramineous; each posterior tibia with three lateral spines, the basal one smallest, and with six apical spurs; basal tarsite of left posterior tarsus with 18 apical spurs; including lateral pair, but each one of the 16 spurs between lateral pair having a small membranous, scalelike tooth attached distally; basal tarsite of right posterior tarsite with 18 spur-scale combinations and 2 lateral spurs for a total of 20 spurs; second tarsite of left posterior tarsus with 14 spur-scale combinations and 2 lateral spurs for a total of 16 spurs; second tarsite of right posterior tarsus with 16 spur-scale combinations and 2 lateral spurs for a total of 18 spurs.

Male genitalia. — Aedeagal complex as in figs. 136 and 137; total pointed processes five, plus a platelike process. Periandrium with one pointed process and a platelike process; dextral process stout and very long, directed caudad initially, then broadly curved left-caudad, left-cephalad, and terminating straight cephalad; dextral process with distal portion on dorsal side of aedeagal complex rather than ventral side; sinistral process laterally compressed, platelike, extending dorsoventrally. Flagellum curving left only short distance before turning and extending fairly straight cephalad; with four pointed processes; apically with a short, slender, acute process, wholly visible only in dorsal aspect; basiventral area of flagellum giving rise to two processes, both curving left-cephalad, the outer process nearly twice as long as the inner dorsally, with an additional prominent process arising at the base of the flagellum, curving left-cephalad initially, then cephalad, extending anteriorly almost as far as apex of flagellum. Styles as in figs. 141-142; nearly symmetrical, apex of style rounded and recurved, apex of recurved portion somewhat digitate; shaft broad whole length except where joining expanded apical portion; inner processes ridgelike, basal part abruptly elevated from shaft, not gradually confluent as in most

species of *Oliarus*. Connective as in figs. 146-147; moderately long and slender; in lateral view slightly curving; in posterior view, slightly asymmetrical, base of shaft slightly tilted to the left; combined width of ventral arms less than width of base of shaft. Pygofer as in figs. 143-145; asymmetrical; medioventral process in ventral aspect fairly long and slender, length approximately twice width, middle portion slightly swollen, basal portion slightly narrowed, apex acute; extending posteriorly slightly less than half distance to level of apex of left pygofer lobe; pygofer lobes asymmetrical in ventral or lateral views, the left lobe slightly shorter and stouter, broadly rounded in lateral view; right pygofer lobe longer and more narrowly produced in both ventral and lateral views; caudalmost portion of right lobe closer to midlength of posterior margin than in the left lobe. Anal segment as in figs. 138-140; nearly symmetrical in dorsal view, longer than broad, medioapical margin concave; in left lateral view with central tube or keel hidden only at middle portion by left lateral margin of segment; in caudal view asymmetrical, left margin extending considerably more ventrad than right margin; medioventral profile with keel-like aspect, ventral profile primarily convex between lateral margins and somewhat diagonal.

Types. — *Oliarus habeckorum* is described from the male holotype, female allotype, five male paratypes, five female paratypes, all collected at Clemson College, South Carolina, June 8, 1935, by O.L. Cartwright, sweeping cane, plus one male paratype with the same data except the date is July 12, 1935. These specimens are part of the D.M. DeLong collection in the Ohio State University collection. Other paratypes include two males from Southern Pines, North Carolina, 1952, (B.K. Dozier) Florida State Collection of Arthropods; male and female from "S.P. 64" [Southern Pines, North Carolina], and male from Swan Quarter, North Carolina, VI-30-53 (W.M. Kulash), light trap, these three specimens from the North Carolina State University collection; male, two females from Emporia, Virginia, July 24, 1939 (P.W. Oman) and male paratype, Wayne County, North Carolina, 15-VII-55 (H.V. Weems, Jr.) United States National Museum Collection.

Distributional records. — The known range of *O. habeckorum* is limited to three counties in the eastern half of North Carolina, one county in northwestern South Carolina, and one county in southeastern Virginia.

Notes. — *Oliarus habeckorum* is a comparatively rare species that previously has been misdetermined as *O. cinnamomeus* Provancher. The two species are close morphologically, but there are several consistent differences. Most readily apparent is the overall lighter shade of brown of *habeckorum*, particularly in the tegmina; *habeckorum* males are larger, measuring over 6.5 mm in total length, whereas *cinnamomeus* males are under 6.0 mm. The aedeagal complex of *cinnamomeus* has a short, straight, almost spinelike process near the posterior margin of the platelike sinistral process, but *habeckorum* has a longer, stouter, curving process in this area; the platelike process of *habeckorum* is a little larger than in *cinnamomeus*. A prominent curved process at the base of the flagellum, originates ventrally on *cinnamomeus*, but dorsally on *habeckorum*; the anal segment in caudal view is nearly symmetrical in *cinnamomeus* but that of *habeckorum* is considerably asymmetrical, with a central "keel" more prominent; the medioventral pygofer process of *cinnamomeus* extends caudad two-thirds to three-fourths the distance to

the apex of the left lateral lobe of the pyfoger, but in *habeckorum* it extends caudad one-half or less this distance. The number of scalelike teeth at the apex of the basal metatarsite of *cinnamomeus* is 8 to 11, usually 10 to 11, but in *habeckorum* the number of scalelike teeth is 14 to 18, usually 15 or 16; this same character in the second (middle) metatarsite ranges from 6 to 10, (usually 8 or 9) in *cinnamomeus*, but ranges from 11 to 16 (usually 12 to 14) in *habeckorum*.

Intraspecific variations include some specimens of *O. habeckorum* with spicules on the sinistral process of the periandrium; other specimens are without such spicules; lateral spines on each posterior tibia usually are three but vary from two to four; the tegmina and wings subject to the usual slight variation in branching; the color on the mesonotum of some specimens is a deeper brown than on the majority of specimens.

Little habitat information is available on *O. habeckorum*. The specimens collected at Clemson were obtained by "sweeping cane." In this instance cane would refer to *Arundinaria* sp., the bamboolike grass of the river bottom areas of the southern United States. Mr. O.L. Cartwright of the Smithsonian Institution provided this additional information: Clemson is in the foothills, at 800 feet elevation on the Seneca River, but possibly the collection site is now under water since Clarke's Hill Dam backed water much above [north of] Clemson.

The known seasonal distribution of *O. habeckorum* is in June and July.

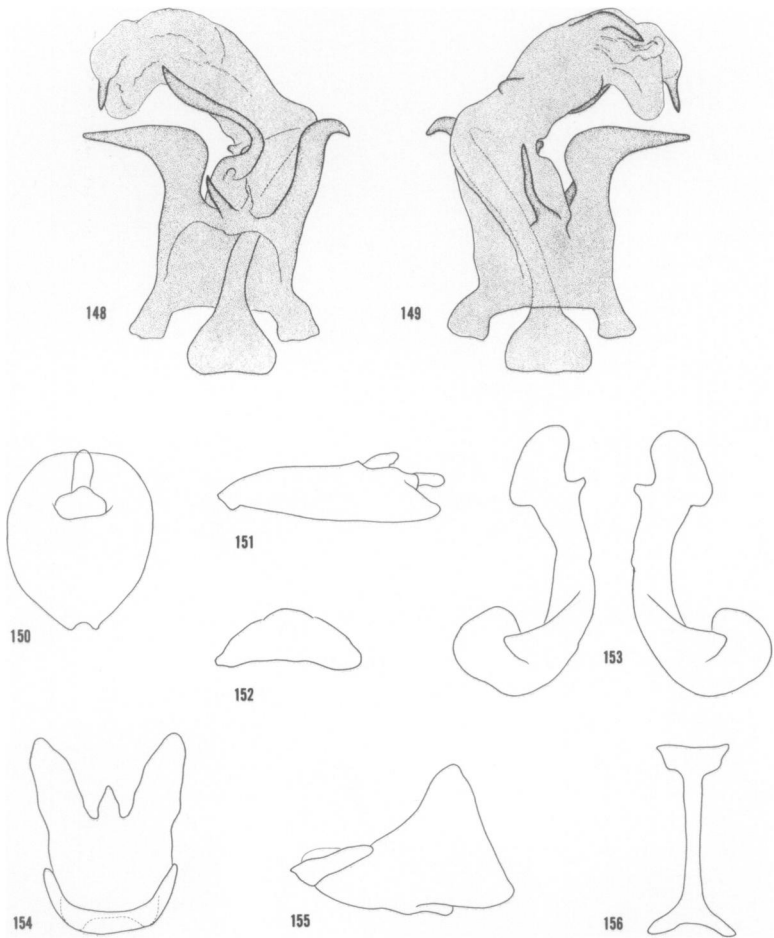
It is with great pleasure that this species is named for Dr. Dale H. Habeck, Professor, Department of Entomology and Nematology, University of Florida, and his wife, Phyllis Pake Habeck, professional artist. They have generously given much valuable assistance during the preparation of this paper.

Oliarus yavapanus Ball

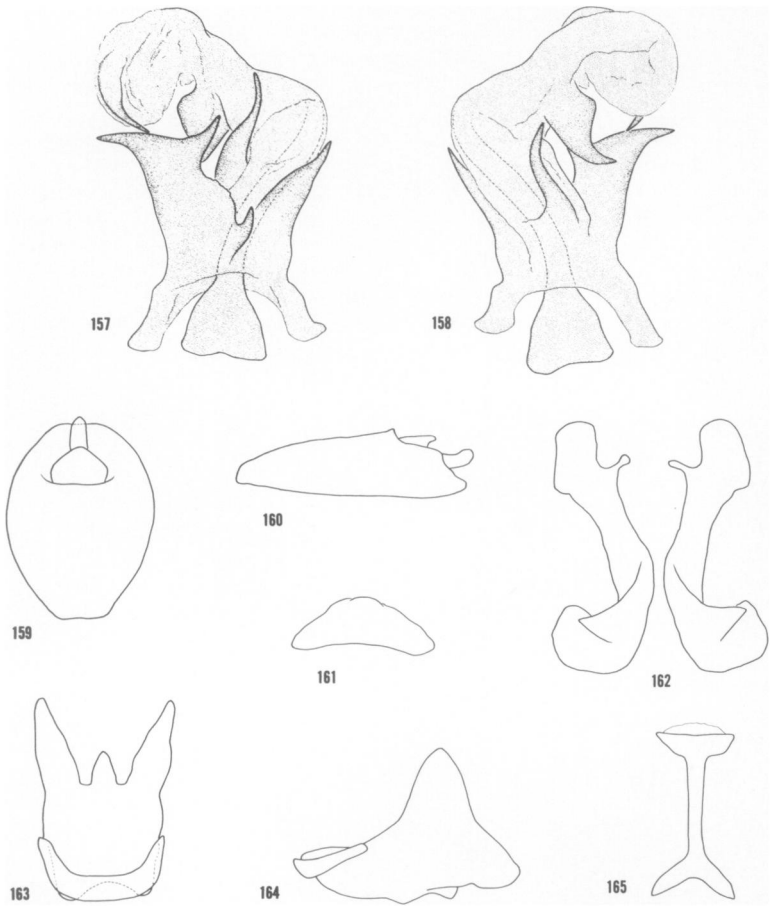
Figs. 148-156

Oliarus yavapanus Ball 1934:274.

Salient features. — Length of male 3.9 to 4.6 mm (based on 26 specimens), allotype male 4.3 mm. Ground color of vertex and mesonotum usually fuscous, piceous in some specimens; mesonotal carinae orange. *Head:* Vertex narrow, substantially longer in middle line than wide at apex of posterior emargination; median carina usually present in basal half of disc. Face usually fuscous, castaneous or piceous in some specimens; median carina prominent, percurrent, weakly forked at base, usually orange entire length; lateral carinae usually pale yellow from base of frons to apex at postclypeus, pale color slightly broadened at epistomal suture in most specimens; frons moderately narrow, width greater than length in middle line. Rostrum short, not surpassing posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually narrowly separated from pale border of posterior margin. Mesonotum with conspicuous carinae. Tegmina with membrane somewhat variable from milky subhyaline to a dusky tinge throughout; some specimens with apical area distinctly browner; apical crossveins suffused, otherwise tegmen immaculate except for usual brownish area on commissure basad from Y-vein juncture; tubercles not prominent; veins pale yellow to light brown in basal two-thirds, brownish apically; apical cells normally 11 and antepical cells 6 in most specimens; stigma brownish, length approximately twice width. Legs not banded.



FIGURES 148-156. Male genitalia of *O. yavapanus* Ball, from paratype Ashfork, Ariz. 148, aedeagus in ventral view. 149, aedeagus in dorsal view. 150, anal segment in dorsal view. 151, anal segment in left lateral view. 152, anal segment in posterior view. 153, styles in broad inner aspect. 154, pygofer in ventral view. 155, pygofer in left lateral view. 156, connective in posterior view.



FIGURES 157-165. Male genitalia of *O. forcipatus* Caldwell, from holotype. 157, aedeagus in ventral view. 158, aedeagus in dorsal view. 159, anal segment in dorsal view. 160, anal segment in left lateral view. 161, anal segment in posterior view. 162, styles in broad inner aspect. 163, pygofer in ventral view. 164, pygofer in left lateral view. 165, connective in posterior view.

Male genitalia. — Aedeagal complex as in figs. 148 and 149; total processes eight. Periandrium with five processes; ventrally with dextral process well developed, directed nearly straight caudad to level of aedeagal joint, then curving to the right shortly before apex; sinistral process the most distinctive process, stout basally and directed only a short distance caudad before enlarging and curving 90 degrees to the left, apical part tapering and straight, profile avicephaliform; median basal area with short, acute process directed left-caudad; left apical area with conspicuous curving process, directed primarily to the left in apical two-thirds; dorsal periandrium with median basal area giving rise to slender, acute process of medium length, slightly curved but directed primarily straight caudad. Flagellum directed left-caudad basal half, then curving left and finally left-cephalad; ventrally with short, slender, acute process arising near apex; dorsally with short, slender, acute process subapically near caudal margin and with a subbasal very short process near caudal margin, this process varying from somewhat rounded to pointed. Styles as in fig. 153; symmetrical; shafts long and slender; apices rounded and recurved; inner processes moderately short, pointed. Connective as in fig. 156; long and slender; combined width of ventral arms broader than base of shaft in posterior aspect. Pygofer as in figs. 154-155; symmetrical; medioventral process in ventral aspect subtriangulate, acute, longer than wide, extending posteriorly slightly less than half the distance to level of apices of pygofer lateral lobes; lateral lobes well produced, subacute. Anal segment as in figs. 150-152; in dorsal view symmetrical or nearly so; slightly longer than wide, nearly uniformly rounded; medioapical margin approximately straight; ventral margin in caudal view nearly straight, slightly concave.

Types. — Ball listed the type series as: "Holotype female, allotype male, and a pair of paratypes, Ashfork Aug. 16, 1929, six paratypes Ashfork July 15, 1929, three Yarnell Heights July 21, 1929, and two from the same place Aug. 20, 1929. All collected by the writer [E.D. Ball] from the higher table lands or mountains of Arizona."

Distributional records. — The range of *O. yavapanus* as determined from males, is as follows: ARIZONA: Mustang Mountains; Pima, Santa Cruz, and Yavapai Counties. CALIFORNIA: Pine Flats Camp, Indio, Riverside County. TEXAS: Davis Mountains, Jeff Davis County. UTAH: Chads.

Notes. — *Oliarus yavapanus* is an uncommon species of the Southwest. The two most diagnostic characters are the avicephaliform sinistral process of the periandrium and the short process on the subbasal, caudodorsal area of the flagellum. The illustrations are based on a paratype male from Ash Fork, Arizona.

This species appears closest to *O. uncatus* Caldwell and next closest to *O. forcipatus* Caldwell. The three species are similar enough in habitus and male genitalia to be considered as a group; all are found in the southwestern United States.

No host plant data are recorded, but the seasonal distribution extends from June 20 to August 29 according to the specimens at hand.

Oliarus forcipatus Caldwell

Figs. 157-165

Oliarus forcipatus Caldwell 1947b:146.

Salient features. — Length of male 4.4 to 4.8 mm (based on 10 specimens);

holotype male 4.6 mm. General appearance same as *Oliarus yavapanus* Ball and *Oliarus uncatatus* Caldwell.

Male genitalia. — Aedeagal complex as in figs. 157 and 158; total pointed processes six, counting a bifid sinistral process as one. Periandrium with four processes as here interpreted; dextral process stout, elongate-triangular in ventral aspect, directed right caudad, not attaining level of aedeagal joint; sinistral process broad, bifid at apex, rami short, acute and subequal; right basal area of sinistral process with a short acute process directed caudad and appearing to originate from the median basiventral area of the periandrium; margin at midlength on right side of sinistral process irregularly serrate; left ventroapical area with a prominent process, stout basally, slender and gently curving left-caudad in distal half; dorsal periandrium with a moderately long, slender process originating mediobasally, this process directed caudad initially, but curving slightly to the left apically. Flagellum directed left-caudad in approximately basal half, but then curving left and somewhat cephalad, and with small process in the ventroapical area; this process swollen basally, acute and slender apically; cephalosubbasidorsal (inner) area of flagellum giving rise to an asymmetrical process that is stout basally, acute apically, and directed primarily left-cephalad. Styles (fig. 162), connective (fig. 165), pygofer (figs. 163-164), and anal segment (figs. 159-161), all consistent with *yavapanus* group.

Types. — The holotype male is in the Ohio State University collection; it forms the basis for most of the present illustrations. Caldwell listed the type series as "male holotype and paratypes, July 23, 1946; female allotype and paratypes, June 2, 1937, from Davis Mts., Texas (D.J. & J.N. Knull), OSU." Two female paratypes from Davis Mountains, June 2, 1937, and July 23, 1946 were the only other specimens seen. They appear to be conspecific with the holotype.

Distributional records. — Males were seen from Davis Mountains, Fort Davis, in Jeff Davis County, Texas; Chisos Mountains, Brewster County, Texas; and Atasco Mountains, Arizona.

Notes. — *Oliarus forcipatus* is so similar to *O. yavapanus* Ball and *O. uncatatus* that examination of the aedeagal complex is necessary to distinguish the species. These three species are similar enough to form what appears to be a natural group (in general appearance certain other medium-sized brownish species in the southwestern United States approach the *yavapanus* group). The most diagnostic characters of *forcipatus* are the sinistral process of the periandrium and the distinctive, subbasal, dorsal, inner process of the flagellum. The pygofer lateral lobes of *forcipatus* are thinner and slightly more produced than in *uncatus* and *yavapanus*.

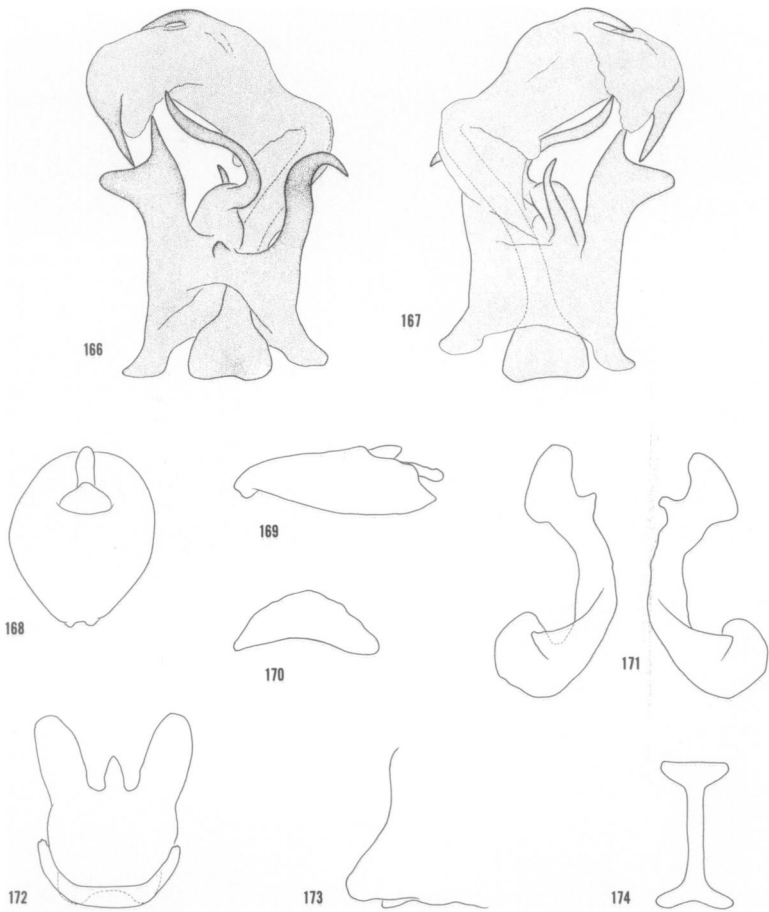
O. forcipatus is known only from a few mountain areas in western Texas and Arizona. No ecological data are recorded, but the species has been taken as early as June 20 and as late as August 16.

***Oliarus uncatatus* Caldwell**

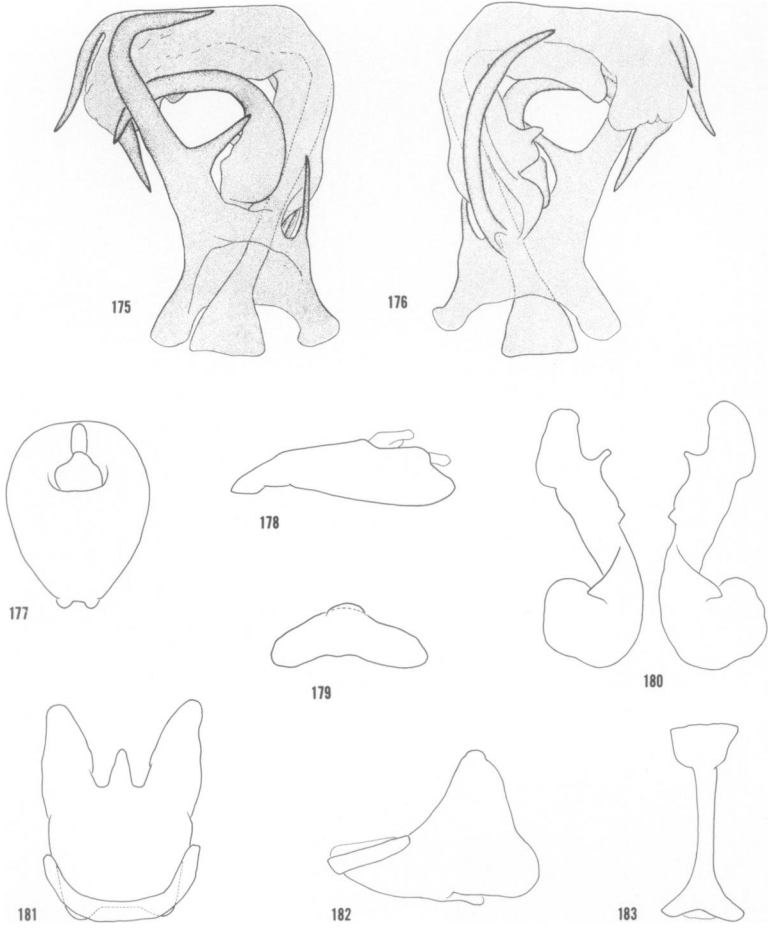
Figs. 166-174

Oliarus uncatatus Caldwell 1947b:151

Salient features. — Length of male 4.4 mm (holotype, unique). Vertex and mesonotum black; mesonotal carinae orange, area between outer and intermediate



FIGURES 166-174. Male genitalia of *O. uncatus* Caldwell, from holotype. 166, aedeagus in ventral view. 167, aedeagus in dorsal view. 168, anal segment in dorsal view. 169, anal segment in left lateral view. 170, anal segment in posterior view. 171, styles in broad inner aspect. 172, pygofer in ventral view. 173, pygofer in right lateral view. 174, connective in posterior view.



FIGURES 175-183. Male genitalia of *O. altanatus* Caldwell, from paratype Zimapan, Hidalgo, Mexico. 175, aedeagus in ventral view. 176, aedeagus in dorsal view. 177, anal segment in dorsal view. 178, anal segment in left lateral view. 179, anal segment in posterior view. 180, styles in broad inner aspect. 181, pygofer in ventral view. 182, pygofer in left lateral view. 183, connective in posterior view.

carinae orange. *Head*: Vertex narrow, troughlike, length in middle line greater than width at apex of posterior emargination (23:18). Face evenly ovate, light brown with yellowish carinae, median carina prominent; frons with width greater than length in middle line (35:28). *Thorax*: Intermediate carinae of mesonotum appearing broken, irregular. Tegmina milky with yellow veins becoming darkened apically; tubercles on veins regular, not prominent; left tegmen with 12 apical cells and 6 antepical cells; right tegmen with 11 apical and 6 antepical cells; stigma long, narrow.

Male genitalia. — Aedeagal complex as in figs. 166 and 167; total pointed processes seven. Periandrium with five processes; dextral process prominent, directed caudad to level of aedeagal joint, then hooklike, with apical portion curving more than 90 degrees right-cephalad; sinistral process broad, unevenly bifid at apex, with left ramus broader, directed left and rounded, right ramus slender, acute, and directed caudad; medioventral basal area with a very short process; ventral left apical area giving rise to a prominent recurved process that is slender for most of its length and directed primarily in a left caudal direction; dorsal periandrium with a basal, slender, apically curved, medium to small process. Flagellum directed left-caudad in basal two-thirds then curving left and cephalad; apically with a small acute process directed cephalad; subapically with a small, acute process along most posterior portion of flagellum and directed primarily to the left. Styles as in fig. 171; symmetrical; each shaft long and slender, with apex rounded and recurved and inner process moderately short, pointed. Connective as in fig. 174; moderately long and slender; combined width of ventral arms slightly greater than width of base of shaft in posterior aspect. Pygofer as in figs. 172-173; medioventral process in ventral aspect subtriangulate, acute, longer than wide, extending posteriorly nearly halfway to level of apices of pygofer lateral lobes; lateral lobes symmetrical or nearly so, well produced, subacute. Anal segment as in figs. 168-170; in dorsal view nearly symmetrical, moderately longer than wide, well rounded; medioapical margin approximately straight; ventral margin in caudal view gently concave.

Type. — Holotype male, Prescott National Forest, Yavapai County, Arizona, June 20, 1947 (D.J. and J.N. Knull), in the Ohio State University collection.

Distributional records. — The species is known only from Arizona.

Notes. — *Oliarus uncatatus* is similar to *O. forcipatus*, but *uncatatus* has no inner, subbasal, stout process on the flagellum as in *forcipatus*. *O. uncatatus* is closest to *O. yavapanus* Ball, but *yavapanus* has a short process on the dorsal, subbasal part of the flagellum that is lacking in *uncatatus*, and the sinistral process of *yavapanus* is not bifid but is produced to the left and is avicephaliform, whereas in *uncatatus* the sinistral process is bifid.

No biological data are recorded with the only known specimen from west central Arizona.

Oliarus altanatus Caldwell

Figs. 175-183

Oliarus altanatus Caldwell 1951:35.

Salient features. — Length of male 3.5 to 4.4 mm (based on six paratypes and three other specimens). Ground color of vertex and mesonotum usually piceous,

occasionally fuscous; mesonotal carinae usually orange, but color faint or evanescent along sections of carinae in some specimens; other specimens with color spreading onto disc. *Head*: Vertex width variable, length in middle line from less than to more than width at apex of posterior emargination (length to width ratio 0.90:1 to 1.19:1); median carina absent or very short. Face piceous or fuscous except for pale carinae; middle carina percurrent in some individuals, becoming obsolete in postclypeus in others, pale yellow to dull orange, usually more prominent on frons; fork of median carina very short, usually broader than long; lateral carinae pale from base through postclypeus, pale border sometimes expanding at epistomal suture but not to degree of becoming distinct macula; frons moderately broad, wider than long in middle line (length two-thirds to three-fourths the width). Rostrum short, distinctly failing to attain caudal margins of posterior trochanters, sometimes by as much as half the length of last segment of rostrum. *Thorax*: Pronotum with intermediate carinae usually not attaining pale band of posterior margin but sometimes becoming tangential. Mesonotum with carinae nearly uniform. Tegmina immaculate except for slightly suffused apical crossveins; veins generally brownish, more so apically; commissure mostly pale except for brown section immediately basad of union of Y-veins; tubercles moderately conspicuous, concolorous with veins; apical cells 10 to 13, usually 11, and antepical cells 5 or 6; stigma brown, ovoid, length slightly more than twice width.

Male genitalia. — Aedeagal complex as in figs. 175 and 176; total pointed processes nine if both prongs of the "caliper process" are counted. Perianthrium with five or six processes; ventrally, the dextral process extremely slender, and extending posteriorly barely half the distance to joint of aedeagus; sinistral process large, caliperlike, the upper and lower "jaws" or prongs equally produced or nearly so; median area of basiventral perianthrium with prominent process considerably swollen at base, directed caudad initially, curving distally to extend straight left before terminating with another curve in a variable left-cephalad direction; dorsal perianthrium with two processes: a long, slender process inserted basally which curves fairly regularly left-caudad, apex usually ending over middle part of flagellum in dorsal aspect with terminal direction of the process varying from straight left to approximately 45 degrees left-caudad; and a short, stout, pointed process originating from left-median, subapical area and directed left-caudad. Flagellum directed to the left and with three medium sized processes in the apical area, smallest of the three on the dorsal surface and not visible from ventral view; apical process longest. Styles as in fig. 180; symmetrical; each shaft slender, somewhat enlarged basally, apex expanded and recurved apically, broadly rounded at apex of recurved portion; inner processes rather short, pointed. Connective as in fig. 183; long and slender; combined ventral arms wider than base of shaft in posterior aspect. Pygofer as in figs. 181-182; medioventral process triangular, moderate in size; in ventral view, width approximately two-thirds the length; process extending posteriorly to less than one-half the distance to the level of the apex of the left lateral lobe in most specimens, in other specimens half the distance; lateral lobes of pygofer in lateral view well produced with each apex below midlength of posterior

margins, and with right lobe slightly more produced than the left. Anal segment as in figs. 177-179; moderately broad but distinctly longer than wide in dorsal view (width to length 7.3-8.0:10); symmetrical or nearly so; medioapical margin straight or nearly so; medioventral profile in caudal view gently concave.

Types. — The types of *O. altanatus* are in the United States National Museum. The holotype male was collected 12 miles south of Jacala, Hidalgo, Mexico, IX-26-41 (DeLong, Good, Caldwell, and Plummer). The two holotype labels on the specimen are misspelled "*altanasus*." The allotype female has the same collection data. Male paratypes examined include one from Mexico City, D.F., W. 18 km. IX-1-39; one from Zimapan, Hidalgo, Mexico, K 222, 10-31-45; two from Jalapa, Vera Cruz, Mexico, K 270, 10-31-45; one from Davis Mountains, Texas, May 13, 1927, *ex mallow*; Tlalpam, D.F., Mexico, X-7-23, M.B. 9. Four female paratypes, from Zimapan, Hidalgo; Jalapa, Vera Cruz, and Cuernavaca, Morelos also were examined.

Distributional records. — In addition to the type material, four other males representing new localities were studied: a paratype male of *O. forcipatus* Caldwell mislabeled "allotype" collected at Davis Mountains, Texas, VI-2-37 (D.J. and J.N. Knull) Ohio State University collection; a male from 13 miles northwest of Comitán, Chiapas, Mexico, III-3-53 (E.I. Schlinger) California Insect Survey collection; a male from Cuernavaca, Morelos, Mexico, August 6, 1938 (L.J. Lipovsky) North Carolina State collection; Ozona, Texas, 7-9-36; R.H. Beamer, University of Kansas collection. Ozona (2347 feet) is in Crockett County.

Notes. — *Oliarus altanatus* is a member of the *O. concinnulus* Fowler group. In general, *altanatus* is similar to several southwestern United States and Mexican species. It can be identified only by the aedeagal complex of the male, according to present knowledge. The two most diagnostic characters of *altanatus* are the dextral and sinistral processes, best seen from the ventral aspect of the dissected and cleared aedeagal complex. The dextral process of the periandrium is comparatively short, extremely slender, and matched in this slenderness only by the slightly longer dextral process of *concinnulus*, therefore, separation of *altanatus* from *concinnulus* depends primarily on the different shapes of the respective sinistral process. In *altanatus* this process is caliperlike, with the apical and basal jaws of the caliper well separated, fairly similar in proportions, and parallel or nearly so (at right angles to the main shaft of the sinistral process); in *concinnulus* the sinistral process is only vaguely caliperlike, the apical portion being clavate, much thicker than the basal jaw or prong, and completing an insufficient portion of the 90 degree curve required to form a well proportioned caliper as normally represented by specimens of *altanatus*. The aedeagal complex of the type specimen of *concinnulus* Fowler is illustrated in the paper by Fennah (1945b).

The available specimens of this uncommon species exhibit considerable variation in many of the characters studied, for example, total length, the width of the vertex, color of the face, number of vein branches reaching apex of tegmen, and details of the processes of the aedeagal complex. A paratype male from Davis Mountains, Texas, has the apical "jaw" of the caliper process recurved approximately 145

degrees for a short distance instead of 90 degrees before curving again finally to extend parallel to the basal "jaw." This specimen also has an adventitious, very short, pointed process on the periandrium in the left, subapical, median portion. Specimens from Mexico City southward tend to have the caliperlike process less strongly developed, the vertex wider, and the total length shorter.

Oliarus concinnulus is entirely Mexican, and *O. altanatus* mostly Mexican, with a possible range overlap in Morelos. The records for *altanatus* are in southwestern Texas and in the southeastern part of Mexico. *O. concinnulus* seems to be primarily in the lower southwestern area of Mexico, but our knowledge of the Mexican fauna is poor. The known distribution of *altanatus* is disjunct to the extent that approximately 700 miles lie between the northernmost Mexican record at Jacala, Hidalgo, and the west Texas localities of Davis Mountains and Ozona.

None of the specimens examined has any host or habitat labels. The available specimens are all from plateau or mountain localities.

Specimens examined were collected in the months of March, May, and June through October.

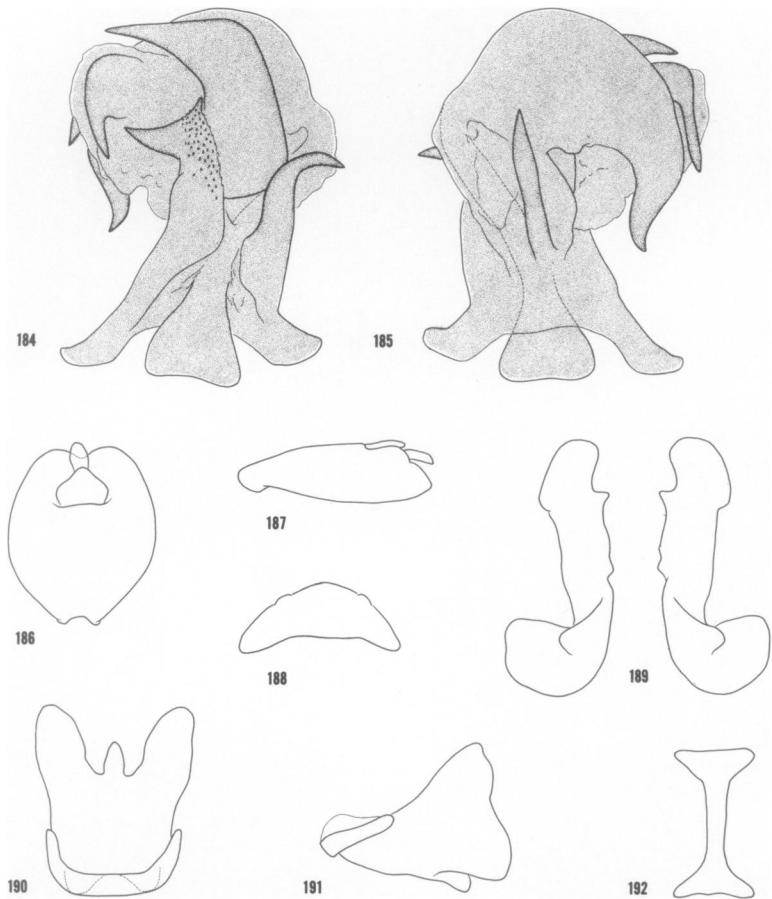
***Oliarus corvinus* Ball**

Figs. 184-192

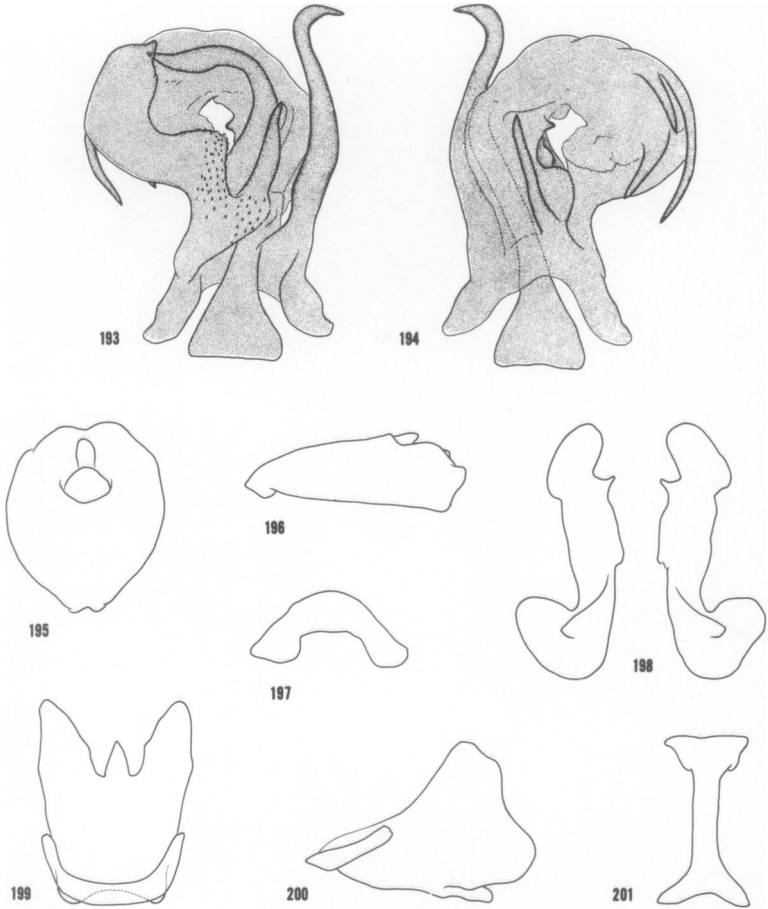
Oliarus corvinus Ball 1934:273.

Salient features. — Length of male 4.0 to 5.4 mm (based on 92 specimens), allotype male 5.0 mm. Ground color of vertex and mesonotum usually piceous, sometimes fuscous; mesonotal carinae orange. *Head:* Vertex relatively long and narrow, with length in middle line usually greater than width at apex of posterior emargination (length to width ratio variable from approximately 1:1 to 1.6:1); median carina absent or very short. Face usually piceous, sometimes fuscous; carinae prominent; median carina with basal fork short and moderately broad, normally percurrent and orange from base through anteclypeus; lateral carinae orange to pale yellow on frons through postclypeus, sometimes slightly expanded at epistomal suture (no maculae); frons distinctly wider than long in middle line. Rostrum short, not attaining caudal margins of posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually slightly separated from pale band of posterior margin. Mesonotum with carinae nearly uniform. Tegmina immaculate except slight brownish suffusion near apical crossveins; commissure pale except for brownish segment immediately basad of union of Y-veins; tubercles moderate in size and colorous with the nearly uniform brown veins; apical cells normally 11 and antepical cells usually 5, sometimes 6; stigma rich brown, distinct, ovoid, length two to two and one-half times width. Legs piceous or fuscous basally, mostly testaceous distally.

Male genitalia. — Aedeagal complex as in figs. 184 and 185; total pointed processes seven, counting the sinistral process as one. Periandrium with four processes, one of which is dorsal; dextral process rather stout, extending caudad initially, curving to the right distally, not quite reaching joint of aedeagus; sinistral process considerably less developed than in other members of *Oliarus concinnulus* Fowler



FIGURES 184-192. Male genitalia of *O. corvinus* Ball, from paratype Papagonia, Ariz. 184, aedeagus in ventral view. 185, aedeagus in dorsal view. 186, anal segment in dorsal view. 187, anal segment in left lateral view. 188, anal segment in posterior view. 189, styles in broad inner aspect. 190, pygofer in ventral view. 191, pygofer in left lateral view. 192, connective in posterior view.



FIGURES 193-201. Male genitalia of *O. littoralis* Ball, from paratype Tampa, Fla. 193, aedeagus in ventral view. 194, aedeagus in dorsal view. 195, anal segment in dorsal view. 196, anal segment in left lateral view. 197, anal segment in posterior view. 198, styles in broad inner aspect. 199, pygofer in ventral view. 200, pygofer in left lateral view. 201, connective in posterior view.

group; distal half of sinistral process heavily spiculate; apical fourth asymmetrically bifid, the left ramus longer than the ramus that extends a short distance caudad; left branch pointed in some specimens, more rounded and thumblike in others; ventral medioapical process rather massive, avicephaliform, basal two-thirds directed caudad, apex acuminate and directed straight left. Dorsal periandrium with one prominent process inserted mediobasally and directed straight caudad, attaining level of aedeagal joint. Flagellum broadly directed to the left and with three apical or subapical processes, the largest one apical, unusually thick and located mostly to the dorsal surface of the flagellum; two subapical processes subequal, moderately short, opposite each other on the dorsal and ventral surfaces of the flagellum. The apices of all three flagellar processes visible ventrally, but only two visible in dorsal aspect. Styles as in fig. 189; symmetrical; shaft moderately long and stout, apex well enlarged, recurved at little more than 90 degree angle, lateral margin of recurved portion subtruncate; inner processes short, broadly pointed. Connective as in fig. 192; moderately short and stout, combined width of ventral arms approximately the same as width of base in posterior aspect. Pygofer as in figs. 190-191; medioventral process in ventral view triangulate, considerably longer than wide, sides subparallel for basal half; extending posteriorly approximately half the distance to the level of the apices of the pygofer lateral lobes; lateral lobes moderately produced; in lateral aspect extending farthest caudad distinctly below midlength of posterior margins. Anal segment as in figs. 186-188; broad, the width four-fifths the length, nearly symmetrical; medioapical margin in dorsal view moderately notched (concave); in caudal view ventral profile broadly and gently concave, but straight in central portion.

Types. — Ball's original description listed holotype female, allotype male, and 12 paratypes, Patagonia, Arizona, August 8, 1932 (E.D. Ball). The insect pins with the holotype and allotype labels each hold three specimens of the appropriate gender. Two of the males on the pin bearing the allotype label proved to be *O. zyxus* Caldwell and the third *O. corvinus* as interpreted here.

Distributional records. — The range of *O. corvinus* was stated as "widely distributed in southern Arizona" in the original description. We add the states of Texas and California. In Texas it seems restricted to the Davis and Chisos Mountain areas of Davis and Brewster Counties, respectively. In Arizona we have seen specimens from numerous localities in Cochise, Coconino, Graham, Mojave, Pima, Pinal, and Yavapai Counties. In California the localities are scattered in Inyo, Riverside, and San Diego Counties.

