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Title: THE TAXONOMIC SIGNIFICANCE OF THE MALE GENITALIA
AND ASSOCIATED STRUCTURES IN THE GENUS EUCCERERIS
CRESSON (HYMENOPTERA: SPHECIDAE)

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Paul O. Ritcher

The male genitalia of 69 species, representing eight genera of
sphecid wasps, were examined in order to ascertain their taxonomic
value. In all, the male genitalia of approximately 1000 specimens
were critically studied.

Emphasis was placed on the genitalia and associated sclerites
of the known males in the genus Eucerceris. The genitalia of most
species are so different that they can be defined by this structure
alone. The pygidia, and to a lesser extent the seventh and eighth
sterna, also offer reliable characteristics with which to distinguish
species. The North American genera of the subfamily Philanthinae
can be differentiated on the basis of male genitalic morphology.

The morphology of the male genitalia of Eucerceris indicates a
close relationship with Cerceris. This relationship is also indicated
by external non-genitalic morphology. The genitalia of Didesmus
males are radically different from those of Cerceris and Eucerceris but nevertheless, Didesmus is most closely related to these genera on the basis of non-genitalic characters.

The male genitalia of the philanthine genera Aphilanthops, Clypeadon and Listropygia are very similar but differ considerably from those of the cercerine genera Cerceris, Eucerceris and Didesmus. These differences and similarities support the presently accepted classification and placement of these genera. Based on genitalic characters, Philanthus and Trachypus appear to be closely related to each other. On the basis of external non-genitalic characters, however, these genera appear to be only distantly related.

Without examining other genera from Africa, Asia and South America, determination of the relationships of Philanthus and Trachypus to other groups is not possible.

A key to the genera and a key to the species of Eucerceris based on male genitalia are provided. In addition, the genital structures of 33 species of Eucerceris are described in detail and the major key characteristics illustrated.
The Taxonomic Significance of the Male Genitalia and Associated Structures in the Genus *Eucerceris* Cresson (Hymenoptera: Sphecidae)

by

Jerry Mitchell Davidson

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THE TAXONOMIC SIGNIFICANCE OF THE MALE GENITALIA AND ASSOCIATED STRUCTURES IN THE GENUS EUCERCERIS CRESSON (HYMENOPTERA: SPHECIDAE)

INTRODUCTION

The taxonomic usefulness of male insect genitalia has been known for many years. Although the male genitalia have been used from time to time in the taxonomy of various groups of Hymenoptera, they have generally been neglected in favor of more readily discernible external characteristics.

The sphecid wasp tribe Cercerini contains approximately 1500 species which are placed in four currently recognized genera. _Cerceris_ is the largest of these genera, contains about 1450 species, and is world wide in distribution. Cercerine females have facial tubercles and processes which facilitates their identification. Males lack these processes as well as other diagnostic features. Consequently, it has become necessary to investigate other structures to find potentially useful taxonomic characters.

The endemic North American cercerine genus _Eucerceris_ contains 40 described species, of which the males are known in 33. Many males of _Eucerceris_ species have, in the past, been separable only on the basis of subtle differences in color pattern or by the locality from which they were collected (Scullen, 1968).

This paper attempts to show that the genitalia and associated
caudal sclerites can be used in the identification of *Eucercerus* males. In some cases the genitalia and caudal sclerites are diagnostic.

*Eucercerus* males have been compared with male representatives of seven other genera which belong to the same subfamily (Philanthinae).
The tribe Cercerini is composed of some 1500 described species of solitary ground nesting wasps, about which hundreds of papers have been written (Menke, 1969, personal communication). Most of these papers are taxonomic, i.e., descriptions of new species, reviews of species complexes or studies of regional cercerine faunas.

As more species are made known through descriptions, taxonomic treatments will become even more difficult. New characteristics must be found that will facilitate the description and definition of species and more effectively divide the genera into more workable taxonomic units.

The taxonomic value of the genitalia of both male and female insects is well known. Unfortunately however, in the Cercerini the genitalia have been largely neglected in favor of more readily discernible external characteristics. Most females of the tribe have peculiar tubercles and processes on the face which are of immense help in their identification. In addition, the cephalic and thoracic maculations are relatively stable as are the variably colored abdominal bands. Male cercerine wasps have not been well studied taxonomically, presumably due to the lack of stable morphological characters at the species level. In most cases, the sexes are dimorphic, especially in cephalic morphology. This has caused a great deal of taxonomic confusion; in many cases one name has been applied to the female and
another to the male. Consequently, there is an increasing need for intraspecifically stable morphological characteristics which can be used to separate males of different species.

*Earlier descriptions of cercerine species occasionally included illustrations of the pygidium and male genitalia. Arnold (1926) was the first, however, to recognize the importance and use the male genitalia in the taxonomy of cercerine species. Mochi (1939) studied the *Cerceris* fauna of Egypt and illustrated the male genitalia of several species. Scullen (1939) was the first person to point out and illustrate differences in the male genitalia of *Eucerceris*, the only cercerine genus endemic to North America. Giner Mari (1941a) illustrated the genitalia of the *Cerceris* of Spain and in later papers (1941b, c, 1942, 1943, 1945a, b) illustrated the pygidia of other species. In more recent works, however, Scullen (1968), Tsuneki (1968) and Krombein (1969) neglected to illustrate the male genitalia but pointed out differences between species based on pygideal configurations. Arnold (1942) was the only worker to label the parts of the male genitalia. Although the genital components are clearly indicated, his terminology is not generally accepted by contemporary hymenopterists.*
MATERIALS

All material examined during this study, approximately 1000 specimens, was obtained from the private collections of Dr. H. A. Scullen, J. M. and J. P. Davidson, and from material collected in southern Arizona in August 1969 by Dr. Charles W. Baker.

As many as 60 specimens of a few species were studied to determine the extent of variability of genital structures. Since variability was found to be negligible and only small numbers of some species were available for study, fewer specimens of most species were examined. This ranged from one specimen in some of the rare or uncommon species to about 15 specimens in common species. When available, paratype specimens were also examined. All species of Eucerceris having known males (33) were studied.

I also examined the male genitalic structures of about 25 species of Cerceris. Some of them will be discussed and the genitalic components illustrated. These represent some of the major species groups as recognized by Scullen (1965). Selection of species was made on the basis of their relatively large size and availability of specimens.

Four specimens of the monotypic cercerine genus Didesmus were also examined. For comparative purposes, 11 other species representing five additional genera, Aphilanthops, Clypeadon, Listropygia, Philanthus and Trachypus, were studied.
METHODS

The methods usually employed for the removal and study of genitalia and related structures of insects vary from worker to worker and from group to group. However, the methods used in this study are fairly standard and with little modification could be used for most aculeate Hymenoptera as well as for other insect orders.

Dried specimens must be relaxed before the genitalia and associated structures can be removed. This can be accomplished either by boiling the specimens in water for a few minutes or by placing them in a humidity chamber for several hours. The usual procedure is to remove all labels and place the pinned specimen in a humidity chamber for 12-18 hours. When the specimen is relaxed, it is held with the thumb and forefinger of the left hand, venter up with the head to the left. A pair of fine pointed forceps held in the right hand is used to open the genital chamber. The pygidium is teased and forced to a more dorsal position and the penultimate sternite teased to a more ventral position. This will expose a greater portion of the apical sternum than is visible in undissected specimens. By grasping the exposed portion of the apical sternum with forceps and pulling gently, it can usually be extracted with little effort. Since the apical sternum and the genitalia are attached basally, the genitalia are usually removed as well. The basal attachment occasionally breaks during the removal of the sternum. A
bent insect pin inserted into the genital chamber can be manipulated to facilitate extraction of the genital capsule.

The second method used in the removal of genitalia and associated structures is essentially the same as in the first method except that the specimen is boiled in water until relaxed. This method is superior to the humidity chamber technique because much less time is involved. There are some disadvantages with this method which, as yet, have not been overcome. When specimens are boiled, they frequently lose color, the wings stick together and the body hairs become matted and appressed. By using the humidifier method these problems are usually avoided. If large numbers of specimens are available, the boiling technique is better, provided the specimens are to be used only for genitalic work. When several specimens which are to be kept for further use are being treated together, care must be taken to keep the collection data and specimens correctly associated.

When all structures to be examined have been removed from the specimen, they are placed in 70% ethanol in a 12-celled spot plate. The sclerotized structures are examined under a microscope and the excess tissue (muscles, etc.) removed with fine pointed forceps. Tissue still clinging to the various parts, or not readily removed with forceps is removed by placing the structures in a strong solution of warm to hot KOH. The KOH will not only dissolve the remaining
tissue but also clear sclerotized cuticle as well. Once the genitalic structures are cleared, they are dried on absorbent paper, returned to the spot plate and are allowed to soak in water for a few minutes until the KOH droplets have been diluted. From there, they are transferred to another cell containing 70% ethanol. If Hoyer's medium is used to mount the specimens no further fixing is necessary. Three small balls of modeling clay are centered on the slide in the form of an equilateral triangle. Several drops of Hoyer's medium are placed on the slide and allowed to set for a few minutes. The specimens are removed from the plate, dried on absorbent paper and carefully placed in the mounting medium. At this point the slide mount should be examined to insure there are no bubbles in the medium or under the specimen. If not enough medium was placed on the slide to cover the specimen, more Hoyer's should be added until the specimen is completely covered. If bubbles are present they are easily removed by using an insect pin to move them to the side of the mounting medium. If many tiny bubbles are present, they are most easily removed by placing the slide in a vacuum dessicator and drawing a vacuum for a few minutes. When the slide is bubble-free, the cover glass is carefully placed on the three balls of modeling clay and adjusted to the desired height. There is usually not enough mounting medium under the cover glass at this point, and more should be added. The medium can be injected under the cover glass with a
tuberculin syringe. A fine gauge disposable needle bent from 45 to 90 degrees is often better for this purpose than an unbent or straight needle. A code number common to the slide mount and the wasp is attached to both. The code number and name of the species is written in a notebook for later reference. The slide is then placed in an oven at 31-32 degrees centigrade and allowed to dry for about two weeks. After two weeks the slide is usually dry enough to permit examination under a microscope without the cover glass sliding off the specimens.

Another material was tried as a mounting medium late in the study and was found to be superior to Hoyer's in several respects. The material, Piccolyte, is a resin base compound that is soluble in xylene but not in water. Specimens mounted in this medium are treated in the same fashion as described above except that after being placed in 70% ethanol for the second time they are transferred to absolute ethanol for three or four minutes and then to xylene until ready for mounting. The balls of modeling clay cannot be used with Piccolyte as with Hoyer's medium. The xylene used to dissolve the Piccolyte crystals draws water from the clay which eventually crumbles causing the slide cover to smash the mounted specimens. The major advantages of Piccolyte over Hoyer's are in the shorter length of time required for the slides to dry and in the resolution of the finished mount. In addition, bubbles were almost never a problem using this material.
The mounted material was then studied and comparisons made with the aid of either an AO microstar compound microscope or a Zeiss photomicroscope. Morphological comparisons were made from the slides, photographs made using the Zeiss microscope and from 'instant' negative photographs made from a converted microfilm reader.
STRUCTURE AND ORGANIZATION OF THE MALE GENITALIA

In philanthine wasps the male genital capsule is composed of three basic paired structures, the parameres, penis valves and volsellae, and the unpaired gonobase. Each of the paired structures can be divided into several components. The capsule is contained in the genital chamber formed dorsally by the heavily sclerotized seventh metasomal tergum (= pygidium) and ventrally by the seventh and eighth sterna. The eighth tergum is reduced to a small, inconspicuous and lightly sclerotized bilobed plate located immediately beneath the pygidium and just dorsal to the anus. The eighth sternum is attached by muscles and connective tissue to the more basal portions of the capsule. The base of this sternum is usually covered by the posterior margin of the seventh sternum leaving the apical half free and exposed (Figure 3).

