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A Revision of the Bee Genus Epeolus Latreille of Western America North of Mexico

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A REVISION OF THE BEE GENUS EPEOLUS LATREILLE OF WESTERN AMERICA NORTH OF MEXICO

by

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CONTENTS

INTRODUCTION

Members of the genus Epeolus are small to medium-sized wasp-like bees which parasitize the colletid genus Colletes. Twenty-two species and two subgenera are recognized in this work.

This study is primarily intended to clarify systematics within the genus Epeolus, but brief discussions of tribal relationships and biology are included. Known or suspected associations with species of the host genus are also given. Geographic boundaries of this study are delimited as follows: Louisiana, Arkansas, Missouri, Iowa, Minnesota, Manitoba, Keewatin, and all states and provinces to the west, that is, approximately the 92nd meridian; the Mexican border to the south; northernmost extensions of Epeolus populations to the north; coastal and insular California to the west. Mitchell's revision of Epeolus in eastern United States (1962), in combination with this paper, survey the genus in all of North America, north of Mexico, with the exception of eastern Canada. Species occurring in both eastern and western North America are treated in both studies.

Speculations regarding phylogeny are purposely omitted. Epeolus is a very homogeneous group, with narrowly defined specific limits. Even characters of genitalia and hidden sternites are of little value in establishing relationships. Also, biological information is practically

nonexistent at this time and provides no assistance in clarifying relationships.

This study partially fulfills the requirements for the Master of Science degree at Utah State University.

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DISCUSSION

Systematic confusion in the genus Epeolus has resulted primarily from the use of highly variable characters. Early descriptions and keys relied heavily upon coloration and pubescence characteristics. Such characters often exhibit much geographical variation as well as variation within local populations. New characters were discovered which strengthen systematic relationships within the genus. Some of the characters which were found to be of value are: relative lengths of antennal flagellomeres, puncturation, size and shape of scutellar axillae, presence of tubercles on frons and vertex, development of frontal carina, modifications of apical fimbria of female sternite V, length of preoccipital ridge, and form of the metanotum.

Biological data were to be used in supporting relationships based on morphological evidence, but currently so little is known of Epeolus biology that this has been impractical. Previous to this study host associations had been recorded for only five of the 22 species within the confines of this study. Additional information was gathered from a nesting site of Colletes ciliatoides Stephen near Delta, Utah. Epeolus pusillus Cresson was positively identified as the parasite of this Colletes species. However, the mode and extent of parasitism is still unknown for any of the Epeolus species.

Infraspecific population variants have been recognized in Epeolus minimus (Robertson) and Epeolus pusillus Cresson. These populations cannot be consistently defined geographically or morphologically and I have elected not to establish new names based on such meager evidence.

TRIBAL RELATIONSHIPS

Classification of nomadid bees is in a rather primitive state and much work is needed before a universal system can be accepted. It is not the purpose of this paper to present a classification of the higher categories of nomadines but a brief discussion of some Epeolus relatives may be of value. For a detailed discussion of nomadines see Linsley and Michener (1939). I am considering Epeolus as a member of the subfamily Nomadinae in the family Anthophoridae. I have examined a limited number of Neotropical and southern United States genera, some of which show distinct relationships with Epeolus.

The tribe Epeolini, as usually constituted, includes only Epeolus, Triepeolus and one small, undescribed genus in North America. Additional Neotropical representatives include Doeringiella and a large, metallic-colored form from Bolivia (probably Thalestria). Male sternites VII, VIII, and genitalia of the latter two genera and female sternite VI of Thalestria (?) are typical of Triepeolus. Thalestria (?) differs from Triepeolus in having a long, barrel-shaped thorax, dorsally convergent eyes in the male, and parallel-sided eyes in the female. Doeringiella, at least, is probably congeneric with Triepeolus. One specimen examined from Brazil, questionably determined as Odyneropsis, has Epeolini features and is also probably in this tribe. I have also seen a pair of specimens from Arizona (Santa Cruz County, Sycamore Canyon, near Ruby) which apparently represent a new genus somewhat closer to Triepeolus than to Epeolus. These specimens differ from other Epeolini in the absence of maxillary palpi,

presence of a darkened, heavily sclerotized flange medially on the pronotum, and by having a tear-shaped, carinate depression basally on the pseudopygidium.

Protepeolus (Protepeolini) from Southern California differs from Epeolini by the absence of a male pygidium, three segmented and rather long maxillary palpi, long, somewhat spatulate female pygidium extending well beyond the apex of the tergite, and obviously different hidden sternites of both sexes. Linsley and Michener (1939) have also placed Isepeolus, a South American genus, in this tribe. Isepeolus is much like Protepeolus, but flagellomere I is longer, about as long as the combined lengths of flagellomeres II-V, and the maxillary palpi are two segmented and short.

The tribe Epeoloidini contains only the Holarctic genus Epeoloides. This genus superficially resembles Epeolini but it has long, four segmented maxillary palpi, lacks a pseudopygidium, the eyes converge dorsally in the males, and are parallel sided in the females, and the hidden sternites are similar to Protepeolini.

Hexepeolus (Nomadini) from Southern California is similar to Epeolini in the robust form and the "Triepeolus-like" male pygidium. It differs in having extremely long, six segmented maxillary palpi, very short axillae, short, plumose hair bands on male sternites, IV, V, and in the hidden sternites and genitalia.

Epeolus and Triepeolus are closely related and often difficult to distinguish. External generic characters are poorly

defined, particularly in the males, and exposure of genitalia and hidden sternites is sometimes required for accurate identification. Triepeolus averages larger than Epeolus and the marginal cell is often longer in relation to the rest of the wing in Triepeolus. However, these characters are not of constant generic value. Diagnostic characters are listed as follows: Triepeolus: male; pygidium long, often slender and sinuate or constricted near the middle (fig. 14); sternite VII broadly expanded apically, apical margin shallowly emarginate medially, lateral margins rounded and converging apically (fig. 17); sternite VIII cruciform, broadly rounded to subtruncate apically, lateral processes often positioned toward basal margin (fig.19); gonostyle strongly curved apically, forming a rather distinct angle within (fig. 21). Female; sternite VI with two long, straight, apical processes bearing long hairs on inner margins, terminating in long, acute spines, connected medially with but a short cross bar (fig. 23). Epeolus: male; pygidium short, broad, at least basally, occasionally narrow, rectangular, but not sinuate or constricted near middle (figs. 11, 12, 13); sternite VII narrowly expanded apically, lateral margins parallel sided or converging basally, rarely converging apically, apical margin flat or with a median protuberance (fig. 15); sternite VIII cruciform, tapering apically, lateral processes positioned near middle (fig. 18); gonostyli usually more weakly arched apically, with a broader inner angle (fig. 20). Female; sternite VI with two short, curved, apical processes arising from a broad basal disc, each bearing short, dark teeth near apex (fig. 22).

BIOLOGY

Epeolus shares a common distribution with *Colletes* and probably parasitizes only this colletid genus. Eucerine hosts have been reported in the Old World but they are probably based on *Triepeolus* (G. E. Bohart, personal communication).

Biological data on *Epeolus* are virtually absent. Of 35 species of *Epeolus* in America North of Mexico host species have been associated (most of these questionably) with only eight species. There is some evidence to suggest that one *Epeolus* species has more than one *Colletes* host. Stephen (1954) listed 95 species of *Colletes* in America North of Mexico, a theoretical ratio of about three *Colletes* species for each *Epeolus* species. Stephen quoted Noskiewicz as stating in a study of Palearctic *Colletes*, " . . . that in many cases one and the same *Epeolus* species can have different *Colletes* species as hosts." Bischoff (Stephen 1954) described minor polymorphism in species of European *Epeolus* and questioned the extent to which a single parasite species can utilize different hosts. He suggested this may play a role in *Epeolus* polymorphism. Single *Epeolus* species have been collected with more than one *Colletes* species in the Nearctic fauna as well. However, the possibility that some *Colletes* are not parasitized must not be excluded. Further knowledge of *Epeolus* biology would not only be of interest *per se*, but would be of benefit in establishing systematic relationships.

Host associations and biological information, when known, are given with the Epeolus species concerned. Host associations are taken from the synoptic catalogue of Hymenoptera of America North of Mexico.

The following account of larval morphology is taken from Michener (1953).

Epeolus larvae belong to the group containing Colletidae, Halictidae, Andrenidae, Melittidae, and the anthophorid genera Neopasites, Nomada, and Triepeolus. The group is characterized by reduced or absent antennal papillae, mandible with a multidentate cusp on inner surface, and salivary opening reduced, without lips. However, Epeolus and Triepeolus (and a few other genera) lack the mandibular cusp but the mandibles are attenuate and show no resemblance to those of other Anthophoridae, Megachilidae, or Apidae. The group containing Epeolus, as construed by Michener, cannot be regarded as either primitive or specialized as it combines primitive mandibles with specialized antennae and salivary openings.

The larvae of anthophorids, as the adults, constitute a diverse and complex group. The epeolines, and to some extent Nomada and Neopasites form a rather unique group within the Anthophoridae. Epeolus and Triepeolus, in addition to the mandibular differences mentioned above, exhibit more labiomaxillary reduction than other bee larvae. Also, the spiracular atria are produced above the body surface. Michener figured the spiracles of Epeolus and Triepeolus. Differences between

the two are the absence of subatrial spines in Epeolus, that portion of the peritreme extending above the body surface is erect in Epeolus and sloping in Triepeolus, and the primary tracheal opening bears a collar in Epeolus. Nomadine prepupae are rigid, dorsoventrally compressed, angled between the thorax and abdomen, rounded laterally between intersegmental lines, and lack tubercles dorsally.

Nomadine females insert their eggs in the wall of the host cell while the cell is still open and the first instar larvae destroy the host egg and then feed on the pollen stored for the host larva. The mandibles of the first instar Triepeolus larvae are long and sickle shaped, and are undoubtedly used for rupturing the host egg. It is reasonable to assume that the mandibles of first instar Epeolus larvae are similarly formed. The feces of mature nomadine larvae are primarily deposited and flattened in an equatorial band around the cell; like other bee larvae which have reduced antennal papillae and reduced salivary openings, the nomadines do not spin cocoons.

SYSTEMATICS

Generic Nomenclature, Description, and Discussion

Genus Epeolus Latreille

Epeolus Latreille, 1802. Hist. Nat. Fourmis, p. 427. Type: (Nomada variegata Fabricius)--Apis variegata Linneaus. Monob.

Pyrrhomelecta Ashmead, 1899. Amer. Ent. Soc. Trans. 26:66. Type: Epeolus glabratus Cresson. Monob. and orig. desig.

Argyroselenis Robertson, 1903. Canad. Ent. 35:284. Type: Triepeolus minimus Robertson. Monob. and orig. desig.

Females: Length 5.5 to 11 mm; forewing length 4 to 9 mm; head black to reddish mahogany, more finely punctured on clypeus, more coarsely on frons and vertex; face often densely pubescent between antennal fossae, vertex often with few, long, simple hairs, short squamiform hairs on posterior margin; labrum broader than long, with two, small apical teeth bordering a median emargination; eyes large, wider than gena, converging below, with a carina on inner margin; maxillary palpi short, two or three segmented; flagellomere II from two-thirds as broad as long to broader than long; mandibles usually with an inner, subapical tooth; thorax robust, black to reddish mahogany, often with reddish orange markings, punctures variable; propodeum nearly vertical; axillae usually prominent, occasionally short, blunt; scutellum varying from nearly straight across to broadly and deeply emarginate; propodeal enclosure finely to moderately rugose dorsally, finely, transversely, irregularly striate medially; metasoma black to brilliant reddish orange, usually with apical fasciae of short, appressed pubescence, punctures fine, dense, occasionally rugosopunctate; tergite V with variously modified pseudopygidium of fine, appressed strongly reflective silvery or golden hairs; pygidium black to reddish orange, with dense, erect, coppery to silvery pubescence; sternite V with a short to long apical fimbria of pale or dark pubescence; sternite VI with two short, curved, apical processes, each bearing short teeth on distal portions.

Males: Length 5.5 to 11 mm; forewing length 4.5 to 8 mm. Much the same as females but differing as follows: face

and thorax often slightly more pubescent; metasomal tergite VII bearing a pygidium which is usually short, broad, occasionally narrow, rectangular, often pointed apically, not constricted or sinuate near the middle, black to reddish orange, variously punctured; sternites IV, V usually with row of long, silvery to coppery, often darkened apically hairs near apical margin; sternite VII weakly expanded apically, parallel sided or converging basally, rarely converging apically; sternite VIII cruciform, usually tapering apically, lateral processes positioned basally or submedially; genital armature with gonocoxites widely diverging distally, apical processes with long, simple hairs arising from ventral margins; gonostyle strongly arched apically, terminating in acute apices, angle beneath rather broad; penis valves usually exceeding gonostyli.

Argyroselenis Robertson was separated from Epeolus on the basis of three segmented maxillary palpi, inner tooth on mandibles, and pubescence and color patterns. These characters are inconsistent; moreover, minimus agrees with other Epeolus in so many characters that a generic separation is not desirable.

Ashmead's description of Pyrrhomelecta as a new genus is extremely short and is based only on red or red and black color, reduction of pubescence and short, acute axillae. E. glabratus has been recorded only from Georgia and Florida and like many other southeastern bees has a preponderance of deep reddish integument and sparse pubescence. The axillar characters do not constitute a generic or subgeneric status. Michener (1954) considered Phyrrhomelecta as a subgenus containing E. bifasciatus obscuripes Cockerell. For reasons given below, I believe bifasciatus to be more allied with Trophocleptria.

Keys to Species of Epeolus from Western North America

Although two subgenera are recognized, subgeneric keys are not presented. Forcing the species into a subgeneric couplet

would undoubtedly increase the difficulty of the key. The sexes of Epeolus are quite monomorphic but separate keys for males and females are given. This is done to facilitate shorter, easier-to-use couplets. Earlier keys, Brues (1903), Robertson (1903), Cockerell (1904, 1921, 1928), and Cockerell and Sandhouse (1924) have relied heavily upon color and pubescence characteristics. I have attempted to avoid such characters whenever possible as they are quite variable and do not always allow for accurate identification and separation of species.

Females

1 Flagellomere II nearly as broad (9/10) or broader than long (mid-dorsal length, width on dorsal face at middle of segment) 2

Flagellomere II at most only 3/4 as broad as long when measured as above 9

2 (1). Vertex laterally with large, shiny, impunctate tubercles 3

Vertex without tubercles 4

3 (2). Interspaces of mesopleuron about as large as one or two puncture diameters; frontal carina large and bulbous below and of a uniform height across its ventral width; axillae concave on inner apical margin . torus n. sp.

Interspaces of mesopleuron about as large as three or four puncture diameters; frontal carina nearly uniformly elevated with ventral area gradually rising to a median elevated area . . . . . lobus n. sp.

4 (2). Frontal carina large and bulbous below, nearly flattened above and of a uniform height across its ventral width, occupying all of the space between the antennal fossae . . . . . australis Mitch. (in part).

Frontal carina uniformly elevated, not bulbous below . 5

5 (4). Apical fimbria of sternite V short, extending only slightly beyond apex of sternite 6

Apical fimbria of sternite V long, extending well beyond apex of sternite 7

6 (5). Femora, tibiae, antennae reddish orange . . . . . barberiellus Ckll.

Femora, tibiae, antennae black . . . . . americanus (Cress.).

7 (5). Two submarginal cells; scutum with primarily long, appressed, coppery pubescence, little white pubescence . . . . . mesillae (Ckll.).

Three submarginal cells; scutum with primarily white pubescence, only sparse, short, coppery hairs . . 8

8 (7). Scutal pubescence of two antero-median, longitudinal lines, labrum without apical tubercles; mesopleuron with some interspaces larger than average puncture diameter; vertex antero-lateral to lateral ocellus with large punctures separated by about one puncture diameter . . . . . brevicornus n. sp.

Scutal pubescence of an antero-median quadrate patch; labrum with two apical, median tubercles; interspaces of mesopleuron less than one puncture diameter; vertex antero-lateral to lateral ocellus with small, dense punctures separated by less than one puncture diameter . . . . . politus n. sp.

9 (1). Axillae distinctly arcuate on lateral margins and extending beyond posterior margin of essentially horizontal dorsal face of scutellum 10

Axillae at most only slightly arcuate on lateral margins and extending hardly to or short of posterior margin of essentially horizontal dorsal face of scutellum . 13

10 (9). Preoccipital ridge joining hypostomal carina at about midway on fossa of mouthparts, often pushing up a sharp tooth at juncture . . . . . ainsleyi Crwfd.

Preoccipital ridge terminating before joining hypostomal carina 11

11 (10). Posterior dorsal border of compound eye with a transverse depression separating the compound eye from the swollen lateral areas of vertex; flagellomere II about 3/4 as broad as long when measured as in couplet 1;

labrum usually with two prominent, longitudinal, median carinae terminating in apical tubercles . . . . . scutellaris Say

Posterior dorsal border of compound eye without transverse depression, lateral areas of vertex evenly rounded; flagellomere II about 2/3 as broad as long; carinae of labrum small if present . . 12

12 (11). Axillae joined to sides of scutellum for about 1/2 their entire length when measured from union of scutellum and axillae at posterior border of scutum, apical ends strongly bent away from sides of scutellum; scutellum with deep median emargination . . . . . crucis Ckll.

Axillae joined to sides of scutellum for nearly 3/4 their entire length when measured as above, tips remaining close to sides of scutellum; scutellum with only shallow, median emargination . . . . . pusillus Cress.

13 (9). Frons with tubercle on upper mesal margin of compound eye or metanotum with blunt, median tooth . . 14

Frons without tubercle; metanotum without tooth 15

14 (13). Frons with tubercle on upper mesal margin of compound eye; metasomal fasciae prominent only on segments I and II . . . . bifasciatus Cress.

Frons without tubercle; metasomal fasciae prominent on all segments; metanotum with blunt, median tooth . . . . . interruptus Robt.

15 (13). Frontal carina large and bulbous below, nearly flattened above and of uniform height across its ventral width, thus occupying all of space between antennal fossae . . . australis Mitch.(in part).

Frontal carina not bulbous below, nearly uniformly elevated and ventral area gradually rising to median elevated area 16

16 (15). Pseudopygidium as long as broad, large, occupying about 1/3 of tergite, and campanulate . . . 17

Pseudopygidium at least twice as broad as long, small, occupying 1/4 or less of tergite, arched but never campanulate 18

17 (16). Mesopleuron with smooth, shiny interspaces as large as one to four puncture diameters . . lectoides Robt.

Mesopleuron coarsely roughened and reticulate, interspaces smaller than one puncture diameter . . . . . ilicis Mitch.

18 (16). Mesopleuron with widely spaced punctures, interspaces as large as four or five puncture diameters . . . . . cretus n. sp.

Mesopleuron densely punctured, interspaces at most as large as two puncture diameters . . . 19

19 (18). Axillae distinctly carinate on lateral margins, with prominent concavity medio-laterally . . . . . autumnalis Robt.

Axillae without carinae, or at most slightly carinate, but never with concavity 20

20 (19). Metanotum with distinct, median, transverse depression lying beneath prominent overhanging shelf . . . . . scopulus n. sp.

