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A REVISION
DIVISION OF THE BEMBICINE WASPS
OF AMERICA NORTH OF MEXICO

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DISSERTATION

PRESENTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE GRADUATE
SCHOOL OF THE OHIO STATE UNIVERSITY

BY

JOHN BERNARD PARKER

COLUMBUS, OHIO

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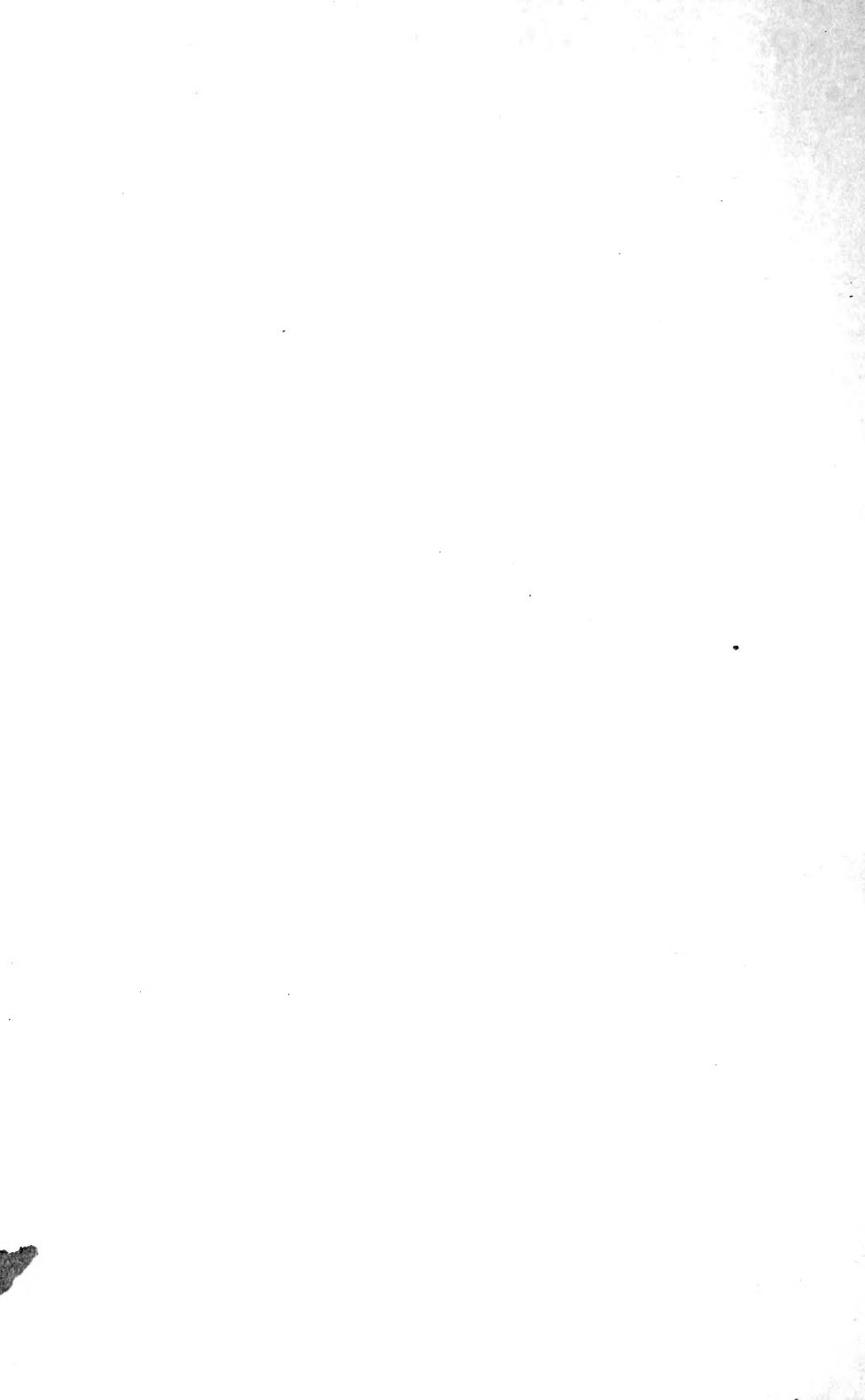
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Associate Professor of Biology, Catholic University of America

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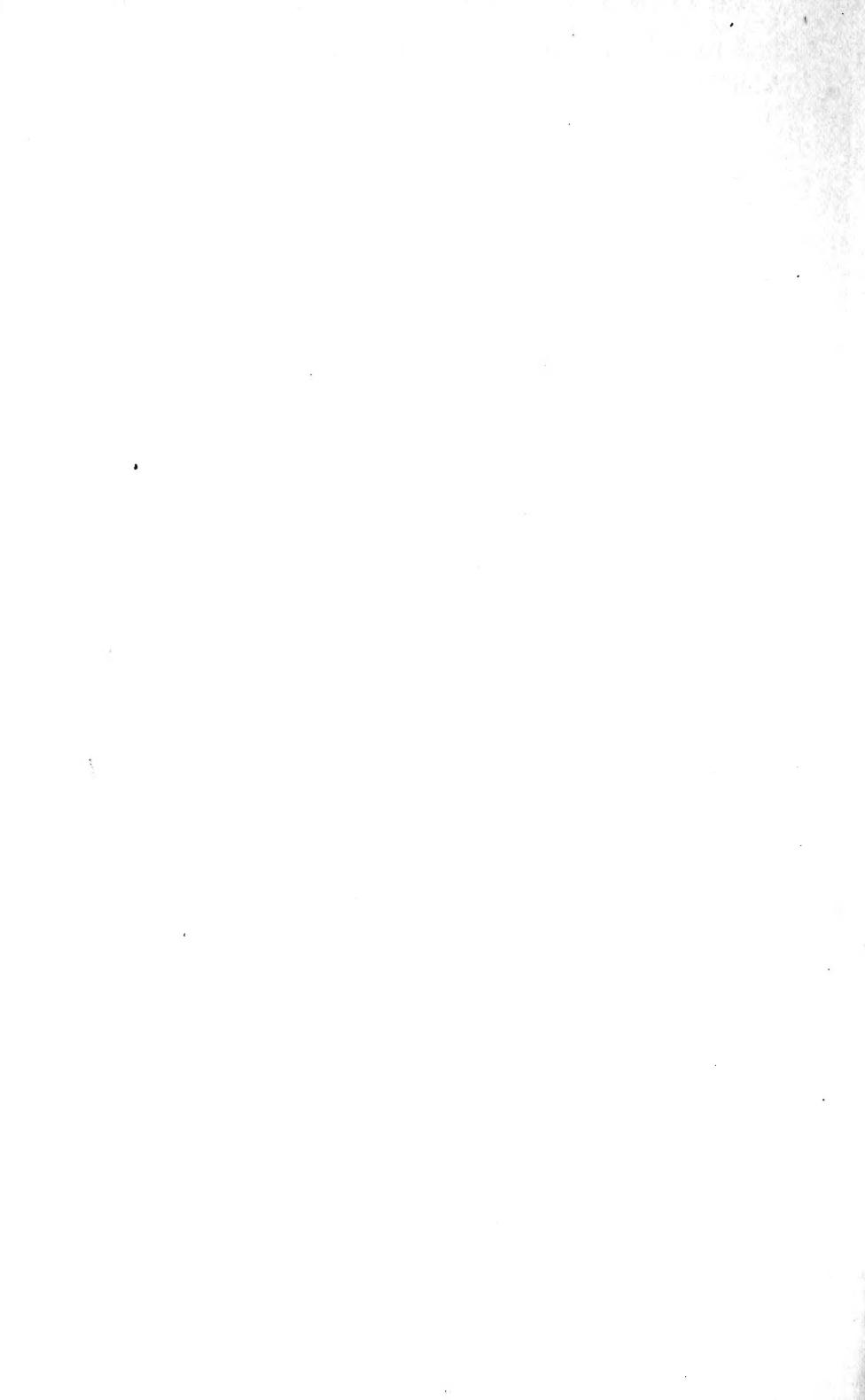
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A REVISION OF THE BEMBICINE WASPS OF AMERICA
NORTH OF MEXICO.

By JOHN BERNARD PARKER,
Associate Professor of Biology, Catholic University of America.

INTRODUCTION.

This revision is based upon a careful study of the collection of Bembicine wasps found in the United States National Museum and of collections in possession of the institutions mentioned below. The writer has also examined the types found in the collections of the American Entomological Society of Philadelphia and of the American Museum of Natural History. Although this work was undertaken as a taxonomic revision of the tribe for North America north of Mexico, it has been thought proper to include a very brief summary of what has been done by other investigators on the biology of several species of these wasps and also to add the results of the writer's own observations.

The Bembicini is a tribe of solitary wasps belonging to the group Fossores or digger wasps. This tribe and the Stizini compose the family Bembicidae. Among these wasps the individuals are either male or female, and the latter constructs her nest alone and provides for her offspring. These nests are burrows dugged in the ground, usually in sandy places, and, although each female constructs a burrow for herself, the wasps generally nest in colonies, which may be made up of several species. The most prominent characters distinguishing the Bembicine wasps are the non-folded wings lying flat on the back, the three closed cubital cells of the anterior wing, of which cells the second receives both discoidal cross veins, the absence of a prepectus, the prominently exerted labrum, and the lack of developed ocelli.

The descriptions, both specific and generic, are based upon a study of the specimens at hand. The original descriptions of all previously described species have been carefully studied and the identification of specimens at hand based thereon. In describing new species the type-specimen, whether male or female, is described first, and consequently the description is that of a single individual. This is

followed by a description of the allotype, if available, and by comments upon the variations and peculiarities of the species as shown by paratypes when the new species is described from a number of specimens. In the case of species already described a detailed description of each sex is given whenever both sexes were represented in the collections, and these descriptions, except where noted, are based not upon single individuals but upon the groups of specimens at hand. The drawings of the wings are made from projections of balsam mounts and are all enlarged on the same scale. The figures of all other parts are camera lucida drawings and, save where noted in the explanation of the plates, are drawn exactly on the same scale of magnification. Consequently these drawings show accurately the relative size of similar structures on the various species. All drawings are the work of the writer save Nos. 213 and 216, which are the work of Mr. Noel Deisch.

The generic name *Monedula* Latreille (1802) must be dropped, as Fox has pointed out,¹ since it is preoccupied in ornithology by *Monedula* Hasselquist (1762). Illiger was aware of this prior use of the term and proposed the name *Stictia*² to replace it. The species included in the genus *Monedula*, as given in Handlirsch's monograph, fall into four groups that possess characters sufficiently distinct to warrant, in the writer's judgment, their separation into good genera. To one group the generic name *Stictia* must be applied and this genus is represented by the species *carolina* Fabricius and *signata* Linnaeus. For the second the name of *Stictiella* is proposed, with the species *formosa* Cresson as the type. For the third the subgeneric name *Hemidula* Burmeister must be raised to generic rank with *singularis* Taschenberg as the type. For the fourth a generic name is yet to be proposed and it can not properly be done here since none of the species belonging in this group are found within the region covered by this revision.

The writer desires to acknowledge here his indebtedness to Prof. Herbert Osborn, of the Ohio State University, under whose supervision and direction this work has been done; to the authorities of the United States National Museum for valuable assistance rendered in the course of the work, and for the privilege of laboratory facilities and access to its collections and library. The writer further desires to express his appreciation of the kindness of the following gentlemen in placing at his disposal collections of Bembicine wasps found in the institutions with which they are (or were) respectively connected: Dr. H. T. Fernald, Massachusetts Agricultural College; Prof. George A. Dean, Kansas State Agricultural College; Dr. J. C. Bradley, Cornell University; Dr. S. Graenicher, Public Museum of Milwaukee; Dr. Henry Skinner, American Entomological Society of Philadelphia;

¹ Ent. News, 1901, p. 269.

² Fauna Etrusca, vol. 2.

Mr. Charles Schaeffer, Brooklyn Institute; Mr. F. X. Williams, University of Kansas; Dr. F. E. Lutz, American Museum of Natural History; and Mr. W. T. Davis, Staten Island, New York.

ANATOMY.

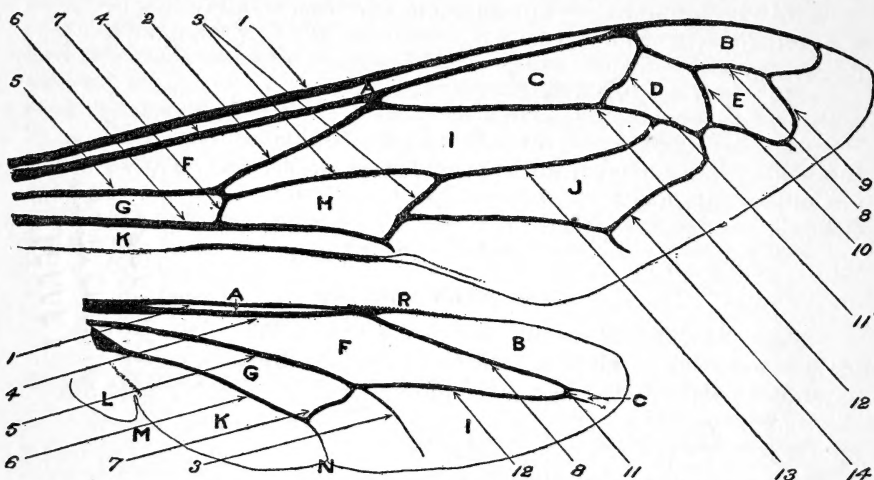
Inasmuch as this work is primarily concerned with a taxonomic revision of the genera and species included, anatomy need be considered only in so far as it has to do with the generic and specific characters used in classification. With this consideration in mind a brief discussion is given below of the anatomy of the Bembicine wasp, such as is deemed sufficient to enable the reader, who is presumed to be familiar with entomological literature, to understand and use intelligently the terms employed in the generic and specific descriptions.

The head is vertical, large, and freely movable upon the prothorax. The compound eyes are large, arched, more or less oval in outline, and naked in all species herein described. Their borders are entire, neither incised nor emarginate. The mouth parts consist of a prominent labrum, a pair of well-developed, pointed mandibles, and a proboscis composed of the highly specialized maxillae and labium. The clypeus is prominent and well defined and varies somewhat in general outline among the genera. The frons from its union with the clypeus, which is marked by an evident suture, extends upward between the compound eyes and joins the vertex, there being no evident dividing line between the two. The antennae are inserted on the frons and are made up of 13 segments in the males and of 12 in the females. The first segment is known as the scape; the remaining segments form the flagellum. The second segment of the antenna, that is, the first segment of the flagellum is frequently called the pedicel, a term not used in my descriptions. The ocelli are not developed in this tribe of hymenoptera and their positions are marked by cicatrices. The anterior cicatrix is found upon the frons while the posterior pair is placed upon the vertex. The occiput is the dorsal part of the head posterior to the eyes and in these wasps is ill defined or wanting, the surface of the head posterior to the eyes being vertical and flat or concave. The temple is that part of the head behind the compound eye visible when the head is viewed from the side.

The prothorax is relatively small; its posterior dorsal border is frequently referred to as the collar and there is a rounded posterior prolongation on either side near the base of the wings to which the term tubercle is applied. The dorsum of the mesothorax is composed of two sclerites of which the anterior is called in my descriptions the scutum, which is equivalent to the term dorsulum of other writers. The posterior sclerite is the scutellum. The dorsum of

the metathorax is the metanotum, more commonly called the post-scutellum. The true first segment of the abdomen is solidly fused with the thorax and is variously termed the median segment, middle segment, or propodeum. In some of the earlier descriptions of species the dorsum of this segment is erroneously called the metanotum.

The term abdomen is applied to that part of the body which is posterior to the median segment and movably attached thereto. Although this is, as a matter of fact, an incorrect use of the term, I have adhered to a practice that has been universal, and consequently the segment that is herein called the first abdominal seg-



WINGS OF *STICTIA CAROLINA* FABRICIUS.—VEINS: 1, COSTAL; 2, BASAL; 3, DISCOIDAL; 4, SUBCOSTAL; 5, MEDIAN; 6, SUBMEDIAN; 7, SUBMEDIAN CROSS=TRANSVERSE MEDIAN OF CRESSON; 8, RADIAL; 9, THIRD CUBITAL CROSS; 10, SECOND CUBITAL CROSS; 11, FIRST CUBITAL CROSS; 12, CUBITUS; 13, FIRST DISCOIDAL CROSS=FIRST RECURRENT OF CRESSON; 14, SECOND DISCOIDAL CROSS=SECOND RECURRENT OF CRESSON. CELLS: A, COSTAL; B, RADIAL; C, FIRST CUBITAL; D, SECOND CUBITAL; E, THIRD CUBITAL; F, MEDIAN; G, SUBMEDIAN; H, SECOND SUBMEDIAN=SECOND DISCOIDAL OF CRESSON; I, FIRST DISCOIDAL; J, SECOND DISCOIDAL=THIRD DISCOIDAL OF CRESSON; K, ANAL; L, BASAL LOBE; M, BASAL SINUS; N, ANAL SINUS; R, RETINACULUM.

ment is in reality the second. Each abdominal segment is composed externally of an arched dorsal plate and a flat ventral plate; the former is termed the tergite, the latter the sternite. The abdomen of the female is composed of six visible segments; that of the male of seven. The eighth segment of the male is concealed and bears the genitalia. The sixth tergite of the female in some species shows a more or less conspicuous lateral ridge at either side and when these ridges are present the area between them is termed the pygidial area or pygidium. The second sternite of the male, or the second and also the sixth, frequently shows a median special structure various in form and variously referred to as a process, tubercle, tooth, or spine.

The wings lie flat when at rest and the general type of venation is shown in the sketch above.

KEY TO GENERA.

1. Anterior ocellar cicatrix circular or elliptical in form, sometimes placed in a pit....2.
1. Anterior ocellar cicatrix linear, transverse, straight or curved, in a few species the ocellus not completely obliterated.....4.
2. Maxillae exceedingly long, when at rest reaching the posterior coxae; maxillary palpi with three segments, labial with one.....*Steniolia*.
2. Maxillae shorter, when at rest folded behind the labrum; maxillary palpi with six segments, labial with four.....3.
3. Anterior ocellar cicatrix not placed in a pit; seventh tergite of male with lateral spines, eighth sternite ending in a single spine and middle femora with a strong, curved tooth below near the distal end.....*Stictia*.
3. Anterior ocellar cicatrix placed in a pit; seventh tergite of male without lateral spines, middle femora without curved tooth below at distal end, eighth sternite ending in three spines, and in many species bearing a fourth discal spine. *Stictiella*.
4. Posterior surface of median segment concave, its lateral angles prolonged, compressed and wedge-like; maxillary palpi with six segments, labial with four; eighth sternite of male ending in three spines.....*Bicyrtes*.
4. Posterior surface of median segment flat or convex, its lateral angles rounded; palpi otherwise; eighth sternite of male ending in a single spine.....5.
5. Mandibles dentate; apical end of radial cell of anterior wing on costal border; maxillary palpi with four segments, labial with two.....*Bembix*.
5. Mandibles not dentate; apical end of radial cell of anterior wing not on costal border; maxillary palpi with three segments, labial with one.....*Microbembex*.

Genus STENIOLIA Say.

Steniolia SAY, Bost. Journ. Nat. Hist., vol. 1, 1837, p. 367.

Steniolia FATTON, Bull. U. S. Geol. Surv., vol. 5, 1880, p. 364.

Steniolia HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, Abth. 1, 1889, p. 504.

Steniolia KOHL, Die Gatt. d. Spheg., 1896, p. 435.

Type.—*Bembex longirostru* Say (monobasic).

The wasps belonging to this genus vary in length from eighteen to twenty millimeters. The head when viewed from in front is wider than long, its width being about equal to that of the thorax. The compound eyes are large and strongly arched; their inner borders are approximately parallel and below they reach almost to the base of the mandibles. On the frons between the antennae there is a short but very evident carina. The ocelli are not developed and their cicatrices are sunk in pits; the posterior pair are circular, the anterior one is elliptical, sometimes approaching the circular form. The occiput is very narrow and the cheeks are but moderately developed.

The mandible, which ends in a single point, has its outer margin entire and its inner margin provided with a tooth near the apex. The maxillae are unusually long, extending when at rest to the third pair of coxae. The tongue, equal in length to the maxillae, is provided at the base with a pair of long thread-like paraglossae. The maxillary palpus is composed of three segments, the labial of one. The labrum is large, blunt, and but slightly emarginate at the apex. It is swollen at the base and appears somewhat pear-shaped. It shows a flat-

tened, median area near the base, on either side of which there is a slight, rounded prominence.

The clypeus is arched, wider than long, its apical border straight or slightly arcuate; it bears a slight median carina continuous with the carina between the antennæ. These are long and slender and possess few characters of value in separating species, although in the case of the male of some species several of the flagellar segments are carinate on the posterior surface. The antennae are inserted on the frons quite close to the basal margin of the clypeus and the distance between the points of insertion is slightly less than the distance from the point of insertion to the inner margin of the adjacent eye. They consist of 13 segments in the male and of 12 in the female.

The collar, or posterior border of the prothorax, is quite narrow and is placed much below the level of the scutum. The tubercles do not reach the tegulae above. The scutum, scutellum, and metanotum are relatively flat. The epimeron of the mesothorax is well defined, but the suture uniting the episternum and sternum of the mesothorax is lacking. The metapleura joins the side of the median segment almost at a right angle, thus forming a depression into which the femur of the middle leg is drawn when at rest.

The median segment is rather short and tapers toward the posterior. Its lateral angles are not compressed but are rounded off. As in related genera, the dorsal middle-field of the median segment is large, plainly set off, and is extended down upon the nearly vertical posterior surface of the segment. The tergites are arched, the sternites almost flat. On no species is there found a pygidial area set off by lateral lines on the ultimate tergite of the female. The second sternite of the male bears near its posterior margin a median, pointed, backwardly directed, tooth-like process that in most species is prominently developed, but in one is quite rudimentary. The sixth sternite is without a process of any kind in this genus and the seventh is concealed beneath the sixth. The eighth sternite of the male ends in three spines and a fourth is present upon the disk. The development of the spines affords specific characters. The genitalia of the male consists of a short basal piece, which bears the long lateral genital stipites, a pair of median curved sagittae, above which on the median line lies the spatha which ends in a pair of hooks.

The front wing. The pterostigma is vestigial. The radial cell, which is nearly as long as the first cubital cell, is narrowed toward its apical end, which lies on the costal border. Of the three cubital cells the first is long, exceeding the combined length of the second and third. The second is shorter than the third, rectangular in form though usually somewhat narrowed on the radial vein; it receives both discoidal cross veins. The third cubital cross vein is strongly bent toward the apical border of the wing but does not extend far-

ther toward the margin of the wing than the end of the radial cell. The angle formed by this vein and the radial vein and opening toward the apical border of the wing is acute. The second discoidal cross vein on its anterior third is strongly bent toward the apical border of the wing but is not angular and does not subtend a short vein. The first submedian cell, which terminates near the origin of the basal vein, is scarcely longer than the second, which gradually increases in breadth toward its distal end. The basal vein joins the subcosta at a distance from the radial cell equal at least to the length of that cell.

The hind wing. The retinaculum consists of a row of small hooklets beginning near the origin of the radial vein and extending toward the apex of the wing. The median cell is greatly prolonged, reaching almost to the apical border of the wing toward which two short veins extend from the end of the cell. The submedian cell ends anterior to or at the origin of the cubital vein. The hinder angle of the submedian cell, formed by the junction of the submedial and submedian cross veins, is obtuse.

The legs are relatively long and slender. The middle coxae are slightly separated from one another and the middle femora are never toothed, serrate, or dentate on species thus far discovered. The tibiae and tarsi are provided with more or less well-developed spines. The anterior tarsi of the female are provided with combs, consisting of long spines, of which seven are present on the metatarsus and two on each of the three following segments. These tarsal combs are weakly developed on the males and those males having the middle tibiae dilated lack the combs altogether. In the case of the males of the two species that have the middle tibiae dilated the middle metatarsus is somewhat curved and the distal half is flattened and thin. The claws are slender and the pulvilli are well developed.

The sculpturing is fine, close, and uniform, and affords little ground for the distinguishing of species. The pubescence is more prominent on some species than on others, is better developed on the male than on the female and is most conspicuous in all cases on the head, thorax, median segment, and base of abdomen. The maculations consist of spots, stripes, and lines on the head, thorax, and median segment, and of bands, continuous or broken, on the segments of the abdomen. The color of the maculations varies among the species from bright yellow to nearly clear white.

Steniolia is distinguished from nearly related genera as follows: From *all* by the unusual length of the proboscis; also from *Bicyrtes* by the form of the median segment, the number of segments in the palpi, the character of the ocellar cicatrices, the apical narrowing of the radial cell, and the form of the eighth sternite of the male; from *Stictia* by the number of segments in the palpi and the apical narrowing of the radial cell; from *Bembix* by the character of the ocellar

cicatrices, the number of segments in the palpi, the form of the eighth sternite of the male, the narrowing of the radial cell, the direction of the submedial cross vein of the hind wing, and the character of the outwardly opening angle formed by the third cubital cross vein and the radial vein; from *Microbembex* by the character of the ocellar cicatrices, the form of the eighth sternite of the male, and the fact that the apical end of the radial cell in the wing of *Microbembex* does not lie on the costal border.

KEY TO SPECIES.

Males.

- | | |
|---|---------------------|
| 1. Middle tibiae not dilated..... | 2. |
| 1. Middle tibiae dilated..... | 5. |
| 2. Apical segment of tarsi black..... | <i>nigripes</i> . |
| 2. Apical segment of tarsi not black..... | 3. |
| 3. Abdomen almost entirely yellow..... | <i>sulfurea</i> . |
| 3. Abdomen black and yellow..... | 4. |
| 4. Length, 14-18 mm.; dorsal abdominal maculations yellow; spot on mesopleura large, usually meeting its fellow on the midventral line..... | <i>duplicata</i> . |
| 4. Length, 18-20 mm.; dorsal abdominal maculations soiled white; spot on mesopleura small, never meeting its fellow on midventral line..... | <i>albicantia</i> . |
| 5. Abdominal maculations white..... | <i>obliqua</i> . |
| 5. Abdominal maculations yellow..... | <i>tibialis</i> . |

Females.

- | | |
|--------------------------------------|--------------------|
| 1. Middle tibiae not dilated..... | <i>duplicata</i> . |
| 1. Middle tibiae dilated..... | 2. |
| 2. Abdominal maculations white..... | <i>obliqua</i> . |
| 2. Abdominal maculations yellow..... | <i>tibialis</i> . |

STENIOLIA NIGRIPES, new species.

Figs. 7, 12, 17, 18, 19.

Male.—Black: Labrum, mandibles except tips, clypeus, scape and first two flagellar segments below, lower part of frons continuous with the broad anterior orbits, which are narrowed above, triangular spot on either side of anterior ocellus, narrow posterior orbits broadened below, posterior border of pronotum and spot on sides of prothorax united on tubercles but separated in front of them by a long irregular black spot, spot on tegulae, short lateral line above tegulae and pair of discal spots on scutum, triangular spots on scutellum, metanotum, curved fascia on dorsum of median segment extended onto its posterior surface where there is a narrow medial interruption, lateral angles and sides of median segment, large irregular spot on mesopleurae, metapleurae, longitudinal line on mesosternum united at either end with the large spot on mesopleurae thus enclosing a large black area, broad fasciae on tergites 1-6, first interrupted medially, deeply emarginate anteriorly in the middle and acutely though less deeply emarginate posteriorly on either side of the median line,

second continuous though emarginate anteriorly in the middle, the emargination produced to right and left in the middle of the fascia, also thrice emarginate on posterior border, remaining fasciae of similar pattern with emarginations reduced on each succeeding segment, apex of ultimate tergite, first sternite except small lateral spots, second except small anterior lateral spots and a median longitudinal spot, broad fasciae on sternites 3-6 narrowed somewhat irregularly in the middle, coxae, trochanters more or less, femora except a stripe above on all pairs and a stripe below on first pair, tibiae, and tarsi except all apical segments, *yellow*.

The color on the abdomen is light greenish yellow, while that on the rest of the body is of a deeper shade. Segments 3-5 of the flagellum are reddish below, the apical segment slightly curved, and segments 5-11 on the posterior surface are slightly carinate. As on *duplicata* small pits occur on these carinae, but they are limited to the middle part, whereas on *duplicata* they extend the full length of the carina. The legs show no special structures, but the apical segment of all tarsi is black. The head, thorax, basal joints of legs, and base of abdomen are covered with moderately dense white pubescence, rather short except on the head, on the vertex of which it assumes a brownish shade. The spine on the second sternite is short, sharp, and directed obliquely backward. Of the three spines which terminate the eighth sternite the two lateral are quite short, and the middle one, long and very heavy, bears on its ventral side beyond its middle point distally a fourth very short spine.

Length.—18 millimeters.

Habitat.—Los Angeles, California.

Number of specimens—male 1, female, 0.

Type.—Male, in the collection of the American Entomological Society of Philadelphia.

STENIOLIA SULFUREA Fox.

Steniolia sulfurea Fox, Journ. N. Y. Ent. Soc., vol. 9, 1901, p. 84.

Male.—Black: Clypeus, labrum, mandibles except tips, scape except black line above, spot between insertions of antennae, spot on each side of anterior ocellus, anterior orbits, posterior orbits shortened and narrowed above, small spot on tegulae, narrow line on posterior border of sides of prothorax, small spot on anterior part of mesopleurae low down and extending onto the mesosternum, on one specimen second small spot below insertion of wing, two small spots on metapleurae, legs except a variable amount of black on coxae and trochanters, and abdomen entirely except the basal part of the first segment, *bright sulphur yellow*.

The pubescence on the head, thorax, and base of abdomen is long, dense and white except on the vertex and the scutum where it is

somewhat dusky. The flagellum is yellow below basally but is darker toward the apex. Flagellar segments 3-8 on the posterior surface are slightly but distinctly carinate. On the distal border of the second sternite there is a rudimentary process. On one specimen the distal half of the apical tarsal segment is black; on the other there is only a suffused trace of this dark color. This species is very distinct and can not be confused with any other thus far described from the United States.

Length.—About 20 millimeters.

Habitat.—California.

Number of specimens—males, 2; females, none.

Type.—Male, in the collection of the American Museum of Natural History at New York.

STENIOLIA DUPLICATA Provancher.

Figs. 1, 8, 13, 20, 21, 22.

Steniolia duplicata PROVANCHER, Add. Faun. Canada, Hymen., 1888, p. 414, male and female.

Steniolia scolopacea HANDLIRSCH, Sitz. Acad. Wissensch. Wien, Math.-Nat. Cl. vol. 98, 1889, p. 510, male, female.

Steniolia duplicata FOX, Ent. News, vol. 2, 1891, p. 195.

Steniolia edwardsii PATTON, Proc. Ent. Soc. Wash., vol. 3, 1894, p. 45.

Steniolia scolopacea HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 104, Abth. 1, 1895, p. 965.

Male.—Black: Clypeus, mandibles except tips, labrum, scape, first two flagellar segments below, frons below insertion of antennae, broad anterior orbits narrowed above, triangular spot on either side of anterior ocellus sometimes united below it, narrow posterior orbits broadened below, posterior border of pronotum and large spot on side of prothorax united on tubercles but separated by a long irregular black line in front of them, spot on base of anterior wings, tegulae anteriorly, short line on scutum above base of wings, pair of discal spots and frequently a short transverse median line on posterior border of same, pair of triangular spots on scutellum, metanotum, curved fascia on dorsum of median segment extending onto the posterior surface where it is interrupted medially, lateral angles and sides of median segment, large spot on mesopleurae, small one above this beneath base of anterior wing, large spot on metapleurae, broad fasciae on all tergites usually interrupted medially and emarginated both anteriorly and posteriorly in such a fashion as to cut off more or less completely a pair of median rounded spots on the more anterior tergites, first sternite except anterior lateral spots, second except pair of anterior lateral and median longitudinal spots which in many specimens are united, fasciae on sternites 3-6 undulate anteriorly, coxae except basally, trochanters below, femora except stripe above, tibiae except stripe on posterior side of first pair, and tarsi, *yellow*.

The wings are hyaline and the veins brown. The body and the basal joints of the legs are covered with moderately dense white pubescence, longest on vertex, at base of mandibles and on posterior part of median segment. Pubescence of the abdomen except on base of first segment is much shorter than elsewhere on the body. The flagellum, except two basal joints, is reddish below darkening toward the apex and is slightly carinate posteriorly on segments 7-11, the carina inclosing small longitudinal pits. The second sternite bears a well developed process and the eighth ends in three curved spines of which the central, longer one has, arising from its base beneath, a fourth spine, short, stout, pointed and obliquely directed backward.

The female is quite similar to the male in general appearance and color markings. The lower surface of the flagellum is somewhat lighter and the yellow, especially on the scutum and the abdomen, is somewhat more extensive, consequently fewer of the fasciae on the tergites are interrupted medially and the median paired spots less frequently completely formed. The yellow on the sternites is also more extensive. In some specimens the black is limited to a medial spot on the second and narrow basal borders on sternites 3-5. The ultimate segment is yellow apically with a deep median anterior notch above and a less evident one below, and its tergite basally bears at the sides a cluster of short stout spines.

Length.—14-18 mm.

In the last volume of his monograph, page 965, Handlirsch places *duplicata* Provancher as a probable synonym of *scolopacea* Handlirsch, giving as his reasons for so doing the fact that the two descriptions were published at about the same time and that he could not determine from Provancher's description whether it was based upon *scolopacea* Handlirsch or *tibialis* Handlirsch. I cannot accept this contention. The description of *duplicata* Provancher, which appeared in the issue of *Le Naturaliste Canadien* for November, 1888, was published prior to that of *scolopacea* Handlirsch. Provancher's type is what is known to entomologists in America as *duplicata*; it is not *tibialis* Handlirsch. It, therefore, can not by any possible means be made a synonym of *scolopacea* Handlirsch and must stand as a good species. As far as it is possible to judge from the description of *scolopacea* given by Handlirsch his species is identical with Provancher's *duplicata*.

Habitat.—Mexico, New Mexico, Arizona, California, Colorado, Utah, and Washington.

Number of specimens, males 267, females 195.

STENIOLIA ALBICANTIA, new species.

Figs. 9, 14, 23, 24, 25.

Male.—Black: labrum, mandibles except apices, clypeus except a pair of small black basal spots, spot on either side of anterior ocellus, space between antennae, scape and first two flagellar segments below, anterior and posterior orbits, posterior border of pronotum, tubercles and more or less of the sides of the prothorax, spot on tegulae, small lateral spots on scutum above base of wing, triangular lateral spots on scutellum, fascia on metanotum, small spot on mesopleurae, spot on metopleurae, large spot on sides of median segment, smaller one near the spiracle of the segment, fascia of first tergite broken into pair of large lateral spots and a pair of dorsal triangular spots on posterior part of tergite, fascia of second similar to that of first, but with the anterior border of the lateral spots prolonged medially and the pair of dorsal spots larger and more elliptical, remaining fasciae similar in design but in most specimens not broken into dorsal and lateral spots, apex of ultimate tergite, continuous fasciae on all sternites emarginate medially, spot on coxae below, stripe on anterior and posterior surfaces of femora, tibiae except spot below on all, and tarsi, *pale yellowish or soiled white*.

Length.—18–21 mm.

In development the antennae, legs, and genital stipes are quite similar to those of *duplicata*. Segments 4–11 of the flagellum bear narrow elongate pits on the posterior surface. The second sternite bear a prominent, pointed spine. It differs from *duplicata* in having the pubescence of the head and thorax somewhat better developed, in being of larger size, in having the mesosternum black, and in the reduction of the markings of the scutum and dorsum of the median segment, which latter is without maculations on the type and on all specimens except one. It is more robust than *duplicata*, showing a relatively greater width of thorax and abdomen. Furthermore, the maculations, especially the dorsal markings of the abdomen, are in color quite distinct from those of *duplicata*. In that species the markings are usually a bright clear yellow, whereas in *albicantia* they are a soiled faded yellow or muddy white.

Habitat.—Washington and Oregon.

Number of specimens examined—males 9, females 0.

Type.—Cat. No. 19802 U.S.N.M.

STENIOLIA OBLIQUA Cresson.

Figs. 10, 15, 26, 27, 28, 31.

Monedula obliqua CRESSON, Proc. Ent. Soc. Phila., vol. 4, 1865, p. 469, female.

Steniola obliqua HANDLIRSCH, Sitz. Akad. Wissensch. Wien, vol. 98, 1889, p. 511, pl. 1, fig. 16, female and male.

Male.—Black: Clypeus, labrum, mandibles except tips, scape and first two segments of flagellum below, frons below insertion of anten-

nae, broad anterior orbits narrowed above, very narrow interrupted posterior orbits, spot on anterior and medial coxae below, sometimes spot on mesosternum just behind anterior coxae, anterior femora anteriorly for the most part, medial and posterior femora on anterior surface distally, tibiae except stripe on posterior surface, *pale greenish yellow*. Spot on tubercles, spot on tegulae, pair of triangular spots laterally on scutellum, short fascia on metanotum, fascia of first tergite broken into a pair of median rounded spots and a pair of large lateral spots, fasciae on tergites 2-6 continuous and undulate, that on second extended forward on either side of the midline in the form of an inwardly directed tooth, ultimate tergite apically, lateral spots on sternites 2-6, and tarsi more or less, *white*.

The apical segment of the posterior tarsus is black and the remaining segments distally more or less so; the distal half of the ultimate segment of the middle tarsus is also black. The head, thorax, basal joints of the legs including the femora, first segment of the abdomen above and first and second below are densely covered with a long white pubescence. On the posterior part of the abdomen the pubescence is shorter and less conspicuous. The flagellum at the union of the segments is distinctly notched posteriorly and most evident at the distal end of segments 5-9. The somewhat prominent areas seen on segments 6-11 posteriorly lack the pits found on *duplicata*. The middle femora are dilated apically and the spine at the distal end in front is strongly curved. Seen from in front the basal half of the middle metatarsus appears curved or emarginate on the inner side and the distal half dilated, due to the presence of a broad but thin carina on the inner surface running somewhat obliquely downward and forward to the tip of the joint. The second sternite bears a distinct tooth-like process and the eighth ends in three short very hirsute spines. At the base of the middle one on the ventral surface there is a short blunt process from which two carinae diverge basally. The dorsal aspect of this ventral plate is characterized by a semicircular crest continuous with the base of the outer spines and enclosing a prominent pit at the base of the middle spine.

Female.—Black: Clypeus, labrum, mandibles except tips, scape and first two flagellar segments below, frons below insertion of antennae, broad anterior orbits narrowed above, narrow interrupted posterior orbits, posterior margin of pronotum united with tubercles from which a line extends downward, spot on tegulae, spot on anterior and middle coxae below, anterior and posterior stripe more or less well developed on anterior and middle femora, posterior femora distally, tibiae except spot on posterior surface, and coxae, *yellow*, the color deeper on legs than elsewhere. Triangular lateral spots on scutellum, fascia on metanotum, fascia on first tergite broken into a pair of rounded medial spots and broad lateral spots, undulate continuous

fasciae on tergites 2-5, that on segment two on either side of midline prolonged forward in the form of an inwardly pointed tooth, those on third and fourth less prolonged, ultimate tergite with bilobed spot at apex, lateral spots on sternites 2-6, *white*, sometimes tinged with greenish yellow.

The distal joint of the flagellum is reddish at the apex and the segments beyond the second are more or less so below. The middle tibiae are dilated; the first segment of the middle tarsus is only slightly curved basally and lacks the carina found on the male. The pubescence is similar to that of the male but somewhat less well developed.

Length.—14-16 mm.

The color of the markings of this species varies from yellow through yellowish or greenish white to almost white. All the flagellar segments may be lighter beneath than above, but the light color is more pronounced on the proximal ones and always more in evidence on the female than on the male. The lateral spots on sternites 2-5 may or may not be connected by apical lines on the female; they are not so connected on the male. The spots on the sixth sternite of the female are sometimes united. On some specimens there is an irregular spot on the side of the median segment posteriorly, extending slightly onto its posterior surface. The line on the posterior border of the pronotum of the male may be wanting or present as two widely separated spots, and the fasciae on tergites 2-4 may be interrupted medially.

In this species the eyes are not so widely separated as in *duplicata*, and in both males and females they are distinctly divergent at the clypeus.

Habitat.—Colorado, Utah, Wyoming, British Columbia.

Number of specimens examined—males 8, females 14.

STENIOLIA TIBIALIS Handlirsch.

Figs. 11, 16, 29, 30, 32, 33.