The well developed, unpaired gonobase is the most anterior genitalic sclerite and surrounds the genital foramen. The dorsomedial surface is weakly sclerotized in some species and strongly sclerotized in others. The anterior lip serves as a point of muscle attachment and is always strongly sclerotized. The anterior aperture to the gonobase is usually anteriorly oriented, although in some species it takes on a more or less opisthognathos position. In a few species, the anterior portion of the gonobase is dorsally reflexed, the aperture thus
assuming a more or less dorsal position.

The aedeagus is located directly behind the gonobase and just dorsal to the volsellae. Although considered a paired structure, it is composed of three parts, the dorsal plate and two penis valves (Figure 4). Anteriorly, the valves are narrow, elongate apodemes forming internal connections with the ventral surface of the basiparameres. In most of the material examined, the aedeagal apices are somewhat bulbous and vary in size and shape from species to species (Figures 11-16, 25, 37).

The dorsal plate is located above and fused with the aedeagus. It is usually connected anteriorly to the oblique inner margins of the basiparameres by membranes and a tiny longitudinal sclerite, the dorsal bridge. Within any given group, the basic shape, size and position of the plate is relatively constant. The plate is poorly developed in the Philanthini; in Cylpeadon and Aphilanthops it appears to be entirely membranous, in Listropygia it is represented by a largely membranous area which is weakly sclerotized around its borders but in Philanthus both membranous and weakly sclerotized plates occur. A clearly defined dorsal plate is lacking in Didesmus which is unlike other cercerine genera.

The paired volsellae lie beneath the aedeagus and consist of two elongate basally attached processes, the digitus, and a more ventral, somewhat shorter paired cuspis. The cuspis appears to be lacking in
both *Cerceris* and *Eucerceris* but is present in all other genera studied. The digitus is typically an elongate structure which is attached basally and articulates with the volsellar plate (Snodgrass, 1941). The apices of the digiti are usually rounded although in some species they are pointed.

The outermost of the paired genital structures are the "claspers," usually referred to as "parameres". These structures are composed of two parts, the basiparamere and the apical paramere which are separated from each other by an internal longitudinal ridge. In some of the genera the parameres are bladelike while in other groups they are variable. The inner apical margins of the parameres are indented in most Cercerini, giving the appearance of a small oblique fold. Ventrally, the parameres are clothed with hairs of varying lengths and densities. The position and relative density of the hairs appears to be constant within a species and consequently of some taxonomic importance.

The genital capsule is covered dorsally by the pygidium (= seventh metasomal tergum). The pygideal apex of most male philanthine wasps is simple and not modified to any extent. However, males of *Eucerceris* have two apicolateral projections or processes which result from a simple emargination of each side of the pygideal integument (Figures 5, 7, 29-32). The dorsum of the pygidium is convex in some of the genera but highly modified in the Cercerini.
Anteriorly, the pygidium is armed with two lateral apodemes to which muscles are attached. These can be seen only in dissected specimens. The pigmentation and degree of sclerotization varies from species to species and in a few cases from specimen to specimen, consequently the apodemes are not considered to be useful as taxonomic characters. Posterior to the apodemes is a wide, relatively smooth, heavily sclerotized plate, the pregradulus (Michener, 1944). The anterior pregradular margin is broadly arcuate in most species but is somewhat variable. The surface of this structure is smooth in most species but granulose in a few. The caudal margin of the pregradulus is usually arcuate but is sinuate in a few species. There is a well developed ridge or crest behind the pregradulus and bordering the pygideal plate in *Cerceris* and *Eucerceris*. The ridges form the lateral margins of the pygideal plate. In both genera the anterior portion of the ridges is either contiguous with or separated from the caudal pregradular margin (Figures 5, 7, 35). In addition, the shape of the plate is influenced by one of three major configurations of the lateral ridge. In some species the ridges are subparallel giving the plate a rectangular appearance. In other species the ridges converge either anteriorly or posteriorly giving the plate a more or less triangular appearance. The plate of most species is lightly setose although a few have a simple granulose surface.

The eighth sternum is located ventrad to the genital capsule and
serves as a cover or protective plate. The general uniformity of shape of this structure within each genus suggests that it might be used in generic diagnoses (Figures 6, 8, 9, 20, 21, 26, 44). In only a few cases in *Eucerceris* are there differences which can be used as a character at the species level (Figures 10, 23). The lateral and basal portions of the eighth sternum are variously modified. In some genera there is a mediolateral expansion of the integument to which muscles are attached. This expansion is rather wide and more or less rounded in some groups while in others it is thin and pointed. In *Cerceris* the expansion has been lost or has migrated basally. In most genera muscles are attached not only at the anterior margins of the expansions but also at the anterior margin of the sternum. Such anterior muscular attachments are particularly well developed in *Cerceris*. Several of the genera have an anterior constriction of the eighth sternum called a spiculum (Figures 8, 10, 20). The function of this structure is as yet unclear. The outer or exposed ventral surface is clothed with hairs and setae of varying lengths and densities. A few species have definite setal patterns or arrangements of hair which can be used in their taxonomy.
A KEY TO THE MALES OF NORTH AMERICAN GENERA
OF THE SUBFAMILY PHILANTHINAE BASED ON
GENITALIA AND ALLIED STRUCTURES

1. Aedeagus without teeth or spines along basolateral margin ....
   ........................................ Cercerini ............... 2

   - Aedeagus with teeth or spines along basolateral margin ....
   ........................................ Philanthini .............. 4

2. Aedeagus broad, spatulate apically; cuspis present; digitus
lacking apical teeth .............................. Didesmus

   - Aedeagus relatively narrow, usually rounded apically, not
   spatulate, cuspis absent; digitus with apical, medially directed
teeth .................................................. 3

3. Digitus with two pairs of medially directed teeth on apex;
   pygidium with projections or processes along apicolateral
   margin .................................................. Eucerceris

   - Digitus with one pair of medially directed teeth on apex;
   pygidium lacking projections or processes along apicolateral
   margin .................................................. Cerceris

4. Aedeagus with a hatchet-shaped lateral expansion on apex ....
   .............................................. subtribe Philanthopsina ... 5

   - Aedeagus without a hatchet-shaped lateral expansion on apex...
   .............................................. subtribe Aphilanthopsina ... 6

5. Parameres rounded apically ........................ Philanthes

   - Parameres angulate apically ...................... Trachypus

6. Hairs on parameres, adjacent to volsellae, relatively dense;
parameres constricted at middle; aedeagus short, extending about one-half the distance from middle constriction of parameres to apex ............................ Listropygia

- Hairs on parameres, adjacent to volsellae, relatively sparse; parameres not constricted at middle; aedeagus long, almost reaching apex of parameres ...................................... 7

7. Parameres tapering toward apex; outer margin of digitus nearly straight ........................................ Aphilanthops

- Parameres not tapering toward apex; outer margin of digitus arcuately curved ................................. Clypeadon
A KEY TO THE MALES OF THE GENUS EUCERCERIS
BASED ON GENITALIC AND ALLIED STRUCTURES

1. Pygidium with medioapical lobe emarginate .............................. 2
   - Pygidium with medioapical lobe rounded or truncate ............ 16

2. Pygidium without setae between median lobe and lateral processes .................................................. 3
   - Pygidium with setae between median lobe and lateral processes .............................................. 6

3. Sides of gonobase indented; inner apical margins of parameres not notched ................................ velutina
   - Sides of gonobase straight; inner apical margins of parameres distinctly notched ......................... 4

4. Apex of aedeagus distinctly laterally reflexed ........ atrata
   - Apex of aedeagus not laterally reflexed ......................... 5

5. Pygidium with medioapical lobes rounded ......................... barri
   - Pygidium with medioapical lobe truncate ......................... insignis

6. Lateral ridges contiguous with hind pregradular margin .... 7
   - Lateral ridges separated from hind pregradular margin .... 12

7. Pygideal setal cluster extending to hind pregradular margin ................................................................. 8
   - Pygideal setal cluster not extending to hind pregradular margin ........................................ 9

8. Seventh sternum emarginate distally .......................... pimarum
   - Seventh sternum bisinuate distally .............................. baja

9. Aedeagus with a subapical, laterally directed spine on each margin .................................................. zonata
   - Aedeagus without subapical spines ................................. 10
10. Seventh sternum bisinuate distally ......................... morula
   - Seventh sternum distally emarginate to almost truncate ...... 11
11. Distal sternum with a small, subapical, darkened, dorso-
    later al tubercle on each margin ......................... elegans
   - Distal sternum without a small, subapical, dorsolateral
     tubercle on each margin .......................... pacifica
12. Apicolateral processes each with a tiny secondary process
    ventrally ............................................ melanovittata
   - Apicolateral processes lacking secondary processes ......... 13
13. Parameres ventrally with extremely long dense hairs ...... 14
   - Parameres lacking long, dense hair ventrally; hair of
     moderate length and density .......................... 15
14. Apex of each paramere rounded, without a notch on inner
    margin ............................................... flavocincta
   - Apex of each paramere pointed, with a distinct notch on inner
     margin ............................................... ruficeps
15. Seventh sternum deeply, distinctly emarginate ..........  similis
   - Seventh sternum shallowly, indistinctly emarginate .. mojavensis
16. Aedeagus distinctly elongated distally, apex not bulbous ...... 17
   - Aedeagus not elongated distally, apex bulb-like ............. 26
17. Medioapical lobe extending beyond apicolateral
    processes ............................................. 18
   - Medioapical lobe not extending beyond apicolateral
     processes ............................................. 19
18. Seventh sternum emarginate distally; genital structures
    dark .................................................... melanosa
   - Seventh sternum truncate distally; genital structures
     orange ............................................... mellea
19. Seventh sternum emarginate distally ....................... 20
   - Seventh sternum truncate distally ........................ 22

20. Aedeagus with a subapical bulbous expansion .......... rubripes
   - Aedeagus lacking a subapical bulbous expansion .......... 21

21. Medioapical lobe wide, truncate .............................. apicata
   - Medioapical lobe relatively narrow, rounded ........... sinuata

22. Gonobase with a dorsal longitudinal suture ........ zimapanensis
   - Gonobase lacking a dorsal longitudinal suture ............ 23

23. Gonobase not anteriodorsally emarginate .............. vittatifrons
   - Gonobase anteriodorsally emarginate ....................... 24

24. Surface of pygideal plate clothed with long conspicuous
    setae; hairs adjacent and laterad to ridges extending to
    pregradular margin ................................... canaliculata
   - Surface of pygideal plate clothed with shorter setae; hairs
     adjacent and laterad to ridges not extending to pregradular
     margin ............................................... 25

25. Pygidium uniformly dark brown (except for medioapical
    lobe), plate rugosely pitted ......................... fulvipes
   - Pygidium darkened laterally; plate pale, with sparse
     shallow pits ........................................ sonorae

26. Apical sternum rounded distally, not emarginate;
    digitum mucronate .................................... lacunosa
   - Apical sternum emarginate distally; digitus not mucronate ... 27

27. Parameres rounded apically; gonobase elongated, with a
    dark longitudinal suture dorsally ........................ 28
   - Parameres anulate apically; gonobase not elongated, with-
     out a longitudinal suture dorsally ........................ 30