Metanotum flat, or at most with poorly defined, faintly depressed median area, without overhanging shelf 21

21 (20). Scutellum with broad, median emargination occupying central 1/2 of scutellum and extending nearly to anterior margin of scutellum; lateral areas of vertex elevated from remainder of vertex or with transverse depression behind posterior dorsal border of compound eye separating compound eye from slightly swollen lateral corners . . . . . artus n. sp.

Scutellum with narrow, median emargination occupying central 1/4 or less of scutellum and terminating much short of anterior margin; vertex without elevated areas and without transverse depression behind posterior dorsal border of compound eye . . . 22

22 (21). Mesopleuron coarsely punctured, with some interspaces as large as one puncture diameter; scutal pubescence composed of antero-median, quadrate patch or two antero-median lines uniting posteriorly to enclose black triangular area; metasomal fascia II without antero-lateral lobe of pubescence; apical fimbria of sternite V either short and dark, or, if golden, then usually with hairs of uniform length, and often with black band and base of hairs which delimits fimbria from sternite . . . . compactus Cress.

Mesopleuron densely punctured, with interspaces smaller than one puncture diameter; scutal pubescence of two antero-median, longitudinal lines of uniform pubescence; metasomal fascia II rarely without antero-lateral lobe of pubescence, apical fimbria of sternie V long, golden, with hairs of unequal lengths, without black line at base of hairs . . . . . minimus (Robt.).

Males

1 Pronounced tubercle on vertex laterally, or near upper mesal margin of compound eye 2

Tubercle lacking on vertex laterally and near upper mesal margin of compound eye 4

2 (1). Granulate tubercle near upper mesal margin of compound eye; metasomal fasciae prominent only on segments I and II . . . . . bifasciatus Cress.

Large, shiny, impunctate tubercle on vertex laterally; metasomal fasciae prominent on all segments . 3

3 (2). Interspaces of mesopleuron equal to one or two puncture diameters; frontal carina bulbous below and of uniform height across its ventral width; axillae concave on inner apical margin . torus n. sp.

Interspaces of mesopleuron equal to three or four puncture diameters; frontal carina nearly uniformly elevated, with ventral areas gradually rising to median elevated area . . . . . lobus n. sp.

4 (1). Axillae distinctly arcuate on lateral margins, extending beyond posterior margin of essentially horizontal dorsal face of scutellum 5

Axillae at most only slightly arcuate and extending to or before posterior margin of essentially horizontal dorsal face of scutellum 8

5 (4). Preoccipital ridge joining hypostomal carina about midway along fossa of mouthparts, often pushing up a sharp tooth . . . . . ainsleyi Crwfd.

Preoccipital ridge terminating before joining hypostomal carina 6

6 (5). Posterior dorsal border of compound eye with transverse depression separating compound eye from swollen lateral corners of vertex . . . scutellaris Say

Posterior dorsal border of compound eye without transverse depression; lateral corners of vertex evenly rounded, not swollen 7

7 (6). Axillae joined to sides of scutellum for about 1/2 their entire length when measured from union of scutellum and axillae at posterior border of scutum; apical ends of axillae strongly bent away from sides of scutellum; scutellum with deep median emargination . . crucis Ckll.

Axillae joined to sides of scutellum for nearly 3/4 their entire length when measured as above; axillary tips remaining close to sides of scutellum; scutellum with only shallow median emargination . . pusillus Cress.

8 (4). Axillae extremely short, extending less than 1/2 length of scutellum when measured from postero-median margin of scutum, or, if axillae extend slightly more than 1/2 length of scutellum, then vertex laterally with interspaces larger than puncture diameters and mesopleuron rugoso-punctate 9

Axillae more prominent, extending more than 1/2 length of scutellum when measured as above, and vertex laterally with interspaces smaller than puncture dimaters and mesopleuron not rugosopunctate 13

9 (8). Vertex laterally with large, widely spaced punctures, interspaces larger than puncture diameters; mesopleuron rugoso-punctate; axillae often extending slightly more than 1/2 length of scutellum . . brevicornis n. sp.

Vertex laterally with small, closely packed punctures, interspaces smaller than puncture diameters; mesopleuron often densely punctured but not rugoso-punctate; axillae extending less than 1/2 length of scutellum . 10

10 (9). Outer face of mandible basally with small, dense, often elongate punctures; mesopleuron with long, silvery, appressed pubescence obscuring integument; two submarginal cells . . . . . mesillae (Ckll.).

Outer face of mandible basally impunctate, shining, at most with few widely spaced punctures; mesopleuron nearly nude with much integument visible; two or three submarginal cells 11

11 (10). Posterior face of propodeum submedially with long, straight, erect hairs, punctate, with a rather dull finish; metasomal fasciae interrupted medially, often sinuate or interrupted sublaterally, white to off-white 12

Posterior face of propodeum submedially nude, impunctate, highly polished; metasomal fasciae entire, not interrupted or sinuate, yellowish . . . politus n. sp.

12 (11). Femora, tibiae, antennae black or mahogany . . . . . americanus (Cress.).

Femora, tibiae, antennae reddish orange . . . . . barberiellus Ckll.

13 (8). Pygidium narrow, median length nearly twice as great as basal width 14

Pygidium broad, median length less than or at most only slightly more than basal width 15

14 (13). Frontal carina bulbous below, of uniform height across ventral width; pygidium narrowing apically; lateral areas of vertex rounded, not elevated from rest of vertex . . . . . australis Mitch.

Frontal carina not bulbous ventrally, gradually rising to elevated ridge ventrally; pygidium parallel sided or narrowing basally; lateral areas of vertex elevated from rest of vertex . . . . . artus n. sp.

15 (13). Mesopleuron sparsely punctured, some interspaces as large as four or five puncture diameters . cretus n. sp.

Mesopleuron densely punctured, interspaces smaller than two puncture diameters, if with some interspaces larger than three puncture diameters, then axillae joined to sides of scutellum for only 1/2 their entire length, or metanotum with a large, median, blunt tooth . . . 16

16 (15). Axillae joined to sides of scutellum for about 1/2 their entire length or less and apical ends strongly bent away from sides of scutellum; metasomal fasciae narrow, occupying only about 1/5 of tergite, and clear white; metasomal discs with sparse, black pubescence, revealing much shiny integument 17

Axillae joined to sides of scutellum for at least 2/3 their entire length and apical ends nearly straight, not bent away from scutellum; metasomal fasciae broad,

occupying nearly 1/3 of tergite, and cream-colored to yellowish; metasomal discs with much dark pubescence nearly obscuring integument 18

17 (16). Mesopleuron with large, shiny interspaces as large as two to three puncture diameters; scutum with some interspaces as large as puncture diameters . . . . . lectoides Robt.

Mesopleuron closely punctate, interspaces if present, generally smaller than puncture diameters; scutum with punctures contiguous, interspaces generally smaller than puncture diameters . . . . . ilicis Mitch.

18 (16). Flagellomere II about 3/4 (7/10) as broad as long; lateral margins of axillae carinate and elevated from rest of axillae . . . . . autumnalis Robt.

Flagellomere II nearly as broad as long (9/10); lateral margins of axillae usually gently rounded, not carinate and elevated from rest of axillae . . 19

19 (18). Mesopleuron widely punctured, with interspaces as large as two or three puncture diameters, or if smaller than this, then scutal pubescence composed of two antero-median, longitudinal, clavate lines and metanotum with a blunt, median tooth . . . interruptus Robt.

Mesopleuron closely punctured, with interspaces less than one puncture diameter, or if interspaces larger than one puncture diameter, then scutum without clavate lines and metanotum flat or with a transverse ledge which overhangs a median depression 20

20 (19). Metanotum with a distinct median, transverse depression lying beneath an overhanging ledge . . . . . scopulus n. sp.

Metanotum flat or at most with a faintly depressed median area, but without overhanging ledge . . 21

21 (20). Mesopleuron coarsely punctured, with some interspaces as large as one puncture diameter; scutal pubescence composed of an antero-median, quadrate patch or two antero-median lines which unite posteriorly to enclose a black triangular area; metasomal fascia II without antero-lateral lobe of pubescense . compactus Cress.

Mesopleuron densely punctured with interspaces smaller than one puncture dimater; scutal pubescence of two,

antero-median, longitudinal lines or uniformly pubescent; metasomal fascia II rarely without antero-lateral lobe of pubescence . . . . . minimus (Robt.).

Subgenus Trophocleptria Holmberg

Trophocleptria Holmberg (1886, An. Soc. Cient. Argentina, 22:275) described from southern South America is here considered as a subgenus of Epeolus. It was considered synonymous with Epeolus by Brethes (1909, An. Mus. Nac, Buenos Aires, 19:68) and Ducke (1912, Zool. Jahrb., Abt. Syst., Geogr. Biol. Tiere, 34:99). I have seen neither of these papers but they are cited in Michener (1954). Also, Michener (1954) suggested that Trophocleptria is a subgenus of Epeolus.

E. bifasciatus Cresson is the only species in this subgenus occurring in the United States. The subgenus also includes fumipennis Say from Mexico and those species originally described in the genus Trophocleptria. Combinations of the following characters distinguish Trophocleptria from Epeolus s. str.: dorsal face of pronotum wide, strongly angulate on anterior margin; male pygidium short, nearly as broad as long, parallel sided, usually subtruncate apically; lateral faces of propodeum without punctures, faintly granulate, often shining; upper mesal margins of compound eyes with tubercles, occasionally rather reduced or absent; antero-lateral margin of mesopleuron often with an irregular carina; posterior portion of mesopleuron often with a carina or broad, impunctate band extending from postero-dorsal margin of metacoxal carina toward pronotal lobes.

E. bifasciatus Cresson (described from Illinois) extends from Eastern United States into the Southwest where it possibly intergrades with E. fumipennis Say from Mexico. The type of fumipennis has been destroyed and Say's description (1837) is inadequate for accurate identification. Cresson (1864) was not familiar with fumipennis and Robertson (1897) noted that Say mentioned pubescent lines on the thorax but Cresson did not. Nine males and eleven females determined as fumipennis in collections of KU and the ANSP from Midwestern and Southeastern United States are "typical" bifasciatus. Two females and one male from "Mex.", one female from nine miles east of Chupaderos, Sinaloa, Mexico, and one female from seven miles west of Tuxtla Gutierrez, Chiapa, Mexico are probably the true fumipennis. These specimens are very similar to bifasciatus but more closely fit Say's description. They differ from bifasciatus as follows: scutum with pale yellowish or whitish, antero-median lines; tubercles on upper mesal margins of compound eyes smaller, impunctate, shining; frontal carina with a more pronounced elevation between antennal fossae; metasomal tergite I of male with a broad, medially interrupted fascia, III, IV, V, VI with a conspicuous yellowish fascia, tergites III, IV of female also with prominent fasciae; punctures of mesopleuron and scutum dense, with smaller punctures intermixed with the large, interspaces smaller than an average puncture diameter; antero-lateral margins of mesopleuron broadly rounded, lacking a carina; carina near posterior margin of meso-

pleuron absent and without broad, impunctate band. However, another specimen labelled "Mex." differs from fumipennis in that it has fasciae only on segments I and II, lacks scutal lines, and has both carinae on the mesopleuron.

I have been able to examine a rather limited number of Trophocleptria, but those I have seen are closely allied to bifasciatus Cresson. T. odontothorax Michener from Costa Rica (determined by R. R. Snelling) can be distinguished by the long, acute axillae, granulate interspaces of the mesopleuron, longer marginal cell, and differences in male sternite VII (fig. 16). Another species (probably undescribed) from southern Mexico and El Salvador is similar to odontothorax but differs in having shorter, axillae, shiny interspaces of the mesopleuron, slightly shorter marginal cell, and one specimen lacks the tubercle on the upper mesal margins of the compound eye. One male specimen from Old Panama determined as bifasciatus obscuripes by C. D. Michener agrees with bifasciatus s. str. except it has very small tubercles, metasomal fasciae present on all segments, and the metanotum has a large, blunt, median tooth. Four specimens from southern Arizona (Patagonia, Santa Cruz County) and one from Snowflake, Navajo County may belong to obscuripes. However, the tubercles are large and granulate and the metanotum lacks a tooth.

Trophocleptria comprises a large, amazingly variable, intergrading complex extending from southwestern United States into Central and South America. The marginal cell is shorter in bifasciatus and fumipennis, longer in some Central American

populations, and reaches a maximum in odontothorax from Panama and Costa Rica. Also, the axillae tend to become progressively longer and more acute in southward extending populations. Clarification will have to await comparative studies of large series of Central and South American specimens.

Epeolus bifasciatus Cresson

Epeolus bifasciatus Cresson, 1864. Ent. Soc. Phila. Proc. 3:38.

Female. Length 7 to 9 mm; forewing length 5.5 to 7 mm; labrum reddish orange, often darkened basally, medially; clypeus reddish orange to black or mahogany; scape, pedicel, flagellomere I reddish orange, remaining flagellomeres reddish orange to mahogany; legs reddish orange to coppery, often with variable black markings; pronotum, scutellum, axillae, tegulae, anterolateral corners of scutum reddish orange; scutal disc black; propodeum yellowish orange to black; mesopleuron, metasomal tergites, pygidium reddish orange to black or mahogany; face with appressed, off-white pubescence around antennal fossae; clypeus, vertex with but few erect, whitish hairs; pronotum, metanotum, with dense, appressed, whitish or yellowish pubescence; mesopleuron with irregular border of a few whitish or yellowish hairs, nude otherwise; metasomal tergite I with a broad, basal, entire band of yellowish pubescence overlying reddish orange integument; tergite II with a narrow, apical band of yellowish pubescence overlying darker integument; remaining tergites with few whitish or yellowish hairs, occasionally weakly fasciate; apical fimbria of sternite V with long, coppery hairs of unequal lengths, darkened at base; pseudopygidium poorly defined but usually twice as broad as long; clypeus finely rugoso-punctate; punctures larger, deeper between large, granulate, dull tubercles on upper mesal margins of compound eyes; vertex densely rugoso-punctate between lateral ocelli and transverse depression behind posterior margin of compound eye; scutal disc, scutellum, axillae, upper one half mesopleuron coarsely, deeply rugoso-punctate with large punctures; lower one half mesopleuron with large, shiny interspaces larger than a puncture diameter on some areas; propodeal enclosure moderately rugose dorsally, finely, irregularly, transversely striate medially; remainder of posterior face of propodeum impunctate medially, with coarse, irregular, oblique striae, extreme lateral margins with shallow, dense punctures; forewings with three submarginal cells, entirely fulvous, somewhat darker apically, veins mahogany; flagellomere II two-thirds as broad as long; anterior, lateral faces of mesopleuron separated

by an irregular carina; posterior portion of mesopleuron often with a carina extending from postero-dorsal margin of metacoxal carina towards pronotal lobes; frontal carina with a more uniform slope, not abrupt between antennal fossae; metanotum often with a blunt, median tooth; axillae prominent but not attaining posterior margin of essentially horizontal dorsal face of scutellum, slightly arcuate on a lateral margin; scutellum weakly emarginate medially, with a rugose depression around postero-ventral margin.

Male. Length 7 to 9 mm; forewing length 6 to 7 mm; In general this sex agrees with description of female but differs as follows: flagellomere II more than three-fourths as broad as long; sternites IV, V with a subapical row of long, golden to coppery hairs; pygidium subtruncate apically, shallowly, sparsely punctured, dark reddish orange to black.

The type of this species is in the collection of the ANSP.

For the diagnosis and discussion of bifasciatus see the subgeneric discussion.

Distribution. E. bifasciatus exhibits much color variation throughout its range in North America. Populations from the Midwest and Northeast, where it is more common, generally have the legs, labrum, clypeus, propodeum, and pygidium black. Peripheral populations in the Southeast are usually dark, burnt red in the above-mentioned characters, whereas populations from the Southwest tend to be reddish orange. See fig. 10 for bifasciatus distribution.

Biology. Colletes latitarsis Robt. has been suggested as the host of this species.

Subgenus Epeolus Latreille

In the New World Epeolus s. str. occurs predominantly in the United States, but Southwestern species extend into arid

portions of Mexico and collection localities from Southern Canada are not uncommon. This subgenus is differentiated from Trophocleptria by the characters listed in the discussion of the latter.

Epeolus ainsliei Crawford

Epeolus ainsliei Crawford, 1932. Ent. Soc. Wash. Proc., 34:74.

Female. Length 7 to 9 mm; forewing length 5 to 7 mm; labrum, clypeus apically or entirely, antennae reddish orange, except often mahogany on apical flagellomeres; legs entirely reddish orange; thorax black, except reddish orange on pronotal lobes, lateral margins of scutum, mesopleuron above, scutellum, axillae; metasomal tergites black through deep reddish mahogany to reddish orange; face with appressed, silvery pubescence around antennal fossae, sparser on vertex and clypeus; pronotum, metanotum with dense, subyellowish to whitish pubescence; scutum with subsilvery to subyellowish pubescence varying from nearly nude with two antero-median, longitudinal lines and lateral and posterior margins well defined to nearly uniformly pubescent with lines almost obscured; mesopleuron nearly nude below, usually with some silvery pubescence above; metasomal tergite I with dense whitish to yellowish pubescence, except sparsely pubescent or nearly nude with short, coppery hairs on a long, narrow, transverse band on disc; tergites II, III, IV with whitish to yellowish apical fasciae, often with diffuse hairs on discs; tergite V with lateral patches of whitish to yellowish pubescence; sternite V usually with a short, coppery to silvery, regular, apical fimbria; pseudopygidium usually about two and one half times broader than long; clypeus rugoso-punctate, larger punctures intermixed with the small, particularly laterally, interspaces variable, often larger than a puncture, apical margin impunctate; frons above, vertex with larger, coarser punctures; scutum, scutellum, axillae, mesopleuron rugoso-punctate, interspaces larger on mesopleuron below; propodeal enclosure moderately rugose dorsally, finely to moderately, irregularly, transversely striate medially; lateral areas of posterior face of propodeum closely, coarsely punctured; forewings with three submarginal cells, hyaline, nearly nude basally, darker, more pubescent apically, veins ferruginous to mahogany; flagellomere II approximately two-thirds as broad as long; preoccipital ridge joins hypostomal carina on fossa of mouthparts, often pushing up a tooth and is angulate at its dorsal margin behind compound eye; apical portion of metasomal tergites (underlying fasciae) weakly depressed; axillae distinctly arcuate on

lateral margins and extend well beyond essentially horizontal dorsal face of scutellum, tips often weakly bent away from sides of scutellum and usually not finely pointed; scutellum with an extremely shallow, median emargination, occasionally moderately emarginate; metanorum with a small to moderate sized blunt, median projection.

Male. Length 5.5 to 9 mm; forewing length 5 to 7 mm; This sex differs from the female as follows: labrum, clypeus, thorax from reddish orange to black; metasomal tergites black to reddish mahogany; clypeus, mesopleuron often more pubescent; flagellomere II approximately as broad as long; sternites IV, V with subapical rows of long, coppery to silvery hairs; pygidium reddish orange, broadly rounded to subtruncate apically, with large, coarse, rather dense punctures; metasomal tergites (underlying fasciae) moderately to strongly depressed.

The holotype of ainsliei is in the collection of the USNM.

Diagnosis. E. ainsliei is very similar to crucis Cockerell. The species can readily be differentiated on the basis of the preoccipital ridge which joins the hypostomal carina in ainsliei but terminates before the carina in crucis. The following characters of ainsliei will also distinguish it from crucis: clypeus rugoso-punctate, male tergites more deeply depressed apically, axillae often blunter and less divergent from the scutellum, the propodeal enclosure is often more coarsely striate, and it has a larger median projection on the metanotum.