Steniolia tibialis HANDLIRSCH, Sitz. Akad. Wissensch. Wien, vol. 98, 1889, p. 513, pl. 2, fig. 1, male and female.

Male.—Black: Labrum, mandibles except tips, clypeus, scape below, first two flagellar segments below, small spot between antennae, anterior orbits, narrow posterior orbits, broken line on posterior border of pronotum, tubercles and narrow line on sides of prothorax, spot on tegulae, lateral spots on scutellum, sometimes short fascia on metanotum, pair of large lateral spots and pair of small medium posterior dorsal spots on first tergite, continuous fasciae on tergites 2-6, that on second with a deep anterior medial emargination which is produced to right and left posteriorly, remaining fasciae with shallow anterior median biemarginations, seventh tergite apically, lateral spots on sternites 2-6, femora distally more or less, tibiae except line on first pair below, and tarsi, *yellow*.

The flagellum, except the basal segments below, is black and although specialized areas are present these do not bear pits as do those found on *duplicata*. The middle tibia and metatarsus are modified in a fashion almost identical with that of *obliqua*. The apical half of the ultimate segment of the tarsi is decidedly dusky. The process on the second sternite is short sharp and obliquely directed backward.

Female.—Black: Clypeus, labrum, mandibles except tips, scape, and basal joints of flagellum below, frons below insertion of antennae, small spot before anterior ocellus, anterior orbits, posterior orbits quite narrow above, posterior of pronotum, tubercles, spot on tegulae, brief lateral line on scutum above base of anterior wings, large lateral spots on scutellum, fascia on metanotum, spot on lateral angles of median segment extended on the side and somewhat on the posterior surface of same, spot on mesopleurae, small spots on metapleurae, fascia of first tergite broken into a pair of very large lateral spots and a pair of elliptical medial spots approximated on median line, the remaining fasciae slightly undulate laterally, deeply and double emarginate medially, the fasciae on second and third produced forward and inward on either side of the emargination, most conspicuous on second, broad fasciae on sternites 2-5, ultimate segment apically both above and below, spot on coxae below, quite small on posterior pair, anterior and posterior borders of anterior and middle femora, most evident on anterior pair, and coxae, *yellow*.

The intermediate tibiae are dilated as in the case of *obliqua* and the first segment of the middle tarsus is slightly curved basally; wings very slightly infumated. The pubescence is similar to that of *obliqua*, to which species this one is very similar, save in the color of the maculations.

Length.—16 mm.

Habitat.—California, Nevada.

Number of specimens—males 3, females 3.

Genus STICTIA Illiger.

Vespa signata LINNAEUS, Systema Naturae, ed. 10, vol. 1, 1758, p. 574.

Bembyx FABRICIUS, Syst. Ent., 1775, p. 361.

Bembex FABRICIUS, Mant. Ins., vol. 1, 1787, p. 285.

Monedula LATREILLE, Hist. Nat. Ins., vol. 3, 1802, p. 343.

Stictia ILLIGER, Fauna Etrusca (Rossi), ed. 2, vol. 2, 1807, p. 131.

Bembex DAHLBOM, Hym. Eur., vol. 1, 1845, p. 486.

Monedula DAHLBOM, Hym. Eur., vol. 1, 1845, p. 492.

Monedula BURMEISTER, Bol. Acad. Cordova, vol. 1, 1874, p. 110.

Monedula HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, Abth. 1, 1890, p. 77.

Monedula KOHL, Die Gatt. d. Spheg., 1896, p. 436.

Stictia FOX, Ent. News, 1901, p. 269.

Type.—*Vespa signata* Linnaeus, by present designation.

The head seen from in front is broader than long and almost as broad as the thorax. The compound eyes are large and strongly arched. The inner margins are divergent at the clypeus, rarely subparallel, and the lower margin reaches the base of the mandible. The facets near the inner border of the eye are slightly larger than those near the outer border, the change in size from one margin to the other being almost imperceptible. The frons on the males is usually narrower than the compound eye measured at the level just above the insertion of the antennae; on the females it equals or exceeds the width of the eye at the same level. The ocellar cicatrices are flat, not sunk in a pit, and are semicircular in form. The anterior one is greater than a semicircle, somewhat horseshoe-shaped, with the opening directed toward the clypeus; the posterior ones are a trifle greater than a semicircle, of which the open side is toward the compound eye. The precipitous posterior surface of the head is concave and the temples are quite narrow.

The outer border of the mandible is entire, the apex simple, and the inner border provided with three teeth. The labrum is relatively flat, longer than broad, and, as in the case of *Bicyrtes*, is bluntly rounded at the end, not emarginate. The maxillae are moderately long, stoutly developed and each is half-conical in form so that when the two are approximated they form a tube within which lies the tongue. The maxillary palpi consist of six segments, the labial of four. As in the case of *Bembix* the maxillae when folded at rest are concealed beneath the labrum. The clypeus is wider than long and is but slightly arched, less so than in the case of *Bembix*. On the distal median part above the base of the labrum there is in nearly all species a somewhat triangular area above which on the median line there is a short but evident carina continuous with the median carina of the frons separating the antennæ. On either side of this carina the base of the clypeus slopes abruptly in toward the insertion of the antenna. The antennae are inserted quite close to the base of the clypeus and consist in the female of 12 segments, in the male of 13, in which case several of the flagellar segments may bear modifications that are useful in determining species.

As in the case of *Bembix* the dorsum of the thorax is relatively flat, the posterior border of the prothorax is much below the level of the scutum, and the tubercles do not reach the tegulae. The suture between the sternum and episternum of the mesothorax is obliterated. The median segment shows a clearly defined, broad, dorsal middle-field, which is continued upon the almost vertical posterior surface of the segment. The lateral angles of the segment are roundly prominent, not so sharply compressed as in the case of *Bicyrtes* nor so bluntly rounded off as in the case of *Bembix*.

The abdomen is relatively stout and widest at the junction of the first and second segments. The tergites are strongly arched, the sternites flat. The ultimate tergite of the males is provided with prominent lateral processes or spines and the median prolongation is emarginate at the end. The ultimate tergite of the females lacks the spines, is rounded apically, and its surface, punctate or slightly rugose, is without a pygidial area. On the second sternite of the male there is a median prominence or carina more or less well developed; this is also discernible on the females of some species, but on others it is wholly lacking. The sixth sternite of the male bears a conspicuous median area that is slightly raised and is finely punctate or granular. The eighth sternite of the male ends in a single, stout, curved spine.

The male genital armature consists of a basal piece (cardo) which bears the lateral stipites, the median spatha, and below this the sagittae. The stipites are strongly chitinized, long, curved, and pointed. The spatha is roundly dilated at the end and bears a deep median cleft. The form is distinctly different from that in any of the closely related genera. The sagitta is a divided structure; the dorsal or inner part, the longer and the more slender of the two, is weakly chitinized and somewhat hirsute; the ventral or outer part is heavier, shorter, not strongly chitinized and very hirsute.

The legs are relatively long and strong. The middle coxae are separated. The middle femora of the males bear near the distal end on the lower border a conspicuous, curved, distally directed tooth. All tibiae and tarsi in both sexes are beset with spines, which are better developed in the female than in the male. In both sexes the anterior tarsi are provided with tarsal combs, which are much better developed in the females than in the males. The pulvilli are large and conspicuous and the middle tibiae bear at the distal end a single spur.

The wings are much like those of *Bembix*. The pterostigma of the anterior wing is obliterated. The radial cell is long, narrow, of nearly uniform width and rounded at the distal end, which lies on the costal border of the wing. The first cubital cross vein, as in *Bembix* near its posterior end is strongly bent toward the proximal end of the wing. The second cubital cell, which receives both discoidal cross veins, is much wider on the cubital vein than on the radial. The third cubital cross vein is deflected toward the distal end of the wing and at the posterior end is rounded so that the third cubital cell extends as far toward the distal end of the wing as does the radial cell. The angle formed by the junction of the radial and third cubital cross veins and opening outward is acute. The first submedian cell is longer than the second, which steadily increases in width

toward the distal end. The basal vein arises at the distal end of the first submedian cell.

The retinaculum on the hind wing, consisting of an unbroken row of hooklets, begins proximal to the origin of the radial vein, which reaches near to the distal end of the wing. The median cell is long. The cubitus arises quite near the distal end of the submedian cell. The posterior distal angle of the submedian cell formed by the submedian and submedian cross veins is obtuse, sometimes approaching a right angle. The submedian vein terminates in the anal sinus. In some species the wings are more or less infumated, in others they are hyaline.

The pubescence is short and inconspicuous, especially on the females. The punctation is shallow, fine, and uniform affording little ground for the separation of species.

This generic description is based on a limited number of species from the United States, Mexico, West Indies, Central and South America

KEY TO SPECIES.

Males.

1. Lateral spines of seventh tergite pointed at tip; thorax maculated; first tergite with a double fascia interrupted medially; fasciae of following tergites not broken into spots.....*signata*.
 1. Lateral spines of seventh tergite truncate at tip; thorax immaculate; fascia on third tergite reduced to four (rarely two) spots.....*carolina*.

Females.

1. Scutum with a pair of lateral and pair of discal stripes; sternites 1-4 almost wholly yellow.....*signata*.
 1. Scutum black; yellow on sternites confined to triangular lateral spots.....*carolina*.

STICTIA SIGNATA Linnaeus.

Figs. 34, 35, 38, 39, 43.

Vespa signata LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 574.

Bembex signata FABRICIUS, Syst. Ent., 1775, p. 361.

Bembex vespiiformis OLIVIER, Encycl. Meth., vol. 4, 1789, p. 290, pl. 106, fig. 18.

Monedula signata LEPELETIER, Hym., vol. 3, 1845, p. 283.

Monedula signata HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 86.

Male.—Black: Labrum, mandibles except apices, clypeus except a pair of vertical lines basally which may be broken into spots, lower part of frons usually extended medially above the insertion of the antennæ, scape below, broad anterior orbits ending above in a lateral spot on either side of the anterior ocellus, posterior orbits broad below, narrow above, and ending in a small spot on either side of the vertex, posterior border of pronotum continued to the tubercles, where it is united with a large spot on sides of prothorax, pair of

broad lateral lines and pair of discal lines on scutum, spot on tegulae, spot on base of anterior wings, fascia on anterior margin of scutellum widest laterally, metanotum, curved fascia on dorsum of median segment, pair of triangular spots on its posterior surface, which are sometimes united with the fascia above, its postero-lateral angles and its sides almost wholly, mesopleuræ and metapleuræ except borders of sutures, mesosternum except pair of lateral spots, fasciæ of tergites, interrupted medially, the first broad laterally and horseshoe-shaped dorsally on either side of the midline, second to fifth of the same pattern as the first, but with the anterior half of the horseshoe more or less imperfectly developed, sixth broken into four spots, pair of lateral spots on ultimate tergite, sternites 1-5 except medial spots on 2-5, which on 5 and sometimes on 4 are continuous with an anterior black border, the legs except small black spot on posterior side of all femora and black spot on knees prolonged on upper side of posterior tibiae, *yellow*.

The flagellum is black, with the underside somewhat testaceous especially toward the apex. Its ultimate segment is slightly curved and obliquely truncate apically. Segments 6 and 10-12 are excavated or pitted and 7-9 are somewhat rounded out below. The middle femora below near the distal end bear a short, blunt, curved tooth. The second sternite basally bears a moderately developed carina. The sixth is black and medially bears a slightly raised, transverse, semicircular area conspicuous for its fine, close punctation. The ultimate tergite is notched at the tip and its lateral angles are developed in the form of short, stout, acutely pointed spines.

Female.—The female is quite similar to the male in general appearance, but to the color description of the male the following additions are necessary: The triangular spots on the posterior surface of the median segment are usually united with the fascia above them; the anterior branches of the horseshoe on the first tergite are extended downward on the anterior surface of the segment; there is a black stripe above on all femora and also on all tibiae; there is a line below on middle femora and also on middle and anterior tibiae; and the black spots on the mesosternum are quite small. The ultimate sternite is black and faintly carinate medially; the ultimate tergite bears a pair of lateral yellow spots and is closely and regularly punctured, showing a slightly rugose appearance and a fairly well-marked longitudinal median ridge.

In both sexes the discal marks on the scutum are more or less rufous, and the legs are a deeper yellow than the markings of the body. The wings are hyaline and the veins brownish black. The pubescence is short, rather sparse and inconspicuous except on the vertex and on under parts of the thorax. There is but little variation in the markings.

Length.—22–24 mm.

This is one of the commonest of tropical species and has been reported from Mexico, West Indies, and as far south as the Argentine Republic. Fox in his Synopsis of the Bembicini of Boreal North America reports a single specimen from California, taken by D. W. Coquillett. I have before me from Mexico and the West Indies 9 males and 13 females.

STICTIA CAROLINA Fabricius.

Figs. 2, 36, 37, 40, 41, 42, 44.

Bembex carolina FABRICIUS, Ent. Syst., vol. 2, 1793, p. 249.

Monedula carolina LATREILLE, Hist. Nat., vol. 13, 1805, p. 302, pl. 102, fig. 3.

Monedula carolina LEPELETIER, Hist. Nat. Hym., vol. 3, 1845, p. 281.

Monedula carolina HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 110.

Male.—Black: Lateral stripes on labrum, pair of lateral spots and median stripe on clypeus usually contiguous, spots between antennae, base of mandibles, scape below, anterior and narrow posterior orbits both shortened above, *white or greenish yellow*. Fasciae of first tergite broad laterally, acutely narrowed, and rather widely interrupted medially; second, broad laterally, somewhat less widely interrupted medially, roundly emarginate on either side of the midline with anterior margin curved forward medially; third usually broken into four spots, sometimes only two; small lateral spots occasionally on tergites four and five, lateral spots on seventh usually connected on midline, lateral spots on sternites 2–3 and occasionally on 4, tarsi above more or less, *light creamy or faintly greenish yellow*. Tibiae except a broad stripe on inner surface of posterior pair, distal extremities of femora, *orange-yellow*.

When seen from above the ultimate segment of the flagellum is roundly pointed at the apex, and segments 6–11 on their posterior surfaces show more or less well-marked prominences. Segments 6–12 bear pits on their posterior surfaces most conspicuous on segment 6. There is a conspicuous tooth on the underside of the apical end of the middle femora, which, when the legs are folded, is covered by a dilation on the posterior side of the base of the metatarsus. There is a trace of a median carina on the second sternite, and on tergite 6 there is a small, weakly developed median tubercle, behind which there is a transverse area more finely sculptured than the surrounding surface. The ultimate tergite is notched at the tip and each lateral angle is produced into a broad truncated spine.

Female.—Black: Labrum, mandibles except tips, clypeus except usually a pair of black spots basally variable in size, pair of spots continuous with the apical border of frons, scape below; anterior and narrow posterior orbits; broken line on posterior border of pronotum;

tubercles, spot on mesopleura posterior to tubercles, pair of small lateral spots on scutellum, sometimes wanting; spot on lateral angles of median segment, fascia on first tergite broad, interrupted and deeply emarginate medially, second interrupted medially and emarginate on either side of the midline anteriorly, third broken into four spots, fourth and fifth reduced to lateral spots; lateral spots on sternites 2-4, sometimes 2-5, femora distally; tibiae except more or less of posterior surfaces, tarsi, *yellow or pale greenish yellow*.

Length.—24-28 mm.

This handsome insect is our largest representative of the *Bembicini*. The variation in the markings is not wide but is more prevalent in the male than in the female. The distribution of the light and dark areas on the labrum and clypeus of the male differs with almost every individual, the prevailing pattern being set forth in the description above. The shade of the color of the markings is quite varied on the male, less so on the female. The wings are slightly infumated. The coxae, trochanters, and femora, except more or less of the apical ends, are black; the tibiae and tarsi are yellow, with more or less black below; the apical segment of the tarsi is somewhat dilated and in the male is mostly black. The pubescence is nowhere conspicuous except on the vertex, and the sculpturing on the body is fine and close. The labium in both sexes is covered with coarse, shallow, scattered punctures, and the apical portion of the ultimate tergite of the male is quite similarly punctured. The ultimate tergite of the female is densely and rather coarsely punctured and the apical portion appears somewhat rugose.

Habitat.—Pennsylvania, New Jersey, Georgia, Louisiana, Texas, New Mexico, Oklahoma, Kansas, and Illinois.

Number of specimens examined—males, 26; females, 19.

STICTIELLA, new genus.

Monedula HANDLIRSCH and Authors (part).

Type of the genus.—*Monedula formosa* Cresson.

The species belonging to this genus are on the whole more slender than those of the genera *Stictia* and *Bembix*, resembling more closely those of the genus *Steniolia*. In length they vary from 10 to 20 millimeters. The head when viewed from in front is broader than long. In the majority of species it is about as broad as the thorax; in a few, however, it is distinctly narrower than the thorax. The compound eyes are large, strongly arched and naked. The facets near the inner border are very slightly larger than those on the outer. The inner margins of the eyes are usually subparallel, occasionally divergent at the vertex. The lower margin reaches the base of the mandible. The precipitous posterior surface of the head is concave and the

temples are narrow. The ocellar cicatrices are circular or nearly so and are sunk in pits, the anterior one having a conspicuous elevation round about it.

The outer border of the mandible is entire, the inner is provided with one or two teeth and the apex is simple. The labrum is longer than broad at the base, not strongly arched, roundly truncate at the apex, but not emarginate. The maxillae are well developed, relatively as long as in the genus *Stictia*, half conical in shape and forming a tube enclosing the tongue which is strongly divided at the apex. The maxillary palpi are composed of six segments and the labial of four. The clypeus is much broader than long, and very slightly arched. There is no proximal median carina and no distal flattened median area. The distal border is curved. The antennae are inserted on the frons quite close to the clypeus and their insertions divide the distance between the compound eyes into three equal parts. In the male the antenna consists of thirteen segments, in the female of twelve. The flagellum of the male seldom shows conspicuous secondary sexual modifications, and consequently is of little use in the separation of species.

The dorsum of the thorax is relatively flat, but the posterior border of the prothorax is much below the level of the scutum, and the tubercles do not reach the tegulae. The suture between the sternum and the episternum of the mesothorax is obliterated. The median segment is short, its lateral angles are rounded, and its posterior surface nearly vertical and flat. The dorsal middle-field is clearly defined and is broadly continued on the posterior surface.

The wings are usually clear, rarely somewhat infumated. The radial cell at its distal end is narrowed and rounded and lies on the costal border of the wing. The first cubital cell in length exceeds the second and third combined. The first cubital cross vein is usually straight, in some species slightly bent near its junction with the cubitus but never so strongly as in the case of *Stictia* or *Bembix*. In many species the second cubital cell is about as wide on the radial as it is on the cubitus, but in others this cell is decidedly narrowed on the radial. It receives both discoidal cross veins. The third cubital cross vein is strongly bent outward, but its form and consequently the form of the third cubital cell vary somewhat in the different species. This cell extends as far toward the distal end of the wing as the distal end of the radial cell, and the angle formed by the radial and third cubital cross veins and opening outward is acute. The first submedian cell is longer than the second, which increases in breadth toward its distal end. The basal vein arises a short distance proximal to the distal end of the submedian cell.

On the hind wing the retinaculum, consisting of an unbroken row of hooklets, begins a short distance proximal to the origin of the

radial vein, which extends almost to the apical border of the wing. The median cell is long and distally bears two longitudinal veins (prolongations of the cubitus and radial) extending to near the border of the wing. The cubital vein arises at some distance from the submedian cell. The posterior angle of this cell, formed by the junction of the submedian and submedian cross veins is obtuse. The legs are relatively long and slender and, as in related genera, the middle coxae are not contiguous. In the female the combs of the anterior tarsi are strongly developed; in the males they are weakly developed or lacking. In the case of the male of many species the middle femora are serrate, dentate or emarginate. Likewise the middle metatarsus may be curved, in which case the inner curved surface may or may not bear a number of spines. In many species the tarsal segments especially the ultimate segments are more or less dilated and flattened. The tarsal claws are long, slender, and simple, but in one species those of the first pair of legs are modified and are not symmetrical. In many species the pulvilli are large and conspicuous; in others, much reduced or lacking. In one species the hind femora are emarginate.

The male genital armature consists of a basal piece (cardo), which bears the lateral stipites, the median spatha below which lie the sagittae. The stipites are large, more or less strongly chitinized, variable in form but never similar in general outline to those of *Stictia*. The median spatha is deeply cleft at the distal end, the two parts strongly chitinized, rounded and curved downward. At some distance from the distal end of the spatha on either side there is a short projection, like the barb of an arrow, somewhat similar to that found in the case of *Bembix*. As in related genera the sagitta is divided near its base into two parts. The inner division is strongly chitinized, rounded, curved and usually ends in a sort of hook. In the exerted genitalia the inner divisions of the two sagittae lie side by side directly below the spatha. The outer division of the sagitta is the shorter of the two, less strongly chitinized and usually somewhat hirsute.

KEY TO SPECIES.

Males.

- | | |
|---|---------------------|
| 1. Medial metatarsus more or less strongly curved; inner curved surface frequently beset with several spines | 2. |
| 1. Medial metatarsus not curved | 12. |
| 2. Second sternite nontuberculate | 3. |
| 2. Second sternite unituberculate | 7. |
| 2. Second sternite bituberculate | 8. |
| 3. Medial femora smooth beneath | <i>pictifrons</i> . |
| 3. Medial femora serrate or dentate beneath | 4. |
| 4. Pulvilli large and distinct; apical segment of all tarsi black; those of the anterior pair dilated and flattened | <i>formosa</i> . |
| 4. Pulvilli indistinct; tarsi normal | 5. |

5. Scutum with discal marks; abdominal fasciae all continuous. *melanosterna*.
 5. Scutum without discal marks; no continuous fasciae on venter of abdomen. 6.
 6. Wings distinctly infumated; lateral ventral spots on abdomen not confined to sternites 2 and 3. *serrata*.
 6. Wings hyaline; lateral ventral spots on abdomen lacking or confined to sternites 2 and 3. *plana*.
 7. Apical segment of fore tarsus broadly dilated and black; process on second sternite blunt and strongly hirsute distally. *tuberculata*.
 7. Apical segment of fore tarsus normal and yellow; process on second sternite pointed and smooth distally. *callista*.
 8. Medial femora smooth; head narrower than thorax. 9.
 8. Medial femora dentate or serrate below; head normal. 10.
 9. Width of the second cubital cell on the radial vein and on the cubital about equal; second sternite almost wholly yellow. *bituberculata*.
 9. Width of the second cubital cell on the radial vein about half its width on the cubital; second sternite mostly black. *emarginata*.
 10. Pulvilli indistinct; apical segment of tarsi normal. *pulchella*.
 10. Pulvilli distinct; apical segment of tarsi black; anterior pair dilated. 11.
 11. Large and stout, 18-20 mm; fasciae on tergites broad and except first continuous; second inclosing pair of black medial spots; fasciae on sternites 1-5 continuous or narrowly interrupted. *speciosa*.
 11. Slender, about 15 mm; fasciae on tergites interrupted on 1 or on 1-3, leaving on one or more of these tergites a pair of yellow medial spots; yellow on sternites in the form of lateral spots. *melampous*.
 12. Head, thorax, base of abdomen and basal joints of legs covered with long, white, dense pubescence; most specimens but not all have the second sternite bituberculate. *villosa*.
 12. Pubescence of head, thorax, etc. of normal character. 13.
 13. Second sternite nontuberculate. *tenuicornis*.
 13. Second sternite unituberculate. *megacera*.
 13. Second sternite bituberculate. 14.
 14. Medial femora of normal form, not emarginate. 15.
 14. Medial femora more or less strongly emarginate posteriorly. 16.
 15. Scutum with a pair of large discal marks. *exigua*.
 15. Scutum without discal marks. *pulla*.
 16. Scape black above; mesosternum marked with black; genital stipes as in fig. 77. *femorata*.
 16. Scape entirely yellow; mesosternum yellow; genital stipes as in fig. 79. *divergens*.

Females.

1. Pulvilli distinct. 2.
 1. Pulvilli indistinct. 13.
 2. Scutum without discal markings. 3.
 2. Scutum with discal marks more or less well developed. 5.
 3. Head narrower than thorax; width of second cubital cell on the radial vein about half its width on the cubital vein. *emarginata*.
 3. Head normal, wide as thorax; second cubital cell normal. 4.
 4. Spots on scutellum rectangular; spots on either side anterior ocellus. *pulla*.
 4. Spots on scutellum triangular; V-shaped spot inclosing anterior ocellus. *megacera*.
 5. Discal marks consisting of a pair of irregular spots, or of lines not broken, not curved inward or approximated posteriorly. 6.
 5. Discal marks in form of a U, either unbroken, interrupted medially, or broken into lines and spots. 7.
 6. Scutellum with pair of large rectangular lateral spots. *pulla*.

6. Scutellum with a continuous fascia, rarely narrowly interrupted on the median line.....*pictifrons*.
7. Second sternite more or less black; its lateral yellow spots sometimes connected apically.....8.
7. Second sternite wholly yellow.....10.
8. Species small, 10–12 mm.; discal marks narrow and broken; fasciae on tergites rather narrow, wavy, scarcely to be considered emarginate.....*femorata*.
8. Species larger, 16–20 mm.; discal marks two broad lines curved and approximated posteriorly; fasciae on tergites broad and emarginated anteriorly.....9.
9. Tergites without posterior black border; posterior tarsi save basal joint dusky above.....*speciosa*.
9. Tergites with a posterior black border; posterior tarsi yellow.....*formosa*.
10. Species large, 16–20 mm.....11.
10. Species small, 10 mm.....12.
11. Scape yellow; black spot on mesosternum near middle coxae.....*tenuicornis*.
11. Scape with black spot above; mesosternum yellow.....*bituberculata*.
12. Fascia of first tergite inclosing a medial black spot basally; head, thorax and base of abdomen sparsely covered with long white pubescence, most evident on lateral angles of median segment.....*scitula*.
12. Fascia of first tergite without medial black spot; not pubescent as above; face and sides of thorax more or less silvery.....*exigua*.
13. Scutum without discal markings.....14.
13. Scutum with discal markings.....15.
14. Mesopleura immaculate; fascia of first tergite interrupted widely.....*serrata*.
14. Mesopleura with large yellow spot; fasciae on tergites all continuous....*pulchella*.
15. Discal marks on scutum small; mesopleura black, rarely with small maculations; venter of abdomen almost entirely black.....16.
15. Discal marks on scutum conspicuous; mesopleura yellow; venter of abdomen almost entirely yellow.....17.
16. Wings infumated; fascia of first tergite widely interrupted and yellow....*serrata*.
16. Wings hyaline; fascia on first tergite narrowly interrupted and white.....*plana*.
17. Species large, 18–20 mm.; no black on mesosternum.....*callista*.
17. Species smaller, 12–14 mm.; black spot, variable in size, in front and slightly above the middle coxa.....*melanosterna*.

STICTIELLA PICTIFRONS Smith.

Figs. 45, 46, 80, 96.

Monedula pictifrons SMITH, Cat. Hym. Brit. Mus., vol. 4, 1856, p. 335, female.*Monedula inermis* HANDLIRSCH, Sitz. Acad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 144, male.*Monedula denverensis*¹ CAMERON, Trans. Amer. Ent. Soc., vol. 34, 1908, p. 235, female.

Male.—Black: Labrum, clypeus, mandibles except apices, scape, basal segments of flagellum below, lower part of frons extended upward between antennae, semicircular spot before anterior ocellus, sometimes connected with the yellow of the frons below, broad anterior orbits, posterior orbits broad below, posterior border of pronotum connected on tubercles with large spot on sides of prothorax, spot

¹ Mr. Rowland E. Turner has written Mr. Rohwer as follows: "I had placed the types of *denverensis* Cam. and *pictifrons* Sm. together. They are certainly the same species although the carina of the anterior ocellus is more clearly defined in *denverensis* giving the depression a deeper appearance. The shape of the second cubital cell is the same."

on tegulae, short lateral lines above tegulae on scutum, lateral spots on scutellum narrowed and approximated medially, fascia on metanotum, curved fascia on median segment above, narrow laterally and broad on posterior surface, where it may be interrupted medially, lateral angles of median segment, sides of same almost entirely, large spots on metapleurae, large spot covering almost the entire mesopleurae and continuous with the yellow on mesosternum inclosing a black spot in front of middle coxae, fascia on first tergite broad laterally, widely and deeply emarginate on anterior middle, the emargination usually extended back from its lateral angles to meet the posterior black border thus inclosing a median bilobed yellow spot, the remaining fasciae of similar pattern, second about as broad as first, others narrower, medial emargination shallower and not extended backward to meet the posterior black border of the segment, sixth fascia sometimes broken into three spots, apex of ultimate tergite, first sternite except lateral basal spots, second except basal border, broad fasciae on third and fourth and narrower ones on fifth and sixth on some specimens, on others large connected lateral spots on third and fourth and disconnected lateral spots on fifth and sixth, coxae, trochanters except spot above, femora except stripe above, tibiae except sometimes a minute stripe on posterior pair above, tarsi except more or less above, *pale yellow* or *yellowish white*.

The yellow is brightest on the legs, sides of thorax, and the under sides of the abdomen. The under surface of the flagellum gradually changes from yellow to testaceous toward the apex, where the ultimate segment is slightly flattened and curved. The anterior tarsi are conspicuously flattened and bear a moderately well-developed tarsal comb, and segments three and four bear well-developed posterior apical processes that are invariably black and are characteristic of this species. The middle and posterior tarsi are less evidently flattened, but segments 3 and 4, and 5 basally, are black above. A male from Arizona shows the black marks only on the anterior tarsi. The middle femora are smooth and the middle metatarsus is curved, but is without spines on curved surface. The second sternite is without process of any kind and the eighth bears a discal spine.

Female.—Black: Labrum, clypeus, mandibles except apices, scape, flagellum basally below, frons below, large spot inclosing anterior ocellus frequently united with yellow on lower part of frons, broad anterior orbits, posterior orbits broad below and frequently continued across the posterior border of vertex, posterior border of pronotum and sides of prothorax except spot in front of tubercles, spot on tegulae, lateral lines and pair of large discal marks anteriorly on scutum, fascia on scutellum narrowed, sometimes interrupted medially, fascia on metanotum, curved fascia on dorsum of median seg-

ment continued medially downward on its posterior surface, sides of median segment entirely or in part, lateral angles of same, metapleurae, mesopleurae, and mesosternum almost entirely, broad fasciae on tergites 1-5, the first broadly and squarely emarginate anteriorly in the middle, sometimes cut through leaving a medial spot as in the male, second with medial emargination usually narrow and much prolonged posteriorly to right and left, third to fifth with more shallow emarginations, which have their posterior middle notched with yellow, apex of ultimate tergite, first sternite entirely, fasciae on 2-5 broadest on two and narrowest on five, apex of ultimate sternite, legs except spot on coxae, trochanters, and femora, above and rarely spot on tibiae above, and tarsi, *lemon yellow*, the color somewhat deeper on the legs than elsewhere.

Length.—12-15 mm.

The flagellum below varies from yellow to testaceous, and above from testaceous to black. In most specimens the mesopleurae and mesosternum are wholly yellow; on a few the mesosternum is more or less black, and on two it is entirely black. The second and third sternites may be entirely yellow or may show more or less of a black basal border.

In both sexes the wings are hyaline and the veins fuscous. The pubescence is short, sparse, and not conspicuous. On the male the markings are lighter than on the female and are not so extensively developed. The fasciae on the tergites are narrower on the male than on the female, and the emarginations are broader and apparently deeper. On one male from Kansas all the tergal fasciae are continuous, and below the yellow color is as extensive as on the brightest of the females. This species is remarkable in the superficial resemblance of the female to *Steniolia duplicata* Provancher.

Habitat.—Virginia, North Carolina, Missouri, Kansas, Texas, New Mexico, Arizona, and Lower California (Handlirsch).

Number of specimens examined.—Males, 5; females, 15.

STICTIELLA FORMOSA Cresson.

Figs. 47, 48, 81, 97, 98.

Monedula formosa CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 221, female, male.

Monedula speciosa HANDLIRSCH, Sitz. Akad. Wissensch. Wien; Math.-Nat. Cl., vol. 99, 1890, p. 140, male, female.

? *Monedula speciosa* FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 366.

Monedula speciosa CAMERON, Trans. Amer. Ent. Soc., vol. 34, 1908, p. 236, male.

Male.—Black: Labrum, clypeus, mandibles except apices, scape, first and second flagellar segments below, entire frons except pit of anterior ocellus and pair of spatulate lines that run downward and inward from the vertex and are narrowly separated below the ante-

rior ocellus, posterior orbits broad below, narrow above, and may be prolonged on the posterior edge of the vertex, prothorax except a broad anterior dorsal spot undulate on its posterior border, which may be extended laterally almost to the tubercles or interrupted, leaving a pair of lateral spots, tegulae in large part, lateral lines on scutum forming with the curved fascia on the scutellum a continuous curved line, fascia on metanotum, curved fascia on dorsum of median segment produced on the posterior surface and narrowly interrupted medially, lateral angles broadly and sides of median segment, mesopleurae except curved line back of tubercles and spot in front of middle coxae, large spot on metapleurae, fascia on first tergite interrupted medially, its anterior border deeply, broadly emarginate medially and extended forward at the extreme sides, posterior border with a broad shallow emargination on either side of the midline, second fascia of similar pattern except that the anterior medial emargination is extended slightly to the right and left at the posterior angles, and the anterior lateral prolongation is divided showing a lateral black spot, third fascia similar to second except that the median emargination is wider and shallower and the anterior lateral prolongation is interrupted, showing a lateral yellow spot, remaining fascia similar in pattern, but much reduced and modified, apex of seventh tergite, first sternite entirely or nearly so, large lateral spots on second, successively smaller lateral spots on sternites 3-5, coxae, trochanters except spot at base, femora except stripe above, tibiae except more or less of lower surface, tarsi except apical segments, *yellow*.

The flagellum is light below and beyond the second segment is of a ferruginous cast. Viewed from above it gradually increases in width from the base to the fourth segment, whence it gradually decreases toward the apex, and segments 3-10 appear very slightly carinate posteriorly, due to specialized areas on the posterior surface. The apical segment of the tarsi is black, dilated, and flattened. This is remarkably so of the anterior pair on which the claws are developed in a fashion peculiar to this species. On the middle and posterior tarsi the apical segment is not so greatly dilated and the claws are of the normal form. The middle femora are dentate on the posterior side; the middle tibiae are club-shaped, being dilated apically (fig. 97), and bear on the apex anteriorly a short, blunt, reddish spine. The middle metatarsus is strongly curved on the inner side, on which, near the base, it bears a number of spines, the most basal one being smallest. The second sternite is plain, without trace of carina or tubercle; the eighth ends in three spines.

Female.—Black: Labrum, mandibles except apices, clypeus, frons except a pair of broad spatulate lines running from the vertex downward and inward, broadly united on the middle of the face and enclos-

ing a Y-shaped spot below the anterior ocellus, scape and first segment of flagellum, second below, posterior orbits broad below and continued across the posterior border of the vertex, prothorax except a broad anterior dorsal spot undulate on posterior margin, tubercles, tegulae, U-shaped discal mark on scutum interrupted at posterior middle, broad lateral lines on scutum continuous with the broad curved fascia on scutellum, metanotum, curved fascia on dorsum of median segment, sides of same continued over lateral angles onto posterior surface, mesopleurae except curved spot behind tubercles and large spot in front of middle coxae and separated from its fellow by a broad median line on mesosternum, metapleurae, fasciae on tergites, all continuous and fashioned like those of the male, but lacking the lateral black spot on second and yellow spot on third, apex of ultimate tergite, first sternite except lateral spots, triangular spots on posterior lateral angles of sternites 2-5 successively smaller, apical edges of ultimate sternite, coxae, trochanters except spot above, tibiae except spot below, smallest or wanting on posterior pair, and tarsi, *yellow*. The posterior border of the middle femora is curved so that when seen from below the segment appears much wider in the middle than at either end. The middle tibiae are somewhat dilated apically, but much less so than in the male.

Length.—17-20 mm.

The wings in both sexes are hyaline, relatively short, and the veins are brown. The legs are strong and the tibiae and tarsi very spiny. The tarsal combs are strongly developed in the female but are practically wanting in the male. The pubescence is white, short, sparse, and inconspicuous even on the male. The color of the markings is a lemon yellow lighter on the head and abdomen than on the thorax and darker on the legs. The labrum, the apical half of the clypeus and the anterior orbits of the female are very light, almost white on one specimen. The lateral spots on the sternites may or may not be connected apically by narrow lines. One male is smaller and more slender than the other two; the thorax and median segment are immaculate above except for narrow broken line on scutellum; the extent of the yellow on sides of prothorax and sides of thorax and median segment is greatly reduced. The fasciae on the first three tergites are widely interrupted, leaving a pair of medial spots on two and three; the remaining three are more or less completely interrupted on either side the midline, leaving a median spot. Structurally it shows no variation whatever. Judging from Cameron's description of the male he referred to *speciosa*, his specimen must have been very similar to this one.

Handlirsch considered this species identical with *speciosa* Cresson and accordingly placed it as a synonym under that species. As far as I can discover it has been so regarded by others since that time, but

the specimens before me make it necessary to restore the species. Cresson's type of *speciosa*, a female, came from Colorado and his type of *formosa* from Texas. Both Handlirsch's and Cameron's specimens were all from Texas, and the descriptions indicate that they belong to Cresson's *formosa*. I have before me females from Colorado, Texas, and Kansas and males from New Mexico and Texas. The males from these two localities are structurally distinct as well as differently maculated, and those from New Mexico are so nearly like the female from Colorado in color and general appearance as to warrant, in my opinion, the assumption that they are sexes of the same species. Aside from the fact that the males in question are positively distinct, the color of the females and the pattern of their abdominal fasciae are sufficiently unlike to justify the contention that they belong to different species.

Habitat.—Texas, Kansas.

Number of specimens examined—Males, 5; females, 4.

STICTIELLA MELANOSTERNA, new species.

Figs. 49, 50, 82, 99.

Male.—Black: Labrum, mandibles except apices, clypeus except narrow basal border, lower part of frons, irregular V-shaped spot inclosing anterior ocellus, anterior orbits irregularly notched and reduced to a very narrow line above, comparatively broad posterior orbits extended for some distance on the posterior border of the vertex, prothorax except a median anterior dorsal spot, and a dusky spot anterior to tubercles, tegulae, broad lateral lines and a broken U-shaped discal spot on scutum, broad fascia on scutellum narrower medially, metanotum, broad curved fascia on dorsum of median segment extended in a pair of triangular points on its posterior surface, lateral angles including much of the posterior surface and all the sides of the median segment, metapleurae, mesopleurae, and mesosternum except a pair of large black spots in front of the middle coxae, broad fasciae on tergites 1-6, the first roundly or somewhat triangularly emarginate on its anterior middle and slightly biemarginate on its posterior border, second with anterior medial emargination somewhat extended at its posterior lateral angles and notched with yellow on the middle of its posterior border; the remaining fasciae with four anterior emarginations, the middle pair somewhat the larger and deeper, apex of ultimate tergite, broad continuous fasciae on all sternites, coxae except basal spot below, trochanters except more or less black above, femora except broad stripe on anterior pair above, tibiae, and tarsi, *bright lemon yellow*.

The ultimate segment of the antennae is curved and segments 5-11 are faintly carinate on the posterior surface. The middle femora are slightly angulated below near the base, and from this point to the apex extends a row of short stout spines. The middle metatarsi are

curved on the inner side and basally bear a group of spines, the more apical two being large and conspicuous. At the apical end of the curved surface are several smaller spines. The second sternite is plain and the eighth lacks a discal spine. Genital stipes as in figure 50.

Female.—The female is so similar to the male in color and maculations that a separate description is unnecessary. The following differences, however, are noted: Black basal border of clypeus is lacking; anterior orbits are broader; posterior orbits are connected across vertex; the U-shaped discal mark is usually interrupted on posterior middle; black spot anterior to middle coxae is quite small; lateral emarginations on anterior of fasciae on tergites 2-5 shallow and usually covered by the segment preceding; black on coxae wanting and reduced on trochanters; black stripe on all femora above; ultimate sternite yellow. A female from Arizona has the yellow much more extensive; the black spots on the sternum are reduced to mere points, the U on the scutum is broad and continuous, and the legs and sternites are wholly yellow.

In both sexes the flagellum is fulvous or yellowish-fulvous below, darkening toward the apex. The pubescence is short, sparse, and inconspicuous and the punctation is of the usual character. The tarsal combs are strongly developed on female; weakly on the male. On both sexes the pulvilli are indistinct.

Length.—11-14 mm.