28. Apical sternum with a subapical dark tubercle on each
- Apical sternum lacking subapical tubercles on each side ...... 29

29. Pygideal plate dark brown, rugosely punctate ......... montana
   - Pygideal plate pale testaceous, sparsely, shallowly punctate ............... stangei

30. Pygideal plate coarsely, heavily punctate; lateral ridges contiguous with hind pregradular margin .......... superba
   - Pygideal plate sparsely, shallowly punctate; lateral ridges not contiguous with hind pregradular margin ........ 31

31. Apicolateral processes of pygidium notched along inner apical margins ........................................ 32
   - Apicolateral processes of pygidium straight along inner apical margins ........................................ 33

32. Emargination of apical sternum distinctly narrower than process ................................................. baccharidis
   - Emargination of apical sternum as wide as process ....... tricolor

33. Apex of paramere not sharply angulate, expanded slightly behind middle; lateral ridges contiguous with hind pregradular margin ................................................. rubripes
   - Apex of paramere sharply angulate, not expanded behind middle; lateral ridges not contiguous with hind pregradular margin ................................................. arenaria
DESCRIPTION OF THE GENUS EUCERCERIS

**Eucerceris Cresson**
(Figures 1-7, 8-19, 22-23, 27-32)

GENITALIA: Rufous to testaceous, lateral margins sometimes piceous. Gonobase converging anteriorly; anteriodorsally emarginate; anterioventral margin often slightly projecting; dorsal surface sometimes with a longitudinal suture. Aedeagus elongate, extending beyond digitus almost to apex of parameres, terminating in a bulb-like or elongate expanded swelling; with a subapical swelling in some species. Parameres with outer margins relatively straight, usually slightly indented at middle; apices acutely angulate to rounded; venter sub-apically clothed with relatively long, dense setae; setae bristle-like apically, projecting laterally, distally, mesally. Digitus elongate, sides subparallel to slightly converging distally; inner margins distally with two pairs of mesally directed teeth.

PYGIDIUM: Pregradulus elevated, wider than long, anterior margin arcuately emarginate, hind margin truncate or weakly emarginate. Plate wider anteriorly, converging toward apex; side margins elevated, forming lateral ridges, surface relatively flat, variably punctate, variably setose; apicolateral angles projecting, forming distally diverging processes; distal margin with a projecting medial lobe; setae clustered adjacent, lateral to lateral ridges.
APICAL STERNUM: Acutely angulate anteriorly, sides diverging distad, widest in front of middle, abruptly constricted behind, forming an elongate shaft; distal margin medially emarginate, forming apicolateral processes. Surface subapically clothed with long appressed pale colored setae; lateral margins with long obliquely projecting setae.

SEVENTH STERNUM: Anteriomedial margin broadly, arcuately emarginate. Distal margin truncate to deeply emarginate; apicolateral angles with small tooth-like processes. Surface densely clothed with long, pale, apicolaterally clustered setae; midline glabrous.

On the basis of genital morphology, the genus Eucerceris appears to be most closely related to the cosmopolitan genus Cerceris. It differs from Cerceris in having two pairs of digital teeth instead of one pair, by the presence of apicolateral processes on the pygidium and by having a differently shaped apical sternum. Eucerceris also differs in many ways from the neotropical genus Didesmus. The aedeagus of Didesmus is spatulate distally whereas it is bulbous or slightly expanded in Eucerceris. Didesmus has both a digitus and a cuspis while Eucerceris has only a digitus. The digitus of Didesmus lacks inner apical teeth which are present in Eucerceris.
Eucerceris angulata Rohwer
(Figures 28, 32, 49)

Scullen, H. A. (1939:75-76; 1968:82)

GENITALIA: Testaceous to dark brown. Gonobase elongate; sides subparallel, slightly converging anteriorly; dorsal suture present, greatly reduced; dorsum and venter anteriorly emarginate. Parameres slightly curved on basal two-thirds, greatly expanded on distal one-third; ventral setae dense, long, directed medioventrally; apex rounded, clothed with short, bristle-like setae on margins; inner subapical notch distinct. Aedeagus bulbous distally; subapical expansion small, reduced. Digitus with lateral margins diverging distally, then sharply angulate mesally; distal teeth large, acute, elongate; basal teeth smaller, obtuse.

PYGIDIUM: Dark brown, piceous laterally. Hind pregradular margin broadly arcuate; lateral ridges contiguous with hind pregradular margin, not well developed; plate dark, sparsely, shallowly punctate, asetose; lateral setae long, uniformly dense to hpm; medioapical lobe broadly rounded; hairs projecting between medioapical lobe and apicolateral processes; processes short, rounded, barely projecting.

APICAL STERNUM: Distal emargination wider than each apicolateral process; processes testaceous, glabrous; surface subapically punctate, clothed with short, appressed setae; lateral setae
short, sparse; entire sternum greatly elongate, squamae greatly reduced; lateral tubercles present, distinct, dark.

SEVENTH STERNUM: Distal emargination obtusely, angulate; surface testaceous distally, dark brown subapically, pale brown anteriorly; clothed with long setae apically, shorter toward base; midline glabrous.

DISCUSSION: This species has a number of unique features which will immediately separate it from other species. The lateral ridges are contiguous with the hind pregradular margin but the ridges are reduced in height to the point that the plate and the ridges are almost on the same horizontal plane. The deeply, narrowly emarginate anterior margin of the gonobase is also unique. This species belongs to the angulata species group (angulata, montana, stangei) as defined in the discussion under E. montana. Eucerceris angulata can be separated from these species by the asetose pygideal plate, by the deeply angulate dorsal emargination on the gonobase and by the elongate, tuberculate apical sternum.
Eucerceris apicata Banks


GENITALIA: Testaceous. Gonobase with sides converging anteriorly; dorsal suture absent; dorsum emarginate anteriorly; venter projecting anteriorly. Parameres almost straight, slightly irregular; ventral setae dense, long, projecting distally; apex acutely angulate; inner subapical notch distinct. Aedeagus with apex slightly expanded, elongate, not bulbous; subapical expansion absent. Digitus weakly converging toward apex.

PYGIDIUM: Testaceous in middle, lateral ridges rufotestaceous. Hind pregradular margin arcuately curved; lateral ridges contiguous with hind pregradular margin; plate testaceous, glabrous, impunctate; lateral setae densest near base of apicolateral processes, not reaching hind pregradular margin; medioapical lobe truncate; hairs projecting between medioapical lobe and apicolateral processes; processes obliquely, laterally directed, dark laterally, pale medially.

APICAL STERNUM: Emargination narrower than width of each apicolateral process; distal margin rounded; surface clothed with short, semierect setae throughout; lateral tubercles absent.

SEVENTH STERNUM: Broadly, arcuately emarginate; processes well developed; surface apicolaterally clothed with long, pale setae; midline glabrous.
DISCUSSION: *Eucerceris apicata* appears to be closely related to *E. sinuata* in overall appearance but differs from *sinuata* in many details. The parameres of *E. sinuata* are sinuately curved on the outer margins and the bases robust whereas in *apicata* the parameres are less sinuate laterally and less robust basally. The aedeagus is elongate toward the apex in both species but expanded laterally in *apicata*. The apical lobe of the pygidium is truncate, the apices of the processes almost truncate and the plate glabrous and impunctate in *apicata*. In *sinuata*, the apical lobe is rounded, and relatively small compared to other species, the processes are more angulate, and the plate is distinctly punctate and covered with erect setae.
**Eucerceris arenaria Scullen**

(Figure 12)

Scullen, H. A. (1939:75-76; 1968:83)

**GENITALIA:** Testaceous. Gonobase with venter exposed anteriorly; weakly emarginate medially; dorsum emarginate anteriorly; dorsal suture absent; sides converging toward apex. Parameres with sides weakly sinuate, subapical margin obliquely directed mesad; apex sharply angulate; venter with moderately long, dense subapical setae, inner margins with long, more sparsely placed setae, distal setae bristle-like; inner subapical notch distinct. Aedeagus bulbous distally; subapical expansion well developed. Digitus with sides subparallel, indented subapically; distal teeth long, acute; basal teeth broader, obtuse.

**PYGIDIUM:** Rufotestaceous medially, dark brown laterally. Pregradulus with hind margin weakly curved, almost truncate; lateral ridges almost contiguous with hind pregradular margin; plate sparsely clothed with long, pale setae; sparsely, shallowly punctate; lateral setae rufotestaceous, not reaching hind pregradular margin; medioapical lobe rounded, almost truncate; hairs projecting between medioapical lobe and apicolateral processes; apicolateral processes robust, rounded apically, obliquely directed away from midline.

**APICAL STERNUM:** Distal emargination narrower than width of apicolateral processes; processes testaceous, glabrous; sides of shaft
subparallel, dorsum clothed with short, appressed setae; sides with long, pale, moderately dense, obliquely directed setae; subapical tubercles absent.

SEVENTH STERNUM: Distal emargination variable, truncate to moderately emarginate; surface with long, dense, pale apicolaterally clustered setae; midline apically glabrous.

DISCUSSION: The genitalia and associated structures of this species do not possess any unusual or unique features. However, _E. arenaria_ appears most closely related to _E. rubripes_ based not only on genitalic features but on external characters as well. This species can be separated from closely allied species by the characters given in the key to species.
Eucerceris atrata Scullen
(Figure 25)

Scullen, H. A. (1968:83)

GENITALIA: Rufotestaceous. Sides slightly anteriorly converging; dorsal suture absent, dorsum emarginate anteriorly; venter slightly projecting anteriorly. Parameres with outer margins straight in middle, curved at ends; ventral setae long, dense subapically; apex acutely angulate, with bristle-like setae; inner subapical notch distinct. Aedeagus bulbous, distinctly laterally reflexed distally; subapical expansion well developed, fused with distal aedeagal bulb. Digitus with sides subparallel anteriorly, subapical lateral margins converging distally; distal teeth narrow, acute; basal teeth short, wide, obtuse.

PYGIDIUM: Piceous laterally, rufotestaceous in middle. Hind pregradular margin slightly curved; lateral ridges not contiguous with hind pregradular margin; plate lightly, punctate and setose; testaceous anteriorly, darker posteriorly; lateral setal cluster small, setae pale, short, not extending to hind pregradular margin; medioapical lobe weakly, shallowly emarginate; hairs between apicolateral processes and medioapical lobe absent; apicolateral processes not obliquely directed away from midline, outer margins straight, apices rounded.

APICAL STERNUM: Distal emargination narrower than width of apicolateral processes; processes rounded, glabrous, testaceous;
dorsum clothed with short, dense, pale, appressed setae; lateral setae extending most of length of shaft; lateral tubercles absent.

SEVENTH STERNUM: Distal margin truncate, not emarginate; apicolateral setal cluster dense, setae pale, rather short; surface testaceous, slightly darker subapically along midline.