Discussion. E. lectus Cresson antedates ainsliei and may be synonymous with it but I have not seen representatives of that species. For a discussion of lectus refer to section on Unexamined species.

Distribution. E. ainsliei is a Midwestern species and is sympatric with crucis throughout part of its range. However, ainsliei extends northward into southern Alberta and Manitoba. Southern expansions of the range are in southeastern Texas.

Epeolus americanus (Cresson)

Phileremus americanus Cresson, 1878. Amer. Ent. Soc. Trans. 7:83.

Phileremus montanus Cresson, 1878. Amer. Ent. Soc. Trans. 7:83. New synonymy.

Epeolus asperatus Cockerell, 1909. Ann. Mag. Nat. Hist. (8) 5:25. Ney synonymy.

Epeolus melectimimus Cockerell and Sandhouse, 1924. Proc. Calif. Acad. Sci. 13(4):317. New synonymy.

Epeolus lanhami Mitchell, 1962. N. C. Agric. Exp. Sta. Tech. Bull. no. 152, vol. II, p. 450. New synonymy.

Female. Length 6 to 10 mm; forewing length 4.5 to 7 mm; labrum, clypeus, pronotal lobes antennae, legs, thorax mahogany to black, except apices of femora, tibiae, tarsi sometimes dark reddish orange; metasomal tergites, pygidium dark reddish orange to black; clypeus basally with pale appressed pubescence, hair above antennal fossae more dense, erect; pronotum with appressed, off-white pubescence; scutum with dense, off-white pubescence on margins, except antero-medially; scutal disc with dark coppery pubescence, except white on two antero-medial, longitudinal, lines, few scattered hairs between; upper one half of mesopleuron with sparse, whitish pubescence, lower one half nearly nude; metanotum, posterior face of scutellum with appressed, off-white pubescence; metasomal tergite I with white pubescence, except black antero-laterally, postero-medially or large transverse band on middle of disc, sometimes mixed with black on anterior face; tergite II with apical white hair band broadened laterally; tergites III, IV often interrupted or sinuate sublaterally; sternite V with a short, apical, dark brown to ferruginous fimbria; pseudopygidium about twice as broad as long; punctures of clypeus fine, dense, somewhat elongated longitudinally; those of vertex larger, more sparse medially, often separated by shining areas around ocelli; scutum scutellum, lower one half of mesopleuron with punctures varying from nearly contiguous to separated by slightly more than one puncture diameter; propodeal enclosure moderately rugose dorsally, finely rugose medially, minutely roughened otherwise; forewings with two or three submarginal cells, subhyaline basally, darker, more pubescent apically, veins ferruginous to black; flagellomere II as broad as long; vertex often with slight depressions lateral to lateral ocelli; axillae short, extending less than one half distance to posterior margin of scutellum, tips often blunt; scutellum usually weakly emarginate medially.

Male. Length 6 to 8 mm; forewing length 4 to 6 mm; Agrees well with description of female but differs as follows: flagellomeres broader than long; lower one half of mesopleuron often more densely punctured; pygidium often narrowed apically, sometimes acute, irregularly punctured; sternites IV, V bearing long, white to coppery hairs subapically, often darkened apically.

The following collections contain the types of this species: ANSP, americanus and montanus; UCR, asperatus; CAS, melectimimus; and NCSC, lanhami.

Diagnosis. E. americanus is separated in the key with barberiellus, brevicornus, mesillae, and politus. It can be differentiated from those species by the characters given in couplets 5 through 8 in the female key and couplets 9 through 12 in the male key.

Discussion. Cresson described americanus and montanus in 1878 and placed them in the genus Phileremus on the basis of two submarginal cells in the forewing. In 1904 Cockerell recognized americanus as an Epeolus, and in 1934 he placed montanus in Epeolus and considered it as being related to E. asperatus. E. asperatus and E. melectimimus were described as species with three submarginal cells. The second intercubital vein undergoes much variation in this species and also varies among individuals. The following specimens belong to a series from Sagehen, near Hobart Mills, Nevada County, California which was collected from June 18 to July 5, 1962: one female with three submarginal cells, a male and two females with two submarginal cells, and a male with the second intercubitus represented only by a stub on the left wing and absent on the right wing. Of two females

taken from Kaibab Forest, Arizona on August 9, 1936 one has three submarginal cells on the left wing and two on the right; the other has two submarginal cells on the left wing (right wing absent).. Three males from Grass Lake, Eldorado County, California taken on July 5, 1962 have two submarginal cells; a female from the same series has three. A male from Arroyo Seco Camp, Monterey County, California collected on May 11, 1958 has two submarginal cells; a male from the same area collected May 5, 1956 has three. The type of asperatus has two submarginals on one side and only the lower one half of the second intercubitus is present on the other (Cockerell 1934). The recently described E. lanhami (Mitchell 1962), which has two submarginal cells, is a synonym of this species. I have seen 85 specimens of this species, 36 of which have three submarginal cells, 42 have two, and seven express some form of intercubital vein irregularity.

Distribution. (fig. 7). This species occurs most commonly in western United States, but peripheral populations are in eastern United States and Canada, and southwestern Canada.

Biology. Unknown.

Epeolus artus Brumley, new species

Female (Holotype). (fig. 11). Length 9 mm; forewing length 8 mm; labrum black, slightly reddened laterally, apically; clypeus black; scape, pedicel reddish orange anteriorly, mahogany posteriorly; flagellomere I nearly entirely reddish orange, somewhat darker medially, others brownish mahogany anteriorly, except II reddish orange basally, reddish orange posteriorly, except nearly black apically; coxae black to dark mahogany; trochanters mahogany, except those of fore legs reddish orange;

femora reddish orange, except mahogany on dorsal strip on fore legs, outer surface, median bar on inner surface of mid and hind legs; tibiae, tarsi almost entirely reddish orange; thorax black; tegulae, pronotal lobes reddish orange; metasomal tergites black, apices clear; pygidium reddish orange, darkened centrally, marginally; clypeus basally, margins of antennal fossae with dense, plumose, subsilvery pubescence; frons, vertex with short, squamiform, golden haris intermixed with long, straight, golden hairs; pronotum, metanotum, scutellum laterally, ventrally with squamiform, yellowish pubescence; scutellum dorsally with few coppery, squamiform hairs and long, straight golden hairs; mesopleuron with a transverse, submedian band of dense, silvery pubescence, with sparse, coppery to silvery hairs below, only slightly denser above band; scutum with short to moderately long coppery pubescence, except yellowish on lateral, posterior margins, two antero-median, longitudinal bands; metasoma with tergite I yellowish, except black with coppery reflections antero-laterally, postero-medially, on apical margin, large, agaric-shaped mark on disc; tergites II, III, IV with broad, apical, yellowish fasciae, that on II somewhat expanded antero-laterally; tergite V with fascia broadly interrupted medially ;sternite V with a long, irregular, apical fimbria, hairs silvery apically, more coppery basally; pseudopygidium about three times broader than long, with silvery hairs extending beyond apex of tergite; clypeus with small, dense punctures, interspaces less than a puncture diameter; punctures of frons, vertex larger, coarser, more elongate; scutum finely rugoso-punctate, coarser laterally; scutellum mesopleuron more widely punctured, some interspaces nearly as large as one puncture diameter; propodeal enclosure moderately rugose dorsally, in a median vertical strip terminating in a deep, impunctate sulcus, finely, irregularly, transversely striate otherwise; remainder of posterior face of propodeum impunctate, shiny near enclosure, coarsely punctured laterally between oblique, poorly defined striae; forewings with three submarginal cells, darkened throughout, except clear just distad of third submarginal cell, nearly uniformly pubescent, veins ferruginous to mahogany; lateral areas of vertex elevated, producing angulate preoccipital ridge dorsally; antennae long, flagellomere II about two-thirds as broad as long; axillae promiment, joined to sides of scutellum for about three-fourths their entire length; scutellum with a broad, rather deep, median emargination; scutum slightly elevated laterad of parapsidal lines.

Male (Allotype). Length 9 mm; forewing length 7 mm; This sex agrees well with description of female but mandibles basally, scape, pedicel, flagellomeres entirely black, except flagellomere I reddish orange laterally; clypeus completely covered with dense, plumose, subsilvery pubescence; apical fascia of metasomal tergite I entire, that of II not expanded antero-laterally, those of III, IV, V, VI broad, entire; sternite III with a subapical row of

long, dense, silvery hairs, coppery apically; sternites IV, V with subapical rows of long, less dense, coppery hairs, darkened apically; pygidium dark reddish orange, blackened basally, laterally, narrow, median length nearly twice as great as basal width, truncate apically, with coarse, irregular punctures.

Type material. Holotype, allotype, 28 male, and five female paratypes: Santa Catalina Mountains, Pima County, Arizona, collected on the following dates; VII-18-54, VII-25-54, VIII-14-54, VIII-15-54, VIII-22-51, by the following collectors; G. D. Butler and F. G. Werner, G. E. Bohart and G. D. Butler, R. M. Bohart; one male paratype: Willow Creek, New Mexico, IX-3-33 (G. E. Bohart); one female paratype: Coyotes, Durango District, Mexico, VIII-8-47 (C.D. Michener, D. Rockefeller Exp.).

The holotype and allotype are on permanent loan from the University of Arizona and are deposited in the Snow-Entomological Museum, University of Kansas, Lawrence. Paratypes are deposited in the following collections: UA, CAS, KU, NCSC, and WBPL.

Diagnosis. Males of artus are separated in the key with australis (couplet 14) but they are not closely related to that species. E. artus more closely resembles compactus, minimus, and autumnalis. It can be separated from those species by the key characters (couplets 19, 21), by the more setose wings, and by puncturation and pubescence differences.

Discussion. Paratypes of artus vary little from the type, the only differences being in size, color, and pubescence patterns. Variation commonly found among the paratypes is as follows: Females; length 6.5 to 9 mm; forewing length 6.5 to 8.5 mm; mid and hind femora nearly entirely dark mahogany; apex of sternite

V reddish orange; flagellum reddish mahogany; apical fascia of metasomal tergite I entire; metasomal integument of Mexican specimen deep reddish mahogany. Males; length 7.5 to 9.5 mm; forewing length 7 to 8 mm; clypeus less pubescent, nearly nude; pubescence of pronotum, scutum, and metanotum more whitish.

Female sternite VI has the apical margin of the basal disc pointed medially and bears few, long, straight hairs. The apical arms of sternite VI are weakly arched and bear seven apical teeth. Male sternites VII and VIII fit the descriptions of several other species in the genus.

Distribution. (fig. 2). The known distribution of artus suggests that it is confined to a Sonoran environment. As yet only three localities have been recorded for this species, those being Santa Catalina Mountains, Santa Cruz County, Arizona, Willow Creek, New Mexico, and Coyotes, Durango District, Mexico.

Biology. Unknown.

Epeolus australis Mitchell

Epeolus australis Mitchell, 1962. N. C. Agric. Exp. Sta. Tech. Bull. no. 152, vol. II, p. 441.

Female. (figs. 12, 15). Length 7 to 9 mm; forewing length 5 to 6 mm; labrum black, often reddened medially; clypeus black; antennae reddish mahogany, somewhat more reddish on first three segments; legs reddish orange, except black to dark mahogany on coxae, occasionally faint marks on femora; pronotal lobes, tegulae reddish orange; scutum black with reddish lateral margins; axillae reddish orange to burnt red; scutellum nearly entirely dark reddish orange to black with reddish spots submedially; metasomal tergites black to dark mahogany, apices clear, except tergite V reddish orange apically; pygidium reddish orange; clypeus, margins of antennal fossae with appressed silvery pubescence

to nearly nude with few hairs apically; frons above, vertex with squamiform, subsilvery pubescence, few straight, semi-erect, faintly coppery hairs; pronotum, metanotum with dense, silvery to whitish pubescence; mesopleuron nearly nude ventrally, with only sparse, silvery pubescence, except white, squamiform on margins, two often poorly defined, antero-median, longitudinal lines; metasoma with tergite I with whitish pubescence, except black with coppery reflections on large, transverse band on disc; apical fascia on tergite II whitish, entire, with antero-lateral extensions forming acute angles within; fascia of tergites III, IV entire, that of V usually interrupted anterior to pseudopygidium; sternite V with a moderately long apical fimbria with a dark basal line, hairs coppery, of unequal lengths; pseudopygidium poorly defined, usually about twice as broad as long, silvery hairs extending beyond apex of tergite; clypeus with small, contiguous punctures, slightly elongate, more widely spaced laterally; frons above, vertex more coarsely punctured, interspaces about as large as one-half puncture diameter; scutum finely rugoso-punctate, punctures somewhat larger laterally; scutellum with slightly larger, more widely spaced punctures; mesopleuron densely punctured, few interspaces ventrally nearly as large as one puncture diameter; propodeal enclosure finely, irregularly, transversely striate medially, only slightly more coarsely striate dorsally; remainder of posterior face of propodeum often impunctate bordering enclosure, closely punctured laterally; forewings with three submarginal cells, subhyaline basally, darker apically, veins ferruginous to mahogany; frontal carina large and bulbous below, of a uniform height across its ventral width, occupying the entire space between antennal fossae; flagellomere II usually slightly more than three-fourths as broad as long; axillae prominent, often slightly arcuate on lateral margins, joined to sides of scutellum from two-thirds to three-fourths of their entire length; scutellum with a broad, rather shallow, median emargination.

Male. Length 6.5 to 8 mm; forewing length 5 to 6 mm; Much the same as female but differs as follows: flagellomere II short, slightly broader than long; frons, vertex, mesopleuron more densely pubescent; scutellum axillae often entirely black; sternites IV, V with subapical row of coarse, coppery hairs, often darkened apically; pygidium narrow, median length nearly twice as great as basal width, tapering apically, reddish orange, darker marginally, rather coarsely punctured.

The holotype and allotype are in the collection of T. B. Mitchell. Paratypes are in collections of T. B. Mitchell and R. R. Snelling.

Diagnosis. Males of australis run out in the key with artus but can be separated from that species by the key characters (couplet 14), by less setose wings, puncturation of propodeal enclosure, smaller size, and other differences. Females are separated in the key twice (couplets 4, 15). Flagellomere II is often nearly as broad as long and as a result australis runs out with species having short antennae. It can be differentiated from those species by the key characters. Some specimens have flagellomere II somewhat longer and are separated with bifasciatus and interruptus. E. australis differs markedly from these species in the frontal carina, pubescence, puncturation, absence of tubercles on frons, and absence of a metanotal tooth.

Distribution. (fig. 7). Mitchell (1962) recorded this species from North Carolina and Georgia. I have seen specimens from the following Texas localities: Kerrville, Kerr County; Odessa, Ector County; Pecos, Reeves County; and Eagle Pass, Maverick County.

Biology. Unknown.

Epeolus autumnalis Robertson

Epeolus autumnalis Robertson, 1902. Ent. News. 13:81.

Female. Length 8 to 10 mm; forewing length 6.5 to 7.5 mm; labrum, clypeus, scape, pedicel, flagellomere I mahogany to black, remaining flagellomeres dull, brownish mahogany; pronotal lobes, integument of metasoma mahogany to black; tegulae light reddish orange; legs dark reddish orange to mahogany, except apices of femora, tibiae, tarsi light reddish orange; thorax black, often mahogany on mesopleuron, sternum; pygidium dark reddish orange; clypeus nude or with few short, appressed, off-white hairs basally; lateral margins of antennal fossae with fairly dense, appressed,

off-white pubescence; vertex with few scattered, erect, white to coppery hairs; pronotum, posterior face scutellum, metanotum with appressed whitish to yellowish pubescence; scutum with weakly defined posterior, lateral margins of pale pubescence; scutal disc with coppery hairs, except two poorly defined, antero-median, longitudinal bands of off-white pubescence; mesopleuron with few, off-white hairs posterior to pronotal lobes, beneath tegulae, posterior margin, essentially nude otherwise; metasomal tergite I with dense whitish or yellowish pubescence, except black or mahogany antero-laterally, large transverse band on disc, often postero-medially; tergites II, III, IV with broad, yellow, apical hair bands broadened laterally; sternite V with a moderately long, golden to coppery apical fimbria; pseudopygidium poorly defined anteriorly, essentially flat in lateral view; punctures of clypeus fine, dense, more irregular laterally on apical margin, impunctate triangle medially on epistomal suture; frons above with larger, deeper, sparser punctures; vertex with coarse, dense punctures laterally; scutum, scutellum rugoso-punctate; mesopleuron with upper one half covered with small, dense punctures, lower one half more coarsely punctured, interspaces often more than a puncture diameter; propodeal enclosure weakly rugose dorsally, finely, irregularly, transversely striate medially; remainder of posterior face of propodeum with large, shallow punctures, often between widely spaced, oblique striae; forewings with three submarginal cells, subhyaline basally, darker apically, veins ferruginous to mahogany; antennae long, flagellomere II two thirds as broad as long; axillae long, nearly attaining posterior margin of essentially horizontal dorsal face of scutellum, slight concavity near base, carinate on lateral margin; scutellum with weak median emargination.

Male. Length 8 to 11 mm; forewing length 6.5 to 8 mm; Fits description of female in general but differs as follows: flagellomere II slightly more than two-thirds as broad as long; face often covered with appressed, silvery pubescence; upper one half of mesopleuron with uniform covering of sparse, silvery pubescence; sternites IV, V weakly emarginate medially, with a subapical row of long, yellowish to coppery, often black tipped hairs; pygidium broadly rounded apically, rugoso-punctate to sparsely punctured.

I have not seen the type of autumnalis, but T. B. Mitchell kindly loaned determined material from his collection.

Diagnosis. E. autumnalis is most similar to compactus but is less hairy, has carinate axillae, longer antennae, weakly emarginate sternites IV and V, and is somewhat larger.

Distribution. (fig. 6). This is primarily an Eastern species. Mitchell (1962) recorded it from Michigan to Maine and south to North Carolina. It does, however, extend as far west as Ashland, Saunders County, Nebraska.

Biology. The host has been questionably determined as Colletes compactus Cresson.

Epeolus barberiellus Cockerell

Epeolus barberiellus Cockerell, 1907. Entomologist. 4:266.

Female (Holotype). Length 6 mm; forewing length 6 mm; labrum reddish orange, apical teeth red; clypeus, scape mahogany; pedicel, flagellomeres reddish orange with apical borders lighter; thorax entirely mahogany; tegulae light reddish orange; legs coppery, except apices of femora, tibiae, tarsi light reddish orange; metasomal tergites reddish mahogany, apices clear, except V reddish orange; pygidium reddish with darkened margins; clypeus with appressed, whitish pubescence, more erect above antennal fossae; vertex with few erect, whitish hairs; pronotum, metanotum, scutal margins except antero-medially, posterior, lateral faces of scutellum with appressed, off-whitish pubescence; scutum with short, coppery hairs, except white on two-antero-median, longitudinal lines, few scattered hairs between; upper one half mesopleuron with appressed, off-white pubescence anteriorly, more sparse, erect posteriorly, lower one half nude; metasomal tergite I with off-white pubescence, except dark antero-laterally, postero-medially, short, transverse band on disc; tergite II with broad, off-white pubescence on apical band, slightly broadened laterally, interrupted medially; tergite III with a continuous fascia, somewhat sinuate sublaterally; tergite IV similar to III, except strongly constricted; sternite V with a short, golden, apical fimbria; clypeus with shallow, dense, irregular punctures; vertex with larger, more widely spaced punctures around ocelli, on posterior margin of head; finely, densely punctate between ocelli and compound eye; lower one half of mesopleuron with punctures often separated by slightly more than one puncture diameter, denser above; scutum, scutellum with punctures slightly denser than mesopleuron, separated by less than a puncture diameter; propodeal enclosure moderately rugose dorsally, finely rugose medially, nearly impunctate laterally; forewings with three submarginal cells, faintly pubescent apically, extremely clear basally, veins ferruginous; antennae short, flagellomere II

nearly as broad as long; vertex slightly concave laterad of lateral ocelli; axillae short, tips extending less than one half distance to posterior margin of scutellum, blunt; scutellum with but a weak median emargination.