This species is characterized by its indistinct pulvilli, broad fasciae on tergites, yellow sides of thorax and median segment, and small size. It is described from six males and seven females. Of the females five are from New Mexico, one from Arizona, and one from Utah; the males are all from New Mexico.

Type.—Male. Cat. No. 19803 U.S.N.M.

STICTIELLA SERRATA Handlirsch.

Figs. 51, 52, 83, 100.

Monedula serrata HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 143, male.

Monedula serrata FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 366.

Male.—Black: Labrum, mandibles except apices, clypeus except very narrow basal border, spot between antennae, small spot before anterior ocellus, scape, broad anterior orbits, posterior orbits, posterior dorsal border of pronotum, tubercles continuous with spot on sides of prothorax, spot on tegulae, feebly marked lateral spot above tegulae on scutum, large lateral spots on scutellum, fascia on metanotum, narrow border of mesosternum reaching upward to tubercles, fascia on first tergite reduced to widely separated rectangular lateral spots, remaining fascia narrowly interrupted medially, that on second tergite broadest and deeply and widely emarginate on anterior middle, those on 3-6 much narrower and slightly emarginate anteriorly on either side

the mid line, posterior lateral spots on sternites 2-6, which on some segments may be connected by an apical line, coxae and trochanters more or less, femora except stripe above on anterior and middle pairs and above and below on posterior pair, tibiae except stripe on anterior pair below, and tarsi, *yellow*. The antennae are slightly carinate posteriorly and the apical segment is curved. The middle femora are dentate below and the middle metatarsi are curved on the inner side, the curved surface bearing basally several rather large spines. The second sternite is plain and the eighth is without a discal spine.

Female.—Black: Labrum, mandibles except apices, lower half of clypeus, lower part of frons, spot before anterior ocellus, scape except a dusky spot above on some specimens, broad anterior orbits, posterior orbits, posterior dorsal border of pronotum, spot or line on sides of prothorax united with tubercles, spot on tegulae, short lateral lines on scutum above tegulae, large lateral spots on scutellum, fascia on metanotum, spot near lateral angles and another below the spiracle on median segment, fasciae on tergites 1-5 similar in all respects to those of the male except that some or all (except the first) may be continuous, posterior lateral spots on sternites 2-5, spot on anterior and middle coxae below, trochanters apically above, anterior and posterior borders of femora shortened basally on posterior pair, tibiae except more or less prominent dusky line below and usually also above on anterior pair, and tarsi, *yellow*. The apical sternite is black and the legs, especially the tarsi, are tinged with ferruginous.

Length.—11-13 mm.

In both sexes the flagellum is lighter below than above, especially the basal segments, and in the female, and slightly also in the male, is more or less tinged with ferruginous. The wings are somewhat strongly infumated, nearly as much so as those of *Stictia carolina*. On the female the pubescence is short, sparse, and inconspicuous; on the male short, rather dense, and conspicuous on the head, thorax, and more apical sternites. The pulvilli are indistinct on both sexes. One female bears a pair of discal marks on the scutum, and a male from Wisconsin has the fasciae on the tergites almost white.

Habitat.—Florida, Georgia, North Carolina, Wisconsin.

Number of specimens examined—males, 4; females, 5.

STICTIELLA PLANA Fox.

Figs. 53, 84.

Monedula plana Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 367, male.

Monedula usitata Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 371, female.

Male.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, scape below, spot in front of anterior ocellus, broad anterior orbits, posterior orbits, posterior border of pronotum, tubercles, large spot on sides of prothorax, anterior part of tegulae, small lateral spot on scutum above tegulae, large lateral spots on scutel-

lum approximated medially, fascia on metanotum, small oblique spots on dorsum of median segment, the lateral angles more or less and spot on sides of median segment, all absent on the type specimen, narrow vertical line on anterior border of mesopleurae, fascia on first tergite broad laterally, interrupted and narrowed to a point medially, fasciae on tergites 2-5 narrowly interrupted medially or continuous, with broad, shallow, anterior, medial emargination deepest on tergite 2, on which the fascia is the broadest, fascia on tergite 6 broken or complete, lateral spots on ultimate tergite, lateral spots on sternites 2 and 3, which may be absent, spot below on anterior and middle coxae, anterior and middle trochanters apically, anterior and middle femora except stripe above, posterior femora distally, tibiae except spot below on anterior pair, and tarsi, *greenish yellow or yellowish-white*. The apical segment of the flagellum is curved; the middle femora bear below a number of spines; the middle metatarsi are slightly curved on the inner side, which basally bears a row of four rather stout spines and apically a few very short ones. The second sternite is plain and the eighth is without a discal spine.

Female.—Black: Labrum, mandibles except apices, lower border of clypeus, scape below, space between antennae, spot below anterior ocellus, broad anterior orbits, narrow posterior orbits, line, sometimes broken, on posterior dorsal border of pronotum, tubercles and line leading downward from them, spot on tegulae, lateral spots above them and a pair of small discal spots on scutum, fascia on scutellum interrupted medially, short fascia on metanotum, pair of oblique lateral lines on dorsum of median segment, small spot on lateral angles, and another on sides of median segment, fascia on first tergite, interrupted medially and broadly emarginate on anterior middle, fascia on 2-4 continuous, all broadly, and that on second deeply emarginate on anterior middle, fascia on fifth narrow and interrupted medially, minute lateral spots on second sternite, anterior femora below, middle and posterior femora distally, tibiae more or less above, *greenish yellow or yellowish white*.

In both sexes the flagellum is testaceous below, the wings hyaline, pulvilli indistinct, and pubescence short, sparse, and not conspicuous. The tarsi of the female except the anterior pair, which show some yellow markings, are dusky almost black in some specimens; the middle and posterior pairs, as in the male, are very slender with all the segments except the ultimate one provided at their distal ends with long straight spines. The tarsal combs on the anterior pair are well developed in the female, but in the male only feebly. The claws are very slender and but slightly curved.

Length.—12-14 millimeters.

Habitat.—Kansas, South Dakota.

Number of specimens examined—Males, 2; females, 3.

STICTIELLA TUBERCULATA Fox.

Figs. 54, 55, 101, 102.

Stictia tuberculata Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 366.

Male.—Black: Labrum, mandibles except tips, clypeus except marginal line at base, scape and basal flagellar segments below, space between antennae, pair of minute spots below anterior ocellus, anterior orbits, posterior orbits, line on posterior border of pronotum, sides of prothorax almost entirely, elongated irregular spot on mesopleurae, large spot on metapleurae, spots on side of median segment, short lateral lines on scutum above base of wings, triangular lateral spots on scutellum approximated medially, fascia on metanotum, oblique lines on dorsum of median segment and spots on its posterior surface, larger part of lateral angles of same, fascia of first tergite broken into pair of spots broad laterally, fasciae on remaining tergites continuous, broadly emarginate medially on anterior border and slightly sinuate laterally, ultimate tergite and sternite apically, broad continuous fasciae on other sternites narrowed medially, legs except more or less black on trochanters, black lines above on all femora, and black ultimate segment of tarsi, *yellow*.

Length.—14 mm.

The ultimate segment of the antenna is longer than its immediate predecessor, narrowed somewhat distally, rounded at the apex, and distinctly curved. The middle femora are serrate; the middle tibiae are distinctly dilated distally, resembling those of *formosa* in this respect; the middle metatarsi are curved and bear a group of spines near the base; and the ultimate segment of all tarsi is black and that of the anterior pair is distinctly dilated. The dilation of the last segment of the anterior tarsus is not symmetrical, being much more prominent on the posterior than on the anterior border of the segment. The second sternite bears a prominent median process decidedly hirsute in character.

This is a well-marked and distinct species.

Habitat.—Nevada.

Number of specimens examined—Males, 2; females, 0.

Type.—In the collection of American Entomological Society of Philadelphia.

STICTIELLA CALLISTA, new species.

Figs. 56, 85, 103.

Male.—Black: Labrum, mandibles except apices, clypeus except narrow black basal border, lower part of frons prolonged upward between antennae and narrowly separated from a broad V-shaped spot enclosing the anterior ocellus, broad anterior orbits, scape below, broad posterior orbits connected across the vertex and produced downward on either side the mid line of the occiput, prothorax except

median anterior dorsal spot and dusky line in front of tubercles, tegulae, broad lateral lines and U-shaped discal mark interrupted on posterior middle on scutum, broad fascia on scutellum narrower medially, metanotum, broad curved fascia on dorsum of median segment produced medially in a pair of triangular points on its posterior surface, likewise its lateral angles broadly and sides entirely, metapleurae, mesopleurae, and mesosternum except spot in front of middle coxae, broad fasciae on tergites, first deeply and roundly emarginate on anterior middle, and somewhat narrowed medially on posterior border and acutely notched on the midline, second with a narrow transverse median spot on either side the midline, third, fourth and fifth each with a wide but not very deep emargination on anterior middle, which is squarely notched with yellow on its posterior middle, sixth slightly biemarginate on anterior border, apex of ultimate tergite, sternites entirely except median anterior black spots on sternites 3-6, which are hidden when the abdomen is slightly flexed, coxae, trochanters except spot above, femora except stripe above, tibiae except spot below on anterior pair, and tarsi, *bright lemon yellow*.

The middle femora are distinctly serrate below; the middle metatarsi are curved, and basally on the inner side bear three stout spines. The second sternite bears a prominent tubercle and the sixth apically on the median line bears a distinct, somewhat triangular hump or elevation. The eighth below is strongly hirsute, the middle spine is long, stout and curved, and a discal spine is wanting.

Female.—Black: Labrum, mandibles except apices, clypeus, lower part of frons prolonged upward between antennae and narrowly separated from a broad V-shaped spot about the anterior ocellus, broad anterior orbits reaching almost to the posterior orbits on vertex, scape except apical dusky spot above, broad posterior orbits connected across the posterior border of vertex, prothorax except median anterior dorsal spot, tegulae, lateral lines and broad U-shaped discal mark on scutum, broad fascia on scutellum, metanotum, median segment entirely except a narrow curved black border adjoining metanotum and narrow black lines bordering the oblique sutures on dorsum and posterior surface, sides, and venter of mesothorax and metathorax, broad fasciae on tergites 1-5, first with a median anterior bilobed black spot, second with a median elliptical black spot on either side the midline, third, fourth, and fifth biemarginate on anterior middle, first to fourth slightly notched on posterior middle, ultimate tergite except three black emarginations at base, sternites entirely except more or less black basally on 4-6, legs entirely except spots on trochanters and stripes on femora above *bright lemon yellow*.

Length.—18-20 mm.

On both sexes the flagellum is testaceous below with the first and second segments yellowish. The ultimate segment is conical at the apex and on the male is slightly curved. The pulvilli are indistinct in both sexes and the pubescence is decidedly short and sparse; the female is almost nude. The wings are hyaline and long, the veins brown. On both male and female the fasciae on tergites 1-5 are slightly notched on posterior middle and on the males the anterior emargination on the third fascia may take the form of a pair of median spots similar to those on the preceding fascia. On some males the clypeus lacks the black basal border and the posterior orbits may not be connected across the vertex. Two females from Arizona (collected by F. H. Snow), which I have referred to this species are extremely yellow; the prothorax, sides, and venter of mesothorax and metathorax, median segment, first four tergites, and the first two sternites, are entirely yellow. It is a beautiful species, and owing to its large size and bright colors it is not likely to be confused with any species except *tenuicornis*, from which it can be readily distinguished by the absence in this species of distinct pulvilli in both sexes, by the absence of long spines on the lateral areas of the ultimate tergite of the female and by the presence of the serrate femora and curved metatarsi of the middle legs and the unituberculate second sternite of the male.

Habitat.—New Mexico, Arizona.

Number of specimens examined—males, 4; females, 3.

Type.—Male, Cat. No. 19806, U.S.N.M.

STICTIELLA BITUBERCULATA, new species.

Figs. 57, 58, 86, 104.

Monedula tenuicornis Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 369, male (not female).

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, lower part of frons, broad anterior orbits, broad V-shaped spot inclosing anterior ocellus, posterior orbits broad below but narrower above, a rather narrow line across the posterior border of pronotum, sides of prothorax except a dusky line in front of tubercles and a small round lateral spot above this line, tegulae, weak lateral lines above tegulae on scutum, lateral spots on scutellum, fascia on metanotum, curved fascia on dorsum of median segment, sides and lateral angles of same, metapleurae, mesopleurae almost entirely, mesosternum except small lateral spots in front and slightly above middle coxae, fasciae on tergites 1-6 are more or less perfectly broken into large rectangular lateral spots, and a pair of ellipsoidal medial posterior spots, apex of seventh tergite, sternites entirely except small lateral spots of first and small medial spots on 3-6, coxae, trochanters below, femora except broad stripe above, tibiae

except spot below on first pair and stripe on posterior pair, and tarsi, *yellow or yellowish white*.

The medial spots on the tergites are decidedly white, as are also those on scutellum and metanotum. The clypeus is a very light yellow and the head is narrower than the thorax. The flagellum, long and slender, is tawny yellowish below, darkening toward the apex; segments 5-11 are faintly carinate posteriorly and the ultimate segment is slightly curved. The pulvilli are large and distinct, the middle femora smooth, and the basal half of the middle metatarsi is curved on its inner surface, which is not beset with spines. The second sternite bears two distinct, closely approximated but not large tubercles and the eighth bears a prominent discal spine. The wings are hyaline and the veins fuscous. Pubescence and punctation are of the normal character. Genital stipes as in figure 58.

Female.—Black: Labrum, mandibles except apices, clypeus, lower part of frons extended upward between antennae, scape except small spot above, basal segments of flagellum below, V-shaped spot inclosing anterior ocellus, broad anterior orbits, posterior orbits broad below, narrower above and prolonged upon vertex, posterior dorsal border and sides of prothorax, lateral lines on scutum, pair of longitudinal lines and pair of approximated spots on disk of scutum, fascia narrowed medially on scutellum, fascia on metanotum, broad curved fascia on dorsum of median segment, lateral angles and sides of same, fasciae on tergites 1-5 similar in pattern to those of the male but better developed and all continuous except the first, ultimate segment both above and below except at base, second sternite, broad fasciae on sternites 3-4 with shallow median emarginations, fascia on fifth biemarginate, legs except stripe above on femora and below on anterior tibiae, *yellow*. The color is much richer than that on the male. The flagellum above is dark; below and at the apex tawny. The wings are clear, less than twice the combined length of the thorax and median segment; the veins are brown.

Length.—18 mm.

Two males of this species before me differ greatly from the type in the extent of the maculations (but not at all in structure). The first, from the same locality as the type, is a trifle smaller; the yellow on the prothorax is much reduced; the dorsum of the thorax and middle segment is black except a pair of small lateral spots on the scutellum; there is an irregular line on the mesopleurae, a spot on the metapleurae and another on sides of median segment; the paired median spots on the dorsum of the abdomen are separated from one another and from the lateral spots on all segments except the sixth; and the black on the sternites and on the legs is somewhat more extended. In a word, the maculations on the specimen are reduced.

On another, a specimen from Arizona, the maculations are better developed than on the type; the spot inclosing the anterior ocellus is united with the yellow on the frons below; the posterior orbits extend in a broken line across the vertex; the prothorax except for a median anterior dorsal spot is wholly yellow; there are lateral yellow lines and a broken U-shaped discal mark on the scutum, a fascia on the scutellum, another on metanotum, and a curved fascia on dorsum of the median segment, which is extended on its posterior surface; the lateral angles broadly and the entire sides of the median segment, the mesopleuræ, metapleuræ, and the mesosternum are wholly yellow; the paired median spots on dorsum of abdomen are all united with the lateral spots and those on tergites 2 and 3 are united medially, thus forming continuous, though deeply emarginated, fasciæ; and the black on the legs and sternites is much reduced.

This species is characterized by a narrow head, the basally curved middle metatarsi destitute of spines, the pair of tubercles on the second ventral and the paired spots almost white in color on the dorsum of the abdomen. This species stands close to *emarginata*, from which it can be readily distinguished by its abdominal maculations and by the fact that the second cubital cell is almost square. In my judgment Fox erred in considering this species as the male of *tenuicornis*, and my reasons for so thinking are stated in my discussion of that species.

Habitat.—California, New Mexico, Arizona.

Number of specimens examined—Males, 5; females, 1.

Type.—*Male*, Cat. No. 19804, U.S.N.M.

STICTIELLA EMARGINATA Cresson.

Figs. 59, 60, 87, 105.

Monedula emarginata CRESSON, Proc. Ent. Soc. Phila., vol. 4, p. 468, female and male.

Monedula mamillata HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 146.

Male.—Black: Labrum, mandibles except tips, clypeus, apical part of frons, scape below, usually a very small spot before anterior ocellus, broad anterior orbits, narrow posterior orbits, pair of transverse spots on posterior border of pronotum, spot on tegulæ, lateral spots on scutellum, usually a narrow fascia on metanotum, rather narrow fasciæ on tergites 1–6, first usually reduced to widely separated lateral spots, second sometimes narrowly interrupted medially and widely and shallowly emarginate on anterior middle and sometimes prolonged forward on either side the emargination, third, fourth, and fifth usually continuous and the anterior emargination reduced to undulations, sixth usually broken into three spots, apex of ultimate tergite, lateral spots or continuous fasciæ on sternites 2–5, fascia on 6, femora apically more or less, tibiæ except frequently spot below, and tarsi, *yellow or yellowish white*.

The four males before me show an unusual amount of variation both in the maculations and in the color of same. On one specimen the body markings are decidedly white; on others bright lemon yellow. On a specimen from Kansas the dorsal fasciæ are comparatively broad and only the first is narrowly interrupted. On the same specimen there is a large spot on sides of prothorax. Another specimen from the same State shows a short pair of lateral lines on the scutum. The antennæ show no special modifications; the middle femora are smooth below; the middle metatarsi are curved on the inner side medially and basally on the same side bear a row of about five or six comparatively stout spines. The second sternite bears a pair of short, pointed, prominent tubercles and the eighth a discal spine.

Female.—Black: Labrum, mandibles except apices, clypeus, space between antennæ, scape below, very small spot in front of anterior ocellus extended slightly upon the vertex, very broad anterior orbits, moderately broad posterior orbits, pair of transverse spots on posterior border of pronotum, tubercles, spot on sides of prothorax, tegulæ, usually short lateral lines above base of wings on scutum, lateral spots on scutellum narrowed medially and more or less approximated, fascia on metanotum, spot on sides near lateral angles of median segment, rarely small spot on metapleurae, broad fasciæ on tergites 1-5, first interrupted medially and anteriorly deeply emarginate in the middle, in some specimens cut through in such fashion as to leave a median posterior pair of spots, fasciæ 2-5 biemarginate anteriorly on dorsum of tergite, apex of ultimate tergite and sternite, lateral spots on sternites 2-5, and small median posterior spots on 3-4, *white or faintly yellowish white*. Femora more or less, tibiae except spot below, and tarsi, *yellow*. The tarsi are more or less testaceous, especially the posterior pair. The first and also the second segment of the flagellum may be yellowish below. On some specimens the median abdominal ventral spots are wanting; on others the lateral spots are connected by apical lines.

Length.—15-18 mm.

In both sexes the head is narrower than the thorax and the white, dense, rather short pubescence on the head, thorax and base of abdomen is somewhat better developed on the male than on the female. The pulvilli are distinct in both sexes. The wings are slightly infumated and the width of the second cubital cell on the radial vein is about half its width on the cubitus.

It seems highly probable that Handlirsch's *mamillata* is identical with this species, and I have so considered it. In his description of the male Cresson makes no mention of tubercles on the second sternite. I have, however, examined the specimens of this species in the collection of the American Entomological Society of Philadelphia,

among which is the type of the species, and the males there agree with the description given above. All specimens that I have referred to this species, both males and females, have the second cubital cell narrowed on the radial vein, and all the Males have the second sternite bituberculate, thus agreeing with Handlirsch's *mamillata*.

Habitat.—New Mexico, Colorado, Wyoming, Kansas.

Number of specimens examined—males, 9; females, 14.

STICTIELLA PULCHELLA Cresson.

Figs. 61, 62, 88, 106.

Monedula pulchella CRESSON, Proc. Ent. Soc. Phila., vol. 4, 1865, p. 471, female and male.

Monedula minutula HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 148, female.

Male.—Black: Labrum, mandibles except apices, apical half of clypeus, pair of minute spots on frons below and between antennae, pair of spots laterad of the insertion of antennae prolonged upward as exceedingly narrow anterior orbits, comparatively broad posterior orbits, broken line on posterior border of pronotum, tubercles connected with an irregular spot on side of prothorax, spot on tegulae, small lateral spots on scutellum, narrow broken fascia on metanotum, spot on lateral angles and spiracles of median segment, spot on metapleurae, two small spots on mesopleurae, widely separated lateral spots on first tergite, continuous fasciae on tergites 2–6, that on second broadly but not very deeply emarginate on anterior middle, remaining fasciae biemarginate on anterior border and all with a notch on posterior middle, apex of ultimate tergite, continuous fasciae on all sternites, apical spot on coxae below, femora except stripe above and below, tibiae except stripe below on first and second pairs, and tarsi, *yellow*.

The eyes are distinctly divergent above. The middle femora are serrate below and the middle metatarsi are distinctly curved on the inner side and basally bear several spines. The second sternite bears a pair of small tubercles and the eighth lacks a discal spine.

Female.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, curved spot below anterior ocellus, scape below, broad anterior orbits, posterior orbits broad below, posterior border of pronotum, sides of prothorax except line in front of tubercles, tegulae, lateral lines on scutum, fascia on scutellum narrow medially, fascia on metanotum, curved fascia on dorsum of median segment interrupted medially, lateral angles and nearly the entire sides of the median segment, metapleurae, mesopleurae, and mesosternum except large area in front of the middle coxae, continuous fasciae on tergites, first with a wide anterior medial emargination ending in three points posteriorly and with three shallow emarginations on posterior border,

second with a wide square medial anterior emargination, remaining fasciae slightly biemarginate on anterior middle, heart-shaped spot on apex of ultimate tergite, apical fasciae on all sternites distinctly narrowed medially on 5, apex of ultimate sternite, coxae, and trochanters below more or less, femora except broad stripe above and short stripe below on posterior pair, tibiae except spot below on first and second pairs, and tarsi, *yellow or yellowish white*.

Length.—14–16 mm.

On both male and female the flagellum is ferruginous above and fulvous below; the apical segment is curved, and in the male the posterior border of the flagellum is slightly carinate. The wings are hyaline, the veins fulvous. The pulvilli are indistinct. The fascia on the scutellum of one female is broken into spots similar to those on the male, the fascia on the median segment appears as faint oblique lines, yellow on mesosternum and mesopleurae much reduced, and the black on the legs present on all tibiae and below on posterior and middle femora. The frons and clypeus of the female show a silvery reflection; the eyes are widely separated and only slightly divergent above.

All specimens differ from the original description in that they show no trace of discal marks on the scutum, and the male has the base of the clypeus black.

Habitat.—California.

Number of specimens examined—Males, 17; females, 10.

STICTIELLA SPECIOSA Cresson.

Figs. 63, 64, 89, 107.

Monedula speciosa CRESSON, Proc. Ent. Soc. Phila., vol. 4, 1865, p. 470, female.

?*Monedula speciosa* PATTON, Bull. U. S. Geol. Surv., vol. 5, 1879, p. 361.

Male.—Black: Clypeus, labrum except an indefinite medial stripe, mandibles except apices, lower part of frons extended in a triangular area above insertion of antennae, semicircular spot below anterior ocellus, scape below, broad anterior orbits, posterior orbits broader below than above, prothorax except a broad anterior dorsal spot, tegulae, short lateral lines on scutum above tegulae, broad fascia on scutellum, narrow fascia on metanotum, broad curved fascia on dorsum of median segment extended down medially on posterior surface, sides of same entirely including lateral angles and much of posterior surface, mesopleurae except large spot below extended on mesosternum almost to the median line, metapleurae, fascia on first tergite broad laterally, interrupted narrowly in the middle, broadly emarginate on anterior middle and slightly on either side the posterior middle, fascia on second broad, continuous, inclosing a pair of median, elliptical, transverse, black spots and triundulate on posterior margin, fasciae on 3–6 broad, biemarginate on anterior margin

and undulate on posterior, apex of ultimate tergite, first sternite except small lateral spots, second except median longitudinal line, triangular lateral spots on 3-6, which may or may not be connected by apical lines, coxae, trochanters except spot above, femora except line on first and traces of line on second above, tarsi except all ultimate segments, *pale yellow*, deeper in shade on the legs.

The flagellum is ferruginous below, shading to yellowish on the basal segments, and 3-6 bear inconspicuous specialized areas. The second cubital cross vein is decidedly curved, so that the width of the second cubital cell on the radial veins is much less than its width on the cubitus. The middle femora below are dentate. The tibiae are not dilated as in *formosa* and are provided on the anterior at the apex with a short, stout spine. The middle metatarsi on the inner side are curved and bear near the base a row of four stout spines, of which the two in the middle are largest. The ultimate segment on all tarsi is flat and black and on the anterior pair is greatly broadened, but the claws are of the normal form. The second sternite bears near its posterior margin a pair of short but conspicuous tubercles, and the eighth lacks a discal spine; the ultimate tergite basally bears a number of short lateral stout spines.

Female.—Black: Labrum, mandibles except tips, clypeus, scape, first two flagellar segments below, frons except a pair of widely separated points at base of clypeus and a large butterfly-shaped black spot on the middle, which may be connected laterally with the black of the vertex; large spot almost inclosing the anterior ocellus; broad posterior orbits extended across the posterior edge of vertex; prothorax except a broad anterior dorsal spot and a dusky line in front of tubercles, tegulae, lateral lines, and a U-shaped discal mark that may be narrowly interrupted at posterior middle on scutum, broad transverse fascia on middle of scutellum, fascia on metonotum, median segment entirely except a black fascia on anterior border, a short black vertical line on posterior surface and rather broad black bands bordering sutures on dorsum and posterior surface, pair of large spots on mesopleurae of which the anterior one may be prolonged on the front border of the mesosternum to the ventral midline, thence backward narrowly to spot in front of middle coxae, metapleurae, all tergites (except a medial, rounded, black emargination on the first, a narrow anterior black margin somewhat broader laterally and continuous with a small but deep black emargination on either side the midline on the second, a somewhat broader anterior black margin with broader, shallower emargination on either side the midline on third, fourth, and fifth, and black lateral spots on sixth), lateral spots on sternites 1-5, the posterior ones smallest, pair of spots on apex of ultimate sternite, coxae except basal spots, trochanters except spot above, femora except line above reduced on posterior

pair, tibiae, and tarsi except tips of middle and posterior pairs, *yellow or yellowish white*.

On the abdomen the markings are almost white, the color approximating Ridgway's *marguerite yellow*. On the thorax and median segment above and on the head the yellowish tinge is somewhat more apparent; it is still more conspicuous on the scape and sides of thorax and median segment, and the legs, except the coxae, are decidedly yellow. The under side of the flagellum is yellowish, changing to testaceous toward the apex. The ultimate segments of the tarsi are but slightly dilated, and that of the middle tarsi and all the segments of the posterior pair except the metatarsi are decidedly dusky above.

Length.—18–20 mm.

The wings in both sexes are hyaline and the nervures brown. The narrowing of the second cubital cell on the radial vein is less pronounced in the female than in the male. The pubescence is relatively short, moderately dense and white except on the vertex, where it assumes a brownish color. The head is somewhat narrower than the thorax, more evident in the male than in the female, and the inner margins of the eyes are approximately parallel. On the type (a female) there are fasciae on sternites 2–4; on the female from Kansas the lateral spots on sternites 1, 2, and 6 are united on the midline. The fasciae on the tergites of the male are narrower than those of the female, and the first is interrupted medially, but in design they are quite similar.

In the discussion of *formosa* it is pointed out that that species has been regarded as identical with this, but it is very easy to separate the males on structural differences, and, although the females lack these structural characters, their markings are just as distinctly different as are the structures on the males. On *formosa* all tergites except the last possess a black apical border; this black border is entirely wanting on *speciosa*. The apical tarsal segments of *formosa* are yellow; the middle and posterior pairs of *speciosa* are dusky, almost black. The fasciae on the tergites of *formosa* are yellow; on *speciosa* they are almost white.

Habitat.—Colorado, New Mexico, Kansas.

Number of specimens examined: Males, 2; females, 4.

STICTIELLA MELAMPOUS, new species.

Figs. 65, 66, 108.

?*Monedula speciosa* PATTON, Bull. U. S. Geol. Surv., vol. 5, 1879, p. 361.

Male.—Black: Labrum, mandibles except apices, clypeus, scape, and first two segments of the flagellum below, lower part of frons produced upward between antennae, curved spot in front of anterior ocellus, broad anterior orbits, narrow posterior orbits, prothorax

except broad anterior dorsal spot with undulate posterior border and a line in front of tubercles enlarged at inner end, tegulae, narrow line above base of wings on scutum, lateral spots on scutellum narrowed toward the median line, narrow fascia on metanotum, pair of broken oblique lines on dorsum of median segment, lateral angles and spot near spiracle of same, metapleurae, small spot on mesopleurae behind the tubercles and another large one on anterior border that meets its fellow on the midline of the mesosternum, spot on mesosternum between middle coxae, broad, widely separated lateral spots and a pair of small median posterior spots on first tergite, narrow fasciae on tergites 2-5 continuous except that on tergite 2 and all biemarginate on anterior middle, sixth with a large median and small lateral spots, apex of ultimate tergite, lateral spots on sternites 2-5, coxae except basally, trochanters apically below, femora except stripe above on first pair, tibiae, and tarsi except ultimate segment on first and second pairs, and the last three segments on posterior pair, *yellow*.

The flagellum is testaceous below and slightly carinate posteriorly; the apical segment is reddish, much lighter than the others, slightly flattened apically, neither curved nor truncate, and somewhat longer than the segment immediately preceding. The middle femora are serrate below and the middle metatarsi are distinctly curved on the inner side and basally bear three spines, of which the distal two are large and prominent. The apical segment of all tarsi is *black*, dilated, flattened, and rounded apically, those on the anterior pair being dilated most, those on the posterior pair least, on which pair the third and fourth segments also are dark above and below. The pulvilli are large and distinct. The second sternite bears a pair of low, rounded, and somewhat widely separated tubercles and the eighth lacks a discal spine. The seventh tergite bears at the extreme lateral edges an inconspicuous ridge, from below which spring a number of short, stout spines. The pubescence is white, short, and moderately dense on head, thorax, and base of the first segment of the abdomen; the remaining segments are scarcely pubescent at all and show a beautiful bluish-violet iridescence.

Length.—15 mm.

The second specimen lacks the medial spots on the first tergite, but has a pair on the second and third. On the fourth and fifth they are united medially, and on the fourth also with the lateral spots. It also lacks the broken lines on the dorsum of the median segment and has all the femora striped with black above.

This species stands quite close to *speciosa*, with which it agrees in respect to the special structures of the legs, the tubercles on the second sternite, and the lateral spines on the ultimate tergite. It differs from *speciosa*, however, in that the second cubital cross vein is

scarcely curved, and consequently the second cubital cell is narrowed but little on the radial vein. Furthermore this species is much smaller and more slender and the pattern of its maculations is entirely different. It is my conviction that it was a male of this species that Patton in Bulletin 5, United States Geological Survey (p. 361), described as the male of *speciosa*.

Described from two males collected by Mr. F. X. Williams, August, 1911.

Habitat.—Seward County, Kansas.

Type and Paratype.—Collection of University of Kansas.

STICTIELLA VILLOSA Fox.

Figs. 3, 67, 68.

Monedula mamillata Fox (not Handlirsch), Proc. Cal. Acad. Sci., (2) vol. 4, 1893, p. 10.

Monedula villosa Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 370, male.

Male.—Black: Labrum, mandibles except apices, clypeus, scape and basal segments of flagellum below, space between insertion of antennae, spot on either side anterior ocellus, broad anterior orbits, posterior orbits broader below than above, prothorax except median anterior dorsal spot and spot before tubercles, tegulae, short lateral line above tegulae and pair of anterior discal spots on scutum, large lateral spots on scutellum, fascia on metanotum sometimes interrupted medially, spot on sides of median segment, metapleurae, large spot on mesopleurae in most specimens continuous with a longitudinal median mesosternal stripe that may be reduced to a median spot in front of middle coxae, broad fasciae on tergites 1-6, the first deeply and somewhat roundly emarginate on anterior middle, second, third, and fourth more widely and successively less deeply emarginate on anterior middle, fifth and sixth slightly waved, but not emarginate, apex of ultimate tergite, sternites entirely except black anterior lateral spots on 1 and 2, a narrow median anterior black spot on 3 and 4 and a narrow anterior black border on 5 and 6, spot on all coxae below, trochanters apically more or less, femora except stripe above, tibiae, and tarsi, *bright greenish yellow*.

Length.—10-13 mm.

The clypeus is almost white, faintly tinged with greenish yellow. The fasciae on the first four tergites posterior to the medial emargination are also white—a character that is constant and in degree varies only slightly on the first fascia. The flagellum varies below from greenish yellow basally to testaceous apically. The head, thorax, basal joints of the legs, including the femora, and the base of the abdomen, are densely covered with long, shaggy, white pubescence—a character that distinguishes this species from all others herein listed. The legs show no special modifications and the pulvilli are large and

distinct. The second sternite in some specimens bears a pair of tubercles rather poorly developed but quite distinct; in other specimens this sternite lacks these tubercles entirely. The eighth bears a prominent discal spine. The wings are hyaline and very long, reaching almost to the end of the abdomen and being more than twice as long as the thorax and middle segment together. Variation in the extent of the maculations is slight, yet there is some reduction in the size of the spots on the thorax and median segment. When the abdominal segments are closely drawn together the venter appears almost entirely yellow.

Habitat.—New Mexico, Arizona, Mexico.

Number of specimens examined—Males, 11; females, 0.

STICTIELLA SCITULA Fox.

Monedula scitula Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 369, female.

Female.—Black: Labrum, mandibles except apices, clypeus, scape, flagellum below, frons except a median black spot (shaped somewhat like an expanded butterfly), connected laterally above with a transverse black stripe across the vertex, from which a stripe occupies the pit of the anterior ocellus, broad posterior orbits broadly connected across the vertex, prothorax, tegulae, broad lateral lines and U-shaped discal mark, which may be broken into three spots, on scutum, large lateral spots on scutellum approximated medially, fascia on metanotum, broad curved fascia on dorsum of median segment, broad lateral angles and sides of median segment, sides and venter of thorax entirely except the narrow lines of the sutures, broad fasciae on tergites 1-5, first with a median anterior black spot, which in some cases is connected with the black on base of segment, second, third, and fourth with wide, shallow, median, anterior emargination, slightly extended backward at the posterior lateral angles, especially on the second, fifth with anterior border undulate, apex of ultimate tergite, sternites entirely, legs entirely, *bright lemon yellow*.

Length.—10-11 mm.

The flagellum is testaceous above, lightest at apex. The clypeus and labrum are much lighter in color than the rest of the body markings. The region posterior to the base of the mandibles, frons above the antennae, and the vertex are provided with long, dense, white pubescence; the pubescence of the thorax and base of the abdomen is shorter and more sparse. Altogether the pubescence is more conspicuous on this species than is common on females of this genus. The pulvilli are large and distinct. The wings are hyaline, long, reaching nearly to the end of the abdomen, and fully twice the length of the thorax and median segment combined. The species is of normal form, but in the case of many specimens the abdomen is abnormally contracted, and it was from specimens of this kind that the

original description was made. The unusual development of the pubescence on this species and on *villosa*, the similarity of the wing venation of the two and their common habitat raise the question as to whether this may not be the female of that species. I should not be surprised if later investigation should prove such to be the case.

Habitat.—New Mexico, Arizona.

Number of specimens examined—Males, 0; females, 16.

STICTIELLA TENUICORNIS Fox.

Figs. 69, 70, 90.

Monedula tenuicornis Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 368, female.

Male.—Black: Labrum, clypeus, mandibles except apices, inferior part of frons, large spot about anterior ocellus connected by a vertical line with the yellow of the frons below, broad anterior orbits, posterior orbits continued somewhat on the posterior border of vertex, prothorax except median anterior dorsal spot, broad lateral lines and U-shaped discal mark, which may be broken, on scutum, tegulae, fascia on scutellum broad laterally, metanotum, broad, curved fascia on dorsum of median segment, lateral angles broadly and sides of same, metapleurae, mesopleurae and mesosternum except small spot in front of middle coxae, broad fasciae on tergites 1-6, the first squarely and deeply emarginate on anterior middle and deeply and triangularly emarginate on either side of the posterior middle, second with a transverse, arcuate, medial, anterior black spot and three shallow posterior emarginations, third with a narrow medial anterior emargination greatly extended to right and left on middle of tergite and with three posterior emarginations, the middle one deepest, fourth, fifth, and sixth similar to third, but with anterior emargination modified and posterior black border reduced, apex of ultimate tergite, first and second sternites entirely, broad fasciae on 3-6 narrowed medially and sometimes also laterally, coxae except spot on posterior pair below, trochanters except spot above, femora except stripe above, tibiae, and tarsi, *bright lemon yellow*, of deeper shade on the legs.

Female.—Black: Labrum, clypeus, mandibles except apices, scape and basal segments of flagellum below, frons below, V-shaped spot in front of anterior ocellus, broad anterior orbits, posterior orbits broad below and extended on vertex, sometimes entirely across, prothorax except medial anterior dorsal spot, tegulae, lateral lines and U-shaped discal mark, sometimes broken into three spots, on scutum, fascia on scutellum narrowed medially, metanotum, broad fascia on dorsum of median segment prolonged medially on posterior surface, its sides, lateral angles, and most of its posterior surface, metapleurae, mesopleurae, mesosternum except spot in front of middle coxae, broad

fasciae on tergites 1-6, first with a deep rectangular emargination at anterior middle and three slight emarginations on posterior border, second with an elliptical black spot near the middle on either side the median line and three slight posterior emarginations, third similar to second, but with two black spots narrowly united to an anterior medial emargination, fourth and fifth on anterior margin dorsally biemarginate and laterally waved, ultimate tergite except narrow anterior border, first and second sternites entirely, third entirely or with only a central anterior black spot, fourth and fifth with rather broad fasciae narrowed medially and laterally, ultimate sternite apically, coxae, trochanters except spot above, femora except stripe above, tibiae except sometimes a stripe below, and tarsi, *lemon yellow*.

Length.—16-18 mm.

The flagellum in both sexes is slender, and the apical half is testaceous below. In the male the apical half is carinate on the posterior side and the ultimate segment curved. The intermediate femora of the male are smooth beneath and the metatarsus not curved. The second sternite is nontuberculate and the eighth is without a discal spine. In color and markings the sexes are remarkably similar and the different specimens show but little variation from the typical form. On the first tergite the emargination may appear as an anterior rectangular black spot or it may be connected with the posterior emargination so as to cut off a pair of posterior median yellow spots or a single yellow spot. On the second on both male and female we usually find a single median black spot that may or may not be connected by a narrow medial emargination with the anterior black border. Other slight modifications may occur but the basic pattern remains the same, the variations being due to a greater or less extension of the black on the dorsal surface. The lateral borders of the ultimate tergite of the female, especially toward the base, are provided with numerous stout spines. The wings are hyaline and relatively long; the pubescence short and sparse, and the labrum, clypeus, and anterior orbits of the female show a silvery reflection when viewed at the proper angle. In his description of this species Fox associated as male and female of the species a male that I regard as representative of a different species entirely. I base this judgment on the fact that males I have before me and the female of Fox's *tenuicornis* are so similar that they can be distinguished only by their sexual characteristics, whereas the male Fox assigned to this species differs from the female not only in color and widely in the pattern of the markings, but also in having the head narrower than the thorax. I have accordingly considered the male as representative of a new species and have redescribed it herein under the name *bituberculata*.

Habitat.—California, Arizona, Texas.

Number of specimens examined—Males, 3; females, 7.

STICTIELLA MEGACERA, new species.

Figs. 71, 72, 91.

Male.—Black: Labrum, mandibles except apices, clypeus, scape except narrow line above, first two flagellar segments below, lower part of frons, V-shaped spot below anterior ocellus, broad anterior orbits, posterior orbits, narrow posterior dorsal border and sides of prothorax except narrow line in front of tubercles, tegulae, short lateral lines above base of wings on scutum, large lateral spots on scutellum, short fascia on metanotum, lateral angles and sides of median segment, metapleurae, broad irregular line on mesopleurae and mesosternum meeting on the middle of the latter and prolonged backward to the middle coxae, fasciae on tergites, first broad laterally but widely and deeply emarginate on anterior middle, biemarginate on posterior border and almost interrupted on midline, second broad with a narrower anterior median emargination, of which the posterior lateral angles are strongly produced obliquely laterally, third with broad, shallow, anterior, median emargination, the remainder with slightly undulate anterior borders, apex of ultimate tergite, first sternite, second except irregular anterior border, remaining sternites with broad fasciae (which, when the abdomen is strongly flexed, cause the sternites to appear entirely yellow), coxae, trochanters except spot above, tibiae, and tarsi, *yellow*.