DISCUSSION: The placement and relationship of *Eucerceris atrata* to other species is not completely resolved. *E. atrata* has some affinities with the *E. angulata* species group since, except for some minor differences, the genitalia is almost the same as those of the *angulata* group. However, the pygidium and distal sternum are quite different from the *angulata* group, suggesting that it does not properly fit there. In addition, *E. atrata* seems to be somewhat related to *E. velutina*. This relationship is reflected in the key, but when a character by character comparison is made, the result indicates a greater difference than between *E. atrata* and species of the *E. angulata* group.
Eucerceris baccharidis Scullen
(Figures 15, 22, 29)

Scullen, H. A. (1968:83)

GENITALIA: Pale testaceous. Gonobase with anterior margin emarginate dorsally; dorsal suture absent; venter exposed on anterior margin; sides converging anteriorly. Parameres with sides straight except at base and apex, base slightly arcuately curved mesad, sub-apex obtusely angulate on sides; apex acutely angulate; setae on venter sparse, densest adjacent to apex of digitus; inner subapical notch distinct. Aedeagus bulbous distally, laterally reflexed; subapical expansion indistinct. Digitus with apical teeth long, rounded; basal teeth shorter, obtuse; lateral margins subparallel on basal two-thirds, converging distally on apical one-third.

PYGIDIUM: Dark testaceous, piceous laterally. Hind pregradular margin irregularly truncate; lateral ridges not contiguous with hind pregradular margin; plate rufotestaceous, sparsely, shallowly punctate, clothed with short, erect bristle-like setae; lateral setae long, dense, not reaching hind pregradular margin; medioapical lobe broadly rounded, not extending beyond apex of apicolateral processes; hairs projecting between medioapical lobe and apicolateral processes; processes dark, notched on inner margins.

APICAL STERNUM: Distal emargination narrower than width of apicolateral processes; processes glabrous, almost transparent at
extreme apex; surface testaceous, clothed with short, appressed, dense setae subapically; lateral margins with long, subapically dense, testaceous setae; lateral tubercles absent.

SEVENTH STERNUM: Shallowly, weakly emarginate; apicolateral processes distinct; setal cluster extending transversely across distal margin.

DISCUSSION: The distinctly notched inner margins of the apicolateral pygideal processes are the most unusual features of the caudal abdominal sclerites in *E. baccharidis*. Only two other species, *E. tricolor* and *E. vittifrons* to which *baccharidis* is most closely related, have this feature. These species can be separated by the characters given in the key.
Eucerceris baja Scullen


GENITALIA: Testaceous. Gonobase with sides converging anteriorly; dorsal suture absent; dorsum weakly emarginate anteriorly; venter exposed, projecting anteriorly. Parameres with outer margins almost straight, indented at middle; ventral setae sparse, long sub-apically; apex acutely angulate, setae projecting distally, bristle-like; inner subapical notch distinct. Aedeagus elongated, not bulbous; subapical expansion absent. Digitus converging toward apex, sides straight, indented subapically then converging to a rounded apex.

PYGIDIUM: Brunneus. Hind pregradular margin truncate; lateral ridges contiguous with hind pregradular margin; plate rugose, clothed with long, dark setae; lateral setae reaching hind pregradular margin; medioapical lobe obtusely, angulately emarginate; hairs present between medioapical lobe and apicolateral processes; processes rounded distally, obliquely directed away from midline.

APICAL STERNUM: Emargination much wider than width of each apicolateral process; processes rounded, obliquely, distally directed away from midline; shaft converging distally, clothed with dense, rufose, semierect setae; lateral setae shorter.

SEVENTH STERNUM: Distal margin weakly bisinuate; surface apicolaterally clothed with small, dense, rufotestaceous setal clusters; midline glabrous.
DISCUSSION: *Eucerceris baja* closely resembles *E. pimarum* from which it can be separated by the bisinuate distal margin of the seventh sternum. In *E. pimarum* the distal portion of the seventh sternum is arcuately emarginate. Further discussion can be found under *E. pimarum*. 
Eucerceris barri Scullen

Scullen, H. A. (1968:84)

GENITALIA: Testaceous. Dorsum anteriorly emarginate; dorsal suture absent; sides anteriorly converging, angles curved; venter projecting anteriorly. Parameres weakly sinuate laterally, with numerous laterally projecting setae; ventral setae very dense; apex sharply angulate; inner subapical notch distinct. Aedeagus elongated apically; subapically expansion absent. Digitus with sides distally converging; apex clothed with short, pale, dense distally projecting setae.

PYGIDIUM: Lateral margins piceous, becoming testaceous toward midline. Hind pregradular margin irregular, weakly curved, almost truncate; lateral ridges contiguous with hind pregradular margin; plate sparsely clothed with long, erect setae; lateral setae long, dense, not extending to hind pregradular margin; medioapical lobe emarginate; hairs between medioapical lobe and apicolateral processes absent; apicolateral processes rounded distally, rather elongate, not obliquely directed away from midline.

APICAL STERNUM: Distal emargination deep, narrower than width of apicolateral processes; surface subapically clothed with short, appressed setae; lateral setae dense, longer than on dorsum; lateral tubercles absent.
SEVENTH STERNUM: Distal emargination shallow, arcuate; lateral processes weakly developed; apicolateral setal cluster small, setae long, dense; midline glabrous.

DISCUSSION: The structure and configuration of the genitalia and associated structures indicate that *Eucerceris barri* has a close affinity with *E. similis*. This confirms Scullen's (1968) supposition on the apparent affinities of *E. barri*. 
**Eucerceris canaliculata** (Say)
(Figures 1-3, 13)

Scullen, H. A. (1939:75-76; 1968:85)

**GENITALIA**: Testaceous. Gonobase with sides converging anteriorly; dorsal suture absent; dorsum moderately emarginate anteriorly; venter not projecting. Parameres with outer margins indented adjacent to digital apex; ventral setae moderately long, dense, projecting laterally; apex acutely angulate; inner subapical notch distinct. Aedeagus elongate distally, not bulbous; subapical expansion fused with distal portion of aedeagus. Digitus with sides sub-parallel; basal teeth obtuse, distal teeth acute.

**PYGIDIUM**: Testaceous medially, lateral margins darker. Hind pregradular margin straight; lateral ridges not contiguous with hind pregradular margin; plate impunctate, sparsely clothed with long, moderately dense setae; lateral setae thickest near base of apicolateral processes, not extending to hind pregradular margin; medio-apical lobe rounded, sometimes truncate; hairs present between medioapical lobe and apicolateral processes; processes rounded distally, blunt.

**APICAL STERNUM**: Distal emargination as wide as width of each apicolateral process; processes rounded distally, glabrous; clothed with long, dense setae dorsally and laterally; lateral setae longest; lateral tubercles absent.
SEVENTH STERNUM: Distal margin truncate; surface densely clothed with long apicolateral setae; anterior to apex setae short, medioapically glabrous.

DISCUSSION: *Eucer ceris canaliculata* is closely related to *E. sonorae*; males can be separated only on the basis of slight differences in color patterns. *Eucer ceris canaliculata atronitida* Scullen is inseparable from *E. sonorae* at this time even on the basis of color. The females of these species are very distinct, however, and separating them from each other is no problem. The male genitalia of these two species offer no differences which can be used in their separation but the setae laterad to the pygideal ridges and setae on the plate have slight differences which can be used in their separation.
Eucerceris elegans Cresson

Scullen, H. A. (1939:75-76; 1968:85)

GENITALIA: Testaceous. Gonobase with sides converging anteriorly; venter exposed, slightly projecting anteriorly; dorsal suture absent; dorsum emarginate anteriorly. Parameres straight except for base and subapex, slightly indented at middle; ventral setae dense subapically; apex acutely angulate, clothed with distally projecting bristle-like setae; inner subapical notch distinct. Aedeagus elongated distally, not bulbous; subapical expansion absent. Digitus with sides sinuate, converging distally, apically rounded.

PYGIDIUM: Dark testaceous. Hind pregradular margin shallowly curved; lateral ridges continuous with hind pregradular margin; plate rugose, shallowly punctate, sparsely clothed with pale, erect setae; lateral setae not extending to hind pregradular margin; medio-apical lobe emarginate; hairs present between medioapical lobe and apicolateral processes; processes rounded distally, obliquely, distally directed away from midline.

APICAL STERNUM: Emargination narrower than width of each apicolateral process; processes rounded distally, rufotestaceous, glabrous; surface subapically clothed, with long, pale setae; lateral setae shorter; lateral tubercles small.

SEVENTH STERNUM: Truncate to weakly emarginate distally; setae of apicolateral clusters dense, short, pale.
DISCUSSION: *Eucerceris elegans* closely resembles *E. mojavensis* from which it is difficult to separate. The type series of *E. mojavensis* was small and only a few paratypes were available for examination. Several characteristics of *E. mojavensis* and *E. elegans* are variable and overlapping, which suggests the possibility that these two species are synonymous. Even in non-genitalic characters these species are closely related. An examination of longer series of both species will be necessary to determine the status of *mojavensis*. 
Eucerceris flavocincta Cresson

Scullen, H. A. (1939:75-76; 1968:86)

GENITALIA: Pale brown. Sides of gonobase converging anteriorly; dorsal suture present; dorsum angulately emarginate anteriorly; venter not projecting. Parameres with outer margins indented at middle; ventral setae dense throughout, clustered sub-apically, measally directed, not extending to area adjacent to apex of digitus; apex rounded; inner subapical notch absent. Digitus with sides weakly curved, slightly indented apicolaterally.

PYGIDIUM: Dark testaceous, laterally and apically dark brown. Hind pregradular margin arcuate; lateral ridges not contiguous with hind pregradular margin; plate densely, shallowly punctate, each puncture with a single short seta; lateral setae long, cluster small, not extending to hind pregradular margin; medioapical lobe emarginate, nearly bisinuate, not extending beyond apices of apicolateral processes; hairs between medioapical lobe and apicolateral processes present; processes rounded distally, narrow, slightly obliquely directed away from midline.

APICAL STERNUM: Emargination slightly narrower than width of processes; processes rounded distally, glabrous; surface with long, dense, setae laterally longest at apex; sides slightly converging distally; lateral tubercles absent.

SEVENTH STERNUM: Deeply, arcuately emarginate distally;
surface clothed with densely, apicolaterally clustered setae; glabrous along midline.

DISCUSSION: *Eucerceris flavocincta* appears to be only distantly related to other species of *Eucerceris*. The venter of the abdomen lacks all of the rows of stiff bristles which are characteristic of all other species. The large robust size of the genitalia and pygidium, the rounded apices on the parameres and the presence of a dorsal suture on the gonobase suggests a possible close relationship with the *angulata* group. However, the emarginate medioapical lobe of the pygidium indicates that *E. flavocincta* belongs in another section of the genus which primarily contains much smaller species. A notable exception is *E. melanovittata* which keys out near *flavocincta* and which also is close to the *angulata* group. The lack of small secondary process on the apicolateral processes of the pygidium will at once separate *flavocincta* from *melanovittata*. From *angulata*, *montana* and *stangei*, *Eucerceris flavocincta* can be separated by its non-elongate gonobase which converges anteriorly and by the lack of the inner subapical notch on the parameres.
Eucerces fulvipes Cresson

Scullen, H. A. (1939:75-76; 1968:87)

GENITALIA: Dark testaceous. Dorsum of gonobase with a broadly arcuate anterior emargination; venter projecting anteriorly; sides slightly converging anteriorly; dorsal suture lacking. Parameres with lateral margins weakly indented in middle; ventral setae long, densest subapically; apex sharply angulate, clothed with short projecting bristle-like setae; inner subapical notch distinct. Aedeagus elongate, not bulbous distally; subapical expansion absent. Digitus with sides weakly converging distally.

PYGIDIUM: Dark testaceous. Hind pregradular margin weakly curved; lateral ridges not contiguous with hind pregradular margin; plate with long, rufous, erect setae; lateral setae not reaching hind pregradular margin; medioapical lobe truncate; hairs between medio-apical lobe and apicolateral processes present; processes narrow, blunt distally, obliquely diverging distally away from midline.