The type is housed in the collection of UCR and was kindly loaned by P. H. Timberlake.

Diagnosis. E. barberiellus is probably conspecific with americanus as it can be separated from that species only by color differences. The only specimen available to me is the holotype; a larger series could perhaps indicate whether the two forms intergrade. It seems inadvisable at this time to reduce the name on the basis of the meager availabe evidence.

Distribution. (fig. 6). The holotype is from Mesilla Park, Dona Ana County, New Mexico.

Biology. Unknown.

Epeolus brevicornus Brumley, new species

Female (Holotype). (fig. 25). Length 7.5 mm; forewing length 5.5 mm; labrum mahogany, reddened apically; clypeus black; antennae reddish orange; slightly darker, brownish on apical flagellomeres; legs entirely reddish orange; thorax black, except reddish orange on pronotal lobes, tegulae, reddish mahogany on axillae; metasomal tergites dark mahogany, except reddish orange on V apically, apices clear; pygidium light reddish orange, darker on margins; clypeus nearly nude, few silvery hairs; frons with dense, appressed, silvery pubescence; vertex with sparse, silvery pubescence, except few coppery hairs behind ocelli; pronotum, metanotum with dense, appressed, whitish to silvery pubescence; scutum with short, simple, coppery hairs, except whitish on lateral, posterior margins, two antero-median, longitudinal, poorly delimited lines; scutellum with whitish pubescence on posterior face basally, few simple, coppery hairs on dorsal face; mesopleuron with dense, appressed, silvery pubescence above, nuder below with much integument visible; metasomal tergite I with off-white pubescence, except dark coppery postero-medially, large, transverse band on disc; tergites II, III, IV with off-white, apical fasciae entire, that on II expanded antero-laterally

to apex of tergite I; tergite V with moderately dense, silvery pubescence, except few dark hairs on a median longitudinal strip; sternite V with a long, irregular, silvery, apical fimbria; pseudopygidium on a subvertical plane, approximately three times broader than long, silvery hairs extending beyond apex of tergite; clypeus with shallow dense punctures medially, punctures, interspaces larger, more irregular laterally; frons above, vertex with large, deep punctures, some interspaces larger than a puncture diameter; vertex on posterior margin coarsely, closely punctate; scutum, scutellum rugoso-punctate, interspaces larger surrounding, anterior to parapsidal lines; mesopleuron rugoso-punctate, with large, small punctures, some interspaces as large as largest punctures; propodeal enclosure finely, irregularly striate, obliquely above, transversely below, only slightly coarser on dorsal margin; remainder of posterior face of propodeum impunctate, shiny bordering on enclosure, coarsely, closely punctate laterally; forewings with three submarginal cells, hyaline basally, more densely pubescent, darker apically, veins ferruginous to mahogany; metanotum with a slight median, transverse depression; flagellomere II broader than long; axillae short, extending slightly more than one half distance to posterior margin of scutellum, joined to sides of scutellum for nearly their entire length; scutellum with an extremely shallow median emargination.

Male (Allotype). Length 8 mm; forewing length 6 mm; Differs from holotype as follows: scape, pedicel with mahogany markings, flegellomeres darker, more mahogany; coxae nearly black basally; metasomal tergites black; vertex with entirely silvery pubescence; scutum with more whitish pubescence on anterior margin, between lines; scutum more uniformly rugoso-punctate; mesopleuron with interspaces smaller than larger punctures; scutellum with a slightly deeper median emargination; sternites IV, V with subapical row of long, coarse, coppery hairs; pygidium reddish orange, darker on margins, subtruncate apically, coarsely, closely punctate.

Type material. Holotype. Davis Mountains, Jeff Davis County, Texas, VII-10-42 (E. C. Van Dyke); one male paratype: same locality, IV-17-54 (R. H. Beamer); allotype: six miles northeast Douglas, Cochise County, Arizona, IV-16-61 (W. E. LaBerge); one female paratype: Loving, Eddy County, New Mexico, V-28-45 (J. W. MacSwain).

The holotype is in the collection of the CAS and the allotype is deposited in the collection of the UNSM. Paratypes are in the collections of UA and WBPL.

Diagnosis. On the basis of the short flagellomere II in both sexes and short, often blunt axillae, brevicornus is allied with mesillae, americanus, barberiellus, and politus. It is differentiated from those species by the sparsely punctate vertex, rugoso-punctate mesopleuron, small metanotal depression, and long, irregular, apical fimbria of female sternite V.

Discussion. The paratypes (one male and one female) agree in virtually all characters. Coloration and pubescence characteristics are remarkably uniform in the four specimens of brevicornus.

Distribution. (fig. 5). This species is known from only three localities, all being in southwestern United States.

Biology. Unknown.

Epeolus compactus Cresson

Epeolus compactus Cresson, 1878. Amer. Ent. Soc. Trans. 7:89.

Epeolus hitei Cockerell, 1908. Entomologist 41:60. New synonymy.

Epeolus gabrielis Cockerell, 1909. Ann. Mag. Nat. Hist. (8) 5:26. New synonymy.

Epeolus geminatus Cockerell and Sandhouse, 1924. Calif. Acad. Sci. Proc. 13(4):315.

Female. (figs. 13, 18, 24). Length 6 to 11 mm; forewing length 5.5 to 7.5 mm; labrum reddish orange to black, clypeus black; scape, pedicel, flagellomere I often reddish orange, remaining segments black to mahogany; pronotal lobes, tegulae light reddish orange; tibiae, tarsi reddish orange, coxae, trochanters, femora reddish orange to black or mahogany; metasomal tergites black, apices clear; pygidium light to dark reddish orange; clypeus basally, sometimes apically, with sparse, appressed, off-white pubescence, more dense around antennal foassae; vertex with sparse, erect, long, off-white hairs around ocelli; pronotum, metanotum, posterior face of scutellum with appressed whitish or yellowish pubescence; s c u t u m

with whitish or yellowish pubescence on lateral, posterior margins; scutal disc with sparse, white or pale coppery pubescence, two off-white, antero-median lines united posteriorly enclosing a black trangular area or with a quadrate patch of two broad, contiguous bands; mesopleuron nude or with scattered hairs ventrally, a dense, median band of appressed whitish pubescence, often sparsely hairy dorsally; metasomal tergite I with whitish or yellowish pubescence, except with black on a variable, transverse band on disc, postero-medially, often antero-laterally; tergites II, III, IV with apical whitish or yellowish hair band broadened laterally, often interrupted medially; sternite V with short golden or dark ferruginous fimbria; pseudopygidium about twice as broad as long; clypeus with fine, dense punctures, interspaces larger along apical margin; vertex with coarse, irregular punctures anteriorly, more dense posteriorly; scutum weakly rugose; scutellum slightly more coarsely punctured than scutum; lower one half of mesopleuron coarsely punctured, punctures often separated by more than one puncture diameter; propodeum moderately rugose dorsally, finely rugose medially, minutely roughened otherwise; forewings with three submarginal cells, with rather evenly spaced, erect hairs basally, strongly darkened apically, veins ferruginous to black; flagellomere II about two-thirds as broad as long; axillae prominent, pointed apically; not arcuate on lateral margins; scutellum with a broad, often deep, median emargination.

Male. Length 6 to 10 mm; forewing length 6 to 7 mm; Answers to description of female in general but flagellomere II nearly as broad as long; pygidium broadly rounded apically, reddish orange to black, flanged laterally, distally, irregularly punctured; sternites IV, V with subapical row of long, golden to coppery hairs, often darkened apically.

The type of compactus is in the collection of the ANSP, that of gabrielis is at UCR, and the geminatus type is housed at CAS. Four paratypes from the ANSP labeled as compactus are actually minimus.

Diagnosis. E. compactus is much like minimus and separation of the two is often difficult. However, the species can be differentiated by a combination of the characters listed in couplets 22 of the female key and 21 of the male key. Also, compactus usually has darker, more setose wings.

Discussion. E. hitei was described by Cockerell (1908) and separated from compactus by means of a dull second metasomal tergite and a red scape and base of flagellum. Both characters exhibit much variation and are not of constant value. E. gabrielis and geminatus were described on the basis of variations in color and scutal pubescence.

Distribution. (fig. 4). The range of compactus is predominantly west of the Rocky Mountains south of the Canadian border, but peripheral populations are in Indiana, Missouri, and Alberta.

Biology. This species was collected with Colletes sp. at Searchlight, Clark County, Nevada in May of 1964. E. mesillae was also taken in the same series.

Epeolus cretus Brumley, new species

Female (holotype). Length 6 mm; forewing length 4.5 mm; labrum dark mahogany, reddened medially; clypeus black; antennae mahogany on posterior face, median surface of scape, pedicel entirely, anterior face of apical flagellomeres, dull reddish orange otherwise; fore, mid legs reddish orange, except coxae, trochanters mahogany basally, mid tibiae slightly darker on outer face; hind legs mahogany, except reddish orange on a median, ventral strip on coxae, trochanters apically, femora marginally and apically on inner face, tarsi dark reddish orange; thorax black with inner mahogany reflections below, except reddish orange on pronotal lobes, tegulae, axillae, scutellum; metasomal tergites deep mahogany, nearly black, apices clear; pygidium reddish orange, much darker marginally; clypeus nearly nude, few silvery hairs above; frons with dense, appressed, silvery pubescence; vertex with few silvery hairs around ocelli, posteriorly on margin; pronotum, metanotum with dense, appressed, silvery to whitish pubescence; scutum with short, coppery hairs, except whitish on two antero-median, longitudinal lines, lateral margins around tegulae; scutellum sparsely pubescent with few black, coppery hairs; mesopleuron with dense, silvery pubescence above, on anterior face, nude below; metasomal tergite I with whitish

pubescence, except brownish with coppery reflections medially on anterior face, postero-medially, large, transverse band on disc; tergites II, III, IV with apical fasciae of whitish pubescence interrupted medially, that of II somewhat expanded anterolaterally, those of III, IV constricted sublaterally; tergite V with whitish patches extending anteriorly from lateral areas of pseudopygidium: sternite V with an apical fimbria darkened at base, hairs extending only slightly beyond apex of sternite, of slightly different lengths, more silvery laterally; pseudopygidium narrow, about three times broader than long, silvery hairs extending beyond apex of tergite; clypeus with small, dense, shallow punctures, few larger punctures, interspaces about as large as smallest punctures, larger laterally; punctures of frons, vertex larger, deeper, nearly contiguous, except interspaces as large as two to three punctures on upper mesal margins of compound eyes; scutum moderately rugoso-punctate, interspaces less than a puncture diameter; mesopleuron widely punctured, some interspaces as large as four to five punctures, more densely punctate above, anteriorly; axillae scutellum densely punctured, interspaces less than a puncture diameter, except somewhat larger on posterior face; propodeal enclosure moderately rugose dorsally, finely, irregularly, transversely striate medially; lateral areas of posterior face of propodeum closely, coarsely punctate; forewings with three submarginal, densely pubescent throughout, slightly darker apically, veins ferruginous to mahogany; inner margins of compound eyes slightly curved outwardly above antennal fossae; flagellomere II about three fourths as broad as long; axillae prominent, joined to sides of scutellum for about three-fourths their entire length; scutellum with a narrow, rather shallow, median emargination.

Male(Allotype). Length 6 mm; forewing length 4.5 mm; Much like female but differs as follows; labrum nearly entirely reddish mahogany; fore femora mahogany on a ventralstrip; hind legs with tibiae on inner face, tarsi reddish orange; axillae, scutellum on dorsal face, posterior face basally dark mahogany; clypeus, vertex slightly more pubescent; scutum pubescent on posterior margin; clypeus more uniformly punctate, lacking larger punctures; flagellomere II nearly as broad as long; sternites IV, V with subapical row of nearly black, long hairs, reduced medially; pygidium reddish mahogany basally, reddish orange apically, nearly black on margins, narrowed, nearly truncate apically, rugoso-punctate basally with rather elongated, irregular punctures apically.

Type material. Holotype and allotype: three miles west of Marana, Pima County, Arizona, IX-13-62 (J.C. Becquaert); one female paratype: Tucson, Pima County, Arizona, X-27-39 (R. H. Crandall).

The holotype is in the collection of the CAS, San Francisco, and the allotype is on permanent loan from the UA at Snow Entomological Museum, University of Kansas, Lawrence. The paratype is in the collection of the LACM.

Diagnosis. The position of cretus in the genus Epeolus is not certain. It resembles other species in several characters but can readily be separated by the widely punctured mesopleuron, slightly curved inner margins of the compound eyes, and pubescence and coloration characteristics.

Discussion. The holotype and allotype are very monomorphic, differing only in sexual characters and minor variations in color and pubescence; The female paratype from Tucson differs only in coloration. The labrum and clypeus are entirely reddish and the legs and antennae are a brighter reddish orange. The second intercubitus is interrupted on both wings of the paratype and cretus with two submarginal cells may eventually be collected.

Distribution. (fig. 1). The known distribution of E. cretus is restricted to Pima County, Arizona.

Biology. Unknown.

Epeolus crucis Cockerell

Epeolus crucis Cockerell, 1904. Ann. Mag. Nat. Hist., (7)13:89.

Epeolus novomexicanus Cockerell, 1912. Ann. Mag. Nat. Hist., (8) 10:487. New synonymy.

Epeolus rufulus Cockerell, 1941. Canad. Ent., 73:36. New synonymy.

Female. Length 7 to 8 mm; forewing length 5 to 6 mm; labrum reddish orange to mahogany; clypeus reddish orange apically;

antennae reddish orange to mahogany; thorax black, except reddish on pronotal lobes lateral margins on scutum, mesopleuron below, scutellum, axillae, laterally on posterior face of propodeum; metasomal tergites I, II reddish, remaining tergites often black or darkened; face with appressed, subsilvery pubescence around antennal fossae, sparser on frons, vertex; pronotum, metanotum with appressed, whitish pubescence; scutum with sparse subsilvery pubescence, denser on lateral margins, antero-medially; mesopleuron nearly nude, few hairs above; metasomal tergite I with whitish pubescence, except sparse, black pubescence on a large, transverse band on disc; tergites II, III, IV with apical whitish fasciae; tergite V with black hairs bordering pseudopygidium; sternite V with a moderately long, silvery, regular, apical fimbria; pseudopygidium approximately three times broader than long; clypeus with fine, contiguous punctures, somewhat elongate on apical margin; frons above, vertex with larger, coarser punctures; scutum, scutellum axillae, mesopleuron rugosopunctate, interspaces larger on mesopleuron below; propodeal enclosure rugose dorsally, finely, irregularly, transversely striate medially; lateral areas of posterior face of propodeum coarsely, closely punctate; forewings with three submarginal cells, hyaline, nearly nude basally, more pubescent apically, veins mahogany; flagellomere II about two-thirds as broad as long; preoccipital ridge terminates before joining hypostomal carina and is rounded at its dorsal margin behind compound eye; apical portion of metasomal tergites (underlying fasciae) weakly depressed; axillae distinctly arcuate on lateral margins and extend well beyond essentially horizontal dorsal face of scutellum, tips strongly bent away from sides of scutellum and finely pointed; scutellum with a narrow, rather deep, median emargination; metanotum with at most a small, median, blunt projection.

Male. Length 6 to 7 mm; forewing length 4 to 5 mm; Much the same as female but differs as follows: scutum, mesopleuron black to deep reddish mahogany, scutellum axillae black or red; face more densely pubescent, particularly clypeus; scutum, mesopleuron nearly uniformly pubescent; mesopleuron uniformly punctate below; flagellomere II approximately as broad as long; sternites IV, V with subapical rows of long, coppery to silvery hairs, reduced medially; pygidium reddish orange, broadly rounded apically, with large, widely spaced punctures.

The holotypes of crucis and novomexicanus are in the collection of UCR. The holotype of rufulus is deposited in the CUM.

Diagnosis. E. crucis most resembles ainsliei Crawford but can be distinguished from that species by the key

characters (couplets 10-12 in the female key and couplets 5-7 in the male key) and by the characters listed under the diagnosis of ainsliei.

Discussion. The types of crucis (female) and novomexicanus (male) are conspecific and were undoubtedly separated on the basis of sexual characters. The scutum and mesopleuron of the male are more pubescent and the scutellum and axillae are predominantely black, whereas the female is less pubescent and has reddish scutellum and axillae. The type of rufulus is a female and differs little from that of crucis.

Distribution. (fig. 3). This species has been recorded only from east of the Rocky Mountains extending from Southern New Mexico through Colorado into Kansas and Nebraska.

Biology. Unknown.

Epeolus ilicis Mitchell

Epeolus ilicis Mitchell, 1962. N. C. Agric. Exp. Sta. Tech. Tech. Bull. No. 152, p. 448.

Female. Length 6 to 9 mm; forewing length 5 to 6.5 mm; labrum mahogany; antennae black often with reddish orange markings on scape, flagellomere I; pronotal lobes reddish orange, somewhat darker anteriorly; tegulae reddish orange; thorax entirely black; legs varying from reddish orange to mahogany, except tarsi always reddish orange; metasomal tergites black, apices clear; pygidium mahogany, margins darkened; clypeus was thinned, silvery, appressed pubescence, longer, denser around antennal fossae; vertex with scattered, erect, silvery pubescence; pronotum, posterior margin of scutum, posterior face of scutellum with short, semi-erect, squamiform, silvery hairs; scutum with sparse, coppery pubescence, except two antero-median, longitudinal, widely spaced bands of silvery hairs; metanotum with appressed, silvery pubescence; upper one half of mesopleuron with appressed, silvery pubescence, more dense medially, lower one half nearly nude; metasomal tergite I with appressed, silvery pubescence, except black antero-laterally, antero-medially, postero-medially, large transverse band on disc; tergites II, III, IV with narrow, apical, silvery, fasciae, broadened laterally, often interrupted medially; tergite V with two broad, apical silvery fasciae lateral to pseudopygidium, sternite V with a short, golden or coppery apical fimbria; pseudopygidium campanulate

more than one third as long as tergite, about as broad as long; clypeus densely punctured, faintly wrinkled; punctures of frons, vertex larger, widely separated medially, smaller, denser laterally; mesopleuron with irregular punctures, separated by less than one puncture diameter, interspaces somewhat shining, reticulate; scutal punctures more regular, not as coarse as mesopleuron; scutellum deeply, coarsely rugoso-punctate; propodeal enclosure finely regose dorsally, medially, minutely roughened laterally; forewings with three submarginal cells, yellowish basally, somewhat darker apically, veins ferruginous to mahogany; flagellomere II slightly more than two-thirds as broad as long; axillae prominent, tips distinctly free from sides of scutellum; scutellum with a deep, median emargination.