The flagellum is dark above, reddish below. The second segment widens apically and the third is still broader; from the fourth to the apex the width decreases imperceptibly. The ultimate segment is slightly curved and somewhat flattened apically. The legs are relatively short and unusually stout. The middle femora are decidedly short, thick and heavy and are smooth below; the middle metatarsi are also unusually short, thick, and heavy and show no trace of curve or spines on inner surface. The posterior are likewise unusually thick, heavy, and rounded and when seen from in front are plainly arcuate, the hollow of the bow being on the upper side. The pulvilli are large and distinct. The wings are hyaline and a trifle over twice as long as the combined length of the thorax and median segment. The pubescence is white, moderately long, and dense on head, thorax, and base of abdomen; it is somewhat shorter and less dense yet quite evident on all sternites and very short and sparse on tergites. The second sternite bears a very large median spine, very heavy at the base, bluntly pointed and hirsute. The terminal spines of the eighth are very short and a discal spine is lacking.

Female.—Black: Labrum, mandibles except tips, clypeus, scape below, greater part of flagellum below, lower part of frons, V-shaped spot below anterior ocellus, broad anterior orbits, posterior orbits

narrow above, narrow line on posterior border of pronotum, greater part of sides of prothorax, tegulae, narrow lateral lines on scutum, large lateral triangular spots on scutellum, fascia on metanotum, curved fascia on dorsum of median segment narrowly interrupted on posterior surface of segment, lateral angles and sides of same, large spot on metapleurae, small posterior and larger anterior spot on mesopleurae the latter of which extends downward to join its fellow on the sternum and forming with it a longitudinal band that reaches the middle coxae, fasciae on tergites, first broad laterally but deeply and widely emarginate on the anterior middle, nearly interrupted on mid-dorsal line, and slightly biemarginate on the posterior border, second with lateral sinuations and broad median emarginations on anterior border, third with anterior lateral sinuations and dorsally biemarginate, fourth and fifth undulate on anterior border, apex of sixth broadly, broad fasciae on sternites, the more posterior ones narrowed medially, coxae, tochanters and femora except broadly above, tibiae, and tarsi, *yellow*, the color being very pale on the labium, clypeus, orbits, and fasciae of the tergites.

The flagellum is dark, testaceous above, yellow below, basally becoming somewhat rufous apically. It does not show the broadening of the medial segments seen on the male. The legs are relatively short and stout, the middle metatarsus being similar to that of the male. The second cubital cell is almost a perfect rectangle. The pubescence is like that on the male.

Length.—14–16 mm.

Described from two males and one female; one male from Arboles, Colorado, second male from Iron County, Utah, and the female from North Yakima, Washington.

Type.—Male in the Brooklyn Museum. Allotype and paratype, Cat. No. 19805, U.S.N.M.

STICTIELLA EXIGUA Fox.

Figs. 73, 74, 92.

Monedula exigua Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 370, *female*.

Male.—Black: Labrum, mandibles except apices, clypeus, inferior part of frons, curved spot on either side the anterior ocellus, almost inclosing it, scape except apical spot above, broad anterior orbits narrowed to a point above, posterior orbits more or less perfectly connected across the posterior of vertex, prothorax except small anterior median dorsal spot, lateral lines and a pair of large discal spots on scutum, broad fascia roundly emarginate on anterior middle or narrowly interrupted on midline on scutellum, metanotum, broad curved fascia on dorsum of median segment, lateral angles broadly and sides of same, metapleurae, mesopleurae, and mesosternum except narrow anterior black border and large lateral black spot on front and

above the middle coxae continued upward along the suture between the mesopleurae and metapleurae, broad fasciae on tergites, first with a broad rounded shallow emargination on anterior middle, second to fifth each with a wide and very shallow anterior emargination on either side the dorsal midline, apex of ultimate tergite, sternites 1-3 entirely, broad apical fasciae on 4-6, legs entirely except spots above on trochanters and femora basally, *yellow*. The legs are of the normal form, without any special modifications. The second sternite bears a pair of closely placed, sharply pointed, prominent tubercles, and the eighth a prominent discal spine.

Female.—Black: Labrum, mandibles except apices, clypeus, frons below, pair of curved spots almost inclosing anterior ocellus, broad anterior orbits narrowed to a point above, scape, posterior orbits continuous on vertex, prothorax, tegulae, broad lateral lines and pair of broad discal lines narrowed posteriorly on scutum, scutellum, metanotum, dorsum of median segment except curved black fascia on anterior border, lateral angles, sides and almost all the posterior surface of median segment, metapleurae, mesopleurae, and mesosternum except lateral spots in front and slightly above middle coxae, tergites except shallow median anterior black emargination on first, narrow anterior black border on remainder, slightly waved on 3-5 and notched on 6, sternites entirely except basal border of 5 and 6, legs entirely except basal spots above on trochanters, and femora, *yellow*. The clypeus, labrum, and frons are decidedly silvery, the sides of the thorax less so, and even the venter of the abdomen shows a trace of this.

In both sexes the flagellum is cylindrical in form, testaceous above, yellowish or testaceous below, and lighter in the female than in the male. The silveriness of the face and sides of the thorax is less evident in the male than in the female. The pubescence is short and inconspicuous. The wings are hyaline and the veins brown. The pulvilli are distinct.

Length—9-13 mm.

The description above is made from two males and one female collected by F. H. Snow, in Arizona. A comparison with Fox's type of *exigua* convinces me of their identity, although the markings on these specimens are somewhat more extensively developed than are those on the type which is a female from Montana.

This species stands very close to *Stictiella pulla* Handlirsch, from which it is distinguished chiefly by the more extensive maculations.

Habitat—Arizona, Montana.

STICTIELLA PULLA Handlirsch.

Figs. 75, 93.

Monedula pulla HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 99, 1890, p. 149, female.

Monedula usitata FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 371, male.

Male.—Black: Labrum, mandibles except apices, lower part of clypeus variable in extent, scape below, space between insertion of antennae, minute spot on either side of anterior ocellus, anterior orbits, posterior orbits, posterior border of pronotum, tubercles and narrow lines on border of side of prothorax, tegulae, lateral spot on scutum above tegulae, large lateral spots on scutellum, fascia on metanotum, curved fascia on dorsum of median segment sometimes reduced to two spots or entirely wanting, spiracle and spot on sides of median segment usually extended on lateral angles, spot on metapleurae, irregular spot on mesopleurae, broad fasciae on tergites 1-6, the first with broad, shallow, medial, anterior emargination, remainder with a shallow anterior emargination on either side the mid-dorsal line, ultimate tergite apically, first sternite except anterior lateral spots, the remaining sternites except narrow basal border varying somewhat in width on the several sternites, coxae except base more or less, trochanters below, femora except broad stripe above and below which stripes are united on posterior pair, tibiae except spot below on anterior and middle pairs and occasionally on posterior pair, and tarsi, *yellow*. The antennae and legs show no special modifications. The second sternite bears a pair of short approximated processes and the eighth a prominent discal spine.

Female.—The female, with regard to general appearance and pattern of maculations, is essentially like the male. The black on the clypeus is wanting or reduced to small basal lateral spots; that on the legs is somewhat more extensively developed. The yellow markings are somewhat brighter in color and slightly better developed; on one female there is a pair of small discal spots on the scutum. Aside from these differences in color and the absence of the secondary sexual modifications found on the male, the description above will apply to the female also.

Length—10-14 mm.

In both sexes the flagellum below is yellowish or testaceous, decreasing in intensity toward the apex. The black on the clypeus of the male is variable in extent; it is never entirely absent and it never spreads over the entire clypeus. On both male and female the clypeus appears somewhat silvery, more evident on well-preserved specimens of the female than on the male. The fasciae on the tergites of the male show two distinct shades of color, lemon yellow and yellowish white, somewhat variable in their arrangement; this

diversity of shade in the fasciae is less apparent on the female owing to their deeper and brighter color. The apical segment of all tarsi on the female is longer than the two preceding segments together, is heavy, not flattened, rectangular in outline and thickly beset with stout hair below; on the male this segment is more slender, conical and comparatively shorter. The pulvilli on both male and female are large and distinct and the pubescence is not at all conspicuous. The wings are hyaline and the form of the three cubital cells, identical in the sexes.

I have associated here as sexes of one species Handlirsch's *pulla*, a female, and the male of Fox's *usitata*. I have done this for the following reasons: The pattern of their maculations is almost identical; the pulvilli are large and distinct in both cases; the form of the third cubital cell is peculiar and common to both; they are of the same size and are found in the same locality. The female of Fox's *usitata* has indistinct pulvilli, the sternites wholly without fasciae, and the form of the third cubital cell is distinctly different from that of the male he associated with it. Furthermore, I am convinced that the female referred by Fox to his *usitata* is the female of his *plana*. The character of the pulvilli, the maculations and the habitat all point to this conclusion.

Habitat.—California, Washington.

Number of specimens examined—males, 12; females 8.

STICTIELLA FEMORATA Fox.

Figs. 76, 77, 94, 109.

Monedula femorata Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 363, male.

Male.—Black: Clypeus, labrum, mandibles except apices, scape below, spot in front of anterior ocellus and inferior part of frons, separated by a butterfly-shaped spot that above is broadly connected laterally with the black of the vertex, broad anterior orbits shortened above, narrow posterior orbits, posterior border of pronotum connected on tubercles with a large spot on sides of prothorax, small spot on tegulae, small spot near tegulae on scutum, lateral spots on scutellum, metanotum, curved fascia on dorsum of median segment more or less broken, irregular spot on mesopleurae extending on the mesosternum, small spot on metapleurae, spot on lateral angles of median segment, fasciae on tergites 1-6 narrowly interrupted medially, apex of ultimate tergite, fasciae on sternites 1-6, legs except upper side of coxae, trochanters, femora and more or less of the posterior tibiae, *yellow or yellowish white*.

The flagellum is testaceous beneath except the more basal joints, which are yellowish; segments 6-11 seen from below are distinctly carinate on the posterior border and the apical segment is flattened

and curved. The pulvilli are distinct; the anterior tarsi are unusually flat and broad, the apical segment less so, and each segment below bears a black spot. The medial femora are strongly emarginate below and bear a slight notch beyond the emargination. The hind femora are also more or less emarginate below, sometimes taking the form of a slight dilation of the segment apically beyond the middle. The second sternite is bituberculate.

Female.—Black: Clypeus, labrum, mandibles except apices, scape except small spot above, semicircular spot in front of anterior ocellus and lower part of frons separated by a black butterfly-shaped spot that above is broadly connected laterally with the black of the vertex, posterior orbits usually united across the vertex, posterior border of pronotum including the tubercles, sides of prothorax except spot in front of tubercles, tegulae, lateral lines above tegulae and medial longitudinal discal lines which may be continued posteriorly to form a more or less broken U-shaped mark on scutum, curved fascia on scutellum, narrowed medially, fascia on metanotum, continuous curved fascia on dorsum of median segment, lateral angles of same, mesopleurae and sternum almost entirely, spot on metapleurae, spot on side of median segment anteriorly, fasciae on tergites continuous and rather broad, the first with a broad shallow anterior emargination, the remainder slightly waved anteriorly but not emarginate, medial spot on apex of ultimate tergite, middle and narrow apical margin of first sternite, fasciae on sternites 2-5, that on second broad and deeply emarginate anteriorly, apex of ultimate sternite, legs below except spot on middle and posterior coxae, and above except spots on all coxae, trochanters, femora, and posterior tibiae, *yellow or pale yellowish white*. The flagellum is testaceous below. The middle femora are short and stout; the posterior femora are incrassate near the middle; the apical segment of the anterior tarsi is not dilated so much as that of the male; the pulvilli are present but small.

Length.—9-12 mm.

Of the four male specimens before me one, the type specimen, is from Florida, and three are from Texas. The specimens from Texas differ from the type in that the emarginations of the middle and posterior femora are less pronounced. One of the males from Texas is somewhat smaller than the type. In his description Fox states that the intermediate metatarsus is curved, which statement can scarcely be considered accurate; the segment is bent quite near the base but it is not curved as is that of *serrata* or *speciosa*. It is, however, near the base slightly dilated on the anterior margin and somewhat roundly incised on the inner side in much the same fashion as is the corresponding segment on the anterior tarsus. Furthermore the inner, posterior angle of the middle tibia is produced into a short

spine, which, with the incision on the metatarsus, forms a structure quite similar to the antenna cleaner invariably found on the first pair of legs of wasps and bees. In addition to the two prominent processes on the second sternite of the type specimen, there is a smaller and more widely separated pair on the third and an inconspicuous pair on the fourth. These secondary ventral processes are also more or less well developed on the other males.

In both sexes the wings are hyaline, short, and scarcely reach the posterior border of the third abdominal segment. The veins are brown. The pubescence is short, white, and not conspicuous. The male of this species can scarcely be confused with that of any other except *divergens*, from which it can be distinguished by the more extensive maculations of the latter and particularly by the form of the genital stipes. The peculiar modification of the middle femora, the unique structure found at the union of the middle tibia and metatarsus, and the presence of secondary processes on sternites three and four separate this species and the one following from all others. Length, 9–12 millimeters.

Habitat.—Florida, Texas.

Number of specimens examined—Males, 4; females, 5.

STICTIELLA DIVERGENS, new species.

Figs. 78, 79, 95, 110.

Male.—Black: Labrum, mandibles except tips, clypeus, scape, flagellum below, lower part of frons extended upward between antennae, irregular semicircular spot below anterior ocellus, broad anterior orbits shortened and narrowed to a point above, narrow posterior orbits, posterior border of pronotum, sides of prothorax except irregular spot in front of tubercles, tegulae, lateral lines and pair of discal lines (absent on paratype) on scutum, fascia on scutellum, curved fascia on dorsum of median segment narrowly interrupted medially, lateral angles and spot at spiracles on median segment, spot on metapleurae, mesopleurae almost entirely, mesosternum entirely, fasciae on tergites 1–6, first broad laterally, narrower medially with deep acute anterior median emargination, remaining fasciae somewhat narrower medially than laterally and slightly sinuate (those on tergites 4–6 of paratype narrowly interrupted medially), apex of seventh tergite, second sternite except pair of small anterior lateral black spots, continuous fasciae on sternites 3–6 the more posterior ones narrowest, legs entirely except black spots above on trochanters and basally on femora and conspicuous black spots on all segments of the anterior tarsi below, *bright yellow*. The more posterior fasciae on the abdomen both above and below are, however, yellowish white.

The flagellum is testaceous above and segments 6-10 are slightly carinate on the posterior surface. The ultimate flagellar segment is curved and obliquely truncate at the apex. The wings are hyaline and the second cubital cell is decidedly narrower on the radial vein than it is on the cubitus. The anterior tarsus is somewhat flattened but scarcely as much so as in the case of *femorata*, and like that species it has a distinct black spot below on anterior tarsal segments. The middle femora are emarginate and the middle tibia apically on the posterior side bears a short spine, which in conjunction with flattened and slightly curved base of the metatarsus forms a structure somewhat similar to the antenna cleaner of the first pair of legs. The posterior femora are slightly curved below and distally incrassate, but they are not emarginate. The second sternite bears a pair of short, pointed, closely approximated tubercles, and there is a smaller, inconspicuous pair on each of the third and fourth sternites more widely separated than those on the second. The pubescence is white, short, and sparse, except on the seventh sternite, where it is relatively long, dense, and brown. The eighth sternite lacks a discal spine, but there is a longitudinal prominence at the base of the middle spine. The genital stipes is distinct in pattern.

Length.—12-14 mm.

This species stands very close to *femorata* Fox, but it differs from that species in its more extensive maculations, its richer yellow color, and especially in the form of the genital stipes. The species is described from two male specimens taken by Mr. F. X. Williams.

Habitat.—Kansas.

Type.—Male and paratype in the collection of the University of Kansas.

Genus BICYRTES Lepeletier.

Bembex OLIVIER (part), *Encycl. Meth.*, vol. 4, 1789, p. 288.

Monedula DAHLBOM (part), *Hym. Eur.*, vol. 1, 1845, p. 492.

Bicyrtes LEPELETIER, *Hist. Nat.*, vol. 3, 1845, p. 53.

Type: *Bicyrtes (servillii) Lepeletier ventralis* Say. Monobasic

Bembidula BURMEISTER, *Bol. Acad. Cordova*, vol. 1, 1874, p. 122.

Type: *Monedula discisa* Taschenberg. (Present designation.)

Bembidula HANDLIRSCH, *Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl.*, vol. 98, 1889, p. 473.

Bembidula KOHL, *Die Gatt. d. Spheg.*, 1896, p. 442.

The head seen from in front is wider than long. The compound eyes are large and strongly arched; their inner borders are somewhat divergent at the vertex, and their lower borders reach the mandibles. The frons is relatively flat, variable in width, and bears a slight carina between the antennae. The anterior ocellar cicatrice is situated on a slight prominence. It is linear, arcuate, and transversely placed. The posterior cicatrices are also linear but not so narrow as the anterior one, semicircular, and almost longitudinally placed. The

occiput is quite narrow and the posterior surface of the head vertical and flat. The temples are narrow. The mandibles on their anterior border are entire; on their posterior border they are provided with two teeth and the apex ends in a point. The maxillae are moderately long, and when folded at rest they are concealed beneath the labrum. The maxillary palpi are formed of six segments and the labial of four. The labrum is about as long as broad at the base, somewhat arched from side to side and broadly rounded at the apex, not emarginate. The clypeus is broad and arched and its lower border is slightly curved.

The antennae are inserted on the frons on either side of the median carina a short distance above the base of the clypeus. They consist of 12 segments in the female and of 13 in the male. In the case of the males of some species some of the flagellar segments show secondary sexual modifications that are of use as characters in the distinguishing of species. The first flagellar segment (pedicel) is about as thick as long and the second exceeds any of the following ones in length.

The dorsum of the thorax is comparatively flat and the collar is placed much below the level of the scutum. The tubercles do not reach the tegulae. The suture between the sternum and episternum of the mesothorax is obliterated. The surface of the metapleura is almost at right angles to the long axis of the body and as a result its junction with the side of the median segment forms a depression into which the femora of the middle leg is drawn when at rest. The median segment shows a clearly defined dorsal middlefield which extends down upon the posterior surface of the segment. In a manner that is characteristic of the species of this genus the lateral angles of the median segment are extended, strongly compressed and wedge-like, and consequently the posterior surface of the segment from side to side is conspicuously curved or concave. The tergites are arched, the sternites flat, and in general the abdomen appears relatively longer and more slender than in *Bembix*. In the case of the female of some species the ultimate tergite bears a more or less well defined pygidial area set off by lateral ridges. The eighth sternite of the male, concealed beneath the seventh, ends in three spines instead of one as in *Bembix*. On none of the species so far recorded from North America north of Mexico do we find processes on the sternites of the males. The male genital apparatus consists of a short basal piece that subtends the long, strongly hirsute, weakly chitinized, lateral stipites, variable in form among the species, the median cleft spatha, which, seen from above, ends in a prominent rectangular dilation, and below the spatha the sagittae. Each sagitta is composed of two parts; the inferior part is straight, relatively slender, weakly chitinized and hirsute; the superior part is curved somewhat, strongly chitinized

and enlarged at the distal end. This enlargement resembles somewhat a truncate spoon, the concave surface being faced inward toward the midline.

Front wing.—The pterostigma is vestigial. The apical end of the radial cell is rounded off and lies on the costal border. Of the three cubital cells the first is about as long as the second and third combined. The first cubital cross vein is almost straight; the second is almost sigmoid in shape; and is far from parallel with the first so that the second cubital cell is much narrower on the radial vein than on the cubital, on which it receives both discoidal cross veins. The third cubital cross vein is quite strongly directed outward and roundly curved at its posterior end so that the rounded apical end of the third cubital cell frequently extends beyond the end of the radial cell. The angle formed by the radial and third cubital cross veins and opening outwardly is acute. The second discoidal cross vein posterior to its junction with the cubital is angularly bent outward and subtends at the angle a short longitudinal vein. The first submedian cell is as long or longer than the second, which gradually increases in width toward its apical end. The basal vein arises proximal to the terminus of the first submedian cell.

Hind wing.—The retinaculum, consisting of an unbroken row of small hooklets, begins near the origin of the radial vein, which extends distally almost to the apical border of the wing. The median cell is extremely long. The cubital vein arises distal to the terminus of the submedian cell. The posterior angle of the submedian cell, formed by the submedial and submedial cross veins, is, like that of *Steniolia*, obtuse. The submedial vein terminates in the anal sinus. The wings, particularly the anterior pair, in both sexes of many species are more or less infumated, the infumation being more evident in the female than in the male of the same species. The character and the degree of infumation is of value in the separation of species.

The legs are relatively long and slender. The middle coxae are not contiguous, and on the inner distal margin of the hind pair of some species there is a distinct tooth. The middle femora of the males of some species are compressed below to a sharp edge and in others there is present basally below a prominent, flattened tooth. The middle tibia at the distal end is provided with a single spur. The anterior tarsus of the female is flattened and provided with a strong tarsal comb; in the case of the male, with the exception of a few species, the anterior tarsus is not flattened and the tarsal comb is but weakly developed. The pulvilli are well developed and the claws simple.

The pubescence is short and sparse, not at all prominent except on the vertex. The punctations are evident, fine, and usually uni-

form, and their character and distribution on certain areas are used as specific characters, but such use is not wholly satisfactory. The ground color is black, frequently showing iridescence. The maculations are usually yellow but the shade of yellow varies greatly among the different species, in some almost white, in others very dark and in still others it may be tinged or replaced by ferruginous.

Bicyrtes differs from all related genera in the character of the posterior surface and the lateral angles of the median segment. Furthermore, it differs from *Bembix* in the number of segments in the palpi, in the form of the ocellar cicatrices, in the character of the first cubital cross vein, the eighth sternite, the apex of the labrum, and the male genitalia; from *Microbembex* in the number of segments in the palpi, the character of the mandibles, the radial cell, and the ocellar cicatrices; from *Stenolia* in the number of segments in the palpi, the length of the maxillae, the ocellar cicatrices, and the form of the male genitalia; from *Stictia* and *Stictiella* in the form of the ocellar cicatrices, and the male genitalia.

The generic synonymy given above was called to my attention by Mr. Rowland E. Turner, who writes Mr. S. A. Rohwer as follows:

Bembidula ventralis Say. A specimen in our collection is labelled "*Bicyrtes servillei* Lep. compared with type by Spinola." If this is correct *Bicyrtes* has priority over *Bembidula*, but *servillei* will sink as a synonym.

On receipt of this information I made a careful study of Lepeletier's description of *Bicyrtes servillei* and am convinced that Spinola's comparison is reliable. I, therefore, feel fully justified in changing the name of the genus.

KEY TO SPECIES.

Males.

1. Posterior coxa with tooth on inner distal margin. *fodiens*.
1. Posterior coxa without tooth. 2.
2. Middle femora with distinct tooth at base. 3.
2. Middle femora without tooth at base. 4.
3. Ultimate tergite black; fasciae on tergites narrow *ventralis*.
3. Ultimate tergite with lateral yellow spots; fasciae on tergites relatively broad. *parata*.
4. Mesopleura more or less conspicuously marked with yellow. 5.
4. Mesopleura black. 7.
5. Anterior wings heavily clouded in the region of the first cubital cell. . . *viduata*.
5. Anterior wings without heavily clouded area. 6.
6. Fasciae on tergites attenuated medially; the posterior one more widely interrupted than the anterior one; sixth reduced to widely separated spots. *quadrifasciata*.
6. Fasciae on tergites scarcely attenuated medially; the posterior one less widely interrupted than the anterior one; sixth almost or quite continuous. . *annulata*.
7. Anterior wings with heavily clouded area in region of first cubital cell. 8.
7. Anterior wings without clouded area; infumation, if present, diffused. 9.
8. Dorsum of median segment unmarked; genital stipes as in fig. 123. *gracilis*.
8. Dorsum of median segment with a more or less complete yellow fascia; stipes as in fig. 125 *viduata*.

9. Flagellum black; fascia on sixth tergite wanting or reduced to widely separated lateral spots; genital stipes as in fig. 118. *quadrifasciata*.
9. Flagellum not wholly black; fascia on sixth tergite always developed and scarcely more widely separated than the other fasciae; genital stipes otherwise formed. 10.
10. Scape, first two joints of flagellum and legs ferruginous; genital stipes as in fig. 127. *insidiatrix*.
10. Scape and first two joints of flagellum not entirely ferruginous; genital stipes otherwise; legs black and yellow or black and ferruginous 11.
11. Legs black and ferruginous; markings deep yellow, frequently with dashes of ferruginous *capnoptera*.
11. Legs black and yellow; markings pale or creamy yellow, with no trace of ferruginous *mesillensis*.

Females.

1. Posterior coxa with tooth on inner distal margin 2.
1. Posterior coxa without tooth 3.
2. Fasciae on tergites narrow; ultimate tergite black *fodiens*.
2. Fasciae on tergites broad; ultimate tergite yellow *burmeisteri*.
3. Pygidial area on ultimate tergite bordered with distinct lateral ridges 4.
3. Pygidial area and lateral ridges on ultimate tergite lacking 5.
4. Mesopleurae black; scutum without discal marks; fasciae on tergites interrupted medially and the more posterior ones narrowed laterally *capnoptera*.
4. Mesopleurae yellow or bearing more or less conspicuous yellow markings; scutum with a pair of discal marks; fasciae on tergites usually continuous, not narrowed laterally *annulata*.
5. Mesopleurae black 6.
5. Mesopleurae marked with yellow more or less 7.
6. Flagellum for the most part, legs and apex of ultimate tergite ferruginous; fascia on first tergite broad and best developed *insidiatrix*.
6. Flagellum black; legs black and yellow or black and ferruginous; apex of ultimate tergite black; fascia on first tergite narrow and least well developed. *ventralis*.
7. Ultimate tergite black; largest of the species 8.
7. Ultimate tergite with lateral maculations; size similar to *ventralis* 9.
8. Anterior wings with clouded area in region of first cubital cell; discal spots on scutum large and tinged with rufous *viduata*.
8. Anterior wings not clouded; discal spots on scutum absent or present in the form of narrow yellow lines *quadrifasciata*.
9. Fasciae on all or at least on the fifth tergite continuous; fifth sternite almost entirely yellow *parata*.
9. Fasciae on all tergites interrupted; fifth sternite with a pair of scarcely connected lateral spots *mesillensis*.

BICYRTES FODIENS Handlirsch.

Figs. 111, 112, 134, 135.

Bembidula fodiens HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889 p. 497, pl. 2, fig. 14, male, female.

Male.—Black: Scape below, first and second joints of flagellum below, basal half of clypeus, abbreviated anterior and very narrow posterior orbits, posterior margin of pronotum including tubercles, tegulae, posterior lateral borders of scutum, pair of spots on scutellum, transverse fascia on metanotum, lateral angles of median segment,

fasciae on tergites 1-6, widely interrupted on first, continuous on second, interrupted medially on the remainder, lateral spots on sternites 2-5 connected by faint apical lines, tarsi, tibiae, and distal extremities of femora, *yellow*. Wings rather heavily infumated somewhat more so than the wings of *ventralis*. Dorsum of thorax and median segment finely, closely, and evenly punctured, punctures of mesopleura somewhat larger; ultimate tergite closely and more heavily punctured, punctures less numerous on the apical median area. Intermediate femora carinate below; short but evident tooth on inner distal margin of posterior coxae; second ventral abdominal segment bears a short but conspicuous basal median carina.

Female.—Resembles the male in general appearances and coloration, and likewise has the characteristic tooth on the inner distal margin of the posterior coxae. The ultimate sternite is carinate medially and the ultimate tergite bears a pygidial area set off by conspicuous lateral ridges and sparingly punctured. The ultimate sternite extends beyond the lateral margins of the tergite apically in the form of prominent rounded angles. This character distinguishes this species from all others except *burmeisteri*.

Length.—11-14 mm.

The variation in the markings or in their color, as far as it is possible to judge from the number of specimens at hand, is not great. All males and the one female have the labrum black and the clypeus yellow with the lower margin bordered more or less widely with black which is nearly divided by a V-shaped prolongation of the yellow above. On one male the black margin is reduced to an extremely narrow apical border. The scape and first two segments of the flagellum are yellow below or may be entirely yellow, the extent and the intensity of the black above being variable. The anterior orbits are broad but greatly shortened above; the posterior are very narrow. The thoracic markings are constant; the coxae and trochanters are invariably black; the black on the femora varies in the males somewhat and the posterior tibiae may also be more or less dusky. The tibiae and tarsi of the females may be also more or less ferruginous; the males show but little of this color. The lateral spots on the sternites may or may not be connected by narrow apical lines. The fascia of the second tergite is usually continuous, and when not so the interruption is very narrow. The fasciae posterior to the second are successively more widely interrupted medially, and the more posterior ones may also be abbreviated laterally, consequently appearing as lateral spots. On one male, however, all the fasciae on the tergites, even that on the first, are continuous.

Habitat.—Louisiana, Mississippi, Texas, Georgia, Florida, Kansas, and Wisconsin.

Number of specimens examined—Males, 8; females, 4.

BICYRTE BURMEISTERI Handlirsch.

Fig. 136.

Bembidula burmeister HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889, p. 500.

Female.—Black: Labrum, clypeus, mandibles except apices, broad anterior orbits, posterior orbits, scape, first and second flagellar segments almost entirely, posterior border of pronotum and tubercles, tegulae, lateral borders of scutum, lateral spots on scutellum, short fascia on metanotum, several small spots on dorsum of median segment representing a suppressed curved fascia, lateral angles of median segment, fascia of first tergite broken into a pair of large lateral and a pair of small dorsal spots, broad continuous fasciae on tergites 2–5 deeply emarginate at anterior middle, ultimate tergite, small lateral spots on sternites 2–5 connected by narrow apical lines, apex of sixth sternite, femora above, tibiae, and tarsi, *yellow*.

The wings are distinctly though diffusely infumated. The flagellum below and its ultimate segment apically are yellowish. The coxae are more or less marked with yellow and the hind pair, as in *fodiens*, are provided with a distinct tooth on the inner apical margin. The ultimate sternite bears a longitudinal carina and the corresponding tergite a well-defined pygidial area set off by distinct lateral ridges. The sternite projects beyond the tergite in a manner similar to that of *fodiens*, but it differs in detail from that of *fodiens*. The pubescence is exceedingly short and sparse and the puncturing is rather coarse, close, and uniform; it is closest and finest on the scutum, more coarse and scattered on the sixth tergite.

Length.—15 mm.

I have but a single specimen at hand—a female taken at Brownsville, Texas, by J. C. Crawford.

BICYRTE VENTRALIS Say.

Figs. 4, 113, 114, 132.

Monedula ventralis SAY, Exp. St. Peters River, vol. 2, 1824, p. 336, male.

Bicyrtes servillii LEPELETIER, Hist. Nat., vol. 3, 1845, p. 53.

Monedula ventralis CRESSON (part), Trans. Amer. Ent. Soc., vol. 4, 1872, p. 220.

Monedula ventralis PROVANCHER, Faun. Ent. Can., 1883, p. 629, female, male.

Bembidula ventralis HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889, p. 495.

Male.—Black: Scape of antennae below, broad abbreviated anterior orbits, narrow posterior orbits, posterior margin of pronotum including the tubercles, rounded lateral spots on scutellum, line on metanotum, lateral angles of median segment, narrow fasciae on tergites 1–5 narrowly interrupted medially, lateral triangular spots on sternites 2–5, distal extremities of the femora, tibiae except more or less of the posterior surfaces, tarsi, *yellow*. Face silvery when

viewed with light at proper angle; wings somewhat infumated; eyes divergent at vertex. Punctures of dorsal surface fine, close and even, those of median segment somewhat larger; punctures of mesopleurae and dorsal surface of last abdominal segment coarser and not so closely and evenly distributed. Joints 7-9 of flagellum prominently rounded out below; intermediate femur with a prominent tooth posteriorly at base; hind tibia with a carina on inner side of distal half.

Female.—In coloration and general appearance similar to the male with such exceptions as are pointed out below. The ultimate tergite is devoid of all traces of lateral ridges or of a pygidial area; on the ultimate sternite there is a median longitudinal carina.

Length.—10-16 mm.

This is the most widely distributed species in the United States. The color of the markings varies from deep intense orange-yellow, through lighter shades of yellow to light creamy white, and this variation in color is true for both sexes. There is great variation also in the extent of the markings. In the female usually the greater part of the clypeus is yellow, but in many specimens it is reduced to a small area near the base. In some specimens the yellow covers almost the entire clypeus, but even in such cases the apical margin is black. In the male the clypeus is usually black but in many specimens there are two small yellow spots basally and in others only one, which varies in extent. In the male I found the labrum invariably black; among the many females examined only four showed any trace of yellow on the labrum. The coxae, trochanters, and the greater part (basal) of the femora are black. The color of the tibiae and tarsi varies greatly, showing shades varying from yellow through ferruginous to almost black in a few specimens. The scutum is unmarked except that in some individuals there is a short line at the posterior lateral borders. Two females show on the dorsal surface of the median segment small yellow spots suggesting a suppressed curved line thereon. The fasciae on the tergites vary somewhat in width and on 3, 4, and 5 may be interrupted laterally; in the males this is frequently true for tergites 3, 4, 5, and 6. On the first tergite the fascia may be much reduced or wholly lacking, especially in the male. The lateral spots on sternites 2-5 in the female and 2-6 in the male may or may not be joined by faint yellowish apical bands.

Habitat.—Georgia, North Carolina, Virginia, Tennessee, Pennsylvania, New Jersey, New York, Connecticut, Massachusetts, Maine, Canada, Indiana, Michigan, Illinois, Wisconsin, Colorado, Washington, Oregon, California, and Texas.

Number of specimens examined—Males, 107; females, 126.

BICYRTES PARATA Provancher.

Figs. 115, 116.

Monedula parata PROVANCHER, Add. Hym. Quebec, 1888, p. 416.*Bembidula parata* FOX, Proc. Acad. Sci. Phila., 1895, p. 353.*Bembidula meliloti* ROHWER, Ent. News, vol. 19, 1908, p. 376, male.

Male.—Black: Scape and first two joints of flagellum beneath, large spot on clypeus, frequently spot on base of mandibles, broad abbreviated anterior and narrow posterior orbits, posterior margin of pronotum including tubercles, tegulae anteriorly, lateral stripe on scutum at base of anterior wing, rounded lateral spots on scutellum, transverse fascia on metanotum, lateral angles of median segment, broad fasciae on tergites 1–6, the more anterior of which, and in some specimens all, may be narrowly interrupted medially, triangular lateral spots on apical tergite, lateral spots on sternites 2–6, which may or may not be connected by apical bands, tarsi, tibiae, and femora distally, *yellow* or *greenish yellow*. Wings clear; eyes divergent at vertex; punctures of dorsum of thorax fine, close, and even, those of median segment somewhat larger; punctures of mesopleurae and apical tergite coarser and less evenly distributed. Segments 6–10 of flagellum rounded out below; intermediate femora with tooth at base posteriorly; hind tibiae with carina on inner surface of apical half.

Female.—In general appearance and coloration similar to the male: Clypeus and labrum entirely, spot on mesopleura variable in size, usually pair of discal spots on scutum, more or less well-developed curved line on dorsal surface of median segment, fasciae on tergites 1–5 broad, all of which may be continuous, lateral spots or the entire surface of sixth tergite, lateral spots on sternites broadly connected, apical sternite usually in part, and sometimes entirely, *yellow*. Apical tergite without pygidial area or lateral ridges, apical sternite with faint longitudinal median carina.

Length.—12–15 mm.

The clypeus, on both males and females, may be wholly yellow or may have only a narrow apical border of black. In specimens on which all or only part of the fasciae on the tergites are continuous, such fasciae are more or less deeply emarginate anteriorly in the middle. The apical sternite of the male and occasionally of the female lacks the yellow spots; usually in the female these spots are large and may be confluent or the entire segment may be yellow. The extent of the yellow on the sternites of the female is variable. On one specimen the venter of the abdomen is almost entirely yellow; on another the bands on sternites 2–4 are almost interrupted medially, and on all the fifth is almost completely yellow.

This species was described by Provancher from a single specimen from California, and in view of the fact that this specimen was a female the following statement by Fox with regard to this species is not clear:¹

The maculation of this species is a much richer yellow than in *ventralis*, and the female, which has been heretofore unnoticed, is very much like the male and has a well developed pygidium.

As a matter of fact, the female has no pygidial area whatever and up to the time Fox published his Synopsis the male had not been described. The first account of the male is found in Rohwer's description of *B. meliloti*, which I consider identical with the male of *parata*, since it differs not at all from the latter in structure or in color pattern and since the series before me shows a well-marked gradation from the bright yellow at one extreme to the greenish white of *meliloti* at the other.

Habitat.—California, Washington, Arizona, and Utah.

Number of specimens—Males, 9; females, 6.

BICYRTIS QUADRIFASCIATA Say.

Figs. 117, 118.

Monedula quadrifasciata SAY, Expd. St. Peters River, vol. 2, 1824, p. 336, male, female.

Monedula sallei GUERIN, Icon. du Regne Anim., vol. 7, Insect, 1845, p. 437.

Bembidula quadrifasciata HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889, p. 492.

Bembidula variegata FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 353.

Male.—Black: Scape below, apical border of clypeus variable in extent, medial stripe on labrum variable in width or sometimes wanting, spot on base of mandible, broad anterior orbits abbreviated above, narrow posterior orbits, posterior margin of pronotum, spot on side of prothorax, tubercles, pair of small rounded lateral spots on scutellum, lateral angles of median segment, fasciae on tergites 1-5 interrupted and attenuated medially, those on 4 and 5 shortened laterally, frequently lateral spots on 6, small lateral spots on sternites 2-5, small spot on anterior coxa below, distal ends of femora below most extensive on anterior pair, tibiae except stripe on posterior pair above, tarsi except tips of segments on second and third pairs, which are more or less dusky, yellow. Wings slightly infumated; legs without special structures.

Female.—Black: Scape below, clypeus except spot of variable size at base, labrum except sometimes the lateral borders, spot on base of mandible, broad anterior orbits abbreviated above, narrow posterior orbits, posterior margin of pronotum, spot on side of prothorax, tubercles, narrow lateral line on extreme sides of scutum, frequently

¹ Synopsis of Bembicini of Boreal America, Proc. Acad. Nat. Sci. Phila., 1895, p. 353.

a pair of discal marks on same, spot on tegulae, another on base of anterior wing, pair of lateral spots on scutellum, pair of spots on metanotum, occasionally a curved line on dorsal surface of median segment, lateral angles of same, one or two spots on mesopleura, fasciae on tergites 1-4 interrupted and narrowed medially, lateral spots on sternites 2-3, spot on anterior coxae below, stripe on lower surface of femora less extensive on posterior pair, tibiae, and tarsi, *yellow*; wings as in the male; apical tergite densely punctured laterally, more sparingly along the midline, lateral ridges short and feebly developed, pygidial area lacking; apical sternite with faint longitudinal median carina.

Length.—12-14 mm.

This is one of our largest and most easily recognized species. The ground color is decidedly black and shows a marked bluish iridescence. The color of the markings is pale or creamy yellow, sometimes tinged with orange, more rarely faintly greenish. The yellow of head, thorax, and legs is usually deeper than that of the abdomen. The scape of the antenna is always yellow below and the flagellum is always black, save that the apical joint in some females shows a trace of reddish. The flagellar segments of the male are not rounded out or prominent below, but joints 6-10 have flattened specialized areas beneath, most conspicuous on 6 and 7. The marking of the labrum varies greatly; on the female it is usually yellow with the lateral margins piceous, but in a few specimens it is entirely yellow and in about as many it is wholly black. In the male the labrum is usually black, but in some individuals only the lateral borders are black, and in a few it is entirely yellow. The clypeus is marked basally with a black spot that varies in size in both sexes and is usually more extensive in the male than in the female, but in all cases there is always more or less yellow on the apical border.