APICAL STERNUM: Distal emargination narrower than width of apicolateral processes; processes rounded apically; surface and sides subapically clothed with dense setae, lateral setae longest; subapical lateral tubercles absent.

SEVENTH STERNUM: Distal emargination shallow, obtusely angulate; setae of apicolateral clusters long, dense; midline glabrous distally.
DISCUSSION: *Eucerceris fulvipes* is closely related to both *E. canaliculata* and *E. sonorae*. Genital characteristics used to separate these species from each other are subtle but uniform within each species. *E. fulvipes* is probably more distantly related to *sonorae* and *canaliculata* than the latter are to each other. *Fulvipes* is widespread in the Rocky Mountains and adjacent areas whereas *sonorae* and *canaliculata* are found in the deserts of Northern Mexico and Southwestern United States. *Fulvipes* is more easily separated from other species by using non-genitalic characteristics than genitalic ones.
**Eucerceris insignis** Provancher
(Figures 6, 18)

Scullen, H. A. (1939:75-76; 1968:87)

**GENITALIA:** Testaceous. Gonobase with sides anteriorly converging; dorsal suture absent; dorsum anteriorly emarginate; venter projecting anteriorly. Parameres with lateral margins weakly sinuate, with a few laterally projecting setae; ventral setae sparse, relatively short, bristle-like distally; apex acutely angulate; inner subapical notch distinct. Aedeagus bulbous distally, not laterally reflexed; subapical expansion present, weakly developed; digitus strongly converging distally.

**PYGIDIUM:** Rufotestaceous, piceous laterally. Hind pregradular margin slightly curved; lateral ridges contiguous with hind pregradular margin; plate sparsely clothed with long pale setae; lateral setae very dense at base of apicolateral processes, not reaching hind pregradular margin; medioapical lobe weakly emarginate medially, almost truncate; hairs between medioapical lobe and apicolateral processes absent; processes distally truncate, slightly expanded laterally.

**APICAL STERNUM:** Distal emargination as wide as apicolateral processes; processes and subapical margin clothed with short, dense setae; shaft subparallel.
SEVENTH STERNUM: Apex obtusely emarginate; surface testaceous apically, pale brown in middle; setal cluster dense, long; midline glabrous.

DISCUSSION: *E. insignis* appears to be most closely related to *E. barri* than to any other known species. *E. insignis* can be distinguished from allied species by the distally converging digitus, by the almost truncate medioapical lobe, and by the lateral ridges being contiguous with the hind pregradular margin.
**Eucerceris lacunosa Scullen**

(Figures 11, 23)

Scullen, H. A. (1939:75-76; 1968:88)

**GENITALIA:** Testaceous. Gonobase with dorsum broadly emarginate anteriorly; dorsal suture lacking; sides converging anteriorly; venter exposed, projecting anteriorly. Parameres with outer margins slightly expanded distad to middle; setae uniformly, densely clothed on distal two-thirds; apex rounded, not angulate; inner subapical notch absent. Aedeagus long, extending to apex of parameres; apex bulbous, club-shaped, directed ventrally; subapical expansion lacking. Digitus mucronate, lacking mesally directed, subapical teeth; sparsely clothed with short erect setae.

**PYGIDIUM:** Rufotestaceous. Hind pregradular margin arcuately curved; plate very pale, with long, pale setae on basal two-thirds; lateral setae long, pale, dense, extending to hind pregradular margin; lateral ridges not contiguous with hind pregradular margin; medio-apical lobe rounded, barely extending beyond apices of apicolateral processes; hairs between medioapical lobe and apicolateral processes absent; processes poorly developed, indistinct, distally rounded, not directed away from midline.

**APICAL STERNUM:** Rounded distally, emargination lacking; surface glabrous apically, medially; lateral margins setose; lateral tubercles absent.
SEVENTH STERNUM: Distal emargination deep, acutely angulate; apicolateral processes acutely angulate; surface apicolaterally clothed with extremely long, dense rufous setae.

DISCUSSION: The caudal tergites and sternites, including the genitalia, of males of *Eucerceris lacunosa* are unlike those found in other males of *Eucerceris*. Many structures are so different in fact that this species should probably be placed in a new subgenus. The digitus is the most obviously different structure as compared to other species of the genus. In *lacunosa* it is narrow and tapers to a sharp point at the apex. Mesally directed subapical teeth common to other members of the genus are lacking on the digitus of this species. The aedeagus is also peculiar in its length and in the position and shape of the apical bulb. In other species having a bulbous adeagal apex, the bulb is directed distad or occasionally, laterad; in this species the bulb is slightly flattened laterally and is directed ventrally. The aedeagus is longer in proportion to the length of the parameres than in all other species, and extends to the apex of the parameres.

The relationship of *E. lacunosa* to other species is still unclear. It is evident however, that *lacunosa* has little or no relationship to other species known at this time.
Eucerceris melanosa Scullen


GENITALIA: Dark testaceous. Gonobase with sides converging anteriorly; dorsum with longitudinal suture; dorsum deeply emarginate anteriorly; venter anteriorly projecting. Parameres with outer margins deeply, indented at middle; setae very long, dense on distal half; apex rounded; inner subapical notch distinct. Aedeagus elongate at apex; subapical expansion weak, poorly developed. Digitus sub-parallel on basal half, converging distad.

PYGIDIUM: Piceous laterally, testaceous at middle. Hind pregradular margin arcuately curved; lateral ridges piceous, not extending to hind pregradular margin; plate pale testaceous, sparsely clothed with long, pale setae; medioapical lobe extending beyond apices of apicolateral processes, elongate, rounded distally; hairs between medioapical lobe and apicolateral processes present; apicolateral processes rounded, pale distally, darker proximally.

APICAL STERNUM: Emargination narrower than width of apicolateral processes; processes slightly expanded laterally; surface dark subapically, apex testaceous; dorsum clothed with short appressed setae; lateral setae dense, longer; lateral tubercles not present.

SEVENTH STERNUM: Distal emargination very shallow, almost truncate; surface dark apically; punctate apicolaterally, clothed with
DISCUSSION: This species appears to be most closely related to *E. mellea* Scullen which it closely resembles genitalically. Scullen (1968) indicates that *E. melanosa* is related to *E. melanovittata*. Although the genitalia of these two species are quite different and indicate completely different affinities, the pygidia are similar in at least one respect. On the venter of the pygidium there is an oblique, distally converging fold in the integument, the function of which is unknown. This plus external morphological characteristics given by Scullen (1968) may indicate a relationship with *E. melanovittata* which is much closer than that indicated by the genitalia alone.
Eucerceris melanovittata Scullen
(Figures 4, 7, 9)


GENITALIA: Uniformly dark rufotestaceous. Gonobase with dorsal suture present; sides anteriorly converging; dorsum arcurately emarginate anteriorly; venter slightly projecting. Parameres straight on outer margins, with a few laterally projecting setae subapically; apex sharply angulate; notch on inner margin absent. Aedeagus bulbous distally, laterally reflexed; subapical expansion well developed. Digitus robust, subparallel basally, slightly indented distally; dorsum sparsely clothed with short, appressed setae.

PYGIDIUM: Rufotestaceous, piceous laterally. Hind pregradular margin straight; lateral ridges not contiguous with hind pregradular margin; plate dark rufotestaceous, moderately deeply punctate, with a single seta arising from each puncture; lateral setae pale, dense apically, not extending to hind pregradular margin; medioapical lobe emarginate, not extending beyond apicolateral process; hairs between apicolateral process and medioapical lobe present; apicolateral processes strongly diverging, with a small ventral secondary process.

APICAL STERNUM: Distal emargination narrower than width of apicolateral processes; processes rounded distally; surface testaceous, glabrous. Basal half of shaft densely clothed with pale setae; dorsolateral setae shorter, more sparse anteriorly; lateral tubercles
small, rufotestaceous.

SEVENTH STERNUM: Distal emargination moderately deep, arcuately rounded; processes prominent. Surface densely clothed with long setae apicolaterally; glabrous along midline, dark in middle.

DISCUSSION: Eucerceris melanovittata is more closely related to the E. angulata species complex than to other species. The robust configuration of the genitalia, the presence of a very distinct gonobasal structure, and the shape and structure of the pygidium suggest a close relationship with the angulata group.

However, if the medioapical lobe were truncate instead of emarginate, it would key to E. superba which also has some affinities with the angulata group.
Eucerceris mellea Scullen


GENITALIA: Testaceous. Sides converging anteriorly; dorsal suture absent; dorsum emarginate anteriorly; venter exposed, projecting anteriorly. Parameres with outer margins straight; ventral setae dense, pale, directed ventrally; apex acutely angulate; inner subapical notch distinct. Aedeagus elongate, note bulbous distally; subapical expansion present. Digitus converging distally.

PYGIDIUM: Testaceous. Hind pregradular margin shallowly curved; lateral ridges not contiguous with hind pregradular margin; plate smooth except for sparse, rufose, erect setae; lateral setae densest adjacent to apicolateral processes, not contiguous with hind pregradular margin; medioapical lobe elongate, rounded, extending well beyond apicolateral processes; hairs present between medioapical lobe and apicolateral processes; processes rounded distally.

APICAL STERNUM: Emargination narrower than width of apicolateral processes; processes pale, rounded distally; surface subapically clothed with long, semierect, rufous setae; lateral setae longer, pale; shaft converging distally; lateral subapical tubercles absent.

SEVENTH STERNUM: Angulately emarginate distally; densely, apicolaterally clothed with short, rufous, erect setae.
DISCUSSION: The genitalia and associated structures of *E. mellea* closely resemble those of *E. melanosa* with which *mellea* is apparently most closely related. External, non-genitalic characters differ considerably between these species. The almost totally black color and the deeply ridged propodeal enclosure will separate *E. melanosa* males from *E. mellea* which has a yellowish markings and less distinct propodeal ridges. Further discussion can be found under *E. melanosa*. 
Eucerceris mojavensis Scullen

Scullen, H. A. (1968:90)

GENITALIA: Testaceous. Dorsum of gonobase weakly emarginate anteriorly; dorsal suture absent; sides anteriorly converging; venter not projecting anteriorly. Parameres with lateral margins weakly indented at middle; setae long, dense, densest subapically; apex sharply angulate; setae bristle-like apically; inner subapical notch distinct. Aedeagus elongate, expanded laterally, not bulbous distally; subapical expansion absent. Digitus slightly diverging distally; apical teeth short, acute; basal teeth obtuse.

PYGIDIUM: Pale testaceous. Hind pregradular margin weakly curved; lateral ridges not contiguous with hind pregradular margin; plate rufotestaceous, sparsely clothed with long, pale setae; lateral setae not reaching hind pregradular margin; medioapical lobe emarginate; hairs between medioapical lobe and apicolateral processes present; apicolateral processes elongate, rounded, dorsoventrally flattened.

APICAL STERNUM: Emargination narrower than width of each process; processes distally truncate, rufous, glabrous on surface; dorsal surface distally clothed with long, dense setae; lateral setae more sparse, shorter than surface setae; lateral tubercles small.