Notes. — *Oliarus corvinus* is a member of the *O. concinnulus* Fowler group but apparently is more distantly related to *concinnulus* than are the other species included in this group. *O. corvinus* is best diagnosed by examining the aedeagal complex, where the sinistral process is the least developed within the *concinnulus* group; the thick, apical, median, ventral process is distinctive (resembling the profile of the head of a corvine bird), and the three apical and subapical processes of the flagellum have a characteristic appearance which alone is sufficient to separate *corvinus* from any other species.

An interesting variant of *O. corvinus* was collected 65 miles south of Marathon, Texas (Big Bend National Park), 7-10-38, by R.H. Beamer (University of Kansas collection). The left-ventral process (sinistral) is wrenchlike in shape, much as in some of the Kinney County and Uvalde County, Texas specimens of *O. zyxus*. The dorsoapical process of the flagellum is reduced in this specimen; all three flagellar processes are similar in length and thickness but still retain a characteristic *corvinus* appearance. The dextral process remains somewhat hooklike with a sharp apical curve to the right, and the other processes are fairly typical except the ventromedio-apical process is not as thick as usual for *corvinus*.

Habitats seem to be primarily in mountainous areas according to the locality labels of determined males. Altitude labels on *Oliarus corvinus* specimens showed the lowest, 3600 feet, near Kits Peak, Baboquivari Mountains, Arizona, the highest, 6300 feet, nine miles northeast of Big Pine, Inyo County, California. "Host" plants on the labels of *corvinus* males include, "on *Acacia greggii*" [Gray], "ex *Solidago wrightii*" [Gray], and "sapind." The latter presumably is an abbreviation of *Sapindus*, the generic name of soapberry.

One specimen out of nearly 200 examined had a parasite attached to the abdomen.

Seasonal distribution, as determined from the available specimens, extends from April 28 to October 5, with peak numbers apparently occurring during midsummer.

***Oliarus littoralis* Ball**

Figs. 193-201

Oliarus littoralis Ball 1934:274.

Salient features. — Length of male 4.0 to 4.7 mm (based on 55 specimens); allotype male 4.5 mm. Ground color of vertex and mesonotum fuscous; mesonotal carinae testaceous. *Head:* Vertex narrow, distinctly longer in middle line than wide at apex of posterior emargination; median carina absent. Face usually fuscous, occasionally fusco-testaceous; median carina prominent, percurrent, weakly forked at base, yellowish entire length; lateral carinae conspicuously pale yellow on frons and postclypeus, pale border slightly broader on frons; frons moderately narrow, width slightly but consistently greater than length in middle line. Rostrum short, seldom reaching posterior trochanters. *Thorax:* Pronotum with intermediate carinae not joining pale band of posterior margin. Mesonotum with carinae usually equally prominent. Tegmina with spotting confined to suffusion at apical crossveins and at commissure immediately basad of Y-vein junction; tubercles moderately prominent, brownish; veins tending to be testaceous basally, brown apically; apical cells normally 11 and anteapical cells 6; stigma brown, rounded, length approximately twice the width. Legs not banded.

Male genitalia. — Aedeagal complex as in figs. 193 and 194; total pointed processes eight or nine depending upon interpretation of structures. Periandrium with five or six pointed processes; dextral process long and slender, its apex usually most posterior part of aedeagal complex, apex curved to right, acute; sinistral process an enlarged, complex structure generally extending left-caudad; basal median portion of sinistral process developed into a prominent, fairly slender, acute subprocess extending slightly right-caudad; apex of sinistral process thick and curved slightly

right-caudad; parallel to basal subprocess, thereby forming caliperlike structure, with interior margin between "caliper" points greatly expanded, forming a strong convexity; spicules common on much of basal half of sinistral process; ventroapical part of periandrium with a long, moderately slender process curving to the left; dorsal periandrium with slender, straight, moderately long process originating medio-basad, apex ending approximately at level of aedeagal joint; left apical dorsal periandrium with short, inconspicuous process directed primarily to the left. Flagellum broadly developed to the left and with three unequal processes in the apical area, best seen dorsally. Styles as in fig. 198; symmetrical or nearly so; shafts broader basally, abruptly narrowed near midlength; apices rounded and recurved; inner processes short, broadly pointed. Connective as in fig. 201; moderately stout; combined width of ventral arms slightly broader than base of shaft in posterior aspect. Pygofer as in figs. 199-200; nearly symmetrical; medioventral process in ventral aspect triangular, longer than broad, acute, widest at or near base; extending posteriorly approximately half the distance to level of apices of pygofer lateral lobes; lateral lobes stout in ventral view; in lateral aspect well produced, apices rounded to obliquely subtruncate. Anal segment as in figs. 195-197; in dorsal view nearly symmetrical, longer than wide, but fairly broad; medioapical margin slightly concave; in caudal view hoodlike; middle portion broadly, deeply, and subrectangulately emarginate.

Types. — Ball listed the holotype female, allotype male, and seven pairs of paratypes taken by him at Tampa, Florida, September 10, 1927. The type material is in the United States National Museum.

Distributional records. — United States records are limited to Florida. Florida distribution of *littoralis* by counties is: Dade County: Everglades National Park, Homestead; Hillsborough County: Tampa; Levy County, Cedar Keys; Monroe County: Big Pine Key, Conch Key, Duck Key, Grassy Key, Greyhound Key, Key Largo, Key Vaca, Lower Matecumbe Key, Stock Island, and Garden Key (of the Dry Tortugas Islands, 60 miles west of Key West); Sarasota County: Venice.

Notes. — *Oliarus littoralis* is a member of the *O. concinnulus* group, and seems closest to *O. zyxus*. Diagnostic characters of *littoralis* include the prominent introrse convexity on the median part of the sinistral process and the broad, deep, rectangular excavation of the anal segment as seen in posterior view.

In southern Florida *O. littoralis* is found in the same ecological situations as is *O. viequensis*. Sometimes the two species are taken together in the collecting samples. Male genitalia of the two species are vastly different, but the habitus is similar. Males of the two species can be separated without dissections. *O. littoralis* is usually larger, ranging 4.0 to 4.7 mm whereas *viequensis* ranges 3.2 to 4.1 mm in total length; *littoralis* usually is a tawny brown, *viequensis* usually is black, occasionally fuscous; *littoralis* normally has six anteapical cells in the tegmen, *viequensis* five; the apex of the anal segment of *littoralis* is concave, without a tooth or process, whereas the apex of the anal segment of *viequensis* has a deflexed, acute, apical tooth or process.

Oliarus littoralis is typical of tidal flat situations where salt marsh grasses predominate. Circumstantial evidence points to *littoralis* using these grasses as host

plants, with the nymphs presumably feeding on roots. *O. littoralis* sometimes is associated with *O. viequensis* in the Florida Keys, as previously noted; however, at any one habitat or collecting spot there is a distinct tendency for one species to greatly predominate over the other or be unique. It has been Mead's collecting experience that *viequensis* is more abundant in the *Monanthochloe littoralis* Engelm. grassy tidal flats, and that *littoralis* is more abundant in the tidal flats where taller salt marsh grasses such as *Distichlis spicata* (L.) Greene or *Sporobolus virginicus* (L.) Kunth. predominate. Further investigations are needed to corroborate and add to these observations and to gain a better understanding of the factors involved.

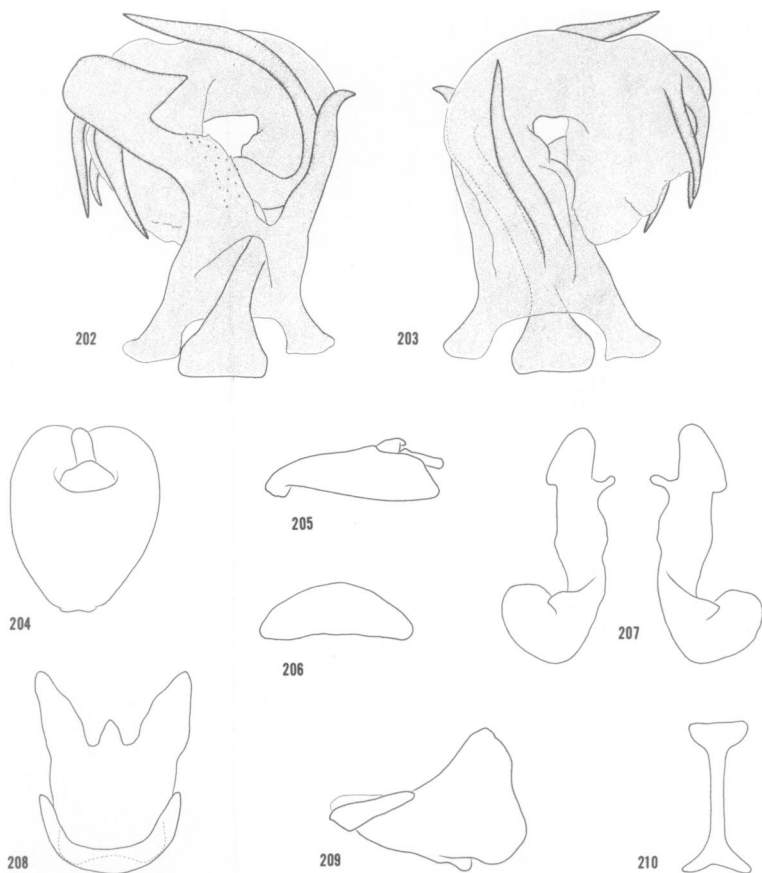
Oliarus sylvaticus Caldwell

Figs. 202-210

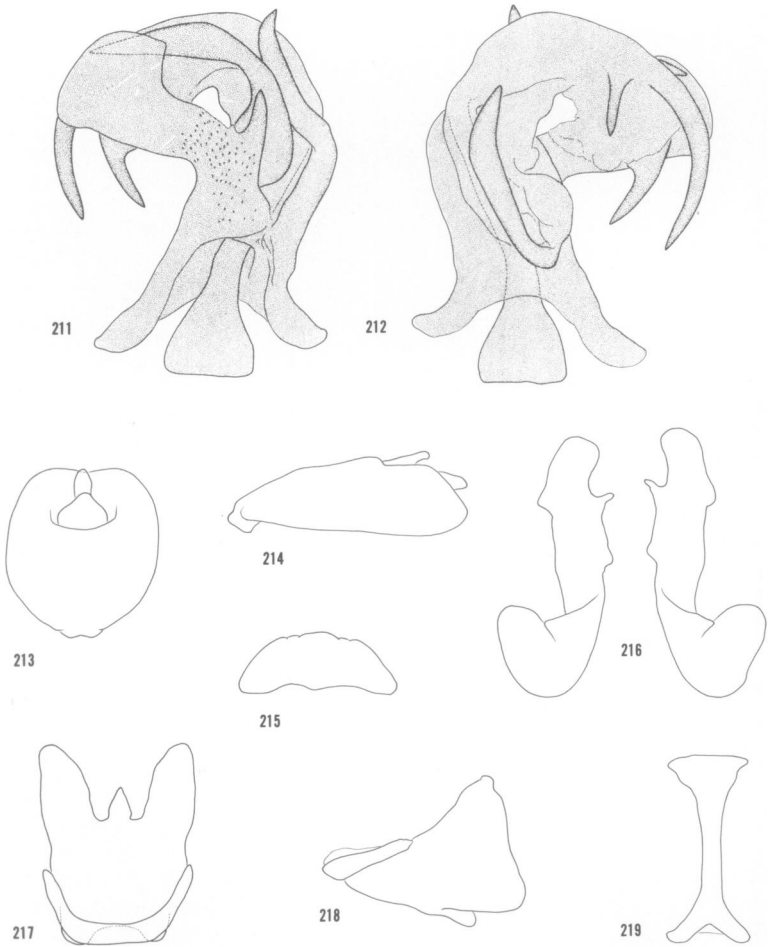
Oliarus sylvaticus Caldwell 1947b:151.

Salient features. — Length of male 3.5 to 4.0 mm (based on three specimens). Ground color of vertex and mesonotum fuscopiceous; carinae of mesonotum varying from brown to dull orange and brownish yellow. *Head:* Vertex moderately narrow, length in middle line greater than width at apex of posterior emargination; median carina short. Face fuscous to fuscopiceous; lateral carinae narrowly pale yellow on frons, becoming dull on postclypeus; median carina yellowish brown, weakly forked at base, prominent on frons, evanescent slightly distad from median ocellus; frons wider than length in middle line. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae narrowly failing to join pale border of posterior margin. Mesonotum with carinae equally prominent or nearly so. Tegmina milky subhyaline; clavus without spots; corium with brownish suffusion at crossveins r-m and m-cu and at apical crossveins; tubercles comparatively large, dark brown, blending with dark veins; usually with 11 apical cells and 5 antepical cells; stigma brownish, approximately twice as long as broad. Legs brown to yellowish without bands.

Male genitalia. — Aedeagal complex as in figs. 202 and 203; total pointed processes seven. Periandrium with four processes; dextral process entire, extending caudad to level of aedeagal joint, fairly straight except curving right at apex; sinistral process large, directed left-caudad, inner subapical portion triangulately produced and directed to the right, no inner subprocess, spicules common on basal half of process; median apical area with long curving process primarily directed to the left; dorsally with long slender process inserted basally, directed caudad primarily, and extending to, almost to, or slightly beyond basal posterior margin of flagellum. Flagellum with three moderate-sized apical processes of fairly equal length, the apical parts of all three visible from either dorsal or ventral view. Styles as in fig. 207; symmetrical or nearly so, rounded and recurved apically; inner process short, pointed. Connective as in fig. 210; rather slender, combined width of ventral arms slightly greater than width of base in posterior aspect. Pygofer as in figs. 208-209; medioventral process in ventral aspect short, triangular, broadest at base, extending posteriorly less than half the distance to level of apices of pygofer



FIGURES 202-210. Male genitalia of *O. sylvaticus* Caldwell, from holotype. 202, aedeagus in ventral view. 203, aedeagus in dorsal view. 204, anal segment in dorsal view. 205, anal segment in left lateral view. 206, anal segment in posterior view. 207, styles in broad inner aspect. 208, pygofer in ventral view. 209, pygofer in left lateral view. 210 connective in posterior view.



FIGURES 211-219. Male genitalia of *O. zyxus* Caldwell, from paratype Torreon, Coahuila, Mexico. 211, aedeagus in ventral view. 212, aedeagus in dorsal view. 213, anal segment in dorsal view. 214, anal segment in left lateral view. 215, anal segment in posterior view. 216, styles in broad inner aspect. 217 pygofer in ventral view. 218, pygofer in left lateral view. 219, connective in posterior view.

lateral lobes; pygofer lobes in ventral aspect slightly diverging; in lateral aspect symmetrical or nearly so, lateral margins broadly rounded caudally. Anal segment as in figs. 204-206; in dorsal aspect nearly symmetrical, flaplike, moderately broad, longer than wide, medioapical margin straight or slightly concave; in caudal view nearly symmetrical, ventral profile nearly straight, slightly concave.

Types. — The type series listed by Caldwell was “male holotype and paratype, and female allotype from Oak Grove, California, June 3, 1946 (D.J. and J.N. Knull), OSU” [Ohio State University collection]. All were examined.

Distributional records. — Other specimens examined included a male from Boulevard, California, VI-12-51 (D.J. and J.N. Knull) Ohio State University collection, and a male from San Diego, California, 6-7-13 (E.P. Van Duzee) California Academy of Sciences collection (previously determined as *Oliarus concinnulus*).

Notes. — *Oliarus sylvaticus* is apparently a rare member of the *O. concinnulus* Fowler group. It is very close to an atypical form placed under *O. zyxus* Caldwell below. Possibly future studies will show that one or two of the variations included under *zyxus* should be placed under *sylvaticus*, or that *sylvaticus* should be synonymized under *zyxus* as one of its many variations. A principal difference between *sylvaticus* and *zyxus* is in the shape of the sinistral process. The apical part is shaped differently, and the inner basal part in *sylvaticus* lacks the toothlike sub-process present in nearly all variations of *zyxus* and in other species of the *concinnulus* group. The dorsal periandrial process of *sylvaticus* is longer and straighter than normally present in the other species of the *concinnulus* group.

O. sylvaticus is known only from San Diego County, California from habitats characterized by desert oaks. All of the specimens studied were taken in early June.

Oliarus zyxus Caldwell

Figs. 211-241

Oliarus zyxus Caldwell 1947a:76.

Salient features. — Length of male 3.4 to 5.3 mm (based on 130 specimens). Ground color of vertex piceous to fuscous, mesonotum usually piceous, but some specimens fuscous, or even mixed with testaceous, mesonotal carinae variable in color but usually dull orange or yellow-brown, occasionally concolorous, in various degrees, with intercarinal areas of mesonotum. *Head:* Vertex narrow to moderately broad, usually narrow, with length in middle line usually distinctly greater than width at apex of posterior emargination; some specimens having width as great as length or even slightly greater; median carina absent or very short. Face usually fuscous but variable from fuscopiceous on one extreme to yellowish brown on the other; median carina, with few exceptions, prominently traversing whole face, yellowish, weakly forked at base; lateral carinae prominent pale yellow from base to apex of postclypeus, broader on frons, especially at epistomal suture; frons moderately broad, width greater than length in middle line. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae narrowly separate or occasionally tangential to pale band of

posterior margin. Mesonotum with all carinae prominent. Tegmina without prominent spots or bands; apical crossveins usually weakly infuscate, commissure with usual dark area basad of Y-vein juncture; tubercles not prominent; veins usually a fairly uniform light brown; apical cells normally 11 and anteapical cells 5 or 6; stigma roundish, approximately twice as long as wide. Legs without banded pattern.

Male genitalia. — Aedeagal complex as in figs. 211 and 212; total pointed processes seven to nine, depending upon variation and interpretations. Periandrium with at least four, sometimes five processes, counting the sinistral process as one; dextral process prominent, varying from medium-sized, straight and stout, to long, variously curved, and moderately slender; sinistral process variously expanded to the left, the caudal margin usually excavate between two pointed or semipointed expansions, thus forming a crude outside "caliper-shaped" process; shape of sinistral process highly variable as shown in figs. 220 to 241; spicules usually abundant on ventral surface of basal half of sinistral process; medioapical area of ventral periandrium with prominent process curving to the left, varying from uniformly slender in some specimens to combination of slender and stout in other specimens; dorsal periandrium with a mediobasal process extending primarily caudad, usually making slight bend to the left in distal half, and superimposed over the aedeagal apodeme, with apex of process usually slightly surpassing level of aedeagal joint, left apical area of dorsal periandrium without a short pointed process in most specimens but with such a process in minority of specimens. Flagellum directed to left and with three processes in the apical and subapical area; shortest of these processes variously located in the subapical dorsal side of the flagellum and directed cephalad; all three flagellar processes somewhat variable in length and shape, although consistent in being fairly slender. Styles as in fig. 216; symmetrical, rather long, recurved apically, and with inner processes short and pointed. Connective as in fig. 219; moderately long and slender; combined width of ventral arms equal or nearly equal to the width of the base in posterior aspect. Pygofer as in figs. 217-218; symmetrical or nearly so; medioventral process in ventral aspect longer than wide, acute, rather short, triangulate, widest at base in some specimens, slightly constricted at base in other specimens; extending posteriorly approximately half the distance to level of apices of pygofer lateral lobes; lateral lobes stout in ventral aspect, moderately produced and rounded in lateral aspect. Anal segment as in figs. 213-215; in dorsal view nearly symmetrical, rather broad, but with length exceeding width in nearly all specimens (an occasional specimen with width equal to length); medioapical margin straight or slightly concave; apex in caudal view with ventral profile slightly concave and sinuate but primarily fairly straight.

Types. — Caldwell listed the male holotype of *Oliarus zyxus* and a paratype from Nuevo Laredo, Nuevo Leon, Mexico, September 22, 1941 (DeLong, Good, Caldwell, and Plummer). Another male paratype was collected at Torreon, Coahuila, Mexico, "(M B 237, Dampf)." All three of these specimens in the United States National Museum were studied. The Nuevo Laredo types have the additional information "30 miles south" on the locality label. "Dampf" is not on the collector label of the other paratype; apparently Caldwell recognized A. Dampf as the collector by the style of the label.

Distributional records. — Male specimens of *O. zyxus* have been collected in the following areas: CANADA: British Columbia; MEXICO: Coahuila, Nayarit, Nuevo Leon, and a few islands in the Gulf of California; UNITED STATES: Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Texas, and Utah.

Notes. — Superficially, *O. zyxus* resembles all the other members of the *O. concinnulus* group plus several other moderately small species of *Oliarus* of the southwestern United States and northern Mexico. *O. zyxus* can be distinguished from *O. sylvaticus* by the shape of the sinistral process. *O. concinnulus* and *O. altanatus* have extremely slender dextral processes not found in any of the *zyxus* variants and have differently shaped sinistral processes that normally lack spicules that are always present in the forms of *zyxus*. *O. littoralis* has an extreme convexity or "hump" on the margin of the sinistral process which is not developed to this degree in *zyxus*. *O. littoralis* has a unique apex of the anal segment and apparently is endemic to Florida. *O. corvinus* Ball differs from *zyxus* by the reduced size and different shape of the sinistral process, the shorter, stouter, and differently located apical and subapical processes of the flagellum, and the very stout medioapical process of the ventral perianthrium. *O. dondonius* Ball is the species most often having forms resembling *zyxus*, but *dondonius* has a preapical flagellar process that is different in shape and position from its counterpart in *zyxus*, the process being unusually short and directed primarily to the left or left-caudad from its base on the left caudodorsal position of the flagellum in *dondonius*. In *zyxus* this flagellar process is longer, directed cephalad, and is not inserted at the extreme left-caudodorsal position. In most specimens of *dondonius*, the sinistral process has a very characteristic deeply U-shaped excavation in which the cavity is deeper than the distance across the opening as viewed in ventral aspect, a condition not approached by *zyxus* except in some of the uncommon variants. All specimens presently interpreted as *zyxus* have at least a few spicules on the sinistral process. These spicules are not found on the sinistral process of *dondonius*.

The variations so prevalent in *O. zyxus* can be associated with geography to a considerable extent. Specimens with the forked subprocess of the sinistral process (figs. 228-229) apparently are restricted to the Gulf Coast of Texas from Brownsville, Cameron County, to Cedar Lake, Matagorda County. Specimens with a wrench-like sinistral process (figs. 237 and 240) seem to be restricted to southern Texas, the records so far being from Lake Corpus Christi and the counties of Kinney, Uvalde, and Val Verde. Sinistral processes of approximately the form exhibited in the type series (fig. 211) are the most prevalent and have been seen in specimens from the Texas counties of Medina, Terrell, Val Verde, Webb, and Zavala; the New Mexico counties of Chaves, Eddy, Hidalgo, Otero, Socorro, and Valencia; the Arizona counties of Cochise, Maricopa, Pima, Santa Cruz, and Yavapai; the Utah County of Sevier, and the California counties of Inyo, Orange, San Diego, and Ventura. Specimens from Craig, Moffatt County, Colorado and Benjamin, Utah County, Utah, have long, twice-curved dextral processes and usually have sinistral processes produced at both the inner and outer angles of the apex (figs. 220 and 234). Other variations of the sinistral process not far removed from those of typical forms include forms from Clarion, Idaho, (fig. 223); Deep Spring,

Inyo County, California (fig. 222); Carson City, Ormsby County, Nevada (fig. 221); and 11 miles north of Nixon, Washoe County, Nevada. Forms from Los Angeles County, California (figs. 238 and 241); have the right basal portion of the sinistral process swollen. Another type of sinistral process shown in figs. 230 and 231 is present, with slight variations, on specimens from Del Puerto Canyon, Stanislaus County, California; Palm City, San Diego County, California and San Blas, Nayarit Mexico. This is one of the most distinctive variant forms. Yet another form, in which variation of the sinistral process possibly is discontinuous, is shown in figs. 235 and 236 (sinistral process). This particular form is represented by four male specimens collected one mile north of McKittrick, Kern County, California, April 16, 1966, by C.W. O'Brien, on *Atriplex spinifera* Macbride, and by one male from Los Angeles, California, in the P.R. Uhler collection in the United States National Museum. A specimen from Isla Raza, Gulf of California, Mexico, has a sinistral process slightly different from United States forms. Specimens from Shasta County, California (fig. 233); Medford, Jackson County, Oregon (fig. 234); and Vernon, British Columbia, Canada (fig. 232) exhibit considerable similarity in their sinistral processes as well as in other structures.

Another variable structure in *O. zyxus* is the short, acute process located at the left apex of the dorsal perianthium of some specimens. Most specimens lack this short process, but when present it usually extends dorsally or toward the left.

Oliarus zyxus is one of the most common and widespread species in western North America. It is also one of the most variable species, and future studies may demonstrate that forms included above as variants of *zyxus* are in reality separate species. The presence of certain intermediate specimens, the lack of biological data, and the paucity of specimens in certain variant groups are reasons for not proposing new taxa in the *zyxus* complex of forms at this time.

Habitat and host labels on specimens of *O. zyxus* include: "sweeping grass," "*Carex* sp.," "*Baccharis sergiloides*" [Gray], "*Monadra citriodora*" [Cerv.], "at night on *Atriplex spinifera*" [Macbride], "at blacklight."

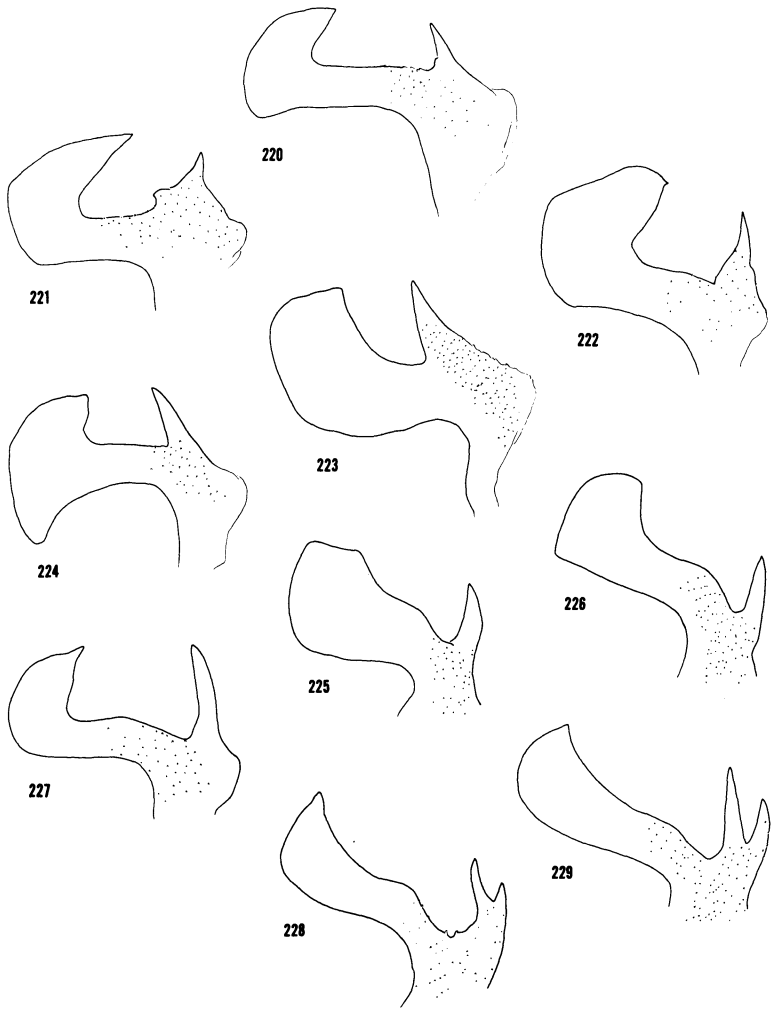
The known seasonal distribution of *O. zyxus* extends from March 25 to November 27, but only two records are available for October and November.

***Oliarus dondonius* Ball**

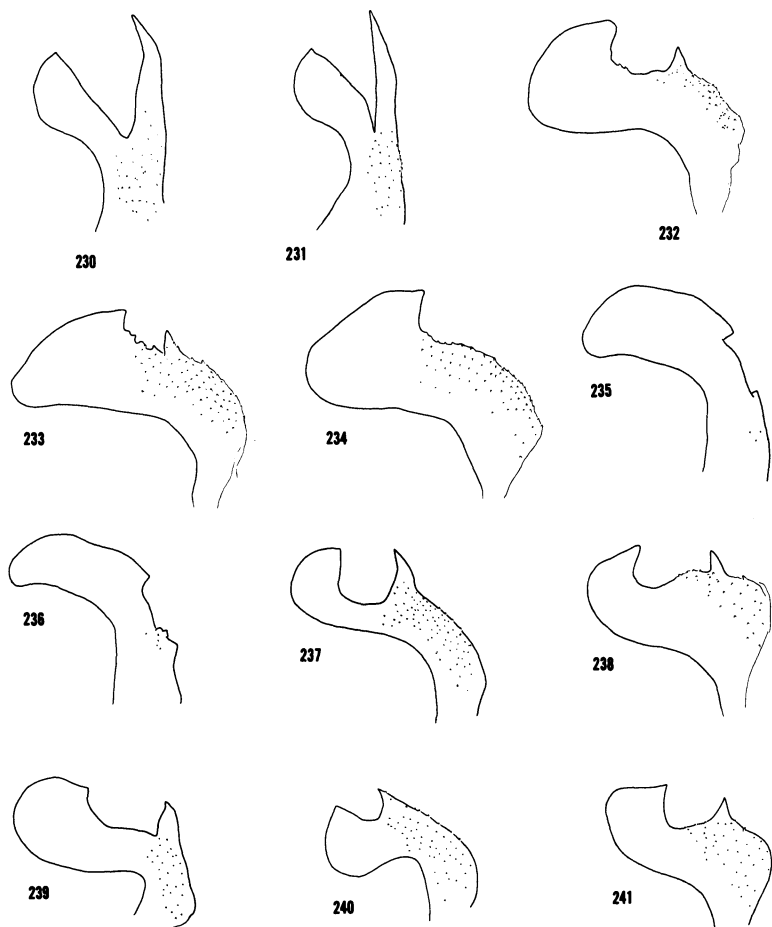
Figs. 242-254

Oliarus dondonius Ball 1934:276.

Salient features. — Length of male 3.6 to 4.7 mm (based on 103 specimens). Ground color of vertex and mesonotum highly variable, from ochraceous at one extreme through various shades of brown to fuscipiceous on the other extreme; mesonotal carinae varying from pale yellow to yellow-brown. *Head:* Vertex as in fig. 3; narrow to broad, usually distinctly longer in middle line than wide at apex of posterior emargination, but some specimens with width greater than length; median carina feeble. Face varying from ochraceous to fuscipiceous; median and lateral carinae conspicuous and broadly pale yellow on frons, less so on postclypeus; median carina weakly forked at base, extending through anteclypeus; frons moderately broad, width greater than length in middle line. Rostrum short, not attaining

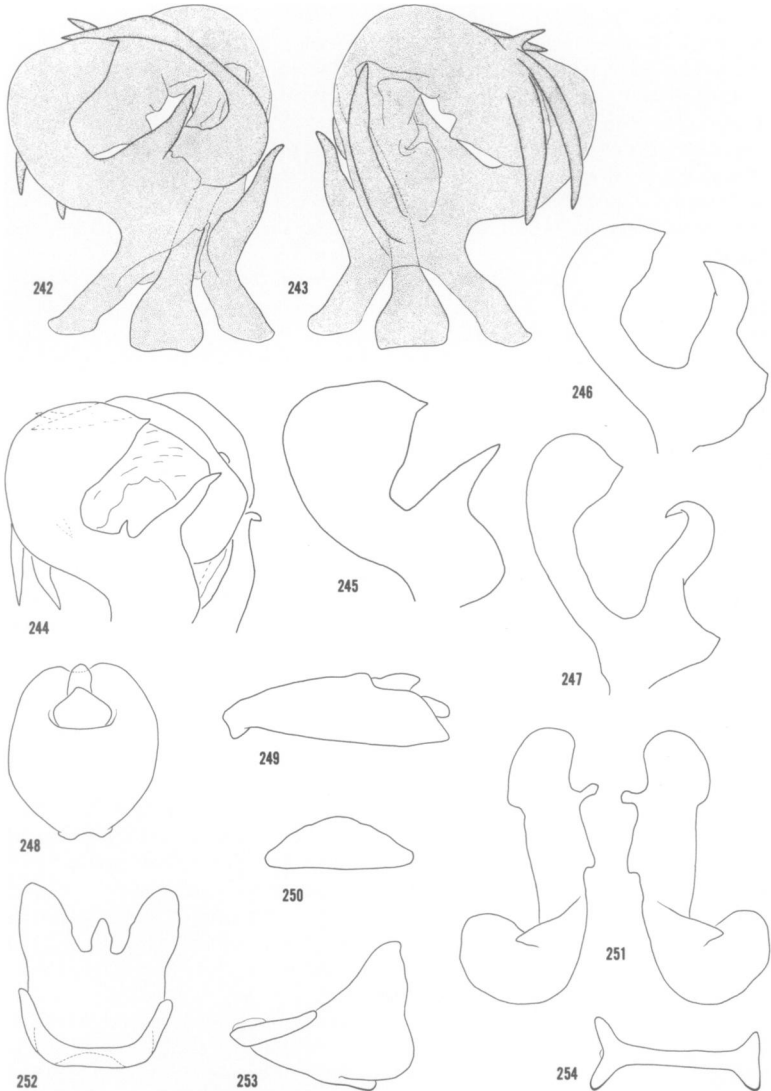


FIGURES 220-229. Male genitalia of *O. zyxus* Caldwell, variations of the sinistral process of the aedeagus in ventral view from various localities. 220, Benjamin, Utah. 221, Carson City, Nevada. 222, Inyo Co., Calif. 223, Clarion, Idaho. 224, Benjamin, Utah. 225, Rodeo, N.M. 226, Val Verde Co., Tex. 227, Yavapai Co., Ariz. 228, Brownsville, Texas. 229, Cedar Lane, Texas.



FIGURES 230-241. Male genitalia of *O. zygus* Caldwell, variations of the sinistral process of the aedeagus in ventral view from various localities. 230, Stanislaus Co., Calif. 231, San Blas, Nayarit, Mexico. 232, Vernon, B.C. 233, Shasta, Co., Calif. 234, Medford, Oregon. 235, Kern Co., Calif. 236, Kern Co., Calif. 237, Kinney Co., Texas. 238, Los Angeles Co., Calif. 239, San Diego Co., Calif. 240, Val Verde Co., Texas. 241, Los Angeles Co., Calif.

FIGURES 242-254. Male genitalia of *O. dondonius* Ball, from paratype Tucson, Ariz. 242, aedeagus in ventral view. 243, aedeagus in dorsal view. 244, aedeagus in ventral view from Mendota, Calif. Sinistral process of aedeagus in ventral view. 245,



Chaves, N.M. 246, Los Banos, Calif. 247, Sacramento, Calif. 248, anal segment in dorsal view. 249, anal segment in left lateral view. 250, anal segment in posterior view. 251, styles in broad inner aspect. 252, pygofer in ventral view. 253, pygofer in left lateral view. 254, connective in posterior view.

caudal margin of posterior trochanters. *Thorax*: Pronotum as in fig. 3; intermediate carinae tangential to or joining pale border of posterior margin. Mesonotum as in fig. 3; carinae usually equally prominent. Tegmina with dark areas confined to narrow infuscation along apical crossveins, to crossveins r-m and m-cu, and to a short distance along commissure immediately basad of Y-vein juncture; tubercles not prominent, usually concolorous with veins which tend to be pale yellow or light brown on basal half to two-thirds of tegmen, medium to dark brown in apical area; apical cells normally 11 and anteapical cells 5; stigma variable from pale yellow to medium brown, its length a little more than twice the width. Legs unbanded.

Male genitalia. — Aedeagal complex as in figs. 242-247; total pointed processes eight or nine depending upon variation and interpretation of structures. Perianthrium usually with four processes, occasionally with an extra dorsal process; dextral process entire, comparatively short (not surpassing level of aedeagal joint), usually fairly straight except some specimens with apex curved somewhat; sinistral process greatly expanded left-caudad into a cheliform process with long axis of concavity usually directed approximately 45 degrees right-caudad; apical prong much thicker than basal prong or subprocess; basal prong usually straight, occasionally curved, sometimes slightly serrate or crenulate along right basal area; concavity deeper than distance between apices of "jaws"; without spicules; medioventral area of perianthrium giving rise to a thick process directed to the right initially, then recurving to a left-caudad direction primarily and becoming long and slender; dorsal perianthrium with a moderately stout, fairly straight process originating mediobasally and extending superimposed over apodeme of aedeagus to level of joint of aedeagus; left apical perianthrium without short process in most specimens, but occasionally with a short, pointed process. Flagellum directed to the left and with two similar medium-sized apical processes directed cephalad, the more dorsal process somewhat larger and longer; left dorsal subapical area of flagellum with a short, slender, acute process which is normally directed left or left-caudad; a lightly sclerotized, short, tooth-like process occurring occasionally on the apical membranous part of the flagellum tending to be directed right-cephalad, usually hidden from view by overlying processes; occasionally a very short, broadly pointed, cryptic process present in the left dorsal area of the flagellum, hidden from direct ventral or dorsal view (thus flagellum with at least three fairly conspicuous processes and sometimes with one or two other short, cryptic processes). Styles as in fig. 251; symmetrical or nearly so; shafts broader basally, abruptly thinner near midlength of inner margin; apex enlarged and recurved; inner processes short and pointed. Connective as in fig. 254; moderately long and slender; combined width of ventral arms greater than width of base in posterior aspect. Pygofer as in figs. 252-253; symmetrical; medioventral process in ventral aspect subtriangular, longer than wide, not or very slightly constricted at base; process extending posteriorly approximately half the distance to level of apices of pygofer lateral lobes; lateral lobes thick in ventral aspect, moderately produced and rounded in lateral view. Anal segment as in figs. 248-250, in dorsal aspect nearly symmetrical, rather short and broad, length but little greater than the width; medioapical margin variable, sometimes slightly convex, usually slightly concave; in caudal aspect the ventral profile normally straight or nearly so.

Types. — Ball listed the type material as follows: "Holotype female, allotype male, and 10 paratypes, Tucson, Ariz. July 24, 1930, 4 paratypes, Grand Junction, Colorado, Aug. 7, 1906, all taken by the writer on sea blite (*Dondia*)." This type material is in the United States National Museum.

Distributional records. — The range of *O. dondonius*, as determined by specimens studied, is as follows: CANADA: Alberta, Manyberries; British Columbia, Osoyoos. MEXICO: Gulf of California and Baja California, Mulege, San Francisco Island, San Lorenzo Island, and Santa Inez Island. UNITED STATES: Arizona, California, Colorado, Nevada, New Mexico, Oregon, Texas, Utah.

Notes. — *Oliarus dondonius* is a member of the *O. concinnulus* group. Within the *concinulus* group, *dondonius* apparently is closest to *O. zyxus*, under which differences between the two species are discussed. Probably the two most distinctive characteristics separating *dondonius* from the other members of the *concinulus* group are the greatly enlarged, deeply and rather narrowly excavate, cheliform sinistral process of the perianthium and the short, left-directed, preapical process of the flagellum.

Variation in *O. dondonius* is common. In addition to that previously mentioned, the interior margin of the U-shaped excavation of the cheliform process occasionally has one or two short teeth. Also, in habitus *dondonius* varies from a rusty ochraceous color to dark brown or black.

Ball (1934) wrote that *Oliarus dondonius* "is common in alkaline areas from western Colorado through Utah to Arizona and Sonora, Mexico." Host or habitat labels on male *O. dondonius* studied include the following: "*Atriplex bracteosa*" [(Durand and Hilgard) Watson; = *A. serenana* A. Nelson]; "*Atriplex hastata* L."; "*Atriplex rosea* L."; *Atriplex torreyi* S. Wats."; "black sage" [presumably *Artemisia nova*]; "collected on cotton" [*Gossypium* sp.]; "on corn" [*Zea mays* Linnaeus]; "*Dondia*"; "*Dondia* spp."; "*Dondia nigra*" [(Raf.) Standl.; = *Suada nigra* (Rafinesque) MacBr.] "*Houstonia*"; "potato" [*Solanum tuberosum* Linnaeus]; "*Salicornia*"; "*Salsola pestifer*" [Nelson]; "swept from rice" [*Oryza sativa* Linnaeus].

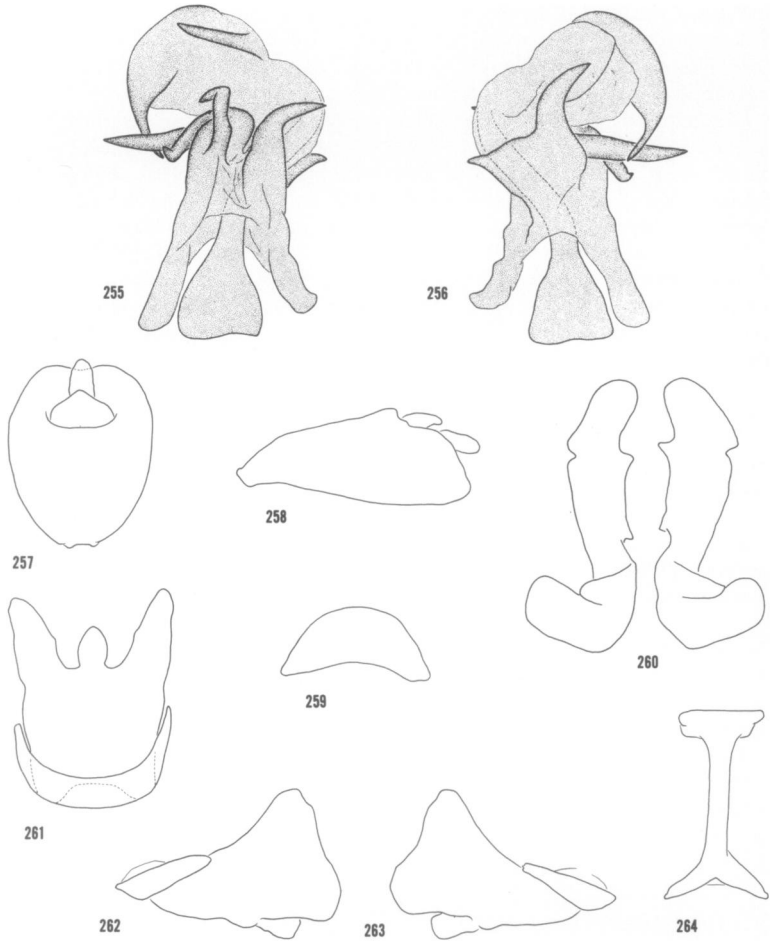
The earliest known collecting date for *O. dondonius* is March 27 and the latest is September 15.