The line on the posterior border of the pronotum may be wanting, may be represented by two or more spots, or may be broad and conspicuous. The scutum may be immaculate, may have a small spot on each lateral margin, which in some cases takes the form of a rather broad lateral stripe, and in some specimens may bear a pair of short discal lines or spots. In specimens on which the markings are best developed a pair of lateral spots occurs on both scutellum and metanotum, and in extreme cases there is a more or less well developed curved line on the dorsal surface of the median segment. In such specimens the small spots on the mesopleura form one large confluent area, and a smaller spot may be present on the metapleura. All coxae may be more or less spotted with yellow. The color of the fasciae and spots on the tergites, together with their arrangement are the characters that best distinguish this species. The fasciae are broad at the sides and narrowed toward the median line, where they

are narrowly interrupted anteriorly, more widely posteriorly; the anterior ones well developed, the posterior abbreviated; present on 1-4 and sometimes 5 in the female, on 1-5 and sometimes 6 in the male. The lateral spots on the sternites vary in size and also in number. They are usually found on 2-4 in the female, but occasionally are present on 5; in the males on 2-5, but may occur on 6 or be reduced to 2-4. In the case of two very light females from Kansas the lateral spots are present on 1-5 and sternite 2 is almost entirely yellow.

The terminal tergite of the female lacks a pygidial area, but short, feebly marked lateral ridges are present. The apical sternite is longitudinally carinate on the median line and throughout its apical half it narrowly extends laterally beyond the tergite, which is roundly triangular apically.

Two males, which I have referred to this species, were collected by Mr. Ashmead in New Mexico and were referred by Fox to *B. variegata* Olivier. These males differ from the typical male of *quadrifasciata* only in the possession of more extensive maculations; in other respects, including the genitalia, there is no essential difference. *B. variegata* Olivier was described from South America, and the genital stipites of the male are quite different from those of *quadrifasciata*, as is shown by a comparison of figures 117, 118, 119 and 120, of which 119 and 120 represent the stipites of a male of *variegata* taken in Venezuela.

Habitat.—Florida, Georgia, Alabama, South Carolina, Virginia, Pennsylvania, New Jersey, New York, Connecticut, Indiana, Ohio, Wisconsin, Kansas, and New Mexico.

Number of specimens examined—Males, 28; females, 23.

BICYRTES ANNULATA, new species.

Figs. 121, 122, 137.

Female.—Black: Labrum, clypeus, mandibles except apices, scape except spot on upper side, first joint of flagellum below, second almost entirely, lower part of frons, narrow vertical line in front of anterior ocellus, broad anterior orbits, posterior orbits narrowed above, broad below, and extended somewhat upon the vertex toward the posterior ocelli, prothorax except narrow anterior border connected with spot in front of tubercles, tegulae, broad lateral lines on scutum, pair of discal spots on same, pair of large lateral spots on scutellum approximated at median line, metanotum, curved fascia on dorsum of median segment, lateral angles of median segment, mesopleurae almost completely, spot on metapleuræ, broad fasciae on tergites 1-5, continuous but with an acute triangular emargination medially, fasciae on sternites 2-5 continuous, triangular lateral spots on ultimate tergite, ultimate sternite, and legs almost entirely, *bright yellow*. The coxae basally are more or less marked

with black; the trochanters and proximal ends of the femora are more or less suffused with ferruginous. The wings are very slightly infumated.

Male.—Black: Labrum, mandibles except apices, clypeus, spot between antennae, scape except spot above, basal segments of flagellum more or less, broad anterior orbits, narrow posterior orbits, posterior margin of pronotum broadly including tubercles, tegulae, lateral borders of scutum, pair of discal marks on same rarely absent, large lateral spots on scutellum, narrowly connected in one specimen, metanotum, curved fascia on dorsum of median segment more or less broken, lateral angles of medium segment, one or more spots on mesopleurae, fasciae on tergites 1–6 broad, narrowly interrupted medially, the first narrowed somewhat medially, fasciae on sternites continuous but greatly narrowed medially, spot on all coxae, remainder of legs except more or less of trochanters and base of femora, *bright yellow*. The wings are but slightly infumated, less so than in the case of *capnoptera*. The flagellum is somewhat ferruginous and without conspicuous modifications, although segments 4–11 bear specialized areas similar to those of *capnoptera*. The intermediate femora and the genital stipes are likewise similar to those of *capnotera*.

Length.—14–16 mm.

This species stands close to *capnoptera* Handlisch, but differs from it in the presence of mesopleural markings, greater clearness of the wings and the better development of the abdominal fasciae. On the type (male) of the species the abdominal fasciae are broad and continuous, really forming continuous rings around the body, hence the name, *annulata*. On the allotype (female) all the dorsal fasciae are interrupted except the sixth. The ultimate tergite of the female bears a pair of well marked lateral ridges inclosing a pygidial area slightly rugose basally and sparingly punctate elsewhere. The lateral areas bear short scattered spines or bristles. The ultimate sternite throughout its apical half extends out laterally beyond the tergite as shown in figure 137. On the type the lateral areas of the ultimate tergite and the corresponding sternite are yellow, but in some specimens the ultimate segment is black both above and below, while in others the proportions of black and yellow vary.

Habitat.—Arizona, New Mexico, Texas.

Number of specimens examined—Males 4; females, 13.

Type.—Female in the collection of University of Kansas, *Paratype*, Cat. No. 19678, U.S.N.M.

BICYRTER GRACILIS, new species.

Fig. 123.

Male.—Black: Clypeus except narrow apical border, mandibles except tips, crescent shaped spot on frons below antennae, scape

below, broad anterior orbits shortened and narrowed above, narrow posterior orbits, posterior border of pronotum including tubercles, pair of short narrow discal lines on scutum, short lateral lines on same above base of anterior wing, spot on base of anterior wings, tegulae, pair of rounded lateral spots on scutellum, narrow transverse curved fascia on metanotum, lateral angles of median segment, fasciae on tergites 1-6 rather widely interrupted medially, triangular lateral spots on sternites 2-5, distal extremity and short longitudinal stripe on anterior and posterior edge of anterior femora, anterior tibiae except stripe on posterior surface and below, anterior tarsus above, extreme distal ends of middle and posterior femora, greater part of intermediate tibiae below, and part of the posterior tibia below, *yellow or slightly greenish yellow*. Anterior wings with a heavily infumated spot in region of first cubital cell.

The black color of the body is intense, shining and shows a beautiful bluish-violet iridescence. The punctures of the thorax are fine, close, and evenly distributed; those of the apical tergite somewhat larger, closely placed basally but more widely separated on the apex especially on the middle area. Antennae and legs show no peculiar modifications. The fascia on the first tergite is slightly shortened laterally, much attenuated medially, and more widely interrupted than the others; second slightly attenuated medially; third and fourth narrowed, and fifth and sixth interrupted laterally. The middle and posterior tarsi are almost black, the distal ends of the segments showing traces of ferruginous. The face when viewed at the proper angle shows a silvery reflection.

This species resembles quite closely the male of *viduata*, but it is smaller and more slender than that species, the markings are less well developed and the genital stipes are quite different.

Habitat.—Santa Rita Mountains, Arizona (coll. F. H. Snow.)

Number of specimens examined: Males, 1.

Type.—The collection of the University of Kansas.

BICYRTES VIDUATA Handlirsch.

Figs. 124, 125.

Bembidula viduata HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889, p. 491, female.

Male.—Black: Clypeus, base of mandibles, frons below insertion of antennae, scape below, anterior orbits not reaching to vertex, narrow posterior orbits, posterior margin of pronotum including the tubercles, spot on tegula, narrow lateral line on either side the scutum above base of anterior wing, pair of discal spots on scutum near anterior margin variable in size, one or two spots on mesopleura, pair of rounded lateral spots on scutellum, transverse fascia on metanotum, more or less complete curved fascia on dorsal surface

of median segment, lateral angles of same, broad fasciae on tergites 1-6 interrupted medially, slightly attenuated medially on 1 and 2, and attenuated or interrupted laterally on 2-6, triangular lateral spots on sternites 2-5 joined by faint apical lines, tips of femora with short line extending inward on anterior and posterior surfaces of anterior pair, tibiae except a part or all of the posterior surface of the several pairs, anterior tarsi, *yellow*. Anterior wings with a heavily infumated spot in region of first cubital cell; antennae and legs without special modifications.

Female.—Black: Clypeus, base of mandibles, frons below antennae, scape below, anterior orbits not reaching to vortex, posterior orbits narrowed above, posterior margin of pronotum including tubercles, lateral lines on scutum, pair of large diamond-shaped discal spots on same anteriorly, large spot on mesopleura, pair of large rounded spots on scutellum, metanotum, curved fascia on dorsum of median segment, lateral angles of same, broad fasciae on tergites 1-5 interrupted medially, first greatly and second slightly attenuated toward median line and second to fifth attenuated laterally, triangular lateral spots on sternites 2-5, spot on anterior coxae, tips of femora with line both above and below on anterior pair, tibiae except more or less of posterior surfaces, anterior tarsi, *yellow*. Anterior wings with heavily infumated spot in region of first cubital cell; apical tergite without pygidial area, sparingly punctured medially, more closely laterally, especially at base, lateral ridges short and feebly developed; apical sternite with faint median carina.

Length.—16-18 mm.

In coloration the males and females of this large and handsome species are very much alike, the markings being a rich yellow in the females and creamy yellow in the males. But little variation is found. The clypeus is predominantly yellow; in the male it is almost invariably so and in the female the black is confined to the apical margin, where it forms a more or less conspicuous border, or may appear as two small median spots. The discal spots on the scutum, variable in size and form, show in the majority of specimens a decided rufous color, which color may also appear on the spots on the mesopleurae. The median segment bears on its dorsal surface a curved yellow fascia, broad and conspicuous in the female, much reduced in width or present as a series of spots in the male. The fasciae on the tergites are all rather widely interrupted. The first is much narrowed medially, the second less so. Contrary to the original description all these fasciae except the first and occasionally the the last, reach the border of the segments even in the males, in which the fasciae are narrower than in the females. The lateral spots on the sternites may or may not be connected by narrow apical bands. The antennae of the male show no evident modifications but segments

5-11 of the flagellum bear on their lower surfaces specialized areas scarcely at all prominent and difficult to distinguish. The large size, conspicuous fasciae of the abdomen together with the thoracic markings, and the medial dark spot on the anterior pair of wings distinguish this species at once from all other members of the genus herein described.

Habitat.—Texas, New Mexico, Arizona, and probably Mexico.

Number of specimens examined—Males, 7; females, 8.

BICYRTER INSIDIATRIX Handlirsch.

Figs. 126, 127.

?*Monedula ventralis* CRESSON (part), Trans. Amer. Ent. Soc., vol. 4, 1872, p. 220.

Bembidula insidiatrix HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889, p. 494, female, male.

Male.—Black: Clypeus except apical border, broad anterior orbits, narrow posterior orbits, posterior border of pronotum including tubercles, lateral stripes on scutum not reaching anterior border, usually a pair of discal lines or spots on same, pair of lateral spots on scutellum more or less approximated at median line, transverse fascia on metanotum, lateral angles of median segment, fasciae on tergites 1-6 narrowly interrupted medially, sometimes first or first and second continuous, lateral spots on sternites 2-3, *yellow*. Labrum, mandibles except tips, scape, first and second joints of flagellum, remainder of flagellum more or less, legs except coxae, *ferruginous*. Wings infumated about the same as the wings of *ventralis*. Intermediate femora carinate but not dentate.

Female.—Black: Clypeus except apical border, broad anterior and narrow posterior orbits, lateral lines on scutum not reaching the anterior border, usually a pair of discal spots or lines on same, pair of large lateral spots on scutellum, curved fascia on dorsum of median segment (sometimes absent), lateral angles of same, fasciae on tergites 1-5 narrowly interrupted medially, first or first and second continuous, lateral spots on sternites 2-4, *yellow*. Scape, first and second joints of flagellum, remainder of flagellum more or less, labrum, mandibles except tips and usually a spot on base, tegulae, apex of ultimate abdominal segment above and below, legs except coxae, *ferruginous*. Wings somewhat more heavily infumated than those of the male; ultimate tergite without a pygidial area or lateral lines; ultimate sternite faintly carinate.

Length.—12-14 mm.

The labrum and mandibles, especially among the males, may be black; the ferruginous markings elsewhere, especially on the legs, may vary from almost yellow to nearly black. The dark area on the clypeus always arises from the apical border, never from the base. The scape below may be more or less yellowish; the flagellum of the

male is for the most part black, that of the female largely ferruginous. One female bears a yellow spot on the mesopleurae. The fascia on the first tergite is broadest and all are but slightly narrowed toward the median line; they do not reach the lateral edge of the segments and the more posterior ones may appear as elongated lateral spots.

The female of his species may be distinguished from the female of *ventralis* by the presence of the ferruginous markings on the legs, antennae, and terminal segment and also by the fact that the first abdominal fascia is the one best developed in this species and most reduced in *ventralis*; from *fodiens* and *capnoptera* by the absence of a pygidial area and lateral lines on the ultimate tergite. The male can be distinguished from *ventralis* by the absence of a tooth on the intermediate femora; from *fodiens* by the absence of a tooth on the posterior coxae, and from *canoptera* by the form of the genital stipes.

Habitat.—Texas, Florida, New Mexico.

Number of specimens examined—Males, 6; females, 5.

BICYRTE CAPNOPTERA Handlirsch.

Figs. 128, 129, 133, 138.

? *Monedula ventralis* CRESSON (part), Trans. Amer. Ent. Soc., vol. 4, 1872, p. 220.

Bembidula capnoptera HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 98, 1889, p. 497, pl. 2, figs. 7, 12, female, male.

Male.—Black: Labrum (in some specimens ferruginous, in others black), clypeus (may be wholly or in part black), scape below, basal joints of flagellum below, anterior orbits, narrow posterior border of pronotum continuous with tubercles and narrow line on side of prothorax, lateral lines on scutum above base of wings, tegulae, lateral spots on scutellum, fascia on metanotum, lateral angles of median segment, fasciae on tergites 1–6 all interrupted medially, the more posterior ones usually shortened or narrowed laterally, lateral spots on sternites 2–6, which may be connected by narrow apical lines, *yellow* more or less dashed or suffused with ferruginous. Legs ferruginous with the coxae and more or less of the basal part of the femora much darker, sometimes black.

Segments 4–11 of the flagellum have raised specialized areas on the posterior surface, which, when viewed from a certain angle, cause the flagellum to appear slightly carinate. The wings as in *ventralis* are strongly infumated. The femora of the second pair of legs are not toothed but are carinate and slightly angular at the base below.

Female.—Black: Clypeus, labrum usually, spot between antennae, scape below, basal segments of flagellum below, anterior orbits, narrow posterior orbits, posterior border of pronotum continuous with tubercles and line on side of prothorax, lateral lines on scutum above base of wings, lateral spots on scutellum, fascia on metano-

tum, lateral angles of median segment, fasciae on tergites 1-5 interrupted medially and the more posterior ones shortened laterally, lateral spots on sternites 2-5 usually connected by narrow apical lines, *yellow*, more or less dashed or suffused with ferruginous. The legs are ferruginous, the basal joints usually darker than other parts but not so black as in the male.

The flagellum is more or less ferruginous, especially below, but in some specimens it is almost entirely black. The wings are heavily infumated, especially in the case of specimens from Georgia. The sixth tergite bears a well-defined pygidial area, set off by distinct lateral ridges as shown in figure 138.

Length.—10-15 mm.

This species shows considerable variation. In the female the clypeus is invariably yellow, but the labrum varies from yellow through ferruginous to black; in the male the clypeus may be entirely yellow or entirely black, but is usually black with a yellow apical border. The labrum of the male is generally black. Variation in the maculations is less pronounced, though the dorsal markings on the abdomen of the females from Texas are much better developed than are those on the females from Georgia. On one female from Texas there is a small pair of discal marks on the dorsulum. In no case do we find the mesopleurae maculated in either sex and rarely the dorsum of the median segment.

Habitat.—Georgia, Texas, Kansas.

Number of specimens—Males, 9; females, 8.

BICYRTES MESILLENIS Cockerell.

Figs. 130, 131.

Bembidula capnoptera HANDLIRSCH, var. *mesillensis* COCKERELL, Davenport Acad. Nat. Sci., vol. 7, 1898, p. 142.

Bembidula mesillensis COCKERELL, Can. Ent., 1899, p. 255.

Male.—Black: Labrum, irregular spot on base of mandibles, apical half of clypeus, scape below, broad anterior orbits not reaching vertex, narrow posterior orbits, posterior border of pronotum including tubercles, narrow lateral lines on scutum above base of anterior wing, lateral spots on scutellum, transverse fascia on metanotum, lateral angles of median segment, comparatively broad fasciae on tergites 1-6 interrupted medially, the first broadest and slightly attenuated medially, the remainder attenuated but not shortened laterally, lateral spots on sternites 2-6 united by faint lines on apical margins of sternites, distal extremities of femora, most obvious on first pair, tibiae, and tarsi, *yellow*. First and second joint of flagellum yellowish below, remainder below ferruginous; wings slightly infumated, darkest at apical end of median cell of anterior wing; antennae with slightly prominent specialized areas on segments 4-12 below;

carina of intermediate femora and genital stipes similar to those of *capnoptera*.

Female.—Black: Labrum, mandibles except apices, clypeus, scape below, broad anterior orbits not reaching vertex, narrow posterior orbits, posterior border of pronotum including tubercles, lateral lines on scutum not reaching anterior margin, tegulae, spot on base of anterior wings, one large and two smaller spots on mesopleurae, rounded lateral spots on scutellum, transverse fascia on metanotum, four spots (a suppressed curved line) on dorsum of median segment, lateral angles of same, broad fasciae on tergites 1-5, interrupted medially, first greatly and second slightly narrowed medially, small lateral spots on ultimate tergite, triangular lateral spots on sternites 2-5 connected by narrow apical lines, spot on anterior coxae below, *pale creamy yellow*. Coxae (except anterior pair) and trochanters entirely black; femora with more or less of the distal part yellow; tibiae yellow with very dark spot below on first and second pairs; tarsi tawny yellow. Wings somewhat infumated, slightly darker than those of the male but not so dark as those of *ventralis*. The ultimate tergite lacks lateral ridges and a pygidial area.

Length.—15 mm.

A female from Texas has the mandibles and labrum black with faint pale yellowish markings basally; another, from Arizona, has a pair of discal spots on the scutum, small lateral spots on prothorax and a very large spot on mesopleurae. A male from Arizona has the labrum ferruginous, the yellow on the clypeus restricted to two lateral apical spots, a pair of small lateral spots on the dorsum of the median segment, and the black on the femora much reduced in extent and intensity.

The male of this species is very similar to the male of *capnoptera* Handlirsch with which it agrees with respect to the character of the intermediate femora and the development of the antennae. It differs from that species only in the color of its maculations and to a slight degree in the form of the genital stipes. The female, however, is quite closely allied to *parata* and *ventralis*, from which it may be distinguished only by the character and color of its maculations. It differs markedly from *capnoptera* in the absence of lateral ridges and a pygidial area. The association of a male and female of such divergent relationships as sexes of the same species without biological evidence to sustain it is open to question. I have retained them, however, as sexes of the same species since they have been so associated and since I have no data to show that such association is not the correct one.

Habitat.—New Mexico, Arizona, Texas.

Number of specimens examined.—Males, 4; females, 3.

Genus **BEMBIX** Fabricius.

Apis LINNAEUS, Syst. Nat., ed. 10, vol. 1, 1758, p. 574.

Bembix FABRICIUS, Syst. Ent., Char. Gen., 1775, No. 115.

Bembyx FABRICIUS, Syst. Ent., 1775, p. 361, No. 115.

*Bembex*¹ FABRICIUS, Gen. Insect, 1776 (or 1777), p. 122.

Bembex OLIVIER, Encycl. Meth., vol. 4, 1789, p. 288.

Bembex FABRICIUS, Ent. Syst., vol. 2, 1793, p. 247.

Bembex LATREILLE, Gen. Crust. et Ins., vol. 4, 1809, p. 97.

Monedula DAHLBOM, Hym. Eur., vol. 1, 1845, p. 492.

Bembex HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, Abth. 1, 1893, p. 663.

Bembex KOHL, Die. Gatt. d. Spheg., 1896, p. 430.

Type.—*Apis rostrata* Linnaeus, designated by Latreille 1810, or more recently by Morice and Durant 1915.

The wasps belonging to this genus vary from 12 to 22 millimeters in length and are comparatively robust in build. The head is as broad as the thorax or even slightly broader in some species. The compound eyes are large, convex, naked, and the facets are of uniform size. The inner margins of the eyes are usually almost parallel, but in some species they diverge toward the vertex and in others toward the clypeus, consequently the shape of the frons is not constant in the genus. The lower margin of the eye reaches the base of the mandible. The anterior ocellar cicatrix is linear, transverse, and slightly curved; the posterior pair are also linear, not transverse, and more nearly semicircular. In at least two species the ocelli are fairly well developed and are probably functional. The occiput is very narrow and the precipitous posterior surface of the head is somewhat concave. The temples are moderately developed but not as broad as the eye seen from the side.

The mandible is well developed and the outer border is entire; the inner border bears one or two teeth, the development of which in a few species is decidedly weak. The apex ends in a single point. The maxillae are relatively long, but when folded at rest they are concealed beneath the labrum. The maxillary palpi consist of four segments, the labial of two. The labrum is beaklike, much longer than broad, and is deeply emarginate at the apex. In some species it bears a transverse impression above which it shows a slight median prominence. The clypeus is broad and convex and its distal margin curved. The antennae are inserted on the frons quite near its lower border and the distance between them is about equal to the distance from the antenna to the margin of the adjacent eye. The scape is thicker, heavier and usually, but not invariably, longer than any of the flagellar segments. The first segment of the flagellum (pedicel)

¹ This is an obvious emendation of the more correctly formed name *Bembix*. The mentioning of *Bembex signata* at the bottom of the page is intended to enlarge the generic description so as to include the species that were later separated into the genus *Stictia*, and can not be construed as limiting the genus to those species congeneric with *signata*.

is small, rounded, not longer than thick, and the second segment exceeds in length any of those following it. In the male, except in the case of a few species, the flagellum bears secondary sexual modifications that serve as specific characters. They consist of pits, spines, dilations, curvings, etc., on various flagellar segments.

The thorax is strong, compact, and flattened above. The prothorax is never strongly developed; the collar is much below the level of the scutum and the tubercles do not reach the tegulae. The sternum and episternum of the mesothorax are fused, leaving no suture. The junction of the metapleura and the side of the median segment forms a depression into which the femur of the middle leg is drawn when at rest. The median segment is short and its dorsal surface is lower than that of the thorax. The dorsal median area, or middle-field, is definitely set off by oblique sutures and is broadly continued down upon the almost vertical posterior surface of the segment. The lateral angles are usually somewhat prominent but are always rounded, never angular or wedge-like.

In general appearance the abdomen is relatively compact and robust, more rarely somewhat slender. The tergites are strongly arched, the sternites flat. The ultimate tergite of the female is somewhat conical in form, rarely with a pygidial area differentiated, for the most part hirsute and provided with short lateral spines near the base, usually punctate, but in a few cases more or less strongly rugose. The second sternite of the male may or may not bear a more or less well developed process, but the sixth, except in a very few species, always does so. The form of these processes affords specific characters. The seventh also varies in development and the eighth, which is concealed by the seventh, ends in a single spine.

The male genital armature consists of a short basal piece (*cardo*), which bears the lateral *stipites*, the median cleft *spatha* and below this the *sagittae*. The *stipes*, which alone is figured in the accompanying plates, and which should never be left out of consideration in the determining of species, is prominent and variable in form, according to the pattern of which the species may be separated into groups. Its variation in form among the groups is very marked. Its variation within the different groups is sometimes very slight, so that, unless it is supported by other characters, simply a slight variation in the form of the *stipes* can not be regarded as safe ground on which to separate species, for slight variations in the *stipes* occur among individuals that are manifestly members of the same species. The median cleft *spatha* terminates below in a pair of recurved hooks that vary in form among the species and at a short distance proximal to these hooks is a pair of short, sharply pointed, barb like teeth. Below the *spatha* lie the *sagittae*, each of which is composed of two parts, the one short, pointed, straight, and strongly hirsute; the

other longer, curved, laterally compressed, strongly chitinized, smooth, and variable in form at the apex.

In the majority of the species the wings are hyaline, but in a few species they are more or less strongly infumated, the infumation being less evident in the wings of the male than in those of the female of the same species. In the anterior wing the radial cell, pointed at the proximal end and blunt at the distal end, lies on the costal border. The first cubital cell is about as long as the second and third combined. The second cubital cell is narrower on the radial vein than on the cubitus and receives both discoidal cross veins. The first cubital cross vein in nearly all species just before it joins the cubitus bends strongly toward the proximal end of the wing. The third cubital cross vein is roundly curved outward toward the distal end of the wing and with the radial vein forms a right or obtuse angle opening toward the distal border of the wing. The second submedial cell is as long as the first, or a trifle longer, and gradually increases in width toward the distal end of the cell. The basal vein arises just proximal to the distal end of the first submedial cell.

On the posterior wing the retinaculum, as in related genera, is formed of an uninterrupted row of little hooklets beginning distal to the origin of the radial vein, which is prolonged and reaches almost to the distal border of the wing. The median cell is greatly elongated and from its distal end two short veins, the ends of the radius and cubitus, are extended, of which in some species one may be obliterated. The cubitus arises distal to the end of the submedian cell, which is long, and its posterior distal angle, formed by the submedian and submedian cross veins, is an acute or a right angle. The submedian vein terminates in the anal sinus. The basal lobe is oblong or oval and is approximately equal to one-half the length of the submedian cell.

The legs are well developed. The middle coxae are separated, the trochanters are comparatively small, and the tibiae and tarsi are strongly bespined. The middle tibia ends in a single spur. The anterior tarsi are provided with tarsal combs on the outer (posterior) side; these are strongly developed on the female, much less so on the male. The claws are always simple, never toothed, and the pulvilli are always developed.

The males of the different species show a variety of secondary sexual characters, appearing on the antennae, legs, and sternites. Various segments of the antennae are pitted, dilated, curved, or spinose; the middle femora are sometimes serrate or dentate; the middle metatarsus may be curved and the second or sixth sternite (or both) may bear a process or a carina of some kind. All these characters are available for the determination of species.

The general color of the body is black. The color of the maculations varies from white or yellowish white to rich orange yellow. In some species the extensive development of the maculations almost suppresses the black ground color. On the species of this genus, especially on the males, the pubescence is on the whole better developed than on those of closely related genera.

In the determination of species in this genus we take into consideration (1) the relative direction of the inner borders of the compound eyes, (2) the width of the frons in comparison with the width of the compound eye at a given level, (3) the relative length of the segments of the antennae, (4) the secondary sexual modifications of the segments of the flagellum of males, (5) the development of the mandibles, (6) the development of the labrum, (7) the character of the middle femora of the males, (8) the form of the ultimate tergite, (9) the character of the processes on sternites 2 and 6 of the male, (10) the character of the seventh sternite of the male, (11) the form of the male genital armature, and (12) the character of the maculations, size, and habitat.

KEY TO SPECIES.

Males.

- | | |
|--|----------------------|
| 1. Intermediate femora distinctly serrate or dentate..... | 2. |
| 1. Intermediate femora smooth; not distinctly serrate or dentate..... | 16. |
| 2. Second and sixth sternites without processes, plain..... | 3. |
| 2. Second and sixth sternites with more or less well developed processes..... | 6. |
| 3. First segment of middle tarsus distinctly curved, its inner surface beset with several stout spines..... | 4. |
| 3. First segment of middle tarsus not so formed, development normal..... | 5. |
| 4. Mesosternum marked with black; sternites 2-4 for the most part black; genital stipes as in fig. 140..... | <i>arcuata.</i> |
| 4. Mesosternum yellow; sternites 2-4 almost entirely yellow; stipes as in fig. 141..... | <i>U-scripta.</i> |
| 5. Clypeus with lateral borders black; tarsi more or less heavily suffused with black above..... | <i>cinerea.</i> |
| 5. Clypeus wholly yellow; tarsi entirely yellow..... | <i>hinei.</i> |
| 6. Process on sixth sternite prominent, its ventral surface flattened and bifurcate at apex; genital stipes as in figs. 149, 151..... | 7. |
| 6. Process on sixth sternite a transverse ridge not sharply pointed but slightly curved on either side the midline..... | 8. |
| 6. Process of sixth sternite prominent, flattened and bluntly pointed; an additional pair of small processes or ridges on this same sternite..... | <i>nubilipennis.</i> |
| 6. Process on sixth sternite not as above; relatively small, acutely pointed or if flattened the sixth sternite lacks the lateral processes or ridges..... | 9. |
| 7. Spur on the middle tibia reaching to or beyond the middle point of the metatarsus..... | <i>amoena.</i> |
| 7. Spur on the middle tibia not reaching to or beyond the middle point of the metatarsus..... | <i>sayi.</i> |
| 8. Fasciae on tergites interrupted; labrum with transverse impression; seventh sternite not conspicuously narrowed..... | <i>belfragei.</i> |

8. Fasciae on tergites continuous; labrum without transverse impression; seventh sternite conspicuously narrowed.....*stenebdoma*.
9. Fasciae on second tergite inclosing a pair of black spots; lateral spots on sternites may be connected by apical lines.....10.
9. Fascia on second tergite not inclosing black spots; lateral spots on sternites not connected by apical lines.....11.
10. Dorsum of median segment not maculated; genital stipes as in fig. 156.....*foxi*.
10. Dorsum of median segment bearing lateral spots; genital stipes not as in fig. 156.
conneza.
11. Sides of median segment and of thorax (excluding prothorax) black, or rarely with small spot on mesopleura.....12.
11. Sides of median segment and of thorax conspicuously maculated.....15.
12. Fasciae on tergites narrow, usually (but not always) all interrupted; ultimate tergite black.....*spinolae*.
12. Fasciae on tergites broader, all except the first continuous; ultimate tergite maculated.....13.
13. Fifth flagellar segment spinose; pubescence normal; process on sixth sternite short, broad, and roundly pointed; fasciae on tergites bright yellow...*cameroni*.
13. Fifth flagellar segment not spinose; pubescence unusually well developed; process on sixth sternite narrow and sharply pointed; fasciae on tergites white or greenish yellow.....14.
14. Fasciae on tergites white.....*comata*.
14. Fasciae on tergites greenish yellow.....*primaestate*.
15. Scutellum with a pair of lateral spots.....*similans*.
15. Scutellum without lateral spots.....*primaestate*.
16. Second and sixth sternites without processes.....*pruinosa*.
16. Second sternite with a longitudinal carina; sixth with two small approximate tubercles; seventh terminating in a spine.....17.
16. Process on sixth sternite simple, median, pointed; that on second more or less well developed, in exceptional cases lacking.....18.
17. Sides of thorax and median segment black; yellow on tergites limited to lateral spots.....*beutenmulleri*.
17. Sides of thorax and median segment almost entirely yellow; tergites with continuous broad yellow fasciae.....*occidentalis*.
18. Scutum usually with a pair of more or less well developed discal marks; dorsum of median segment with a curved yellow fascia.....*troglydites*.
18. Scutum without discal spots; dorsum of median segment black.....19.
19. Postscutellum with a narrow whitish fascia; second sternite with a broad yellow fascia embracing the posterior part of the median process and may include a pair of black spots.....*melanaspis*.
19. Postscutellum immaculate; second sternite with triangular lateral spots that may be connected by narrow apical band.....20.
20. Markings of abdomen and sides of thorax white or creamy white; species somewhat robust.....*texana*.
20. Markings of abdomen and sides of thorax bright lemon yellow; species slender.
helianthopolis.

Females.

1. Neither postscutellum nor dorsum of median segment (excluding postero-lateral angles) marked with yellow.....2.
1. Postscutellum or dorsum of median segment or both marked with yellow.....15.
2. Fasciae on tergites all interrupted medially.....3.
2. A part or all of the fasciae on tergites continuous.....9.
3. Ultimate tergite strongly wrinkled.....*belfragei*.
3. Ultimate tergite not wrinkled, punctate.....4.

4. Pubescence on head and thorax, especially on the sides, unusually long and hoary; spur on middle tibia reaching to or beyond the middle point of the metatarsus.....*amoena*.
4. Pubescence not unusually long; spur on middle tibia not reaching middle point of metatarsus.....5.
5. Fasciae on tergites sinuate but not greatly attenuated medially; body rather slender.....6.
5. Fasciae on tergites wide laterally and much attenuated medially or reduced to widely separated lateral spots; body relatively robust.....7.
6. Fascia on second tergite imperfectly inclosing a pair of dorsal black spots, those on third and fourth with pair of anterior emarginations; fasciae yellow...*foxi*.
6. Fascia on second tergite sinuate like those on third and fourth; fasciae white.
spinolae.
7. Eyes not widely separated and plainly divergent at the clypeus; lateral spots on sternites connected by narrow apical lines.....*beutenmulleri*.
7. Eyes widely separated and not divergent at the clypeus; lateral spots on sternites not connected.....8.
8. Abdominal markings creamy white; tibiae heavily marked with black; length about 16 mm.....*cinerea*.
8. Abdominal markings yellow; tibiae yellow; length 18-20 mm.....*hinei*.
9. Clypeus with a more or less conspicuous pair of basal black spots; fasciae on tergites white, second usually inclosing a pair of black spots.....*texana*.
9. Clypeus not marked basally with black spots.....10.
10. Sides of thorax and median segment with evident maculations.....11.
10. Sides of thorax and median segment black, rarely with inconspicuous maculation on mesothorax.....13.
11. Form large and robust, 17-20 mm; fascia on second tergite inclosing more or less perfectly a pair of dorsal black spots.....*connexa*.
11. Form more slender, 14 mm; fascia on second tergite not inclosing black spots..12.
12. Fasciae on tergites yellow.....*similans*.
12. Fasciae on tergites white.....*primaestate*.
13. Fasciae on tergites bright yellow; ultimate tergite with central yellow maculation.....*cameroni*.
13. Fasciae on tergites soiled or greenish white or rarely greenish yellow; ultimate tergite black or with white maculation.....14.
14. Pubescence normal; ultimate tergite black.....*spinolae*.
14. Pubescence unusually conspicuous; ultimate tergite with white maculation, which in some cases is much obscured.....*comata*.
15. Wings distinctly clouded medially.....16.
15. Wings clear.....17.
16. Clypeus black or marked with black basally; lateral spots on sternites united by apical lines.....*melanaspis*.
16. Clypeus yellow; lateral spots on sternites not connected (except rarely on second sternite).....*nubilipennis*.
17. Scutum with no trace of discal marks.....18.
17. Scutum with more or less well developed discal marks.....22.
18. Large, 17-20 mm; eyes divergent at clypeus; frons narrow; fasciae on tergites continuous.....19.
18. Smaller, 14-16 mm; eyes very slightly divergent at vertex; frons relatively wide; fascia on first tergite almost always interrupted.....20.
19. Fasciae on tergites white; that on second never inclosing black spots; clypeus usually with basal black mark.....*pruinosa*.
19. Fasciae on tergites yellow; that on second always inclosing pair of black spots; clypeus yellow.....*occidentalis*.

20. Fasciae on tergites yellow.....21.
 20. Fasciae on tergites white.....*primaestate*.
 21. Clypeus yellow.....*similans*.
 21. Clypeus black.....*helianthopolis*.
 22. First transverse cubital vein but slightly bent; development of ocelli unusual.....23.
 22. First transverse cubital vein normal; ocellar cicatrices normal.....24.
 23. Lateral spots on sternites 2-5 and apex of six yellow.....*U-scripta*.
 23. Yellow on tergites limited to lateral spots on 2-4.....*arcuata*.
 24. Frons narrow; eyes divergent at the clypeus; mandibles slender, nearly devoid of teeth.....*occidentalis*.
 24. Frons normal; eyes not divergent at the clypeus; mandibles normal.....25.
 25. Labrum unusually long (see fig. 217); ultimate tergite rugose (see fig. 216).....*rugosa*.
 25. Labrum normal; ultimate tergite not rugose, punctate.....26.
 26. Clypeus black or marked with black basally.....27.
 26. Clypeus yellow or pale.....28.
 27. Labrum yellow; ultimate tergite marked with yellow.....*trogloodytes*.
 27. Labrum black; ultimate tergite black.....*helianthopolis*.
 28. Species large, 17-20 mm.; discal marks on scutum in form of a U, complete or broken into spots.....29.
 28. Species smaller, under 17 mm.; discal marks on scutum consisting of a pair of narrow lines.....30.
 29. Second and third sternites broadly banded with yellow; second flagellar segment not equal to the combined length of the third and fourth.....*latifrons*.
 29. Second and third sternites with only lateral spots; second flagellar segment equal to or greater than the combined length of the third and fourth.....*sayi*.
 30. Fasciae on tergites yellow.....*similans*.
 30. Fasciae on tergites white.....*primaestate*.

BEMBIX ARCUATA, new species.

Figs. 139, 140, 185, 206, 207.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, frons except a butterfly-shaped spot below anterior ocellus, posterior orbits prolonged above but not meeting on vertex, prothorax, lateral lines, and narrow longitudinal discal lines on scutum, broad fascia on scutellum, fascia on metanotum, curved fascia on dorsum of median segment extending down on posterior surface, lateral angles and sides of same, metapleurae almost completely, spot on posterior part of mesopleurae, anterior part of mesosternum, fasciae on tergites 1-5, first narrowly interrupted medially, the anterior border emarginate on either side the midline, second and third narrowed and interrupted medially, biemarginate on anterior dorsal border and on posterior border curved forward on either side toward the midline, fourth similar in design to the third, fifth continuous and biemarginate on anterior border, median spot on sixth, apex of seventh, greater part of the first sternite, lateral spots on 2-4, greater part of coxae and trochanters, femora except stripe on posterior surface, tibiae, and tarsi, *yellow*.

The scape is short, broad, and unusually hirsute, and segments 6-11 of the flagellum are slightly spinose on the posterior side. As

in the following species this character is in great part produced by the apical borders of the segments on the posterior surface. The ultimate segment is curved, flattened dorso-ventrally, pointed at the apex, and in length somewhat less than the combined length of the two segments immediately preceding. The middle femora below are beset with numerous short spinelike teeth and the middle tibiae, slightly carinate on the inner surface, have the apical margin on the anterior side drawn out into a process bearing a short spine at its tip. The middle metatarsi are curved on the inner side and bear near the base four spines. The second and sixth sternites are devoid of processes, the seventh bears a pair of carinae that diverge basally, and the eighth ends in a single spine. The genital stipes is very strikingly different from that of *U-scripta* Fox.

The maculations on the paratypes vary somewhat from those of the type specimen. Some specimens show a more or less well developed, but broken, U-shaped discal mark on the scutum, the curved fascia on the median segment may be broad and conspicuous or narrow and broken; the spots on the sides of the thorax vary in extent; the first tergal fascia may be continuous, and the fifth may be broken into spots.

Female.—Black: Labrum, mandibles except apices, clypeus except median pair of black spots, scape and flagellum below, frons except butterfly-shaped spot below anterior ocellus, posterior orbits not prolonged on vertex, prothorax, lateral lines and broken U-shaped discal mark on scutum, fascia on scutellum, fascia on metanotum, broken curved fascia on dorsum of median segment, lateral angles and sides of same, metapleurae and mesopleurae almost entirely, anterior border of mesosternum, fasciae on tergites 1-4, all continuous except the third and similar in design to those of the male, three spots on the fifth, apex of the sixth, lateral spots on sternites 2-4, spot on anterior coxae, trochanters distally, femora except a broad stripe above and a short one also below on posterior pair, tibiae, and tarsi, *yellow*. The ultimate tergite is somewhat wrinkled and is bordered apically by short but well marked lateral ridges.

Length.—17-19 mm.

The scape is short but not so broad as in the male. The flagellum is tawny yellow below in the female but in the male it is more testaceous. The wings are hyaline, the veins dark brown. The first transverso-cubital vein is only slightly curved. The pubescence is tolerably long and dense and is yellowish white in color; on the abdomen it is quite short. The ocelli and the labrum are similar to those of the following species to which this species is very closely related.

This species is described from four males in the United States National Museum, three of which were collected in Texas and one in New Mexico, and from one female in the collection of the Uni-

versity of Kansas. The male can be distinguished from the male of *U-scripta* Fox, by the character of the genital stipes as shown in the figures and by the fact that *U-scripta* has the mesosternum and the second and third ventral abdominal segments completely yellow and yellow fasciae on the fifth and sixth. The mesosternum of *arcuata* is marked with black, sternites two and three have only lateral spots and five and six are entirely black. The female of *U-scripta* has the mesosternum wholly yellow, lateral spots on sternites 2-5, and the apex of six marked with yellow; the female of *arcuata* has the mesosternum marked with black and the yellow on the sternites confined to small lateral spots on 2-4.