SEVENTH STERNUM: Emargination broadly, shallowly arcuate; setae of apicolateral clusters long, sparse, pale.
DISCUSSION: **Eucerceris mojavensis** is very closely related to **E. similis** from which it can be separated by the deep, more distinctly emarginate seventh sternum in the latter species. Scullen (1968) states that **mojavensis** may represent the male of **E. ferruginosa** which is not recognized at this time. Both species were taken in series near Mojave, California, but the opposite sex of neither species has ever been recognized. If this presumed association is proven correct, it will be the most highly developed case of sexual dimorphism known for the entire genus. Female **E. ferruginosa** are bright rusty-red colored wasps which have no trace of other colors. On the other hand, the males of **E. mojavensis** are 'typical' **Eucerceris** males. They have only a small area with reddish maculations and otherwise are much like many other species.
Eucerceris montana Cresson
(Figure 16)

Scullen, H. A. (1939:75-76; 1968:90)

**GENITALIA:** Rufotestaceous, dark brown basally on parameres. Gonobase elongate; sides weakly converging anteriorly; dorsal suture present; dorsum emarginate anteriorly; venter slightly projecting anteriorly. Parameres with apical third weakly expanded; venter with dense, ventromedially directed subapical setae; apex broadly rounded; inner subapical notch distinct. Aedeagus bulbous distally, apex ventrally directed; subapical expansion lacking. Digitus broad, rather darkly pigmented, widest at subapex, narrowest just behind base, distal teeth small, acute at apex; basal teeth broad, obtuse.

**PYGIDIUM:** Rufotestaceous, piceous laterally. Hind pregradular margin arcuately curved; lateral ridges not contiguous with hind pregradular margin; plate rugose, heavily, moderately punctate, with short pale setae; lateral setae extending to hind pregradular margin; medioapical lobe rounded; hairs absent between medioapical lobe and apicolateral process; processes short, blunt, not well developed.

**APICAL STERNUM:** Distal emargination as wide as apicolateral processes; processes glabrous, pale testaceous; entire structure elongated, squamae somewhat reduced; dorsum with short, pale, appressed setae; lateral setae dense, long, very pale.
SEVENTH STERNUM: Distal emargination obtusely, angulate; surface flavous distally, dark brown subapically, pale brown anteriorly; clothed with long setae apically, becoming shorter toward base; glabrous along midline.

DISCUSSION: *Eucerceris montana* appears to be more closely related to *E. angulata* and *E. stangei* than to any other known species. All have unusually elongate gonobases, are heavily sclerotized and pigmented, have robust, well developed digiti, and have rounded apices on the parameres. These features, together with the apparent close relationship as indicated by non-genitalic external morphology, suggest that this is a complex of species. This relationship is also suggested by the characteristics given in the key to species.
Eucerceris morula Scullen

(Figure 5)

Scullen, H. A. (1968:91)

GENITALIA: Testaceous, margins of digitus darkest. Gono-base with sides converging anteriorly; dorsal suture absent; dorsum deeply, arcuately emarginate; venter exposed, slightly projecting anteriorly. Parameres with outer margins nearly straight basally; distal half slightly laterally expanded; setae on venter very long, dense subapically; apex straight on outer margin, curved on inner margin, apex nearly 90°; notch on inner subapical margin distinct. Aedeagus elongated, rounded distally; subapical expansion absent. Digitus with sides subparallel, apicolateral margin indented.

PYGIDIUM: Dark testaceous medially, piceous laterally. Hind pregradular margin nearly truncate; lateral ridges contiguous with hind pregradular margin; plate dark testaceous, rufotestaceous distally; sparsely clothed with long setae; lateral setae dense distally, not extending to hind pregradular margin; medioapical lobe emarginate, not extending beyond apicolateral process; hairs between medioapical lobe and apicolateral process present; processes weakly, obliquely diverging distally.

APICAL STERNUM: Emargination narrower than width of apicolateral processes; processes rounded distally, glabrous, testaceous; shaft on distal half clothed with short, distinct setae;
lateral setae extending almost total length of shaft; subapical lateral tubercles absent.

SEVENTH STERNUM: Distal emargination bisinuate; apicolateral process small, well developed. Apicolateral clusters small, with long dense setae; midline wide, glabrous.

DISCUSSION: Scullen (1968) states that the males of Eucerceris morula are closely related to both E. baja and E. pacifica and that the females are related to E. vittatifrons. My studies of the male genitalia and associated structures indicate that E. morula is close to E. baja but not to vittatifrons. The genitalia of E. morula is close to E. insignis but can be separated by the subparallel sides of the digitus of the former species. In E. insignis, the sides of the digitus converge very noticeably toward the apex. The apex of the seventh sternum is bisinuate in both E. morula and E. baja and the overall configuration of the pygidium of morula is similar to that of baja.
Eucerceris pacifica Scullen


GENITALIA: Testaceous. Dorsum anteriorly arcuately emarginate; dorsal suture absent; sides anteriorly converging; venter slightly projecting anteriorly. Parameres with weakly sinuate outer margins; ventral setae moderately sparse, densest subapically; apex sharply angulate, with tiny bristle-like projecting setae; inner sub-apical notch distinct. Aedeagus elongated, not bulbous, rounded distally. Digitus with side margins converging distally, straight; subapex slightly engulate, converging distally.

PYGIDIUM: Testaceous. Hind pregradular margin truncate; lateral ridges contiguous with hind pregradular margin; plate nearly glabrous, surface irregular, weakly, shallowly punctate; lateral setae not reaching hind pregradular margin; medioapical lobe emarginate; hairs projecting between medioapical lobe and apicolateral processes; processes short, blunt, distally truncate.

APICAL STERNUM: Distal emargination narrower than width of apicolateral processes; processes short, blunt, more or less truncate; surface densely clothed with short rufose, semiappressed setae; lateral setae more sparse; lateral tubercles absent.

SEVENTH STERNUM: With a distal, obtusely, angulate emargination; setae in apicolateral clusters pale, moderately dense, long.
DISCUSSION: *Eucerceris pacifica* appears to be most closely related to *E. elegans* on the basis of genitalic and associated structures. Non-genitalic structures suggest a closer affinity with *E. baja*. Both *E. pacifica* and *E. baja* occur on the peninsula of Baja California, whereas *E. elegans* occurs in the Mojave and Colorado deserts. Physical barriers isolating these two species are well developed. The Vizcaino Desert seems to be the major topographic feature separating *pacifica* to the south from *baja* to the north.
Eucerceris pimarum Rohwer


GENITALIA: Pale testaceous. Gonobase with sides converging anteriorly; dorsal suture absent; dorsum emarginate anteriorly; venter projecting anteriorly. Parameres straight, irregular on outer margins, curved at base and apex; ventral setae dense, very long subapically, bristle-like at apex; apex rounded; inner subapical notch present. Aedeagus elongate, not bulbous distally; subapical bulbous expansion absent. Digitus with sides almost subparallel, weakly converging distally.

PYGIDIUM: Rufotestaceous. Hind pregradular margin irregular, straight; lateral ridges contiguous with hind pregradular margin; plate rugosely punctate, clothed with long, rufous, erect setae; lateral setae extending to hind pregradular margin; medioapical lobe angulately emarginate; hairs present between medioapical lobe and apicolateral processes; processes rufous, obliquely directed away from midline.

APICAL STERNUM: Emargination wider than width of apicolateral processes; processes rufous, clothed with setae; surface densely clothed with long, semierect, rufous setae; lateral margins with longer setae; lateral tubercles absent.
SEVENTH STERNUM: Distal emargination deep, arcuate; apicolateral setal clusters long, dense; midline glabrous.

DISCUSSION: *Eucerceris pimarum* closely resembles *E. baja* in many aspects of the pygideal and genital morphology; it differs from *E. baja* by having an emarginate seventh sternum, by the more rugose appearance of the pygideal plate and by the reddish color of the pygidium. In non-genitalic features, these species appear to be distantly related. *E. baja* has two whitish colored, oval maculations on the sides on the propodeum which are lacking in *E. pimarum*. 
Eucerceris rubripes Cresson

Scullen, H. A. (1939:75-76; 1968:92)

GENITALIA: Pale testaceous. Gonobase with dorsum emarginate anteriorly; venter exposed anteriorly; sides converging toward apex, dorsal suture absent. Parameres with outer margins straight; apex obtusely angulate; venter with dense subapical setae, densest on inner margin; inner subapical notch distinct. Aedeagus slightly bulbous distally, laterally reflexed; subapical expansion moderately well developed. Digitus with sides irregular, nearly straight, slightly converging distally.

PYGIDIUM: Testaceous medially, rufotestaceous laterally. Hind pregradular margin truncate; lateral ridges contiguous with hind pregradular margin; plate sparsely, shallowly punctate, with long, pale testaceous setae; lateral setae dense, extending to hind pregradular margin; medioapical lobe truncate, shorter than length of apicolateral processes; hairs projecting between medioapical lobe and apicolateral processes; processes extremely narrow, elongate, obliquely diverging distally.

APICAL STERNUM: Testaceous. Emargination narrower than width of apicolateral processes; shaft narrow, sides nearly subparallel; setae dense, appressed, testaceous on subapex; lateral setae longer, paler; lateral tubercles absent.
SEVENTH STERNUM: Deeply, arcuately emarginate, angles prominent; surface pale testaceous, setae long, densely clustered apicolaterally.

DISCUSSION: The genitalia and associated structures do not possess any outstanding or unique features. The pygidium, which has a rufose pigmentation throughout, is unusual although a few other species are similar in this respect. *Eucerceris rubripes* is probably most closely related to *E. arenaria* since they have more characteristics in common than *rubripes* has with other species.
Eucerceris ruficeps Scullen

Scullen, H. A. (1968:92)

GENITALIA: Dark testaceous anteriorly, pale posteriorly.
Gonobase with dorsal suture lacking; sides converging anteriorly;
dorsum weakly emarginate anteriorly; venter not projecting anteriorly.
Parameres with outer margins slightly irregular, almost straight;
dense setae projecting laterally near subapex; ventral setae extremely
long, dense; apex sharply angulate; notch on inner subapical margin
distinct. Aedeagus elongate distally, not bulbous; subapical expansion
absent. Digitus subparallel, apex setose distally.

PYGIDIUM: Dark brown. Hind pregradular margin weakly
curved; lateral ridges not contiguous with hind pregradular margin;
plate rugose, densely, shallowly punctate; clothed with long, erect,
testaceous setae; lateral setae contiguous with hind pregradular
margin; medioapical lobe emarginate; hairs between medioapical lobe
and apicolateral processes present; processes with outer margins
twisted dorsally, dark.

APICAL STERNUM: Distal emargination sharply angulate
medially, narrower than width of apicolateral processes; processes
pale testaceous, rounded distally, glabrous; surface pale on anterior
half, rufotestaceous on distal half; clothed with long dense setae; side
margins distinctly converging distad; lateral tubercles absent.
SEVENTH STERNUM: Distal emargination irregularly truncate; apicolateral setal clusters long, dense.

DISCUSSION: The venter of the parameres of this species has unusually long, dense setae which project not only ventrally but laterally and well beyond the apices. This feature alone will separate E. ruficeps from all other known species. The relationship of this species to others is not yet understood. Scullen (1968) indicates that ruficeps may be closely related to elegans but when considered on the basis of genitalic characters, ruficeps seems to be more closely related to E. similis. I doubt that either species is close to E. ruficeps.
Eucerceris similis Cresson

Scullen, H. A. (1939:75-76; 1968:92)

GENITALIA: Testaceous. Gonobase with dorsal suture absent; sides subparallel, rounded anteriorly; dorsum anteriorly emarginate; venter projecting anteriorly. Parameres with outer margins slightly indented at middle; ventral setae dense subapically, directed ventrad; apex acutely angulate; inner subapical notch distinct. Aedeagus apex bulbous, not elongate; subapical expansion absent; digitus with sides weakly converging distally; distal and proximal teeth about same size.