***Oliarus sablensis* Caldwell**

Figs. 255-264

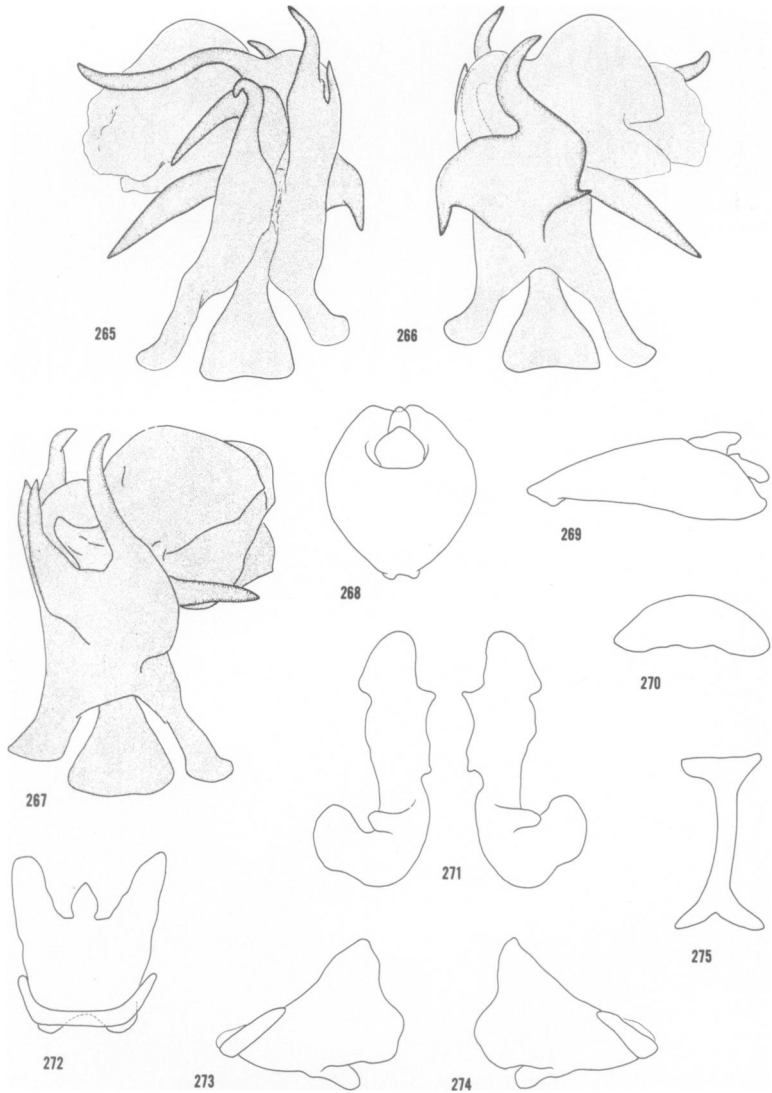
Oliarus sablensis Caldwell 1951:34.

Salient features. — Length of male 3.4 to 4.4 mm (based on 85 specimens). Ground color of vertex, mesonotum and face fuscous in most specimens, occasionally piceous or fuscocastaneous; mesonotal carinae usually concolorous, occasionally a contrasting orange. *Head:* Vertex elongate, length in middle line greater than width at apex of posterior emargination; width approximately five-sixths the length; median carina absent or very short. Face fuscous to piceous, with median carina orange, yellow or brownish yellow and well elevated throughout its length, the basal fork small; lateral carinae usually pale yellow to brownish yellow, usually conspicuous throughout length; maculae absent; frons narrow, width only slightly

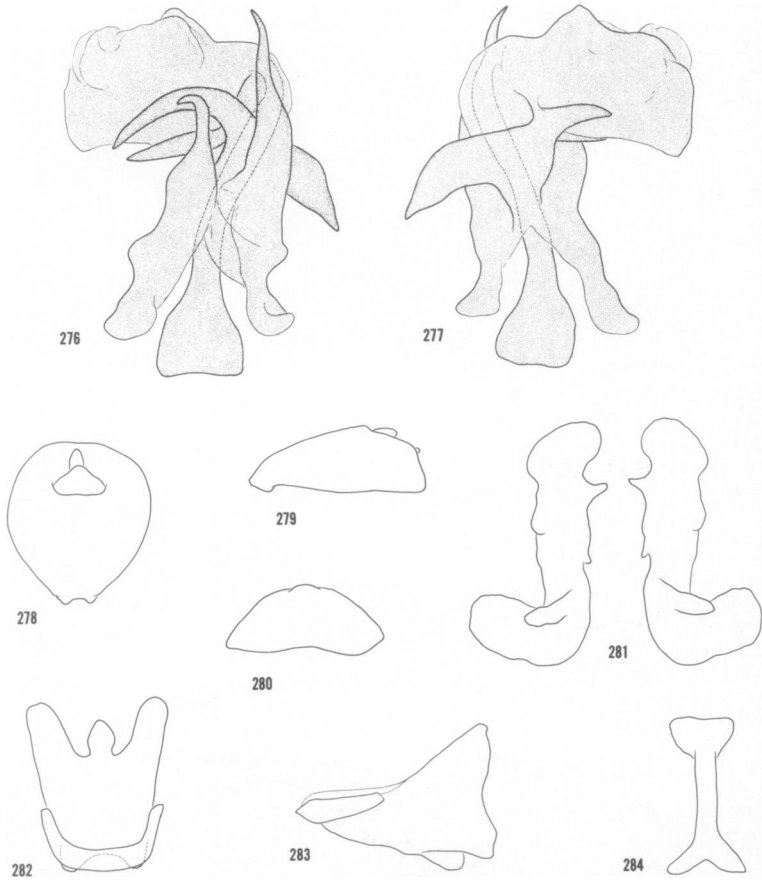


FIGURES 255-264. Male genitalia of *O. sablensis* Caldwell, from holotype. 255, aedeagus in ventral view. 256, aedeagus in dorsal view. 257, anal segment in dorsal view. 258, anal segment in left lateral view. 259, anal segment in posterior view. 260, styles in broad inner aspect. 261, pygofer in ventral view. 262, pygofer in left lateral view. 263, pygofer in right lateral view. 264, connective in posterior view.

FIGURES 265-275. Male genitalia of *O. chuliotus* Ball, from allotype. 265, aedeagus in ventral view. 266, aedeagus in dorsal view. 267, aedeagus in dorsal view,



Hocking Co., Ohio. 268, anal segment in dorsal view. 269, anal segment in left lateral view. 270, anal segment in posterior view. 271, styles in broad inner aspect. 272, pygofer in ventral view. 273, pygofer in left lateral view. 274, pygofer in right lateral view. 275, connective in posterior view.



FIGURES 276-284. Male genitalia of *O. bispinus* Caldwell, from holotype. 276, aedeagus in ventral view. 277, aedeagus in dorsal view. 278, anal segment in dorsal view. 279, anal segment in left lateral view. 280, anal segment in posterior view. 281, styles in broad inner aspect. 282, pygofer in ventral view. 283, pygofer in left lateral view. 284, connective in posterior view.

greater than length in middle line. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax*: Pronotum with intermediate carinae usually narrowly separated from pale border of posterior margin. Mesonotum with prominent carinae, the intermediate pair less distinct. Tegmina usually nearly immaculate, some specimens slightly infuscated at apical crossveins and numerous specimens with tegmina presenting a vague dusky appearance; tubercles not prominent, concolorous with yellowish to light brown veins which become darker brown apically; apical cells normally 10 and anteapical cells 5, variation fairly common; stigma medium brown, short, with length one and one-half times to twice the width.

Male genitalia. — Aedeagal complex as in figs. 255 and 256; total pointed processes eight (but differences in interpretation or counting of adventitious sub-process could change total from seven to nine). Periandrium with six processes, not counting adventitious subprocesses; dextral process usually long, extending caudad past aedeagal joint, tapered, fairly straight, usually curving to the right apically, in a few specimens unequally forked in distal third, with this fork or subprocess developing right-laterad; sinistral process somewhat shorter than the dextral process; swollen or undulate in most of basal two-thirds, narrowed apically, apex uncinata, usually curving 90 degrees to the left; median ventroapical area giving rise to moderately prominent process which curves left-cephalad after initial caudal direction, this process variable, distal half in some specimens fairly straight, in others continuously curving; inner left apical area giving rise to a fairly straight, tapering, acuminate, left-directed process, usually extending left to left of apex of flagellum; dorsal periandrium with prominent sclerotized plate giving rise to two pointed processes, the larger one extending caudad and curving to the left, the smaller one directed right-laterad; processes somewhat variable. Flagellum directed to the left and with two processes, one of which is ventrobasal, generally slender, highly variable in length, the other apical and variable in length and quite short in a few specimens. Styles as in fig. 260; apex of each shaft rounded and recurved at approximate 125 degree angle, apex of recurved portion bluntly rounded; inner processes rather short, broadly pointed. Connective as in fig. 264; moderately slender; combined width of ventral arms slightly broader than base of shaft in posterior aspect. Pygofer as in figs. 261-263; medioventral process in ventral view somewhat ovate, slightly constricted at base, apex broadly pointed; extending posteriorly more than half the distance to level of apices of pygofer lateral lobes; lateral lobes moderately produced, apices broadly rounded, nearly symmetrical. Anal segment as in figs. 257-259; in dorsal view symmetrical, short and broad, the width in most specimens almost as great as the length; medioapical margin nearly straight, usually slightly concave; in caudal aspect ventral profile slightly concave.

Type. — *Oliarus sablensis* was described from the holotype male. Cape Sable, Monroe County, Florida, February 14, 1950, (J.S. Caldwell). It has been examined and illustrated and is in the United States National Museum.

Distributional records. — Numerous specimens of *O. sablensis* were examined from CANADA: Nova Scotia, Kings County; Ontario, London and Mer Bleue; UNITED STATES: District of Columbia and states of Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Minnesota,

New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and West Virginia.

Notes. — *Oliarus sablensis* is a member of the group that contains *O. bispinus* Caldwell and *O. chuliotus* Ball. These three species can be separated by the aedeagal complex only, as discussed under *chuliotus* of the *chuliotus* group. *O. sablensis* is so close to *chuliotus* that it can be separated only by the presence of the apical process on the flagellum. *O. sablensis* has a distinct process in most specimens, but some of the examples from Ohio and New York, for instance, have much reduced apical processes. No specimen from the southern United States was seen with a really short apical process.

Oliarus sablensis bears a superficial resemblance to several other species, one of which is *O. ecologus* Caldwell. *O. sablensis* and others of the *chuliotus* species group can be separated from *ecologus* by examination of the male terminalia *in situ* or, in case of doubt, very obvious differences can be observed after dissection of the male genitalia (see discussion of *O. ecologus*).

The range of *O. sablensis* extends from Nova Scotia on the northeast through most of the eastern seaboard states to the southern tip area of Florida, north and northwest from Tennessee to Ontario and Minnesota.

Habitat data on the labels of *O. sablensis* males determined include: meadow, herbaceous vegetation, taken in open field, savannah grasses, *Carpinus*, *Populus alba* Linnaeus, *Quercus alba* Linnaeus, *Alnus rugosa* (Du Roi) Sprengel on weeds, "Fish Hatch. Brook.", *Andropogon furcatus* [= *Andropogon gerardi* Vitman], and *Spartina* sp.

On a continental basis, the collection records appear to be in keeping with Hopkin's bioclimatic law. In south Florida the earliest record is February 14 (holotype). At Gainesville, in north central Florida, adults have been collected from early April to the last of May, with peak numbers coming in late April and early May. In the northern part of its range, records extend from late May to late July in the United States, with June being the peak month. The Mer Bleue, Ontario, Canada, specimens were collected August 9, 1932.

Oliarus chuliotus Ball

Figs. 265-275

Oliarus chuliotus Ball 1934:271.

Oliarus gladensis Caldwell 1951:35. New Syn.

Salient features. — Length of male 3.8 to 4.9 mm (based on 36 specimens). Ground color of vertex and mesonotum medium brown to brownish black; mesonotal carinae from concolorous to contrasting orange. *Head:* Vertex varying from moderately narrow to moderately broad, the length in middle line varying from distinctly less than, to equal to width at apex of posterior emargination; median carina variable, usually short and feeble. Face various shades of brown; carinae prominent, orange; maculae absent; frons wider than long in middle line. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually joining pale band of posterior margin but in some specimens tangential to or slightly separated from posterior margin.

Mesonotum with carinae fairly prominent, intermediate pair slightly weaker than other carinae. Tegmina usually nearly immaculate, most specimens with only slight brownish suffusion at apical crossveins, other specimens with membranes of basal half of tegmen moderately fumose with brown or with entire tegmen slightly dusky in addition to fuscous at apical crossveins; tubercles concolorous, not prominent; veins generally brownish throughout; apical cells normally 10, anteapical cells 5; stigma a distinct roundish, short, brownish area usually less than twice as long as broad. Legs brown basally, pale yellow distally, unbanded.

Male genitalia. — Aedeagal complex as in figs. 265-267; usually with seven pointed processes, rarely with only six, occasionally with adventitious subprocesses or forks which would increase the total to eight or more if counted. Periandrium usually with six processes, two of which are dorsal; dextral processes well developed, usually fairly straight, unforked, long, and acuminate, extending caudad of aedeagal joint, apex straight or curving slightly left; some specimens with dextral process having a short lateral fork or subprocess originating approximately two-thirds the distance from the base of the process; sinistral process well developed but shorter than dextral process, its basal half swollen but directed straight caudad, apical part thinner and usually ending in a short hook to the left, the recurvature usually approximately 180 degrees; median apical area giving rise to a moderate-sized process directed caudad then curving left-cephalad, usually fairly straight apically but in a few specimens curving throughout length and almost completing a loop; inner left apical area giving rise to a prominent process directed primarily to the left; dorsal periandrium with sclerotized mass giving rise to two pointed processes both variable in shape and length, but the left one nearly always longer than the right one, the latter extending right-laterocephalad sufficiently far to be seen when complex is arranged for ventral view, but some specimens (from Illinois, Mississippi, and Ohio, for example) with this right dorsal process longer and directed primarily caudad "over" the flagellum; left process of dorsal periandrium curved variously from nearly straight left to nearly straight caudad. Flagellum directed left and with no apical process, but with a slender basiventral process which is usually slimmer in basal half or at least than the middle portion; this process directed nearly straight left to a variable extent. Styles as in fig. 271; symmetrical; apex of shaft recurved approximately 125 degrees, apex of recurved portion bluntly rounded; inner process fairly short, somewhat fingerlike. Connective as in fig. 275; moderately proportioned; combined width of ventral arms slightly broader than base of shaft in posterior aspect. Pygofer as in figs. 272-274; medioventral process in ventral aspect somewhat ovate, constricted at base, apex broadly pointed, extending posteriorly a little more than half the distance to level of apices of pygofer lateral lobes; pygofer lateral lobes very nearly symmetrical, moderately produced, apices subtruncate, usually slightly convex in lateral view. Anal segment as in figs. 268-270; short, nearly as wide as long; symmetrical; medioapical margin in dorsal aspect usually slightly concave (occasional specimens have straight or slightly convex margins); medioventral profile in caudal aspect usually slightly concave.

Types. — Ball (1934) published the type series as follows: "Holotype female April 17, 1927, allotype male Apr. 18, 1927, paratype females Apr. 17, 1927, and

Apr. 15, 1928, all taken by the writer [E.D. Ball] at Sanford, Fla. A female, Homestead, Fla., May 15, 1928. A male, Eustice, Fla. Apr. 6, 1926, taken by the writer [Ball] and a male, Haw Creek, Fla., Oct. 8, 1887." "Eustice" is misspelled in the publication but is correct on the pin label as "Eustis". Ball's type material is in the United States National Museum.

Distributional records. — Specimens examined include males from ARKANSAS: Howard County; DISTRICT OF COLUMBIA; FLORIDA: Dade, Flagler, Lake, Okaloosa, and Seminole Counties; GEORGIA: Thomasville in Thomas County; ILLINOIS: Charleston in Coles County, DuBois and Elizabethtown in Hardin County; KANSAS: Douglas County; MISSISSIPPI: Okalona in Chickasaw County, Tupelo in Lee County; NORTH CAROLINA: Lake Junaluska in Haywood County; OHIO: Delaware and Hocking Counties; SOUTH CAROLINA: Clemson College in Pickens County.

Notes. — Specimens of *O. chuliotus* require examination of the aedeagal complex for diagnosis. It is close to *O. bispinus* Caldwell and very close to *O. sablensis*, and these three species form a distinct group. They may be separated by the absence of a flagellar process in *bispinus*, a basiventral process on the flagellum in *chuliotus*, and two processes on the flagellum, one ventral, the other apical, in *sablensis*. A few specimens of *sablensis* have the apical process of the flagellum reduced and almost intermediate with *chuliotus*.

The holotype of *O. gladensis*, located in the collection of the United States National Museum, was found to be identical with *O. chuliotus*.

Habitat information on *O. chuliotus* is limited, but there is some evidence from the locality labels that *chuliotus* inhabits mesic situations. At Destin, Florida, it was taken at night by R.E. Woodruff, May 16, 1960, when he was beating turkey oak, *Quercus laevis* Walter. Mr. O.L. Cartwright of the Smithsonian Institution collected a good series of *O. chuliotus* by sweeping cane, *Arundinaria* sp., in bottomland of the Seneca River, Clemson South Carolina.

The known range of *O. chuliotus* includes localities in nine states plus the District of Columbia. The states are all in the southeastern United States except Ohio, Illinois, and Kansas. The northernmost record is Delaware County in central Ohio, the southernmost, Dade County, Florida.

The earliest seasonal record for *O. chuliotus* is February at Paradise Key, Florida. Other Florida records include April, May, and October 8, 1887. Farther north, most of the records are in May, June, and July, and there is one August record.

Oliarus bispinus Caldwell

Figs. 276–284

Oliarus bispinus Caldwell 1947b:150.

Salient features. — Length of male 3.7 to 4.0 mm (based on five specimens). Ground color vertex and mesonotum fuscous to piceous; mesonotal carinae usually concolorous, occasionally weak orange, with median carina usually having the most color. *Head:* Vertex elongate, width variable, but longer in middle than broad at apex of posterior emargination, median carina present, usually extending anteriorly one-third the basal length of the disc, but in some specimens extending nearly one-

half length of disc. Face fuscous to piceous; median carina narrowly orange, color usually more conspicuous on frons; median carina distinctly elevated and with triangle formed by basal fork well calloused; pale color of lateral carinae conspicuous on frons, not or scarcely extending distally to postclypeus; frons rather narrow, width but little greater than length in middle line. Rostrum short, not attaining caudal margins of posterior trochanters. *Thorax*: Pronotum with intermediae carinae narrowly separated from pale band of posterior margin or tangential thereto. Mesonotum with all carinae conspicuous, especially the median one. Tegmina immaculate except for slight brownish suffusion at apical crossveins; commissure darkest immediately basad of union of Y-veins, the dark area gradually fading basally; tubercles moderately prominent, concolorous with brownish veins; apical cells normally 10 and anteapical cells 5; stigma rich brown, distinct, ovoid, length approximately twice the width. Legs dark brown basally, grading to yellowish distally; not banded.

Male genitalia. — Aedeagal complex as in figs. 276 and 277; total pointed processes six. Perianthrium with six processes, two of which are dorsal in origin, in ventral aspect the dextral process unusually long, extending posteriorly over and past the aedeagal joint, stout basally but tapering into a slender, acuminate, slightly sinuous process distally; sinistral process shorter, less tapered than the dextral process, stout basally, with left profile twice repand, apex curving left, uncinately, medioapical area with a prominent falciform process to the left; inner apical area with a fairly straight process emerging and directed to the left; dorsal perianthrium with two processes coming off a common sclerotized area, with the sclerotized area originating to the median basal position, then diverging into two opposed, unequal processes, the left process much the smaller and directed to the left, the right process much thicker, longer and directed to the right, then curving lateroventrad and slightly cephalad. Flagellum directed to the left, without pointed processes, but the cephalodorsal apex with a semirounded sclerotized plate, the caudoventral apex with conspicuous membranous tissue. Styles as in fig. 281; apex recurved more than 90 degrees but less than 135 degrees; apex of recurved portion bluntly rounded; the recurved portion about same width and twice as long as width of shaft of style when viewed in broadest aspect; shaft of style moderately stout, long and straight; inner processes moderately short and slender, and with apices broadly pointed. Connective as in fig. 284; moderately short and stout; combined width of ventral arms slightly greater than width of base of shaft in posterior aspect. Pygofer as in figs. 282-283; symmetrical; medioventral process in ventral view symmetrical, somewhat ovate, broadly pointed; process extending posteriorly approximately two-thirds distance to the level of the apices of the pygofer lateral lobes, lateral lobes in lateral view moderately produced, extending farthest caudad distinctly below midlength of posterior margins, apices slightly variable, subacute. Anal segment as in figs. 278-280; short, almost as wide as long in dorsal aspect, very nearly symmetrical; medioapical margin in dorsal view nearly straight or slightly concave; in caudal view ventral profile slightly concave.

Type. — The type material is limited to the holotype male from Chisos Mountains [Brewster County], Texas, July 17, 1946 (D.J. and J.N. Knull), in the Ohio State University collection.

Distributional records. — Male specimens examined, in addition to the type, include three from the Davis Mountains, Jeff Davis County, Texas (D.J. and J.N. Knull), July 2, 1940, July 23, 1946, and July 28, 1946, Ohio State University collection; one from Uvalde County, Texas, May 11, 1946 (D.J. and J.N. Knull), Ohio State University collection; and two from Big Bend, Brewster County, Texas, June 24, 1947 (R.H. Beamer), University of Kansas collection.

Notes. — *Oliarus bispinus* is a rare species of southwestern Texas. It superficially resembles a small specimen of *O. corvinus*. *O. bispinus* is closest to *O. chuliotus* and *O. sablensis*, the three forming a distinct group. *O. bispinus* is the only one of these three species lacking a ventral, left-directed process originating in the basal area of the flagellum.

The known range of *O. bispinus* is southwestern Texas, primarily in the Chisos Mountains of the Big Bend area and the Davis Mountains that lie approximately 100 to 125 miles northwest of the Chisos Mountains. The only other locality is Uvalde County, Texas, which lies approximately 200 miles due east of the Chisos Mountains.

No specific habitat or host information is available concerning *O. bispinus*, but the known seasonal distribution extends from May 11 to late July or early August.

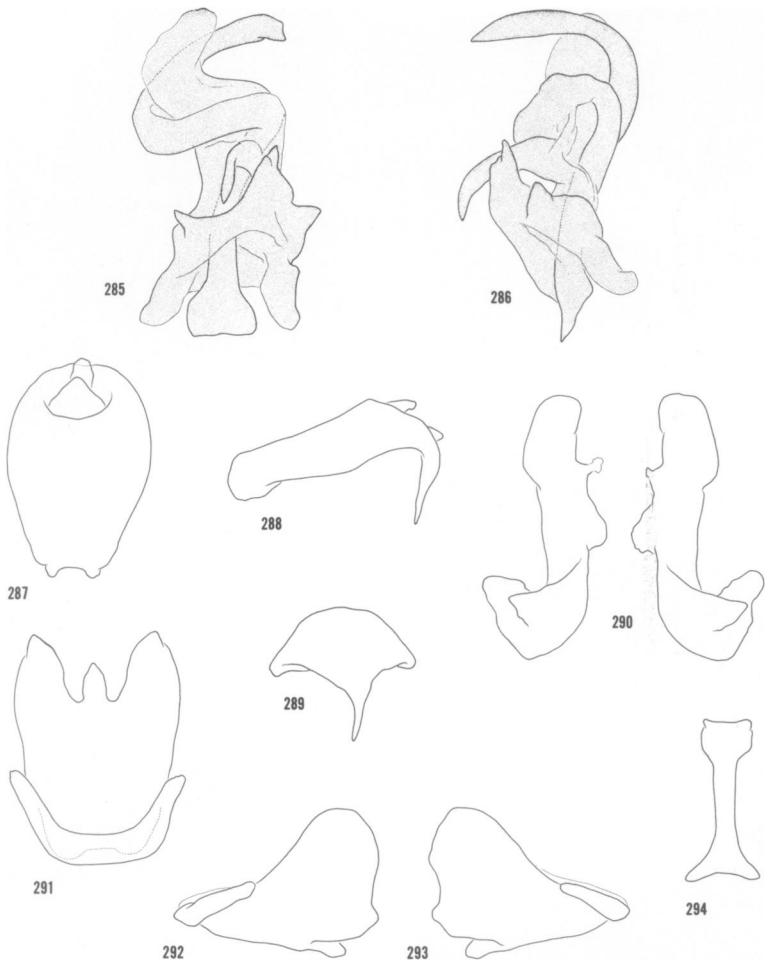
Oliarus acicus Caldwell

Figs. 285–294

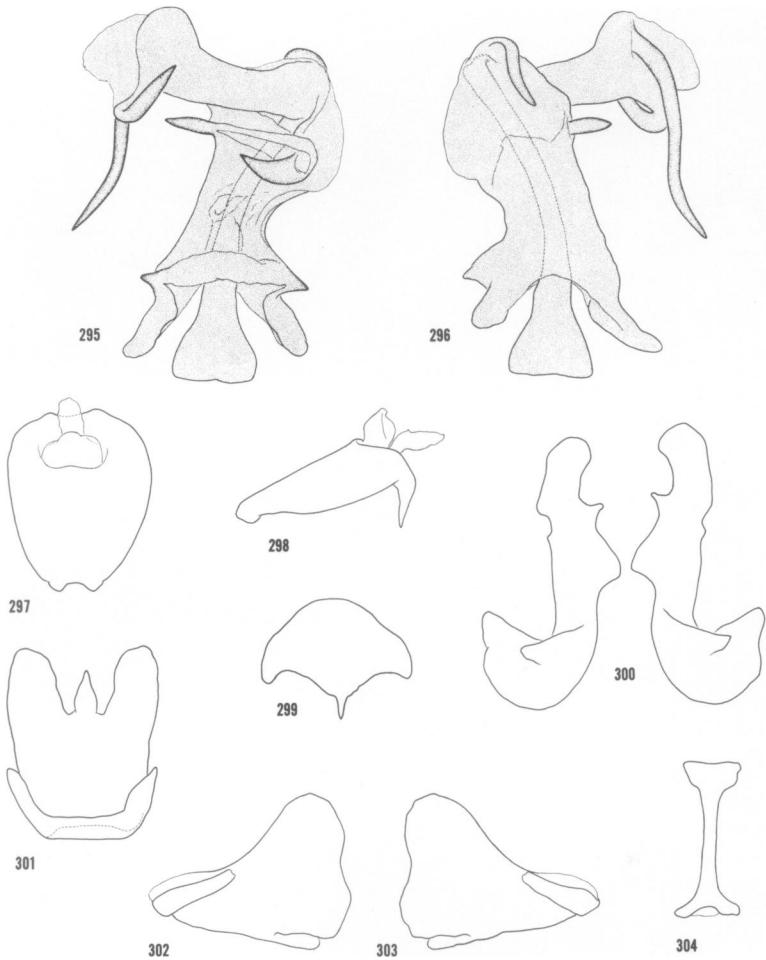
Oliarus acicus Caldwell 1947a:76.

Salient features. — Length of male 4.1 to 5.1 mm; (based on 31 specimens) holotype 4.7 mm. Ground color of vertex and mesonotum piceous; mesonotal carinae concolorous. *Head:* Vertex barely longer in middle line than broad at apex of posterior emargination; median carina absent or very short. Face usually piceous; median carina percurrent but orange color confined mostly to frons. Basal fork usually slightly longer than wide; lateral carinae usually a broader and paler orange or yellow; frons distinctly wider than long in middle line. Rostrum short, distinctly failing to attain caudal margins of posterior trochanters. *Thorax:* Pronotum with intermediate carinae joining posterior margin. Mesonotum with carinae approximately equally prominent. Tegmina immaculate, without spots or suffusion around apical crossveins; tubercles not prominent; veins mostly brownish; usually with 11 apical and 5 antepical cells; stigma brown, well defined, ovoid, approximately twice as long as wide. Legs primarily piceous or fuscous basally, testaceous distally.

Male genitalia. — Aedeagal complex as in figs. 285 and 286; pointed processes somewhat variable and subject to interpretation but with three conspicuous processes and usually with one or two small ones. Periandrium with three or four processes, without the usual elongate dextral and sinistral processes of most species of *Oliarus*; no dorsal processes; ventrally, the longest process originating in the apical area and directed left-ventrocephalad; other processes all variable in size but three in number and developing from a well sclerotized basal ring, the median of these largest and deltoid in ventral aspect and sometimes with a confluent sub-process; left process of basal ring short, acuminate, tending to be larger than right



FIGURES 285-294. Male genitalia of *O. acicus* Caldwell, specimen from Brownsville, Texas. 285, aedeagus in ventral view. 286, aedeagus in right lateral view. 287, anal segment in dorsal view. 288, anal segment in left lateral view. 289, anal segment in posterior view. 290, styles in broad inner aspect. 291, pygofer in ventral view. 292, pygofer in left lateral view. 293, pygofer in right lateral view. 294, connective in posterior view.



FIGURES 295-304. Male genitalia of *O. complectus* Ball, specimen from Big Pine Key, Fla. 295, aedeagus in ventral view. 296, aedeagus in dorsal view. 297, anal segment in dorsal view. 298, anal segment in left lateral view. 299, anal segment in posterior view. 300, styles in broad inner aspect. 301, pygofer in ventral view. 302, pygofer in left lateral view. 303, pygofer in right lateral view. 304, connective in posterior view.

process which varies from a stout, toothlike process to a small protuberance or even obsolescence. Flagellum directed to the left, subapically curving 90 degrees caudad; flagellum with one process, a very unusual helical or convolute process inserted basiventrally and extending left, curving dorsad and caudad, and looping back to nearly straight-ventrad or right-ventrad. Styles as in fig. 290; essentially symmetrical in all features; somewhat angulately recurved distally, apex of recurved portion bluntly pointed; inner process moderately produced, pointed; midlength of inner margin of shaft with large protuberance. Connective as in fig. 294; moderately long and slender; combined width of ventral arms slightly greater than width of base of shaft in posterior aspect. Pygofer as in figs. 291-293; medioventral process moderate in size; in ventral profile subterete basally, acuminate at apex, greatest width one-half to two-thirds length; extending posteriorly one-half to two-thirds distance to level of apex of left lateral lobe; lateral lobes moderately produced, symmetrical, appearing pointed and directed nearly straight caudad in ventral aspect; apices subacute to truncate in lateral view, most strongly produced somewhat below midlength of posterior margin. Anal segment as in figs. 287-289; in dorsal view nearly symmetrical, distinctly longer than wide; medioapical margin slightly concave; in caudal view ventral profile with a conspicuous spiniform process.

Types. — The male holotype, Brownsville, Texas, Feb. 19, 1946, (Caldwell) and allotype female Hermosillo, Sonora, Mexico March 23, 1937, (Dampf) and 15 paratypes are in the United States National Museum.

Distributional records. — Specimens were examined from UNITED STATES: Texas (mostly Rio Grande Valley locations): Bexar, Brewster, Cameron, Hidalgo, Nueces, Uvalde, Val Verde, and Webb Counties; Arizona: Cochise County (Portal 4800'), Pima County (San Xavier Mission, Baboquivari Mountains, Arivaca), Yuma County (Yuma); California: San Diego County, Imperial County (several locations in the Colorado River delta and in the Imperial Valley); MEXICO: Lower California: San Miguel; Sonora: Hermosillo and Yaqui Valley; Sinaloa: 11 miles south of Guasave, El Dorado, and Los Mochis.

Notes. — *Oliarus acicus* agrees with the salient features of the subgenus *Melanoliarus* (Fennah 1945b) and is hereby assigned to it. Characters of this subgenus were previously discussed. The other United States species in this distinctive subgenus are *O. compectus* Ball and *O. viequensis* Caldwell. They differ from *acicus* by not having the tortuous, recurved, basiventrally inserted flagellar process, nor having the apical half or third of the flagellum curving caudad at right angles. Both *compectus* and *viequensis* have processes originating on the apical area of the flagellum which *acicus* does not. From the standpoint of male genitalia, *acicus* is one of the most easily recognized species in the Nearctic region. It is very distinct even from other members of the same subgenus.

The range of *O. acicus* is the southwestern border area of the United States and parts of northern Mexico. Specimens of *O. acicus* have been collected primarily in river valleys and irrigated areas of the southwestern United States and northern Mexico.

Oliarus acicus seems to be positively phototropic, because several specimens from several states have such labels as "at light," "ex Argon light trap," "blacklight

trap." Other habitat labels read: "ex peach" [*Prunus persica* (L.) Stokes] and "on *Sphaeralcea angustifolia*" [(Cavanilles) George Don], from Texas; "ex *Gossypium* sp. by D-Vac machine," ex *Gossypium hirsutum*" [Linnaeus], and "ex *Melilotus indica*" [Allioni], from Imperial Co., California; "sweeping alfalfa [*Medicago sativa* Linnaeus] in Los Mochis, Sinaloa.

Oliarus acicus apparently is a multivoltine species. The available specimens were collected in every month except April. The Sinaloa records are for January, May, and December; the Sonora records are for March and November; Lower California for July; Arizona for April and July; Texas for February, March, and May through December; California for March, and June through October.

Oliarus complectus Ball

Figs. 295–304

Oliarus complectus Ball 1902:152.

Oliarus campestris Fennah 1945b:141.

Salient features. — Length of male 3.4 to 4.2 mm, allolotype male 3.95 mm. Ground color of vertex and mesonotum dark brown to black; mesonotal carinae usually concolorous. *Head:* Vertex in middle line a little longer than broad at apex of posterior emargination; median carina absent. Face fuscous except carinae yellowish to dull orange, color sometimes confined to carinae of frons but usually variably extending into clypeal region; fork of median carina forming small equilateral triangle; frons wider than long in middle line. Rostrum short, distinctly failing to attain caudal margins of posterior trochanters. *Thorax:* Pronotum with intermediate carinae tangential to pale band of posterior margin. Mesonotum with carinae nearly uniform. Tegmina immaculate; veins brownish, commissure pale to ochraceous except for fuscous portion immediately basad of union of Y-veins; tubercles moderate in size, concolorous and therefore not conspicuous; 11 apical and 5 anteapical cells; stigma brown, ovoid, well defined, with length approximately twice width. Legs fuscous basally, usually ochraceous to testaceous distally.

Male genitalia. — Aedeagal complex as in figs. 295 and 296; total pointed processes seven or eight depending on variation and interpretation of same. Perianthrium with five or six processes, without any lengthy dextral or sinistral processes developing basally; a medium small, slender, dorsoapical, retrorse process originating adjacent to dorsal base of flagellum; with two medium-sized, ventroapical processes, the larger one directed right-ventrad initially but also immediately curving left-ventrad and slightly cephalad; smaller ventroapical process originating more dorsad and to the left, and directed primarily to the left in ventral aspect, smoothly curving left-ventrad from cephalic viewpoint; ventral, basal ring with two short, broad, pointed processes right- and left-laterad median process often obsolete or represented by a callosity. Flagellum with two slender and acuminate processes in the apical area, the longer one originating dorsally, following contour of flagellum, looping dorsad, then basad, nearly attaining level of basal ring; the other shorter process originating basidorsally, and directed primarily right-caudad; these flagellar processes somewhat variable in directions extended. Styles as

in fig. 300; nearly symmetrical in all features; apex enlarged and recurved, becoming somewhat narrowed and pointed at end of recurved portion; inner processes fairly short, pointed; midlength of shaft with large protuberance. Connective as in fig. 304; moderately long and slender; combined ventral arms wider than base of shaft in posterior aspect. Pygofer as in figs. 301-303; medioventral process moderate in size; length nearly twice the width; process extending posteriorly a little more than half the distance to level of lateral lobes; lateral lobes of pygofer moderately produced, rounded to subtruncate at apices which lie somewhat ventrad of midlength of posterior margin. Anal segment as in figs. 297-299; distinctly longer than wide in dorsal view (width about three-fourths the length) and nearly symmetrical, distinctly concave at apical medioventral margin; convex in caudal view, with apex becoming a sharp downward-pointed spine; in lateral view apical process deflexed and attenuated.

Types. — The type series of *O. complectus* is mixed. Ball (1934) stated that his original series contained at least two and probably three species. We have seen 18 marked individuals of the type series of 24 or 25 specimens and discovered four species in this group. Ball (1934) wrote that, "in order to definitely limit it [*complectus*] to the species intended in the original description, the holotype is fixed on a female from Port-au-Prince, Haiti, and the allotype on a male from the same place, both examples so labeled and in the author's collection." This really is a lectotype designation, although it is somewhat deficient in detailed information usually given in such designations. Additional information on the lectotype follows. The top label reads "Pt. au Pr." on the first line, "Hayti feb" on the second, with all machine printed on white paper except that "feb" is hand printed with India ink. The next label has "TYPE" machine printed on white paper. The third label is red paper and is machine printed "Cotype No." on the first line, "U.S.N.M." at the bottom, with blank space between top and bottom lines. The fourth label is red and has "HOLOTYPE" machine printed across the top, "*O. complectus*" hand printed with India ink in the middle area, and "E.D. Ball" machine printed at the bottom. A black-bordered lectotype label with "LECTOTYPE" machine printed in red across the top, "*Oliarus complectus* Ball" hand printed with India ink in the middle area, and "E.D. Ball" in India ink on the bottom after the machine printed "By" in red ink. This lectotype is located in the United States National Museum, along with most of the type series. In addition to Ball's "holotype" and "allotype" from Port-au-Prince, Haiti, two males and four females with "cotype" labels also are from this locality. Some of the original type series with the same label data may be unmarked as to type status. For example, a male in the Iowa State University collection perfectly matches the locality label of the lectotype and allolectotype. The only type material seen outside the United States National Museum consists of a male and a female on the same pin, having yellow paratype labels, and located in the California Academy of Sciences collection. This pair is labeled: "Effingham, Ks. July 1900, EPVan Duzee, Collector." The male was dissected and found to be *O. ecologus* Caldwell. A "cotype" male collected at Las Animas, Colorado, July 17, 1901, was dissected and determined as *O. dondonius*. Three "cotype" males from Phoenix, Arizona, May 1897, were found to be *O. zyxus*. Ball (1934) assumed all

the forms with a medium apical spine on the anal segment were *complexus*; hence, he considered specimens from southern Arizona, adjacent Mexico, and "many places in Florida" to be conspecific with the Haiti specimens of *complexus*.

Distributional records. — Florida records include the following specimens from Monroe County: one male, on grasses, Big Pine Key, December 28, 1951 ("Rich. & Stan."); one male, Big Pine Key, 7-V-61 (H.V. Weems, Jr.); two males, Big Pine Key, Stop #3, 7-V-61 (F.W. Mead); and one male, Big Pine Key, VI-18-1965 (Lois and C.W. O'Brien). Other male specimens have been seen from Cuba, Haiti, Dominican Republic, and Puerto Rico. Literature records that seem valid include Jamaica, Vieques Island, Caja de Muertos Island, Mona Island, and St. Thomas and St. Croix, Virgin Islands.

Notes. — *Oliarus complexus* is the most commonly collected *Oliarus* in the Greater Antilles but is rare in the United States, being known only from a few specimens in Florida. In the United States *complexus* is closest to *O. acicus* Caldwell and *O. viequensis* Caldwell, which are the other United States members in the subgenus *Melanoliarus*. The Caribbean fauna may not be sufficiently understood to permit full diagnosis of *complexus* in this subregion, but other forms in subgenus *Melanoliarus* are present. *O. complexus* is similar enough to *O. viequensis* and *O. acicus* that examination of the aedeagal complex is usually necessary. *O. complexus* is easily separated from these two species by the presence of an apical retrorse process on the dorsal periandrium. The other two species not only lack this process but have no processes anywhere on the dorsal periandrium. Furthermore, *complexus* has two fairly similar ventroapical processes of the periandrium that primarily extend to the left. The other two species routinely have only one apical process which is directed ventrad primarily. *O. complexus* and *O. viequensis* each have two apical processes on the flagellum compared to none for *acicus*, although the last does have one long corkscrew-like process originating basally. In *complexus* the members of this apical pair of flagellar processes are fairly similar in length and thickness, with the shorter member usually directed right-ventrocephalad. However, in *viequensis* neither one of the processes is directed right-ventrocaudad, and the anteriorly directed member of the pair is approximately twice as large in thickness and length. The deflexed median apical spine of the anal segment in *complexus* is distinctly shorter than that in *acicus*, but only slightly shorter than that of *viequensis*.

The most noticeable variation routinely encountered concerns the different directions taken by the apical processes of the flagellum. Another common variation is the basal ring of the periandrium which is either binate, ternate or grading between. The most atypical *complexus* examined is a specimen from Crescent City, Florida, formerly in the P.R. Uhler collection but now in the United States National Museum. Crescent City lies adjacent to freshwater Crescent Lake in Putnam County, 25 miles inland from the Atlantic Ocean. In this specimen the only process of the basal ring is located on the right side. The ventroapical periandrium has only one process, instead of the usual two; furthermore, this one process is directed primarily to the right instead of to the left as is usual. The apical pair of processes on the flagellum shows differences, with one member exceedingly long and directed left initially, then curving back to the right and dorsad, as seen in ventral view, to

disappear and end behind the median dorsal area of the periandrium. The retrorse apical process of the dorsal periandrium in this specimen is present as usual.

The range of *O. complectus* is primarily in the Greater Antilles, but it has been taken sparingly in Florida and in the northern Lesser Antilles.

"Host" labels on specimens determined as *O. complectus* Ball include *Cordia*, at canefield, on sugarcane leaves, on *Cedrela odorata* Linnaeus and on citrus. The last was in Cuba, the others in Puerto Rico. Agricultural situations and crops from which *O. complectus* has been taken include pastures, cotton, soybeans, eggplants, papayas, pigeon peas, carrots, beans, tomatoes, potatoes, asparagus, corn, avocado, yams (*Dioscorea* sp.) and sugarcane. Sein (1932, 1933) found that the nymphs of *O. complectus* (reported as *O. franciscanus*) are subterranean and feed on the roots of sugarcane and "malojillo." The latter is better known as paragrass, *Panicum purpurascens* Raddi (= *P. barbinode* Trin.). Sein (1933) noted that the nymphs were somewhat gregarious, whitish, and covered with waxy white fluff, the surplus of which lined the cavity in soil where they fed on a sugarcane rootlet. Apparently, neither nymphs or adults caused any feeding or other injury to the sugarcane plants. Attempts by Sein (1932) to implicate *complectus* as a vector of sugarcane mosaic were unsuccessful. Wolcott (1950) stated that Dr. Alexander Wetmore found them (*complectus*) eaten by the tody, *Todus mexicanus*, and they are so preferred by lizards as to constitute 5 percent of the food of the grass lizard, *Anolis pulchellus*. *O. complectus* apparently is a multivoltine species, since numerous records are available for all months of the year.