Male. Length 6 to 8 mm; forewing length 5 to 7 mm; Agrees well with description of female but flagellomere II nearly as broad as long; pygidium mahogany, narrowly to broadly rounded apically, apical flange clear testaceous, apex nearly impunctate; sternites IV, V with only sparse, short, golden or silvery hairs subapically, occasionally absent.

The holotype and allotype are in the collection of T. B. Mitchell.

Diagnosis. E. ilicis most closely resembles lectoides, as it agrees in the large, campanulate pseudoypgidium, the form of the axillae and scutellum, and pubescent markings. It can be separated from that species by its smaller size, absence or reduction of subapical rows of hairs on male sternites IV and V, and by differences in the puncturation of the scutum and mesopleuron.

Distribution. (fig. 5). Mitchell (1962) recorded this species from northeastern and southeastern United States. Additional localities are Lee and Fayette Counties, Texas.

Biology. Unknown.

Epeolus interruptus Robertson

Epeolus interruptus Robertson, 1900. Trans. Acad. Sci. St. Louis. 10:55.

Female. Length 7 to 10 mm; forewing length 6 to 8 mm; labrum black or mahogany, lateral margins usually with some reddish color; clypeus black; scape, pronotal lobes, tegulae clear reddish orange; pedicel, flagellomere I occasionally mahogany, remaining flagellomeres usually dull, brownish mahogany, reddish orange otherwise; coxae, trochangers, femora, tibiae black or mahogany to reddish orange, tarsi always reddish orange; scutellum, axillae reddish orange to burnt red, often bordered with black; scutum black, except often burnt red on antero-lateral corners; mesopleuron black, except often with dark red markings on a median, transverse, dorsally arcuate band, or as small, median areas on anterior, posterior margins; integument of metasoma black or mahogany, apices of tergites clear; pygidium dark reddish orange; clypeus with few, scattered, appressed, silvery hairs; antennal fossae bordered with dense, appressed, silvery pubescence; vertex with sparse, erect, short, coppery or silvery pubescence, hairs longer near upper mesal margins of compound eyes; postero-medial margins of head with irregular border of semi-erect, densely plumose, silvery hairs; pronotum, posterior face of scutellum, metanotum medially, upper one half of mesopleuron, lateral margins of posterior face of propodeum with appressed, whitish pubescence; scutum with short, coppery hairs, except whitish or yellowish pubescence on lateral, posterior margins, two antero-medial, longitudinal, clavate lines; metasomal tergite I with whitish or yellowish pubescence, except black antero-laterally, antero-medially, postero-medially, large, transverse band on disc; tergites II, III, IV with whitish or yellowish apical fasciae broadened laterally, often interrupted medially; sternite V with apical fimbria of long, coppery to silvery hairs of unequal lengths; pseudopygidium short, about three times broader than long, with silvery hairs extending well beyond apex of tergite; clypeus with small, shallow, dense punctures, lateral margins largely impucntate; frons, vertex rugoso-punctate, except punctures more widely spaced near upper mesal margins of compound eyes; scutum, scutellum finely to moderately rugoso-punctate; lower one half of mesopleuron with interspaces from twice as large as average puncture diamter to about as large; propodeal enclosure moderately rugose dorsally, finely, transversely, irregularly striate medially; remainder of posterior face of propodeum with a narrow, impunctate band bordering lateral margins of enclosure, finely, shallowly rugoso-punctate otherwise; forewings with three submarginal cells, subhyaline basally with many short, erect hairs, darker, more pubescent apically, veins mahogany; labrum often depressed longitudinally between apical tubercles; flagellomere II nearly three fourths as broad as long; axillae short, pointed apically; scutellum with a broad, median emargination; metanotum with a blunt, median tooth.

Male. Length 7 to 10 mm; forewing length 6 to 8 mm; Much the same as female but differs as follows: flagellomere II

nearly as broad as long; sternite III with long, whitish, semi-erect, apical hairs laterally, IV, V with row of long, golden, subapical hairs; pygidium broader at base, broadly rounded to subtruncate apically, black to burnt red, with shallow, elongate punctures.

I have not seen the type of this species, but several determined specimens were made available to me.

Diagnosis. The position of interruptus in the genus Epeolus is not clear, but it seems to indicate relationships with bifasciatus. However, it can be differentiated from that species by the absence of tubercles on the frons, clavate lines on the scutum, and less coarsely punctured mesopleuron, scutum, and vertex.

Distribution. (fig. 9). This species is predominantly Midwestern but has been recorded from Manitoba, West Virginia, Georgia and southwestern United States and Mexico.

Biology. E. interruptus is perhaps a parasite of Colletes aestivalis Patton.

Epeolus lectoides Robertson

Epeolus lectoides Robertson, 1901. (fig. 26). Canad. Ent. 33:231.

Epeolus semilectus Cockerell, 1907. Entomologist. 40:136.

Female. Length 7.5 to 9 mm; forewing length 7 to 7.5 mm; labrum dark reddish orange to black; scape, pedicel, flagellomere I with combinations of reddish orange, mahogany, remaining flagellomeres dull brownish; legs reddish orange to mahogany; thorax black; pronotal lobes black or dark red basally, reddish orange apically; tegulae clear reddish orange; axillae dark reddish orange to black; scutellum black often with deep, reddish undertones; metasomal tergites black to dark mahogany, shining through sparse, black pubescence, apices clear; pygidium dark coppery; clypeus, frons with short, appressed, silvery pubescence, somewhat

denser on frons; vertex nearly nude, except few long, erect, straight, silvery hairs anterior, lateral to ocelli; postero-median margin of head; pronotum, metanotum with dense, appressed, whitish subsquamiform pubescence; mesopleuron with rather sparse, silvery hairs dorsally, fewer hairs, nearly nude ventrally; scutum with short, erect, silvery hairs, except silvery squamiform on lateral, posterior margins, two antero-median, longitudinal lines; metasomal tergite I with whitish pubescence, except black antero-laterally, postero-medially, large, transverse band on disc; tergites II, III, IV with narrow, white, apical fasciae broadened laterally, interrupted medially; tergite V with two broad, white patches lateral to pseudopygidium; sternite V with a short, coppery to silvery, apical fimbria; pseudopygidium campanulate, about one-third as long as tergite, elevated from rest of tergite, nearly as long as broad, with silvery hairs extending beyond apex of tergite; clypeus minutely rugoso-punctate medially, punctures smaller, shallower laterally, frons, vertex more coarsely punctured, with large, shining impunctate areas between compound eyes and ocelli, small, dense punctures between lateral ocelli; scutum, scutellum coarsely rugoso-punctate, interspaces often larger than average puncture diameter; mesopleuron with large, widely spaced punctures, separated by two or three puncture diameters; propodeal enclosure finely rugose dorsally, finely, irregularly, transversely striate medially; remainder of posterior face of propodeum impunctate, shining, with fine, oblique, irregular striae; forewings with three submarginal cell, fulvous basally, darker apically, veins mahogany; flagellomere II nearly two-thirds as broad as long; axillae long, nearly attaining posterior margin of essentially horizontal dorsal face of scutellum, distinctly free from sides of scutellum, tapered apically; scutellum usually with a deep, median emargination.

Male. Length 6 to 8 mm; forewing length 6 to 8 mm; In general, agrees with description of female but differs as follows: flagellomere II more than three-fourths as broad as long; pygidium dark red to black, broadly to moderately rounded apically, with shallow, irregular punctures; apical row of hairs on sternites IV, V golden to coppery basally, often darker apically; antennae, axillae, scutellum often entirely black; lower one half of mesopleuron with punctures often only one puncture diameter apart.

I have not seen the type of *lectoides*, but T. B. Mitchell has kindly loaned me determined material. The type of *semilectus* is housed in the collection of the USNM.

Diagnosis. *E. lectoides* is most similar to *ilicis* but can be distinguished by the characters listed under the diagnosis of that species.

Distribution. (fig. 4). This species is primarily confined to eastern United States, extending from New York to Georgia. I have one specimen from Sheldon, North Dakota.

Biology. Unknown.

Epeolus lobus Brumley, new species

Female (Holotype). Length 6 mm; forewing length 5 mm; labrum dark mahogany; clypeus black; scape mahogany, except small yellow mark at base; flagellomeres brownish mahogany, I somewhat lighter; coxae, trochanters dark mahogany basally, reddish orange to yellowish at apices; fore legs reddish orange, except mahogany on femora basally, ventrally, tibiae slightly darker near apices; middle and hind legs mahogany, except coppery reddish orange on femora apically, tibiae, tarsi; thorax black, except coppery reddish orange on pronotum dorsally, tegulae, axillae, scutellum; metasomal tergites black, except reddish orange to ferruginous under fasciae, apices clear; pygidium reddish orange, slightly darker marginally; clypeus nearly nude, few simple, silvery hairs with squamiform hairs; frons with dense, appressed, silvery pubescence, few coppery hairs above; vertex sparsely pubescent, mixture of coppery, silvery hairs posteriorly on margin, between ocelli, few hairs antero-lateral to ocelli; pronotum with rather sparse, silvery, coppery pubescence, except black medially; metanotum silvery laterally, black medially; scutellum with silvery hairs, except mixture of black, coppery basally on posterior face, subsilvery on a median longitudinal strip, few black hairs on posterior, dorsal faces; scutum with primarily coppery pubescence, except silvery on two antero-median, longitudinal lines, antero-lateral extensions of lines becoming long, simple, erect at corners, black anteriorly between lines; mesopleuron with dense, appressed, silvery pubescence above, nude below; metasomal tergite I with subsilvery pubescence, except brownish gray medially on anterior face, laterally on margins, postero-medially, somewhat agaric shaped mark on disc; tergite II with apical fascia of subsilvery pubescence narrowly interrupted medially, with a large patch of pubescence antero-laterally; tergites III, IV with apical fasciae of subsilvery pubescence narrowly interrupted medially, deeply constricted sublaterally on apical margins; tergite V with pubescent patches extending anteriorly from lateral margins of pseudopygidium; sternite V with a moderately long apical fimbria of silvery hairs of unequal lengths; pseudopygidium narrow, about four times broader than long, with rather coarse, silvery hairs extending well beyond apex of tergite; clypeus irregularly punctured with large and small punctures, interspaces larger than small punctures,

becoming larger laterally; frons above, vertex widely punctured, interspaces as large as three to four punctures; scutum moderately rugoso-punctate, interspaces larger submedially near posterior border; mesopleuron widely punctured, some interspaces as large as three to four punctures; scutellum punctate only on median emargination, borders, punctures closer than a puncture diameter; axillae with only few punctures basally, impunctate apically; propodeal enclosure moderately rugose dorsally, finely, transversely, irregularly striate medially; remainder of posterior face of propodeum coarsely, closely punctate; forewings with three submarginal cells, densely pubescent throughout, much darker apically, veins ferruginous to mahogany; vertex laterally with large, impunctate, shining, tubercles; vertex behind ocelli elevated, swollen; flagellomere II slightly longer than broad; frontal carina small, not bulbous below; axillae prominent, nearly straight on lateral margins, joined to sides of scutellum for about two-thirds their entire length, at most only slightly concave on inner apical margins; scutellum with a rather narrow, shallow, median emargination.

Male (Allotype). Length 7 mm; forewing length 5.5 mm; This sex is much the same as the female but differs as follows: fore legs with trochanters lighter, femora mahogany only on a ventral strip, tibiae uniformly reddish orange; frons with entirely silvery pubescence; dark pubescence of metasomal tergites with coppery reflections; clypeus more regularly punctate with punctures nearly of same diameter; scutellum with few punctures on posterior, dorsal faces; flagellomere II slightly broader than long; axillae not concave on inner apical margins; scutellum with a deeper median emargination; sternites IV, V with subapical row of hairs not reduced medially, silvery apically, slightly coppery basally; pygidium reddish orange, darkened marginally, basally, slightly narrowed, subtruncate apically, with rather deep, dense, punctures.

Type material. Holotype: 14 miles southwest of Apache, Cochise County, Arizona, VIII-4-61 (J.G. Rozen); allotype: Dewey, Yavapai County, Arizona, VII-2i-56 (Butler and Gerhardt).

The holotype is deposited in the collection of the AMNH, New York. The allotype is on permanent loan from the UA at the Snow Entomological Museum, University of Kansas, Lawrence.

Diagnosis. This species shows close affinities with torus Brumley. These species are separated on the basis of punctuation of the mesopleuron, shape of the frontal carina, and

concavity of the axillae in couplets three of both male and female keys. Other differences are: widely spaced punctures on upper frons and vertex of lobus; irregularly punctured clypeus of female lobus; male pygidium of torus with punctures of different diameters; reduction of subapical rows of hairs medially on sternites IV and V of male torus; and relatively impunctate axillae and scutellum of both sexes of lobus. Also, minor differences in coloration and pubescent markings are present. E. lobus and torus occur in the arid Southwestern part of the United States and are obviously closely related. Intermediates may eventually be discovered.

Discussion. E. lobus and torus differ quite markedly from other Epeolus occurring within the United States, particularly in the form of the vertex. A subgeneric separation may eventually be required.

Distribution. (fig. 1). E. lobus is known only from the type localities, namely central and southern Arizona.

Biology. Unknown.

Epeolus mesillae (Cockerell)

Phileremus mesillae Cockerell, 1895. Psych. 7 (sup.):10.

Epeolus mesillae palmarum Linsley, 1939. Pan-Pac. Ent. 15(1):2.

Female. (fig. 22). Length 5.5 to 8.5 mm; forewing length 4 to 6 mm; labrum black, often reddened laterally, apically, or entirely reddish orange; clypeus black; antennae reddish orange on anterior face, usually mahogany on posterior face; legs reddish orange, except black on femora proximally, often coxae, trochanters; thorax black, except pronotal lobes, tegulae reddish orange;

metasomal tergites black to mahogany, apices clear, except V reddened apically; pygidium reddish orange; clypeus, at least basally, frons with extremely dense, silvery, appressed pubescence; vertex with silvery to coppery, semi-erect hairs long anterior, lateral to, between ocelli, short on posterior margin; pronotum, metanotum with dense, whitish pubescence, scutellum with white, coppery pubescence, less dense on dorsal face; mesopleuron with dense, silvery, appressed pubescence, often with coppery hairs medially, dorsally, occasionally nearly nude medially; scutum with long, appressed, coppery hairs, except white on posterior, lateral margins, two short, antero-median, longitudinal lines; metasomal tergite I with whitish pubescence, except dark to light coppery on wide to narrow, transverse band on disc; tergites II, III, IV with apical whitish bands broadened laterally, coppery otherwise; tergite V with whitish pubescence anterior, lateral to pseudopygidium; sternite V with an extremely long, golden to silvery, apical fimbria, extending well beyond apex of sternite; pseudopygidium elevated from rest of tergite, about twice as broad as long, with silvery hairs extending well beyond apex of tergite; clypeus with punctures small, shallow, dense; punctures of frons larger, shiny interspaces evident; vertex often with shiny, impunctate areas lateral to lateral ocelli, punctures about one-half a puncture apart, often obliquely elongated antero-lateral to lateral ocelli; scutum scutellum, mesopleuron closely, shallowly punctured, interspaces less than average puncture diameter; axillae with larger, deeper, more widely spaced punctures; propodeal enclosure finely rugose dorsally, finely, irregularly, obliquely striate dorso-medially, transversely striate ventrally; remainder of posterior face of propodeum with shallow, widely spaced punctures, two to three puncture diameters apart, very dense, compact laterally, or enclosure a narrow, median, longitudinal, striate strip separated from lateral punctures by a broad, shiny, impunctate area; forewings with two submarginal cells, hyaline throughout, only slightly darkened apically, veins ferruginous to black; antennae short, flagellomere II nearly as broad as long; axillae short, extending less than one-half distance to posterior margin of scutellum, blunt apically; scutellum with a deep or narrow median emargination.

Male. Length 4.5 to 8 mm; forewing length 3.5 to 6 mm; This species exhibits more sexual dimorphism than perhaps any other species. The male differences can be described as follows: flagellomere II often broader than long; scutum often without coppery hairs, with uniform, long, silvery pubescence, antero-median lines poorly defined; metasomal fasciae usually distinctly pronounced, discs with little pubescence, or if discs pubescent then primarily silvery, rarely coppery; scape, pedicel black, flagellomeres mahogany, except I often reddish orange; striae of propodeum often entirely transverse; sternites III, IV, V with long, golden to silvery, subapical rows of hairs; pygidium reddish

orange to black, with deep, elongate punctures apically, fewer, round punctures basally, or uniformly punctured with large, deep punctures.

The holotype and allotype of Epeolus mesillae palmarum are in the collection of the CAS.

Diagnosis. E. mesillae belongs to the group of species (americanus, barberiellus, politus, and brevicornis) with short antennae in both sexes and short, often blunt axillae. It can be differentiated from those species by the characters listed in couplets six through eight of the female key and couplets nine through twelve in the male key.

Discussion. Cockerell (1895) described mesillae in the genus Phileremus because of the two submarginal cells. In 1934 he correctly placed it in Epeolus. Linsley (1939) described palmarum as a subspecies of mesillae from southern California, which he said differs as follows: larger, 7.5-8 mm. as compared to 5.5-6 mm; metasomal bands less distinctly defined; dark areas of tergites clouded with white pubescence. I do not recognize this subspecies because the differences in the fasciae are primarily sexual, the females having less distinct fasciae; "clouded" and "non-clouded" forms have been taken from southern California and eastern Arizona; and finally, there is much size variation in mesillae, but it is irrespective of geographical localities.

Distribution. (fig. 2). E. mesillae is confined to the deserts of southwestern United States. Northern extensions are central Nevada and Utah; the easternmost locality is Big Bend National Park, Texas.

Biology. The host of this species is not known but it has been collected with Colletes sp. at Searchlight, Clark County, Nevada. E. compactus was also taken in the same series.

Epeolus minimus (Robertson)

Triepeolus minimus Robertson, 1902. Ent. News. 13:81.

Epeolus beulahensis Cockerell, 1904. Ann. Mag. Nat. Hist., (7) 13:40. New synonymy.

Epeolus olympiellus Cockerell, 1904. Ann. Mag. Nat. Hist., (7) 13:41. New synonymy.

Epeolus tristicolor Viereck, 1905. Canad. Ent., 37:20. New synonymy.

Epeolus humillimus Cockerell, 1918. Ann. Mag. Nat. Hist., (9) 1:160. New synonymy.

Epeolus lutzi Cockerell, 1921. Amer. Mus. Novitates, 23:16. New synonymy.

Epeolus rufomaculatus Cockerell and Sandhouse, 1924. Proc. Calif. Acad. Sci., 13(4):314. New synonymy.

Epeolus rubrostictus Cockerell and Sandhouse, 1924. Proc. Calif. Acad. Sci., (13(4):318. New synonymy.

Epeolus arciferus Cockerell, 1924. Proc. Calif. Acad. Sci., 13(4):319. New synonymy.

Epeolus arciferus Cockerell, 1924. Proc. Calif. Acad. Sci., 13(4):319. New synonymy.

Epeolus pilatei Cockerell, 1924. Proc. Calif. Acad. Sci., 13(4):320. New synonymy.