Habitat.—Texas, New Mexico, Kansas.

Type.—Cat. No. 19807, U.S.N.M.

BEMBIX U-SCRIPTA Fox.

Figs. 141, 208.

Bembex U-scripta Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 362, pl. 14, figs. 5, 9, female, male.

Male.—Black: Labrum, mandibles except apices, clypeus, scape, flagellum below, frons except pair of triangular black spots below anterior ocellus, and pair of widely separated points at base of clypeus, broad posterior orbits united across vertex, prothorax entirely, tegulae, broad lateral lines and broad U-shaped discal mark on scutum, broad fascia on scutellum, fascia on metanotum, dorsum and posterior surface of median segment except black band adjacent to postscutellum and narrow border of oblique sutures, sides of median segment, metapleurae and mesopleurae entirely, mesosternum, broad fasciae on tergites 1-5, each with a pair of emarginations and a medial notch on anterior border, the emarginations on second and third deepest, three spots on sixth tergite, apex of seventh, sternites 1-3 almost entirely, broad fascia on fourth with medial emargination on anterior border, narrow broken fascia on fifth, broader one on sixth, apex of seventh, legs except narrow stripes on posterior surface of anterior and posterior femora, *yellow*.

The scape is very short and broad and segments 5-11 of the flagellum are slightly spinose on the posterior surface, 8-11 most evidently so. The apical segment is curved, conical in outline and almost as long as the two segments immediately preceding it. The middle femora are dentate. The middle tibiae are slightly carinate on the inner surface and the anterior margin at the apex is drawn out into a process that bears a short spine at its tip. The middle metatarsi are strongly curved on the inner side and basally bear four spines. The second and sixth sternites are without processes of any kind, but the seventh bears a pair of carinae that diverge basally. The eighth ends in a single spine.

Female.—Black: Labrum, mandibles except apices, clypeus except a pair of medial spots that may merge into one, scape and flagellum below, frons except a butterfly-shaped spot below anterior ocellus, broad posterior orbits united across vertex, prothorax, broad lateral lines, and U-shaped discal mark on scutum, fascia on scutellum, metanotum, dorsum and posterior surface of median segment except black transverse border adjacent to postscutellum and border of oblique sutures, sides of median segment, metathorax and mesothorax, mesosternum entire on greater part, broad continuous fasciae on tergites 1–4, each with a medial notch and a pair of dorsal emarginations on anterior border, second, third, and fourth with less prominent lateral emarginations, three spots on fifth, apex of sixth, first sternite, second except a rather broad, medial, longitudinal black mark, lateral spots on 3–5, apex of sixth, legs except stripe on posterior surface of femora, and sometimes on tibiae below, *yellow*. The sixth tergite is somewhat wrinkled and apically there is a pair of short but well marked lateral ridges.

Length.—18 mm.

The scape in the female is short but not so broad as in the male. The ocelli in this and the preceding species are peculiar in that the posterior pair are well developed, though not perfectly round, and are in all probability functional. The anterior ocellus is also developed, appearing in long oval form but to what extent it is functional, if any, is yet to be learned. All three ocelli are light or amber in color on the dried insects. At the base the labrum bears a triangular flattened median area the apex of which forms a slight prominence on the median line. When viewed from the side a slight transverse depression is evident just distal to this prominence from which to the apex along the midline extends a slight carina. The wings are hyaline, the veins dark brown, and the first transverso-cubital vein is but slightly curved. The pubescence on the head and thorax is long, tolerably dense and yellowish white; that on the abdomen is quite short. The extent of the color on the thorax is unusually variable. On one specimen, from Arizona, the thorax is entirely yellow except for the narrow longitudinal lines on the scutum.

Habitat.—Arizona, California, and New Mexico.

Number of specimens examined—Males, 2; females, 4.

BEMBIX CINEREA Handlirsch.

Figs. 142, 143, 186.

Bembex cinerea HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 837, pl. 2, fig. 34; pl. 3, fig. 29, female, male.

Male.—Black: Labrum, except the lateral borders, sometimes small spots on mandibles, clypeus except the more or less wide lateral borders, small spot between antennae, scape below, abbreviated

anterior orbits, which may be lacking, narrow posterior orbits, which also may be lacking, lateral spots on tergites 1-4 or 1-5, lateral spots on sternites 2-4 or 2-5, femora distally below more or less, tibiae below and on anterior border, tarsi in varying degree, *yellow*.

The flagellum is cylindrical; segments 7 and 8 are very faintly spinose on posterior border, due to the presence of specialized areas, which on these and on the more apical segments do not assume the form of prominent pits. The apical segment is not curved, is rounded at the apex and is somewhat shorter than the combined length of the two just preceding it. The middle femora are finely serrate below. The middle tarsus is relatively shorter than is usual for the species of this genus, but on all specimens before me it is somewhat longer than its subtending tibia. The second and sixth sternites are usually without processes of any kind, but occasionally a very small one is found on the sixth. The seventh bears a median carina and also a pair of less prominent lateral carinae.

Female.—Black: Labrum, clypeus, scape below, spot between antennae, abbreviated anterior orbits, much reduced posterior orbits, femora distally below more or less, tibiae on anterior borders, tarsi in varying degree, *yellow*. Lateral spots on tergites 2-4 or 2-5, in some specimens broad at the sides but attenuated toward the midline, where they are more or less approximated, lateral spots on sternites 2-4 or 2-5, *yellowish or greenish white*.

Length.—13-17 mm.

The eyes in this species are widely separated, slightly more so in the female than in the male, and their inner margins are almost parallel. The head, thorax, and base of abdomen are covered with rather long white pubescence; elsewhere on the abdomen the pubescence is shorter. The ultimate tergite of the female is evenly and coarsely punctate, giving its surface a roughened appearance; laterally it is provided with long white pubescence among which are placed some short black spines. The extent and the intensity of the black marks upon the tarsi vary much, but on both sexes the hind tarsi are constantly very dark, almost black above. In his description of this species Handlirsch fails to state the color of the maculations.

The male of this species is distinguished by the presence of the black borders on the clypeus, which leave the central yellow spot in the form of a triangle with the apex at the midline of the base of the clypeus. It is further distinguished from the following species by its smaller size and by the presence of the black color of the tibiae, a mark that also distinguishes the female of this species from that of the following.

Habitat.—Georgia, Florida, Texas, and New Jersey.

Number of specimens examined—Males, 13; females, 5.

BEMBIX HINEI, new species.

Figs. 144, 145, 187, 209.

Male.—Black: Labrum, clypeus, mandibles except apices, spot between antennae, scape below, broad anterior orbits much shortened above, narrow posterior orbits, spot on sides of prothorax including lower part of tubercles, tegulae in part, spot on base of anterior wing, conspicuous lateral spots on tergites 1–5, lateral spots on sternites 2–6, greater part of femora, tibiae, and tarsi entirely, *yellow*. The flagellum is neither spinose nor dentate, the middle femora are feebly serrate, and the middle tarsi are short as in the case of *cinerea*. The second and sixth sternites are without processes. The seventh bears a median carina and a lesser pair of lateral carinae.

Female.—Black: Labrum, clypeus, mandibles except apices, spot between antennae, scape below, broad anterior orbits, narrow posterior orbits, spot on sides of prothorax including part of tubercles, tegulae in part, spot on base of anterior wing, conspicuous lateral spots on tergites 1–5, those on first segment widely separated, those on 2–4 attenuated toward mid-dorsal line and more or less approximated, lateral spots on sternites 2–5, greater part of the femora, tibiae, and tarsi entirely, *yellow*.

Length.—15–19 mm.

The wings in both sexes are hyaline and the pubescence is white, tolerably dense, and short except on the frons. It is very short on the abdomen except on the sixth tergite of the female, where it is white, long, and mingled with short, stout black spines. The variation in the maculations is slight and insignificant.

This species stands quite close to *B. cinerea* Handlirsch, to which species most of the individuals of this one found in our collections have been referred by those who identified them. A few specimens have been confused with *B. beutenmulleri* Fox, from which species the female of this one can with difficulty be distinguished. It differs from *cinerea* both in size and coloration. These differences, although they are the least satisfactory to depend upon in determining species, are clear cut in both males and females, and I have found no intermediate forms. In *cinerea* the abdominal markings on the female are creamy white, in *hinei* they are deep yellow; in *cinerea* the clypeus is bordered with black in the male, in *hinei* the clypeus is invariably yellow. In *cinerea* in both sexes the mandibles are black and the tibiae and tarsi are more or less black; in *hinei* these parts are almost wholly yellow, the tarsi invariably so. The genital stipes also differs in form from that of *cinerea*.

Named for my friend and first instructor in entomology, Prof. James S. Hine.

Habitat.—Texas, and Louisiana.

Number of specimens examined—Males, 10; females, 21.

Type.—Cat. No. 19809, U.S.N.M.

BEMBIX NUBLIPENNIS Cresson.

Figs. 146, 147, 188.

Bembex nublipennis CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 218, female, male.

Bembex nublipennis HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 838, pl. 2, fig. 38; pl. 7, fig. 25.

Male.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, spot before anterior ocellus, scape below, broad anterior orbits, posterior orbits, narrow line on posterior border of pronotum, sometimes widely interrupted medially or entirely wanting, spot on sides of prothorax variable in extent and usually including the tubercles, spot on tegulae, short lateral lines on scutum above base of wings, sometimes small lateral spots on scutellum, spot on lateral angles of median segment very frequently lacking, small spot on mesopleurae on a few specimens, broad fasciae on tergites 2-5 and sometimes 6, the first abruptly narrowed and more or less widely interrupted medially, the remaining fasciae with rare exceptions all continuous, biemarginate, and slightly notched medially, on anterior border and more widely notched medially on posterior border, lateral spots on sternites 2-5, which may or may not be connected by apical lines, femora except basally, tibiae, and tarsi, *yellow*.

Segments 6-9 of the flagellum are spinose on the posterior border and segments 4-11 on the posterior surface bear pits, those on 10 and 11 being large and conspicuous. The ultimate segment is a trifle longer than the preceding segment, only slightly curved, broader at the base than at the apex, and is roundly truncate apically. The intermediate femora are unevenly and raggedly serrate below. The second sternite bears a large median tubercle, hooked and pointed posteriorly, and the sixth bears a prominent oblique process, flattened on its distal surface and roundly pointed at the apex. This sternite also bears an additional pair of rounded lateral processes or ridges.

Female.—Black: Labrum, mandibles except apices, clypeus, scape below, space between insertions of antennae extended upward slightly, spot in front of anterior ocellus, broad anterior orbits, broad posterior orbits narrowed above, posterior border of pronotum, sides of prothorax except dusky line in front of tubercles, tegulae, lateral lines on scutum frequently shortened, sometimes a pair of discal lines on scutum, broad fascia on scutellum sometimes narrowed medially, fascia on metanotum, curved fascia on dorsum of median segment frequently interrupted medially, lateral angles of median segment and more or less of sides of same, spot on metapleurae, spot variable in size on mesopleurae, broad continuous fasciae on tergites 1-5, the first sometimes interrupted medially, more frequently roundly emarginate on anterior middle, rarely inclosing a pair of small medial anterior black spots, second usually inclosing a pair of black spots

which may appear as anterior emarginations, third, fourth, and fifth more or less distinctly biemarginate on anterior border, second, third, and fourth acutely notched at middle of posterior border, lateral spots on sternites 2-5, those on second sometimes connected by an apical line, femora except to a slight extent basally, tibiae, and tarsi, yellow.

Length.—17-20 mm.

The wings of the female are conspicuously clouded medially; those of the male are hyaline with only a trace of the clouding on the wings of some individuals. The veins are dark brown. The flagellum on the female is usually fulvous or tawny below, but on the male the color is limited to the more basal segments. The pubescence is light, sparse and relatively short. The variation in the maculations of this species is greater than usual, especially on the female. The great majority of the females do not show discal marks on the scutum but a few specimens show not only a well developed pair of longitudinal discal lines but also a posterior transverse line. On some the sides of the thorax and median segment are almost wholly yellow, whereas on others these parts are almost entirely black.

Habitat.—Tennessee, Iowa, Illinois, Kansas, Texas, New Mexico, Colorado, and Arizona.

Number of specimens examined—Males, 31; females, 46.

BEMBIX AMOENA Handlirsch.

Figs. 148, 149, 189, 210.

Bembex amoena HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 769, male, female, pl. 1, fig. 32; pl. 6, fig. 31.

Male.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, scape below, broad anterior orbits sometimes shortened above, narrow posterior orbits broader below and not reaching vertex above, spot on sides of prothorax sometimes including tubercles, spot on tegulae, wanting in some specimens, large irregular spot on side of mesopleurae united on mesosternum, pair of small spots on mesosternum in front of middle coxae, sometimes wanting, fasciae on tergites entirely absent or present on 1-5, first broad laterally, narrow and widely interrupted medially, remainder narrow, strongly undulate and narrowly interrupted medially, pair of median spots on sixth, lateral spots on sternites 1-5, sometimes reduced to 2-3, coxae below more or less, trochanters more or less in some specimens and in others not at all, femora below, tibiae except spot below in some specimens, and tarsi, *greenish yellow or white*.

Segments 5-8 of the flagellum when viewed from above show small but distinct spines on the posterior surface, and segments 5-12 bear pits or excavations on their posterior surfaces best developed on

9-11. The apical segment is only slightly curved and when seen from above is of uniform width from base to near the apex, which is slightly rounded. The middle femora are distinctly dentate below and the middle tibiae bear on their inner surface a distinct, but not greatly compressed carina. The apical spur of the middle tibia reaches to or beyond the middle point of the metatarsus. The second sternite bears a median longitudinal process and the sixth a prominent, elongated process that is flattened on its ventral surface in a plane nearly parallel with the long axis of the body and is usually bifurcate at the tip. The seventh bears a median prominent carina and laterally near the base a pair of slight elevations.

Female.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, anterior orbits, scape below, posterior orbits broader below, broken spot on sides of prothorax, one or two small spots on mesopleurae, fasciae on tergites 1-4 or 1-5, first narrowed medially and rather widely interrupted, remainder strongly undulate and narrowly interrupted medially, that on 5 sometimes broken or suppressed, lateral spots on tergites 2-4 or 2-5, spot on anterior coxae below, absent on some specimens, femora below more or less, tibiae except broad stripe below, and tarsi, *greenish white or greenish yellow*, the tibiae and tarsi having a rusty tinge. The sixth tergite is coarsely and irregularly punctated with a tendency to become rugose at the sides apically.

Length.—19-22 mm.

The wings in both sexes are hyaline, veins brown. The head, thorax, median segment and base of abdomen are covered with long, dense pubescence, particularly well developed about the head, on the median segment and base of abdomen. The pubescence on the basal segments of the legs, dorsal surface of the thorax and the abdomen, except the base, is shorter and less conspicuous. The scape is heavy and stout, especially on the male. The flagellum is much lighter below than above on the female, less evidently so on the male. The apical spur on the middle tibia of the female is the same as on the male.

The extremes of the series show a wide variation in the color markings. This is especially true for the male. At one extreme the abdomen is entirely black; at the other, tergites 1-5 each bears a comparatively broad fascia interrupted medially, and the sixth a pair of median spots. With reference to other maculations the extremes show a like divergence. At one extreme we find the sides of the thorax and median segment showing only a small spot on the mesopleurae; at the other not only the thorax but even the sides of the median segment show prominent maculations. Between these extremes, however, we find a well-graded series passing from one to the other. In the female the divergence, though evident in the series, is not so great.

On some specimens a pair of irregular black basal spots is found on the clypeus which spots are lacking on those on which the yellow maculations are best developed.

It is difficult to distinguish the most highly colored males of this species from the least well maculated males of *sayi*. The characters that distinguish this species from the latter are, however, the long apical spur of the middle tibia and the shape of the process on the sixth sternite. The genital stipes of the two are almost identical.

Habitat.—Yellowstone Park, Utah, Idaho, Wyoming, and California.

Number of specimens examined—Males, 17; females, 5.

BEMBIX SAYI Cresson.

Figs. 150, 151, 190, 211.

Bembex sayi CRESSON, Proc. Ent. Soc. Phila., vol. 4, 1865, p. 467, female.

Bembex sayi HANDLIRSCH, Sitz. Acad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 877, female.

Male.—Black: Labrum, mandibles except apices, clypeus, lower part of frons continued upward between the antennae and united with spot in front of anterior ocellus, broad anterior orbits, scape except narrow stripe above, posterior orbits, prothorax entirely, tegulae, lateral lines and a pair of narrow discal lines on scutum, narrow fascia on posterior border of scutellum greatly enlarged laterally, narrow fasciae on metanotum, large triangular spot squarely emarginate below on posterior surface of median segment, lateral angles and sides of same, metapleurae, one large irregular spot continued on mesosternum and two small posterior ones on mesopleurae, broad fasciae on tergites 1–6, all undulate laterally and continuous except the first, second inclosing a pair of elliptical dorsal black spots, third, fourth, and fifth biemarginate on anterior dorsal border, second to sixth distinctly notched medially on posterior border, posterior border of first sternite, large lateral spots on second almost united medially, smaller lateral spots on 3–6, legs entirely except black stripe above on anterior femora, small black spots on base of trochanters and at base of posterior femora, *yellow or yellowish white*.

The description above is made from the most highly colored male in the series before me. The least highly colored is as follows: Labrum, mandibles except apices, clypeus, lower part of frons, scape below, anterior and posterior orbits, small lateral spots on dorsal border of pronotum, large spot on sides of prothorax including tubercles in part, spot on tegulae, minute spot above tegulae on scutum, two spots on mesopleurae, pair of smaller ones on mesosternum, narrow undulate, interrupted fasciae on tergites 1–5, small lateral spots on sternites 2 and 3, spot on anterior and middle coxae below,

femora except broad stripe above on all and a short one below on posterior pair, tibiae except narrow line below on anterior and middle pairs, and tarsi, *yellow or yellowish white*. The markings of the abdomen are decidedly white.

Between these two extremes I have before me a very complete series of gradations wherein the extensive markings of the one are almost imperceptibly reduced to the meager maculations of the other. In other respects the series is remarkably uniform. The scape is broad and stout and viewed from the side is larger apically than at the base. Segments 5-8 of the flagellum are spinose posteriorly and 4-12 bear pits or excavations on their posterior surface, most conspicuous on 9-11. The apical segment seen from above is curved and widest at the base, the width decreasing perceptibly toward the apex. The middle femora are dentate below and the middle tibiae bear a longitudinal carina on the inner side. The spur at the apex of the middle tibia is less than half the length of the middle metatarsus. The second sternite bears a prominent, laterally compressed, median process, and the sixth a process equally prominent, usually bifurcate at the apex, its ventral surface flattened or provided with a median groove but not placed parallel with the long axis of the body as in the case of *amoena*.

Female.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, spot before anterior ocellus, broad anterior orbits, posterior orbits broad below, prothorax except dusky spot in front of tubercles and an anterior dorsal median spot sometimes broken into lateral spots, tegulae, lateral lines on scutum, pair of longitudinal discal lines and a posterior transverse discal line, sometimes wanting, on scutum, transverse fascia on posterior border of scutellum enlarged laterally, fascia on metanotum rarely wanting, curved fascia on dorsum of median segment, its lateral angles and sides except a median black emargination on dorsal border of side, metapleurae, mesopleurae wholly or for the most part, broad fasciae on tergites, all continuous except the first, which is narrowly interrupted medially, the second or second and third inclosing a pair of dorsal elliptical black spots, which in some specimens are united with the anterior black border in the form of emarginations, fourth and fifth with a pair of anterior dorsal emarginations and a less evident pair of lateral ones, second to fifth with a deep acute median notch on posterior border, spot on apex of ultimate tergite, reduced in some specimens and wanting in others, lateral spots on sternites 1-5 or 2-4, legs almost entirely in the lighter specimens, in the darker ones spots on anterior and middle coxae, femora except above and stripe below on posterior pair, tibiae except stripe below on all, and tarsi, *yellow or yellowish white*.

Length.—17-19 mm.

On both sexes the pubescence on the head, thorax, median segments and base of abdomen is white and moderately long and dense, but not so well developed as in the case of *amoena*. The wings are hyaline, veins brown. The scape is relatively short and heavy; the flagellum is reddish below, especially in the female. The punctures of the scutum are moderately large, evenly but not closely distributed. Those of the median segment smaller and more closely placed. The punctures of the ultimate tergite are coarser, variable in size, and more irregularly placed. A small female from Texas apparently belongs in this species, though it lacks the discal marks on the scutum, the yellow fascia on the median segment and the dorsal fasciae are narrow and none inclose paired black spots.

Habitat.—Florida, Texas, New Mexico, Colorado, Kansas, South Dakota, and Wyoming.

Number of specimens examined—Males, 29; females, 15.

BEMBIX BELFRAGEI Cresson.

Figs. 152, 153, 191, 212, 213.

Bembex belfragei CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1873, p. 220, male.

Bembex cressonis HANDLIERSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 792, male, female, pl. 5, fig. 6.

Bembex insignis HANDLIERSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 793, male, female, pl. 2, fig. 7; pl. 6, fig. 32.

Bembex belfragei FOX, Proc. Acad. Nat. Sci., Phila., 1895, p. 357.

Male.—Black: Labrum wholly or with small basal spots or not at all, clypeus, wholly or with pair of apical spots or not at all, mandibles except apices, scape below or not at all, anterior orbits and spot between antennae which marks may all be lacking, posterior orbits, spot on sides of prothorax continued on tubercles or wholly wanting, rarely spot on mesopleurae and small lateral spots on scutellum, fasciae on tergites 1-4 or 1-6 all interrupted medially, first broad and more widely interrupted than the remainder, second and third broad laterally and abruptly narrowed dorsally on either side the midline, remainder narrower and somewhat undulate, lateral spots on sternites 2-3 or 2-5, femora below more or less, tibiae except much of lower surface, and tarsi, *yellow or greenish yellow*.

Segments 7-9 of the flagellum are slightly produced on their posterior margin and 9-11 bear prominent pits. The apical segment is slightly curved and is longer but narrower than the segment preceding it. The middle femora are dentate below on the distal half. The second sternite bears a large medial, laterally compressed, slightly hooked process. The sixth bears a heavy prominent transverse ridge usually drawn to a sharp edge on its posterior distal border, bluntly pointed medially and slightly curved on either side. The seventh bears a small median posterior process from which a pair of inconspicuous carinae diverge basally. The apical surface of the ultimate tergite is more or less rugose.

Female.—Black: Spot on mandibles not always present, very small lateral spots on scutellum, fasciae on tergites 1–4 interrupted medially, the first broad and a trifle more widely interrupted than the others, second and third broad laterally and on anterior border abruptly narrowed or emarginated on either side the midline, fourth narrower but similar in design to the third, small posterior lateral spots on sternites 2 or 2–4, only the border of the femora, tibiae, and tarsi more or less, or distal ends of the femora and the tibiae and tarsi almost entirely, *yellow or greenish yellow*. The dorsal surface of the ultimate tergite is strongly wrinkled longitudinally.

Length.—16–18 mm.

The females from Wisconsin have the antennae and the front of the head, except spot on mandibles, entirely black. In both specimens there are yellow spots on the mesopleurae, lateral spots on the scutellum, also on metanotum and median segment dorsally, and on sternites 2–3. On one the spots are better developed than on the other, the first and second tergal fasciae are very broad, the second dorsally enclosing a pair of black spots, a character peculiar to Handlirsch's *insignis*. The females from Kansas have the antennae, the head, except the much-reduced posterior orbits, and the thorax, except small lateral spots on scutellum, wholly black. The legs also, including the tibiae and tarsi, are almost entirely black, and the yellow on the venter of the abdomen is reduced to small lateral spots on sternites 2 or 2–3. The characteristic wrinkling of the sixth tergite is constant on all the specimens.

In both sexes the labrum when viewed from the side shows a distinct transverse impression. The scape is short and stout; the flagellum is black and the apical segment is longer but slightly narrower than the preceding segment. The wings are very slightly infumated, the veins brown. The head, thorax, median segment and base of abdomen are covered with relatively short, moderately dense pubescence, dark on dorsum of thorax, white elsewhere. The punctuation of the dorsum of the thorax is regular, close, and moderately fine. The eyes are widely separated and are slightly divergent at the vertex.

Handlirsch arrived at the conviction that Cresson, in his description of *belfragei*, included two distinct species and being unable to determine to which the name *belfragei* should be applied, discarded that name entirely and substituted the names *cressonis* and *insignis* instead. Fox in his Synopsis of the Bembicini of Boreal America restored the original name by making *cressonis* Handlirsch a synonym of *belfragei* Cresson and retained *insignis* Handlirsch as a good species. A careful study of the specimens at hand and also of those in the collection of the American Entomological Society of Philadelphia raises the question of the validity of Handlirsch's *insignis*. Structurally it is, as Handlirsch himself points out, essentially like *cressonis* and in

his table Handlirsch makes use of only color differences to separate his two species. These differences, made use of by Handlirsch, represent, as a matter of fact, simply extremes in a variable series, as is shown by the series of specimens I have examined. In the series I find one male that has the labrum, clypeus, lower side of scape, frontal spot, wide anterior and narrow posterior orbits *yellow*—character peculiar to *insignis*. It also has narrow, interrupted, conspicuous fasciae on fourth, fifth, and sixth tergites—characters that distinguish *cressonis*—thus combining in one individual the very characters by means of which the two species have been separated. Other specimens also, both males and females, show a greater or less degree of variation in their maculations and these variations are present in those maculations that we should expect to find relatively constant if they are to be regarded as specific characters. Furthermore, so far as I can discover, there is no variation whatever in structure in either sex. I have, therefore, been forced to conclude that we have only one species variable in color and also somewhat in size and have placed the specimens in Cresson's original species *belfragei*.

Habitat.—Georgia, Louisiana, Texas, Kansas, and Wisconsin.

Number of specimens examined—Males, 11; females, 7.

BEMBIX STENOBDOMA, new species.

Figs. 154, 192, 214, 215.

Male.—Black: Labrum, mandibles except apices, clypeus, scape, basal segments of flagellum below, spot between antennae, broad anterior orbits narrowly prolonged onto vertex and joined by a transverse line below anterior ocellus, broad posterior orbits narrowed to a fine line above, prothorax almost entirely, lateral lines and a pair of discal lines on scutum, tegulae, narrow fascia on scutellum enlarged laterally, narrow curved fascia on metanotum, short narrow oblique lines basally on dorsum of median segment, sides of median segment, mesothorax and metathorax entirely, mesosternum except small black spots in front of middle coxae, broad fasciae on tergites 1–6, first slightly narrowed medially, second to sixth biemarginate and also notched medially on anterior dorsal border, apex of seventh tergite, first sternite, second except three anterior black spots, broad fasciae on third and fourth with a median triangular anterior emargination, lateral spots on fifth, apex of sixth, seventh, legs except basal black spots on middle and posterior coxae and narrow black stripe on all femora above, *greenish yellow*. The markings of the scutellum, metanotum, and dorsum of abdomen are more white than yellow; this is true to a less extent of the clypeus while the legs lack the greenish tinge.

The scape is very short, stout, and thick and the flagellum is unusually light in color, shading below from yellow at the base to tawny

at the apex. The flagellum is cylindrical, the first segment smallest in diameter, the last three slightly flattened and decreasing in width imperceptibly to the apical segment, which is very slightly curved and rounded at the apex. Segments 9–11 bear conspicuous pits and 7–8 smaller ones. The seventh is spinose on the posterior surface. The middle femora are dentate below, and the spur at the apex of the middle tibia is curved. The middle metatarsus is unusually short and is bent in outline. The wings are hyaline, veins brown. The pubescence on head, thorax, and base of abdomen is white, short, and sparse, elsewhere on abdomen almost lacking. The second sternite bears a large prominent hooked process; the third, an evident median carina; the fifth, a pair of very small approximated tubercles apically; the sixth, a low broad transverse process whose posterior face is at right angles to the plane of the segment. With respect to this process on the sixth sternite the species resembles *B. belfragei*. The seventh sternite is greatly narrowed, but it is not reduced to the form of a spine.

Length.—16 mm. Described from a single specimen.

Habitat.—Florence, Arizona.

Type.—Male, in collection of American Entomological Society of Philadelphia.

BEMBIX RUGOSA, new species.

Figs. 216, 217.

Female.—Black: Labrum, mandibles except apices, clypeus, anterior orbits, scape and flagellum below, small rounded spot on either side of anterior ocellus, narrow posterior orbits, sides of prothorax united by a narrow line on posterior border of pronotum, tegulae, lateral lines and a pair of short anterior discal lines on scutum, fascia on scutellum narrowed medially, fascia on metanotum, pair of short, broad, oblique lines on dorsum of median segment, spot on mesothorax, broad fasciae on tergites 1–4, first slightly emarginate on anterior middle, second, third, and fourth each with five emarginations on anterior border—i. e., a shallow median notch, a deeper square indentation on either side of this and laterally on either side a shallow sinuation, pair of spots on fifth, lateral spots on sternites 2–4, the last pair quite small, apex of ultimate sternite, femora distally, tibiae, and tarsi, *pale greenish or creamy yellow*.

The antennae are cylindrical, long, and slender. The clypeus is strongly arched, shows a silvery reflection and on the midline at the apical border it bears a very slight depression. The labrum is unusually long and slender, as shown in figure 217. The legs are also slender and longer than usual. The spur at the apex of the middle tibia does not reach the middle metatarsus and the spine on the posterior side is almost equally well developed. The wings are hyaline, the veins brown. The pubescence on head, thorax, and

base of abdomen is white, relatively long and moderately dense; elsewhere on the abdomen short and sparse. The ultimate tergite of the abdomen apically bears short, well-marked lateral carinae that, though not evident in a dorsal view, set off a fairly well defined middlefield, which is strongly wrinkled, a character in which it resembles *B. belfragei*. This character and the unusually long labrum form a pair of distinguishing features by which this species can be readily recognized.

Length.—14 mm.

It is possible that this is the female of the preceding species. Although these two specimens, on which the two species are based, do not resemble one another sufficiently to warrant my associating them as sexes of one species, nevertheless their resemblance to the male and female respectively of *belfragei* causes me to suspect that they may be sexes of a single species.

Described from a single specimen in the United States National Museum.

Habitat.—Arizona.

Type.—Cat. No. 19782, U.S.N.M.

BEMBIX FOXI, new species.

Figs. 155, 156, 193.

Bembex sayi Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 359, female, male.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, frons between antennae, broad anterior orbits somewhat shortened and also deflected inward above, spot below anterior ocellus, narrow posterior orbits, posterior border of pronotum, sides of prothorax except irregular spot in front of tubercles, weak lateral lines and pair of short discal lines on scutum, spot on sides of median segment, spot on metapleurae, irregular spot on mesopleurae, fasciae on tergites 1-6, first somewhat widely interrupted, second broadest and inclosing a pair of elliptical dorsal black spots, third with a pair of dorsal anterior emarginations, fourth and fifth similar to the third but with broader and more shallow emarginations, apex of seventh, fascia on second sternite inclosing transverse black area posterior to the median process, lateral spots on sternites 3-7, spot on anterior and middle coxae, femora except basally and line above on first pair, tibiae except line below on first pair, and tarsi, *bright yellow*.

The flagellum is dark above, light or yellowish below; segments 7-8 are slightly spinose on the posterior border; the ultimate segment is somewhat curved and tapers toward the apex where it is roundly but obliquely truncate. The pubescence is white and tolerably well developed on head, thorax, median segment and base of abdomen; it is shortest on the dorsum of the thorax and longest on

sides of thorax and median segment. The middle femora are finely but not deeply serrate. The second sternite bears a large, prominent, hook-like process, of which the backwardly directed distal prolongation, ending in a sharp point, is relatively greater than that of any other species herein described. The sixth bears a pointed, narrow, triangular process whose ventral surface is slightly concave longitudinally.

Female.—Black: Labrum, mandibles except apices, clypeus, scape below, frons between antennae, broad anterior orbits shortened and deflected inward above, spot before anterior ocellus, narrow posterior orbits, posterior border of pronotum, sides of prothorax except irregular spot in front of tubercles, lateral lines and pair of discal lines on scutum, lateral spots on scutellum, spot on sides of median segment, spot on metapleurae, irregular spot on mesopleurae, fasciae on tergites 1-5, first widely interrupted, remainder very narrowly interrupted, second imperfectly inclosing a pair of dorsal black spots, remainder with a pair of broad, shallow, anterior, dorsal emarginations, apex of sixth tergite, lateral spots on sternites 2-5, spot on anterior and middle coxae, femora except basally and upper surface of anterior pair, tibiae except stripe above and below on anterior and middle pairs, and tarsi, *yellow*.

Length.—14 mm.

The flagellum is light below, more so than in the male, and the pubescence is similar to that on the male. The wings in both sexes are hyaline and the sculpturing is of the normal character. On the female and on one male the fasciae on the tergites are very narrowly interrupted, appearing for the most part as if developed in lateral halves that have just failed of uniting on the dorsal midline.

This species in the pattern and color of its maculations resembles very closely *B. troglodytes* Handlirsch, from which the male of this species can be readily distinguished by the presence of the serrate middle femora and spinose antennae. The female is distinguished from *troglodytes* by the absence of any black on the clypeus and by the absence of maculations on the metanotum and dorsum of median segment. The male differs from *spinolae*, *similans*, and *cameroni* in the character of the process on the second sternite, the spinose segments of the antennae and the form of the genital stipes. From the females of these three species the female of this one differs in the character of the maculations. Fox referred the males of this species to *sayi* Cresson, and it was doubtless on these same specimens that he based his description of the male of that species.

Described from two males and one female.

Habitat.—Illinois.

Type.—Male and paratypes in collection of the American Entomological Society of Philadelphia, Pennsylvania.

BEMBIX SPINOLAE Lepeletier.

Figs. 157, 158, 159, 160, 194.

Bembex spinolae LEPELETIER, Hist. Nat., 1845, vol. 3, p. 277.*Bembex fasciata* DAHLBOM, Hymen. Europ., vol. 1, 1845, p. 487, female.*Bembex fasciata* WALSH and RILEY, Amer. Ent., vol. 1, 1860, p. 126, fig. 98.*Bembex spinolae* HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 825.*Bembex spinolae* FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 357.

Male.—Black: Labrum, mandibles except apices, clypeus, scape and first two flagellar segments below, spot between antennae, broad anterior orbits, narrow posterior orbits, spot on sides of prothorax sometimes extensive and sometimes wanting, tubercles and posterior border of the segment both above and below tubercles variable in extent, tegulae more or less, sometimes small spot on mesopleurae, rarely small lateral spots on scutellum, fasciae on tergites 1-5, all of which may be interrupted medially or all continuous except the first, lateral spots on sternites 2-5, femora distally more or less, tibiae except stripe on posterior surface variable in extent, and tarsi, *light or greenish yellow*.

The antennae are slender and segments 7-9 and sometimes 6 also are spinose on the posterior surface, due to the presence of small pits, of which larger ones are found on 10 and 11. The middle femora are dentate. The second sternite usually bears a prominent median tubercle but this in some specimens is much reduced or wholly wanting. The sixth bears a small median process that is pointed and obliquely directed backward. The seventh bears a median carina more or less pointed posteriorly. The genital stipes vary somewhat, as is shown in the accompanying figures. The variation in the extent of the maculations is great. As a rule the maculations are less extensive on those specimens from the north than on those from the south, but this is by no means universal. The abdominal fasciae may be very narrow or relatively broad, closely approximated or widely separated medially and more or less sinuate in outline. The markings of the thorax also varies.

Female.—Black: Labrum, mandibles except apices, clypeus, spot between antennae, scape and basal part of flagellum below, broad anterior orbits, posterior orbits, spot on side of prothorax variable in extent, tubercles more or less, posterior border of the segment above and below the tubercles variable in extent, spot upon sides of mesopleurae variable in size and sometimes wanting, sometimes spot on sides of median segment, fasciae on tergites 1-5, the first invariably interrupted medially, the remainder in some cases all interrupted medially, in others only part interrupted, and in still others all continuous, lateral spots on sternites 2-4, femora distally more or less,

tibiae, except stripe, of greater or less extent below, and tarsi, *light yellow or greenish white*.

Length.—14–17 mm.

The wings in both sexes are hyaline and the nervures brown. The pubescence is white, relatively short and tolerably dense on head, thorax and base of abdomen; on the remaining segments of the abdomen it is quite short. The punctation in both sexes is of the usual character.

Habitat.—Texas, Kansas, Missouri, Alabama, Florida, Georgia, North Carolina, West Virginia, District of Columbia, Maryland, Pennsylvania, New Jersey, New York, Long Island, Connecticut, Rhode Island, Massachusetts, New Hampshire, Ontario, Ohio, Indiana, Michigan, Illinois, Wisconsin, Iowa, South Dakota.

Number of specimens examined—Males, 41; females, 83.

BEMBIX CAMERONI Rohwer.

Figs. 161, 162, 195.

Bembyx cameroni ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1912, p. 467.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, very broad anterior orbits abbreviated above, space between insertions of antennae prolonged upward, spot below anterior ocellus, line on posterior border of pronotum, tubercles, sides of prothorax in part, spot on tegulae, small lateral spots on scutum at base of anterior wing, broad fasciae on tergites 1–6, first narrowly interrupted medially, second, third, and fourth biemarginate dorsally and sinuate laterally on anterior margin and on posterior margin acutely emarginate medially, fifth and sixth but slightly emarginate or sinuate, small spot on apex of seventh, lateral spots on sternites 2–5, the greater part of the femora distally, tibiae except spot below on anterior pair, and tarsi, *yellow*.

The middle femora are dentate and the antennae are spinose on the posterior border of segments 5–9. The second sternite bears a prominent hooked process and the sixth a somewhat short, broad, roundly pointed process whose ventral surface distally is slightly concave, presenting a spoon-shaped appearance. The spot before the anterior ocellus is wanting on some specimens, and the line on the pronotum consists of spots. On some specimens the scutellum bears small lateral spots and lateral spots may occur on the sixth sternite.

Female.—Black: Labrum, mandibles except apices, clypeus, scape below, broad anterior orbits shortened above, space between antennae, line on posterior border of pronotum tubercles, sides of the prothorax in part, spot on tegulae, short lateral line on scutum at base of wings, lateral spots on scutellum, fasciae on tergites 1–5, first interrupted, second, third, and fourth biemarginate dorsally and somewhat sinuate

laterally on anterior border, and notched medially on both anterior and posterior borders, more evident on the latter, fifth deeply and acutely notched on posterior middle, central spot on sixth tergite, small lateral spots on sternites 2-5, femora distally, tibiae except spot below on first and second pairs, and tarsi, *yellow*.

In both sexes the flagellum is tawny below and the pubescence is well developed, especially on the males. The eyes are widely separated and their inner margins are approximately parallel. The wings are hyaline and the general build is somewhat robust.

Length.—16-18 mm.

This species seems to be intermediate between *nubilipennis* and *spinolae*, not so large as the former and a trifle larger and more robust than the latter. From the former the males of this species can be readily distinguished by the absence in this species of the secondary lateral processes on the sixth sternite and the presence of an evident spine on the fifth segment of the antennae. From the latter it may be distinguished by the flattened, roundly pointed process of the sixth sternite, the richer color of the maculations, which show less of the greenish tinge, and the presence of the spine on the fifth segment of the antennae, characters not found on *spinolae*.

The female is distinguished from *nubilipennis* by its clear wings and from *spinolae*, and the light banded species closely related to it by the deeper yellow of the maculations, and from the yellow-maculated *similans* by the absence of any maculations upon the mesopleurae and metapleurae.

Habitat.—Mexico, New Mexico, Arizona.

Number of specimens examined—Males, 11; females, 3.

BEMBIX COMATA, new species.

Figs. 163, 164, 165, 196.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, spot between antennae, broad anterior orbits, very narrow posterior orbits, broken line on posterior border of pronotum, posterior edge of tubercle continued in a line downward and spot on side of prothorax, spot on tegulae, short lateral lines on scutum, broad sinuate fasciae on tergites 1-6, all except the first continuous, apex of seventh tergite, lateral spots on sternites 2-6, femora distally, tibiae except stripe below on first pair, and tarsi, *pale or greenish yellow or soiled white*.

Female.—Black: Labrum, mandibles except apices, clypeus, scape below, spot between antennae, broad anterior orbits, narrow posterior orbits, broken line on posterior border of pronotum, tubercles, spot on sides of prothorax, spot on tegulae, short lateral lines on scutum above base of wings, lateral spots on scutellum, small spot on mesopleurae, spot on sides of median segment, broad sinuate fasciae on

tergites 1-5, all except first continuous, apex of sixth tergite, lateral spots on sternites 2-5, femora distally, tibiae except stripe below on all pairs, reduced in extent on posterior pair, and tarsi, *pale or greenish yellow or soiled white*.