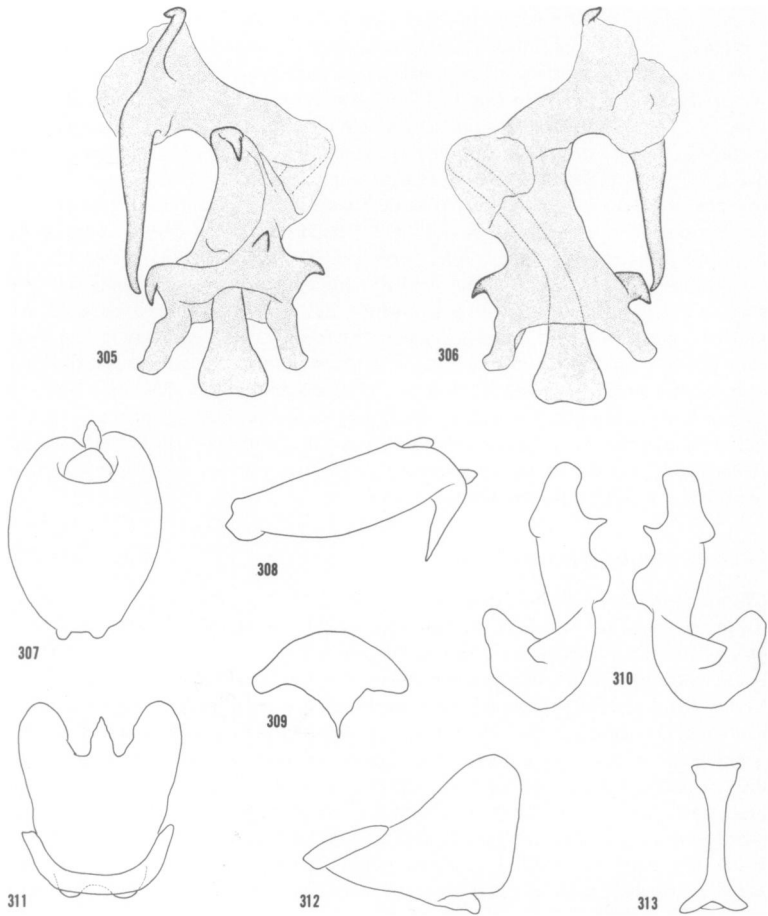
Oliarus viequensis Caldwell

Figs. 305-313

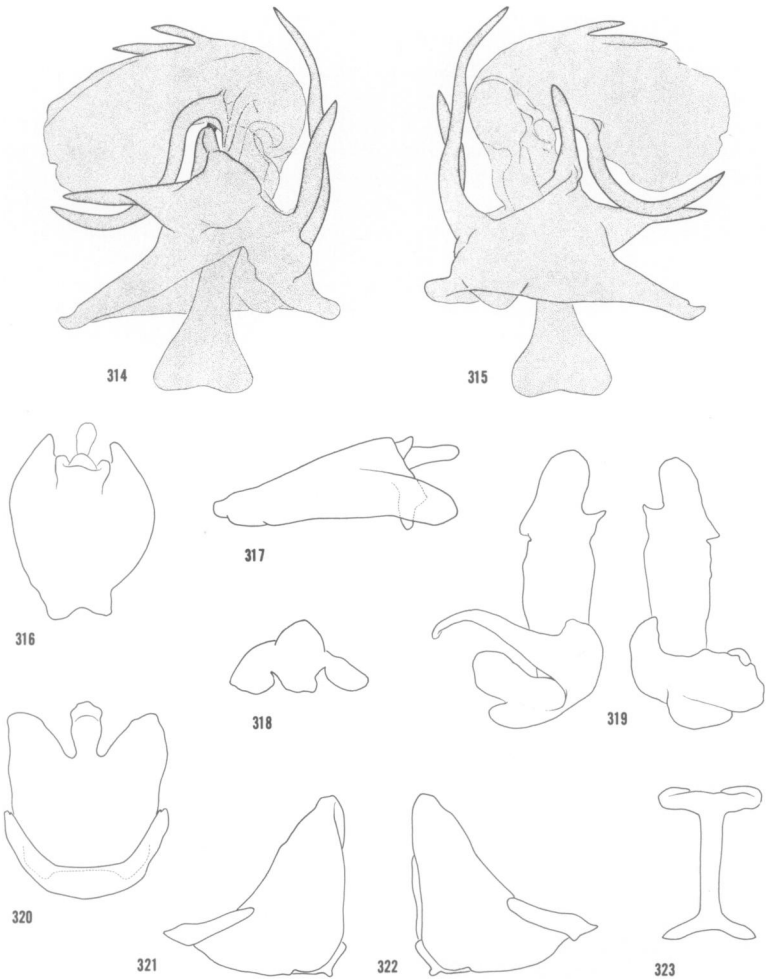
Oliarus viequensis Caldwell 1952:141.

Salient features. — Length of male 3.2 to 4.1 mm (based on 125 specimens); ground color of vertex and mesonotum fuscous to piceous; mesonotal carinae usually concolorous but in some specimens partially a contrasting dull orange. *Head:* Vertex distinctly longer in middle line than broad at apex of posterior emargination; median carina absent. Face fuscous to piceous; median carina percurrent, usually ochraceous to dull orange on frons and duller on clypeus, basal fork narrow but distinct; lateral carinae varying from ochraceous to dull orange to light brown; frons moderately narrow, with length in middle line usually two-thirds the width. Rostrum short, distinctly failing to attain caudal margins of posterior trochanters. *Thorax:* Pronotum with intermediate carinae joining pale band of posterior margin. Mesonotum with carinae conspicuous, the middle one usually a little more so; tegmina immaculate, except for faint suffusion at apical crossveins; tubercles not conspicuous; veins usually light brown basally, becoming darker brown apically except claval veins and basal and apical portions of commissure which are stramineous, 11 apical and 5 anteapical cells; stigma brown, well defined, with length usually twice that of width. Legs with femora fuscous except narrowly pale yellow at apex, and with tibiae and tarsi mostly pale yellow or ochraceous.

Male genitalia. — Aedeagal complex as in figs. 305 and 306; total pointed processes six. Periandrium with four processes, without any lengthy dextral and sinistral processes; no dorsal processes; with three well-spaced short processes on



FIGURES 305-313. Male genitalia of *O. viequensis* Caldwell, from paratype Cape Sable, Fla. 305, aedeagus in ventral view. 306, aedeagus in dorsal view. 307, anal segment in dorsal view. 308, anal segment in left lateral view. 309, anal segment in posterior view. 310, styles in broad inner aspect. 311, pygofer in ventral view. 312, pygofer in left lateral view. 313, connective in posterior view.



FIGURES 314-323. Male genitalia of *O. exoptatus* Van Duzee, from holotype. 314, aedeagus in ventral view. 315, aedeagus in dorsal view. 316, anal segment in dorsal view. 317, anal segment in left lateral view. 318, anal segment in posterior view. 319, styles in broad inner aspect. 320, pygofer in ventral view. 321, pygofer in left lateral view. 322, pygofer in right lateral view. 323, connective in posterior view.

sides and ventromedian area of a basal ring; ventroapical area with a moderate-sized, slightly curving process directed ventrad primarily. Flagellum with two processes originating from common tissue in ventroapical area; the shorter process directed caudad initially, curving dorsad apically; the longer process approximately twice as thick and long as the shorter process and directed cephalad primarily but also slightly curving dorsad. Styles as in fig. 310; nearly symmetrical in all features; each shaft with large protuberance and with apex unevenly recurved, the apex of recurved portion bluntly pointed; inner processes rather short, pointed. Connective as in fig. 313; moderately long and slender; combined ventral arms slightly wider than base of shaft in posterior aspect. Pygofer as in figs. 311-312; medioventral process in ventral aspect moderate in size, sides subparallel basally, acute, width approximately two-thirds the length, and extending posteriorly at least half the distance to level of lateral lobes but more often about three-fifths this distance; lateral lobes of pygofer symmetrical, weakly produced below midlength of posterior margin in lateral view. Anal segment as in figs. 307-309; distinctly longer than wide in dorsal view and fairly symmetrical but with left caudal margin slightly longer than its right counterpart; medioapical margin distinctly concave; in caudal view ventral profile with moderately long, acuminate spine or process extended ventrad; spine in lateral view rather stout and directed nearly 45 degrees ventrocephalad.

Types. — The holotype male from Vieques Island, Puerto Rico, allotype female, and eight paratypes from Cape Sable, Monroe County, Florida in the United States National Museum were studied.

Distributional records. — The range of *O. viequensis* is primarily Antillean, but includes Florida. The original description lists Vieques Island, Puerto Rico; St. John, Antigua; and Cape Sable, Florida. Typical specimens were seen from Puerto Rico, St. Marc, Haiti, and from coastal situations in the following Florida counties: Collier, Dade, Lee, Monroe, Pinellas, Sarasota, and Volusia. Specimens were available from most of the Florida Keys from Key Largo to Key West. Thus, in Florida, the only Atlantic Coast records north of the Florida Keys are from Daytona Beach and New Smyrna Beach of Volusia County.

Notes. — *Oliarus viequensis* agrees with the major features of the subgenus *Melanoliarus* Fennah and is hereby assigned to it. The other United States species in this distinctive subgenus are *O. acicus* Caldwell and *O. complectus*. *O. viequensis* and *complectus* have two apical processes on the flagellum which *acicus* lacks, but *acicus* does have a basally-arising, helical flagellar process not present on the other two species. *O. viequensis* can be separated from *complectus* as follows: *viequensis* has only one ventroapical process on the periandrium, whereas *complectus* has two; *viequensis* has no dorsal processes, but *complectus* has a retrorse apical process on the dorsal periandrium.

Morphological variation is minor for the most part. Occasional specimens have the small, median, basiventral, toothlike process obsolete. The most atypical specimens are five males from Cedar Key, Levy County, Florida, "Ju. 12, 1939" (P.W. Oman). These specimens have the basiventral process of the periandrium larger than normal and more to the left; the apicoventral process of the periandrium instead of emanating from a smoothly rounded area, arises from a protuberance;

the apical processes of the flagellum are shaped somewhat differently and directed more to the left, particularly the more caudal member of the pair which loops dorsad over the flagellum, then curves left-cephalad in such a way as to become parallel with the larger process of the pair.

The only habitats in Florida where *O. viequensis* adults seem to be abundant are in open, low-lying, grassy situations of tidal flats, or on woody plants adjacent to the tidal flats. These woody plants probably are temporary resting places or possibly food plants but not host plants. The nymphs almost certainly are subterranean and most probably have adaptations to withstand short periods of flooding as mentioned in some detail by Hacker (1925) on the life history of *Oliarus felis* Kirkaldy (he believed that the waxy secretion which covers the bodies of the nymphs renders them waterproof).

Seasonal data indicated that *O. viequensis* is at least biovoltine. In Florida, adults are numerous in collections from March through July and were found to be abundant on Mullet Key and the Lower Florida Keys during October. Records for the other months are fairly scarce.

Additional collecting data on *O. viequensis* are quoted here from labels on the specimens. "*Borrichia arborescens*" [(L.) DC.] in the Everglades National Park; "blacklight trap"; "collected at light"; "(ex) Mangrove"; "on *Avicinnia nitida*" [Jacq.] a Plantation Key, Florida. Several specimens from Puerto Rico have the host label of sea purslane, *Sesuvium* sp., on them.

Oliarus exoptatus Van Duzee

Figs. 314-323

Oliarus exoptatus Van Duzee 1917a:308.

Salient features. — Length of male 3.5 to 5.6 mm (based on 20 specimens); holotype nearly 5.6 mm. Ground color of vertex and mesonotum usually fuscous or piceous; mesonotal carinae usually concolorous, occasionally some or all carinae edged with a contrasting light brown or dull orange. *Head:* Vertex very broad, length in middle line conspicuously less than width at apex of posterior emargination; median carina usually absent or feebly developed but occasionally extending forward one-half to two-thirds length of disc. Face with ground color usually fuscous; median carina usually orange and percurrent but in some specimens partially obsolete on clypeus; basal fork conspicuous; each lateral carina distinct but narrow and yellowish or dull orange throughout its length; maculae absent; frons broad, length in middle line approximately two-thirds width of frons. Rostrum moderately long, extent varying from not quite attaining to slightly exceeding caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae well separated from pale band of posterior margin. Mesonotum with carinae conspicuously and uniformly elevated. Tegmina with degree of spotting variable, a few specimens nearly immaculate, typical specimens with three distinct spots on clavus, a brownish area immediately basad of node, spots on clavus and corium, and conspicuous smoky brown areas in distal third; commissure pale yellow or light brown, without contrasting brown section basad of Y-vein juncture; tubercles conspicuous;

veins usually pale yellow on basal three-fourths and fuscous on distal one-fourth of each tegmen; apical cells usually 11 and antepical cells 6; stigma variable, usually small and brownish, length usually one and one-half to two times the width, but width sometimes equal to length. Legs with all tibiae usually having an indistinct narrow fuscous ring near base; basal segments of legs fuscous, distal segments varying from pale yellow to light purplish brown; posterior leg with first tarsite having seven or eight apical spurs including the lateral pair; second tarsite consistently with eight apical spurs including lateral pair, but each of the six spurs between lateral pair having a small scalelike tooth distally attached.

Male genitalia. — Aedeagal complex as in figs. 314 and 315; total pointed processes seven. Periandrium with four processes; right basal area giving rise to two long slender processes, the more ventral member of this pair, in ventral aspect, almost straight and directed caudad primarily, but in lateral view uniformly curving caudodorsally, shorter than its dorsal complement; dorsal member of the pair of dextral processes slightly sinuate, extending primarily caudad in lateral or ventral view; sinistral process, in ventral aspect, broad basally and constricted near midlength, thence bladelike and extending nearly straight left to a level near outer margin of flagellum in typical specimens; in other specimens length of process somewhat reduced but with apex acute, not bifid in ventral or caudal view; dorsal periandrium with a moderate-sized acuminate right apical process directed caudad or right-caudad. Flagellum directed left-cephalad; with three processes: two slender approximate acuminate processes along median posterior margin, both directed to the left; basiventral area of flagellum giving rise to a long slender sinuate process usually directed successively left-cephalad, left and left-dorsad. Styles as in fig. 319; greatly asymmetrical; left style stout, distally unequally bilobed to the left, inner process in the form of an extremely long, strongly curved, acuminate spine; right style broad, distally unequally bilobed, the proximal lobe thumblike, forming an acute angle with main shaft of style, distal lobe shorter, rounded, and directed caudolaterally, inner process in the form of a stout, nearly flattened, obtusely pointed plate, somewhat molarlike in dorsal profile. Connective as in fig. 323; combined length of ventral arms slightly variable, usually equal to width of base in posterior aspect. Pygofer as in figs. 320-322; slightly asymmetrical; medioventral process in ventral aspect slightly constricted at base, irregularly obtuse at apex, subterete between base and apex, and with a transverse keel on ventral surface slightly behind midlength; process extending posteriorly slightly farther than apices of pygofer lateral lobes; lateral lobes short, in lateral view nearly symmetrical, with posterior margin slightly produced and apex occurring well below midlength. Anal segment as in figs. 316-318; in dorsal view slightly asymmetrical, apex of left margin more laterally expanded than right margin; longer than wide, width approximately three-fourths the length; apical margin broadly and irregularly deeply concave; in caudal aspect ventromedian profile produced into a truncate process.

Types. — Van Duzee described *O. exoptatus* from the holotype male taken by W.M. Giffard at Fallen Leaf Lake [Eldorado County], California, August 21, 1916, on manzanita [*Arctostaphylos* sp.], elevation 6300 feet above sea level, and from the allotype female “taken in Placer Co, August 20, 1916 — in collection of Mr. Gif-

pard." The allotype was not seen, but the holotype is in the California Academy of Sciences (No. 375) and was used for illustration.

Distributional records. — Other material here determined as *O. exoptatus*: CALIFORNIA: Butte County, Paradise; Eldorado County?; "G. Alpine Cr. Tahoe"; Lassen County, Madeline; Marin County, Lagunitas and Mt. Tamalpais; Marisposa County?, Yosemite National Park; Nevada County, Truckee; Placer County, Auburn and Colfax; Plumas County, four miles west of Quincy; Sierra County, Sardine Lakes; Sonoma County, Guernaville; Toulume County, Soulsbyville; Tulare County, California Hot Springs; IDAHO: Latah County, Moscow; NEVADA: Ormsby County, Carson City; UTAH: Cache County, Logan Canyon; ? County, "Blacksmith Fk." Female specimens probably *exoptatus*, have been collected in COLORADO: Routt County: Steamboat Springs [map elevation 6683 feet above sea level]; and WYOMING: Teton County: 12 miles south of Jackson [elevation 6100 feet above sea level].

Notes. — *Oliarus exoptatus* was the first described of three very closely related species that form the highly distinctive *exoptatus* group, of which characteristics have been enumerated in the introductory part of this paper. Separation of *O. exoptatus*, *O. beirnei*, new name, and *O. fidus* Van Duzee is difficult, and is based almost entirely upon the shape of the sinistral process of the perianthium and apex of the left style. *O. fidus* can be identified by the spinelike apex of the left style contrasted to the gently convex apex in *beirnei* and *exoptatus*; in ventral view the perianthial sinistral process of *fidus* usually appears semitruncate and directed left-caudad, but in *exoptatus* it develops into a conspicuously longer, acuminate structure directed straight left or nearly so; in *beirnei* the sinistral process is somewhat bifid at the apex and the distal portion is usually directed somewhat ventrad instead of left of left-caudad as in *exoptatus* and *fidus*, respectively.

In some areas of California, forms believed to be *O. exoptatus* have a shorter sinistral process and are close to forms believed to be *beirnei*. *O. beirnei* and *O. exoptatus* are sympatric in the northern half of California. More collecting and further study are needed to confirm the present treatment of the *exoptatus* complex.

The known range of *O. exoptatus* is primarily in the northern half of California, with Lake Tahoe area the apparent center of abundance; elsewhere, the species is known from scattered localities of the northern Rocky Mountains of the United States. Although the data are limited, the preliminary evidence is that *exoptatus* is not common in the Basin and Range areas. Nearly all of the collecting records are in or near mountainous areas where the habitats presumably are of a more mesic character than found in much of the West.

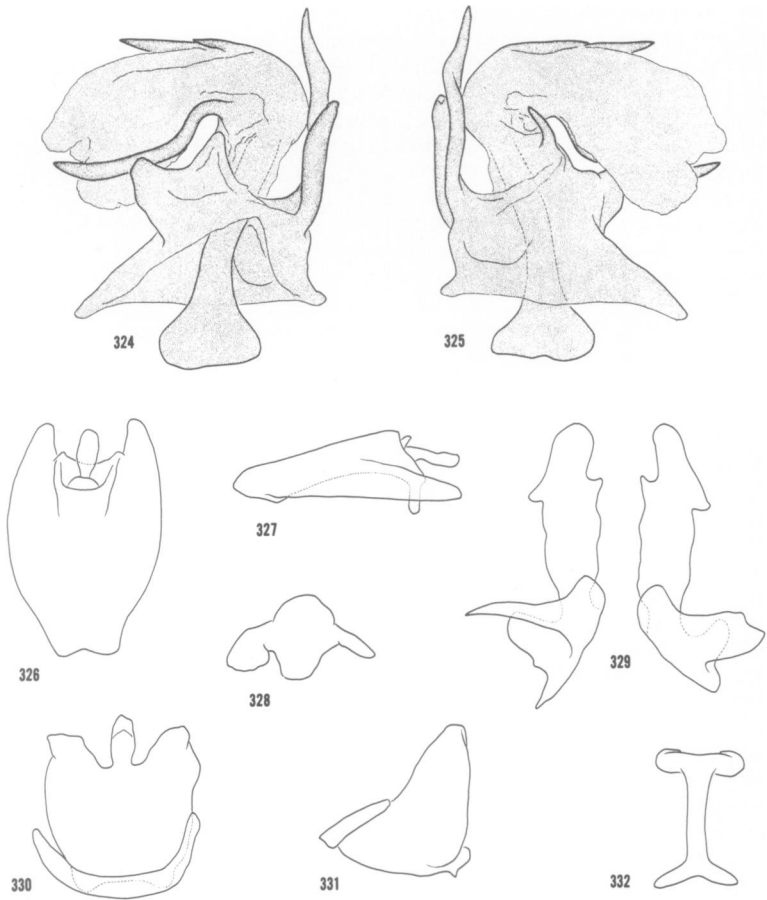
The available host data include: "ex manzanita" *Arctostaphylos* sp., "visiting flowers of sage," and "ex *Malus* sp." The earliest known collecting date is May 15, the latest August 1, with most of the records in June and July.

Oliarus fidus Van Duzee

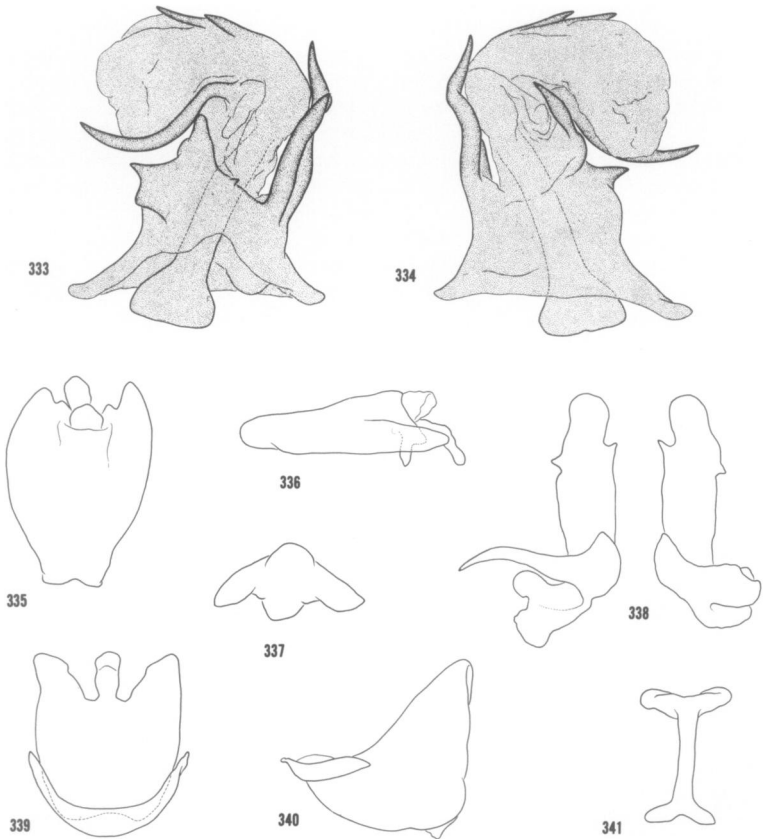
Figs. 324-332

Oliarus fidus Van Duzee 1914:37.

Salient features. — Length of male 3.8 to 4.7 mm (based on 10 specimens).



FIGURES 324-332. Male genitalia of *O. fidus* Van Duzee, from lectotype. 324, aedeagus in ventral view. 325, aedeagus in dorsal view. 326, anal segment in dorsal view. 327, anal segment in left lateral view. 328, anal segment in posterior view. 329, styles in broad inner aspect. 330, pygofer in ventral view. 331, pygofer in left lateral view. 332, connective in posterior view.



FIGURES 333-341. Male genitalia of *O. beirnei*, n. n., from paratype, same data as holotype. 333, aedeagus in ventral view. 334, aedeagus in dorsal view. 335, anal segment in dorsal view. 336, anal segment in left lateral view. 337, anal segment in posterior view. 338, styles in broad inner aspect. 339, pygofer in ventral view. 340, pygofer in left lateral view. 341, connective in posterior view.

Ground color of vertex and mesonotum usually fuscous, sometimes piceous or fuscocastaneous; mesonotal carinae usually concolorous, but median carina orange or yellow in some specimens. *Head*: Vertex very broad, length on middle line distinctly less than width at apex of posterior emargination; median carina usually absent or feebly developed. Face with ground color fuscous; median carina yellow to brownish yellow and traversing length of face, more conspicuous on frons than on more distal clypeal area; basal fork conspicuous; lateral carinae yellowish and conspicuous; maculae absent or poorly developed; frons broad, ovoid, length in middle line approximately six-tenths the width. Rostrum moderately long, usually reaching or slightly exceeding caudal margin of posterior trochanters. *Thorax*: Pronotum with intermediate carinae well separated from pale band of posterior margin. Mesonotum with carinae conspicuously and uniformly elevated. Tegmina with degree of spotting variable, most specimens lightly spotted, a few nearly immaculate; most specimens with costal cell having two or three light brown spots, a few specimens without spots, nearly all specimens with brownish area immediately basad of node; distal portion of each tegmen with suffusion at crossveins, and apical cells occasionally having light brownish areas; most specimens milky subhyaline, others with partial to complete light smoky brown cast; commissure of typical specimens a nearly uniform pale yellow or yellowish brown; tubercles conspicuous; veins usually pale yellow except fuscous near apex; apical cells normally 11 and anteapical cells 6, but variation occurring commonly in number of branches reaching apex of tegmen; stigma unusually small, usually brownish, but sometimes mostly pale; width sometimes equal to length but length usually one and one-half to two times the width. Legs fuscous basally, becoming pale yellow or brownish yellow distally; each front and middle tibia with narrow fuscous band near base; posterior leg having seven or eight apical spurs, including the lateral pair; second tarsite consistently with eight apical spurs including lateral pair, the six spurs between lateral pair having small scalelike teeth distally attached, one per spur.

Male genitalia. — Aedeagal complex as in figs. 324 and 325; total pointed processes seven. Periandrium with four processes; right basal area giving rise to two long slender processes, the more ventral member of this pair, in ventral aspect, fairly straight and directed caudad primarily, but in lateral view uniformly curving caudodorsally, shorter than the dorsal member of the pair, the dorsal of the two dextral processes slightly sinuate, primarily extending caudad in lateral or ventral view; sinistral process, in ventral aspect appearing bluntly produced left-caudad from a broad base, but in most views with apex pointed (not bifid) and primarily extended ventrad; dorsal periandrium with a moderate-sized acuminate right apical process usually directed right-caudad. Flagellum directed left-cephalad; with three processes; two slender approximate acuminate processes along median posterior margin, both directed to the left; basiventral area of flagellum giving rise to a long slender sinuate process successively directed left-cephalad, left, and left-dorso-caudad. Styles as in fig. 329; greatly asymmetrical; left style stout, distally unequally bifid, one ramus extending laterally as a lobe, the other ramus acuminate, spinelike, slightly curved and extended left-caudad; inner process in the form of an extremely long, strongly curved, acuminate spine; right style stout, distally bilobed,

the proximal lobe thumblike, forming an acute angle with main shaft of style; the distal lobe shorter, semirounded, and directed caudolaterally; inner process in the form of a stout, nearly flattened, obtusely pointed plate, somewhat molarlike in dorsal profile. Connective as in fig. 332; short and slender; combined width of ventral arms approximately equal to width of base in posterior aspect. Pyfoger as in figs. 330-331; slightly asymmetrical; medioventral process in ventral aspect slightly constricted at base, apex obtuse, subterete between base and apex, and with a transverse keel on ventral surface near midlength; process extending posteriorly slightly farther than apices of pygofer lateral lobes; lateral lobes short, in lateral view nearly symmetrical, with posterior margin slightly produced and apex occurring well below midlength. Anal segment as in figs. 326-328; in dorsal view slightly asymmetrical, left margin more laterally expanded than the right margin, longer than wide, with width approximately two-thirds the length; apical margin broadly and irregularly deeply concave; in caudal aspect ventromedian profile produced into a truncate process.

Types. — Van Duzee described *O. fidus* from “numerous examples taken on the rocky hillside south of the railway station at Foster [San Diego County, California] on May 24th 1913.” No holotype was designated, but Van Duzee later selected a specimen as lectotype and placed yellow paratype labels on nearly all the remainder of the syntypes. Van Duzee never published this lectotype designation. His “lectotype” was studied and used for most of the illustrations in this paper. This specimen is hereby designated lectotype of *Oliarius fidus* Van Duzee. The lectotype data are “San Diego Co. Cal., 5-24-13, E.P. Van Duzee,” all machine printed (on white paper) except the date which is hand printed. The exact number of specimens in the original type series is not known, but 16 specimens marked as “paratype” or “cotype” were studied. The lectotype and all but two of the paralectotypes are in the California Academy of Sciences collection at San Francisco. These other two are located in the United States National Museum.

Distributional records. — *O. fidus* is known only from San Diego County, California at this time.

Notes. — *Oliarius fidus* is a member of the *O. exoptatus* complex and very close to *exoptatus* as well as to *O. beirnei*, new name, the other species in this complex. It can be separated from *exoptatus* and *beirnei* by the spinelike caudal extension of the left style of *fidus* as contrasted to the rounded, lobelike development in the other two species (see discussion under *O. exoptatus* for more comments on diagnosis).

No biological data are available or were recorded with any of the specimens studied.

***Oliarius beirnei*, new name**

Figs. 333-341

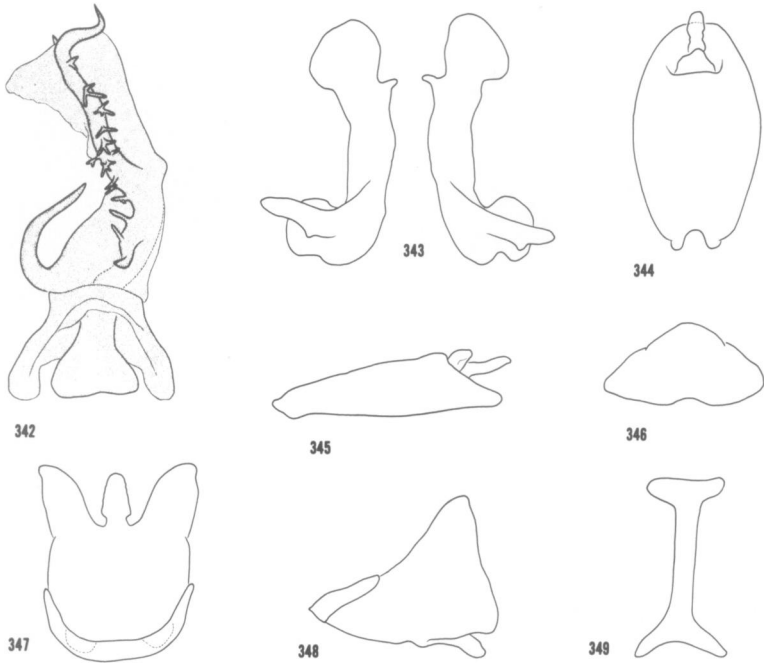
Oliarius artemisiae Beirne 1950:93. (Preoccupied by

Oliarius artemisiae Matsumura 1914:428.) See Metcalf 1936:52.

Salient features. — Length of male 4.2 to 5.5 mm (based on 17 specimens). Ground color of vertex and mesonotum usually fuscous, sometimes piceous or fuscocastaneous; mesonotal carinae usually concolorous, sometimes a lighter

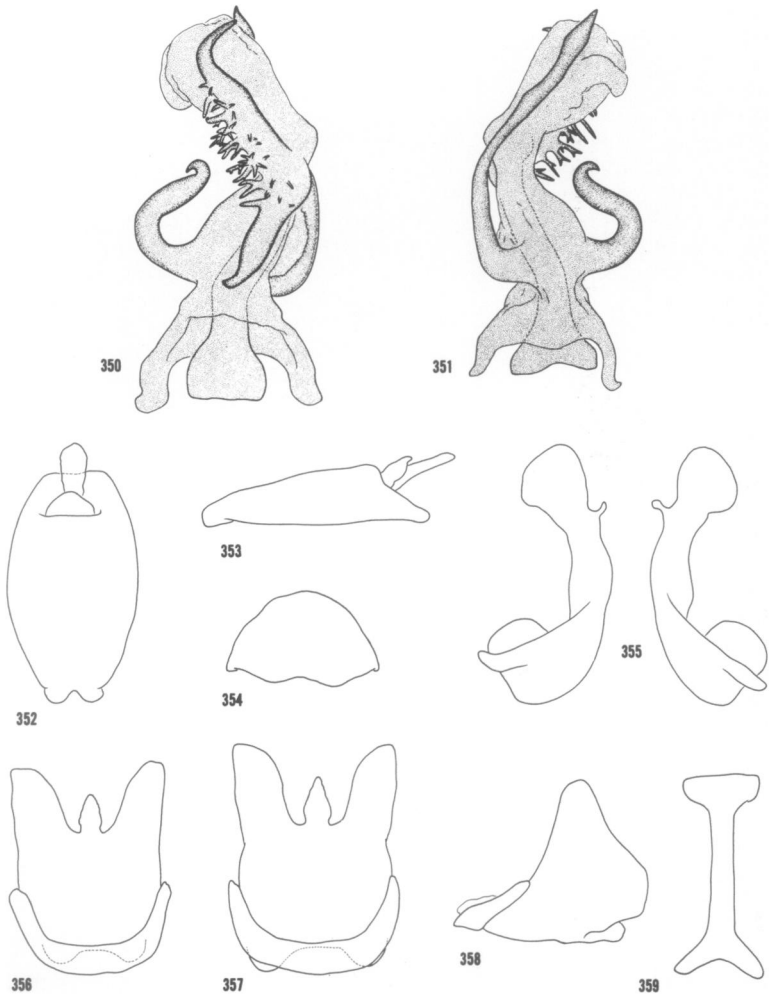
orange-brown. *Head*: Vertex very broad, length in middle line distinctly less than width at apex of posterior emargination (1:1.2-1.47); median carina absent or weakly developed. Face with ground color fuscous; median carina yellowish, well elevated at basal fork and distally along frons and part of postclypeus, but usually becoming confluent or nearly so in apical part of postclypeus; lateral carinae yellowish and conspicuous; maculae absent or poorly developed; frons broad, ovoid, length in middle line approximately seven-tenths the width. Rostrum moderately long, apex approximately even with caudal margin of posterior trochanters. *Thorax*: Pronotum with intermediate carinae well separated from pale band of posterior margin. Mesonotum with carinae conspicuously and uniformly elevated. Tegmina with degree of spotting greatly variable, some specimens nearly immaculate except for suffusion around apical crossveins, other specimens heavily spotted in several areas; most specimens with four spots in costal cell, including one immediately basad of node; spots in discal cells, areas around forks of Cu_1 and Y-vein forming a nearly continuous diagonal line in better marked specimens; distal third of tegmen with brownish areas at crossveins and apical margin; tubercles large, conspicuous in contrast to veins which mostly are pale yellow or brownish yellow except fuscous near apex; commissure pale yellow throughout its length in some specimens, an indistinct yellow-brown basad of Y-vein juncture in other specimens; apical cells normally 11 and antepical cells 6; stigma brownish and small, less than twice as long as wide. Legs fuscous basally, becoming pale yellow or brownish yellow distally; each front and middle tibia with narrow fuscous band near base; first tarsite of each posterior leg having seven or eight apical spurs, including the lateral pair; second tarsite consistently with eight apical spurs, including lateral pair, but the six spurs between lateral pair having very small scale-like teeth distally attached, one tooth per spur.

Male genitalia. — Aedeagal complex as in figs. 333 and 334; total pointed processes seven, but somewhat subject to interpretation and variation. Periandrium with four conspicuous processes and occasionally with a very short toothlike sub-process near middle portion of ventral surface; right basal area giving rise to two long slender processes, the more ventral of these, in ventral view, directed caudad and straight to slightly sinuate, but in lateral view of curving uniformly caudodorsally; shorter than the dorsal member of the pair; the more dorsal of the two dextral processes slightly sinuate, primarily extending caudad in lateral view or ventral view; sinistral process a broad, poorly developed, somewhat bifid process directed straight left, somewhat variable in shape; dorsal periandrium with a moderate-sized right apical process directed dextrocaudad primarily. Flagellum directed left-cephalad; with three processes: two approximate slender acuminate processes along median posterior margin, both directed to the left; and a long slender sinuate process arising on left basiventral area of flagellum, directed left-cephalad most of basal portion, distally curving to left or left-caudad. Styles as in fig. 338; greatly asymmetrical; both stout, distally curving outward at approximately 90 degree angle into an asymmetrical bilobed structure; inner process of left style in the form of an extremely long, outwardly curved, acuminate spine; inner process of right style in the form of



FIGURES 342-349. Male genitalia of *O. quinquelineatus* (Say), specimen from Roselle, N.J. 342, aedeagus in ventral view. 343, styles in broad inner aspect. 344, anal segment in dorsal view. 345, anal segment in left lateral view. 346, anal segment in posterior view. 347, pygofer in ventral view. 348, pygofer in left lateral view. 349, connective in posterior view.

a stout, nearly flattened, obtusely pointed plate, somewhat molarlike in dorsal profile. Connective as in fig. 341; rather short and slender; combined width of ventral arms slightly less than width of base in posterior aspect. Pygofer as in figs. 339-340; nearly symmetrical; medioventral process in ventral aspect long, subterete, apex obtuse, subapically with a transverse keel, process extending posteriorly as far as or slightly farther than apices of pygofer lateral lobes; pygofer lateral lobes short, in lateral view posterior margin slightly produced, caudalmost part occurring well



FIGURES 350-359. Male genitalia of *O. vicarius* (Walker), specimen from Jacksonville, Fla. 350, aedeagus in ventral view. 351, aedeagus in dorsal view. 352, anal segment in dorsal view. 353, anal segment in left lateral view. 354, anal segment in posterior view. 355, styles in broad inner aspect. 356, pygofer in ventral view. 357, same. 358, pygofer in left lateral view. 359, connective in posterior view.

below midlength. Anal segment as figs. 335-337; in dorsal view slightly asymmetrical, longer than wide, with width approximately two-thirds the length; apical margin broadly, irregularly, and deeply concave; in caudal aspect median profile produced into a stout process; ventral profile concave between median process and tectiform lateral margins.

Types. — The type series of *O. beirnei* consists of the holotype male and a paratype male having the same collection data of Seton Lake, Lillooet, British Columbia, Canada, on sagebrush [*Artemisia* sp.], June 30, 1926 (J. McDunnough). Both the holotype and paratype have the number 5876 in the Canadian National Collection, Ottawa. The head and male genitalia of the holotype were illustrated by Beirne. The paratype was used to illustrate this paper.

Distributional records. — Other male specimens examined and found to be *O. beirnei* are: CANADA: British Columbia: Goldstream, Vancouver Island; UNITED STATES: California: Del Norte County, Siskiyou National Forest; Fresno County, Huntington Lake; Mendocino County, Twin Rocks; Placer County, Auburn and Colfax; Shasta County; Tehama; 15 miles west of Mineral; Trinity County, Weaver-ville; Oregon: Jackson County, Medford; Washington: Pierce County, Puyallup.

Notes. — *Oliarus beirnei*, new name, is very close to *O. exoptatus* and *O. fidus*, these three species forming the *exoptatus* complex. Diagnosis of these species is dealt with in the discussion of *exoptatus*.

The apparent range of *beirnei* includes scattered localities from the southwestern corner of Canada, south through western Washington and Oregon to the northern half of California in the United States.

The only host information available for *beirnei* is that the type series was collected "from sagebrush" [*Artemisia* sp.]. The collecting dates on 14 specimens of *beirnei* extend from June 9 to July 14.

***Oliarus quinquelineatus* (Say)**

Figs. 342-349

Flata quinquelineata Say 1830:241.

Salient features. — Length of male 5.4 to 6.7 mm (based on 50 specimens). Ground color of vertex and mesonotum fuscous to castaneous; carinae of mesonotum usually concolorous, occasionally a specimen having one or more of the carinae dull orange. *Head:* Vertex moderately broad, variable, length in middle line usually about equal to width at apex of posterior emargination; median carina variable, extending anteriorly various distances up to midlength of disc; fovea moderately broad, length approximately twice the width. Face usually fuscous to brunneus, occasionally castaneous; carinae prominent, color variable from brown to orange, median carina usually dull orange in full extent, lateral carinae usually orange only on frons; maculae usually present but reduced to a slightly curved line, nearly obsolete in some specimens; frons moderately narrow, width distinctly greater than length in middle line. Rostrum moderately long, usually slightly surpassing posterior trochanters. *Thorax:* Pronotum with intermediate carinae

separated from pale band of posterior margin. Mesonotum with all carinae prominent. Tegmina highly variable, some specimens almost immaculate, other specimens variously banded and spotted with fuscous; well marked specimens with two or three spots in costal cell; tubercles unusually conspicuous because of heavy pigmentation contrasting with pale veins, the veins generally pale except where brownish spotting or banding occurs; apical cells normally 12, antepical cells 6 in number; stigma a distinct brown patch, broad, length usually one and one-half to two times the width. Legs with front and middle tibiae indistinctly banded, the brown bands two in number for each tibia.

Male genitalia. — Aedeagal complex as in fig. 342; major pointed processes four, plus many spinelike processes and lightly sclerotized, lobelike process or pseudo-processes. Periandrium with four processes of the usual sort plus many short, spiny subprocesses; general structure of periandrium highly modified and subject to different interpretations; ventrally with a gross multispined, heavily sclerotized process originating in apical area of the periandrium, giving rise anteriorly to a moderately slender, fairly straight, pointed process directed ventrocephalad primarily, and posteriorly giving rise to a moderately slender process that curves antepically; with numerous short, slender processes between the two rami of the gross process on extremes of this ventral periandrial mass, some of these entire, others in clusters with several points coming off one stem; basal, left lateral area of periandrium giving rise to a recurved, moderately slender process directed straight right-caudad in the apical portion; dorsal process originating in the right basal area, gradually curving left-caudad, gently sinuate, slender entire length with apex about opposite apex of flagellum. Flagellum directed less than 45 degrees left-caudad, with large flat keellike sclerotized structure, and with a subapical, lightly sclerotized lobe directed a short distance to the left. Styles as in fig. 343; symmetrical or nearly so; apex of style curved approximately 90 degrees dorsolaterally; each shaft fairly straight; inner processes long, fingerlike, extending beyond apex of recurved portion, each process with a tubercle along the caudal margin. Connective as in fig. 349; long and moderately stout; combined width of ventral arms greater than base of shaft. Pygofer as in figs. 347-348; medioventral process long, reaching or nearly reaching level of apices of pygofer lateral lobes; in ventral aspect narrowest at base, somewhat sagittate but rounded at apex; pygofer lateral lobes symmetrical or nearly so, stout in ventral aspect, moderately produced in lateral aspect, apices bluntly rounded or subtruncate. Anal segment as in figs. 344-346; flaplike, long and moderately narrow in dorsal aspect, medioapical margin truncate; ventral profile in caudal aspect nearly straight, with slight concavity at midlength.

Type. — The type locality given by Say was "New Jersey," but the Say type is not extant. A specimen from Roselle, New Jersey was used to illustrate the male terminalia. This specimen was collected "6-23-1924" by E.D. Ball, and is in the United States National Museum collection.

Distributional records. — Numerous specimens were examined as follows: Nova Scotia, Ontario, and Quebec Provinces in Canada; Maine, Massachusetts, Connecticut, and New York in the northeastern United States, south through Pennsylvania, New Jersey, Maryland, Virginia, North Carolina, South Carolina,

Georgia, north Florida, west through Mississippi, Oklahoma (Arbuckle Mountains), and Colorado (Boulder, Colorado Springs, Golden), and east to the midland states of Iowa, Minnesota, Wisconsin, Illinois, Indiana, and Ohio. Female specimens which most probably are *Oliarus quinquelineatus* were seen from Alabama, Arkansas, Louisiana, and Tennessee. There seems little doubt that additional collecting and further examination of insect collections will reveal that *O. quinquelineatus* is in all the states east of the Mississippi River and perhaps a few more states west of the Mississippi River.

Notes. — *O. quinquelineatus* is one of the most common and widely distributed species of *Oliarus* in North America. The only species very close to it in general appearance and in male genitalia is *O. vicarius* (Walker). *O. vicarius* usually is longer and the tegmina are more highly colored. There are several small but consistent differences in the male terminalia, even where the species overlap in range in the southeastern United States. This is excellent evidence that the two forms are distinct species. The medioventral pygofer process of *vicarius* is distinctly shorter and more pointed than in *quinquelineatus*; the inner style process of *vicarius* does not have the small protuberance that is present in *quinquelineatus*, and the recurved apex of the style in *vicarius* is slightly broader than in *quinquelineatus*; the left lateral process of the perianthrium of *vicarius* is recurved at the apex, instead of straight apically as in *quinquelineatus*; the caudal portion of the large, ventral process of the aedeagus complex of *vicarius* is straight, but is curved as much as 90 degrees in *quinquelineatus*; the long dorsal periandrial process of *vicarius* tends to be a little broader than its counterpart in *quinquelineatus*.