Epeolus eastwoodae Cockerell, 1937. Pan-Pac. Ent., 13:149. New synonymy.

Female. Length 5.5 to 10 mm; forewing length 4 to 8 mm; labrum reddish orange to black; clypeus deep reddish mahogany to black, occasionally with reddish orange apical margin; antennae dull brownish to black, except scape, pedicel, flagellomere I often reddish orange; coxae, trochanters black to mahogany, rarely reddish orange, femora, tibiae, tarsi varying from black or

mahogany, often with apices reddish orange, to entirely reddish orange; pronotal lobes, tegulae black to reddish orange; thorax black to deep reddish mahogany; metasomal terga black to deep reddish mahogany, apices clear; pygidium reddish orange to coppery; clypeus, frons below with appressed, silvery pubescence; frons above, vertex with sparse, long, erect coppery to silvery hairs, posterior margin of head, occasionally vertex with shorter, erect, often squamiform, coppery to silvery pubescence; pronotum, metanotum, posterior face of scutellum with dense, appressed, off-white to yellowish pubescence; mesopleuron dorsally with silvery to yellowish, often rather shaggy pubescence, ventrally with fewer hairs or nearly nude; scutum with short, semi-erect, coppery hairs, except off-white to yellowish on posterior, lateral margins (often enlarged at corners), two antero-median, longitudinal lines, often converging posteriorly or connected by a transverse band, or scutum nearly uniformly pubescent; metasomal tergite I with whitish to yellowish pubescence, except black with coppery reflections antero-laterally, often postero-medially, large, transverse band on disc; tergite II with an apical whitish to yellowish band, often interrupted medially, with a broad, antero-lateral lobe (rarely lacking); tergites III, IV with apical, rather undulate whitish to yellowish bands, occasionally interrupted sublaterally; tergite V with subsilvery to yellowish pubescence lateral, often anterior to pseudopygidium; pseudopygidium about twice as broad as long, slightly elevated from rest of tergite; sternite V with a long, apical fimbria of coppery, silvery hairs; clypeus with small, shallow, dense punctures, often larger, more irregular on lateral margins; frons above, vertex finely to moderately rugoso-punctate, often with shiny, impunctate area lateral to lateral ocellus, often with larger punctures, large shiny interspaces on frons sublaterally; scutum finely to moderately rugoso-punctate, interspaces occasionally more than one puncture diameter; scutellum, axillae moderately to coarsely rugoso-punctate; mesopleuron rugoso-punctate, finer, denser dorsally, coarser with larger interspaces ventrally; propodeal enclosure moderately rugose dorsally, finely to moderately, transversely, irregularly striate medially; remainder of posterior face of propodeum finely rugoso-punctate laterally, widely spaced, shallow punctures often with few oblique striate medially; forewings with three submarginal cells (rarely two), marginal cell occasionally subtruncate, appendiculate, hyaline, only slightly darkened apically, veins ferruginous to black; flagellomere II nearly three fourths as broad as long; metanotum varying from completely flat to moderately creased medially; axillae varying from small, blunt to large, distinctly pointed apically; scutellum with a shallow to deep median emargination.

Male. Length 5.5 to 9 mm; forewing length 4.5 to 7 mm; Agrees well with description of female but differs as follows: flagellomere II nearly as broad as long; face and mesopleuron often more densely pubescent; scutum often uniformly pubescent; subapical hairs of sternites IV, V silvery to coppery, often

darkened apically; pygidium subtruncate to broadly rounded apically, reddish orange to black, with large, deep punctures apically, often shallower basally.

The collection of the CAS contains the holotypes of rufomaculatus, rubrostictus, arciferus, pilatei, and eastwoodae. The holotypes of beulahensis and olympiellus are in the collection of the USNM; the holotype of humillimus is in the collection of UCR, and the tristicolor holotype is in the collection of the ANSP.

Diagnosis. E. minimus is most similar to compactus and can be differentiated principally by the key characters (couplet 22 of female key and couplet 21 of male key).

Discussion. E. minimus is a highly variable species which occurs throughout much of western and central United States and Canada. There is also much variation within a given locality. Several infraspecific groups can be recognized, most of which have been names, but they are poorly defined and cannot logically or consistently be separated. Further study may indicate that they are distinct, but I prefer to consider them as conspecific. A brief discussion of the infraspecific variants may be of value. A coastal Californian type (arciferus and pilatei) has more yellowish, somewhat shaggy pubescence, the tegulae are black or mahogany basally and reddish orange apically, the metanotum has a small, transverse crease beneath a slightly protuberant median shelf, the axillae are large, and the scutellum usually has a broad, rather deep emargination. An insular Californian type from San Miguel Island (eastwoodae)

differs from the coastal form only in the short axillae and the narrow, shallow emargination of the scutellum. A series of specimens taken from the high Sierras near Lake Tahoe, California are characterized by their much smaller size and the extremely flat metanotum. No name has been given to this group. A Cascade type, extending from Northern California through Oregon, Washington, often British Columbia, and as far north as Fairbanks, Alaska can often be recognized by a slight, median crease on the metanotum, large size, intermediate sized axillae, and the somewhat sparser, whiter pubescence. The names olympiellus, humillimus, rufomaculatus and rubrostictus have been applied to this group. Some specimens from British Columbia (tristicolor) are large, black, with yellowish pubescence, a deep scutellar emargination, and usually a fairly distinct metanotal crease, and are often quite similar to specimens from Utah and Idaho. Many specimens from Manitoba, Minnesota, Michigan, and North Dakota (minimus) can be recognized by the flat metanota, more reddish mahogany metasomal tergites, the entirely reddish orange legs, and the dense, yellowish pubescence. This form overlaps with a Nebraskan type (no name) which has a flat metanotum, deep reddish tergites and thorax, and is only slightly larger than the Sierran type. A Rocky Mountain form from Wyoming, Colorado, and Northern New Mexico (beulahensis and lutzi) is characterized by dense, yellowish pubescence on the head and thorax, broad metasomal fasciae, relatively flat metanotum, and entirely reddish orange legs. A few specimens from Big Bear Lake, San

Bernadino County, California may be southern extensions of the Sierran type.

It should be reiterated that these infraspecific segregates are not clearly defined and all members of a given locality do not share the features characteristic of that particular area.

Distribution. (fig. 8). This species is found throughout much of western and central United States and Canada. It extends from Fairbanks, Alaska to San Bernadino County California and east to Cheboygan County, Michigan.

Biology. Colletes eulophi Robertson has been recorded as a host of this species.

Epeolus politus Brumley, new species

Female (holotype). (fig. 20). Length 8 mm; forewing length 6.5 mm; labrum, clypeus black; scape, pedicel, flagellomere I reddish orange, remaining flagellomeres brownish mahogany, basal ones lighter at apical margins; legs mahogany, except lighter, more reddish orange on tibiae, tarsi; thorax black, except reddish orange on pronotal lobes, tegulae; metasomal tergites black, except reddish orange under fasciae, on lateral margins, apically on tergite V; pygidium light reddish orange, darker marginally; face with sparse, subsilvery pubescence on clypeus, becoming denser, more silvery on frons, particularly above antennal fossae; vertex with squamiform hairs on posterior margin, long, simple, silvery hair bordering, between ocelli, behind squamiform hairs on posterior margin; prototum with dense, appressed, yellowish pubescence, except silvery medially, on lobes; metanotum with dense, silvery pubescence (scraped medially); scutum with sparse, short, subsilvery, nearly uniform pubescence on anterior one half, slightly sparser posteriorly, lateral, posterior margins with longer, denser, more defined pubescence, antero-medially with a poorly defined quadrate patch of subyellowish pubescence; scutellum with dense, silvery pubescence on posterior face basally, much sparser on dorsal face; mesopleuron with rather sparse, nearly uniform pubescence of subsilvery hairs, denser, more silvery on a submedian, transverse band; metasomal tergite I with dense, subsilvery pubescence, except yellow on a broad, apical fascia, dark coppery on a narrow,

irregular, median band on disc; tergites II, III, IV with broad, yellow fasciae, discs dark coppery, silvery to subsilvery laterally; tergite V with uniform, subsilvery pubescence proximal to pseudopygidium; sternite V with a long, apical fimbria with hairs silvery with faint, golden reflections, forming an even, regular margin at apex; pseudopygidium on a subvertical plane, not flat, about four times broader than long, narrowing laterally' clypeus with shallow, dense punctures, interspaces about one half a puncture diameter, few larger punctures interspersed; punctures of frons, vertex of about same density as clypeus, slightly deeper, interspaces somewhat larger around ocelli; scutum moderately rugoso-punctate, punctures larger anteriorly; mesopleuron rugoso-punctate, largest interspaces slightly larger than a puncture diameter; axillae, scutellum closely, coarsely punctate; propodeal enclosure rugose dorsally, finely, irregularly, transversely striate medially; posterior face of propodeum bordering enclosure with large, shiny, impunctate areas with few coarse, oblique striae, coarsely granulate with few punctures on lateral margins; forewings with three submarginal cells, subhyaline pubescent basally, darker, more densely pubescent apically, especially distad of marginal cells, veins ferruginous to mahogany; metanotum with a slight, median, transverse crease; flagellomere II as broad as long; axillae short, extending less than one half distance to posterior margin of scutellum, joined to sides of scutellum for nearly their entire length; scutellum with a narrow, rather shallow, median emargination.

Male (Allotype). Length 8.5 mm; forewing length 7 mm; Differs from female as follows: scape black, pedicel, flagellomeres very dark mahogany, nearly black; legs black, except reddish orange on apical tarsomeres; pronotal lobes nearly black; tegulae coppery; vertex with entirely simple hairs, lacking squamiform pubescence; metanotum, scutellum with coppery pubescence mdeially; scutum with short, coppery hairs, except silvery on lateral, posterior margins, yellowish on an antero-median, quadrate patch; some interspaces of clypeus as large as one puncture diameter; frons above rugoso-punctate; vertex finely, closely punctate; marginal cell strongly appendiculate; flagellomere II broader than long; sternites IV, V with subapical rows of long, dense, coppery hairs, lighter laterally; pygidium coppery reddish orange, darkened marginally, slightly narrowed, subtruncate apically, punctures uniform, dense basally, becoming larger, more elongate, irregular apically.

Type material. Holotype: Tucson, Pima County, Arizona, V-27-62 (F. D. Parker and L. A. Stange); allotype and one female paratype: mouth of Bear Canyon, Santa Catalina Mountains,

Pima County, Arizona, III-29-64 (F.G. Werner); three male paratypes: Sahuarita, Pima County, Arizona, V-2, 8-57 (G. Butler and F. G. Werner); two female paratypes: Tucson Mountains, Pima County, Arizona, V-29-57 (F. G. Werner and G. Butler); two male paratypes: Aguirre Lake, Pima County, Arizona, V-5-63 (M. L. Noller); one male paratype: five miles south Ray, Pinal County, Arizona, IV-5-61 (J. C. Bequaert); one male paratype: two miles east Tanque Verde, Pima County, Arizona, III-14-54 (F.G. Werner); one female paratype: Canelo, Santa Cruz County, Arizona, V-18-57 (G. Butler); one female paratype: Alpine, Brewster County, Texas, V-29-52 (M. Cazier, W. Gertsch, and R. Schrammel); one female paratype: eight miles south Santa Ana, Sonora, Mexico, V-11-58 (R. C. Bechtel and E. I. Schlinger).

The holotype is on permanent loan from UCD and is deposited in the CAS. The allotype is on permanent loan from UA to KU. Paratypes are deposited in the following collections: AMNH, UCB, LACM, UA, WBPL, CAS, KU, and NCSC.

Diagnosis. E. politus belongs to the group of species having very short axillae and flagellomere II of both sexes as broad as or broader than long. Besides politus this group includes mesillae, brevicornus, americanus, and barberiellus. E. politus can be distinguished from other species in the group by combinations of the following characters: submedian areas of posterior face of propodeum with large, shiny, impunctate areas with few coarse, oblique striae; metanotum with a median, transverse crease; long, coppery to silvery, apical fimbria

of female sternite V; quadrate patch of yellowish pubescence antero-medially on scutum; broad, yellow metasomal fasciae; and puncturation differences.

Discussion. The paratypic series of 13 specimens varies little from the holotype and allotype. The primary differences being in coloration and pubescence. The following variation is commonly demonstrated among the paratypes: labrum and clypeus reddened at site of their union, flagellomeres brownish mahogany, pronotal lobes reddish to black, tegulae coppery, male pygidium light reddish orange to mahogany, clypeus, scutum slightly more pubescent, and scutellum often weakly emarginate.

Distribution. (fig. 3). This species has been recorded from southern Arizona and Texas and northern Mexico.

Biology. Unknown.

Epeolus pusillus Cresson

Epeolus pusillus Cresson, 1864. Proc. Ent. Soc. Phila., 2:393.

Female. Length 6 to 9 mm; forewing length 4 to 6.5 mm; labrum black to reddish orange; clypeus black to reddish mahogany; antennae bright reddish orange to partially reddish orange on scape, pedicel, flagellomere I, with remaining flagellomeres brownish mahogany; pronotal lobes, tegulae, legs bright reddish orange, except coxae, trochanters occasionally mahogany; thorax black, except often reddish on mesopleuron, lateral, apical margins of axillae; metasomal terga black to reddish orange under black, appressed pubescence; pygidium reddish orange; clypeus, frons with varying amounts of silvery, appressed pubescence; squamiform pubescence sparse, off-white to coppery on vertex, more dense on pronotum, posterior face of scutellum, metanotum, lateral margins of posterior face of propodeum; mesopleuron with appressed, silvery pubescence dorsally, less pubescent ventrally, often nearly nude; off-white scutal pubescence varying from uniformly pubescent to bands on posterior, lateral margins with

two antero-median, longitudinal bands, often contiguous with pubescence of lateral margins, often extending nearly to posterior margin of scutum; metasomal tergite I with whitish or yellowish pubescence, except black antero-laterally, large, transverse band on disc: tergite II with subapical, whitish or yellowish fascia, broadened antero-laterally forming an angle of less than 90 degrees with subapical fascia; tergites III, IV with yellowish or whitish, apical or subapical fasciae; tergite V with subsilvery pubescence anterior, lateral to pseudopygidium; sternite V with a long, golden to silvery, apical fimbria; pseudopygidium about one and one half times broader than long; clypeus finely, densely punctate; frons, vertex, scutum, scutellum moderately rugoso-punctate; mesopleuron moderately rugoso-punctate dorsally, interspaces often slightly larger than a puncture diameter, punctures often finer, denser ventrally; propodeal enclosure moderately rugose dorsally, finely, transversely, irregularly striate medially; remainder of posterior face of propodeum finely rugoso-punctate; forewings with three submarginal cells, rarely two, hyaline to subhyaline basally, more pubescent, darker apically, veins dark ferruginous to mahogany; labrum often with weak, longitudinal carinae extending from subapical tubercles; preoccipital ridge gradually rounded dorsally, transverse depression behind compound eye lacking; flagellomere II nearly two-thirds as broad as long; axillae large, extending slightly beyond essentially horizontal dorsal face of scutellum, arcuate on outer margins; scutellum with a weak median emargination.

Male. Length 6 to 9 mm; forewing length 4 to 6 mm; This sex agrees well with description of female but differs as follows: flagellomere II three-fourths as broad as long; clypeus often densely pubescent; mesopleuron often uniformly pubescent; subapical hairs of sternites IV, V sparse, golden to silvery; pygidium large, reddish orange, with few, shallow punctures.

The holotype of pusillus is in the collection of the ANSP.

Diagnosis. E. pusillus bears closest affinities with scutellaris Say but can be distinguished from that species by the key characters (couplets 11 and 12 in the female key and couplets six and seven in the male key). Also, scutellaris lacks the antero-lateral extensions of pubescence on tergite II, the thorax and face are much less pubescent, the legs, particularly the hind femora, often bear mahogany markings, and flagellomere II of the males is nearly as broad as long and in the females it is about three-fourths as broad as long.

Discussion. A series of specimens taken from Great Basin populations, primarily Utah, differ from other members of the species. These populations are characterized by the red or reddish orange labrum, clypeus, antennae, mesopleuron, and metasomal segments. The pubescence is longer, more silvery, metasomal fasciae are broader, and the scutum often has a broad, antero-median patch of pubescence or is uniformly pubescent. Also, specimens taken from Southern Texas average smaller than other members of the species.

Distribution. (fig. 5). E. pusillus extends throughout most of the United States. Peripheral locations are Oswego County, New York, Collier County, Florida, Cameron County, Texas, and Kern County, California.

Biology. Colletes americanus Cresson has questionably been determined as a host of pusillus. Also, G. E. Bohart collected pusillus at a nesting site of C. deserticola Timberlake (?) near Myton, Utah in 1958. P. F. Torchio (1965) observed pusillus entering nests of C. ciliatoides Stephen (determined W. P. Stephen) near Delta, Utah. In his examination of several hundred ciliatoides cells only three parasitic larve were found, a first instar, a third instar, and a predefecating fourth instar. All three died before they could be reared. Mr. R. A. Nielsen and I visited the ciliatoides nesting site in the fall of 1964. A few adult parasites were observed, and several cells were excavated. A dark-eyed pupa of pusillus was found and preserved.

Epeolus scopulus Brumley, new species

Female (Holotype). Length 9 mm; forewing length 7 mm; labrum black, reddened apically; clypeus black; antennae dark brownish mahogany, except reddish orange on scape basally, apically, pedicel, flagellomere I apically, black on scape medially; legs nearly black, except reddish orange on coxae, trochanters, femora apically, tibiae, tarsi entirely; thorax black, except dark reddish orange, almost coppery on pronotal lobes, tegulae; metasomal tergites black, except dark reddish orange laterally on I, apically on V; pygidium light reddish orange, darker on margins; clypeus nearly nude, few silvery hairs above; frons with dense, silvery pubescence, longer, more erect above antennal fossae; vertex with long, simple hairs anterior, between ocelli, squamiform pubescence laterally, on posterior margin; pronotum with dense, silvery to whitish pubescence, narrowed medially; metanotum (scraped medially), posterior face of scutellum basally with dense, silvery to whitish pubescence; scutum with short, sparse, coppery, simple hairs, except whitish squamiform on lateral, posterior margins, two antero-median, longitudinal, poorly delimited lines with few hairs between; scutellum, axillae nude on dorsal faces; mesopleuron with dense, whitish pubescence above, nuder below with integument visible; metasomal tergite I with whitish pubescence, except black with coppery reflections postero-medially, large, nearly rectangular, transverse band on disc; whitish, apical fasciae of tergites II, III interrupted medially, narrowed or sinuate sublaterally, notched postero-medially; tergite V with rather sparse, silvery to whitish pubescence over reddish orange integument; sternite V with a long, apical fimbria, hairs silvery with coppery reflections, of nearly uniform lengths; pseudopygidium poorly defined, about three times broader than long, rather fine, silvery hairs extending slightly beyond apex of tergite; punctures of clypeus shallow, nearly contiguous medially, larger, more widely spaced laterally, with a large impunctate area laterally on epistomal suture; frons above with punctures coarser, deeper, larger; vertex rugoso-punctate, punctures small, except between ocelli, impunctate shiny area lateral to lateral ocelli; scutum densely rugoso-punctate, punctures, interspaces somewhat larger anteriorly; mesopleuron rugoso-punctate, interspaces about one half a puncture diameter, coarser, denser above; axillae, scutellum with coarse, nearly contiguous punctures; propodeal enclosure rugose dorsally, finely, irregularly, transversely striate medially; remainder of posterior face of propodeum shiny, impunctate bordering enclosure, closely, coarsely punctate laterally; forewings with three submarginal cells, hyaline basally, sparsely pubescent, darker, more pubescent apically, veins ferruginous to mahogany; flagellomere II about three-fourths as broad as long; metanotum with a distinct median, transverse depression lying beneath an overhanging ledge; axillae long,

acute, joined to sides of scutellum for about two-thirds their entire length, apices slightly bent away from scutellum; scutellum with a narrow but deep, median emargination giving a bilobed appearance.