In both sexes the color is the same; the fasciae on the tergites are soiled white, the markings of the head more of a greenish yellow shade and the legs are pale yellow. The flagellum is black above, pale or testaceous below, and on the male segments 7-9 are spinose on the posterior border. The wings are hyaline, the nervures brown. The pubescence is white, relatively long and dense. The middle femora of the males are serrate-dentate below, the second sternite bears a prominent median process scarcely hooked at the posterior end and the sixth bears a smaller, pointed process.

Length.—13-17 mm.

This species is very closely related to *spinolae* on the one hand and *primaestate* on the other. The males of this species differ from those of *spinolae* in having the fasciae on the tergites white, the apical tergite maculated and the greater development of the pubescence; from those of *primaestate* in having the fasciae of the tergites white instead of yellow and in the absence of maculations on the sides of thorax and median segment. In the case of the female it differs from *spinolae* in having the apical tergite maculated and in the greater development of the pubescence. In some specimens of this species, however, the maculation of the apical tergite is obscured or even lacking. From *primaestate* the female of this species is distinguished by the absence of conspicuous maculations on the thorax and median segment.

Habitat.—California, Oregon, Washington, Vancouver, and New Mexico.

Number of specimens examined.—Males, 21; females, 18.

Type.—Cat. No. 19780, U.S.N.M.

BEMBIX PRIMAAESTATE Johnson and Rohwer.

Figs. 166, 167, 168, 197.

Bembex primaestate JOHNSON and ROHWER, Ent. News, vol. 19, 1908, p. 378, female.

Bembex primaestate ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1912, p. 466, fig. 3, male.

Male.—Black: Labrum, mandibles except tips, clypeus, scape and first two flagellar segments below, space between antennae, sometimes spot below anterior ocellus, broad anterior orbits shortened above, posterior orbits, usually posterior border of pronotum but not always, tubercles, sides of prothorax variable in extent, spot on tegulae, spot each on sides of median segment, metapleurae, and mesopleurae, on all three variable in extent or even lacking, broad fasciae on ter-

gites 1-6, first interrupted more or less widely and usually narrowed somewhat toward the midline, remaining fasciae continuous though somewhat constricted at the dorsal midline, their borders sinuate especially the anterior, apex of seventh tergite, posterior lateral spots on sternites 2-6, femora more or less distally and below, tibiae except below on first pair, and tarsi, *greenish yellow*. The yellow on the legs lacks the greenish tinge.

The pubescence on the head, thorax, base of abdomen, and the basal joints of the legs is white and unusually well developed. Segments 7 and 8 of the flagellum are distinctly spinose on the posterior surface and on many specimens also 6 and 9, but less evidently so. The intermediate femora are dentate below. The second sternite bears a median, longitudinal process and the sixth a smaller, narrow, pointed process.

Female.—Black: Clypeus, labrum, mandibles except tips, scape below, spot between antennae, frequently united with spot below anterior ocellus, anterior orbits, posterior orbits, posterior border of prothorax almost wholly, tegulae, narrow lateral lines on scutum, lateral spots on scutellum usually connected by a more or less evident line at posterior border of scutellum, fascia on metanotum, sometimes suppressed, spot on sides of median segment, spot on metapleurae, small posterior and larger anterior spot on mesopleurae, broad fasciae on tergites 1-5, first narrowly interrupted medially, remainder continuous, each biemarginate on anterior dorsal border, deep and evident on second and third, more wide and shallow on fourth and fifth, all with an acute emargination at the middle on posterior border, lateral spots on sternites 2-4, frequently connected by very narrow apical lines, femora distally more or less, tibiae except line below, and tarsi, *greenish white or yellow*. The markings on the thorax, median segment, and legs are yellow, elsewhere greenish white.

Length.—13-17 mm.

The pubescence is white and conspicuous but not so well developed as on the male. The flagellum is light on the lower surface, testaceous on the male, yellowish on the female. On most specimens the sixth tergite of the female is black; on some it is maculated and on some of these the dorsum of the median segment is also maculated. It is difficult to distinguish the less extensively maculated females of this species from the most extensively marked forms of *spinolae*, and likewise in many cases it is hard to separate the males from the males of *similans*.

Habitat.—Colorado, Idaho, Washington, Vancouver, California, New Mexico, and Texas.

Number of specimens examined.—Males, 39; females, 28.

BEMBIX SIMILANS Fox.

Figs. 5, 169, 170, 198.

Bembex similans Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 358, female, male.

Male.—Black: Labrum, mandibles except apices, clypeus, scape, and first flagellar segment below, lower part of frons, spot in front on anterior ocellus, sometimes wanting, broad anterior orbits, posterior orbits broader below, posterior border of pronotum, sides of prothorax except variable spot in front of tubercles, tegulae, lateral lines on scutum, lateral spots on scutellum, fascia on metanotum sometimes absent, sides of median segment, large spot on metapleurae, large irregular anterior and smaller posterior spot on mesopleurae, broad fasciae on tergites 1-6, first abruptly narrowed and usually interrupted medially, remaining fasciae continuous and strongly sinuate on anterior border, the medial pair of sinuations on second and third most conspicuous, lateral spots on sternites 2-6, sometimes connected by apical lines, spot on coxae below, trochanters apically more or less, femora except basally and stripe on posterior surface of anterior pair, tibiae, and tarsi, *yellow*.

Segments 7-9 of the flagellum are spinose on their posterior border and 10-11 bear shallow excavations or pits. The apical segment is but slightly curved, rounded apically and of uniform width. The middle femora are dentate below. The second sternite may or may not bear a small median process and the sixth a small short pointed one. The seventh is carinate medially.

Female.—The color and maculations of the female are quite similar to those of the male, though the black on the legs is more extensive. On some specimens the tibiae are striped with black below.

Length.—11-16 mm.

We find some variation in both sexes. One male has all the fasciae on tergites continuous; two females have each a pair of discal marks on scutum, the lateral spots on the scutellum united and a well developed curved fascia on the dorsum of the median segment. The ultimate segment is usually black, but in the case of two females the ultimate tergite is broadly marked with yellow and others show a gradation from the black on the one extreme to the yellow on the other. The eyes are widely separated and in both sexes are distinctly divergent at the vertex. The flagellum is yellowish or fulvous below. The head, thorax, and abdomen are covered with short, white, moderately dense pubescence, shorter on the abdomen than elsewhere and better developed on the male than on the female. The wings are hyaline, veins fulvous. According to Fox the scutum of the male is without pubescence; all the males before me have the

scutum distinctly pubescent although the hairs here are somewhat shorter than elsewhere on the thorax.

Habitat.—New Mexico, Arizona, and Florida.

Number of specimens examined—Males, 7; females, 15.

BEMBIX PRUINOSA Fox.

Figs. 171, 172, 199.

Bembex pruinosa Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 361, female, male.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, space between antennae, anterior orbits, narrow posterior orbits, narrow line on posterior border of pronotum, rarely wanting, spot on tegulae, small lateral spot on scutum above base of wings, sometimes lateral spots on scutellum, fascia on metanotum sometimes absent, occasionally one or two small spots on side of median segment, fasciae on tergites 1–6, all of which may be broad and continuous or all may be somewhat narrowed and interrupted medially, in either case the anterior border being more or less sinuate on either side the midline, apex of ultimate tergite, posterior lateral spots on sternites 2–6 usually, though not always, connected by narrow apical lines, femora except broad stripe above and basally below, tibiae except stripe below, and tarsi, *white or yellowish white*.

Segment 7 of the flagellum seen from above shows a rather conspicuous though blunt spine on its posterior border and segments 9–11 bear pits or excavations. The second sternite is smooth; the sixth bears a pair of low inconspicuous carinae that diverge basally; the seventh ends in a prominent spine that is broadly grooved ventrally and bifid apically. The middle femora are smooth.

Female.—Black: Labrum, mandibles except apices, clypeus except black spot basally, rarely lacking, scape below, space between insertions of antennae, anterior orbits, posterior orbits, narrow posterior border of pronotum, small spot on tegulae, small lateral spots on scutum above base of wings, curved fascia, sometimes broken into spots, on scutellum, fascia on metanotum, curved fascia on dorsum of median segment sometimes interrupted medially, lower part of lateral angles of median segment sometimes reduced to narrow posterior lateral spots, occasionally small spot on mesopleurae, broad continuous fasciae on tergites 1–5, the first narrowed medially, the remainder bisinuate on anterior border, lateral spots on sternites 2–5, which may or may not be connected by apical lines, tibiae except below and spot on posterior border of anterior pair, and tarsi, *white or yellowish white*.

Length.—16–19 mm.

In both sexes the flagellum is yellowish or tawny below and the apical segment is reddish. The head, thorax, median segment, and

base of abdomen are covered with dense, moderately short pubescence shortest on the scutum, where it is of a brownish color. The remaining segments of the abdomen are covered dorsally with close, fine pubescence, longest on the more apical segments and more evident on the male than on the female. The wings are hyaline, veins dark brown. The eyes are parallel or slightly divergent beneath. In some males the carinae on the sixth sternite are reduced or lacking. The variation in the maculations is not great in either sex, but in both a part or all of the tergal fasciae may be narrowed and interrupted medially. The species is well marked and not likely to be confused with any other species herein described.

Habitat.—New York, Ohio, New Jersey, Florida, Texas, Kansas, Iowa, New Mexico, California, Oregon, and Canada.

Number of specimens examined—Males, 13; females, 17.

BEMBIX BEUTENMULLERI Fox.

Figs. 173, 174, 200.

Bembix beutenmulleri FOX, Journ. N. Y. Ent. Soc., vol. 9, 1901, p. 83, male.

Bembix obsoleta HOWARD, Insect Book, 1904, pl. 4, fig. 36.

Bembyx obsoleta ROHWER, Proc. U. S. Nat. Mus., vol. 41, 1912, p. 467, figs. 6, 7, 8, male.

Male.—Black: Labrum, mandibles except apices, clypeus, spot between antennae, small spot in front of anterior ocellus, scape below, anterior orbits, posterior orbits wanting or reduced to small spots near the lower border of eye, sometimes one or more small spots on sides of prothorax, spot on tegulae, small lateral spots above base of wings on scutum, lateral spots on tergites 1-5, lateral spots on sternites 2-5 and sometimes 6, which may be connected by very fine apical lines, femora distally more or less, tibiae except more or less above, and tarsi, *yellow*.

Segments 3-6 of the flagellum are indistinctly carinate on the posterior surface; seen from above 7 appears slightly bispinose, due to the presence of a small pit on the posterior surface; segments 9-11 bear larger pits. The eyes are slightly divergent at the clypeus. The middle femora are smooth. The second sternite bears a median longitudinal carina never very strongly developed; the sixth bears a pair of small closely approximated median processes near its apical border, and the seventh ends in a median spine grooved on its ventral surface.

Female.—Black: Labrum, mandibles except apices, clypeus, spot between antennae, small spot in front of anterior ocellus, scape below, anterior orbits, posterior orbits interrupted above, pair of small lateral spots on posterior border of pronotum, pair of larger spots on sides of prothorax, the more posterior including part of the tubercles, spot on tegulae, small spots on scutum above base of

wings, small spots on sides of median segment, lateral spots on tergites 2-5, lateral spots on sternites 2-5 connected by faint apical lines, femora distally more or less, tibiae below more or less, and tarsi, *yellow*. The eyes are distinctly divergent toward the clypeus, more so than in the male. The ultimate segment of the tarsi are relatively long and are slender at the base, particularly those of the anterior pair.

Length.—17-19 mm.

The resemblance of the male and female is quite close, and in both the head, thorax, median segment and base of abdomen are covered with relatively short, white pubescence. The punctation of the dorsum of the thorax is fine, close, and regular. The vertex is depressed between the eyes, its middle being noticeably lower than the level of the top of the eyes. The wings are hyaline, veins brown. The flagellum is tawny or fulvous below, lighter in the female than in the male. This species in general appearances resembles very much *hinei*, from which it can be distinguished in the male by the presence in this species of the ventral processes on the second and sixth sternites and the form of the genital stipes, and in the female by the divergent eyes and the character of the ultimate segment of the anterior tarsi.

The type and three paratypes (in the New York Museum of Natural History) are much darker than the specimens on which this description is based. In three of the specimens the clypeus is marked with black basally, none show yellow on the scutum, in all the yellow marks on the abdomen are reduced or wanting and the yellow on the legs is less extensive. In structural characters there are no differences.

Habitat.—California.

Number of specimens examined—Males, 13; females, 1.

BEMBIX OCCIDENTALIS Fox.

Figs. 175, 176, 201.

Bembex occidentalis Fox, Proc. Cal. Acad. Sci., (2) vol. 4, 1893, p. 10, female, male.

Bembex occidentalis HANDLIERSCH, Sitz. Acad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 868, pl. 3, fig. 13; pl. 7, fig. 38.

Bembex occidentalis Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 362.

Male.—Black: Labrum, mandibles except apices, clipeus, scape below, median line on frons extending from between antennae to anterior ocellus, broad anterior orbits, prothorax almost entirely, lateral lines on scutum sometimes shortened, pair of longitudinal discal lines on scutum, which lines may be developed into a broken U-shaped mark, fascia on scutellum, fascia on metanotum, curved fascia on dorsum of median segment sometimes interrupted medially,

lateral angles of median segment and sides of same emarginate above, metapleurae, greater part of mesopleurae, broad fasciae on tergites 1-6, first with a more or less extensive medial anterior emargination or inclosing a closely placed medial anterior pair of black spots, second inclosing a pair of dorsal oval black spots that appear in the form of emarginations on some specimens, third to sixth biemarginate on anterior dorsal margin less evident on the more posterior ones, apex of seventh, second sternite except median black line and rarely small anterior lateral spots, third except triangular median anterior black spot, fourth except wide but shallow anterior emargination, narrow biemarginate fascia on fifth, broader fascia on sixth usually with a small triangular median emargination, legs entirely except variable black spots on coxae and trochanters, *yellow*.

Segments 6-8 of the flagellum are very slightly spinose on the posterior border. The middle femora are smooth and the middle tibiae normal. The second sternite bears a more or less prominent median longitudinal carina, and the sixth a pair of small closely approximated processes that diverge slightly toward the base of the segment. When viewed from the side these processes appear as one. The seventh ends in a spine that in some cases is slightly bifid at the apex. The genital stipes, although maintaining the general design, varies somewhat in development.

Female.—Black: Labrum, mandibles except apices, clypeus, anterior orbits, median vertical line on frons, scape below, posterior orbits sometimes prolonged above on occiput, prothorax except median anterior dorsal spot, tegulae, lateral lines on scutum, pair of longitudinal discal lines on scutum, sometimes wanting and sometimes developed into more or less perfect U-shaped mark, fascia on scutellum, fascia on metanotum, lateral angles of median segment and sides of same emarginate above, metapleurae, mesopleurae almost entirely, broad fascia on tergites 1-5, first with a broad shallow medial anterior emargination or inclosing two small black spots, second inclosing a pair of transverse oval black spots, third frequently similar to the second or biemarginate on anterior margin, fourth and fifth biemarginate on anterior border, apex of sixth, second sternite except medial black spot, third except medial anterior black spot, fasciae on fourth and fifth rather narrow and usually biemarginate on anterior border, apex of sixth, legs except a variable amount of black on coxae and trochanters, *yellow*.

Length.—16-20 mm.

This species is conspicuous for its extensive bright yellow markings. In both male and female the eyes are distinctly divergent at the clypeus and in nearly all specimens are golden yellow in the dried specimens. The flagellum is comparatively slender and is yellow below, more so in the female than in the male. The second segment in both

male and female exceeds the combined length of the third and fourth. The mandibles on both male and female are remarkably straight, scarcely curved at the tip, more slender than usual and almost devoid of teeth on the inner border. The reduction of the teeth on the female is very unusual; only one is present and that is vestigial. The pubescence on the head and base of clypeus is long and rather dense; elsewhere on the body it is sparse and quite short. The wings are hyaline and veins brown. The markings on the dorsum of the thorax and median segment in both sexes are variable; at one extreme we find only short lateral lines on scutum, small lateral spots on scutellum and the lateral angles marked with yellow; at the other, broad lateral lines and U-shaped mark on scutum and broad fasciae on scutellum, metanotum and median segment.

Habitat.—Lower California, California, New Mexico, and Arizona. Number of specimens examined—Males, 7; females, 14.

BEMBIX TROGLODYTES Handlirsch.

Figs. 177, 178, 202.

Bembex troglodytes HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 829, pl. 2, fig. 29, male, female.

Male.—Black: Labrum, mandibles except apices, clypeus, lower part of frons, scape except stripe above, spot in front of anterior ocellus, lateral rounded spot on either side of this one, broad anterior orbits, posterior orbits, prothorax almost entirely, tegulae, lateral lines and pair of short discal lines on scutum, lateral spots more or less approximated medially on scutellum, fascia on metanotum, curved fascia on dorsum of median segment usually interrupted medially on the posterior surface of the segment, lateral angles and sides of the segment, metapleurae, large irregular anterior spot and small posterior one on mesopleurae, broad fasciae on tergites 1-6, first narrowly interrupted medially, remainder continuous, second inclosing pair of rounded dorsal spots, third with a similar pair of spots that are usually connected to the anterior black margin, fourth with a pair of anterior emarginations instead of spots, fifth and sixth slightly sinuate, apex of ultimate tergite, apical border of first sternite, broad apical fascia on second, sometimes inclosing a pair of black spots, lateral spots on 3-5 which may be connected by broad apical bands, narrow ones or not at all, sometimes pair of small lateral spots on 6, spot on coxae, trochanters more or less, femora except more or less basally and stripe below on anterior pair, tibiae except sometimes small spot below on anterior pair, and tarsi, *lemon yellow*.

The flagellum is neither spinose nor dentate; segments 4-11 bear specialized areas on their posterior surface, but these do not assume the form of pits or excavations. The middle femora are smooth

below. The second sternite usually bears a prominent median tubercle, but this may appear as a small median carina or be almost entirely lacking; the sixth bears a prominent median process, flattened, broad at base, pointed or slightly truncate at apex and directed obliquely backward. In one specimen this process is decidedly truncate apically and in another smaller one it is almost entirely reduced. There is some variation in the form of the genital stipes, but the figures given show the type.

Female.—Black: Labrum, mandibles except apices, clypeus except pair of black spots basally, spot between insertions of antennae, transverse row of three (or five) spots in front of anterior ocellus, scape below, anterior orbits, posterior orbits, prothorax except anterior median dorsal spot and spot in front of tubercles, tegulae, lateral lines and short pair of discal lines on scutum, lateral spots (sometimes united into a fascia) on scutellum, fascia on metanotum, curved fascia on dorsum of median segment, lateral angles and sides of median segment, metapleurae, mesopleurae almost entirely, fasciae on tergites 1-5, first narrowed and also interrupted medially, remainder continuous, second as in the male inclosing a pair of dorsal spots, third having a similar pair connected with the anterior black border and having on posterior border a deep median notch and lateral sinuations, fourth and fifth each with pair of shallow anterior emarginations and median posterior triangular emargination, apex of ultimate tergite, lateral spots on sternites 2-5, all or part of which may be connected by narrow apical lines, spot on anterior and middle coxae below, femora except stripe above and more or less basally below, tibiae except stripe on anterior pair below, and tarsi, *lemon yellow* with a tinge of greenish in places.

Length.—14-16 mm.

The five females before me vary somewhat in regard to color. Two have the clypeus and the frons, except the spot between the antennae and those in front of the anterior ocellus, entirely black, and four of the five have a median posterior discal mark on the scutum. In the male there is less variation in color, only one of the entire number being without discal marks on the scutum.

The wings in both sexes are hyaline and the pubescence and punctuation are of the normal character.

Habitat.—Mexico, Arizona, New Mexico, and Texas.

Number of specimens examined—Males, 11; females, 5.

BEMBIX MELANASPIS, new species.

Figs. 179, 180, 203.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, frons below, small spot in front of anterior ocellus and a small round spot on either side of this one, broad anterior orbits narrowed

above and also deflected inward from the margin of the eye, posterior orbits, posterior border of pronotum, sides of prothorax and tubercles except irregular elongated spot in front of the latter, spot on tegulae, small lateral spot on scutum above base of wings, triangular lateral spots on scutellum, curved fascia on metanotum, lateral angles, continued in form of spot on sides of median segment, small spot at spiracles on same, spot on metapleurae, spot on mesopleurae elongated vertically, broad fasciae on tergites 1-5, the first slightly attenuated and narrowly interrupted medially, remainder continuous, biemarginate anteriorly and triangularly notched at the middle on posterior border, pair of spots on sixth and seventh tergites, broad fascia on second sternite, fascia on third broadly and deeply biemarginate on anterior border, fascia on fourth similar to that on third but with anterior emarginations much enlarged, lateral spots on fifth and sixth, spot on coxae below, femora except short basal markings, tibiae, and tarsi, *yellow*. Marks on scutellum and metanotum are nearly white.

The flagellum is simple, neither dentate nor spinose, but segments 5-11 on the posterior surface bear shallow pits. The ultimate segment is very slightly curved and rounded at the apex. The middle femora are smooth and the posterior pair is provided with long white pubescence below. The second sternite bears a prominent hooked process and the seventh a prominent median process, triangular in form, obliquely directed backward, broad at base, flat on the ventral surface, and bluntly pointed at the apex.

Female.—Black: Labrum, mandibles except apices, narrow apical border and lateral apical angles of clypeus, spot between antennae, spot in front of anterior ocellus and a small rounded spot on either side of this one, anterior orbits deflected inward from the margin of the eye above, posterior orbits, prothorax almost entirely, lateral lines on scutum, pair of anterior longitudinal and a posterior transverse discal mark on scutum, fascia on scutellum, broad laterally, narrow medially, fascia on metanotum, broad curved fascia on dorsum of median segment extended downward medially on its posterior surface, sides of mesothorax and metathorax and median segment almost entirely, broad continuous fasciae on tergites 1-5, first emarginate on posterior and anterior middle, second and third each inclosing a pair of elliptical dorsal black spots, fourth and fifth each with a pair of anterior emarginations corresponding to the black spots of the preceding segments, ultimate tergite with a pair of apical spots, lateral spots on sternites 1-5 connected by apical lines, the one on second sternite broad and inclosing black spots, spot on coxae, femora except basally and stripe on anterior pair above, tibiae, and tarsi, *yellow*.

The pubescence is relatively short, white, and moderately dense, more in evidence on the male than on the female. The flagellum is black with a shade of reddish below on the more apical segments. On the female the scape is black. The frons just above the insertion of the antennae is about equal to the width of the eye at the same level. The eyes diverge at the vertex and also a trifle at the clypeus. The wings of the male are slightly but distinctly infumated medially; those of the female are heavily infumated, resembling those of *nubilipennis* Cresson in this respect.

Length.—19–22 mm.

One of the males has only a vestige of the process on the second sternite. The sixth tergite of one male has a complete fascia; on the type it has only a pair of yellow spots and on a third it is entirely devoid of yellow. On one female the clypeus, antennae, and frons, except the spot between the antennae and the three small spots in front of the anterior ocellus, are entirely black. A single female from Arizona has been placed in this species. It has the narrow frons and infumated wings, but the black on the clypeus has been reduced to two small basal spots and the scape is broadly yellow below.

This species stands close to *nubilipennis* Cresson from which it can readily be distinguished in the male by the nonspinose antennae and the simple middle femora. The female differs from Cresson's species by the presence of the black on the clypeus and by the much narrower frons, which in *nubilipennis* is much wider than the eye at the point just above the insertion of the antennae. Described from three males and four females.

Habitat.—California, Arizona.

Type, allotype, and paratypes.—Cat. No. 19808, U.S.N.M.

BEMBIX TEXANA Cresson.

Figs. 181, 182, 204.

Bembex texana CRESSON, Trans. Amer. Ent. Soc., vol. 4, 1872, p. 219, female.

Bembex texana HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 830, pl. 2, fig. 30; pl. 7, fig. 21, female, male.

Male.—Black: Labrum, mandibles except apices, clypeus, scape below, space between insertions of antennae, small rounded spot on either side anterior ocellus, anterior orbits, posterior orbits, line on posterior border of pronotum and propleurae including tubercles, spot on sides of prothorax, spot on tegulae, short line above base of wings on scutum, small lateral spots on scutellum, sometimes small spot on lateral angles of median segment, usually a small spot on metapleurae above base of middle legs, narrow rectangular spot on mesopleurae, fasciae on tergites 1–6, first broad and interrupted medially, second continuous, inclosing a pair of black spots dorsally and constricted medially, third, fourth, and fifth interrupted medially

and emarginate anteriorly on either side the midline, sixth continuous, small lateral spots on ultimate tergite, posterior lateral spots on sternites 1-6 the more anterior ones usually connected by narrow apical lines, spot on anterior and middle coxae below, femora except broad stripe above and basally below, tibiae except stripe below on anterior and middle pairs and on posterior border of anterior pair, and tarsi, *white*, more or less strongly tinged with yellow on head and legs.

Segments 4-11 of the flagellum bear specialized areas on their posterior surface, which, on the more apical ones, take the form of shallow pits. The apical segment is not curved, is a trifle longer than the preceding segment, and is about equal to it in width. The middle femora are smooth. The second sternite usually bears a more or less well developed median carina, but sometimes this is entirely lacking. The sixth bears a well developed process, broadly triangular basally and sharply pointed posteriorly; the seventh bears an evident median longitudinal carina which is bordered on either side basally by a shorter one.

Female.—Black: Labrum except a medial stripe or basal spot in some specimens, clypeus except a pair of basal spots that may be contiguous, mandibles except apices, scape below, space between insertions of antennae, small rounded spot on either side anterior ocellus, sometimes spot beneath it, anterior orbits, posterior orbits, posterior border of pronotum continued on the sides of prothorax and including tubercles, also spot on sides of prothorax, spot on tegulae, usually small spot above base of wings on scutum, small lateral spots on scutellum, spot on sides of median segment near lateral angles and another on metapleurae not always present, narrow rectangular spot on mesopleurae, fasciae on tergites 1-5, first broad and interrupted and somewhat narrowed medially, second continuous inclosing a pair of elliptical black spots dorsally and constricted medially, remaining fasciae interrupted or continuous, biemarginate on anterior border and curved forward on posterior border on either side the midline, lateral spots on sternites 1-5 which may or may not be connected by apical lines, spot on anterior and middle coxae below, femora distally more or less, tibiae except stripe below and also stripe on posterior border of anterior pair, and tarsi, *yellowish white* or *pale yellow*.

Length.—15-18 mm.

In both sexes the head, thorax, and abdomen are covered with rather short and dense pale pubescence, shorter on scutum and abdomen except the basal segment. The wings of the female show a slight infumation medially; those of the male show hardly a trace of this. The females invariably have the two black spots on the base of the clypeus, but these spots vary in development. On some

specimens there are lateral spots on the ultimate tergite and in a few cases all the tergal fasciae are interrupted medially. The black spots in the second tergal fascia are sometimes united with the anterior black border. In the male these spots are usually so connected and fasciae 1 and 4 are almost invariably interrupted, and sometimes 3 and 6 also. The second fascia in the male is always continuous. This is a well-marked species, one not likely to be confused with any other species thus far discovered within the territory covered by this paper.

Habitat.—Georgia, Florida, Louisiana, Texas, and New Mexico.

Number of specimens examined—Male, 58; females, 27.

BEMBIX HELIANTHOPOLIS, new species.

Figs. 183, 184, 205.

Female.—Black: Spot on mandibles, lateral borders of labrum slightly, spot between insertions of antennae, small spot in front of anterior ocellus, small spot on either side of this one, posterior orbits, posterior border of pronotum and sides of prothorax except spot in front of tubercles, spot on tegulae, lateral lines on scutum, pair of short anterior discal lines and median posterior spot on scutum, lateral spots on scutellum, fascia on metanotum, curved fascia on dorsum of median segment, lateral angles and most of the side of median segment, large spot on metapleurae, large spot and a second smaller one on mesopleurae, relatively broad fasciae on dorsal abdominal segments 1-5, first interrupted medially, remainder continuous but notched on midline, second inclosing a pair of black spots, third similar to second, fourth and fifth each with shallow anterior emargination on either side the midline, lateral spots on sternites 1-5, spot on anterior coxae below, femora distally more or less, tibiae except stripe on inner and posterior surfaces, and tarsi, *yellow or greenish yellow*. The marks on the scutellum and metanotum are white. The eyes are divergent at the vertex and the flagellum is but slightly testaceous below.

Male.—Black: Labrum, mandibles except apices, clypeus except small transverse medial spot at base, scape below, space between insertions of antennae, broad anterior orbits, small spot in front of anterior ocellus, small rounded spot on either side of this one, narrow posterior orbits, posterior border of prothorax including tubercles, spot on sides of prothorax, spot on tegulae, small spot on base of anterior wing, spot on scutum above base of wing, lateral spots on scutellum, lateral angles of median segment, two small spots on sides of same, large spot on metapleurae, two spots on mesopleurae, the upper the larger, relatively broad fasciae on tergites 1-5, first interrupted medially, remainder continuous but notched on

both sides at the midline, second inclosing a pair of dorsal black spots, third with a pair of anterior emarginations replacing the spots of the second, fourth and fifth with a shallow emargination on either side the midline, sixth and seventh with a medial spot apically, lateral spots on sternites 1-5 connected on one and two by narrow apical lines, small medial posterior spot on two, spot on anterior and middle coxae below, femora except more or less basally, tibiae, and tarsi, *yellow*. The spots on the scutum and scutellum are *white*.

The flagellum is testaceous below and is neither spinose nor dentate. Segments 4-11 bear small pits on the posterior surface and the ultimate segment is short, scarcely exceeding the length of the preceding segment, curved and rounded at the apex. The eyes are widely separated and are slightly divergent above. The middle femora are smooth. The second sternite bears a prominent median tubercle slightly curved posteriorly; the sixth bears a median, triangular, pointed process whose ventral surface is flattened or slightly concave, and the seventh bears a median carina that is bordered basally on either side by a shorter one.

Length.—4-17 mm.

The pubescence is pale, moderately long and dense, shortest on the scutum and abdomen and about equally well developed on male and female. The wings are hyaline and veins brown. The yellow markings have a greenish tinge and the black is intense, resembling in this respect the color of *B. belfragei*. The lateral angles of the median segment are somewhat prominent. The dark color on the legs is irregularly distributed, especially on the tarsi.

There is some variation in the maculations of the female; those on the scutum may be reduced to short lateral lines above the base of the wings; the fascia on the median segment may be interrupted medially; the marking of the mesopleura may be reduced to a single small spot; and the inclosed black spots on the second and third tergal fasciae may appear as deep anterior emarginations. The female of this species, which stands close to *troglydytes* Handlirsch, has the labrum, scape of flagellum, and ultimate tergite black, whereas *troglydytes* has these parts yellow or maculated with yellow. On the male the scutum, metanotum, and dorsum of median segment are black; on *troglydytes* the metanotum and dorsum of median segment each bears a fascia and the scutum a pair of discal marks. The genital stipites of the two also differ.

Habitat.—Kansas, Texas.

Number of specimens examined—Females, 7; males, 1.

Type (female).—Allotype, and paratypes in the collection of the University of Kansas.

Paratype.—Cat. No. 19885, U.S.N.M.

BEMBIX CONNEXA Fox.

Bembex connexus Fox, Proc. Acad. Nat. Sci. Phila., 1895, p. 360, female, male.

Female.—Black: Labrum, mandibles except apices, clypeus, scape, and more or less of the flagellum below, lower part of frons, spot before anterior ocellus, broad anterior orbits, posterior orbits broad below, sides of prothorax almost entirely, frequently more or less complete narrow line on posterior border of pronotum, lateral lines on scutum usually abbreviated and sometimes wanting, sometimes small lateral spots on scutellum, more or less of the side of the median segment, spot on metapleurae, spot on mesopleurae, broad fasciae on tergites, first interrupted and attenuated toward mid-dorsal line, second inclosing pair of elliptical transverse dorsal spots or bearing a pair of anterior dorsal emarginations and notched at midline on both margins, third similar to the second, fourth, and fifth each bearing a pair of anterior dorsal emarginations and interrupted medially or continuous, apex of ultimate tergite, lateral spots on sternites 2-5 and sometimes 6, median posterior spot on sternites 2-5 in some specimens, on 2-4 in others, and entirely lacking in still others, apical lines connecting the ventral spots on some specimens, spots on anterior and middle coxae, greater part of femora, tibiae, and tarsi, *yellow*.

The pubescence is white, tolerably dense, longest on the head, somewhat shorter on the thorax and base of abdomen. The thorax is closely and evenly punctated; the punctations of the ultimate tergite are coarser than that of the thorax and the sides of the segment are provided with long white pubescence amid which are found several short black spines.

The male is smaller. There is a broad yellow line on the posterior border of the pronotum and the sides of the prothorax are almost wholly yellow. There are conspicuous lateral lines on the scutum, lateral spots on the scutellum, fascia on metanotum, lateral spots on dorsum and spots on the posterior surface of the median segment, its lateral angles and sides broadly, and sides of mesopleurae and metapleurae almost entirely yellow. The fasciae on the tergites are broad and, except the first, continuous. The second incloses a small pair of black spots; 3-5 are biemarginate on anterior dorsal margin, and the seventh is maculated apically. There are lateral spots on the sternites but none are connected by apical lines. In other respects the maculations are similar to those of the female. Segments 6-8 of the flagellum are spinose on the posterior surface. The middle femora are serrate. The second sternite bears a well developed process and the sixth a smaller one.

Length.—16-20 mm.

This species is large and robust, conspicuous for its intense black color and bright greenish yellow markings. Not a great deal of

variation is present in the maculations. On one specimen there is a pair of faint discal lines on the scutum and on all there is a more or less suppressed dusky band down the middle of the labrum. This is usually reduced to a dusky spot at the base of the labrum but in one specimen it forms a black median stripe the full length of that organ.

On Fox's type (female) of this species the yellow on the dorsum of the mesothorax is limited to small lateral spots on the scutum; the metanotum and dorsum of median segment are not maculated. The sides of the thorax and median segment, however, are broadly maculated. The color of the fasciae on the tergites is whitish like that of *texana*. None of them inclose black spots, the first and fifth are interrupted, the second and third are not notched at all posteriorly, and the fourth is but slightly so. The emarginations on 2-4 are shallow and widely separated. The lateral spots on the sternites are connected and there is a median spot on 2-5. The sixth sternite has a pair of lateral spots and all ventral maculations are yellow.

Habitat.—Utah, California, Nevada.

Number of specimens examined—Males, 1; females, 8.

BEMBIX LATIFRONS, new species.

Female.—Black: Labrum, mandibles except apices, clypeus, scape below, broad anterior orbits deflected inwardly at the vertex, lower part of frons prolonged upward to unite with a spot below anterior ocellus, spot on either side the central one confluent with the anterior orbits, broad posterior orbits prolonged upon the vertex, prothorax entirely, tegulae, lateral lines on scutum very broad anteriorly, U-shaped discal mark on scutum consisting of a pair of longitudinal marks broad anteriorly but greatly narrowed posteriorly where they unite with a broad transverse rectangular mark, fascia on scutellum narrowed medially, metanotum, broad curved fascia on dorsum of median segment, posterior surface, lateral angles and sides of same entirely, mesopleurae and metapleurae entirely except very narrow lines on sutures, median longitudinal stripe on mesosternum, very broad fasciae on tergites 1-5, first inclosing a pair of closely approximated black spots (confluent with the black base) and showing a shallow emargination on posterior middle, second and third each inclosing a pair of narrow, widely separated elliptical black spots and acutely emarginate on posterior middle, fourth and fifth biemarginate on anterior border, dorsal surface of ultimate tergite, broad fascia and pair of anterior spots on second sternite, broad fascia inclosing a pair of small black spots on third, fascia broadly emarginate on fourth, lateral spots on fifth, coxae and trochanters in part, femora except narrow stripe on posterior surface of first pair and short basal marks on anterior surface of second and third pairs, tibiae except narrow line on posterior surface of first pair, and tarsi, *yellow*.

The flagellum is tawny below, growing lighter toward the apex. The second flagellar segment is not quite equal in length to the combined length of the third and fourth. The ultimate segment is slightly curved, exceeds the length of the segment immediately preceding it, but is not equal to the combined length of the two immediately preceding it. The frons is wide, exceeding the width of the eye at the level of the insertion of the antennae, and the inner borders of the eyes are almost parallel. The wings are long, reaching almost to the tip of the abdomen, hyaline and the veins are brown. The pubescence is white; on the head it is tolerably long and dense; that on the thorax, median segment and base of abdomen is shorter but equally dense; elsewhere on the abdomen it is very short, rather dense and semi-erect. The punctation is of the usual character.

Length.—17 mm.

This form runs in Handlirsch's table, although not accurately, to *B. occidentalis* Fox; in Fox's table it runs to *B. U-scripta* Fox. It differs from *occidentalis* in the broad frons, the eyes being not at all divergent at the clypeus, in the form of the mandibles and in the relative length of the second flagellar segment; it differs from *U-scripta* in the normal form of the ocelli and in the character of the development of the ultimate tergite. Furthermore, it differs from both of these species in the character of the maculations on the sternites.

Described from a single specimen collected by F. H. Snow at Albuquerque, New Mexico, in the year 1894.

Type.—Female, in the collection of the University of Kansas.

Genus MICROBEMBEX Patton.

Microbembex PATTON, Bull. U. S. Geol. Surv., vol. 5, 1879, p. 364.

B. Bembices aberantes HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 878.

Bembex FOX (part), Proc. Acad. Nat. Sci. Phila., 1894, p. 303.

Microbembex FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 363.

Microbembex KOHL, Die Gatt. d. Spheg., 1896, p. 434.

Type.—*Bembex monodonta* Say by original designation.

The wasps belonging to this genus vary in length from 8 to 14 millimeters and are relatively more slender than those of the genus *Bembix*. The head is equal in width to the thorax. The compound eyes are large, convex, and naked. The facets near the inner border are very slightly larger than those near the outer; this is more evident on the male than on the female. The inner margins of the eyes are practically parallel and the lower border reaches the mandible. The ocellar cicatrices are similar to those of the genus *Bembix*, but are almost concealed by the dense pubescence on the frons and vertex. The occiput is very narrow, the posterior surface of the head concave, and the temples almost wanting. The mandibles are long, slender, pointed, and devoid of teeth. The maxillae are comparatively long,

but when folded are concealed behind the labrum. The maxillary palpus is composed of three segments, the labial of one. The labrum at the apex is conical and truncate, but is flat at the base where it joins the curved distal border of the clypeus. On some specimens the labrum shows a slight median longitudinal depression. The clypeus is very strongly arched, in fact almost angular, and the distal part of the median prominence is devoid of pubescence, smooth, and shining. The distal margin is strongly curved, almost semicircular. The antennae, which are inserted on the frons, apparently on the suture joining the frons and clypeus, are composed of 13 segments in the male and of 12 in the female. The scape is heavy and exceeds in length any segment of the flagellum. The first segment of the flagellum (pedicel) is short, about as long as thick, and the second exceeds in length any of the following segments. Some of the flagellar segments on the male bear secondary sexual modifications.

The thorax is quite similar to that of *Bembix*, but the abdomen is more slender. The ultimate tergite of the female is arched and strongly punctate except on the midline, where there is evidence of a slight longitudinal carina. Laterally the tergite is beset with short spines and it terminates in a median notch, the sides of which may be prolonged into evident spines. The second sternite of the male bears a median process that by its form and development affords specific characters.

The male genitalia consist of a basal piece (cardo), paired stipites, paired sagittae, and median spatha. The base of the stipes is heavy, but the distal part is slender and hirsute and varies in form with the different species. The spatha is short and heavy and distally is cleft below. Near the distal end on either side is a conspicuous rounded enlargement, and the apex is in the form of a tube split below. The sagitta is composed of two parts; the inferior one is short, sparingly hirsute, and more or less concealed; the superior part is strongly chitinized, curved, compressed, dilated distally, and truncate apically.

The legs are moderately long and slender. On the female the first four segments of the anterior tarsus are flattened and the posterior distal angle is greatly prolonged. These four segments are provided with long strong spines that form the tarsal comb used in burrowing. On the male the comb is present but not so well developed. The wings may be infumated or entirely hyaline. On the anterior wing the radial cell is pointed at either end and the distal end does not lie on the costal border. The first cubital cell is as long as the second and third combined. The second cubital cell is narrower on the radial vein than it is on the cubitus, and it receives both discoidal cross veins. The first cubital cross vein is straight, and the third, which curves toward the distal extremity of the wing, forms with the

radius in most cases an acute angle, but in some cases a right angle. The second submedian cell is about equal in length to the first and increases in width from its proximal to its distal extremity.