PYGIGIUM: Dark brown. Hind pregradular margin weakly curved; lateral ridges not contiguous with hind pregradular margin; plate deeply, sparsely punctate, dark testaceous; lateral setae not reaching hind pregradular margin; medioapical lobe emarginate medially; hairs present between medioapical lobe and apicolateral processes; processes obliquely directed distad from midline, upper margin twisted, directed dorsally.

APICAL STERNUM: Emargination wider than width of apicolateral process; processes rufotestaceous, glabrous; surface with shaft slightly converging distally; apically clothed with short, appressed setae; lateral tubercles absent.

SEVENTH STERNUM: Shallowly emarginate; processes poorly developed; apicolateral setal clusters small, with pale, erect setae.
DISCUSSION: *Eucerceris similis* is apparently closely related to *E. barri*. This relationship is reflected not only in the similarity of the caudal sclerites and genitalia but in the external morphology as indicated by Scullen (1968). These species can be separated from each other by the lack of setae between the medioapical lobe and the apicolateral processes in *E. barri*. These setae are present in *E. similis*. 
Eucerceris sinuata Scullen


GENITALIA: Testaceous. Gonobase with sides converging anteriorly; dorsal suture absent; dorsum emarginate anteriorly; venter projecting, rounded anteriorly. Parameres with side margins sinuate, weakly indented anterior to middle; ventral setae sparse, short; apex acutely angulate; inner subapical notch distinct. Apex of aedeagus elongate, not bulbous; subapical expansion absent. Digitus robust, slightly diverging distally.

PYGIDIUM: Rufotestaceous laterally, testaceous in middle.

Hind pregradular margin arcuately rounded; lateral ridges not contiguous with hind pregradular margin; plate pale testaceous, darker apically, clothed with long, sparsely placed setae; lateral setae extending to hind pregradular margin, much shorter anteriorly; medioapical lobe rounded, not projecting beyond apices of apicolateral processes; processes with outer margins straight, not obliquely directed away from midline; hairs present between medioapical lobe and apicolateral processes.

APICAL STERNUM: Distal emargination slightly narrower than width of distal processes; processes rounded apically, glabrous; surface clothed with long, dense setae; lateral setae longer, more conspicuous; lateral tubercles absent.
SEVENTH STERNUM: Distal emargination shallow, obtusely angulate; surface clothed with long, dense, apicolaterally clustered setae; glabrous on midline.

DISCUSSION: Scullen (1964) states that the male of E. sinuata closely resembles the males of E. canaliculata and E. rubripes. My findings indicate that E. sinuata is only distantly related to E. rubripes. The parameres of rubripes are broad distally and straight on the outer margins whereas in E. sinuata they are narrow distally and sinuate on the outer margins. The genitalia of E. sinuata is similar to that of E. zimapanensis but can be separated from zimapanensis by the lack of a dorsal suture on the gonobase.
Scullen, H. A. (1968:93)

**GENITALIA:** Testaceous. Gonobase with sides weakly converging toward apex; dorsal suture absent; dorsum shallowly angulately emarginate anteriorly; venter projecting anteriorly. Parameres with lateral margins straight, subapically angled toward midline; apex sharply angulate; setae bristle-like, short, projecting distally; inner subapical notch distinct. Aedeagus elongate, not expanded; apex rounded; subapical expansion lacking. Digitus with sides subparallel; dark testaceous apicolaterally.

**PYGIDIUM:** Rufotestaceous laterally, testaceous medially. Hind pregradular margin curved; lateral ridges contiguous with hind pregradular margin; plate uniformly clothed with long, pale setae; surface very pale on anterior half, dark testaceous on distal half; lateral setae densely clustered anterior to base of apicolateral processes, not extending to apicolateral processes; medioapical lobe rounded distally, very pale, almost transparent; hairs between medio-apical lobe and apicolateral processes present; processes rounded distally, pale; rufotestaceous laterobasally.

**APICAL STERNUM:** Emargination as wide as width of distal processes; processes rounded apically; surface clothed with pale moderately dense setae; lateral setae longer; lateral tubercles absent.
SEVENTH STERNUM: Truncate distally; processes well developed; surface pale testaceous; apicolateral setal clusters long, dense, pale, midline glabrous.

DISCUSSION: See discussion under *E. canaliculata*. 
Eucerceris stangei Scullen
(Figures 27, 31, 33)

Scullen, H. A. (1968:94)

**GENITALIA:** Rufotestaceous, piceous on base of parameres.  
Gonobase elongate, dorsal suture present; sides subparallel; dorsum 
emarginate anteriorly; venter exposed anteriorly. Parameres curved 
on basal two-thirds; venter with long, dense, subapical, medio- 
ventrally directed setae; apex rounded; inner subapical notch distinct. 
Aedeagus bulbous distally; subapical expansion small, distinct in 
dorsal view. Digitus with lateral margins diverging distally, then 
sharply angulate mesally; distal teeth acute, basal teeth obtuse.

**PYGIDIIUM:** Pale testaceous, lateral pregradular margin piceous.  
Hind pregradular margin shallowly, arcuately curved; lateral ridges 
not contiguous with hind pregradular margin; plate pale testaceous, 
densely clothed with long, transparent setae; lateral setae long, dense, 
extending to hind pregradular margin; medioapical lobe broadly 
rounded; hairs projecting between medioapical lobe and apicolateral 
processes; processes short, blunt, straight, not obliquely directed 
away from midline.

**APICAL STERNUM:** Distal emargination as wide as apicolateral 
processes; processes flavous, glabrous, rounded distally; entire 
structure elongated, squamae somewhat reduced; surface clothed with 
short, pale, inconspicuous setae; lateral setae long, pale; lateral
tubercles absent.

SEVENTH STERNUM: Distal emargination obtusely angulate; apicolateral setal clusters dense, short anteriorly, longer distally; processes poorly developed, apicolateral angles rounded.

DISCUSSION: See discussion under E. montana.
Eucerceris superba Cresson

Scullen, H. A. (1939:75-76; 1968:94)

GENITALIA: Testaceous. Gonobase with sides converging anteriorly, anteriobasal angles curved; anteriodorsally emarginate, anterioventral margin projecting; dorsal suture absent. Parameres narrowest at middle, expanded to subapex, subapical margin obliquely directed mesad; apex acutely angulate; venter densely clothed with long, dark testaceous setae; inner subapical notch distinct. Aedeagus bulbous distally; subapical expansion absent. Digitus with sides subparallel; apical teeth robust, acute; basal teeth obtuse.

PYGIDIUM: Rufous to dark testaceous. Pregradulus with hind margin truncate; lateral ridges contiguous with hind pregradular margin; plate coarsely punctate, with short dark setae; lateral setae almost absent, with a tiny cluster adjacent to base of apicolateral processes, not reaching hind pregradular margin; medioapical lobe broadly rounded; hairs present between medioapical lobe and apicolateral processes; processes rather blunt, rounded.

APICAL STERNUM: Emargination narrower than width of apicolateral processes; processes more or less truncate, not distinctly rounded; surface distally clothed with long, rufous setae; lateral setae moderately dense, short; lateral tubercles absent.

SEVENTH STERNUM: Apex broadly, shallowly emarginate; surface clothed with long, pale setae clustered apicolaterally; lateral
setae long, obliquely directed distad; spiculum with apex broad, indented on sides.

DISCUSSION: The large size of the genitalia, the unique spiculum, reduced lateral setae and the mesally directed apices of the apicolateral processes of the pygidium will separate this species from all other known males of *Eucerceris*. Although not unique to this species, the unusually long and dense setae on the venter of the paratermes are uncommon.
**Eucerceris tricolor** Cockerell
(Figures 14, 30)

Scullen, H. A. (1939:75-76; 1968:95)

**GENITALIA:** Testaceous. Gonobase with dorsum emarginate anteriorly; sides converging anteriorly; venter exposed, weakly emarginate; dorsal suture absent. Parameres with outer margins broadly, shallowly arcuate; subapical margin obliquely directed mesad; apex acutely angulate; venter clothed with rather sparse subapical setae; shorter, more sparse, bristle-like distally; inner subapical notch distinct.

**PYGIDIUM:** Rufotestaceous, lateral margins piceous. Pregradulus with hind margin arcuately curved; lateral ridges contiguous with hind pregradular margin; plate sparsely clothed with short, rufous setae; lateral setae long, pale testaceous, not reaching hind pregradular margin; medioapical lobe rounded, transparent distally; hairs present between medioapical lobe and apicolateral processes; processes strongly, obliquely directed away from midline; inner apical margin notched.

**APICAL STERNUM:** Width of emargination equal to width of apicolateral processes; apices of processes rounded, surface dark brown; shaft pale brown, base dark testaceous; surface clothed with short appressed setae; lateral margins with longer, pale setae; lateral tubercles absent.
SEVENTH STERNUM: Moderately emarginate distally; processes well developed; setae densely clustered apicolaterally, long, rufo-testaceous on apical half, pale testaceous on basal half.

DISCUSSION: The most outstanding feature of the genitalia of this species are the notched inner margins of the apicolateral processes of the pygidium. The unusual shape of the processes is found in only two other known species, *E. baccharidis* and *E. vittatifrons*. These species can be separated from each other by the characteristics given in the key, by the darker pigmentation of the genitalia and by the more well developed subapical expansion on the aedeagus of *E. tricolor*. 
Scullen, H. A. (1948:161; 1968:95)

**Eucerceris velutina Scullen**

(Figure 52)

**GENITALIA:** Testaceous. Gonobase with dorsum shallowly emarginate; dorsal suture present, weakly developed; sides weakly emarginate, not converging anteriorly; venter anteriorly exposed, angulately emarginate medially. Parameres with outer margins straight, with a few lateral setae projecting distally; ventral setae long, sparse; apex rounded, with tiny distally projecting, bristle-like setae. Aedeagus bulbous distally, bulb directed ventrad; subapical expansion absent. Digitus with sides straight; subapex slightly converging distally; apex rounded; digital teeth reduced, basal teeth broad, obtuse; apical teeth acutely angulate, curved.

**PYGIDIUM:** Dark brown anteriorly, rufotestaceous distally, testaceous in middle. Hind pregradular margin bisinuate; lateral ridges not contiguous with hind pregradular margin; plate sparsely clothed with long pale, erect setae; lateral setae coarse, long, moderately dense, not extending to hind pregradular margin, anterior setae very short; medioapical lobe and apicolateral processes absent; apicolateral processes greatly reduced, apices rounded.

**APICAL STERNUM:** Distal emargination slightly narrower than width of processes; processes rufotestaceous, glabrous, distally rounded; surface densely clothed with long setae apically; subapical
dorsal setae short; lateral setae long, dense, rufotestaceous; lateral subapical tubercles absent.

SEVENTH STERNUM: Distal emargination obtusely angulate; surface with distal half pale testaceous, basal half pale brown, sides rufotestaceous; apicolateral setal cluster dense, long; midline glabrous.

DISCUSSION: The rounded apices of the parameres, the broad heavily sclerotized digitus and the elongate gonobase suggest certain affinities with the *E. angulata* complex. There are however, both external and genitalic differences which seem to indicate a more distant relationship with this group. Further discussion on this species and its apparent relationships to other species can be found in the discussion under *E. atrata.*
Eucerceris vittatifrons Cresson

Scullen, H. A. (1939:75-76; 1968:96)

GENITALIA: Pale testaceous. Gonobase with sides converging anteriorly; dorsum not emarginate anteriorly; venter projecting; dorsal suture absent. Parameres with outer margins weakly indented at middle, expanded slightly behind; ventral setae sparse, short; not projecting laterally; apex sharply angulate; inner subapical notch distinct. Aedeagus elongate, rounded distally; subapical expansion absent. Digitus with sides subparallel.