Oliarus vicarius and *O. quinquelineatus* both have the very unusual large multispiined ventral process of the aedeagal complex. No other species seen even approaches such a multiplicity of tiny processes. There is a tendency for *vicarius* to have more of these tiny processes than does *quinquelineatus*.

Oliarus quinquelineatus and the closely related *O. vicarius* appear closest to the *O. placitus* Van Duzee group. The general appearance of all these species is much the same, and they all have the unusual aedeagal complex, featuring the flagellum directed caudad primarily, instead of the usual approximately 90 degrees or more to the left.

Say in the original description stated that *quinquelineatus* occurred on *Pinus rigida* [Miller] early in August (in New Jersey). Labels on specimens examined include: "collected from under bark of wilting *Q. ellipsoidalis*" [*Quercus ellipsoidalis* E.J. Hill]; "sweeping hickory" [*Carya*]; "*Quercus laevis* [Walter] association"; "beating turkey oak at night" [*Quercus laevis*]; light trap; blacklight trap and "about 5600 ft. alt." [Boulder, Colorado]; "on *Pinus virginiana*" [Miller] [State of Maryland]; "*Solidago* roots" and "near *Solidago* roots" at Vienna, Virginia, May 15, 1938 (nymphs). These nymphs are assumed to be *O. quinquelineatus* on the basis of similar nymphs from Vienna, Virginia, having been reared the previous year and determined as *O. quinquelineatus* from the adults.

A nymph collected by J.C. Bridwell at Vienna, Virginia, October 11, 1936, emerged as an adult male on January 18, 1937. Another nymph from the same place, collected January 1, 1937, was reared and emerged as an adult male on

January 16, 1937. Apparently nymphs of *O. quinquelineatus* overwinter, since fairly well-developed nymphs emerge as adults in late spring under normal conditions in Virginia.

***Oliarus vicarius* (Walker)**

Figs. 350-359

Cixius vicarius Walker 1851:343.

Oliarus vitreus Metcalf 1923:180. N. Syn.

Salient features. — Length of male 6.0 to 8.2 mm (based on 107 specimens). General appearance of head and thorax approximately same as *Oliarus quinquelineatus* (Say), except stigma of tegmen tending to be more narrow. Tegmen and wing as in figs. 8 and 9.

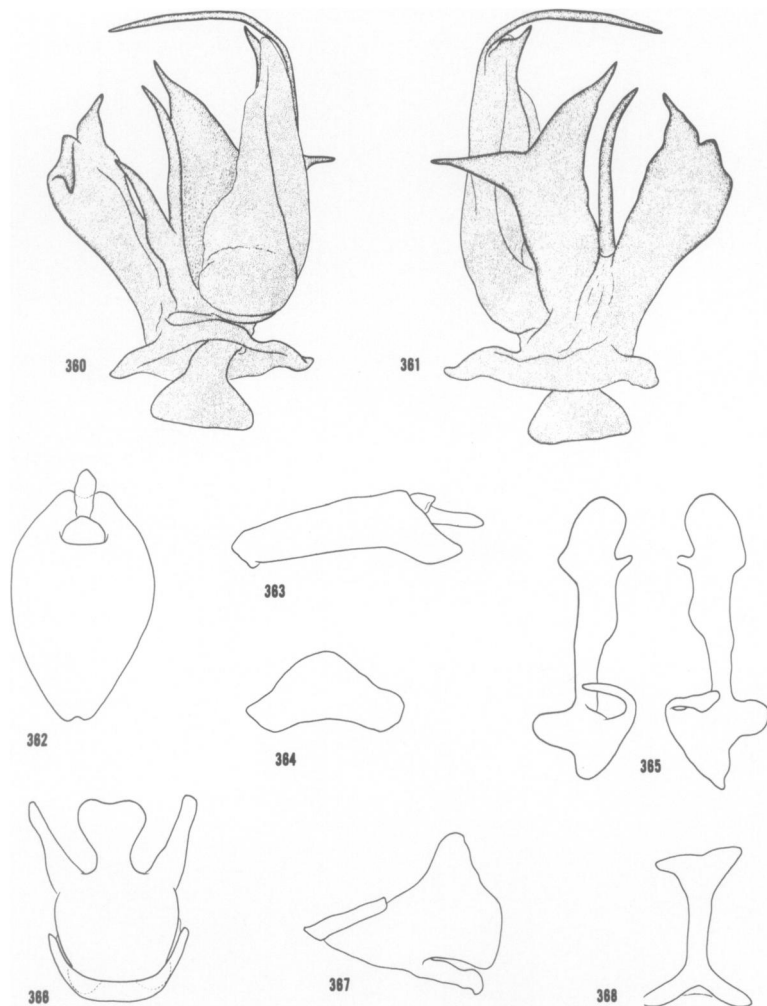
Male genitalia. — Aedeagal complex as in figs. 350 and 351. Styles as in fig. 355. Connective as in fig. 359. Pygofer as in figs. 356-358. Anal segments as in figs. 352-354.

Types. — The type of *O. vicarius* was collected at St. Johns Bluff [Duval County] Florida, and presented to the British Museum by E. Doubleday. Professor David A. Young, Jr., of North Carolina State University examined this type and made pencil drawings of the dorsum of the head and thorax, and also drawings of most of the male genitalia which are in a balsam mount. Professor Young's drawings of the type have formed the basis for determinations of male specimens of *vicarius*, and they also confirm the correctness of Van Duzee's identifications and comparisons made in 1908. The types of *O. vitreus* Metcalf were not seen and apparently are lost. The synonymy is based on the original description and the figures published with it.

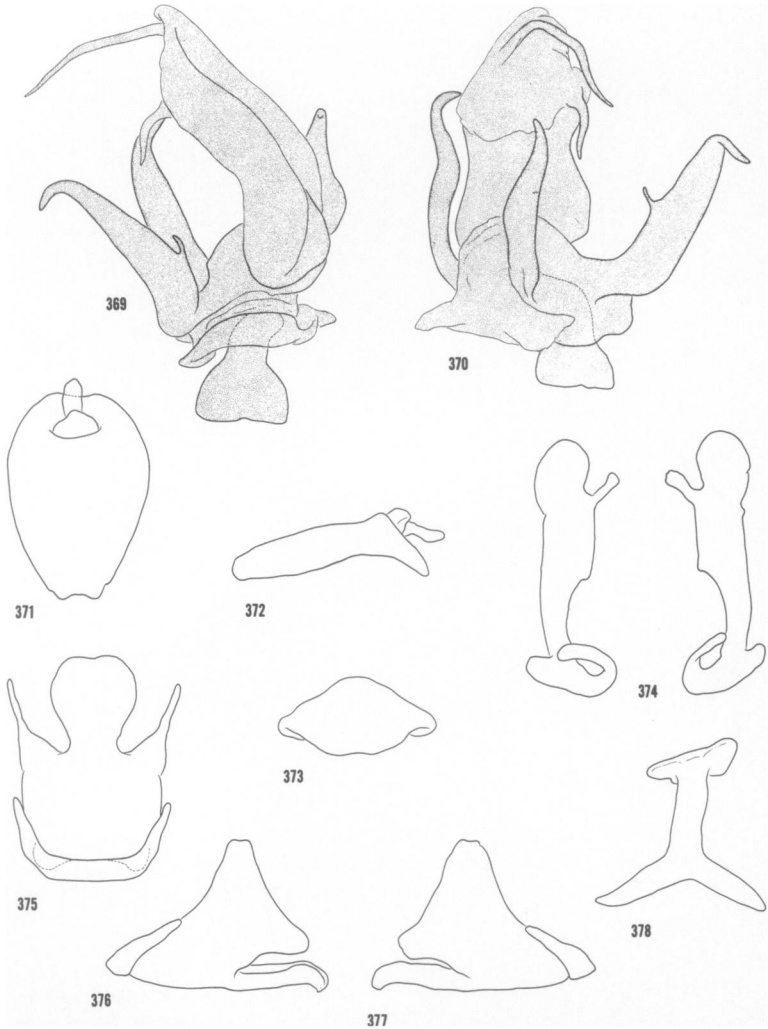
Distributional records. — The known range of *O. vicarius*, from numerous males, is as follows: coastal plain and border areas between coastal plain and piedmont (except one record from Atlanta, Georgia) from North Carolina on the north, south through South Carolina, Georgia, and Florida. In Florida, it is common throughout all regions of the peninsula, but in west Florida (the "Panhandle") it is localized. In this region we have seen it only from Torreya State Park, Liberty County, and Pensacola, Escambia County. Georgia localities include Atlanta and Lowndes and Mitchell Counties. South Carolina localities include River Bridge State Park, Bamberg County, and "Bush House," Aiken County. North Carolina localities include Carolina Beach and Southern Pines.

Notes. — *Oliarus vicarius* is very close to *O. quinquelineatus* and the two species have been in a state of a confusion for a long time. The more obvious differences are noted in the discussion of *quinquelineatus*. Male specimens of *vicarius* almost always can be separated from *quinquelineatus* without recourse to dissections simply by comparing the medioventral process of the pygofer; that of *vicarius* is much shorter and more acuminate.

There is a definite tendency for *vicarius* to be associated with woody plants. At Olustee, Baker County, Florida, E.P. Merkel collected numerous specimens in blacklight traps suspended in pine trees and it has been taken in blacklight traps several other areas in Florida. It was collected on "pine" in Miami, Florida; in



FIGURES 360-368. Male genitalia of *O. placitus* Van Duzee, from paratype Ft. Myers, Fla. 360, aedeagus in ventral view. 361, aedeagus in dorsal view. 362, anal segment in dorsal view. 363, anal segment in left lateral view. 364, anal segment in posterior view. 365, styles in broad inner aspect. 366, pygofer in ventral view. 367, pygofer in left lateral view. 368, connective in posterior view.



FIGURES 369-378. Male genitalia of *O. montanus* Metcalf, from paratype Craggy Mts., Buncombe, Co., N.C. 369, aedeagus in ventral view. 370, aedeagus in dorsolateral view. 371, anal segment in dorsal view. 372, anal segment in left lateral view. 373, anal segment in posterior view. 374, styles in broad inner aspect. 375, pygofer in ventral view. 376, pygofer in left lateral view. 377, pygofer in right lateral view. 378, connective in posterior view.

auto at Miami, Florida; on jeep (automobile) at Crystal Beach, Florida; in malt trap at Estero, Florida, and by beating turkey oak, *Quercus laevis* Walter, at night at Pensacola, Florida (R.E. Woodruff); on *Galactia elliottii* Nuttall (R.A. Morse) in Alachua County, Florida; on guava, *Psidium guajava* Linnaeus at Miami; in Steiner trap with tri-med, QME lure, suspended in a calamondin tree at Bartow, Florida.

The known seasonal distribution of *vicarius* extends from late February to July 26. This is probably a univoltine species.

Oliarus placitus Van Duzee

Figs. 360-368

Oliarus placitus Van Duzee 1912:493.

Salient features. — Length of male 6.1 to 8.8 mm (based on 40 specimens). Ground color of vertex and mesonotum fuscous to fuscocastaneous; carinae of mesonotum concolorous in most specimens, occasionally marked with faint orange. *Head:* Vertex moderately broad, length in middle line varying from slightly less than to slightly more than width at apex of posterior emargination; median carina weakly to moderately developed. Face usually castaneous; carinae pale yellowish to orange throughout lengths; median carina percurrent and unusually prominent, with large fork at base; maculae varying from a weak, narrow spot to conspicuous roundish spot; frons moderately narrow, width distinctly greater than length in middle line. Rostum long, distinctly surpassing caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae separated from posterior margin. Mesonotum with all carinae prominent. Tegmina variable in degree of spotting, some specimens nearly immaculate, others moderately to heavily spotted; costal cell usually with three weakly developed spots (sometimes obsolete); tubercles prominent, especially the pigmented ones on pale veins, veins variable in color from stramineous to brownish, most specimens with veins fairly pale; apical cells normally 12 and anteapical cells 6; stigma a distinct brown patch, length varying from two and one-fourth to three times the width. Legs with front and middle tibiae with alternating yellow and brown bands, the latter two in number for each tibia.

Male genitalia. — Aedeagal complex as in figs. 360 and 361; total pointed processes subject to interpretation because of forking in periandrial processes; minimum five processes, maximum eight. Periandrium unusual, no dextral process present; the sinistral process in more of left-dorsal rather than usual left-ventral position; left, median, basiventral area of periandrium giving rise to a "wishbone" or Y-shaped process, the fork occurring before midlength, each branch fairly slender, the inner one longer; dorsomedian area occupied by a very large, broad process that terminates in two widely diverging, acute branches of an apical fork, the right ramus somewhat shorter than the left; sinistral process bifid at the apex, generally similar to the median dorsal process, but the rami of the apical fork of the left lateral process shorter. Flagellum directed nearly straight caudad but at slight angle to left; with two apical processes, one of which is quite long, very slender, lightly sclerotized and directed at least 90 degrees to the left; the other process very short, slender, well sclerotized, and directed 35-45 degrees to left-caudad. Styles as

in fig. 365; moderately asymmetrical in apical portion; basal part of each shaft approximately twice as broad as part of shaft adjacent to apical expansion; *in situ*, the shafts curving around medioventral process of pygofer; apex of each style with unequal but similar outer, rounded, preapical lobes; apex of right style more pointed than that of the left style; inner processes comparatively long and slender, extending dorsad *in situ*; inner process of right style clavate in profile, stouter than the slender, acuminate inner process of the left style. Connective as in fig. 368; moderately stout, somewhat tilted at base (therefore, slightly asymmetrical); combined width of ventral arms substantially greater than width at base of shaft in posterior aspect. Pygofer as in figs. 366-367; medioventral process in ventral aspect greatly expanded, narrowest at base, widest near apex, apex usually slightly concave, the process appearing slightly bilobate, extending posteriorly to or nearly to level of the apices of the pygofer lateral lobes; lateral lobes in ventral aspect moderately narrow, diverging; in lateral aspect, lobes symmetrical or nearly so, moderately produced and broadly truncate. Anal segment as in figs. 362-364; symmetrical or nearly so; distinctly longer than wide in dorsal aspect and with medioapical margin slightly concave; in caudal view hoodlike, median part of ventral profile moderately concave.

Types. — Van Duzee described *O. placitus* from one male and ten female examples taken at Spring Creek, Decatur County, Georgia, June 7-23, 1911 (J.G. Bradley) and from one male taken by himself at Ft. Myers, Lee County, Florida, May 3-5, 1908. Of the original type series, we examined the Ft. Myers male paratype and used it to illustrate the male genitalia. It is located in the California Academy of Sciences collection and has a yellow paratype label on it. The other male was not found.

Distributional records. — The known range of *O. placitus* extends from New Jersey in the Northeast, south to Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Alabama and Florida, plus the midwestern states of Kansas, Illinois and Ohio. The only Canadian record is a male from Pelee Island in Lake Erie, the southernmost area of Ontario and Canada.

Notes. — *Oliarus placitus* is the most common and the first of four species forming the *placitus* group. *O. placitus* is closest to *O. montanus* Metcalf, in which the vertex is broader and more diverging basally than in most specimens of *O. placitus*, but neither this nor other external characters studied are reliable for separating these two species. *O. placitus* can be separated from *montanus* and other species by the very distinctive characters of the aedeagal complex. The two long, broad, apically expanded and bifid processes of the periandrium are conspicuous and peculiar to *placitus*.

No significant variation in the aedeagal complex of *placitus* was observed, but there is considerable variation in the total length of the individuals and in the degree of brownish areas of spots in the tegmina.

Oliarus placitus apparently is positively phototropic as there are numerous records of it collected at light or in a blacklight trap. It also has been collected in a Steiner trap in an orange tree [*Citrus* sp.], taken in a Malaise trap, taken in

woodland and pine flatwoods, on trucks of apple trees [*Malus* sp.], and on "*Cornus stricta*" at Mount Vernon, Virginia.

The known seasonal distribution of specimens collected in Florida extends from April 17 to July 12; in the more northern part of its range, the records are all for June and July. *Oliarus placitus* probably is a univoltine species.

***Oliarus montanus* Metcalf**

Figs. 369-378

Oliarus montanus Metcalf 1923:179.

Salient features. — Length of male 7.0 to 7.6 mm (based on 20 specimens); length of holotype 7.4 mm. Vertex and mesonotum medium to dark brown, carinae of mesonotum brownish to dull orange. *Head:* Vertex broad, length in middle line distinctly less than width at apex of posterior emargination; median carina usually extending anteriorly approximately half length of disc. Face usually castaneous, varying to fuscous in some specimens; carinae varying from yellow to orange, median carina percurrent and pale from base through most or all of anteclypeus, tending to be less prominent on postclypeus, conspicuously forked at base; maculae weakly developed, crescent-shaped, almost obsolete in some specimens; frons moderately narrow, width greater than length in middle line (1.13-1.4:1). Rostrum long, slightly surpassing caudal margin of posterior trochanters in most specimens. *Thorax:* Pronotum with intermediate carinae separated from posterior margin. Mesonotum with all carinae conspicuous. Tegmina varying from lightly to moderately spotted, with most of spots in clavus and apical portion of corium but three or fewer spots present in costal cell of some specimens, these spots obsolete or nearly so in other individuals; tubercles moderately prominent; veins predominately brownish but becoming intermixed white and dark apically; apical cells normally 12 and anteapical cells 6; stigma a distinct brown patch, somewhat ovoid, length two to two and one-half times width. Legs with front and middle tibiae with alternating yellow and brown bands, the brown bands two in number for each tibia.

Male genitalia. — Aedeagal complex as in figs. 369 and 370; primary pointed processes five, secondary (adventitious) processes appearing in some specimens. Periandrium with three prominent processes, one or more adventitious subprocesses present in some specimens; in ventral aspect, with a stout process developing left-basally tapered and directed left-caudad, curving approximately 90 degrees left-cephalad near apex, thereby becoming hooklike, inner profile entire or with one to three, spines or small subprocesses; two other prominent processes arising from right and left basidorsal areas; right dorsal process slender and sinuate with apex mostly directed right-ventrad; left-dorsal process moderately slender, curving through nearly entire length, but directed caudad primarily in basal two-thirds, then mostly right-ventrad in apical one-third. Flagellum directed at shallow angle (less than 45 degrees to the left) from straight posterior direction; with two very slender, lightly sclerotized processes, the apical one usually longer than the subapical process, both processes slightly curved and extending to left or left-cephalad; right-ventrolateral portion of flagellum with rigid, keellike structure. Styles, as in fig. 374;

weakly to moderately asymmetrical in apical portion; basal half of shaft approximately twice as broad as part of shaft adjacent to apical expansion; *in situ*, the shafts curving around large medioventral process of pygofer; apex of each style unequally bilobate, the outer lobe short and rounded, the inner lobe long, slender, recurved to form a partial loop, bluntly rounded at apex; without inner processes in usual sense unless recurved inner lobe at apex is considered a modified inner process. Connective as in fig. 378; asymmetrical at base of shaft, the left side more caudad, the right side more cephalad (tilted); general aspect short and stout; in posterior view the combined length of ventral arms very long, approximately twice width of base of shaft. Pygofer as in figs. 375-377; medioventral process in ventral aspect greatly expanded, slightly longer than wide, narrowest at base, widest in distal half, slightly asymmetrical, weakly convex, truncate, or concave at apex, extending posteriorly distinctly beyond level of apices of pygofer lateral lobes; lateral lobes in ventral aspect thin, diverging, in lateral aspect symmetrical or nearly so, strongly produced, subacute with apices rounded. Anal segment as in figs. 371-373; hoodlike, nearly symmetrical, distinctly longer than wide in dorsal aspect, with medioapical profile feebly concave, this portion of the anal segment strongly deflexed ventrocaudad; in caudal aspect, ventral profile convex (feebly concave in median part in some specimens).

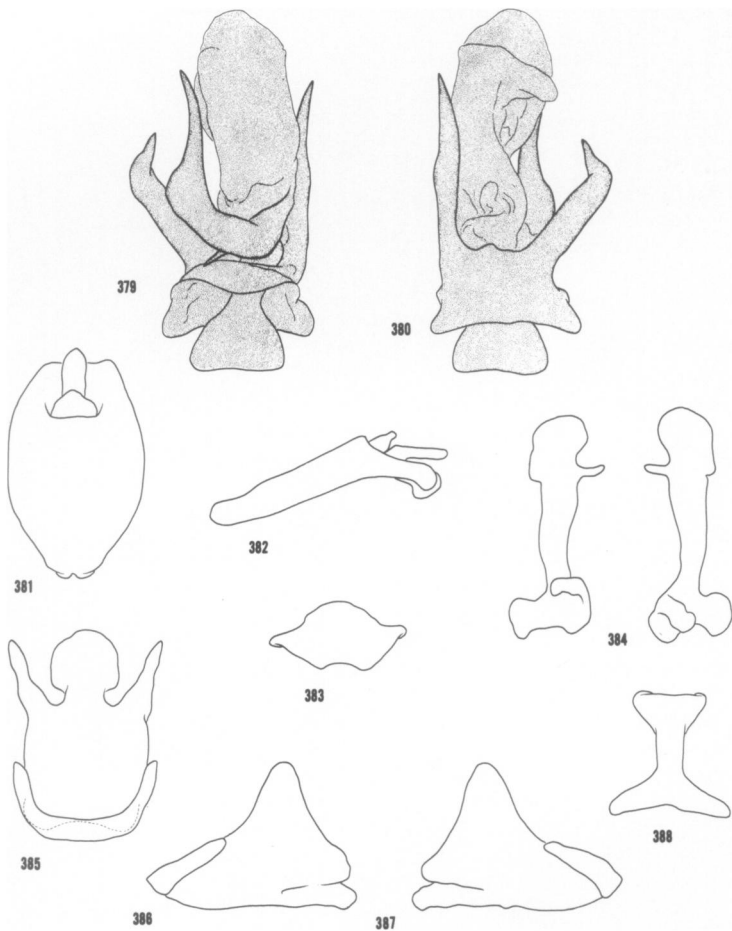
Types. — Metcalf listed the type material as follows: Holotype male, Black Mountains, N.C.; allotype female, Herndon, Virginia; paratype male, Craggy Mountains, N.C., and a male from Makanda [Illinois]. All of the types are in the collection of North Carolina State University, Raleigh. The male paratype from "Craggy Mts., N.C., 8-VI-1916, R.W. Leiby," was used to illustrate the male genital structures.

Distributional records. — Twenty-three male specimens were examined from 11 states in the eastern half of the country. The known range extends from New York south through Pennsylvania, Maryland, Virginia, North Carolina, and northern Georgia, north and west to Tennessee, Ohio, Illinois, Missouri, and eastern Kansas.

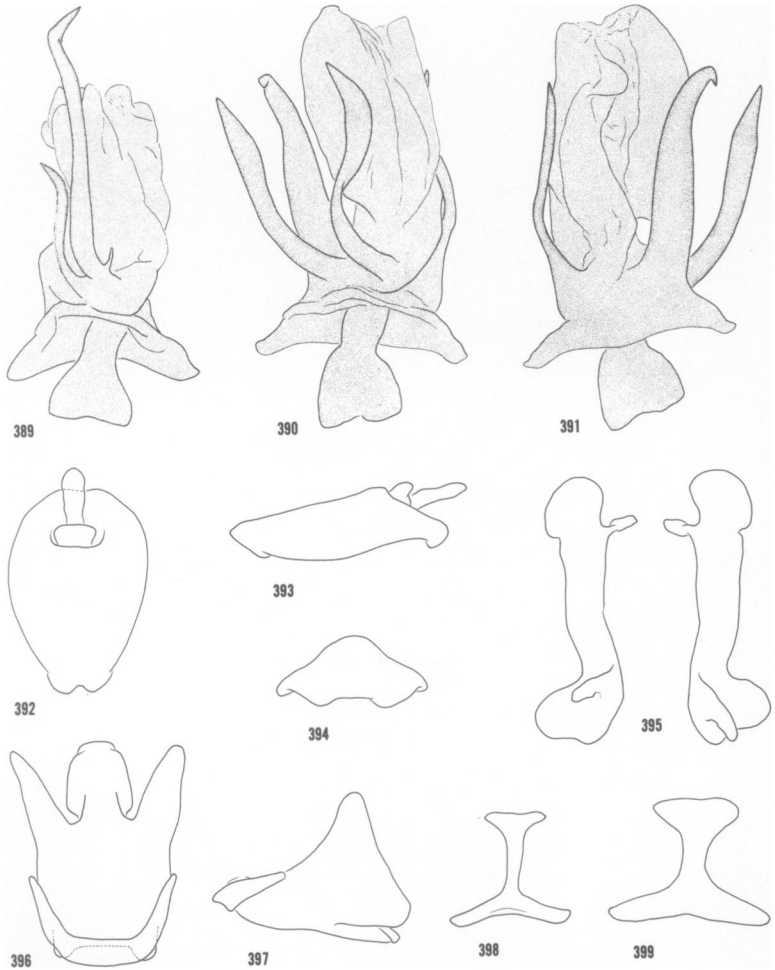
Notes. — *Oliarus montanus* is most likely to be confused with *O. placitus*, a species having much the same range in the eastern United States, but these two species are readily separated by the male terminalia, often without dissection. The apices of the styles of *placitus* are larger; the two very prominent, apically expanded, bilobate periandrial processes of *placitus* are diagnostic, as is the single long, slender, left apical process of the flagellum in *placitus* as compared to two such processes in the apical portion of *montanus*. Both *O. placitus* and *O. montanus* superficially resemble *O. quinquelineatus* and *O. vicarius* but the last two species lack the greatly expanded pygofer process of the *placitus* group.

Variations have already been noted; the holotype terminalia are in agreement with the paratype which is illustrated. But the short, slender spine on the left ventral process of the periandrium of the paratype is papilliform in the holotype.

Oliarus montanus is placed in a distinctive group that includes *O. eximus* Caldwell, *O. placitus*, and *O. teximus* Caldwell. *O. montanus* is sympatric with *placitus* and allopatric to *eximus* and *teximus*. From the available information,



FIGURES 379-388. Male genitalia of *O. eximus* Caldwell, from paratype Santa Rosa Mts., Cal. 379, aedeagus in ventral view. 380, aedeagus in dorsal view. 381, anal segment in dorsal view. 382, anal segment in left lateral view. 383, anal segment in posterior view. 384, styles in broad inner aspect. 385, pygofer in ventral view. 386, pygofer in left lateral view. 387, pygofer in right lateral view. 388, connective in posterior view.



FIGURES 389-399. Male genitalia of *O. teximus* Caldwell, from paratype Uvalde Co., Texas. 389, aedeagus in ventral view, Dallas, Texas. 390, aedeagus in ventral view. 391, aedeagus in dorsal view. 392, anal segment in dorsal view. 393, anal segment in left lateral view. 394, anal segment in posterior view. 395, styles in broad inner aspect. 396, pygofer in ventral view. 397, pygofer in left lateral view. 398, connective in posterior view, Uvalde Co., Texas. 399, same, Davis Mts., Texas.

montanus appears to be a member of the Carolinian fauna with possible center of origin in the southern Appalachian Mountains.

The precise habitat information available on *O. montanus* is very limited. Labels read as follows, "on root of apple tree" [*Malus* sp.], "elev. 2000," "light trap," and "on Hickory" [*Carya*]. Most of the specimens were collected in mountainous or hilly areas.

The known seasonal distribution is from May 22 to August 27, with most records being in June.

Oliarus eximus Caldwell

Figs. 379-388

Oliarus eximus Caldwell 1947b:145.

Salient features. — Length of male 5.3 mm to 6.4 mm (based on nine specimens); holotype male 5.9 mm. Vertex and mesonotum varying from fuscipiceous to castaneous, mesonotal carinae varying from brown to orange, usually a concolorous brown, no single specimen with all five carinae a prominent orange. *Head:* Vertex moderately broad, length in middle line equal to width at apex of posterior emargination; median carina nearly obsolete or short. Face usually castaneous, commonly tinged fuscous or yellow-brown in certain areas; facial carinae prominent, especially the median carinae which is percurrent and yellowish entire length, base with unusually long and prominent fork; maculae present but reduced, somewhat crescent-shaped; frons broad, width substantially greater than length in middle line (1.47-1.66:1). Rostrum long, usually surpassing caudal margin of posterior trochanters; in some specimens extending past posterior trochanters by half length of apical segment of rostrum, in other specimens approximately even with caudal trochanteral margin. *Thorax:* Pronotum with intermediate carinae separated from posterior margin. Mesonotum with all carinae prominent. Tegmina strikingly marked throughout with intermixed white and brown veins, spotting weakly extending to some membranous areas; a small brown spot usually at fork of Y-vein but spot nearly obsolete in some specimens; apical crossveins vicinity of M and Cu usually with brownish suffusion; apical crossveins of Sc and R pale or light brown, not suffused; commissure mostly dark with adjoining membrane of clavus variously fumose with brown, pale area of commissure located at union of claval veins; tubercles large, mixed pale and pigmented, tending to be concolorous with veins; however, some pale veins with pigmented tubercles, numbers of apical cells variable among specimens and between left and right tegmina of individual specimens, range of variability extending from 9 to 12 cells, with 10 and 11 cells most common; antepical cells varying from 3 to 7, with 6 the normal number (in a specimen with 3 antepical cells on one tegmen and 4 on the other tegmen the small number resulted from the lack of some apical crossveins); stigma brown, usually subtriangulate, moderately narrow, length two and one-half to three times width. Legs with each front tibia having two brown bands.

Male genitalia. — Aedeagal complex as in figs. 379 and 380; total pointed process three or four, plus sclerotized, thumblike lobe atypical of usual form of process. Periandrium with three prominent processes and one partially hidden, spinelike,

basiventral process present in more than half the specimens examined; periandrium sufficiently modified to make difficult the discussion of dextral and sinistral processes in the context used in other descriptions; one prominent process developing on ventral side from basal area; this process curving left, then caudad, swollen at approximately midlength, then tapering to a point with slight outward curve, distinctly short of apex of flagellum; basiventral area often with a spinelike process directed to left or left-cephalad, basal portion of spinelike process hidden in ventral view (entirely hidden in dorsal view); periandrium in dorsal view with right dorsolateral and left dorsolateral processes, the process of the right side slender, longer, straight or nearly so, acuminate; the process of the left side extending left-caudad at approximately 45 degree angle to subapical portion that curves approximately 45 degrees abruptly caudad, tapering rather abruptly to a point, this process not reaching as far caudad as the other two prominent processes. Flagellum extended nearly straight caudad, slightly inclined to the left, without processes of the usual type but with a thumblike, subapical dorsal process directed primarily to the left but also somewhat cephalad; much of flagellum with a large platelike or keellike structure primarily on the ventral surface. Styles as in fig. 384; slightly asymmetrical; apical area bilobate; inner process moderately short, somewhat fingerlike, slightly expanded at apices, right inner process directed caudad at an angle, left process not so. Connective as in fig. 388; short and stout, combined width of ventral areas a little less than twice the width of the base of the shaft in posterior aspect. Pygofer as in figs. 385-387; medioventral process in ventral view greatly expanded, nearly as wide as long, spatulate, constricted basally and broadly rounded apically, tending to be slightly asymmetrical, extending posteriorly slightly more than apices of pygofer lateral lobes; lateral lobes symmetrical or nearly so, rather thin in ventral view, greatly produced in lateral aspect, apices subacute and most produced extremely ventrally along the posterior margin. Anal segment as in figs. 381-383; in dorsal view flaplike, considerably longer than wide, nearly symmetrical, medioapical margin slightly concave; in lateral view asymmetrical apically, the left caudoventral portion not expanded as much as the right caudoventral portion; in caudal view the ventral profile concave in median portion, subtended on each side by a protuberance or convexity.

Types. — Caldwell listed the type series as “male holotype from Santa Rosa Mts., California, June 15, 1946; female allotype same locality, May 27, 1946; paratypes May 27, 1946, June 15, 1946, June 25, 1946 (D.J. & J.N. Knull), OSU” [Ohio State University]. The entire type series was examined. The female series is mixed. Of the allotype and six paratypes, only one female is *O. eximus* (collecting date VI-25-46). The allotype female and the other female paratypes are not *eximus* but belong to the mountain form of *O. californicus* Van Duzee.

The simplest characters to separate females of *Oliarus californicus* from those of *eximus* are the intermixed white and brown veins in *eximus*; *californicus* has fairly uniformly brownish veins. *O. californicus* also has a broader, shorter face, large maculae, a much better developed median carina of the vertex, and less conspicuous mesonotal carinae.

Distributional records. — Other specimens examined include a male from New Mexico, Andreas Bolter collection, Illinois Natural History Survey collection; a

male from Inyo County, California, 12 miles northeast of Big Pine, 7200 feet above sea level, collected at night, VI-9-1966 (Lois B. O'Brien) and a female from "Forest Home", San Bernardino County, California, VI-14-28 (E.C. Van Dyke).

Notes. — *Oliarus eximus* is an uncommon species of the southwestern United States. It is a member of the *O. placitus* group. It is closest to *O. teximus* under which distinguishing characters are discussed.

Probably the most important variation occurs in the presence or absence of a short, spinelike process partially hidden at the basiventral portion of the aedeagal complex. The holotype and most but not all of the type series have this process. A specimen from Inyo County, California, has the longest such process; a specimen from New Mexico lacks this process.

Oliarus eximus appears restricted to very local mountainous areas of the southwestern United States from the very little information available. Collecting records start with May 27 and end with June 25.

***Oliarus teximus* Caldwell, new status**

Figs. 389-399

Oliarus eximus teximus Caldwell 1947b:146.

Salient features. — Length of male 4.7 to 5.9 mm (based on six specimens); holotype male nearly 5.1 mm. Vertex and mesonotum fuscous to medium brown; mesonotal carinae usually concolorous, sometimes orange. *Head:* Vertex moderately broad, length in middle line about equal to width at apex of posterior emargination; median carina extending anteriorly to a variable extent, up to half the length of the disc. Face castaneous or yellow-brown, lighter than mesonotum; facial carinae prominent, yellowish, median carina percurrent and yellowish from base through anteclypeus and with unusually long and prominent basal fork; maculae present but of reduced type, somewhat crescent-shaped; frons broad, width greater than middle length, the length two-thirds to seven-tenths the width. Rostrum long, usually surpassing caudal margin of posterior trochanters; in some specimens extending beyond posterior trochanters more than half the length of apical segment of rostrum; in other specimens, approximately as far as caudal margin of trochanters. *Thorax:* Pronotum with intermediate carinae separated from posterior margin. Mesonotum with all carinae prominent. Tegmina strikingly marked with brown spots at forks of Y-veins and with small brownish areas in several apical cells, at all apical crossveins, and along commissure, and several segments or forks of the veins; tubercles mostly prominently pigmented with brown, but a few concolorous with pale vein sections and somewhat difficult to detect; all lengthy veins intermixed with pale and dark sections; apical cells normally 12 in number, occasionally 11, and anteapical cells 6; stigma brownish, somewhat rounded, proportions variable, length usually two to two and one-half times width. Legs with front tibiae bearing alternating pale and dark bands, the latter two in number.

Male genitalia. — Aedeagal complex as in figs. 389-391; total of conspicuous pointed processes four, plus a lobelike, lightly sclerotized structure. Periandrium with four prominent processes and occasionally with adventitious small sub-processes, type specimen having four prominent processes of about equal length, two arising from the basiventral area, two arising from the basal left and right dor-

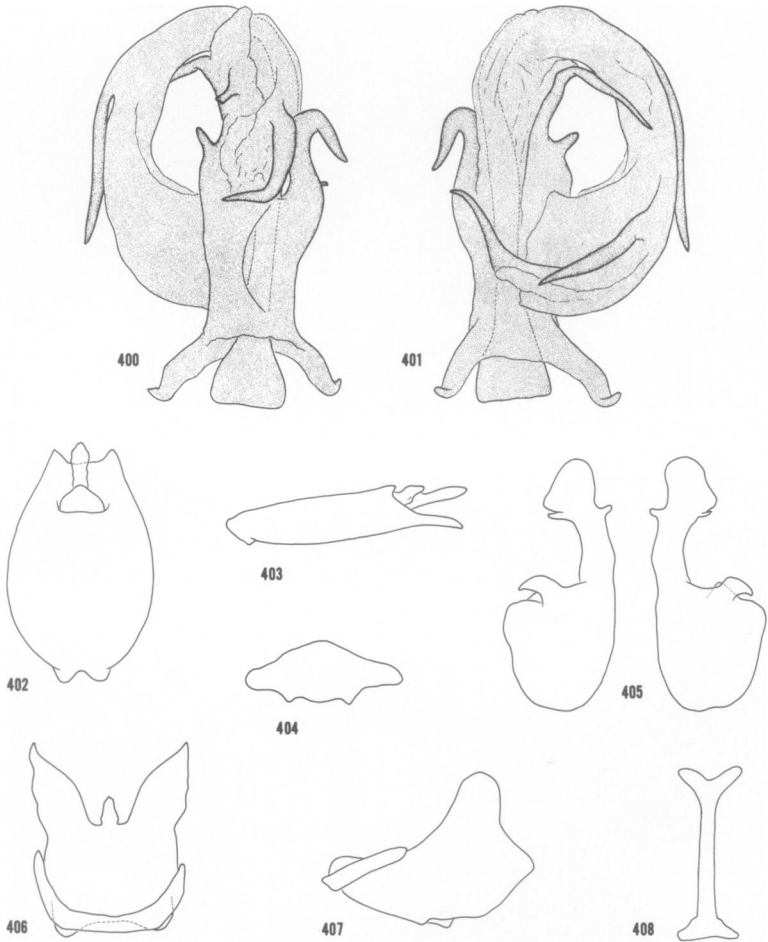
solateral areas. Flagellum as a whole directed nearly straight caudad, slightly inclined to the left; without processes of the usual type but with a thumblike dorsal, subapical lobe directed to the left, this lobe moderately sclerotized, much of flagellum a large rigid, platelike structure primarily on the ventral surface. Styles as in fig. 395; slightly asymmetrical; apical area weakly bilobate; inner processes moderately short, somewhat fingerlike, apex varying from acuminate to moderately rounded. Connective as in figs. 389-399; unusually short and stout; combined width of ventral arms much wider (nearly two times) than width of base of shaft in posterior aspect. Pygofer as in figs. 396-397; medioventral process in ventral view greatly expanded, approximately as wide as long or slightly longer than wide, rounded-spatulate, constricted basally, broadly subtruncate or truncate apically, extending posteriorly slightly more than level of apices of lateral lobes of pygofer; lateral lobes symmetrical or nearly so, rather thin in ventral aspect, greatly produced in lateral aspect, apices subacute and most produced extremely ventrally along the posterior margin. Anal segment as in figs. 392-394; in dorsal view flaplike, considerably longer than broad, symmetrical or nearly so, rather thin in ventral aspect, greatly produced in lateral aspect, apices subacute and most produced distally and ventrally along the posterior margin, medioapical margin slightly concave; in caudal view the ventral profile with a median rectilinear concavity bordered on each side by a ventral protuberance or convexity.

Types. — All the type material of *O. teximus* is in the Ohio State University collection and was examined. Caldwell listed the type series as, "male holotype from Bastrop, N.P., Texas, May 1, 1941; female allotype and male paratype, Uvalde County, Texas, May 3, 1941; female paratypes, Uvalde County, May 11, 1946, and Brownsville, Texas, May 8, 1935 (D.J. & J.N. Knull), OSU." The females do indeed appear conspecific with the males; however, their sexual dimorphism is manifest in much larger brown areas on the tegmina.

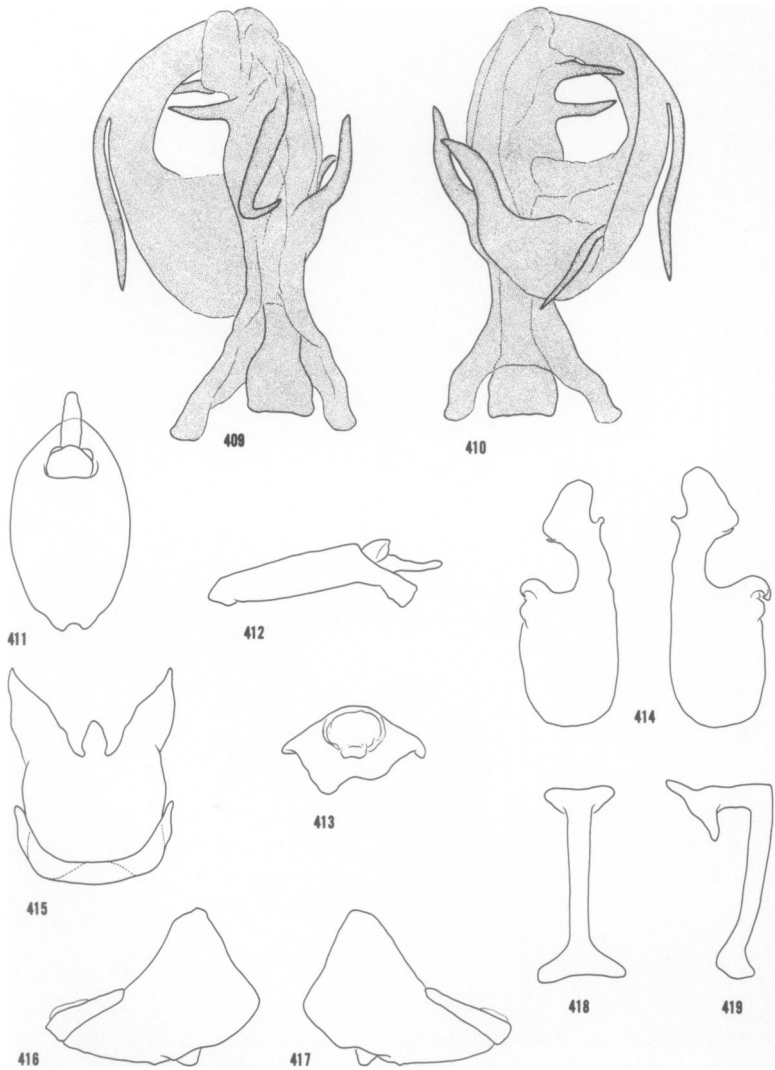
Distributional records. — Other specimens examined include one male and three females from Hidalgo County, Texas, IV-7-50 and one male from Hidalgo County, V-23-51; one female, Uvalde County, V-23-35; one male, one female, Davis Mountains, Texas, VII-11-55, all the above specimens collected by D.J. and J.N. Knull in the Ohio State University collection. The other specimen is a male from Dallas, Texas, IV-25-07 (F.C. Pratt) #28, United States National Museum collection. It is evident that this is an uncommon species.

Notes. — A change in status from a subspecies of *Oliarus eximus* Caldwell to a species is proposed for the concept previously known as *Oliarus eximus teximus* Caldwell. Differences between *eximus* and *teximus* are rather slight for the most part, but the two can be separated by the processes of the periandrium. *Oliarus teximus* has four prominent acuminate processes generally directed caudad, but *eximus* has only three such processes; however, some specimens of *eximus* have a short, spinelike process directed primarily to the left from a basiventral position.

Male terminalia serve to distinguish *O. teximus* from closely related species. *O. teximus* is a member of the *O. placitus* group, and the group characteristics are sufficient to separate *teximus* from non-group species without the necessity of dissections.



FIGURES 400-408. Male genitalia of *O. lobatus* Caldwell, from paratype, same data as holotype. 400, aedeagus in ventral view. 401, aedeagus in dorsal view. 402, anal segment in dorsal view. 403, anal segment in left lateral view. 404, anal segment in posterior view. 405, styles in broad inner aspect. 406, pygofer in ventral view. 407, pygofer in left lateral view. 408, connective in posterior view.