Male (Allotype). Length 8 mm; forewing length 6.5 mm; Much the same as female but labrum mahogany, not reddened apically; antennae entirely brownish mahogany; legs as in female, except tibiae darker on outer surfaces; pronotal lobes black; face, mesopleuron more densely pubescent; clypeus lacking impunctate area laterally on epistomal suture; mesopleuron more densely punctured, interspaces smaller than one half a puncture diameter; posterior face of propodeum punctate on borders of enclosure; forewings only slightly darker apically, veins nearly entirely ferruginous; flagellomere II nearly as broad as long; sternites IV, V with subapical rows of long, rather coarse, coppery hairs, silvery laterally; pygidium reddish mahogany, nearly black on margins, subtruncate apically, with shallow, rather elongate punctures.

Type material. Holotype, five male and five female paratypes: 17 miles north Sparks, Washoe County, Nevada, IX-2-57 (E. G. Linsley); eight female and three male paratypes: Walker Pass, Kern County, California, IX-21-26-57 (E. I. Schlinger, J. C. Hall); Allotype: Antioch, Contra Costa County, California, IX-7-39 (no collector data); three male paratypes: same locality, IX-10-47 (P.D. Hurd); one female paratype: same locality, IX-9-38, (E. C. Van Dyke); one female paratype: same locality, X-2-38 (G. E. Bohart); two male paratypes: same locality, IX-10-36 (G. E. and R. M. Bohart); one female paratype: Oakely, Contra Costa County, California, IX-5-37 (E. C. Van Dyke); one male paratype: Boca, Nevada County, California, VI-19-62 (R. M. Bohart); one female paratype: Purdy, Washoe County, Nevada, IX-6-57 (E. G. Linsley); one male paratype: Upper Santa Ana River, San Bernadino County, California, IX-22-46 (G. H. and J. L. Sperry); one female paratype: Bodie, Mono County, California, IX-21-58

(A. S. Menke and L. A. Stange); one male paratype: Morongo, San Bernadino County, California, IX-27-44 (A. L. Melander); one female paratype: Riverside, Riverside County, California, X-7-34 (P. H. Timberlake); one male paratype: same locality and collector, IX-22-34 (?); one male paratype: Prairie City, Grant County, Oregon, VIII-12-29 (H. A. Scullen); one female paratype: 14 miles east Mitchell, Wheeler County, Oregon, VIII-13-29 (H. A. Scullen); one male paratype: Hereford, Baker County, Oregon, VIII-10-29 (H. A. Scullen).

The holotype is on permanent loan from UCB and is deposited in the CAS. The allotype is in the collection of the LACM. Paratypes are deposited in the following collections: LACM, CAS, UCD, KU, UCR, WBPL, UA and NCSC.

Diagnosis. E. scopulus shows closest affinities to minimus (Robt.). However, the depressed metanotum, long, acute axillae, and strongly emarginate scutellum of scopulus distinguish the species.

Discussion. The paratypic series exhibits some variation, particularly in peripheral populations. Specimens from Riverside County, California are often more pubescent, wings are subhyaline, and the male pygidium is more strongly narrowed apically. Northernmost representatives of the species (Grant, Wheeler, and Baker Counties, Oregon) have slightly shorter axillae, less pronounced scutellar emargination, and smaller metanotal ledge. Minor color variations occur on the labrum, clypeus, antennae, pronotal lobes, and male pygidia of several specimens. Size appears to be relatively constant throughout the range.

Distribution. (fig. 1). E. scopulus has been collected primarily from central California, but peripheral localities include southern California and east-central Oregon.

Biology. Unknown.

Epeolus scutellaris Say

Epeolus scutellaris Say, 1824. In Keating, Narr. Long's 2nd Exped., v. 2, p. 355.

Epeolus vernoniae Cockerell, 1907. Entomologist. 40:136.

Female. Length 7 to 9 mm; forewing length 6 to 7.5 mm; labrum reddish orange to black; clypeus black or dark mahogany; antennae brownish mahogany, except scape, pedicel, flagellomere I often with reddish orange markings; legs reddish orange, often with mahogany markings on coxae, trochanters, femora; thorax black to reddish mahogany, except pronotal lobes, tegulae, scutellum, axillae, antero-lateral corners of scutum often reddish orange; metasomal tergites black to mahogany or reddish orange; clypeus with short, sparse, silvery hairs, or often nude; antennal fossae bordered by dense, silvery, appressed pubescence; vertex with few, erect, silvery hairs; pronotum posterior face of scutellum, metanotum with sparse to dense, off-white, squamiform pubescence; mesopleuron dorsally, lateral margins of posterior face of propodeum with sparse to dense, subsilvery hairs, nearly nude ventrally; scutum with erect coppery to silvery hairs, except white on all margins, two antero-median, longitudinal lines, hairs diffuse between median lines and antero-lateral margins of scutum, or with scutum weakly pubescent to nearly nude; metasomal tergite I with white to yellowish pubescence, except black antero-laterally, large, transverse band on disc; tergite II with apical fascia often slightly broadened laterally; tergites III, IV with fasciae broadened laterally; tergite V with sparse pubescence anterior, lateral to pseudopygidium; sternite V with a long, golden to silvery apical fimbria; pseudopygidium nearly twice as broad as long; clypeus finely, closely punctate, punctures somewhat elongate at apex, interspaces larger laterally; frons, vertex, scutum, scutellum, mesopleuron moderately rugoso-punctate, interspaces rarely larger than average puncture diameter; propodeal enclosure moderately rugose dorsally, finely, irregularly, transversely striate medially; remainder of posterior face of propodeum finely, closely rugoso-punctate laterally, nearly impunctate medially with few shallow punctures between irregular, oblique striae; forewings with three submarginal cells, subhyaline basally, more pubescent, darker

apically, veins dark ferruginous to mahogany; labrum often with pronounced longitudinal, carinae extending from subapical tubercles; preoccipital ridge elevated, angulate dorsally forming a transverse depression behind compound eye; flagellomere II about three-fourths as broad as long; axillae large, extending beyond posterior margin of essentially horizontal dorsal face of scutellum, arcuate on outer margins; scutellum with a deep, often broad, median emargination.

Male. Length 6 to 8 mm; forewing length 5 to 7 mm; Much the same as female but differing as follows: flagellomere II nearly as broad as long; face, mesopleuron often more densely pubescent; antennae often entirely mahogany; sternites IV, V with subapical rows of long, dense, golden to coppery hairs, often darkend apically; pygidium large, narrowed apically, reddish orange to mahogany, widely, shallowly punctured.

I have not seen the holotype of E. scutellaris, and do not know where it is housed.

Diagnosis. E. scutellaris is similar to pusillus but can be separated from that species by the characters given in couplets 11 and 12 of the female key and couplets six and seven in the male key and by the characters listed in the diagnosis of pusillus.

Discussion. Mitchell (1962) synonymized vernoniae Cockerell with scutellaris. I have seen determined vernoniae and agree with Mitchell's treatment. In scutellaris, as in pusillus, the western representatives are characterized by the brighter reddish orange, particularly on the labrum, antennae, mesopleuron, anterolateral corners of the scutum, propodeum, legs, and metasomal segments. Also, the western forms are more pubescent, and the metasomal fasciae are broader.

Distribution. (fig. 6). E. scutellaris is primarily an eastern species, being found from New England to North Carolina. Its distribution extends northward into Quebec, Canada, and it

has been recorded as far west as Utah. Mitchell (1962) recorded it from Texas.

Biology. The biology of scutellaris in unknown.

Epeolus torus Brumley, new species

Female (Holotype). Length 7 mm; forewing length 5.5 mm; labrum dark mahogany; clypeus black; scape yellowish basally, laterally, mahogany otherwise; flagellomeres brownish mahogany, except I slightly yellowish laterally; coxae, trochanters nearly black basally, lighter apically; forelegs entirely reddish orange; midlegs reddish orange, except mahogany on ventral surface of femora, basitarsi; hindlegs mahogany, except reddish orange on femora apically, tibiae, tarsi; thorax black, except pronotum dorsally, tegulae, axillae, scutellum almost coppery reddish orange; metasomal tergites black, apices clear, somewhat reddish under fasciae, more reddish mahogany on apical segments; pygidium reddish orange, darker marginally; clypeus nearly nude, with only sparse, simple, silvery hairs; frons below with dense, appressed, silvery pubescence; frons above, vertex on posterior margin, interocellar area with coppery pubescence; pronotum with rather sparse, silvery pubescence intermixed with few coppery hairs, except black medially; metanotum silvery laterally, black medially; scutellum with silvery pubescence, except black on ventral margin of posterior face, with few hairs extending dorsally, coppery on a median, longitudinal strip; scutum primarily with coppery pubescence, except silvery on two antero-median, longitudinal lines, black anteriorly between lines, mixture of coppery and silvery hairs antero-laterally, becoming long, simple, erect at corners; mesopleuron densely pubescent above with silvery, coppery hairs, nude below; metasomal tergite I with off-white pubescence, except nearly nude laterally, an agaric shaped mark of brownish gray pubescence on disc; tergites II, III, IV with off-white, apical fasciae interrupted medially, deeply constricted sublaterally on III, IV; tergite V with pubescent patches extending anteriorly from lateral margins of pseudopygidium; sternite V with a moderately long apical fimbria of silvery hairs of unequal lengths; pseudopygidium narrow, about four times broader than long, with rather coarse, silvery hairs extending well beyond apex of tergite; clypeus rather coarsely punctured with interspaces about as large as one half a puncture diameter, larger on lateral margins; punctures of frons larger, deeper; vertex widely punctured with some interspaces larger than one puncture diameter; scutum moderately rugoso-punctate, interspaces somewhat larger around parapsidal lines; mesopleuron coarsely, deeply punctured, some interspaces

as large as two puncture diameters; punctures of axillae, scutellum large, often separated by one puncture diameter; propodeal enclosure moderately rugose dorsally, finely, irregularly, transversely striate medially; lateral areas of posterior face of propodeum coarsely, closely punctate; forewings with three submarginal cells, densely pubescent throughout, much darker apically, veins ferruginous to mahogany; vertex laterally with large, impunctate, shiny tubercles; vertex behind ocelli elevated, swollen; flagellomere II slightly broader than long; frontal carina rather bulbous below, gradually inclined from antennal fossae, not uniformly flattened across its ventral width; axillae prominent, slightly acruate on lateral margins, joined to sides of scutellum for two-thirds their entire length, strongly concave on inner apical margin; scutellum with a rather narrow, shallow, median emargination.

Male (Allotype). Length 5.5 mm; forewing length 4.5 mm; Differs from the female as follows: pronotum, axillae, scutellum slightly more coppery; frons with entirely silvery pubescence; scutellum with but few black hairs; scutal pubescent markings poorly defined, with a greater mixing of coppery and silvery hairs; metasomal tergite I with a diamond shaped mark on disc; tergites II, III, IV with apical fasciae only narrowly interrupted medially; sternites IV, V with subapical rows of silvery to coppery hairs, pronounced laterally, nearly absent medially; clypeus with slightly larger, deeper punctures; pygidium dark mahogany basally, reddish orange apically, slightly narrowed, broadly rounded apically, with large,deep punctures basally, smaller more compact punctures apically.

Type material. Holotype: Southmost, Cameron County, Texas, VI-13-53 (Univ. Kans. Mex. Expedition); allotype: Ben Bolt, Jim Wells County, Texas, V-12-52 (M. Cazier, W. Gertsch, and R. Schrammel).

The holotype is in the collection of the AMNH and the allotype is in the collection of the Snow Entomological Museum at KU.

Diagnosis. E. torus is similar only to E. lobus Brumley. Both these species differ markedly from all other Epeolus in the United States and may eventually require a subgeneric separation. E. torus can be distinguished from lobus on the basis of the key characters (couplets three of both male and female

keys) and the characters listed under the diagnosis of *lobus*.

Distribution. (fig. 3). The distribution of *E. torus* is known only from the type localities, both in southern Texas.

Biology. Unknown.

Triepeolus Described as *Epeolus*

During the course of this study several "*Epeolus*" holotypes have been seen (primarily by G. E. Bohart) which are actually *Triepeolus*. Only three of these occur within the confines of this study, but I have included others in hopes that workers may be benefited. Synonyms previously listed in the Synoptic Catalogue of Hymenoptera of America North of Mexico have not been included.

1. *lectiformis* Ckll., Colo., USNM
2. *piscatoris* Ckll., South. Calif. Is., CAS
3. *scelestus* Cress., Texas ANSP
4. *aztecus* Cress., Mex., ANSP
5. *mexicanus* Cress., Mex., ANSP
6. *rufoclypeus* Fox, Jamaica, ANSP
7. *rugulosus* Ckll., Canal Zone, ANSP
8. *virginiensis* Ckll., Va., ANSP
9. *cameroni* Meade-Waldo, nom. nov. for *bifasciatus* Cameron, Mex., BMNH
10. *rufotegularis* Ashm., West Indies, BMNH

UNEXAMINED SPECIES

Epeolus mercatus Fabricius

Epeolus mercatus Fabricius, 1804. Systema Piezatorum, p. 389.

This species is probably *Triepeolus* but until type material is examined it should still be regarded as *Epeolus*. Forty-three specimens determined as *mercatus* are all *Triepeolus*. Fabricius' description is extremely short and could apply to many species of Epeolini. Mitchell (1962) suggested it would apply to *T. pectoralis* (Robt.) or *E. pusillus* Cress. Cresson (1864) stated he had not seen *mercatus* but thought it intermediate between *E. lunatus* Say and *E. donatus* Smith (both *Triepeolus*); he also indicated that Smith recorded it in the British Museum of Natural History. In 1878 Cresson redescribed *mercatus* based on ten specimens from Virginia, Georgia, and Texas and said they were probably the true *mercatus*. One insect label from the Academy of Natural Sciences at Philadelphia records *mercatus* as being synonymous with *T. cressoni* Robt., however, the author's name on the label is illegible. The two specimens in the British Museum of Natural History by Smith were kindly loaned by I. H. Yarrow. These specimens are obviously *Epeolus* and are probably *ilicis* Mitch.; however, they are larger than any *ilicis* known to me. Perhaps the name *mercatus* should not be used until positive identification can be made.

Epeolus pilosulus Provancher

Epeolus pilosulus Provancher, 1888. Addit. Corr. Faune Ent. Ent. Canada Hym., p. 426.

The type locality is Cap Rouge, Canada, an area that I was unable to locate on any map. I have seen neither the original description nor any determined material.

Epeolus lectus Cresson

Epeolus lectus Cresson, 1878. Amer. Ent. Soc. Trans., 7:88.
Epeolus agnatus Cresson, 1878. Amer. Ent. Soc. Trans., 7:88.

The holotype of lectus is a female and that of agnatus a male. E. agnatus was synonymized by Robertson in 1902. G. E. Bohart examined and sketched for me both holotypes in 1964 and agreed with Robertson's treatment. E. lectus is probably conspecific with ainsliei and would thus have priority. However, it may break down the crucis-ainsliei differences. The axillae and scutellum appear similar to those of crucis but the apical portions of the metasomal tergites are depressed, particularly in the male. Harold J. Grant Jr. has kindly examined the preoccipital ridge characters and reports that the ridge terminates before joining the hypostomal carina (suggesting relationships with crucis) but the dorsal region of the ridge behind the compound eye indicates an angulation (characteristic of ainsliei). Clarification will have to await re-examination of type material.

SUMMARY

This paper consists of a systematic revision of the bee genus Epeolus in western America north of Mexico. It is primarily intended to clarify systematics within the genus Epeolus, but brief discussions of biology and tribal relationships are included.

Previous to this paper 35 species had been described from western North America. An alteration of previous synonymies and revision of existing forms have resulted in the treatment of two subgenera containing 22 species which are described in detail.

Seven new species are described: Epeolus artus, E. brevicornus, E. cretus, E. lobus, E. politus, E. scopulus, and E. torus.