PYGIDIUM: Testaceous. Pregradulus with sides subparallel, hind margin straight; lateral ridges contiguous with hind pregradular margin; plate testaceous, shallowly punctate anteriorly, sparsely clothed with short erect setae; lateral setae dense near base of apicolateral processes, not extending to hind pregradular margin; medioapical lobe rounded, not extending beyond apices of apicolateral processes; hairs present between medioapical lobe and apicolateral processes; processes obliquely directed away from midline.

APICAL STERNUM: Emargination narrower than width of each apicolateral process; processes rounded distally; surface densely clothed with short, pale setae; lateral margins with longer, more sparsely placed setae; lateral tubercles absent.
SEVENTH STERNUM: Distal emargination truncate, processes absent; surface distally clothed with short, very pale, moderately dense setae.

DISCUSSION: This species closely resembles *E. tricolor* and *E. baccharidis* in size and in many characteristics of the genitalia. The inner apical margins of the distal pygideal processes are notched. Although this characteristic is not found in many other species, a slight reduction in the thickness of the integument is present in several. *Eucerceris vittatifrons* appears to be more distantly related to *E. tricolor* and *E. baccharidis* than they are to each other.
**Eucerceris zimapanensis** Scullen

Scullen, H. A. (1968:96)

**GENITALIA:** Testaceous. Gonobase with dorsal longitudinal suture; sides converging anteriorly; dorsum emarginate anteriorly; venter exposed anteriorly. Parameres relatively straight on lateral margins, curved mesally at base and apex; setae long, densest sub-apically; apex rounded; setae extending beyond apex; inner subapical notch distinct. Aedeagus elongate, not bulbous, weakly reflexed laterad; subapical expansion lacking. Sides of digitus subparallel.

**PYGIDIUM:** Rufotestaceous. Hind pregradular margin truncate; lateral ridges contiguous with hind pregradular margin; plate deeply, densely punctate, clothed with long, dense rufous setae; lateral setae dense subapically, not extending to hind pregradular margin; medio-apical lobe truncate; hairs between medioapical lobe and apicolateral process present; processes long, thin, rounded distally.

**APICAL STERNUM:** Emargination as wide or slightly wider than width of each process; processes rounded apically; weakly, obliquely reflexed; surface clothed with pale, semierect setae; lateral setae longer, more sparse; lateral tubercles absent.

**SEVENTH STERNUM:** Distal emargination truncate; surface clothed with long apicolaterally clustered setae.
DISCUSSION: Scullen (1968) states that *Eucerceris zimapanensis* "superficially looks very much like the male of *E. mellea*..." I believe these species are only distantly related. *E. mellea* is much more closely related to *E. melanosa* as stated in the discussion under the latter species. *Eucerceris zimapanensis* appears to be more closely related to *E. canaliculata* and *E. sinuata* than to other species. From the latter two species, *E. zimapanensis* can be separated by the presence of a well developed dorsal longitudinal suture on the gonobase. Other characteristics as indicated in the key to species will separate these species.
Eucerceris zonata (Say)
(Figure 37)

Scullen, H. A. (1939:75-76; 1968:97)

GENITALIA: Dark testaceous. Gonobase with a shallow, arcuate emargination anteriodorsally; sides converging anteriorly; dorsal suture absent; venter slightly projecting anteriorly. Parameres with outer margins densely setose subapically; subapex slightly expanded laterally; ventral setae very dense subapically, projecting distally; apex rounded; inner subapical notch distinct. Aedeagus bulbous distally; subapical expansion absent; with a tooth-like spine projecting laterally on each margin. Digitus converging distally; apicilaterally clothed with long, laterally projecting setae.

PYGIDIUM: Rufotestaceous, piceous laterally. Hind pregradular margin shallowly arcuate; lateral ridges not contiguous with hind pregradular margin; plate sparsely, shallowly punctate, each puncture with a single, short seta; lateral setae short, cluster small, not extending beyond apicolateral processes; hairs between medioapical love and apicolateral processes absent; apicolateral processes short, distally rounded, distinctly, obliquely directed away from midline.

APICAL STERNUM: Emargination narrower than width of apicolateral processes; processes clothed with long, dark, erect setae; surface setae extending anteriorly along sublateral margins, setae short, sparse, erect; lateral tubercles absent.
SEVENTH STERNUM: Deeply, angulately emarginate distally; apicolateral setal clusters small; setae short, sparse, midline glabrous. Surface pale testaceous anteriorly, rufotestaceous posteriorly. Shaft not well defined, strongly converging distad.

DISCUSSION: *Eucerceris zonata* is only remotely related to other species. If each structure is considered independently of the others, then certain relationships can be established. The apical sternum for example, is strongly convergent in *E. zonata* and in *E. ruficeps* which may suggest a more or less close relationship. In addition, the venter of the parameres in both is very hairy. If a meaningful phenetic relationship is to be established, all multistate characteristics must be taken into account. *Eucerceris zonata* can be separated from all other known species by the presence of a laterally projecting spine on each side of the subapical portion of the aedeagus.
SUMMARY

The male genitalia and associated caudal tergites and sternites of eight genera of sphecid wasps were found to possess stable morphological characteristics which can be used to facilitate definition and identification of both genera and species. The emphasis of this study was placed on the cercerine genus *Eucerceris* and, as in many other genera containing large numbers of species, the morphological characteristics used to separate species were found to have their limitations. Most characters were common to several species, which in some cases was indicative of species groups. One species, *Eucerceris lacunosa* Scullen, may represent an undescribed subgenus. *Eucerceris* is most closely related to and probably was derived from *Cerceris*. Although unquestionably related to *Cerceris* and *Eucerceris*, the placement of the genus *Didesmus* is uncertain at this time. It departs radically in many genitalic structures from the other cercerine genera but still bears a strong resemblance to them on the basis of external morphology. The other genera belong to a different tribe and are distantly related to the members of the tribe Cercerini.


Giner, Mari J. 1941a. I. Monographia de los Cerceris de Espana (Hym. Spheg.). Eos 15:7-93.


APPENDICES
Aedeagus - the penis or phallus which is composed of paired penis valves located just above the digitus.

Angulate - an angle of less than 90°, often about 60°.

Apex - the distal end or margin of a structure.

Apicolateral process - process projecting distally from the pygidium, sometimes obliquely directed away from the midline.

Bisinuate - a margin having two sinuations.

Bulb-like - more or less swollen as at the apices of the aedeagus.

Bulbous expansion - a slight swelling located anterior to the apex of the aedeagus, usually immediately above and between the teeth on the digitus of Eucerceris spp.

Cuspis - the outer, apical, nonmovable finger of the volsella.

Densely setose - having a dense cluster of setae.

Digitus - the inner, apical, movable finger of the volsella; a paired structure located beneath the aedeagus.

Dorsal longitudinal suture - a dorsal suture on the gonobase which is oriented in an anterior-posterior position.

Emarginate - a curved margin which is basally impressed.

Gonobase - the anterior most of the sclerites in the genitalia.

Hairs - setae which are densely placed within a given area.

Hind pregradular margin - the posterior margin of the pregradulus.

Lateral ridge - a raised, heavily sclerotized crest which forms the lateral boundary of the pygideal plate.
Mediolateral lobe - the posterior median lobe of the pygidium which can be either apically rounded, truncate or emarginate.

Mucronate - very sharply pointed apically; spear-like.

Notched - an angulate indentation, prominent on the inner apical margin of each paramere.

Paramere - as used in this study, the paramere plus basiparamere; the elongate lateral claspers of the male genitalia.

Punctures - pits or small, rounded depressions in the surface of a structure from which a single seta often arises.

Pygideal plate - a relatively flat, dorsal pygideal surface located between the lateral ridges and the hind pregradular margin.

Rounded - a curved margin.

Rugose - a surface which appears to be rough, sometimes heavily, densely pitted.

Setae - hairs or very fine bristles which are relatively sparse and widely separated.

Spine - a tiny tooth-like structure whose apex is sharply angulate.

Subapical secondary process - a small tooth-like process extending from the venter of each apicolateral process as in E. melanovittata.

Subapical tubercles - small nodular structures located subapically on the lateral margins of the apical sternum.

Testaceous - the pale orange-brown color of certain genital structures, especially in the genus Eucerceris.

Truncate - the apical configuration of certain structures denoting a relatively straight as versed to a curved condition.

Volsellae - the cuspis and digitus collectively.
Plate I

Figure 1-3. Abdomen of male *Eucerceris canaliculata*. Figure 1 - dorsocephalic view, (PYG, pygidium). Figure 2 - ventral view, (7th St, seventh sternum; 8th St, eighth sternum; VBR, ventral bristles). Figure 3 - lateral view of apical segments, (AED, aedeagus; PYG, pygidium, 7th St, seventh sternum). Figure 4 - Genitalia, (AED, Aedeagus; DIG, Digitus; PMR, Paramere; GB, Gonobase). Figure 5 - Pygidium of *E. morula* male. Figure 6 - Apical sternum of *E. insignis*. Figure 7 - Pygidium of *E. melanovittata*. Figures 8-10. Apical Sterna of: 8 - *C. tarulus*; 9 - *E. melanovittata*; 10 - *E. zonata*.
Plate II

Figures 11-19. Male genitalia. Figure 11 - Eucerceris lacunosa. Figure 12 - E. arenaria. Figure 13 - E. canaliculata. Figure 14 - E. tricolor. Figure 15 - E. baccharidis. Figure 16 - E. montana. Figure 17 - Trachypus mexicanus. Figure 18 - E. insignis. Figure 19 - Philanthus sp.
Plate III

Figures 20-23. Eighth sterna. Figure 20 - Philanthus sp. Figure 21 - Cerceris mimica. Figure 22 - E. baccharidis. Figure 23 - E. lacunosa. Figure 24. Didesmus sp. genitalia. Figure 25. E. atrata aedeagus and digitus. Figure 26. C. femurrubrum apical sternum. Figure 27. E. stangei genitalia. Figure 28. E. angulata genitalia.
Plate IV

Figures 29-36. Pyidia. Figure 29 - *E. baccharidis*. Figure 30 - *E. tricolor*. Figure 31 - *E. stangei*. Figure 32 - *E. angulata*. Figure 33 - *E. stangei* seventh sternum. Figure 34 - *E. sonorae* seventh sternum. Figure 35 - *C. cochisi* pygidium. Figure 36 - *T. mexicanus* pygidium.
Plate V

Figure 37. *E. zonata* tip of aedeagus and digitus. Figure 38. *Philanthus* sp. genitalia. Figure 39. *P. flavifrons* tip of aedeagus. Figure 40. *C. mimica* tip of aedeagus and digitus. Figure 42. *T. mexicanus* seventh sternum. Figure 43. *Listropygia bechteli* genitalia. Figure 44. *T. mexicanus* apical sternum. Figure 45. *C. californica* seventh sternum.
Plate VI

Figures 46-49. Male genitalia. Figure 46 - *P. gloriosus*. Figure 47 - *P. flavifrons*. Figure 48 - *Clypeadon tarulus*. Figure 49 - *E. angulata*. Figure 50. *Cerceris macrosisticta* apical sternum. Figure 51. *C. mimica* apical sternum. Figure 52. *E. velutina* seventh sternum. Figure 53. *C. fumipennis* pygidium.