FIGURES 409-419. Male genitalia of *O. caldwelli*, n. sp., from holotype. 409, aedeagus in ventral view. 410, aedeagus in dorsal view. 411, anal segment in dorsal view. 412, anal segment in left lateral view. 413, anal segment in posterior view. 414,

Oliarus teximus exhibits infraspecific variation, but no specimens were encountered that were interpreted as hybrids or intergrades with *O. eximus*. One interesting type of variation is in the length of the four processes of the periandrium in *teximus*. The paratype from Uvalde County, Texas, and the two male specimens from Hidalgo County, Texas, agree in the four processes being approximately equal in length. The holotype male from "Bastrop N.P." Texas and two males from Dallas, Texas, and Davis Mountains, Texas, agree in having an extraordinarily long, basal, medioventral process and the other three processes of slightly different lengths. The one long process distinctly extends posteriorly beyond the flagellum but the other processes do not extend as far as the apex of the flagellum.

The specimen from Dallas, Texas, has an adventitious short, very slender, sub-process at the right basal position of the long, basal, medioventral process of the periandrium. The males with the unusually long process are from 4.7 to 5.1 mm in total length; the others with the processes of equal length are from 5.6 to 5.9 mm in length.

The known range of *O. teximus* is confined to Texas where it ranges from Dallas County in the northeast quarter of Texas, south to the Lower Rio Grande Valley, and west to the Davis Mountains, the localities being widely scattered.

No host or habitat information is available for *O. teximus*.

The seasonal distribution of *O. teximus* extends from April 7 to July 11, with most records in April and May.

Oliarus lobatus Caldwell

Figs. 400-408

Oliarus lobatus Caldwell 1938:305.

Salient features. — Length of male 7.0 to 7.8 mm (based on 24 specimens); holotype 7.5 mm. Ground color of vertex and mesonotum fuscous to castaneous; carinae of mesonotum predominately dull orange, often blended with brown. *Head:* Vertex moderately broad, variable, length in middle line varying from slightly less than width at apex of posterior emargination in some specimens, to distinctly greater than width in other specimens; median carina absent or very short. Face usually castaneous; median carina conspicuously forked at base, percurrent, usually orange colored entire length; lateral carinae usually orange to pale yellow; maculae weakly to moderately developed, usually lineate or lunate; frons moderately narrow, width distinctly greater than length in middle line, variable. Rostrum length variable, extending posteriorly from slightly less than to slightly more than distance to caudal margin of posterior trochanters. *Thorax:* Pronotum with intermediate carinae separate from pale border of hind margin. Mesonotum with all carinae conspicuous, somewhat variable. Tegmina with brownish spots of variable intensity; clavus with prominent brown spots at fork of Y-veins and usually halfway from fork

styles in broad inner aspect. 415, pygofer in ventral view. 416, pygofer in left lateral view. 417, pygofer in right lateral view. 418, connective in posterior view. 419, connective in left lateral view.

to commissure; corium with spot near fork of Cu_1 and with brown patches in discal cells, thus forming (usually) a diagonal row of brownish patches to Y-vein fork; apical crossveins suffused, apical cells variously spotted with brownish area; tubercles prominent, pigmented with brown, contrasting with the usually pale (sometimes light brown) veins, normally with 12 apical and 6 anteapical cells; stigma brown, shape variable, usually two to three times longer than wide. Legs with front and middle tibiae vaguely banded.

Male genitalia. — Aedeagal complex as in figs. 400 and 401; total pointed processes eight. Perandrium with five processes; dextral process prominent, sinuate basally, recurved outward apically (hooklike); no basal sinistral process, but left apical area with a short, straight process directed left caudad; ventral medioapical area giving rise to a short process, directed left-cephalad in some specimens, but in other specimens longer, with distal portion curving left dorso-caudad; ventral, right, submedioapical area giving rise to a prominent retrorse process which usually curves approximately 90 degrees to the left in apical third, but curvature much less in some specimens; left apical area, primarily on dorsal surface, with a moderately long, slender process directed left-cephalad, with apical part of process hidden by flagellum in ventral view. Flagellum appearing to make a complete loop when viewed ventrally; with three processes, an apical, preapical, and basal outer process which is longest of the three. Styles as in fig. 405; symmetrical; apical portion greatly enlarged, producing a large flat, lateral lobe; inner processes far removed from posterior end of styles, fairly short, stout, beaklike or hooklike. Connective as in fig. 408; long and slender; combined width of ventral arms approximately equal to width at base of shaft in posterior aspect. Pygofer as in figs. 406-407; nearly symmetrical; medioventral process in ventral aspect small, slightly constricted at base, triangulate, width approximately two-thirds the length; process extending posteriorly distinctly less than half the distance to level of the apices of lateral lobes of pygofer; left lateral lobe slightly longer than right lateral lobe; in lateral aspect lobes broadly pointed, somewhat obliquely truncate, extending farthest caudad near midlength of posterior margin. Anal segment as in figs. 402-404; in dorsal aspect substantially longer than wide, symmetrical or nearly so, broadest near midlength, medioapical margin concave between pointed lateroapical lobes; ventral profile in caudal aspect sinuate between a pair of short submedian pointed protuberances; lateral margins straight, not curving downward; thus, flaplike rather than hoodlike.

Types. — Caldwell listed the type series as: male holotype, Davis Mountains, Texas, VIII-36; female allotype, Davis Mountains, Texas, VI-36; paratypes, Davis Mountains, Texas, and Huachuca Mountains, Arizona, 1936 and 1937; 1936 material collected by J.N. Knull; 1937 material collected jointly by J.N. Knull and Mrs. Knull (Dr. D.J. Knull). The type repository was listed as the Ohio State University collection. The following members of the type series were studied. Ohio State University collection: Holotype male Davis Mountains, Texas, VIII-22-36, (J.N. Knull); 17 male and female paratypes from Davis Mountains, Texas, having the dates of VII-6-36, VIII-22-36, VI-2-37, VIII-2-37. United States National

Museum collection (all paratypes from Davis Mountains, Texas): male, two females, VII-6-36; male, VIII-22-36; male, VI-2-37; male, VIII-2-37.

Distributional records. — The known range of *O. lobatus* is limited to the Big Bend area (Brewster County) and Davis Mountains (Jeff Davis County) of Texas and to Whites City, New Mexico (Eddy County), about 12 miles north of the Texas border, due north of the Davis Mountains.

Notes. — *Oliarus lobatus* is a member of the *O. aridus* group and is closest to *O. caldwelli*, new species, within that group. Diagnosis of *lobatus* is dealt with under the discussion of *caldwelli*.

No specific habitat or host information is available for *O. lobatus* but this species seems restricted, for the most part, to isolated mountain groups of the west Texas area.

The known seasonal distribution of *O. lobatus* extends from June 2 to August 22.

***Oliarus caldwelli*, n. sp.**

Figs. 409-419

Salient features. — Length of male 5.9 to 7.0 mm (based on four specimens); holotype male 6.2 mm. Ground color of vertex and mesonotum fuscous to fuscopiceous, area between mesonotal carinae variously mixed with orange; mesonotal carinae predominately orange; on some specimens carinae all or partly brownish. *Head:* Vertex moderately broad, length in middle line equal to width at apex of posterior emargination in holotype, length slightly greater than width in paratypes; median carina in holotype and most paratypes present in basal half of disc. Face castaneous to fuscous; median carina with conspicuous long fork at base, percurrent distally through anteclypeus, color deep orange to pale yellow; lateral carinae pale from base through postclypeus; maculae weakly to moderately developed, usually linear or lunate; frons moderately narrow, ratio width to length 1.24-1.31:1. Rostrum long, distinctly surpassing caudal margin of posterior trochanters by one-fourth to one-third length of apical segment of rostrum; apical segment almost entirely fuscous. *Thorax:* Pronotum with intermediate carinae not joining pale border of posterior margin; lateral area near tegula with a pale yellow, conspicuous, longitudinal carina connecting intermediate and posterior carina; tegula predominately light brown. Mesonotum with prominent carinae; intermediate pair well developed posterior half or two-thirds of mesonotum, evanescent in anterior quarter, mostly arcuate. Tegmina milky subhyaline, clavus with fuscous spot vicinity of Y-vein fork and another half the distance from Y-vein fork to commissure; commissure brownish to testaceous basad of juncture of Y-veins, pale for a short distance distad Y-vein juncture; an occasional specimen with small spot at Cu, fork and again on media near Cu, fork; costal cell with three well spaced fuscous spots, tending to lie closer to costa than to subcosta; apical crossveins infuscated and most apical cells with brownish areas of spots; tubercles prominent, more so than in most species of genus, usually brown pigmented and contrasting with the pale yellow veins in the basal half or so of the tegmina, apical veins darker; normally with 11 apical cells and 6 anteapical cells; branches reaching apex: Sc two,

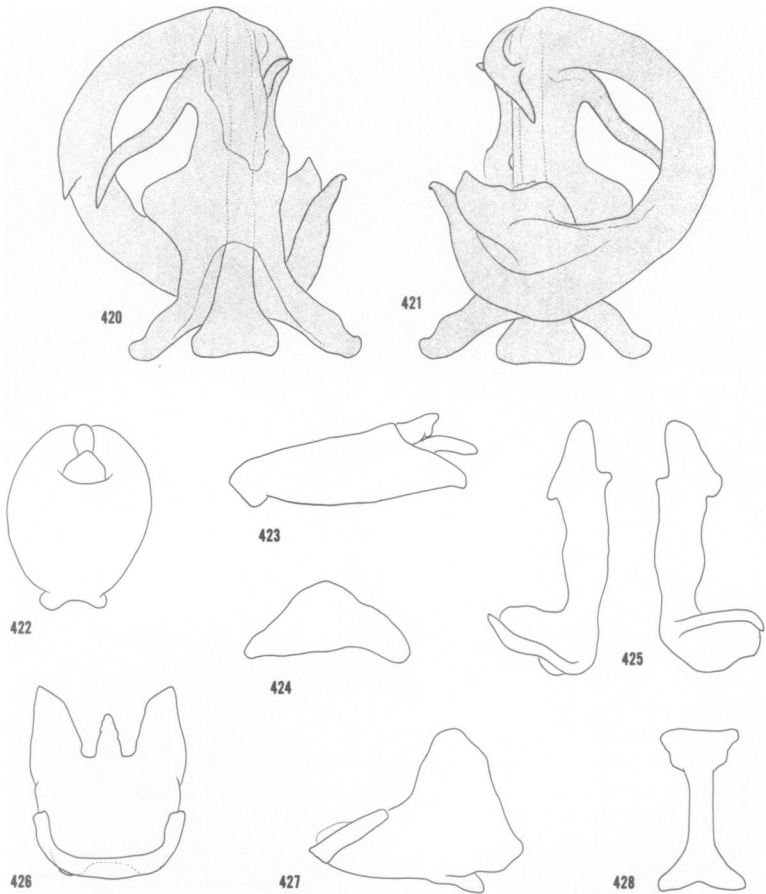
R two M five, Cu, two; stigma brown, with length two to two and one-half times the width. Legs with front and middle tibiae vaguely banded.

Male genitalia. — Aedeagal complex as in figs. 409 and 410; total pointed processes seven. Periandrium with four processes; dextral process moderate in size, apical two-thirds directed nearly straight caudad and slightly to the right; no basal sinistral process; left ventroapical area with a fairly short, acute process directed straight left; ventral, right, submedioapical area giving rise to a retrorse process having the apical fourth recurved to the right, hooklike; dorsal periandrium with a short, slender, straight process directed left from the right apical area. Flagellum appearing to make a complete loop when viewed ventrally; with three processes: one apical and fairly stout, a second dorsal preapical, slender, and a third prebasal outer process, longer than others and directed nearly straight cephalad. Styles as in fig. 414; symmetrical, or nearly so; apical portion greatly enlarged, produced in large, flat subrectangulate, lateral lobe; inner processes far removed from posterior end of styles, fairly short, stout, with apices curving inward from position on outer, basal shoulder of lobe. Connective as in figs. 418-419; long and slender, shaft nearly straight in lateral aspect; combined width of ventral arms slightly more than width of shaft in posterior view; pygofer as in figs. 415-417; nearly symmetrical; medioventral process in ventral aspect short, constricted at base, triangulate, ratio of width to length 7:11, extending posteriorly less than half the distance to level of apex of left lateral lobe; left lateral lobe slightly longer than the right lobe; in lateral aspect lobes broadly pointed, left lobe gently convex ventrad of most posterior part of margin, but right lobe straight (obliquely truncate) ventrad of most posterior part of margin; apex of each posterior margin occurring at midlength. Anal segment as in figs. 411-413; in dorsal view slightly asymmetrical; medioapical margin convex; substantially longer than wide, flaplike, ratio of length to width in holotype 1.7:1, with widest portion at or near middle; in caudal aspect, asymmetrical, ventral profile undulate, with left submedian lobe extending farther ventrad than right submedian lobe.

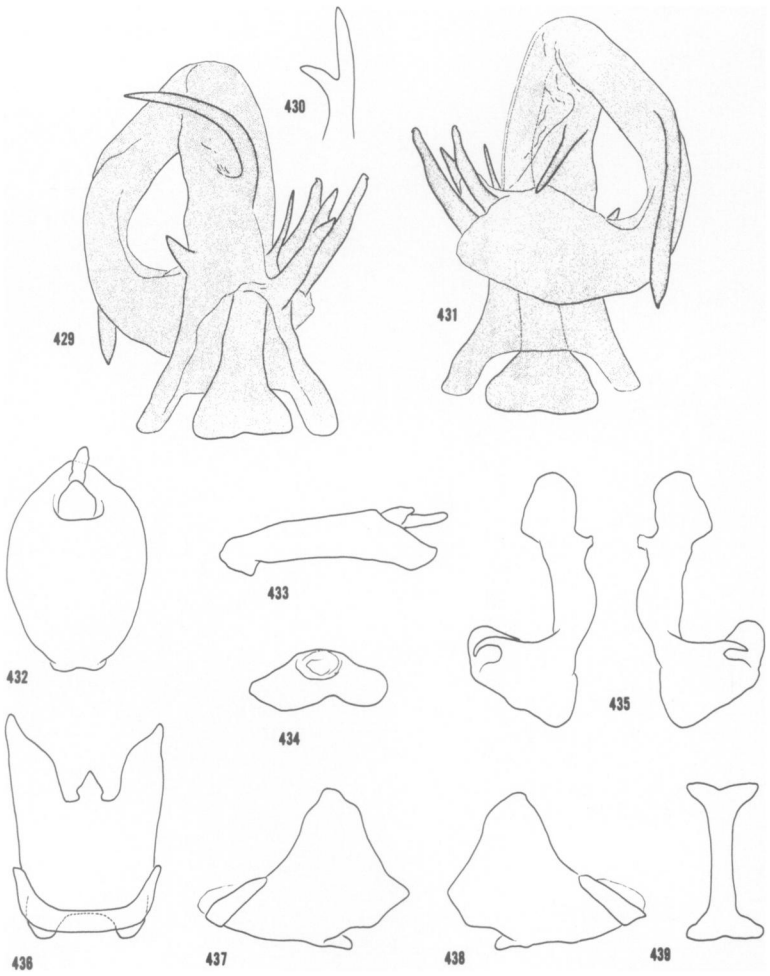
Types. — *Oliarus caldwelli* is described from the male holotype, female allotype, two male paratypes and one female paratype all from 20 miles south of Alpine, Texas [Brewster County], May 12, 1927, (J.O. Martin) California Academy of Sciences collection; a male paratype from Ft. Davis, Texas [Jeff Davis County], #13, June 6, 1933 (P.W. Oman), United States National Museum collection; and a male paratype from Jeff Davis County, Texas, July 12, 1950, (D.J. and J.N. Knull) Ohio State University collection.

Distributional records. — *Oliarus caldwelli* and the closely related *O. lobatus* Caldwell are sympatric; both are known only from the Big Bend — Davis Mountain areas of western Texas, except for one slightly atypical specimen of *lobatus* which has been taken in New Mexico, approximately 12 miles north of the Texas state line.

Notes. — *Oliarus caldwelli* is very close to *O. lobatus*, with which it has been previously identified. The external appearance is much the same, but *caldwelli* is usually smaller than *lobatus* and has three fuscous spots in the costal cell of the tegmen which are not present in *lobatus*. This character is very useful in separating females of these two species and also in separating *caldwelli* from similar members



FIGURES 420-428. Male genitalia of *O. apache* Ball, from paratype Tucson, Ariz. 420, aedeagus in ventral view. 421, aedeagus in dorsal view. 422, anal segment in dorsal view. 423, anal segment in left lateral view. 424, anal segment in posterior view. 425, styles in broad inner aspect. 426, pygofer in ventral view. 427, pygofer in left lateral view. 428, connective in posterior view.



FIGURES 429-439. Male genitalia of *O. knullorum*, n. sp., from holotype. 429, aedeagus in ventral view. 430, dextral process of aedeagus in right lateral view. 431, aedeagus in dorsal view. 432, anal segment in dorsal view. 433, anal segment in left lateral view. 434, anal segment in posterior view. 435, styles in broad inner aspect. 436, pygofer in ventral view. 437, pygofer in left lateral view. 438, pygofer in right lateral view. 439, connective in posterior view.

of the *O. aridus* Ball group. *O. caldwelli* and *O. lobatus* can be separated from many of the southwestern species by the heavier, more prominent tubercles on the veins of the tegmina and also by the narrower head. Every major structure in the male terminalia of *caldwelli* and *lobatus* exhibits differences between these two species. The periandrium of *caldwelli* has four processes, in *lobatus* there are five processes; the ventral retrorse process of *caldwelli* curves to the right near its apex, but in *lobatus* it curves to the left; the dextral process of *caldwelli* is nearly straight, but in *lobatus* is recurved. The apical process of the flagellum in *caldwelli* is stouter than its counterpart in *lobatus*. The greatly expanded lateroapical lobes of the styles are longer and narrower in *caldwelli* than in *lobatus*, and the position and shapes of the inner processes are correspondingly different. There are differences in the respective shapes of the anal segments whether viewed dorsally, laterally, or posteriorly.

No specific habitat or host data are available for *O. caldwelli*. Specimens have been collected from May 12 to July 12.

This species is named in honor of Dr. John Stein Caldwell, Circleville, Ohio, who has contributed so much to our knowledge of Homoptera.

Oliarus apache Ball

Figs. 420-428

Oliarus apache Ball 1934:275.

Salient features. — Length of male 4.0 to 4.6 mm (based on 21 specimens). Ground color of vertex and mesonotum usually piceous, sometimes fuscous; mesonotal carinae concolorous to dull orange. *Head:* Vertex narrow, the length in middle line greater than the width at apex of posterior emargination, usually by 1.4 to 1.6:1; median carinae absent or very short. Face with ground color fuscocastaneous to nearly piceous; median carina orange, distinctly forked at base; lateral carinae lighter and usually pale yellow; carinal light color usually much more conspicuous on frons than clypeus and on some specimens confined to frons, but on others fairly conspicuous on postclypeus; maculae small, indistinct; frons rather broad, its length in middle line only about two-thirds width. Rostrum short, distinctly failing to attain caudal margins of posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually not attaining pale band of hind margin but sometimes becoming tangential or joined by calloused area; some specimens (from California) with intermediate carinae briefly interrupted at posteriormost part of curve. Mesonotum with intermediate carinae weaker than other carinae, becoming obsolete in some specimens, these specimens appearing tricarinate. Tegmina varying from nearly immaculate to having numerous small spots or dark areas; small spots usually present at fork of Cu_1 , fork of M, and at all apical crossveins; some specimens with membrane partially smoky brown in discal area; veins usually whitish throughout, but some specimens with apical veins brownish and with certain other veins brownish if near fumose areas of the membrane; tubercles numerous, large, and very conspicuous because of fuscous pigment which makes them stand out against the white veins; apical cells variable, usually 11, and anteapical cells almost always 6; stigma varying from white to brown, partially darkened by heavy

brown puncture along boundary vein, weakly developed, subtriangulate and short, less than twice as long as wide. Legs with tibiae unusually pale, front tibiae with narrow brown band basad, successively followed distally with a broad pale band, a broad, poorly defined brownish area, and a narrow, pale band at apex.

Male genitalia. — Aedeagal complex as in figs. 420 and 421; total pointed processes six. Periandrium with three processes; dextral process long and slender, attaining level of aedeagal joint, process straight in some specimens, sinuate in others, right-lateral in position, usually adjacent to aedeagal complex and sometimes partly hidden in ventral view, mostly hidden in dorsal view; sinistral process wanting, no more than a swollen area; left lateral apex of periandrium with long, slender, sinuate process variously directed left ventrocephalad; dorsal periandrium with a retrorse process at the extreme left apical area, stout basally, becoming acuminate apically. Flagellum appearing to make a complete loop, in ventral aspect; with three processes: a pair of apical processes with the outer one a rather typical, moderate-sized pointed process, the other apical process atypically expanded, stout, somewhat molarlike in profile in most specimens; loop of flagellum, on outer left margin, having an acuminate process, short in some specimens, moderate in length and rather slender in other specimens. Styles as in fig. 425; asymmetrical; each shaft moderately long, slender, and comparatively straight; *in situ*, left style appearing larger apically and having an apical notch near point of attachment of inner process; also *in situ*, the left apex of right style with a convexity that fits into an adjacent subapical recess of the left style, recurved portion of each style making an approximate right angle with shaft; inner processes long, curving, slender structures, process of left style arising from apex of shaft, process of right style arising from subapical area. Connective as in fig. 428; rather stout; combined width of ventral arms slightly more than width of base in posterior aspect. Pygofer as in figs. 426-427; medioventral process in ventral aspect elongate-triangular, broadest at basal area, apex bluntly pointed; process extending posteriorly over half the distance to level of apices of pygofer lateral lobes; lateral lobes moderately produced, extending farthest caudad distinctly below ventrad of midlength of posterior margins, lobes symmetrical with apices slightly undulate in lateral aspect, but in ventral aspect with main axis of each lobe directed straight caudad. Anal segment as in figs. 422-424; in dorsal view, appearing rounded and distinctly longer than wide (width approximately five-eighths length); nearly symmetrical, but the right side slightly more expanded than the left; medioapical margin slightly concave; basal points of attachment of anal segment more prominent than usual, in caudal view, ventral profile nearly straight from left margin to well towards right margin, but latter produced more right-ventrad; therefore, distinctly asymmetrical with left half of profile.

Types. — The holotype female, allotype male, and four paratypes collected May 15, 1933, and nine paratypes collected May 19, 1929, were taken by E.D. Ball at Tucson, Arizona. All are in the United States National Museum and were studied.

Distributional records. — Other specimens examined were from MEXICO: Sonora, Hermosillo; UNITED STATES: Arizona: Cochise, Maricopa, Pima, Pinal, Santa Cruz, Yavapai, and Yuma Counties; California: Inyo, Riverside, and San Diego Counties.

Notes. — *Oliarus apache*, a member of the *O. aridus* group, is one of the more striking Nearctic species. It usually can be identified in either sex by the numerous, heavily pigmented punctures contrasting with the pale veins of the tegmina. The species closest to *apache*, both in general appearance and male terminalia, is *O. retentus*. Whitish veins predominate in the tegmen of *apache* with few exceptions, whereas the veins of *retentus* vary from pale yellow to brown. In *apache*, the tubercles are more conspicuous than on *retentus* and the lateral carinae of the basal half of the vertex are parallel or nearly so, the lateral carinae are divergent basally in *retentus*. The periandrium of *retentus* has a long, slender sinistral process which is lacking in *apache*.

Ball (1934) stated that the habitat of *O. apache* was "Creosote deserts around Tucson, at Patagonia and Tinajas Altas in Ariz. and near Hermosillo, Mexico." The highest altitude record available is 6300 feet at 9 miles northeast of Big Pine in Inyo County, California, where *apache* was collected at night by Lois and Charles W. O'Brien. At Deep Canyon, Riverside County, California, several specimens were collected at light by E.I. Schlinger and M. Irwin.

The seasonal distribution of *O. apache* is fairly extensive. Months on the labels include March through June, August through October and one December record.

***Oliarus knullorum*, n. sp.**

Figs. 429-439

Salient features. — Length of male 4.7 to 5.6 mm (based on 13 specimens). Ground color of vertex and mesonotum varying from fuscopiceous to castaneous, usually fuscous; mesonotal carinae somewhat variable, usually orange or yellowish brown. *Head:* Vertex variable in width, usually moderately broad, with length in middle line barely greater than width at posterior emargination (holotype 25:24), but some specimens with vertex narrower or fairly broad (ratio length to width in 17 specimens varying from 1.28:1-1:1.22); median carina conspicuous on basal half of disc. Face fuscous to castaneous; median carina orange, broadly forked at base, the resulting triangular area enclosed by feebly elevated or obsolete carinae; median carina traversing length of frons and clypeus but less elevated on postclypeal part of clypeus; lateral carinae narrowly pale yellow or yellowish brown throughout length; each macula conspicuously present as a distinct, pale yellow, oblong spot; frons unusually broad, with width approximately twice as great as length in middle line (holotype 54:26). Rostrum fairly long, usually slightly surpassing posterior trochanters. *Thorax:* Pronotum with intermediate carinae usually narrowly separated from pale band of posterior margin. Mesonotum with carinae moderately and equally conspicuous. Tegmina translucent in most specimens but some having most of basal half of each tegmen a dark smoky brown; spotting quite variable, some specimens appearing immaculate, others heavily spotted; spots usually visible at fork of Y-vein, fork of Cu₁, and distal crossveins; occasionally a few cells with smoky brown patches; tubercles moderately large, but not conspicuous, concolorous or nearly so with veins; veins brownish distally, becoming mostly yellowish or yellowish brown in the basal two-thirds of tegmina in some specimens, but in other specimens with most veins brownish; costa testaceous in nearly all specimens; apical branching of veins variable, usually resulting in 11 or 12 apical cells and six

anteapical cells; stigma variable, usually light brown and with length approximately three times width. Legs fuscous basally, usually yellowish or testaceous distally, front and middle tibia indistinctly banded with brownish bands at ends of segment and separated by broad brownish yellow band.

Male genitalia. — Aedeagal complex as in figs. 429-431; total pointed processes eight, not counting forks. Periandrium with five processes; dextral process moderately long, directed right-caudad, nearly always distinctly forked at or near midlength (fig. 430) (one specimen observed to have fork nearly obsolete); sinistral process short, acute, nearly straight, directed to the left and ventrocaudad; right-lateral, basiventral area with a moderately short, very slender process directed caudad primarily; apicoventral area with a conspicuous process usually directed caudad initially, then curving to the left, (an atypical process has been observed to continue primarily caudad and somewhat to the left for full length); dorsal periandrium with a moderate-sized, slender, acute, retrorse apical process directed primarily cephalad and somewhat right-ventrad. Flagellum in ventral aspect appearing to make a complete loop; with three processes; apically with two long slender subequal processes; outer midlength of flagellum with long, conspicuous, fairly slender process lying adjacent to dorsal surface of flagellum for most of its length; no process on inner margin of flagellar loop. Styles as in fig. 435; nearly symmetrical; each shaft moderately long and slender; apex expanded and somewhat angulately recurved through more than 90 degrees; inner processes nearly symmetrical, moderately long, slender, and curved; left process slightly thicker. Connective as fig. 439; comparatively short and stout; combined width of ventral arms not quite as great as width of base in posterior aspect. Pygofer as in figs. 436-438; slightly asymmetrical; medioventral process slightly longer than wide, constricted basally, widest subbasally, abruptly narrowed distally, and with apex semiacute; extending posteriorly distinctly less than half the distance to level of apex of left pygofer lobe; left pygofer lobe slightly longer than right lobe; in lateral aspect lobes well produced, left lobe with apex more produced and acute than apex of right lobe, apices occurring somewhat ventrad of midlength of posterior margin, with lower margin curving irregularly ventrocephalad. Anal segment as in figs. 432-434; in dorsal view symmetrical or nearly so, distinctly longer than wide (ratio of length to width in holotype 49:33); medioapical margin convex; in caudal aspect ventral profile gently concave.

Types. — *Oliarus knullorum* is described from the male holotype from Chisos Mountains [Brewster County] Texas, June 9, 1939 (D.J. and J.N. Knull); female allotype from Chisos Mountains, Texas, July 17, 1946 (D.J. and J.N. Knull); and the following 30 paratypes: ARIZONA: Cochise County: Chiricahua Mountains, Rustlers' Park [map elevation 8,420 feet above sea level] 7-5-40, one male (D.E. Hardy) and one male (L.C. Kuitert), University of Kansas collection; Chiricahua Mountains, VII-14-36 (J.N. Knull) one male and one female United States National Museum, and one male same data, Ohio State University collection; Cochise or Santa Cruz County; Huachuca Mountains, 6-15-30 (E.D. Ball), four males and five females, United States National Museum; Pima or Santa Cruz County: Santa Rita Mountains, June 12, 1933 (P.W. Oman) three males, and four females; Santa Rita Mountains, 7-11-32 (E.D. Ball) one male; Yavapai County: Granite Dells, 6-29-1933

(P.W. Oman) one male; TEXAS: Brewster County, Chisos Mountains, VI-9-36, (J.N. Knull) one female, and another female VII-17-46 (D.J. and J.N. Knull), Ohio State University collection; Chisos Mountains, VII-17-46 (D.J. and J.N. Knull) one male, United States National Museum collection; Jeff Davis County: Davis Mountains, VIII-22-36 (J.N. Knull) two males and one female, Ohio State University collection, and one female United States National Museum.

Distributional records. — The known range of *O. knullorum* is confined to isolated mountain ranges of Arizona and southwestern Texas. It is estimated that most of the specimens were collected at altitudes between 5,000 and 8,500 feet above sea level.

Notes. — *Oliarus knullorum* is a member of the *O. aridus* group and is a relatively uncommon species in the southwestern United States. In external appearance and in male terminalia *knullorum* resembles *O. pima* Kirkaldy, but *pima* is larger (6.0-7.5 mm) than *knullorum* (4.7-5.6 mm). The flagellum of *pima* has an inner process, but *knullorum* has no inner process of the flagellum. This lack of a process on the inner portion of the flagellar loop is one of the best characters for separating *knullorum* from *O. californicus* Van Duzee and from *O. kieferi*, n. sp., with which it has been confused in the past. Only one other species in the *aridus* group, *O. lobatus* Caldwell, has the combination of five periandrial processes (not counting forks) and three flagellar processes, but *lobatus* has the perianthrium with a retrorse process ventrally but not dorsally; the reverse is true of *O. knullorum*.

The most conspicuous variations were observed in two males and two females from Davis Mountains, Texas. These specimens had a distinctly broader vertex than other members of the type series from Texas and Arizona. There was also greater variation in the male genitalia of the specimens from Davis Mountains.

The only host label on any of the specimens, is "Junip." [*Juniperus*] on specimens from Huachuca Mountains, Arizona.

The collecting dates for *O. knullorum* range between June 9 and August 22.

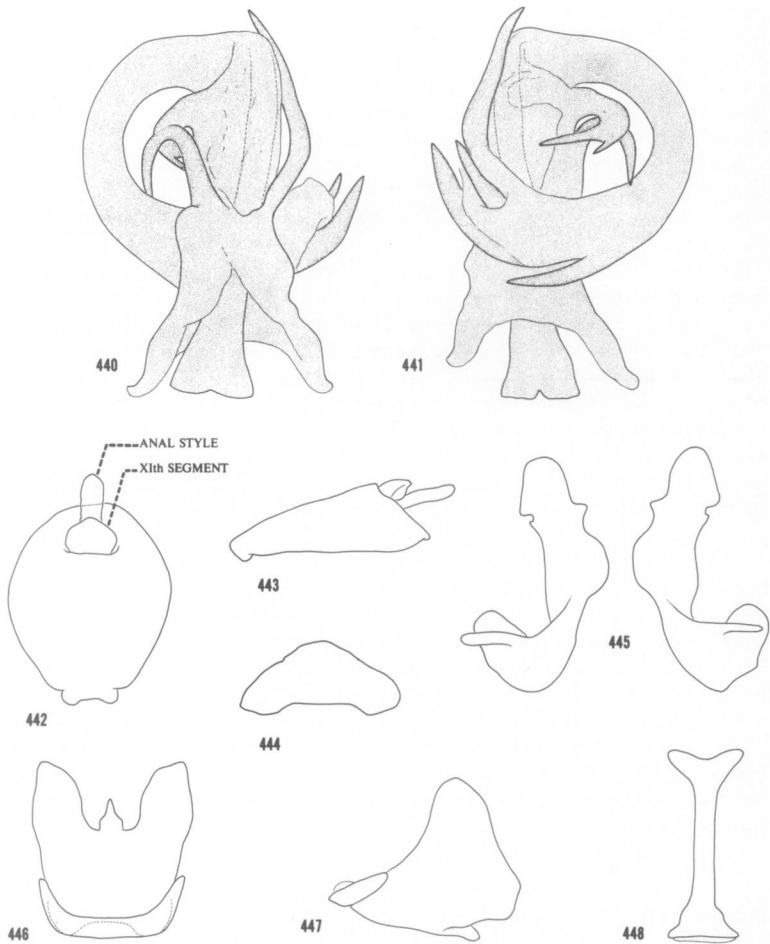
This species is named in honor of the late Josef N. Knull, Emeritus Professor of Entomology, the Ohio State University, and his wife, Dr. Dorothy Johnson Knull. Their dedicated collecting contributed much to our knowledge of American *Oliarus* and other insects.

***Oliarus retentus* Caldwell**

Figs. 440-448

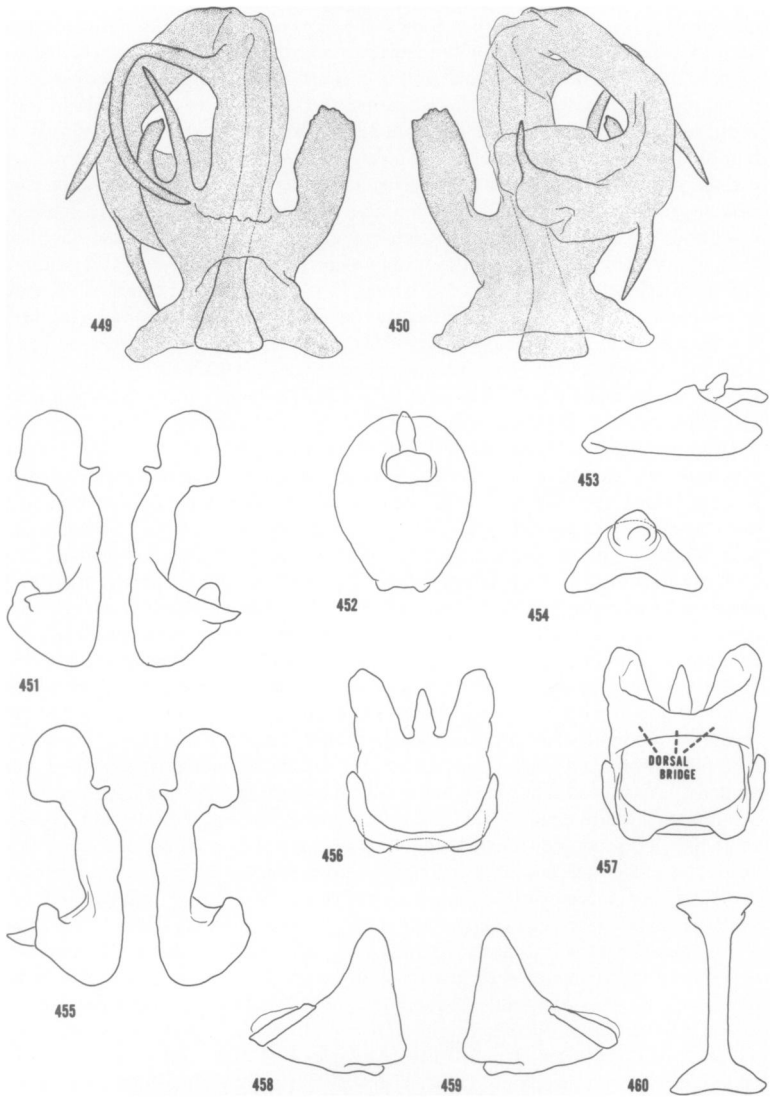
Oliarus retentus Caldwell 1947b:148.

Salient features. — Length of male 3.6 to 5.1 mm (based on 10 specimens). Ground color of vertex and mesonotum fuscous to piceous; mesonotal carinae varying from concolorous with ground color or nearly so in some specimens to dull yellowish brown in other specimens, rarely with all carinae of a given specimen completely dark or light. *Head:* Vertex unusually narrow, width at apex of posterior emargination usually two-thirds the length at middle line; median carina usually present, variable in elevation, length, and contrast. Face fuscous to piceous; median carina with small but distinct fork at base, prominent on frons, less so on postclypeus, often partly obsolete or indistinct on the postclypeus; color of median



FIGURES 440-448. Male genitalia of *O. retentus* Caldwell, from paratype Nogales, Ariz. 440, aedeagus in ventral view. 441, aedeagus in dorsal view. 442, anal segment in dorsal view. 443, anal segment in left lateral view. 444, anal segment in posterior view. 445, style in broad inner aspect. 446, pygofer in ventral view. 447, pygofer in left lateral view. 448, connective in posterior view.

FIGURES 449-460. Male genitalia of *O. canyonensis*, n. sp., from holotype. 449, aedeagus in ventral view. 450, aedeagus in dorsal view. 451, styles in broad inner



aspect. 452, anal segment in dorsal view. 453, anal segment in left lateral view. 454, anal segment in posterior view. 455, styles in broad outer aspect. 456, pygofer in ventral view. 457, pygofer in dorsal view. 458, pygofer in left lateral view. 459, pygofer in right lateral view. 460, connective in posterior view.

and lateral carinae pale yellow to brownish yellow on frons, somewhat darker and narrower on postclypeus; face without distinct maculae but pale color lateral carinae slightly extending onto epistomal suture in most specimens and suggestive of reduced maculae in a few specimens where pale color is broader; frons fairly broad, width substantially greater than length in middle line. Rostrum short, failing to attain caudal margin of posterior trochanters. *Thorax*: Pronotum with intermediate carinae usually tangential to pale border of posterior margin. Mesonotum with carinae prominent, intermediate pair variable, tending to be obsolete or less elevated in anterior portion. Tegmina with membrane milky subhyaline in most specimens but vaguely smoky in some; spotting confined primarily to moderate infuscations at apical crossveins; some specimens with weak spot at fork of Cu_1 ; commissure weakly embrowned basad of Y-vein juncture; tubercles brown and prominent; veins usually pale yellow or light yellowish brown on basal two-thirds, brown on apical third; apical cells normally 11 and anteapical cells 6; stigma variable, pale in some specimens but usually brownish, with length approximately twice the width. Legs generally brown or brownish yellow, without distinct banded pattern.

Male genitalia. — Aedeagal complex as in figs. 440 and 441; total pointed processes six, counting any forked process as one. Periandrium with three processes, not counting any forks; dextral process extending caudad primarily, unusually long and slender, apex usually the most posterior part of aedeagal complex; sinistral process moderately long and slender, extending left-caudad, then abruptly recurving to dorsoanterior direction; left ventroapical area giving rise to acute, moderate-sized process (best seen dorsally) that extends left only a short distance before recurving dorsally and to the right; this process entire in some specimens but in other specimens giving rise to small fork at midlength; no process arising strictly from dorsal surface. Flagellum, in ventral aspect, appearing to make complete loop; with two apical processes (outer one slightly stouter) and one preapical, moderate-sized process, the latter visible only in dorsal view. Styles as in figs. 445; long and slightly asymmetrical; shafts prominently expanded near midlength, narrowed subapically before apical expansion and recurvature; recurved portion somewhat angulate and thumblike; inner processes asymmetrical, slender, fingerlike, left process distinctly longer than right process and slightly broader. Connective as in fig. 448; moderately long and stout; combined width of ventral arms distinctly greater than width of base in posterior aspect. Pygofer as in figs. 446-447; symmetrical or nearly so; medioventral process in ventral aspect slightly longer than wide, broad basally, abruptly narrowed at midlength, apex acute; extending posteriorly approximately half the distance to level of apices of pygofer lateral lobes; lateral lobes unusually stout, moderate in length in ventral view; lobes in lateral view moderately produced, apical portion truncate. Anal segment as in figs. 442-444; in dorsal view symmetrical or nearly so; broad, but length somewhat greater than width; medioapical margin straight or nearly so; in caudal view, ventral profile broadly and shallowly concave.

Types. — Caldwell listed the type series of *O. retentus* as, "Male holotype, female allotype, and 11 paratypes from Nogales, Arizona, September 1906, (Koebele), CAS." Most of the type series of *O. retentus* was deposited in the

California Academy of Sciences, but there are paratypes, two males and three females, in the United States National Museum.

Distributional records. — Other specimens examined were from ARIZONA: 11 miles west of Williams, Coconino County, September 7, 1964 (L. and C.W. O'Brien) elevation 1100 feet; Gila County, 25 miles northeast Seneca, September 10, 1964 (L. and C.W. O'Brien), elevation 5800 feet; Yavapai County, 4 miles north of Prescott, September 6, 1962 (C.W. O'Brien); COLORADO: Grand Junction, August 15, 1936 (J.D. Beamer); UTAH: Kanab, September 7, 1934 (E.D. Ball).

Notes. — *Oliarus retentus* is an uncommon member of the *O. aridus* Ball group. *O. retentus* is a distinctive species apparently not close to any known species; it most greatly resembles *O. apache* Ball, *O. canyonensis*, new species; and *O. papagonus* Ball. Specimens of *retentus* are normally the smallest within the *aridus* group of species; however, there is occasional overlap in size with specimens of other species in the group. Normally, the vertex of *retentus* is the narrowest of the *aridus* group. *O. retentus* is one of the few species in the group without an inner process on the loop of the flagellum. Normally, the dextral process of the periandrium of *retentus* is the longest in the *aridus* group, and it is unforked, which alone distinguishes it from approximately half the species in the group. The low number of periandrial processes (three), in addition to their position and shape, is diagnostic.

With the exception of the Grand Junction, Colorado, specimen (August 15), all known specimens of *O. retentus* have been collected during the month of September.