DISTRIBUTION MAPS

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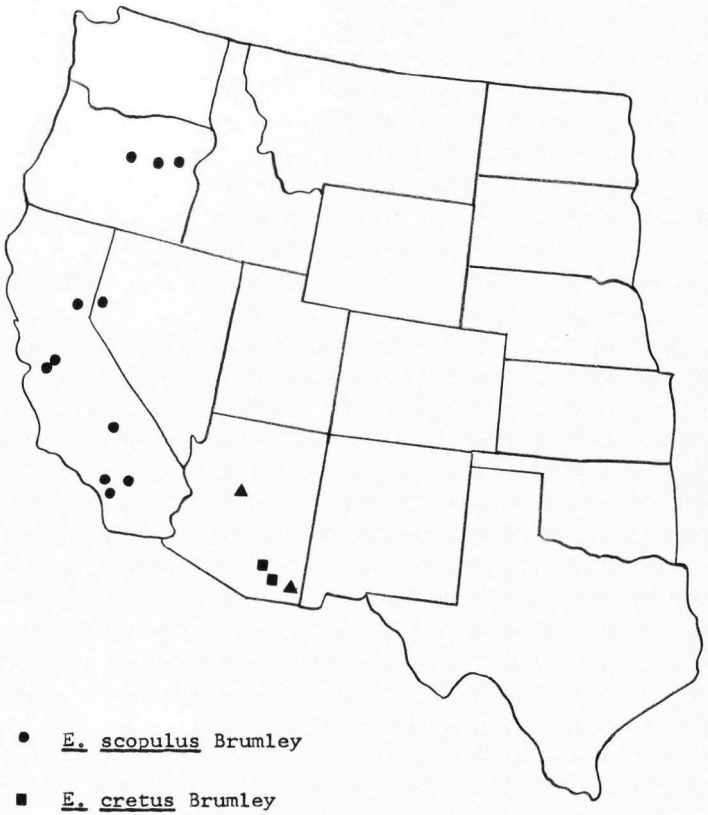


● *E. scopulus* Brumley

■ *E. cretus* Brumley

▲ *E. lobus* Brumley

Figure 1

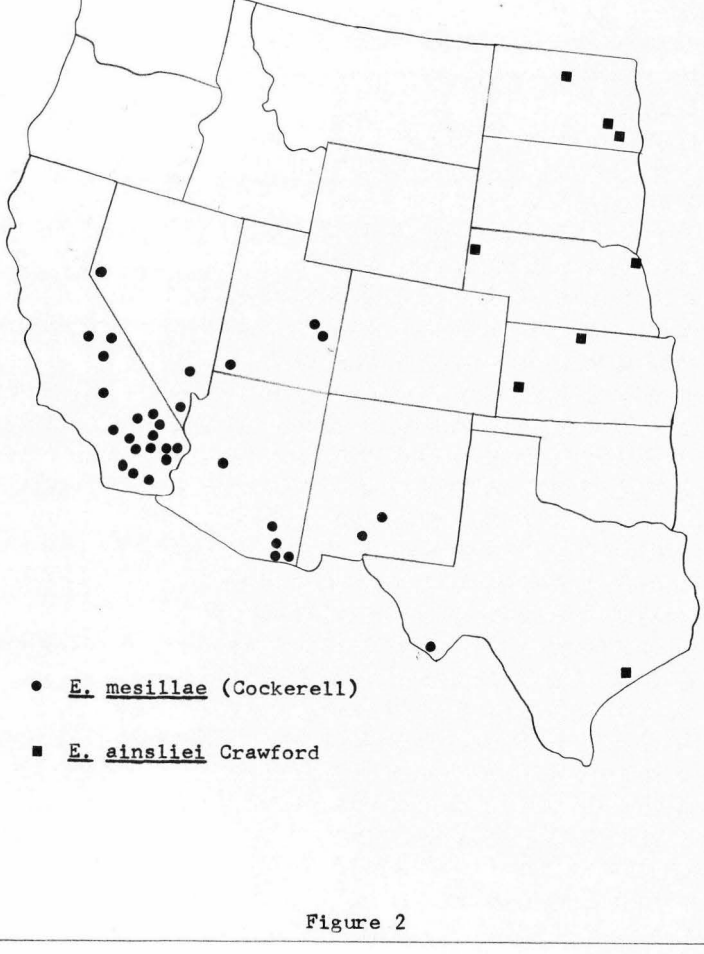
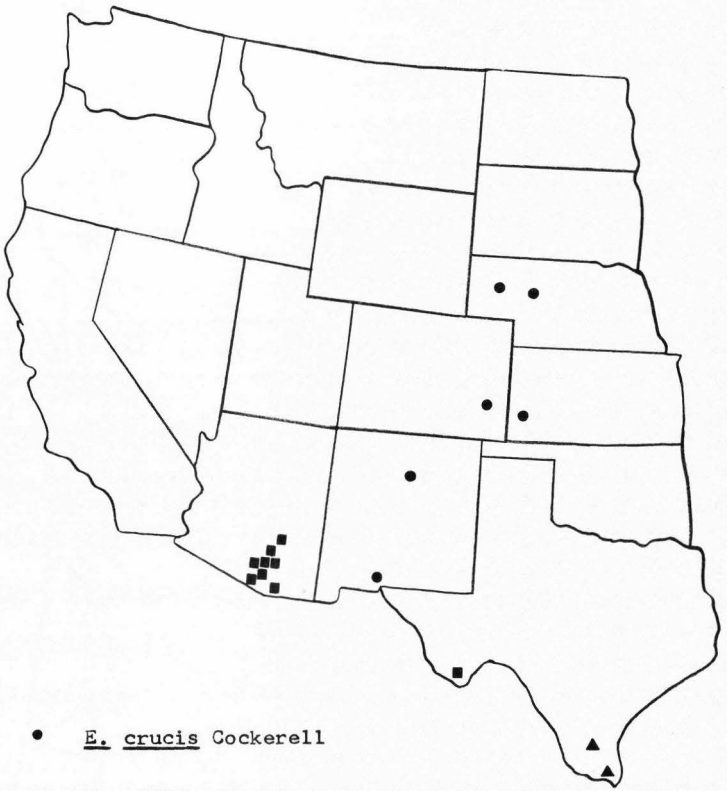


Figure 2



● E. crucis Cockerell

■ E. politus Brumley

▲ E. torus Brumley

Figure 3

Figure 4

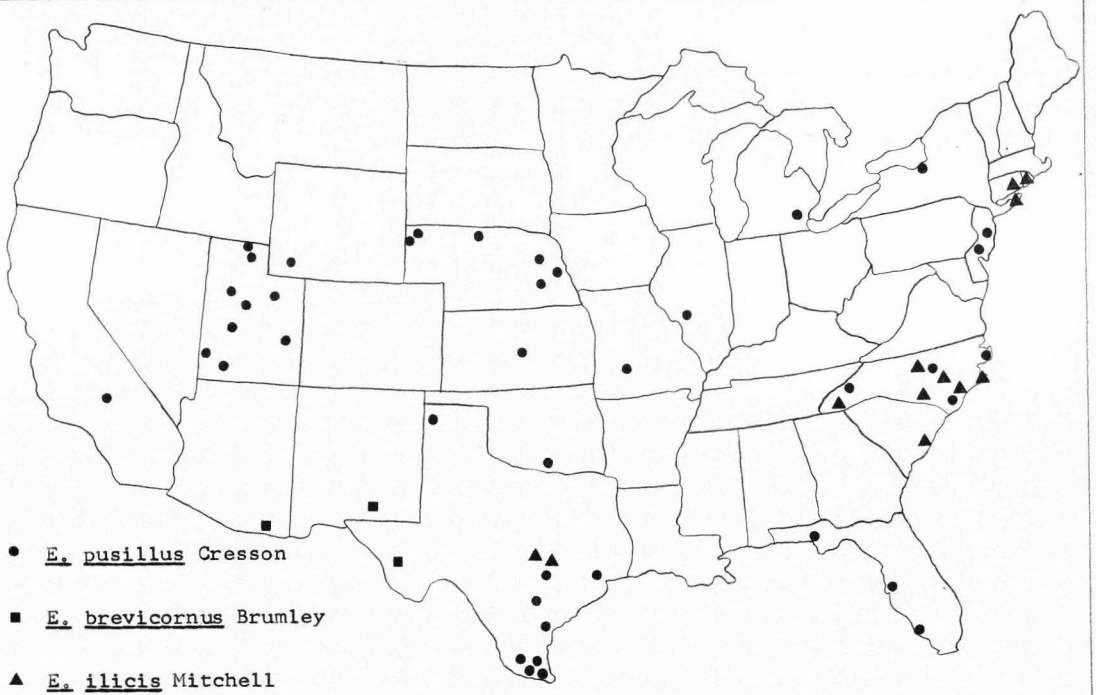

● E. pusillus Cresson
■ E. brevicornus Brumley
▲ E. ilicis Mitchell

Figure 5

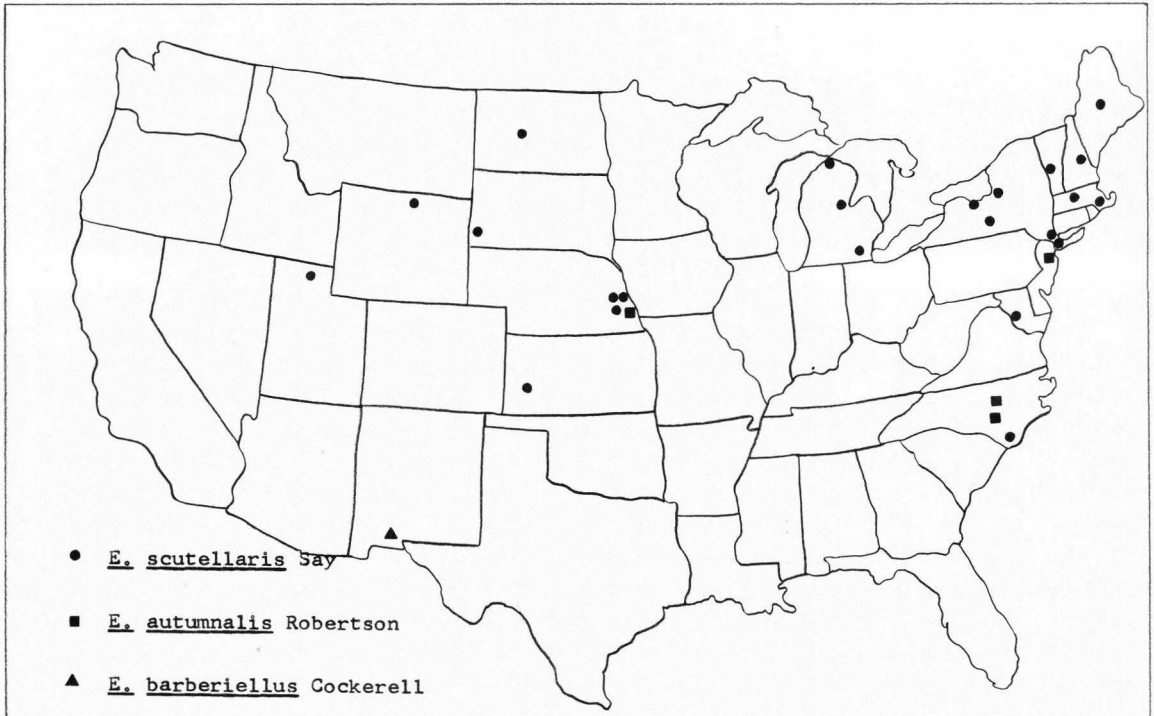

E. scutellaris Say
E. autumnalis Robertson
E. barberiellus Cockerell

Figure 6

Figure 7

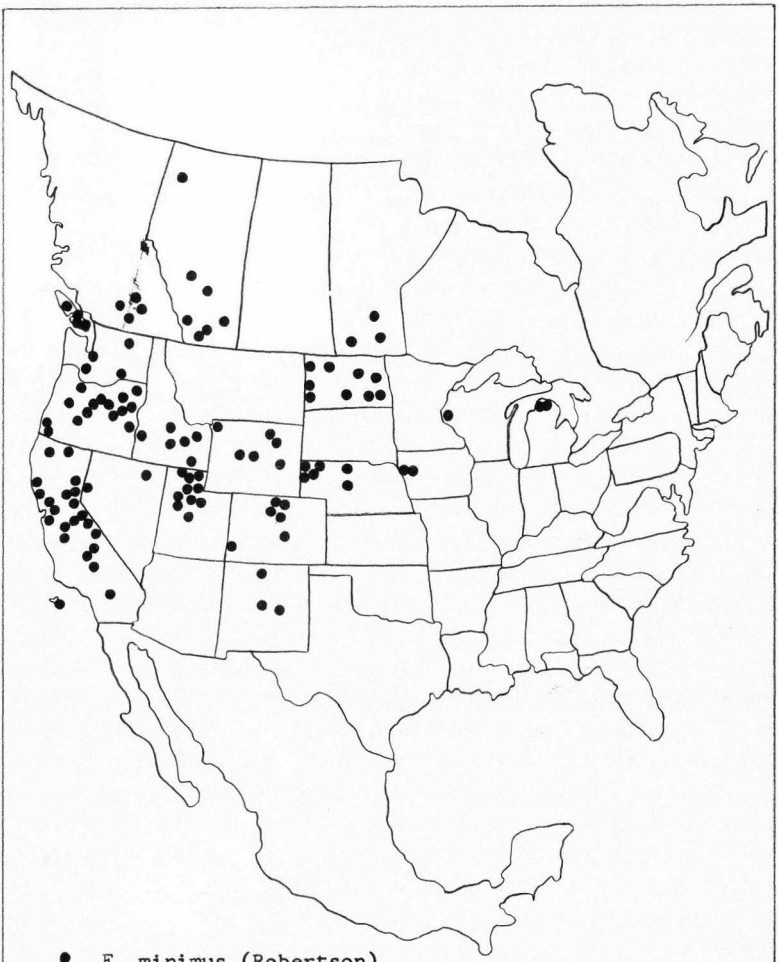
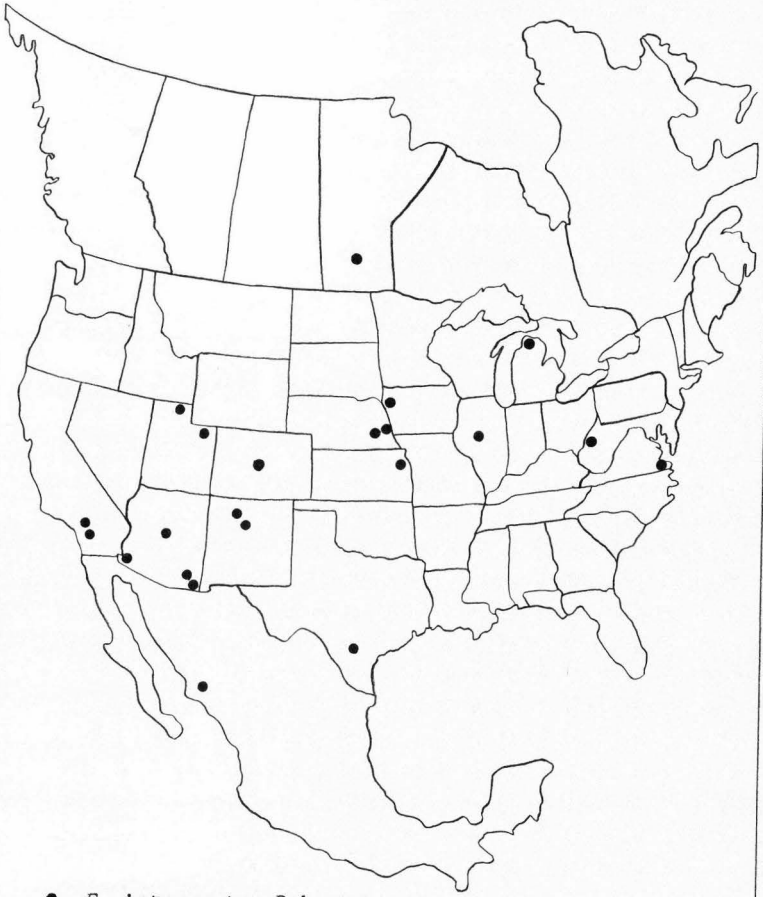


Figure 8



• *E. interruptus* Robertson

Figure 9

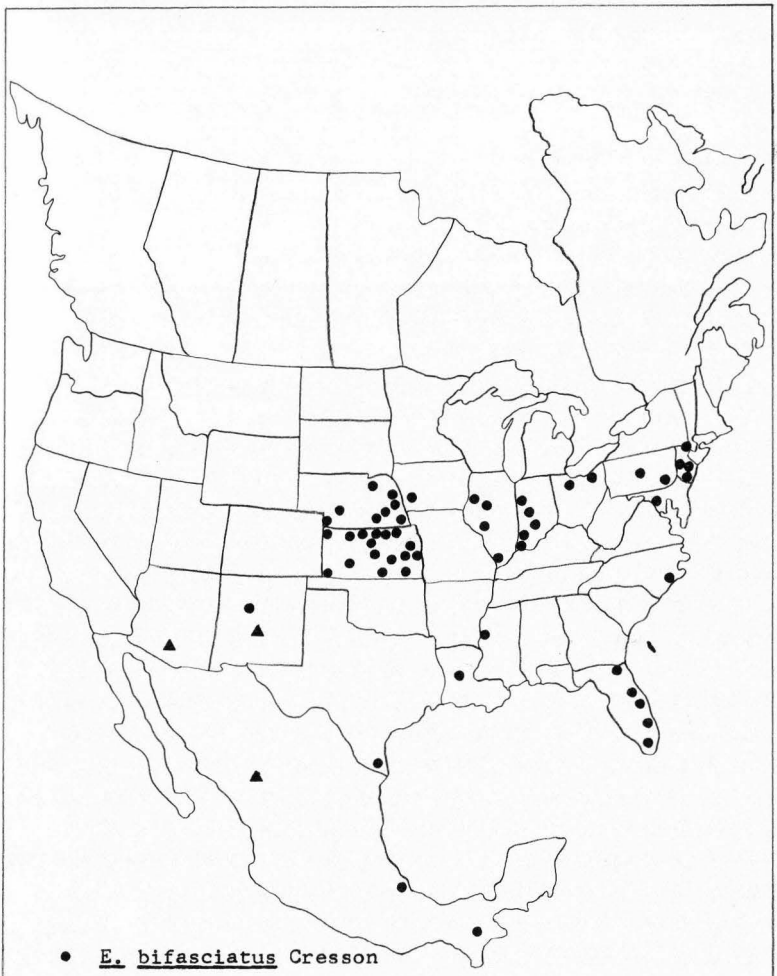
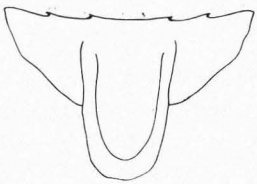
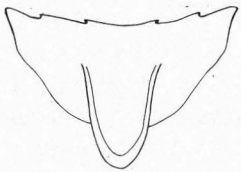


Figure 10

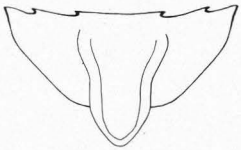


11. EPEOLUS ARTUS

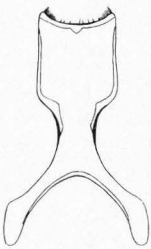


12. EPEOLUS AUSTRALIS

13. EPEOLUS COMPACTUS



14. TRIEPEOLUS CONCOLOR



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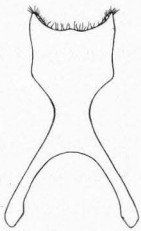
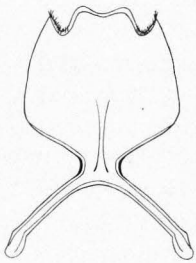
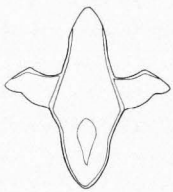


16. TROPHOCLEPTRIA ODONTOTHORAX



17. TRIEPEOLUS SUBNITENS



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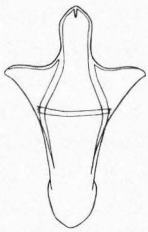

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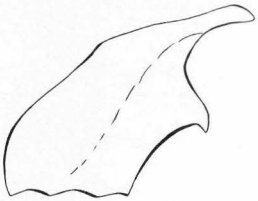

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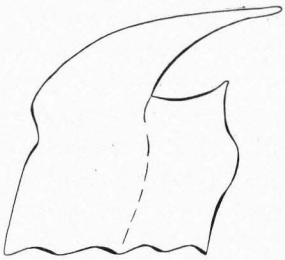
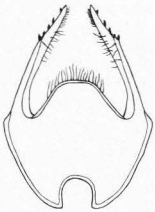


21. TRIEPEOLUS CALIFORNICUS



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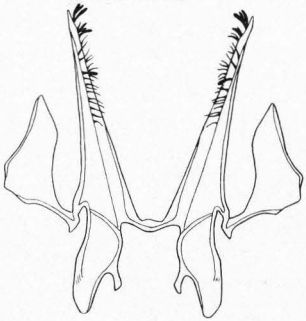

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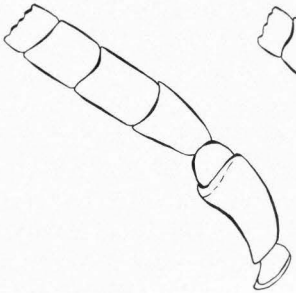

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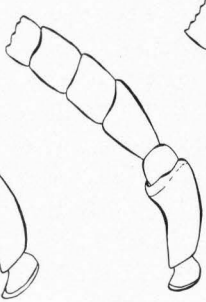

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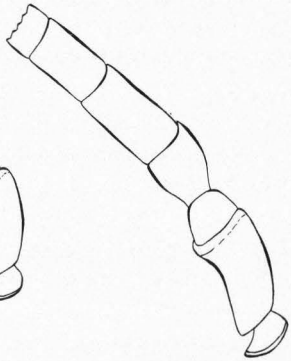

26. EPEOLUS LECTOIDES

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