***Oliarus canyonensis*, n. sp.**

Figs. 449-460

Salient features. — Length of male 4.2 to 5.9 mm (based on two specimens); holotype 4.2 mm. Ground color of vertex and mesonotum fuscous to yellowish brown; mesonotal carinae brownish yellow. *Head:* Dorsum as in fig. 29; vertex diverging posteriorly and unusually broad, ratio of length in middle line to width at apex of posterior emargination 1:1.50 in holotype, 1:1.38 in paratype; median carina prominent, extending anteriorly approximately two-thirds to three-fourths the length of disc; frontal carina a fairly broad, nearly straight, yellowish bar. Face a uniform, medium brown color or moderately dark brown; texture slightly rugose throughout frons and postclypeus, moderately shiny; median carina with large triangular fork at base, percurrent and yellowish to rostrum; median ocellus prominent, wider than median carina; lateral carinae moderately prominent and yellowish to apex at postclypeus, yellowish margin slightly expanded near epistomal suture and narrowly following it for a short distance, thereby suggesting feeble maculae; fenestrae prominent; frons broad, ratio of width to length in middle line 1.48:1 in holotype, 1.41:1 in paratype. Rostrum long, exceeding caudal margin of posterior trochanters by approximately half the length of the apical segment of the rostrum in the paratype, more so in the holotype (apical segment approximately four-fifths of its length past posterior trochanters); rostrum yellowish basally, apical segment mostly brownish. *Thorax:* Dorsal view as in fig. 6; pronotum with intermediate carinae narrowly separated from pale band of posterior margin; shoulder of pro-

notum with prominent carina along lateral margin; all carinae yellowish. Mesonotum with tegulae yellowish; carinae equally prominent, intermediate pair arcuate. Tegmina with venation as in fig. 10; with conspicuous, irregular brown spots on clavus and corium; clavus with spots at Y-vein fork, juncture of Y-vein with commissure, and approximately midlength between these two spotted areas; corium with spots at fork of Cu_1 and middle areas of anterior and posterior discal cells; other spots at middle and apical crossveins, most apical cells, and in middle apical cell; tubercles abundant, prominent and brownish, contrasting well with veins which are primarily yellowish, but occasionally embrowned adjacent to spotted areas; holotype with apical branching as follows: Sc two, R two, M five, Cu_1 two; apical cells 10 and anteapical cells 6; paratype apical branching as follows: Sc two, R three, M five, Cu_1 two; apical cells 12 and anteapical cells 6; stigma light brown and with length approximately two and one-half to three times width. Posterior wings with R not forked in holotype, forked once in paratype; M with three branches and Cu_1 with two branches reaching apex in both holotype and paratype; paratype with triangle formed by first radius and radial sector shorter than triangle formed by first and second media. Legs typically a rather uniform brown on basal segments, becoming yellowish distally; front and middle tibiae vaguely twice brown-banded.

Male genitalia. — Aedeagal complex as in figs. 449 and 450; total pointed or semipointed processes seven. Periandrium with four processes; dextral process thick, straight, and truncate, not attaining level of aedeagal joint, irregularly serrate on apex and inner margin; sinistral periandrial mass developing into two unpaired slender processes (or subprocesses), the outer left process approximately one-half the length of the inner right process; both of these processes directed primarily caudad, the longer process curving slightly to the left, the shorter one straight or curving slightly to the right; left ventroapical area with a long, slender process directed left then curving cephalad and right-cephalad; dorsal periandrium without a process. Flagellum appearing to make complete loop from ventral aspect and with three well-spaced processes, all slender, acute, and moderate in length, one at outer midlength of flagellar loop, one preapical and on outer part of loop, and one apical; no process on inner part of loop. Styles as in figs. 451 and 455; each shaft fairly slender, its apex expanded and irregularly recurved into an anterolateral, thumblike lobe; inner processes asymmetrical, left process much shorter than the right process, both acute. Connective as in fig. 460; moderately long and slender; combined width of ventral arms slightly greater than width of base in posterior aspect. Pygofer as in figs. 456-459; symmetrical or nearly so; medioventral process in ventral aspect long and slender, broadest next to slightly basal constriction, tapering posteriorly to subacute apex, length of process slightly more than twice the width, process extending posteriorly seven-tenths distance to level of apices of pygofer lateral lobes stout, moderately produced and rounded; in lateral aspect caudal margin evenly produced and extending most posteriorly near ventral part of margin. Anal segment as in figs. 452-454; in dorsal aspect fairly symmetrical, right side more broadly developed than left; moderately short and broad, ratio of width to length 7.8:1 in holotype, 7.1:1 in paratype; medioapical margin slightly concave; in caudal view somewhat hoodlike, with ventral profile concave.

Types. — The holotype male was collected at light in Deep Canyon, Riverside County, California, on August 22, 1963 (E.I. Schlinger) and obtained on loan from the collection at the University of California at Riverside. The paratype male was collected in New Mexico and bears no other data except that it formerly was in the Andreas Bolter collection and now is in the Illinois Natural History collection.

Distributional records. — *O. canyonensis* is known only from single localities in southern California and New Mexico.

Notes. — *Oliarus canyonensis* is a rare member of the *O. aridus* Ball group of species but apparently is more remote from *aridus* than some of the other species of the complex. *O. canyonensis* stands well apart from other species. It is easily recognized by the uniquely serrate, truncate, dextral process and unique unequal pair of processes developing out of the basal sinistral area. Externally, the broad vertex, prominent median carina of vertex, lack of distinct macula, long rostrum, fairly short total length, and much spotted tegmina are key characters. Superficially it resembles *O. sementinus* Ball in size, broad vertex, and spotting of tegmina. From the standpoint of male genitalia, *canyonensis* possibly is closer to *O. apache*, *O. papagonus*, or *O. retentus*.

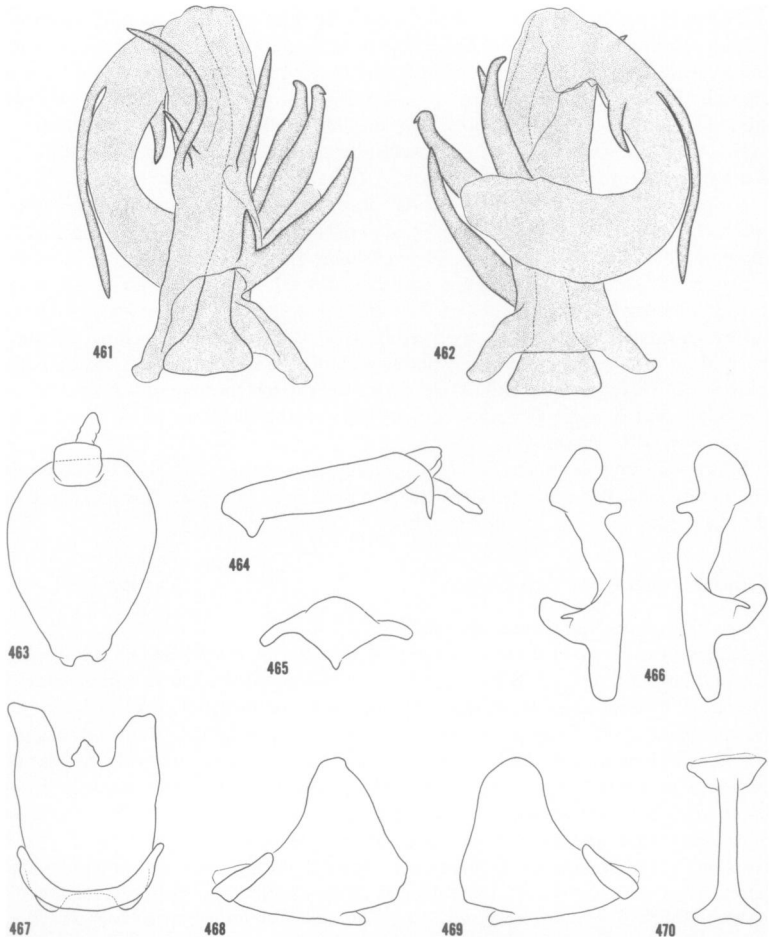
Minor variation was noted in the two available specimens, and both the holotype and paratype exhibit some variation between structures on the left side compared to the right side.

Oliarus hesperius Van Duzee

Figs. 461-470

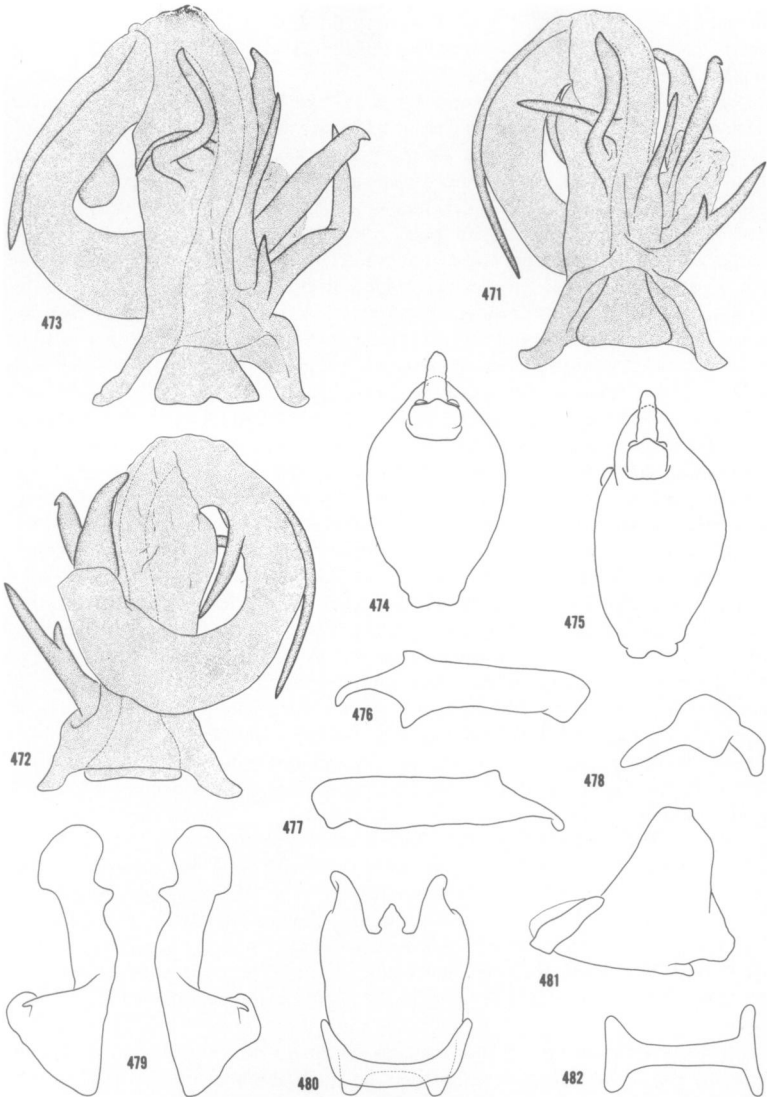
Oliarus hesperius Van Duzee 1917:307.

Salient features. — Length of male 5.4 to 6.9 mm (based on 30 specimens). Ground color of vertex and mesonotum usually fuscopiceous, somewhat variable; mesonotal carinae variable, usually orange, but sometimes individual carina or all carinae partly or completely brownish. *Head:* Vertex variable in shape but usually broad, with length in middle line varying from slightly greater than width at apex of posterior emargination in some specimens, to distinctly less than width in other specimens, but width usually exceeding length; median carina usually extending anteriorly approximately three-fifths length of disc. Face varying from fuscopiceous to castaneous; median carina normally orange and with broad fork at base usually weakly elevated, remainder of carina usually prominent on frons, weak to partially obsolete on postclypeus, prominent again on anteclypeus; lateral carinae narrowly dull yellow or orange; maculae conspicuously ovoid; frons broad, with width distinctly greater than length in middle line. Rostrum moderately long, usually slightly surpassing posterior trochanters. *Thorax:* Pronotum with intermediate carina usually narrowly separated from pale band of posterior margin. Mesonotum with carinae usually equally prominent. Tegmina variably spotted, some specimens nearly immaculate, others with distinct spots at Y-vein fork, fork of Cu_1 , apical crossveins, and with less conspicuous spots at other locations; apical cells of darker specimens heavily infuscated; tubercles conspicuously brownish in contrast to veins which are pale over most of tegmen except for brown veins at extreme apex of some specimens; number of apical branches of veins highly variable



FIGURES 461-470. Male genitalia of *O. hesperius* Van Duzee, from paratype, same data as holotype. 461, aedeagus in ventral view. 462, aedeagus in dorsal view. 463, anal segment in dorsal view. 464, anal segment in left lateral view. 465, anal segment in posterior view. 466, styles in broad inner aspect. 467, pygofer in ventral view. 468, pygofer in left lateral view. 469, pygofer in right lateral view. 470, connective in posterior view.

FIGURE 471-482. Male genitalia of *O. aridus* Ball, from lectotype. 471, aedeagus in ventral view. 472, aedeagus in dorsal view. 473, aedeagus in ventral view, Cameron Co., Texas. 474, anal segment in dorsal view, atypical. 475, anal segment



in dorsal view, typical. 476, anal segment in right lateral view. 477, anal segment in left lateral view. 478, anal segment in posterior view. 479, styles in broad inner aspect. 480, pygofer in ventral view. 481, pygofer in left lateral view. 482, connective in posterior view.

but most often resulting in 11 or 12 apical cells and six anteapical cells; stigma brown, length usually two to two and one-half times the width. Legs with front and middle tibiae indistinctly banded.

Male genitalia. — Aedeagal complex as in figs. 461 and 462; total pointed processes nine, including both branches of a forked process. Periandrium with four processes, one of which is forked; dextral process usually forked near base, outer branch much longer; left median area of ventral periandrium with two processes, the slightly lateral and basal one slender, much longer, extending sinuately to posterior part of aedeagal complex, its apex usually directed left-caudad; other ventral, left median process short, straight and slender, directed left-caudad; ventral right lateral area of periandrium with prominent, slender, straight process, primarily directed caudad, but failing to attain level of aedeagal joint; dorsal periandrium with no process. Flagellum, in ventral aspect, appearing to make complete loop; with four processes a long, slender process on outer left margin of flagellum, a short slender, slightly curved, inner process, and two conspicuous, subequal apical processes. Styles as in fig. 466; symmetrical, each shaft subterete, lateral expansion considerably preapical, slightly recurved, approximately same thickness as shaft and approximately same length as part of shaft distad of preapical lobe or expansion; inner processes weakly developed, apex very short, and slender, suggesting miniature index finger. Connective as in fig. 470; moderately long and slender; combined width of ventral arms usually slightly less than width of base in posterior aspect. Pygofer as in figs. 467-469; slightly asymmetrical; medioventral process in ventral aspect usually wider than long, occasionally with length approximately equal to width, broadly pointed, usually slightly constricted at base; process extending posteriorly less than half the distance to level of apex of left pygofer lobe; left pygofer lobe extending posteriorly slightly farther than right pygofer lobe; lobes appearing stout ventrally, moderately produced and with apices subtruncate in lateral view. Anal segment as in figs. 463-465; in dorsal view slightly asymmetrical, width approximately two-thirds length, and medioapical margin straight or nearly so; in caudal view medioventral margin subtriangulate, extending ventrad as a short, acute process or spine.

Types. — Van Duzee described *O. hesperius* from a "long series" of California collected specimens, including the following material from W.M. Giffard: Los Altos, July 26, 1916; Redwood Canyon, July 2, 1916; Walnut Creek, August 10, 1916; and near Cloverdale, Sonoma County, August 3, 1916. The holotype (Number 374) is a male from Los Altos, Santa Clara County; the allotype female also is from Los Altos; they and the paratypes are in the California Academy of Sciences. A paratype male with the same data as the holotype was used for illustration.

Distributional records. — Other museum specimens determined here as *Oliarus hesperius* Van Duzee were collected in the following states and counties: CALIFORNIA: Alameda, Butte, Contra Costa, Kern, Lake, Lassen, Los Angeles, Merced, Modoc, Monterrey, Napa, Placer, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Shasta, Siskiyou, Solana, Sonoma, Stanislaus, Tehama, Yolo, and Yuba; NEVADA: Storey; OREGON: Benton, Jackson, and Wasco.

Notes. — *Oliarus hesperius* is a member of the *O. aridus* group and is the species most similar to *aridus* in morphology. In spite of its closeness to *O. aridus*, *O. truncatus* Van Duzee, and several other species in the *aridus* group, *hesperius* males are easily separated from males of similar species. The primary diagnostic character is the style, which is unique in that the rather slender lateral expansion is comparatively far removed from the apical area. This is the only species of *Oliarus* known in which the styles have this form. Most male specimens of *hesperius* have a very short and broad medioventral process of the pygofer, but in occasional specimens it is longer and somewhat similar to certain other members of the *aridus* group. Another distinguishing character of *hesperius* is the downward, spinelike, ventroapical extension of the anal segment. *O. hesperius* is the only member of the *aridus* group that has this acute process. The number, shape, and position of the processes of the aedeagal complex are other valuable key characters. The absence of a dorsal process on the perianthium, the presence of a forked dextral process, and the presence of an inner process on the loop of the flagellum will separate all other North American species from *hesperius* except *aridus*.

The known range of *hesperius* Van Duzee extends from northern Oregon on the north, to western Nevada on the east, and south to near Solemint in Los Angeles County. This southernmost location is approximately 50 miles northwest of the northernmost record of *O. truncatus* in Yorba Linda, Orange County, California.

Another closely related and apparently allopatric species is *O. californicus*. A distance of approximately 95 miles separates the Solemint, California record of *hesperius* from the closest record of *californicus* in Riverside County. Thus, *hesperius* is replaced in the southwest corner area of California by *californicus* and *truncatus*, but on the northern end of its range it is sympatric with *O. aridus*.

Collection data on specimens of *O. hesperius* include "on live oak" [*Quercus* sp.], "on apricot" [*Prunus armeniaca* Linnaeus], "swept from *Arcostaphylos manzanita* Parry" [*Arctostaphylos parryana* Lemmon], "blacklight," and "on fencepost." This fencepost and others were two miles north of Sebastopol in Sonoma County. Doctors Lois and C.W. O'Brien collected a long series of *hesperius* from fenceposts, noting that lichens were abundant. Possibly the adults were feeding on these lichens. At the same time of collection in summer, grasses were abundant and golden ripe in the immediate area around the fenceposts. The pasture was dry with large cracks in the soil; there were fewer *Oliarus* at the bottom of the slope where the plants were green.

Adult specimens of *O. hesperius* have been collected from June to September.

Oliarus aridus Ball

Figs. 471-482

Oliarus aridus Ball 1902:151.

Salient features. — Length of male 5.9 to 8.4 mm (based on 140 specimens). Ground color of vertex and mesonotum varying from piceous to castaneous, usually fuscocastaneous; mesonotal carinae nearly concolorous in some specimens, usually a moderately contrasting dull orange or yellow-brown. *Head:* Vertex broad, the length in middle line equaled or exceeded by the width at apex of posterior

emargination; median carina varying from absent to present for three-fourths length of disc. Face with color variable, usually castaneous; median carina usually orange, percurrent, broadly forked at base; lateral carinae pale yellow or orange, more prominent on frons that postclypeus; maculae pale yellow and large, but outline somewhat indistinct; frons broad, with width much greater than length at middle line. Rostrum moderately long, usually slightly surpassing posterior trochanters. *Thorax*: Pronotum with intermediate carinae usually narrowly separated from pale band of posterior margin but occasionally tangential thereto. Mesonotum with carinae moderately conspicuous, the intermediate pair usually weaker, especially anteriorly where the carinae tend to become obsolete. Tegmina usually milky subhyaline, but occasionally vitreous; spotting present but not conspicuous; small spots usually at Y-vein fork and fork of Cu₁, and narrowly present at distal cross-veins; commissure fuscous for one-third to one-half its length immediately basad of Y-vein juncture; tubercles usually moderately prominent; veins usually pale yellow basally, becoming brownish on approximately distal one-third; apical cells usually 12 and anteapical cells 6; stigma light to dark brown, usually with length two to two and one-half times the width. Legs mostly fuscous basally, yellowish distally; front and middle tibiae vaguely banded brown at each end of segment with an extensive yellowish area between.

Male genitalia. — Aedeagal complex as in figs. 471-473; total pointed processes nine (including both branches of forked process). Periandrium with four processes (not counting forks); dextral process moderately long, usually directed right-caudad, straight in some specimens, distinctly and variously curved in other specimens; forked, with the minor branch introrse (to the left) and with location of fork varying from base of process to approximate midlength or slightly beyond; lateral basiventral process (sinistral) absent; mediodistal half of ventral periandrium with two moderate-sized, slender processes, the more basal one sinuately directed caudad, the more distal one straight or curving, primarily directed to the left; ventral periandrium also with a right basal process, moderately long and straight, swollen basally, slender distally; dorsal periandrium not having a process. Flagellum in ventral aspect appearing to make a complete loop; with four conspicuous processes: two long, subequal, apical processes, an inner process, and a long, slender outer process following left contour of flagellum much of its length; inner process variable from slender and acuminate to bulbous. Styles as in fig. 479; moderately asymmetrical; apex of recurved portion of right style broadly truncate, but apex of left style more slender and rounded; each shaft moderately long and straight with apex expanded but not rounded, the recurvature fairly straight, and with long axis of lobe directed approximately 35 to 45 degrees laterocephalad; each inner process very short, slender, and terminating considerably laterad, near apex of recurved portion. Connective as in fig. 482; moderately short and stout; combined width of ventral arms slightly less than width of base of shaft in posterior aspect. Pygofer as in figs. 480-481; nearly symmetrical; medioventral process in ventral aspect subtriangular, constricted at base, widest subbasally, abruptly narrowed distally; slightly longer than wide; extending posteriorly slightly less than half distance to level of apex of left pygofer lobe; pygofer lobes in ventral aspect slightly diverging apically; left lobe slightly longer than the right; lobes in lateral aspect well-produced, apex truncate

and with caudal margin extending most posteriorly in its ventral part. Anal segment as in figs. 474-478; variable, typical forms conspicuously asymmetrical in any view, certain forms on other extreme only slightly asymmetrical; in dorsal view much longer than wide, medioapical margin produced and convex; left side much more expanded than right side in typical forms, but only slightly more so in certain other forms; in lateral or caudal view subapical portion of right margin extending ventrad as a subprocess in typical forms, but other forms with little or no process; in caudal view, ventral profile concave sublaterally, convex medially, variable.

Types. — The type material of *O. aridus* was listed by Ball as 24 specimens from Kansas, California, and various parts of Colorado. A cotype male from Rifle, Colorado, July 25, 1900 is hereby designated lectotype and was used to illustrate the male genitalia. The lectotype and other "cotypes" are in the collection of the United States National Museum. None of the original series includes specimens from California. The following localities are represented: Onaga, Kansas and four localities in Colorado, Ft. Collins, Grand Junction, Las Animas, and Sterling.

Distributional records. — Several hundred specimens of *O. aridus* were examined from the following areas. CANADA: Ontario: Saint Catherine, Stamford, and Virgil; MEXICO: Durango: Tlahualilo; UNITED STATES: Alabama, Arkansas, Arizona, California, Colorado, Georgia, Idaho, Illinois, Indiana, Kansas, Louisiana, Mississippi, Missouri, Montana, Nebraska, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, and Wyoming.

Notes. — *Oliarus aridus* provides the group name for more than one-fourth of the North American species of *Oliarus*. *O. aridus* was the first species described in this group (1902) and is the most widely distributed North American species of the genus.

Oliarus aridus superficially resembles most of the other species in its group and to a lesser extent several species outside its group. Reliable diagnosis, therefore, depends upon examination of the male terminalia. Usually the peculiar shapes of the pygofer lateral lobes and the anal segment are sufficient to distinguish *aridus*. These structures can be seen without dissection. The caudal margin of each pygofer lateral lobe is perpendicular to the horizontal for part of its length to a truncate lobe which is produced in the extreme ventral position. This shape is peculiar to *aridus*. The anal segment of typical forms of *aridus* also is highly distinctive. The apex is extended caudoventrally and distinctively tonguelike; considerable asymmetry is present, with the right margin feebly convex laterally, but produced ventrally, partly as a short process. Certain forms of *aridus* exhibit only a slight amount of asymmetry in the anal segment. The typical forms inhabit at least 10 of the states in the Great Plains and Rocky Mountains and, with very slight differences, extend to several of the eastern and southeastern states. The styles of *aridus* are only slightly different from those in certain other species in the *aridus* group and require careful comparisons if used for diagnosis. The aedeagal complex with its looped flagellum, presence of inner flagellar process, forked dextral process, and lack of a process on the dorsal perianthrium, separates all other species except *O. hesperius*. Although the aedeagal complex of *hesperius* is very close to that of *aridus*, the respective styles of these two species are considerably different and easily distinguished.

Variation in *Oliarus aridus* Ball is considerable. The most noteworthy variant is a form that is usually greater in total length and has the anal segment nearly symmetrical, the inner process of the flagellum bulbous instead of acuminate, and the fork of the dextral process basal instead of at midlength. Specimens fitting this description from Herndon, Virginia, were given the manuscript name of *O. perspicillatus* by Van Duzee, but he never published this concept as a new species. The "Herndon Virginia form" also has been noted in Texas, Kansas, Missouri, Ohio, and Ontario, Canada. In the hundreds of male specimens examined, there have been a number of intergrading forms between the two extremes of "*perspicillatus*" on one hand, and the type material of Ball from Colorado on the other hand.

The only region in the United States without records for *aridus* is the Northeast. The only record of *aridus* that can be substantiated in California is from Imperial County.

Habitat and host data from the labels of specimens determined here as *O. aridus* include the following: "in light trap"; "at light"; "Argon light trap"; "on sunflower" [*Helianthus* sp.]; "on peach" [*Prunus persica* (Linnaeus) Batsch]; "collected from *Vernonia interior* Small" [*V. Baldwini* Torrey variety *interior* (Small)]; "tall smartweed inshore" [*Polygonum* sp.]; "from alfalfa" [*Medicago sativa* Linnaeus]; "on celery" [*Apium graveolens* Linnaeus, var. *dulce* Persoon]; "sour cherry" [*Prunus cerasus* Linnaeus]; "on grapefruit" [*Citrus paradisi* Macfadyen]; "in field"; "sweepings from weeds"; "tree trunks"; "sweepings from grass"; "hickory [*Carya* sp.]; "native grass"; "grass"; "in cotton fields" and "on cotton" [*Gossypium* sp. probably *hirsutum* Linnaeus]; "in spanish moss" [*Tillandsia usneoides* Linnaeus]; "*Quercus virginiana*" [Miller]; "in corn fields" *Zea mays* Linnaeus; "*Forestiera acuminata*" [Poret]; "on spider lilies" [*Zanthoxylum clavaherculis* Linnaeus]. The hosts listed under *Oliarus slossoni* Van Duzee by Dozier (1928) refer to *aridus* Ball. These "hosts" include "on the trunks of plum trees [*Prunus* sp. prob. *domestica* Linnaeus] in an orchard" and "in sweepings made in pure stands of alfalfa"; "on pecan" [*Carya illinoensis* Koch].

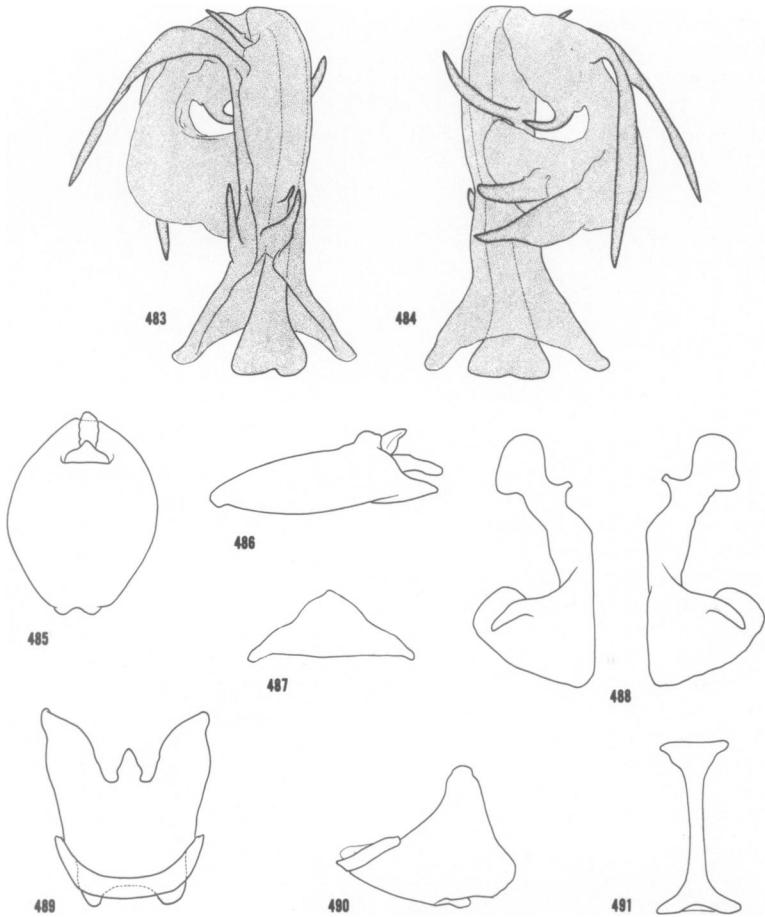
Oliarus aridus has been collected in all months from March to November, with most collections occurring May to September.

***Oliarus truncatus* Van Duzee**

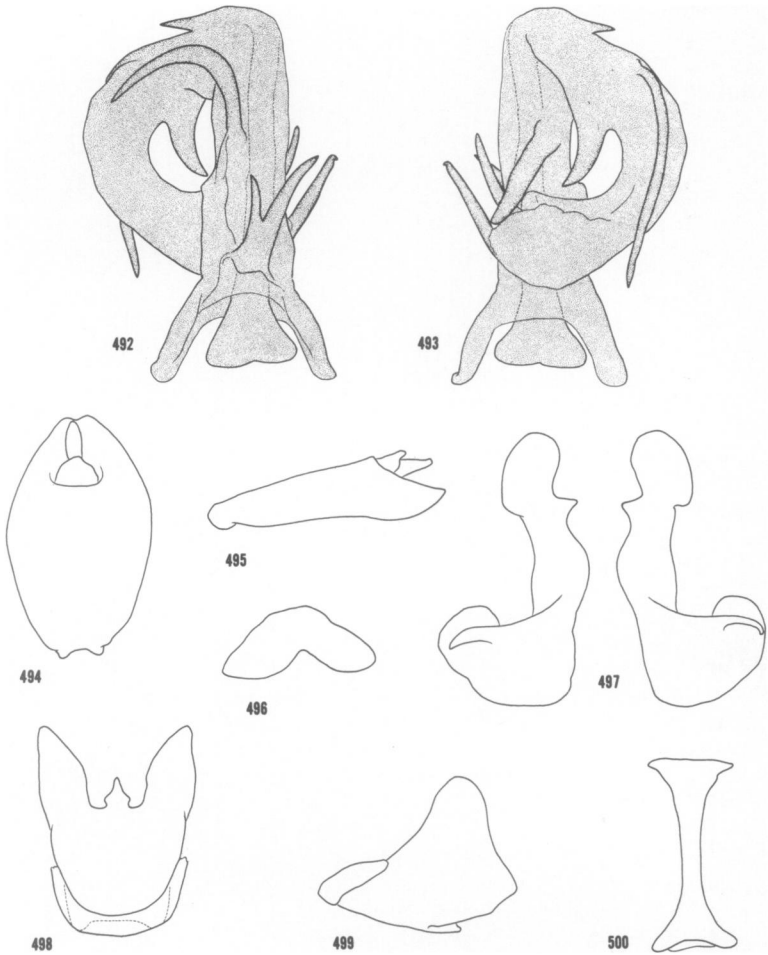
Figs. 483-491

Oliarus truncatus Van Duzee 1929:72.

Salient features. — Length of male 5.1 to 7.2 mm (based on 11 specimens). Ground color of vertex and mesonotum fuscous; mesonotal carinae usually dull orange, sometimes fuscous, varying among specimens and among carinae of single specimen, intermediate carinae tending to be lightest, lateral carinae darkest. *Head:* Vertex moderately broad, length slightly greater than width at apex of posterior margin, sides of vertex subparallel. Face in most specimens mostly castaneous but usually with some fuscous, particularly on frons-postclypeus border area; median carina prominent, distinctly forked at base, percurrent through anteclypeus, usually orange-colored for all or most of length; lateral carinae moderately prominent, yellowish to dull orange-brown, slightly less prominent on postclypeus; maculae



FIGURES 483-491. Male genitalia of *O. truncatus* Van Duzee, from paratype San Diego, Cal. 483, aedeagus in ventral view. 484, aedeagus in dorsal view. 485, anal segment in dorsal view. 486, anal segment in left lateral view. 487, anal segment in posterior view. 488, styles in broad inner aspect. 489, pygofer in ventral view. 490, pygofer in left lateral view. 491, connective in posterior view.



FIGURES 492-500. Male genitalia of *O. sementinus* Ball, from lectotype. 492, aedeagus in ventral view. 493, aedeagus in dorsal view. 494, anal segment in dorsal view. 495, anal segment in left lateral view. 496, anal segment in posterior view. 497, styles in broad inner aspect. 498, pygofer in ventral view. 499, pygofer in left lateral view. 500, connective in posterior view.

varying from moderately conspicuous to absent, usually weak; frons broad, width considerably greater than length in middle line. Rostrum long, usually surpassing caudal margin of posterior trochanters by at least half the length of its apical segment. *Thorax*: Pronotum with intermediate carinae usually narrowly separated from pale band of posterior margin. Mesonotum with carinae of nearly equal prominence. Tegmina usually with brownish areas at apical crossveins and some apical cells, but other specimens (usually from Baja California, Mexico) tending to be immaculate or nearly so; commissure usually weakly embrowned basad of Y-veins juncture; tubercles concolorous, not prominent; veins yellowish to light brown basally, fuscous apically; number of branches of veins at apex of tegmina quite variable, Sc usually with two branches, R usually with three branches, M with four or five branches, rarely three, Cu₁ usually with two branches, sometimes three; apical cells 11 or 12 and antepical cells 6; stigma brown, conspicuous, length usually two and one-half to two and three-quarters times the width; legs mostly brownish without distinct banded pattern.

Male genitalia. — Aedeagal complex as in figs. 483 and 484; total pointed processes usually 9, sometimes 10. Periandrium usually with four, sometimes five processes; without basal dextral process or other right-lateral process; sinistral process short, straight, slender, and acute; median basiventral area with a short, nearly straight acute process, stout basally, slender distally and sometimes with a very small slender process a very short distance caudad from this median basiventral process; left ventroapical area with prominent process directed left-caudad initially, then curving approximately 90 degrees to a left-cephalad direction, becoming nearly straight distal half, gradually rotating or twisting throughout length; dorsal periandrium with a conspicuous, apical, slender, acute process that curves primarily right-ventrocaudad. Flagellum appearing to make a complete loop in ventral view; with five processes; ventrobasally with a very slender small process that appears attached to the apex of the periandrium but which remains with the flagellum when the flagellum is extended to the mating position; outer prebasal area giving rise to a long, gently curving process directed cephalad adjacent to the dorsal surface of the flagellum; inner process moderately long, acute, slender, and smoothly curving right-cephalad; apex of flagellum with two subequal, moderately long and stout processes, with apex of outer process appearing slightly more acute than apex of inner member of pair. Styles as in figs. 488; symmetrical or nearly so; *in situ*, styles contiguous ventrodistally, each style expanded and angulately recurved apically, truncate rounded at apex of recurved portion; inner processes moderately long and fingerlike, not extending beyond recurved portion of style. Connective as in fig. 491; long and slender, combined width of ventral arms slightly greater than width of base in posterior aspect. Pygofer as in figs. 489-490, symmetrical or nearly so; medioventral process in ventral view with width approximately three-fourths length, widest subbasally, abruptly tapering distally to a semiacute apex; process extending posteriorly nearly half the distance to level of apices of the pygofer lateral lobes; lateral lobes stout in ventral view, moderately produced and rounded in lateral view. Anal segment as in figs. 485-487; in dorsal view symmetrical, broadest at midlength,

width approximately four-fifths length; medioapical margin slightly concave; ventral profile in caudal view straight except for short ventral curve at each lateral margin.

Types. — The holotype male of *Oliarus truncatus* Van Duzee was collected by E.P. Van Duzee, July 4, 1913, at Alpine, San Diego County, California. It is in the collection of the California Academy of Sciences at San Francisco. Six male paratypes referred to by Van Duzee in the original description were studied. Three males with San Diego County, California, labels (E.P. Van Duzee) have the inked date "7-27-13." The original description gives "January 27, 1913" as the collecting date and La Jolla [San Diego County], California, as the locality for these three paratypes. The other three paratypes were collected by Mr. W.S. Wright at San Diego, California, August 21, 1913.

Distributional records. — Other species examined were limited to San Diego County, California, in the United States and several localities (including the southern tip area) in Baja California, Mexico. No habitat information has been located on any of the available specimens.

Notes. — *Oliarus truncatus* is an uncommon member of the *O. aridus* Ball group. The only other species in this group with five flagellar processes instead of four or less is *O. sementinus* Ball, but it differs from *O. truncatus* in several characteristics, including a single forked process on the basiventral area of the periandrium, as opposed to the two or three small unforked processes of *truncatus*. The shape and location of these two short processes are unique for *truncatus*. Other unique structures in *truncatus* include the prominent, slightly twisting, left apical process of the ventral periandrium and the apical process of the dorsal periandrium. It is the only species of the *aridus* group with this process directed left-caudoventrally. Another structure which is peculiar to *truncatus* in location and shape is the basiventral process of the flagellum. The lack of any process along the right lateral margin of the periandrium is distinctive. Externally, *truncatus* can be separated from closely related species by its broader tegminal costal cell which is one-half wider than the adjacent outer discal cell in *truncatus* but approximately the same width as this discal cell in other similar species.

Variation, within limits, is common in *O. truncatus*. Specimens in Lower California, Mexico, average greater in total length than those of Southern California, United States; the Mexican specimens tend to have the veins of the tegmina with more branches reaching the apex, and to have the tegmina more immaculate; the United States forms tend to have more conspicuous infuscations around the apical crossveins and some spotting in the apical cells. No Mexican specimens were seen with apical spotting.

The collecting dates for the San Diego County specimens range from July 4 to August 21; the range of collecting dates for the Baja, California, Mexico, specimens is from April to July 29.

***Oliarus sementinus* Ball**

Figs. 492-500

Oliarus sementinus Ball 1902:152.

Salient features. — Length of male 4.0 to 5.4 mm (based on 15 specimens).

Ground color of vertex and mesonotum varying from testaceous and ferrugineous to fuscous; mesonotal carinae usually testaceous. *Head*: Vertex usually wider than long in type series and certain other specimens, varying to slightly longer than wide in other specimens, with ratio of length in middle line to width at apex of posterior emargination varying (1:0.87-1.25); median carinae present and traversing most of disc, more elevated in some specimens than in others. Face usually testaceous or castaneous, frons smooth and polished, postclypeus lightly rugose and polished; median carina indistinct or wanting; lateral carinae feebly elevated but with broad, pale yellow border, widening at epistomal suture, much narrowed and somewhat indistinct along postclypeus; maculae conspicuous; frons unusually broad and convex, width approximately twice the length in middle line. Rostrum moderately long, usually slightly surpassing posterior trochanters. *Thorax*: Pronotum with intermediate carinae usually tangential to pale border of posterior margin. Mesonotum with carinae equally prominent. Tegmina nearly immaculate in some specimens, in other specimens narrowly spotted along apical crossveins and in membrane of some apical cells; clavus occasionally with small brown spot at Y-vein fork, commissure varying from immaculate to lightly embrowned short distance basad of Y-vein juncture; tubercles of moderate size, concolorous with the veins which tend to be a lighter shade of brown basally than apically, except costa which is pale entire length; stigma usually pale yellow, sometimes testaceous, subtriangular, its length usually two and one-half to three times width. Legs pale yellow to light brown without banded pattern.

Male genitalia. — Aedeagal complex as in figs. 492 and 493; total pointed processes nine, including both branches of a forked process. Perianthrium with three processes, one of which is forked; dextral process in a ventral, right-mediobasal position (an atypical position in *O. aridus* group), forked, with left branch one-half to two-thirds of right branch; sinistral process absent; ventral subapical area with long, slender process extending caudad initially, then curving left and left-cephalad; dorsal perianthrium with moderate-sized, retrorse, subapical process. Flagellum appearing to make complete loop from ventral aspect; with five processes; outer, basal portion of flagellum with short, very slender process; outer, left dorsal part of flagellum with very long, fairly straight slender process; inner part of loop with moderately small, gently curved, acute process; apex of flagellum with pair of subequal, moderately long and slender process. Styles as in fig. 497; almost symmetrical fairly long, apically expanded and recurved; inner processes subequal, moderately long, slender, and curved. Connective as in fig. 500; moderately long and slender; combined width of ventral arms approximately equal to width of base in posterior aspect. Pygofer as in figs. 498-499; approximately symmetrical; medioventral process in ventral aspect a little longer than wide, broadest subbasally, abruptly narrowed to acute apex; process extending posteriorly slightly less than half the distance to level of apices of pygofer lobes; lateral lobes rather stout in ventral aspect and well produced; lobes in lateral view obliquely subtruncate. Anal segment as in figs. 494-496; in dorsal view distinctly longer than wide, nearly symmetrical; medioapical margin truncate to slightly concave; in caudal view with median portion of ventral profile distinctly concave.

Types. — *Oliarus sementinus* was described by Ball "from seventeen specimens from Las Animas, Colo." [Colorado]. This series is in the United States National Museum. Each syntype examined was accompanied by three machine printed labels. Each top label is white paper and printed "L. Animas Col. 7-17-01" on two lines, the second label is white paper and printed "TYPE"; the third label is red paper with blank space in the middle, but at the top is printed "Cotype No." and at the bottom "U.S.N.M." One of the males is hereby selected as lectotype and has been marked with a lectotype label. This specimen was used to illustrate *sementinus* in this revision, except the dorsal view of the anal segment is of a different male in the type series.

Distributional records. — Other male specimens determined as *O. sementinus* were collected in ARIZONA: Flagstaff, Holbrook, St. Johns, and Willcox; CALIFORNIA: Laguna Mts.; NEW MEXICO: Elkins; UTAH: Cisco, Thompsons. Thus, the known range of *O. sementinus* is confined to five states in the southwestern part of the United States.

Notes. — *Oliarus sementinus* is the only member of the *O. aridus* group having a short, slender, acute process at the outer base of the flagellum, but *O. truncatus* has a fairly similar process at the ventral inner base. Also, the lack of a sinistral process is diagnostic, as well as a general reduction in number of periandrial processes.

The principal variant encountered is the darkest and largest specimen examined. It was collected at the Laguna Mountains, California, July 27, 1940, by D.J. and J.N. Knull. It was the only specimen seen from California. The ground color of the vertex, mesonotum, and face is fuscous; the costa and stigma are brownish; the tubercles are prominent, being brown in contrast to pale veins over most of the basal two-thirds of the tegmina; its genital characters conform to a syntype.

No specific habitat or host information on *O. sementinus* is available. The known seasonal distribution extends from late June or early July to late August.

***Oliarus pima* Kirkaldy**

Figs. 501-510

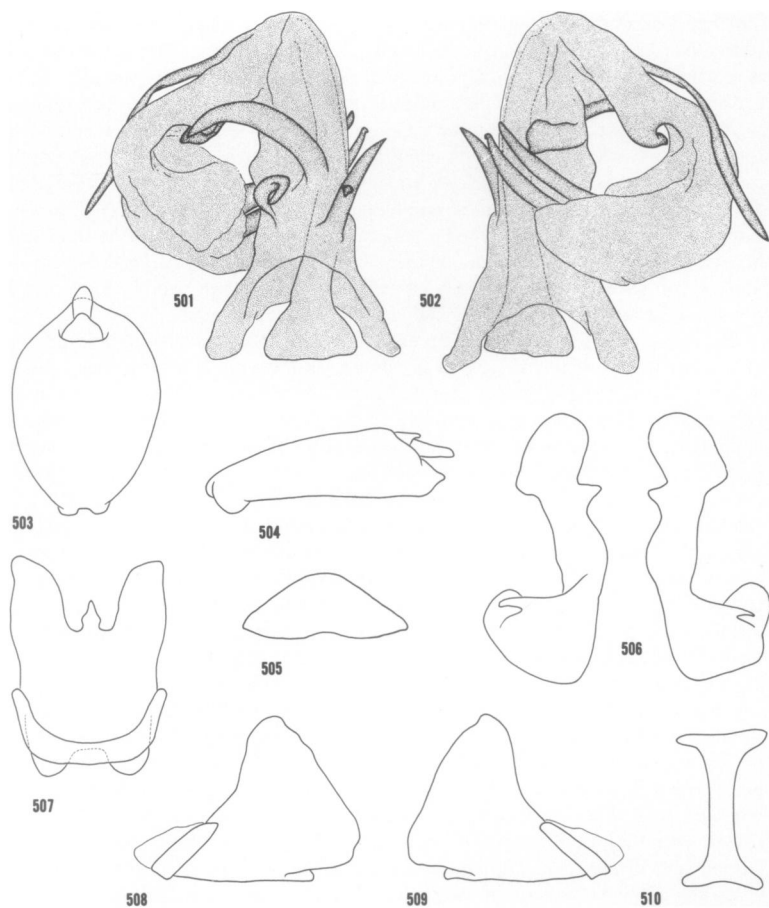
Oliarus pima Kirkaldy 1907:62.

Oliarus nogalanus Ball 1934:272.

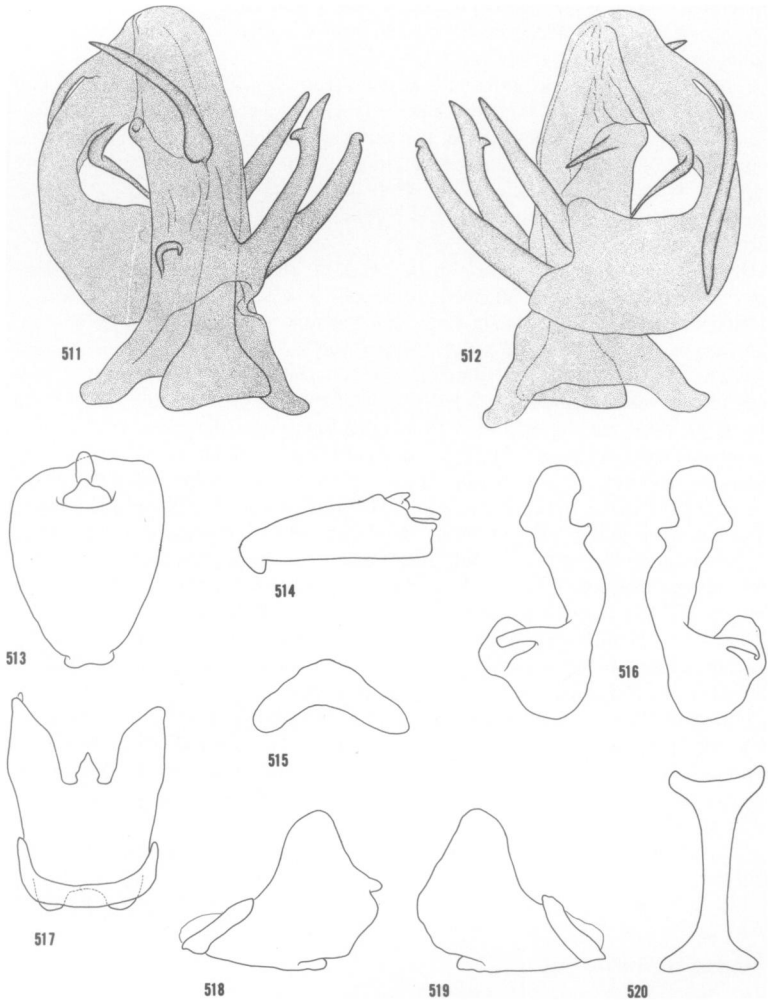
Salient features. — Length of male 6.0 to 7.5 mm (based on 125 specimens); lectotype 7.0 mm. Ground color of vertex and mesonotum varying from piceous to castaneous, usually fuscous; numerous specimens having lateral portion of mesonotum fuscous, disc of mesonotum castaneous or nearly so; mesonotal carinae usually orange, becoming somewhat brownish or yellowish in a few atypical specimens. *Head:* Vertex moderately broad, length in middle line varying from slightly more than to slightly less than width at apex of posterior emargination; slightly diverging basally; median carina usually traversing basal half of disc. Face with color somewhat variable but usually castaneous; median carina with basal fork of comparatively large size but delimited by triangularly shaped darkly pigmented area, bordering carinae of triangular area obsolete or nearly so; median carina usually orange, moderately elevated, and traversing length of face distally from basal fork; lateral carinae narrowly orange, somewhat indistinct throughout length of frons and postclypeus; maculae conspicuous pale yellow, usually elliptical or

oblong, outline somewhat indistinct in some specimens; frons broad, with width conspicuously greater than length in middle line (67:38 in lectotype). Rostrum moderately long, normally with apex slightly surpassing posterior trochanters. *Thorax*: Pronotum with intermediate carinae normally narrowly separated from pale band of posterior margin, occasionally tangential. Mesonotum with moderately conspicuous carinae, usually subequal in prominence except usually feebly elevated anterior portion of intermediate pair. Tegmina variable, but spotting usually pronounced on clavus and corium in contrast to translucent cell membranes; spots normally present at fork of Y-vein, fork of Cu., distal crossveins, and some of the apical cells; some specimens with claval area considerably fuscous, especially along commissure; commissure normally narrowly darkened basad of Y-vein juncture; tubercles moderate in size, comparatively inconspicuous; veins uniformly brown; apical cells normally 12 and anteapical cells 6; stigma brown and moderately narrow, with length approximately three times greater than width. Legs mostly brownish, becoming testaceous distally in numerous specimens.

Male genitalia. — Aedegal complex as in figs. 501 and 502; total pointed process eight (not including forks). Periandrium with four processes, one of which is forked; dextral process not inserted in strict lateral position but in a more right-medioventral position, relatively short, forked, with fork occurring at midlength, shorter branch of fork directed ventrad primarily, main branch curving right-laterad; sinistral process a slender, tortuous process, curving three-dimensionally throughout its length, with successive directions being primarily left-caudad, right-caudad, ventrad, and left-ventrocephalad; apicoventral area of periandrium with a conspicuous, somewhat falcate process, directed primarily to the left; dorsal periandrium with left apical area giving rise to a conspicuous, laterally compressed process, directed dorsally primarily and somewhat to the right, with distal third slightly swollen and apex rounded. Flagellum in ventral aspect appearing to make a complete loop, straight in basal part of loop; with four processes, including two conspicuous subequal, long, apical processes; a long slender outer process inserted prebasally, with distal portion adjacent to dorsal surface of flagellum (hidden in ventral view); inner portion of flagellar loop with a short, stout process having apex directed left-ventrad. Styles as in figs. 506; moderately asymmetrical, apices expanded and recurved; left style with posterior margin uniformly recurved, but right style with posterior margin extended at right angles for most of its width before recurving right-cephalad into rounded apical portion; inner processes slender, moderately short, left process slightly broader than right process and not extending as far posteriorly as the right. Connective as in fig. 510; comparatively short and stout; combined width of ventral arms slightly less than width of base of shaft in posterior aspect. Pygofer as in figs. 507-509; nearly symmetrical; medioventral process in ventral aspect distinctly longer than wide, constricted at base, widest subbasally, abruptly narrowed distally, apex acute; process extending posteriorly slightly less than half the distance to level of apex of left pygofer lobe; pygofer lobes thick, with left lobe slightly longer than right lobe; in lateral aspect lobes with posterior margin most produced near ventral part of length; left lobe usually with very slight concavity at apex, right lobe truncate. Anal segment as in figs. 503-505; in dorsal view slightly asymmetrical, primarily in apical area;



FIGURES 501-510. Male genitalia of *O. pima* Kirkaldy, from lectotype. 501, aedeagus in ventral view. 502, aedeagus in dorsal view. 503, anal segment in dorsal view. 504, anal segment in left lateral view. 505, anal segment in posterior view. 506, styles in broad inner aspect. 507, pygofer in ventral view. 508, pygofer in left lateral view. 509, pygofer in right lateral view. 510, connective in posterior view.



FIGURES 511-520. Male genitalia of *O. sonoitus* Ball, from allotype, same data as holotype. 511, aedeagus in ventral view. 512, aedeagus in dorsal view. 513, anal segment in dorsal view. 514, anal segment in left lateral view. 515, anal segment in posterior view. 516, styles in broad inner aspect. 517, pygofer in ventral view. 518, pygofer in left lateral view. 519, pygofer in right lateral view. 520, connective in posterior view.

moderately broad, width approximately two-thirds the length; medioapical margin convex, in caudal aspect ventral profile nearly straight, slightly concave at midlength.

Types. — The type series apparently all came from Nogales, Arizona and was collected by Koebele (no. 2518) in September. This series was deposited in the California Academy of Sciences but was not labeled as such prior to this study. The series consists of 10 females and 1 conspecific male all with label data "Nogales, Ariz., 1-IX-06, A. Koebele, Collector, Koebele Collection." The male from this series was used to illustrate this paper, and it is hereby selected as the lectotype of *O. pima* Kirkaldy.

Distributional records. — The distribution of *O. pima*, as determined from male specimens, is as follows: ARIZONA: Counties of Cochise, Coconino, Graham, Maricopa, Mohave, Pima, Santa Cruz, and Yavapai; CALIFORNIA: Escondido, San Diego County; NEW MEXICO: Sierra County, UTAH: Washington County.

Notes. — *Oliarus pima* is a common species in the *O. aridus* group, but in contrast to the wide distribution of *aridus*, it is confined to the southwestern United States. *O. pima* can be separated from other species by the shape of the inner flagellar process, which is short, stout, and curved left-ventrad. Another excellent diagnostic character is the straight basal half the flagellum as contrasted to the rounded basal halves in other species of the *aridus* group. *O. pima* is one of three species in the *aridus* group to have a combination of four processes on the perianthrium (counting the forked dextral process as one process). The other two species with this combination are *O. aridus* and *O. hesperius*. Numerous differences exist between these three species; examination of the shapes of the respective styles is sufficient for differentiation; also, *O. pima* is the only one with the perianthrium having a single, stout, left-curving, medioapical ventral process; additional differences are evident in the respective pygofer and anal segments.

The only "host" information on any of the specimens is "*Chrysothamnus speciosus*" [Nuttall = *C. nauseosus* (Pall.) Britton, subsp. *albicaulis* (Nutt.) Hall and Clement], this label on a specimen collected at Leeds, Utah, 20-VII-1931 (E.W. Davis). An "at light" label was on a specimen from Portal, Cochise County, Arizona, 27-VI-1963 (A. Raske).

The available specimens were collected in the months of June, July, August, and September.

Oliarus sonoitus Ball

Figs. 511-520

Oliarus sonoitus Ball 1937:179.

Oliarus nigravittus Caldwell 1938:304. New Syn.

Salient features. — Length of male 6.6 to 8.5 mm (based on 70 specimens); allotype 7.4 mm. Ground color of vertex and mesonotum piceous to castaneous, lateral areas of mesonotum consistently piceous, disc of mesonotum and vertex highly variable; mesonotal carinae orange or brownish yellow, with color in some specimens spreading onto adjacent areas of disc. *Head:* Vertex broad, variable, with length in middle line usually less than width at apex of posterior emargination

(length to width 1.08:1 to 1:1.43); median carina conspicuous on basal half of disc. Face usually castaneous but in some specimens fuscous to piceous, frons commonly partly or entirely darker than clypeus; median carina with basal fork represented by triangular piceous area bordered by very feeble or obsolete basal fork varying from pale yellow to piceous, distally orange (usually) and percurrent distally from indication of basal fork; lateral carinae narrowly orange, occasionally varying to pale yellow and light brown; maculae oblong, pale yellow and conspicuous; frons broad, its width approximately twice as great as length in middle line. Rostrum long, usually slightly exceeding posterior trochanters; apex of rostrum in an occasional specimen almost or completely attaining caudal margin of posterior trochanters, in still other specimens exceeding trochanters by as much as half length of its apical segment. *Thorax*: Pronotum with intermediate carinae usually narrowly separated from pale band of posterior margin. Mesonotum with carinae in most specimens uniformly conspicuous. Tegmina varying from nearly immaculate to conspicuously spotted, usually inconspicuously spotted; typical specimens with small spot at fork of Y-vein, tiny spot at fork of Cu_1 , narrow infuscations around apical crossveins, and with commissure narrowly brown basad of Y-vein juncture; tubercles inconspicuous, concolorous with veins which usually are light brown on most of basal two-thirds of tegmen, fuscous on distal third; apical cells normally 12 and anteapical cells 6; stigma brown, moderately narrow, usually with length three times greater than width; legs mostly fuscous basally, light brown to dingy yellow distally; front and middle tibiae indistinctly banded, each tibia narrowly fuscous at each end and with broad light brown band between.

Male genitalia. — Aedeagal complex as in figs. 511 and 512; total pointed processes nine, not including forks. Periandrium with five processes; dextral process moderately long, directed right-caudad, forked near the apex; sinistral margin uninterrupted from base to near apex where a moderate-sized process is directed ventrally primarily; medioapical area of ventral periandrium giving rise to a conspicuous process, somewhat swollen basally, uniform in width for most of length and directed left-caudad primarily; left basiventral area of periandrium with a fairly small process that usually extends caudad, curves 90 degrees to the right, then ventrocephalad; dorsal periandrium with a moderate-sized apical process that is slender, straight, acuminate, and directed primarily right-cephalad in dorsal view. Flagellum in ventral aspect appearing to make a complete loop; with four processes; apically with two subequal, long, rather stout processes; area near outer left margin of flagellar loop with a long, slender process usually curving to and lying near the dorsal surface of the flagellum and concealed in ventral view except at basal portion, inner margin of loop of flagellum with a comparatively long, very slender process directed left-cephalad after curving 90 degrees away from direction of flagellum. Styles as in fig. 516; slightly asymmetrical; shaft moderately long and slender, unevenly rounded and expanded apically, with apices of recurved portions subtruncate; inner processes moderately long and slender, slightly curved, apex of left process terminating abruptly. Connective as in fig. 520; moderately long and stout; combined width of ventral arms approximately equal to width of base in posterior aspect. Pygofer as in figs. 517-519; asymmetrical; medioventral process in ventral aspect longer than wide (11:8 in allotype), constricted at base, widest sub-

basally, apex acute, extending posteriorly less than half the distance to level of apex of left pygofer lobe; pygofer lateral lobes in ventral aspect with left lobe distinctly longer; right lobe in lateral aspect moderately produced with posterior margin unevenly convex; left lobe with a distinctive notch and a short thumblike lobe in addition to a usually smoothly rounded apex, the thumblike lobe arising above the midlength of the posterior margin, the broader convexity near midlength of the posterior margin. Anal segment as in figs. 513-515; asymmetrical, with left caudolateral angle more produced than right caudolateral angle; longer than wide (width three-fourths the length in allotype), caudal margin irregularly and slightly convex; in caudal view ventral margin conspicuously concave, laterally extending slightly more to right than to left.

Types. — Ball described *O. sonoitus* from a female holotype, male allotype, and 14 paratypes collected by W.W. Jones at Douglas, Cochise County, Arizona, July 12, 1932. These specimens were found without type labels in the line collection of the United States National Museum. A male and female on the same pin with two small rectangular pieces of plain red paper are interpreted as the holotype and allotype. The allotype male was used to illustrate *sonoitus* in this work.

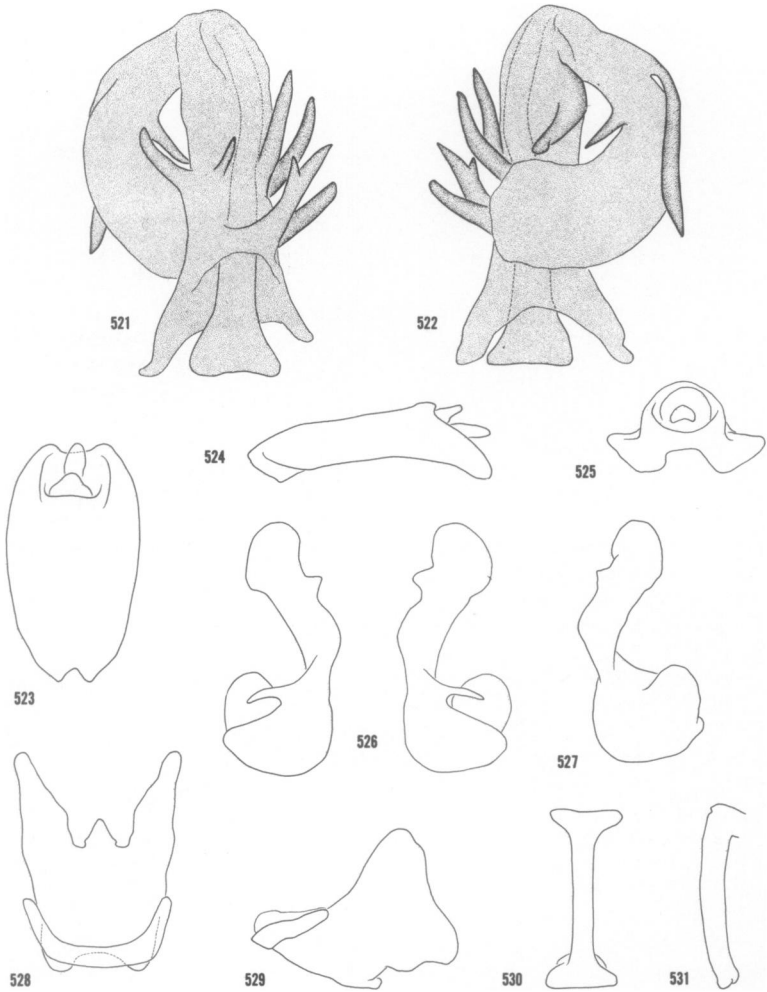
The holotype male and only paratype (a male) of *Oliarus nigravittus* Caldwell [from Uvalde, Texas], in the collection of Ohio State University, were found conspecific with *sonoitus* Ball. Both of these species descriptions were published in 1937, but Ball's name has month priority; therefore, *Oliarus nigravittus* Caldwell is listed as a junior synonym above.

Distributional records. — Other specimens were examined from MEXICO: Chihuahua, 116 miles north of Chihuahua; Tamaulipas, 25 miles south of Ciudad Victoria; UNITED STATES: Arizona: Counties of Apache, Cochise, Graham, Pima, and Yavapai; California: Newberry Springs [San Bernardino County?]; New Mexico: Counties of Chaves, Eddy, and Lincoln; Texas: Counties of Brewster, Jeff Davis, Pecos, Uvalde, and Webb. Thus, the known range of *O. sonoitus* is in the southwestern United States and northern Mexico.

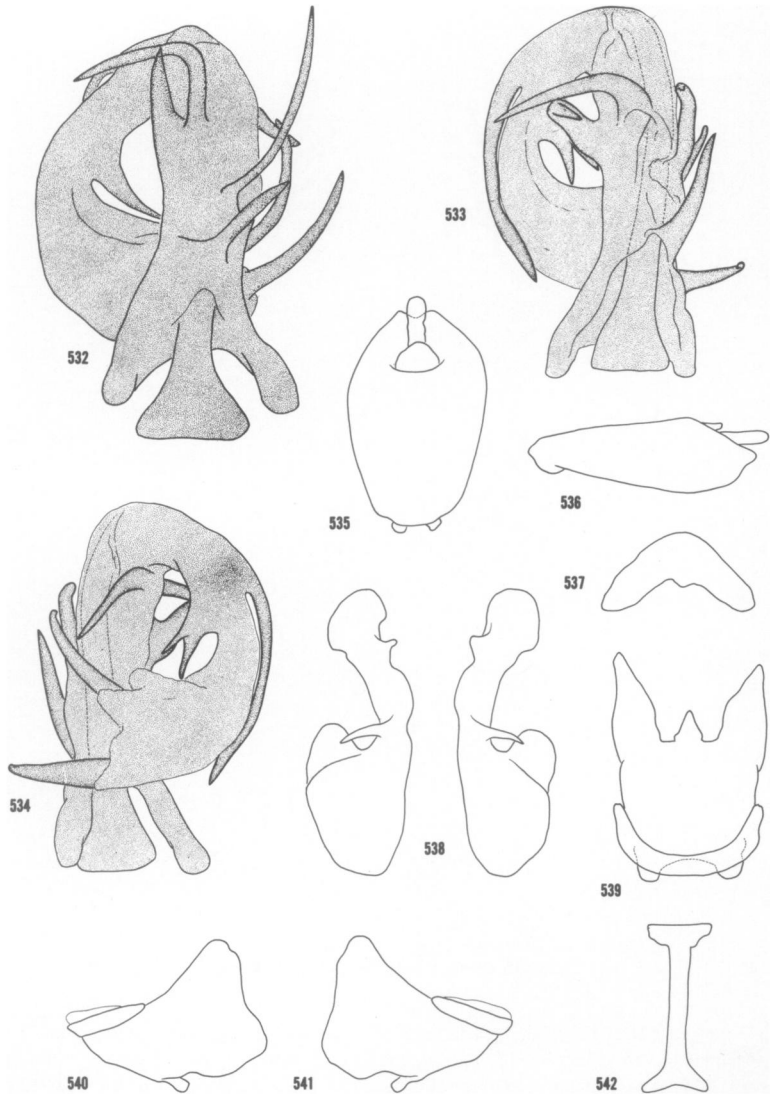
Notes. — *Oliarus sonoitus*, a member of the *O. aridus* group, is closest to *O. aridus* and *O. pima* in size, external appearance, and male terminalia. *O. sonoitus* usually has more black areas around the front of the head than do *aridus* or *pima*, and a dextral process forked near the apex, not at midlength or more basad as in *aridus*, *pima*, or other species of the group. *O. sonoitus* has five periandrial processes instead of four as in *aridus* and *pima*. *O. sonoitus* differs from other species of *Oliarus* in the shape of the anal segment which is both widest subcaudally and with the left caudolateral angle more produced than the right caudolateral angle. Perhaps the most distinctive characters in *sonoitus* are the short thumblike lobe of the posterior margin of the left lateral lobe of the pygofer slightly above the midlength of its caudal margin, the notch below this small lobe, and the similar broadly rounded apex of the right pygofer lobe which has no thumblike lobe above it.

The variation observed in *O. sonoitus* was minor except that the dextral process of one specimen was not forked.

Three specimens of *O. sonoitus* were taken at light in Portal, Arizona; a specimen



FIGURES 521-531. Male genitalia of *O. kieferi*, n. sp., from holotype. 521, aedeagus in ventral view. 522, aedeagus in dorsal view. 523, anal segment in dorsal view. 524, anal segment in left lateral view. 525, anal segment in posterior view. 526, styles in broad inner aspect. 527, left style in lateral view. 528, pygofer in ventral view. 529, pygofer in left lateral aspect. 530, connective in posterior view. 531, connective in right lateral view.



FIGURES 532-542. Male genitalia of *O. californicus* Van Duzee, from lectotype. 532, aedeagus in ventral view, Santa Rosa Mts., Calif. 533, aedeagus in ventral view, typical form. 534, aedeagus in dorsal view. 535, anal segment in dorsal view. 536,

from Mexico was collected in grassland; a specimen from Roswell, New Mexico, was collected on *Gutierrezia longifolia* Green.

Oliarus sonoitus has been collected during the months of May, June, July, August, September, and November.

***Oliarus kieferi*, n. sp.**

Figs. 521-531

Salient features. — Length of male 4.2 to 5.3 mm (based on 36 specimens); holotype 4.8 mm. Ground color of vertex and mesonotum fuscous; mesonotal carinae nearly concolorous in holotype, usually orange in other specimens, with color sometimes spreading onto disc between carinae. *Head:* Vertex broad, variable, ratio of length in middle line to width at apex of posterior emargination (1:1 to 1:1.25), holotype (1:1.04), median carina conspicuous, extending anteriorly one-half to two-thirds length of disc. Face castaneous to fuscocastaneous, median carina conspicuously elevated and testaceous or ochraceous on frons, variable on postclypeus with elevation and color obsolete or nearly so near midlength in some specimens, but in other specimens with elevation and color only slightly less prominent; median carina percurrent and narrowly yellowish on anteclypeus but outline of basal fork on frons feeble or obsolete; lateral carinae moderately elevated and narrowly yellowish; maculae pale yellow, conspicuous; frons unusually broad, with width approximately twice the length in middle line (ratio in holotype 49:25). Rostrum moderately long, usually slightly surpassing posterior trochanters, sometimes conspicuously so. *Thorax:* Pronotum with intermediate carinae narrowly separated from pale band of posterior margin, occasionally tangential. Mesonotum with carinae uniform, and moderately conspicuous. Tegmina milky subhyaline and usually with several moderately conspicuous brown spots (some specimens nearly immaculate); size and number of spots variable but usually present at fork of Y-vein, fork of Cu_1 , crossveins r-m and m-cu, and all apical crossveins; some apical cells and occasionally one or two discal cells with irregular, small, smoky brown areas; commissure usually fuscous basad of Y-vein juncture for approximately one-half the distance to posterior apex of mesonotum; tubercles moderately conspicuous, contrasting somewhat with veins which primarily are testaceous on basal three-fourths of tegmen and fuscous on distal one-fourth; apical branching of tegminal veins subject to considerable variation, but majority of specimens having 11 apical cells and 6 anteapical cells (holotype with number of branches at apex of left tegmen as follows: Sc one, R three, M five, and Cu_1 two); stigma variable, usually light brown, but testaceous or whitish in some specimens, and with length approximately three times greater than width. Legs fuscous basally and pale yellow distally; front and middle tibiae indistinctly banded, with each tibia dingy yellowish in middle portion and brownish basally and apically.

anal segment in left lateral view. 537, anal segment in posterior view. 538, styles in broad inner aspect. 539, pygofer in ventral view. 540, pygofer in left lateral view. 541, pygofer in right lateral view. 542, connective in posterior view.

Male genitalia. — Aedeagal complex as in figs. 521 and 522; total pointed processes nine, not counting forks. Periandrium with five processes, not counting forks; dextral process moderate in length, fork occurring slightly distad from midlength of process, sinistral process prebasal, moderately short, directed left-caudad most of length, apex curving caudad, length approximately one-half the length of the dextral process; median area of ventral periandrium with short, slender, straight process directed caudad primarily and slightly to the right, midlength of right lateral area of ventral periandrium with moderately long, straight process directed caudad primarily and somewhat to the right; dorsal periandrium with apical retrorse process directed right-anterodorsad, apex rounded. Flagellum in ventral view appearing to make a complete loop; with four processes; apically with two long, subequal, moderately slender processes; inner portion of flagellar loop with a straight, slender, acute process; outer portion of loop with a long, slender process arising prebasally and somewhat following contour of loop, but apex of process curving slightly to left, counter to direction of loop. Styles as in figs. 526-527; symmetrical or nearly so; each shaft moderately long and slender, expanded and recurved apically; inner processes moderately long, very slender, slightly curved, arising distal third of each style. Connective as in figs. 530-531; moderately long and slender; combined width of ventral arms equal to width of base of shaft in posterior aspect. Pygofer as in figs. 528-529; symmetrical or nearly so; medioventral process in ventral aspect short, with width equal to length in most specimens, subtriangular, slightly constricted at base, broadest near base, apex slightly rounded; process extending posteriorly approximately one-third the distance to level of apices of pygofer lateral lobes; lateral lobes greatly produced; in lateral aspect with semi-rounded apex unevenly produced and occurring slightly below midlength of posterior margin; ventral portion of posterior margin scalloped. Anal segment as in figs. 523-525; symmetrical or nearly so; in dorsal view long and moderately slender, width approximately three-fifths the length, medioapical margin broadly concave resulting in a pair of posterolateral convexities; in caudal aspect slightly asymmetrical; median portion of ventral profile deeply and subrectangularly concave.

Types. — *Oliarus kieferi* is described from the holotype male, allotype female, and 92 paratypes. The holotype and allotype are from Yarnell heights [Yavapai County], Arizona, June 20, 1935, (E.D. Ball) United States National Museum collection. A male paratype and a female paratype are on the same paper point as the holotype and allotype, making a total of four specimens on the same point. The holotype is glued to the apex of the point, the allotype is next to the pin. The male terminalia of the holotype are illustrated in this work. Paratypes consist of the following specimens, all from Coconino and Yavapai Counties, Arizona: Ashfork (E.D. Ball): 7-13-29, one male, one female; 7-14-29, one male, one female; 7-15-29, four males, five females; 7-18-29, one male, two females; 8-16-29, two males, two females, United States National Museum, Ashfork, June 30, 1933 (P.W. Oman) United States National Museum collection; Prescott National Forest, VI-20-37 (D.J. and J.N. Knull), one female, United States National Museum, and one female, Ohio State University collection, Prescott, VI-8-41 (D.J. and J.N. Knull) one female, Ohio State University collection; Prescott, 7-12-47 (R.H. Beamer) one male, University of Kansas collection; Seligman, 7-29-36 (D.R. Lindsay) three females, Universi-

ty of Kansas collection; Williams, 7-13-29 (E.D. Ball) eight males, three females, United States National Museum collection; Williams, VII-2-39 (D.J. and J.N. Knull), three males, six females, Ohio State University collection; Yarnell Heights (E.D. Ball); 7-21-29, five males, five females; 8-20-29, one male, two females; 6-20-35, six males, seven females; 6-21-35, two males, five females, 8-27-35, three males, four females, all in United States National Museum collection, Yarnell Heights (P.W. Oman) 6-29-33, one female, United States National Museum collection; Coconino County, 8-13-1927, (L.D. Anderson) one male, University of Kansas collection.

Distributional records. — Except for one slightly damaged male from Chads, Utah, the Arizona counties of Coconino and Yavapai provide our only data.

Oliarus kieferi is a member of the *O. aridus* group. The anal segment of *kieferi* is sufficiently distinctive to separate it from other North American species by this structure alone (see figures); in dorsal aspect it is long and fairly slender, the lateral margins are slightly convex and are more nearly parallel than in other North American species; the posterior margin is more broadly concave than in *californicus*. The anal segment of *kieferi* is most distinctive when viewed caudally; especially noteworthy is the subrectangular notch or concavity along the medioventral profile that is peculiar to this species; also the profile does not have the evenly tectiform appearance of the other species with which it might be confused.

No host or habitat data are available concerning *O. kieferi*. The known seasonal distribution is in June, July, and August.

We take great pleasure in naming this species in honor of the late Arthur S. Kiefer, former Chairman of the Science Department, North High School, Columbus, Ohio. Mr. Kiefer was an unusually fine gentleman whose example and encouragement led many young people into careers in biology and other fields of science.

***Oliarus californicus* Van Duzee**

Figs. 532-542

Oliarus californicus Van Duzee 1914:36.

Salient features. — Length of male 5.0 to 5.6 mm (based on 25 specimens). Ground color of vertex and mesonotum fuscous; mesonotal carinae usually orange, variable in intensity; color extending into adjacent areas of disc in some specimens. *Head:* Vertex moderately broad, varying from slightly longer to slightly shorter in middle line than wide at apex of posterior emargination; median carina extending anteriorly approximately three-fifths length of disc. Face usually fuscous, varying to castaneous in some specimens; median carina percurrent, orange or yellowish, forking at base to form a prominent triangle; lateral carinae narrowly pale orange or yellow; frons broad, width much greater than length in middle line (1.7-2.3:1). Rostrum moderately long, usually slightly surpassing posterior trochanters but in some specimens only attaining or not quite attaining caudal margin. *Thorax:* Pronotum with intermediate carina narrowly separated from pale band of posterior margin. Mesonotum with carinae of nearly equal prominence. Tegmina lightly to moderately spotted, size of spots somewhat variable; spots usually present at fork of

Y-veins, fork of Cu₁, apical crossveins, and occasionally in some of the apical cells; tubercles brownish and moderately prominent, contrasting with pale veins except where veins become brown at apex; an occasional specimen with R brown for a short distance distad from juncture with Sc; commissure fuscous for most or all of its length basad from Y-vein juncture; apical cells usually 12 and anteapical cells usually 6; stigma brownish, length approximately three times greater than width. Legs brown basally, pale distally, not banded.

Male genitalia. — Aedeagal complex as in figs. 532-534; total pointed processes nine, not including any forks. Periandrium with five processes; dextral process moderately long, slender, slightly curved, not forked; left side not having a basiventral (sinistral) process but subapically with a curved prominent process which is primarily directed ventrad in typical specimens (San Diego area) but in other specimens (usually a mountain form) often directed straight caudad; median, apicoventral area with a conspicuous process directed caudad initially, then abruptly curving left, the curve in ventral aspect usually 90 degrees but as much as 150 degrees in some specimens; a prominent slender process arising at approximately the midlength of right ventrolateral area directed caudad primarily, apex usually curving ventrad in typical specimens but continuing straight in mountain forms; dorsal periandrium with a slender, acute, apical process directed right-cephalad in dorsal view. Flagellum in ventral aspect appearing to make a complete loop; typical forms with inner process of flagellum subequally forked, but mountain forms not forked or but feebly so; outer left margin of flagellum with long, slender process following flagellar contour; apex of flagellum with two long, moderately slender, subequal processes. Styles as in fig. 538; slightly asymmetrical; broadly expanded distal half, partly recurved, with apex of recurved portion of right style more bluntly rounded than corresponding part of left style, respective apices terminating at midlength of style; inner processes moderately short, very slender, fingerlike, primarily directed outward, but curving slightly caudad at apex; each process arising entirely near midlength on slender shaft. Connective as in fig. 542; moderately long and slender; combined width of ventral arms approximately equal to width of base in posterior view. Pygofer as in figs. 539-541; slightly asymmetrical; medioventral process in ventral aspect subtriangular, slightly longer than wide, extending posteriorly less than half the distance to level of left pygofer lobe; pygofer lobes well produced, the left more so than the right; posterior margins undulate in lateral view. Anal segment as in figs. 535-537; in dorsal aspect slightly asymmetrical, distinctly longer than broad, medioapical margin concave; in caudal view hoodlike, with ventral profile concave to a varying degree.

Types. — The type material of *O. californicus* is in the California Academy of Sciences. Van Duzee did not list a definite number of type specimens, nor a holotype; he simply stated that the species was "described from many specimens of both sexes taken at most all places where I have collected in San Diego County, from May to October." Three males and four females of the type series were examined. One of these males, the specimen illustrated in this revision, is hereby selected as lectotype. This is a male having a yellow "paratype" label placed on it by Van Duzee. The top label on the pin is machine printed "SanDiegoCalif" on the top line, "EPVanDuzee" on the bottom line, and hand printed "6-16-14" in the space

between. This specimen formerly was part of the "EPVanDuzee Collection" but now is in the California Academy of Sciences collection at San Francisco. The apices of the tegmina and wings are damaged. Also on the pin with the lectotype is the misidentified "paratype" female of *californicus* which actually is *fidus* Van Duzee.

Distributional records. — The distribution of *O. californicus* is confined to Riverside and San Diego Counties, California. Forms of this species were collected at San Diego and Cuyamaca Rancho State Park in San Diego County. Specimens from Alpine, San Diego County, were slightly transitional but mostly agreed in morphology with the mountain form. Other mountain forms from San Diego and Riverside Counties include specimens from Santa Rosa Mountains; Pinon Flat, Santa Rosa Mountains; Anza; Pine Flats Camp, Indio; Jacumba; and Beaumont.

Notes. — *Oliarus californicus* is a member of the *O. aridus* group. Characters of the style will separate *californicus* from other species of *Oliarus*. The outstanding feature of the style is the slender inner process that is not attached to any part of the distal expansion but only on the shaft of the style at midlength. Also noteworthy is the elongate distal expansion of the style. The aedeagal complex, with its total of nine processes and characteristic positions and shapes of these processes, also is decisive in diagnosis, but variation in the aedeagal complex can be a source of confusion. Typical forms from the San Diego area have the inner process of the flagellum forked, but in most forms collected in and beyond mountain ranges to the north and east of San Diego this process is simple. The more distal right lateroventral process of the periandrium is usually longer and more slender in the mountain forms than in typical forms from San Diego. The left apicoventral process of the periandrium in the mountain forms is usually straight and directed caudad; in the typical forms it is curved and directed ventrad primarily.

Specific habitat or host information on *O. californicus* is scarce. The specimen from Anza, California, was swept from *Arctostaphylos pungens* Humboldt, Bonpland, and Kunth. The common name for this plant species is Mexican manzanita.

Although Van Duzee listed *O. californicus* from May to October, the specimens seen were collected only from June to September.

CHECKLIST OF UNITED STATES SPECIES OF *Oliarus* WITH STATE RECORDS

1. *acicus* Caldwell 1947a:76. Ariz., Cal., Tex.
2. *altanatus* Caldwell 1951:35. Tex.
3. *altanus* Ball 1934:276. Ariz.
4. *apache* Ball 1934:275. Ariz., Cal.
5. *aridus* Ball 1902:151. Ala., Ark., Ariz., Cal., Colo., Ga., Id., Ill., Ind., Kans., La., Miss., Mo., Mont., Neb., N.M., N.D., Ohio, Okla., Oreg., S.C., S.D., Tenn., Tex., Utah, Va., Wy.
6. *arizonensis*, n. sp. Ariz.
7. *beirnei*, n. n. Cal., Oreg., Wash.
8. *bispinus* Caldwell 1947b:150. Tex.

9. *caldwelli*, n. sp. Tex.
10. *californicus* Van Duzee 1914:36. Cal.
11. *canyonensis*, n. sp. Cal., N.M.
12. *catus* Caldwell 1947b:147. Ariz.
13. *chuliotus* Ball 1934:271. Ark., Fla., Ga., Ill., Kans., Miss., N.C., Ohio, S.C.
-*gladensis* Caldwell 1951:25. N. Syn.
14. *cinnamomeus* Provancher 1889:223. Conn., Mass., Me., N.H., N.J., N.Y.,
Pa.
15. *coconinus* Ball 1934:274. Ariz., Colo., Nev., Tex., Utah.
16. *compectus* Ball 1902:152. Fla.
-*campestris* Fennah 1945b:141.
17. *corvinus* Ball 1934:273. Ariz., Cal., Tex.
18. *difficilis* Van Duzee 1912:494. Fla., Tex.
-*vittatus* Metcalf 1923:181. N. Syn.
19. *dondonius* Ball 1934:276. Ariz., Cal., Colo., Nev., N.M., Oreg., Tex., Utah.
20. *ecologus* Caldwell 1947a:76. Ala., Ark., Conn., Ga., Ill., Kans., Kent., Md.,
Miss., N.J., N.C., Ohio, Pa., S.C., Tenn., Va.
21. *eximus* Caldwell 1947b:145. Cal., N.M.
22. *exoptatus* Van Duzee 1917a:308. Cal., Colo., Id., Nev., Utah., Wy.
23. *fidus* Van Duzee 1914:37. Cal.
24. *forcipatus* Caldwell 1947b:146. Ariz., Tex.
25. *habeckorum*, n. sp. N.C., S.C., Va.
26. *hesperius* Van Duzee 1917a:307. Cal., Nev., Oreg.
27. *humilis* (Say) 1830:240. Ariz., Conn., Ill., Iowa, Kans., Mass., Mich., Minn.,
Mont., Nev., N.H., N.J., N.M., N.Y., Ohio, Oreg., Pa., Utah, Wisc.
28. *kieferi*, n. sp., Ariz., Utah.
29. *knullorum*, n. sp., Ariz., Tex.
30. *littoralis* Ball 1934:274. Fla.
31. *lobatus* Caldwell 1938:305. N.M., Tex.
32. *montanus* Metcalf 1923:179. Ga., Ill., Kans., Md., Mo., N.Y., N.C., Ohio,
Pa., Tenn., Va.
33. *papagonus* Ball 1934:272. Ariz.
34. *pima* Kirkaldy 1907:62. Ariz., Cal., N.M., Utah.
-*nogalanus* Ball 1934:272. N. Syn.
35. *placitus* Van Duzee 1912:493. Ala., Fla., Ga., Ill., Kans., Md., N.J., N.C.,
Ohio, S.C., Va.
36. *pygmaeus* Ball 1937:180. Ariz.
37. *quinquelineatus* (Say) 1830:241. Ala., Ark., Colo., Conn., Fla., Ga., Ill., Ind.,
Iowa., La., Me., Md., Mass., Minn., Miss., N.J., N.Y., N.C., Ohio,
Okla., Pa., S.C., Tenn., Va., Wis.
38. *retentus* Caldwell 1947b:148. Ariz., Colo., Utah.
39. *sablensis* Caldwell 1951:34. Conn., Fla., Ga., Ill., Ind., Iowa, Kent., Md.,
Mass., Minn., N.H., N.J., N.Y., N.C., Ohio, Pa., S.C., Tenn., W. Va.
40. *sementinus* Ball 1902:152. Ariz., Cal., Colo., N.M., Utah.
41. *slossonae* Van Duzee 1912:494. Fla.
-*borinquensis* Caldwell 1952:137. N. Syn.

42. *sonoitus* Ball 1937:149. Ariz., Cal., N.M., Tex.
-*nigravittus* Caldwell 1938:304. N. Syn.
43. *sylvaticus* Caldwell 1947b:151. Cal.
44. *texanus* Metcalf 1923:181. Tex.
45. *teximus* Caldwell 1947b:145. Tex.
46. *truncatus* Van Duzee 1929:72. Cal.
47. *uncatus* Caldwell 1947b:151. Ariz.
48. *vicarius* (Walker) 1851:343. Fla., Ga., N.C., S.C.
-*vitreus* Metcalf 1923:180. N. Syn.
49. *viequensis* Caldwell 1952:141. Fla.
50. *yavapanus* Ball 1934:274. Ariz., Cal., Tex., Utah.
51. *zyxus* Caldwell 1947a:76. Ariz., Cal., Colo., Id., Nev., N.M., Oreg., Tex., Utah.

DISTRIBUTIONAL NOTES

The greatest concentration of species of *Oliarus* in North America is found in the southwestern United States. Arizona has the most species with 22 (7 endemic), followed by Texas with 17 (4 endemic), and California with 16 (4 endemic), but New Mexico has only 6 (none endemic). This low figure for New Mexico probably is the result of limited collecting and possibly a comparative lack of diversity in habitats. Some other totals of species of *Oliarus* for various states follow: Nevada 5, Utah 10, Colorado 8, Kansas 6, Illinois 8, Ohio 8, New York 4, Connecticut 5, North Carolina 9 (1 almost endemic), Florida 10 (1 endemic). Of the 10 Florida species and 17 Texas species, only *O. difficilis* is common to both states. In Texas this species is known only from the Lower Rio Grande Valley near Brownsville; in Florida it has been taken in the southern half of the state. *O. difficilis* is closely related to species taken in the Antilles and South America. Two other species of *Oliarus* in Florida have Neotropical affinities (*O. slossonae* and *O. viequensis*). Another species, *O. littoralis*, is endemic to Florida but is closely related to species occurring in Texas. The other Florida species are mostly typical of the eastern (Carolinean) fauna. Most of the species in the western United States appear related to Mexican species. Three western species and two species primarily eastern in distribution appear to be related to Palearctic species.

The following species of *Oliarus* are recorded in the present paper as present in Canada: *aridus*; *beirnei*; *cinnamomeus*; *dondonius*; *humilis*; *sablensis*; and *zyxus*, a total of seven species (none endemic).

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