On the posterior wing the retinaculum, composed of a row of small hooklets, arises at the origin of the radial vein. The median cell is greatly elongated, and from its distal end two short veins extend toward the distal border of the wing. The cubitus arises distal to the end of the submedian cell, whose posterior distal angle, formed by the submedian and submedian cross veins, is obtuse.

The ground color of the body is black, but in teneral specimens this may appear brown. The color of the maculations varies from pale-yellowish white to rich orange yellow.

KEY TO SPECIES.

Males.

1. Process on second sternite long and curved (fig. 218); clypeus, large spot on mesopleura and large discal spots on scutum yellow.....*aurata*.
1. Process on second sternite otherwise formed; above combination of maculations not present.....2.
2. Process on second sternite hirsute; genital stipes as in fig. 224.....*hirsuta*.
2. Process on second sternite smooth; genital stipes as in fig. 226.....*monodonta*.

Females.

1. Pubescence on head, thorax, and median segment unusually long and dense, very conspicuous on dorsum of median segment.....*hirsuta*.
1. Pubescence not unusually long and dense.....2.
2. Clypeus, scape, mesopleura, and large discal spots on scutum yellow.....*aurata*.
2. Combination of maculations as given above not present.....*monodonta*.

MICROBEMBEX MONODONTA Say.

Figs. 6, 219, 225-230.

Bembex monodonta SAY, Nar. Exp. St. Peters River, Append., 1824, p. 335.

Bembex ciliata LEPELETIER, Hist. Nat., vol. 3, 1845, p. 279.

Bembex monodonta LECONTE, Say's Complete Writings, 1859, p. 226, male.

Bembex argentifrons CRESSON, Proc. Ent. Soc. Phila., vol. 4, 1865, p. 141.

Microbembex monodonta PATTON, Bull. U. S. Geol. Surv., vol. 5, 1879, p. 362.

Monedula nigrifrons PROVANCHER, Add. Faun. Can., p. 362, male, female.

Bembex monodonta HANDLIRSCH, Sitz. Akad. Wissensch. Wien, Math.-Nat. Cl., vol. 102, 1893, p. 882.

Microbembex monodonta FOX, Proc. Acad. Nat. Sci. Phila., 1895, p. 363.

Microbembex monodonta (and varieties) JOHNSON and ROHWER, Ent. News, vol. 19, 1908, p. 374.

Male.—Black: Labrum in part or entirely, apical border of clypeus or entire clypeus, tubercles, narrow line on posterior border of pronotum, spot on tegulae, lateral line above base of wings on scutum variable in extent, sometimes pair of discal marks on scutum, lateral rectangular spots on scutellum variable in size, fascia on metanotum, curved fascia or pair of oblique lines on dorsum of median segment, sometimes postero-lateral angles of median segment, very fre-

quently spot on mesopleurae, fasciae on tegites 1-6, first usually roundly emarginate on anterior middle, second, and third (sometimes fourth) biemarginate on anterior border, frequently lateral spots on seventh, small lateral spots on second and third sternites, distal part of femora variable in extent, tibiae except spot below on first pair and sometimes on second, tarsi except ultimate segments, *yellow*.

The color of the maculations varies from bright orange to pale greenish yellow and the variation in the extent of their development and in their combination on different individuals is such that the description given above may not apply with absolute accuracy to any single specimen. The clypeus is typically black, but it is frequently bordered with yellow and it may be wholly yellow. The labrum likewise may be entirely black or entirely yellow but it is more frequently black with apical yellow markings. The frons, scape, and flagellum are black. The variation in the maculations of the thorax and abdomen are as great as on the head. The wings may be heavily infumated in medial region or they may be hyaline and in the series before me all degrees of infumation may be found. The pubescence is short and white. On the frons and clypeus, especially on well preserved specimens, it gives a bright silvery reflection. It is shorter on the thorax and shows scarcely any silveriness. Segments 6-8 of the flagellum bear evident pits on the posterior surface; the ultimate segment is rounded apically and only very slightly curved. The second sternite bears a prominent, smooth, median, longitudinal process that terminates posteriorly in a short curved point.

Female.—Black: Labrum wholly or in part, mandibles except apices, usually apical border of clypeus, rarely scape below, narrow posterior orbits, spot on tegulae, lateral lines on scutum, frequently pair of discal marks on same, lateral spots on scutellum, fasciae on metanotum, curved fascia on dorsum of median segment, usually spot on postero-lateral angles of same, spot on mesopleurae variable in size, fasciae on tergites 1-5, first roundly emarginate at midline on anterior border, 2-5 biemarginate or bisinuate and usually with median notch on anterior border, sixth tergite apically or with apical lateral spots, lateral spots on sternites 2-3, femora distally, tibiae except line below, on first pair and sometimes on second, and tarsi varying in degree, *pale-yellowish white or yellow*. The wings are distinctly infumated on most specimens, but on some they are almost hyaline. The pubescence on the clypeus and frons is short and dense and gives a silvery reflection; on the vertex it is somewhat longer; on the thorax and abdomen it is short and not conspicuously silvery.

Length.—8-14 mm

As in the case of the male, the variation in the maculations is great. The labrum is usually bordered with yellow but it may be wholly yellow, or, in rare cases, it may be entirely black. This is likewise true for the clypeus. The mandibles also may be entirely black. In the case of some western specimens the scape is yellow below. The scutum frequently bears a pair of prominent discal marks, but the increase or decrease of yellow on the scutum or sides of thorax does not appear to bear any definite relation to the increase or decrease of yellow on other parts of the body. The markings on the females from the eastern part of the United States are for the most part pale-yellowish white, whereas those on the females from the western part are more commonly bright yellow, but yellow forms are found in the East and light ones occur in the West.

Although it is quite possible that, in the large number of specimens before me, collected from such widely separated localities, there may be included distinct varieties or even more than one species, nevertheless I am not able at this time to find characters on which I can make a satisfactory separation.

Habitat.—Florida, Georgia, North Carolina, Virginia, District of Columbia, Maryland, New Jersey, Pennsylvania, New York, Massachusetts, Connecticut, Ohio, Michigan, Wisconsin, Illinois, Iowa, Kansas, Texas, New Mexico, Colorado, Montana, Nevada, California, and Washington.

Number of specimens examined—Males, 197; females, 157.

MICROBEMBEX AURATA, new species.

Figs. 218, 221, 222.

Male.—Black: Mandibles except apices, labrum, clypeus, scape except spot above, narrow shortened anterior orbits, narrow broken posterior orbits, prothorax almost entirely, tegulae, broad lateral lines on scutum, pair of large diamond-shaped discal marks on same, pair of large lateral spots on scutellum, metanotum, broad curved fascia on dorsum of median segment, lateral angles and sides of same, small spot on metapleurae, mesopleurae almost entirely, tergites except a very narrow black basal border and on first tergite a mid-dorsal black spot, sternites except a more or less extensive black basal border, and legs except anterior basal parts of femora, *bright yellow*. Segments 6–8 of the flagellum bear prominent pits on the posterior surface, and the ultimate segment is truncate apically and is distinctly curved. The wings are hyaline. The pubescence on the frons and vertex is tolerably long and dense but is not conspicuously silvery. On the thorax and abdomen the pubescence is short and not conspicuous except on the sides and ventral surface of the ultimate abdominal segment, where it is more evident. The process on the second sternite is large, curved, obliquely directed backward and

pointed. The genital stipites are distinct in shape, yellow in color, hirsute and weakly chitinized.

Female.—The shade of color and the character of the maculations on the female are almost the same as those on the male. As is usual in the case of these wasps the maculations on the female are better developed than on the male; the orbits are more extensive and the black on the legs and abdomen reduced. The pubescence is similar to that on the male with the silveriness on the frons more evident. The sides of the apical emargination of the ultimate tergite are produced into short but evident spines. As in the case of the male the ultimate segment of the flagellum is truncate apically and slightly curved.

Length.—12–14 mm.

The black mark on the mid-dorsal area of the first tergite of the type is replaced on the allotype by an anterior emargination; on the paratypes this mark is obscure or wanting. On one paratype the first two flagellar segments are yellow below and on two others the lateral spots on the scutellum are united on the midline.

Habitat.—California, Arizona.

Number of specimens examined—Males, 3; females, 3.

Type and allotype.—Cat. No. 19672, U.S.N.M. Paratypes in the collection of the University of Kansas.

MICROBEMBEX HIRSUTA, new species.

Figs. 220, 223, 224.

Male.—Black: Tubercles and narrow line on posterior border of pronotum joining them, tegulae, lateral lines on scutum, pair of discal marks on same, pair of large lateral spots on scutellum, metanotum, curved fascia on dorsum of median segment, postero-lateral angles of same, very small spot on mesopleurae, tergites 1–7 almost entirely triangular lateral marks on sternites 2–5, distal part of femora, tibiae more or less especially on posterior pair, basal part of metatarsi of second and third pair of legs, *greenish yellow*. The wings are hyaline. The pits on segments 6–8 of the flagellum are lacking. The process on the second sternite is characteristic of this species; it is short, blunt, not backwardly prolonged and is hirsute. The genital stipites are also very hirsute and are distinct in form from those of *monodonta*.

Female.—Black: Labrum except apex, mandibles except apices, clypeus except a pair of black basal spots, scape below, short anterior orbits, narrow posterior orbits, tubercles joined by a narrow band across the posterior border of pronotum, tegulae, lateral lines on scutum, large lateral spots on scutellum, fascia on metanotum, curved fascia on dorsum of median segment, broad fasciae on tergites 1–5, first very slightly sinuate on anterior middle, remainder slightly bisinuate on anterior border and with a slight median notch, sixth

with lateral apical spots, small lateral spots on sternites 2-4, femora, distally, tibiae except spot on first and second pair below, and tarsi in varying degree, *white or pale-yellowish white*. The wings are hyaline. The frons, vertex, occiput, thorax and median segment are clothed with unusually long, dense, white pubescence, especially conspicuous on the sides of the thorax and on the dorsum and posterolateral angles of the median segment.

Length.—9-13 mm.

The pubescence on the male is not conspicuously different from that on *mondonta* except that the process on the second sternite is hirsute, but on the female it is so markedly different as to furnish a basis for distinguishing the two species. The maculations show but slight variations; the tarsi may be pale with only a brownish shade or they may be decidedly dusky, the distal segments always darker than the proximal ones; on the males the discal marks on the scutum are frequently lacking, the mesopleura is usually black, and the black basal border of the tergites varies in extent; on the female the clypeus may be wholly yellow or it may have the basal border black; the emarginations or sinuations of the anterior border of the tergal fasciae vary in extent but are never very prominent; on a great many of the females from Arizona the black color, especially on the abdomen, is replaced by brown of varying degrees of intensity. Since the series shows all shades from light brown to black this lighter color is believed to show simply a general condition.

Habitat.—Texas, New Mexico, and Arizona.

Number of specimens examined—Males, 19; females, 33.

Type, allotype, and paratype.—Cat. No. 19673, U.S.N.M.

BIOLOGY.

Much valuable work on the biology of various species of Bembicine wasps has been done, especially in Europe, but when we compare the number of species whose life history and habits have been investigated with the number of those about which we know practically nothing we wonder why these interesting insects have been so greatly neglected. With respect to the life-history and habits of species of *Steniolia* I have found in the literature consulted a single observation reported, that given by J. C. Bradley, in which he states that he found *Steniolia duplicata* Provancher in California sleeping in clusters on the stems of plants. Of the habits and activities of species of *Stictiella* I have found no report whatever. Among the species of this genus listed in this paper specimens of two (*formosa* and *melanosterna*) were found that had been collected while holding in their grasp adult forms of diurnal Lepidoptera. The biology of species of *Stictia* and *Bicyrtes* is better understood, but the greatest amount of attention and observation, both in Europe and in America, has been devoted to various species of the genus *Bembix*.

Handlirsch in his monograph gives an excellent summary of what had been discovered with regard to the biology of *Bembix* up to the time when his valuable work was brought out. According to this author the first report we have of observations upon the nesting habits of a species of *Bembix* is that made by Linnaeus in 1745, in which he reports *Bembix rostrata* (*Apis rostrata*) flying about over sandy soil and digging burrows therein, within which the larvae were to be found. What is probably the earliest record of observations on the habits of a Bembicine wasp in this country is that reported by John Bartram in the year 1763¹ in which he says:

I saw several of these wasps flying about a heap of sandy loam: they settled on it, and very nimbly scratched away the sand with their fore feet, to find the nests, whilst they held a large fly under their wings with one of their other feet: they crept with it into the hole, that led to the nest, and staid thereabout three minutes, when they came out. With their hind feet they threw the sand so dextrously over the hole, as not to be discovered: then taking flight, soon returned with more flies, settled down, uncovered the hole, and entered with their prey.

This extraordinary operation raised my curiosity to try to find the entrance, but the sand fell in so fast, that I was prevented, until by repeated essays I was so lucky as to find one. It was six inches in the ground, and at the farther end lay a large magot, near an inch long, thick as a small goose quill, with several flies near it, and the remains of many more. These flies are provided for the magot to feed on before it changes to the nymph state. Then it eats no more until it attains to a perfect wasp. * * *

But this yellow wasp takes a different method, with great pains digging a hole in the ground, lays its egg, which soon turns to a magot, then catches flies to support it, until it comes to maturity.

In 1809 Latreille, in the *Annales du Museum d'histoire Naturelle*, gives a report of his observations on two species of *Bembix*, *rostrata* and *integra* (*tarsata*). In this article he reports the fact that these wasps feed their young upon flies, and gives a description of the burrows constructed for their nests and a detailed description of the larvae. He points out the fact that although these wasps nest in colonies, each wasp digs a nest for herself, using for this work the stout spines with which the front legs are provided. He states that when the wasp has provided sufficient flies for the nourishment of her young she deposits a single egg in each cell and closes it up. He reports that although *rostrata* uses adult flies to store her nest she does not prey upon a single species, but attacks several. He further states that copulation occurs on the wing.

Lepelletier² gives a very complete account of the nesting habits and mode of copulation of *B. rostrata*. In this account he points out the fact that flies taken by the wasp and stored are not killed but paralyzed. He says:

Je lui enlevai sa proie, et la trouvai dans le même état que celles saisies à l'entrée du nid: d'où je conclus que cette pigûre met ses victimes dans une espèce de paralysie qui n'est mortelle qu'au bout d'un laps de temp assez considérable pour qu'elles soient dévorées vivant par la larve du *Bembex*.

¹ Philos. Trans. London, vol. 53, p. 37.

² Hist. Nat., vol. 2, 1841.

Many other investigators have also contributed to the knowledge of the life and activities of *Bembix*, and the names of those to whose works I have had access are given in the bibliography appended. Among these there are two, Fabre and Wessenberg-Lund, whose observations require further consideration here. Fabre maintains that the flies stored by *Bembix* are always dead when placed in the nest, and he suggests three possible explanations of this practice on the part of *Bembix*: (1) *Bembix* does not know how to paralyze her prey; (2) the delicate character of the constitution of the fly is such that death is brought on instead of paralysis; or (3) the nervous system of the fly is not suited to paralysis. Fabre does not state positively that the failure of *Bembix* to paralyze her prey is due to one of these three causes, but he sees no other means of explaining the departure from a practice so universal among the digger wasps. Wessenberg-Lund maintains, as does Fabre, that the flies stored by *Bembix* are killed and not paralyzed when captured; but he rejects Fabre's suggestions as to the probable cause therefor and finds the reason in the structure of the wasp herself. He enters into a critical discussion of the form of the abdomen of various types of wasps and bees and compares the form of the abdomen of those that are known to paralyze their prey with that of those in which the sting is not used for that purpose. He finds that the stalked abdomen, such as is possessed by *Sphex*, is associated with the instinct to paralyze, and arrives at the conclusion that this form of abdomen is necessary for the performance of this function. Consequently his answer to the question, "Why does *Bembix* not paralyze her prey?" is that she can not. Her abdomen is so formed as not to permit her to do so.

Thus, both Fabre and Wessenberg-Lund maintain that *Bembix rostrata* does not paralyze her prey, but each explains this departure from what is the usual practice of digger wasps on different grounds. Fabre finds the cause in the character of the prey, Wessenberg-Lund in the structure of the wasp. If these investigators insist that this departure is true only for *B. rostrata*, as I believe they do, it is possible that they may be right. But if they maintain that this departure is true for all species of *Bembix* they are wrong; for at least one species, *Bembix spinolae* Lepeletier, both possesses this power and makes use of it as the following observations show.

On June 13, 1914 I observed a female of *Bembix spinolae* enter her nest carrying a *Chrysops* fly. After some time, probably about five minutes, she emerged and was captured. I at once dug up the nest and found in the brood chamber a single fly, the one I had seen carried in. Upon the fly, which was lying on its back, was found the newly-laid egg placed in its characteristic position, attached by one end to the thorax at one side just posterior to the base of the wing. I carefully removed the fly and egg from the nest and placed

them in a breeding cell in the basement of my home. The egg of the wasp did not hatch until on June 20, delayed, no doubt, by the low temperature of the room, and the larva died on June 21. On June 23 I removed the dead larva and pinned the fly. This fly was not dead at the time it was pinned and even after the pin had been thrust through the thorax it continued to move its antennae and its legs. In this case a fly paralyzed by *B. spinolae* lived for 10 days and might have lived longer had I not killed it. As will be pointed out farther on the first fly brought to the nest by *spinolae* supports the egg of the wasp until it hatches. Furthermore, so far as my observations go, this fly is not consumed by the larval wasp. If this fly was dead at the time the egg is laid upon it, placed as it is in the warm moist earth, it would in all probability decompose before the egg would hatch and would prove a very unsatisfactory foundation for the support of the larval wasp. In no case where I have taken the fly from the nest within twenty-four hours after the egg was placed upon it has the fly failed to respond to stimulation. All were paralyzed. Just how long they remain in this state in the burrow before death ensues I cannot say. Many of the flies brought in by *spinolae* for the developing larva are dead but by no means all of them. I frequently found in brood chambers, containing half grown larvae, flies that responded readily to stimulation. The Peckhams also report two instances in their observations on *spinolae* in which the fly brought in was not dead but paralyzed.

With regard to the European species *B. rostrata*, which Fabre and Wessenberg-Lund had under observation, I, of course, have had no experience, and the fact that *B. spinolae* can and does make use of her power to paralyze is not a proof that *B. rostrata* does likewise. Lepeletier maintains, as pointed out above, that *rostrata* does paralyze her prey and it is possible that both Fabre and Wessenberg-Lund failed to carry the investigation far enough to discover the whole truth. Be the facts in the case of *rostrata* what they may, Wessenberg-Lund's conclusion that the form of the abdomen of *Bembix* inhibits the power to paralyze can not be accepted; for, in the case of one species of *Bembix* and of two species of *Bicyrtes*, in which genus the form of the abdomen is almost identical with that of *Bembix*, we know the prey is paralyzed. Furthermore, Hartman, in his Observations on the Habits of Some Solitary Wasps of Texas (page 30), reports an observation on *Bembix texana* Cresson, in which the wasp seized and stung a fly that he had caught and fastened down for the express purpose of observing this action on the part of the wasp, and the Peckhams in their observations on *Bembix spinolae* report that they twice observed this species in the act of stinging a fly.

During the summer of 1914 I spent a great part of my time observing the nesting habits of three species of Bembicine wasps: *Bembix spinolae* Lepeletier, *Bicyrtes ventralis* Say, and *Microbembex monodonta* Say. The nesting site was a pile of clean sand on a vacant lot in the city of Washington. The last of these three species I had observed with considerable care the previous summer at Cedar Point, Ohio, and what was observed in Washington simply corroborated the facts previously obtained.

BEMBIX SPINOLAE Lepeletier.

In constructing her nest *Bembix spinolae* digs a sloping tunnel in the sand varying from 5 inches to 1 foot in length and, by enlarging the tunnel at the end, forms a brood chamber which is from 4 to 6 inches below the surface of the ground. These nests are digged at all times of the day; some females are busy at this work early in the morning, others late in the afternoon. On dark, gloomy days these wasps are inactive; they love the sunshine and the hottest part of the day finds them most active. About an hour is required to construct a nest, but the condition of the sand and the individuality of the wasp are important factors in determining the time required. When the nest is complete the wasp closes the entrance carefully and then attacks the pile of sand thrown up in excavating the nest. This she scatters in all directions and continues to work over the surface until all evidence of the presence of the nest is completely obliterated, which usually requires about five minutes. When this has been done the wasp sets forth in search of prey.

The length of time required to secure the first fly for the new nest varied from 2 to 10 minutes. On the first fly placed in the nest the egg is laid and the time spent in this operation varied from 5 to 12 minutes. On emerging from the nest after depositing the egg the wasp shows renewed interest in the concealment of the entrance to her domicile. She spends as much time in effacing the evidence of the opening of the nest as she did in performing the same operation when the nest had just been completed. In this case she throws the sand from all directions toward the entrance to the nest, whereas in the previous operation she throws it away. *B. spinolae* stops up the burrow not only at the entrance but also at a short distance from the brood chamber. This I found true for every nest investigated. In the evening the female wasp usually returns and spends the night within the nest, but not in the brood chamber. In every case where I found a female within her nest she was found between the obstruction at the entrance and the one near the brood chamber.

The males of *B. spinolae* spend much of their time flying about over the nesting area seeking the females and quarreling among themselves. Copulation occurs on the wing. From time to time the males leave

the nesting area to make excursions to the flowers in the vicinity in order to feed on the nectar and presumably also upon the pollen. The males also dig burrows in the sand, in which they spend the nights and the days too during unfavorable weather. These burrows are short and extend to the depth of only an inch or two below the surface. It is an interesting sight on a hot summer day when a sudden shower comes up to see these males hasten to the nesting area and bury themselves in the sand.

There has been much speculation as to whether *Bembix* rears more than one larva at a time and opinions on this point differ. So far as I am aware no positive evidence bearing on this matter has been presented by other investigators and what I have obtained is not conclusive. In a preceding paper on the nesting habits of *B. nubilipennis* Cresson, it was pointed out that this wasp forms a series of lateral branches from the main tunnel and in these rears her larvae, but the evidence obtained in that brief investigation tends to show that but a single larva is reared at a time. My investigations of the nesting habits of *B. spinolae* give evidence of the same character. On two occasions, when keeping under observation a wasp that was busy carrying flies into her nest, she completed this task and sealed up the nest. The sealing of the nest differs from the ordinary mode of closing it, in that in the latter case only the entrance is closed, whereas in the former the tunnel from the brood chamber to the opening is solidly packed with sand. In each case noted the wasp after completing her task of sealing up the nest searched about for a few minutes, and without going out of my sight, began and completed a new nest within which as soon as complete a fly was placed, upon which an egg was deposited.

No more flies are placed in the nest until the larva emerges from the egg, which usually occurs at the expiration of one or two days after its deposition. The young larva does not leave the egg, but moves upward to the open end of the eggshell to which its posterior end remains attached. From this vantage point it can reach with its head to considerable distance on all sides. In no case observed did the larval wasp devour the fly on which the egg was placed. To do so would deprive the young larva of the advantage it enjoys in the position it occupies—a position that appears to be essential to its feeding upon the food provided by the mother wasp at this time. In no case did I succeed in rearing in my breeding cells a larva that was accidentally detached when small from the fly on which the egg was placed. It is my conviction that the flies on which the young larva first feeds are crushed or macerated for it by the mother wasp. In no case did I find a newly-hatched larva in my breeding cells able to feed upon house-flies that were given to it intact and a number of such larvae died for me before I discovered this. By crushing the flies

thereafter so as to permit the larva to reach the internal organs it fed freely and after a day or two it had no difficulty in feeding upon flies that were given intact.

The larva feeds voraciously, grows rapidly, and the mother wasp is kept busy bringing in food for her hungry offspring. In my breeding experiments the shortest period within which the larva passed from hatching to the formation of its cocoon—that is, the time during which feeding occurred—was four days. From my observations in the field I am inclined to think that the time of feeding in the larval stage, provided weather conditions do not prevent the mother from keeping on hand a plentiful supply of food, is on the average about six or seven days. Although I can not state the exact number of flies consumed by any one larva of this species, I should estimate the number of house-flies required to mature the larva to be at least 50. In my breeding experiments I made a practice of supplying more flies than the larva could consume in a day and then on each morning supplying fresh flies after removing from the cell all partly eaten and untouched flies therein. Consequently the exact number was not determined.

The wasp carries her prey ventral side up beneath her body tightly clasped with her middle legs. She retains her hold upon her prey while opening the nest, resting on the posterior pair of feet while she digs open the entrance with her front pair. Wessenberg-Lund states that *rostrata* lays her fly aside while opening the nest, pausing in her work from time to time to make sure the fly is safe. I never saw *spinolae* lay aside her fly when opening her nest save in cases when the sand had been disturbed so as to make it difficult for her to find the entrance to the nest. In such cases the fly was discarded entirely and left lying on the sand. The Peckhams say of *spinolae* that "sometimes she drops the fly behind her and then, turning around, pulls it in with her mandibles." In my observations I have never seen *spinolae* take a fly into the nest in any way other than the usual fashion. Melander in his article on *Bembix* (see bibliography) makes the following statements:

When the nest is of the requisite depth the wasp carefully covers it with loosened soil, concealing the opening. She then departs to sting a fly whereon to deposit her egg. The fly is carried to the nest and left at the door while the wasp digs through. She then descends to the bottom of the nest and returning to the doorway for the fly brings it down as food for her young one.

It is not possible to say with certainty to which species of *Bembix* these statements refer, but the fact that one of the illustrations in the article is labeled, "Adult of *Bembex spinolae*, enlarged five times," would seem to show that the article was written with this species in mind. Since two other species quite similar to *spinolae* are known to occur in northwestern United States, *primaestate* and *comata*, it

is quite possible that the above observations may refer to one of these.

On leaving the nest the entrance is invariably closed. The rapidity with which the wasp secures flies is shown by the following record of intervals between visits to the nest on each of which a fly was brought in. With wasp No. 29 observations began with the visit at 11.18 a. m., and closed with the visit at 12.30 p. m. The successive intervals between visits were 5, 4, 12, 14, 5½, 11½, 3½, 11½, and 5 minutes. In the case of No. 37 the intervals, beginning at 9.32 a. m. and closing at 11.02 a. m., were as follows: 5, 4, 6, 3, 5, 6, 14, 18, 5, and 24 minutes. These two cases may be taken as fairly representing the energy with which the wasp goes about her task. In each of these nests the larva was nearing maturity.

As soon as the larva ceases feeding it encases itself in a cell or cocoon composed of grains of sand entangled in meshes of silk and firmly cemented together by a hard, tough substance probably furnished from glands in the mouth. When it begins to form its cocoon the larva spins a loose felt-work of silk about it as a foundation for the formation of the cocoon proper. In one case this silken felt-work was attached to the under surface of the glass covering the breeding cell, so that the cocoon formed within it was held above the sand in the cell and was firmly cemented to the underside of the glass. Although this larva was not surrounded on all sides by sand, as is the case when the cocoon is formed in the nest, nevertheless, by some means that were not observed, it succeeded in incorporating grains of sand in the wall of the cocoon.

Two cases coming under my observation throw new light upon the life-history of *B. spinolae*. In the first (No. 37) the nest was constructed and the egg deposited late in the afternoon of June 27, the nest was marked and kept under observation until July 3, when the mother wasp was captured and the nest dugged up. The larva therein was nearly full grown. I placed it in a breeding cell together with the flies found in the brood chamber with it. On July 4 I gave it an additional supply of house-flies and on the morning of July 5 it had begun the formation of its cocoon. The larva was covered at once with sand and the cocoon was complete on July 6. This cell with its contents was then set aside and not inspected again until August 24, when to my surprise I found the adult wasp had emerged and unable to escape had perished in the cell. The date of its emergence is not definitely known. In the second case (No. 48) the egg was laid July 10 and hatched on July 12. The larva began forming its cocoon on the afternoon of July 17 and completed it on July 18. It was this wasp that formed its cocoon without being covered with sand. This cell was also set aside, but after the discovery related above it was closely watched and the adult wasp emerged on September 2. Thus this wasp completed its transformations from egg to

adult between July 10 and September 2—a period of 54 days. In both cases the emerging wasps were females. It follows from this that in this locality *Bembix spinolae* has more than a single brood each year. I may add here that the wasps were still active in the field after September 2.

The prey of *spinolae*, as in the case of other species of *Bembix*, consists of flies. The species found in greatest numbers in the nests opened in the course of my investigations was the common house-fly, due perhaps to the fact that the nesting site was located in a suburb in the city where this fly could be most easily obtained. Some individuals, however, showed a preference for other species, and not a single nest was found in which the flies were all of one species. Below are given the contents of three different nests, each of which contained a larva that I judged to be four or five days old. The flies found in these nests were kindly determined for me by Mr. W. R. Walton.

First nest.

- 2 *Winthemia 4-pustulata* Fabricius.
- 10 *Pseudopyrellia cornucinia* Fabricius.
- 1 *Musca domestica* Linnaeus.
- 2 *Sarcophaga*, species ?

Second nest.

- 1 *Chrysops pudicus* Osten Sacken.
- 1 *Chrysops niger* Macquart.
- 2 *Tabanus coffecatus* Macquart.
- 16 *Odontomyia virgo* Wied.

Third nest.

- 1 *Chrysops lugeus* Wied.
- 2 *Chrysops pudicus* Osten Sacken.
- 1 *Tabanus pumilus* Macquart.
- 1 *Tabanus lasiophthalmus* Macquart.
- 13 *Odontomyia virgo* Wied.

BEMBIX BELFRAGEI Cresson.

All investigators that have observed the habits of species of *Bembix* report that these wasps provision their nests exclusively with dipterous insects. I know of but one exception to this: Hartman in *Observations on the Habits of Some Solitary Wasps of Texas*, page 32, reports *Bembix belfragei* Cresson as provisioning her nest with a large species of bug, a hemipterous insect. He informs me that the specimens on which this observation was based can not now be located. I am strongly of the opinion that identification in this case has been incorrect; that the species reported upon has been a member of the genus *Bicyrtes*. This is, however, only a matter of opinion based on a limited experience with species of the two genera. If *B. belfragei* does provision her nest with hemipterous insects she forms a marked exception among the species of *Bembix* thus far

investigated. Prof. J. S. Hine, in circular No. 6 of the State Crop Pest Commission of Louisiana, page 27, makes a short report of his observations on a species of *Bembix* that was determined for him as *B. belfragei*. I have examined his collection and the specimens bearing the label *B. belfragei* is not that species at all but belong to my new species *B. hinei*.

STICTIA CAROLINA Fabricius.

In the same paper (pp. 20-27) Prof. Hine gives a detailed account of the nesting habits of *Stictia carolina* Fabricius (*Monedula carolina* Drury), the activities of the wasps, the character of the nest and its construction, a description of the larva, its size and mode of feeding, the cocoon and the character and quantity of food consumed. According to his observations these wasps prefer to feed their young on adult horse-flies, although they do not confine themselves exclusively to these flies. Hartman also has investigated the nesting habits of this species and in the paper cited above states that *Stictia carolina* deposits her egg in the empty nest and does not provide food until the egg has hatched. In this respect this species resembles *Microbembex* instead of *Bembix*. In other respects the reports show that its breeding habits are quite similar to those of *Bembix*.

BICYRTE VENTRALIS Say.

The species of *Bicyrtes*, so far as my own observations have gone and so far as is shown by the reports of other investigators, always use hemipterous insects, usually nymphs of the so-called stink-bugs, with which to provision their nests. These insects are paralyzed and in my breeding cells many remained alive for over a week. The nest of *B. ventralis* Say is made in the sand in situations similar to that chosen by *Bembix spinolae*, in fact, I have found them nesting side by side in the same sandy area. The nest of *Bicyrtes* is not so deep as that of *Bembix* and is kept closed only at the entrance. When the nest is constructed and closed *Bicyrtes* goes at once in search of prey. When this is secured she returns to the nest carrying her booty in the same fashion as *Bembix* and in the same fashion retains her hold upon it while opening the nest. The bugs are placed upon their backs in the brood chamber and the egg is deposited upon the first one brought in.

Unlike *Bembix*, *Bicyrtes* does not wait for the egg to hatch before bringing in more food, but proceeds at once to complete the provisioning of her nest, which is usually finished and the nest sealed before the egg has hatched. Usually each nest has but a single brood chamber, but in the course of my investigations I found two each of which had two brood chambers reached from the same entrance. In each case, however, the first chamber was provisioned and sealed before

the second was constructed. If unfavorable weather interferes with the work of the wasp before the nest is completely provisioned, she will return to it later and complete the store of food necessary to develop her offspring. Under such circumstances I have observed *Bicyrtes ventralis* carrying bugs into a nest that contained a half-grown larva. On one occasion, after a few days of adverse weather and while the sand was yet wet, I observed a female *ventralis* open and enter a nest but without carrying in a bug. After a few minutes spent inside she emerged and sealed up the nest. I at once dug up the nest and found within it a half-grown larva, several untouched bugs, and the remains of several more that had been devoured. I placed the contents of the nest in a breeding cell and in due time the larva completed its growth and spun its cocoon. Here it would seem that the mother wasp, after an absence of two or three days caused by rainy weather, visited the nest for the purpose of ascertaining whether the larva had been sufficiently provided for. The fact that she sealed up the nest after the inspection indicates that she found conditions satisfactory and my subsequent investigation proved the correctness of her good judgment.

On June 13 I marked a nest in which the wasp was busily storing bugs. I dug this nest up on June 20 and found the larva safely inclosed in its cocoon. It had passed from egg to mature larva within a week. On June 23 a wasp was observed storing her nest. While under observation she completed the provisioning of this brood chamber and sealed it up. She at once constructed a second brood chamber leading off from the same entrance as the first. She placed a few bugs in this, but night came on before the work was complete. She resumed her task on the morning of June 24, completed provisioning the nest and then sealed it. I then marked the nest, but it was not again visited by the wasp. On June 26 I dug up the nest and placed the contents of the two brood chambers in separate breeding cells. The larva from the brood chamber that was first constructed completed its feeding and began forming its cocoon on June 28; the one from the second chamber, on June 30. The results of further investigations show that the egg usually hatches from forty-eight to seventy-two hours after being deposited. As in the case of *Bembix* the larva moves up to the top of the empty eggshell and remaining with its posterior end attached thereto makes use of this vantage point to reach for food in all directions. The number of bugs placed in a brood chamber varied from 3 to 11. In cases where the number of bugs was large the individuals were smaller than where the bugs were less numerous. The larva completes its feeding in from three to five days, so that the time from newly-laid egg to encased larva is approximately one week.

BICYRTES QUADRIFASCIATA Say.

In the course of my investigations I discovered two nests of *Bicyrtes quadrifasciata*—one at Sandusky, Ohio, and the other at Great Falls, Maryland. In both instances my attention was drawn to the insect by the loud, humming noise she makes as she approaches her nest with her victim. Unlike *ventralis*, which species flies hither and thither over the nesting area in search of her burrow, *quadrifasciata*, when she arrives in the vicinity of her nest, poises in the air several feet above the ground and, while making the humming noise referred to, slowly and steadily descends directly to the entrance to the burrow. The nest at Sandusky contained two bugs, nymphs of a species of *Nerarra*, of which both were paralyzed, and upon one, evidently the first brought in, the egg was placed in the same fashion as that noted for *ventralis*. At Great Falls the wasp was taken at the entrance to her nest as she was about to enter with her first victim.

BICYRTES, species?

Hartman, in his paper cited above, reports upon two species of *Bicyrtes* that were identified for him as *Bembidula parata* Provancher and *Bembidula pictifrons* Smith. I am strongly of the opinion that we have here another case of misidentification. *Bicyrtes* (*Bembidula*) *parata* Provancher was described from California and I have not seen a single specimen of this species from Texas. I suspect that the observations reported by Hartman for *parata* refer either to *capnoptera* Handlirsch or to my new species, *annulata*. With regard to the second species, *B. pictifrons* Smith, no such species, so far as I am aware, was ever described. It is possible that the man who determined the specimen may have meant to write *Monedula pictifrons* Smith instead of *Bembidula pictifrons*, but the character of the observations indicates that the species in question belongs to the genus *Bicyrtes*. It is to be hoped that the specimens on which these determinations were based may yet be located and the identity of the species so carefully observed and reported upon may be positively established.

MICROBEMBEX MONODONTA Say.

The data, on which is based the following discussion of the biology of *Microbembex monodonta* Say, were obtained between June 17 and July 25, 1913, at the Lake Laboratory of the Ohio State University located at Cedar Point, Sandusky, Ohio. This strip of land is a great sand-bar more or less sparsely covered with vegetation. In the immediate vicinity of the Lake Laboratory the surface is very irregular, due to the shifting of the sand by the wind, and on the bottoms and sides of these "blow-outs," where vegetation is exceedingly scarce, these wasps nest in countless numbers. They prefer

the open spaces entirely free from vegetation, but their burrows may be found almost anywhere among the clumps of grass and even under the trees wherever the sand is free from leaves or not hidden by foliage. Although a high wind, when the sand is dry or a violent rain-storm, invariably alters in no small measure the surface of the naked sand, nevertheless such changes in no way discourage these energetic little insects or even seriously interfere with their prosperity.

On June 17 the wasps were found in great numbers flitting about over the sand and many were already at work on the construction of nests. The great majority, however, at this time were males, from which fact it seems that the males emerge somewhat earlier than the females. A number of pupae were dugged out of the sand and the insects permitted to emerge in the laboratory. In all 10 insects were secured in this way and all were females. In searching the sands from day to day many emerging wasps were dugged out, but only a very few of these were males, and my records show that not a single male was thus discovered after the 1st day of July.

Mating occurs immediately after the female has emerged. The fact that the male emerges in advance of the female appears to be a provision of nature to insure the fertilization of all females. The males are constantly searching the sands for the emerging females, and a female is not long above ground before she is discovered by a passing male and fertilized. The female is usually found and seized by a male before she has made any attempt to fly, and a fierce but brief struggle precedes copulation, the pair rolling about on the sand or in some instances rising into the air. Copulation requires but a brief time, about half a minute, and the male seems capable of fertilizing a number of females. All data secured tends to show that copulation occurs but once. While the females are digging their burrows and searching the sands for food for their young they are continually pestered by the roaming males, every one of which in passing a busy female either hovers about her for an instant or pounces upon her back. In the majority of such cases the male retains his hold but momentarily, apparently realizing very quickly that he has made a mistake; in others a struggle ensues upon the sand and occasionally the male will retain his position on the back of the female for some time, but in all of these cases, and hundreds were observed, not a single mating was effected. At the close of the period of investigation very few males were in evidence and the females in great numbers were digging their burrows in peace.

The nest is a simple unbranched tube and a single larva is reared in each. The young is reared at the extreme end of the burrow, which is enlarged somewhat to form a brood chamber. These burrows are from 8 inches to 1 foot in length from end to end and the brood chamber is from 3 to 6 inches below the surface of the sand.

The variation in the length and depth of the burrow depends a great deal upon its location. If it is constructed on a level spot the brood chamber, as a rule, is not so far below the surface as it is when the burrow is placed on a sloping site, and the wind by shifting the sand may alter its depth, no matter where placed. In no case did I find a burrow branched or with more than a single young within it.

The wasp digs with great rapidity, but the length of time required to complete a burrow varies with the condition of the sand and the abundance and activity of the males. After a rain the sand is wet and heavy and the work is laborious, and when the sand is quite dry and loose it slides down into the entrance as fast as the wasp digs it out. In fact, if the sand is very dry and loose the wasps can not construct their burrows at all, and I have seen them work for half a day without being able to get out of sight in the sand, whereas when the sand is in good condition—i. e., shortly after a rain—a burrow can be completed in the course of two or three hours or even less.

Occasionally we find two and even three females contending for the same burrow, and it is interesting to watch the struggle that ensues. When the contestants are of the same size the argument becomes decidedly strenuous. They push and shove and crowd each other about the entrance to the burrow. One will gain the entrance only to be seized by the wing or hind leg and dragged out by the other, which, on gaining the entrance, is subjected to the same treatment by her rival. Frequently as one of them seeks to enter the burrow the other will pounce upon her back, seize her, and rising on the wing carry her to a short distance and drop her without ceremony upon the sand. These struggles sometimes last for hours with no decided advantage to either and apparently no harm sustained by either. The explanation of these contests apparently lies in the fact that, owing to the great number nesting in the same area, two or more burrows are constructed with their entrances quite close together, so that one wasp in opening her burrow disturbs the entrance to the nest of a neighbor, and if this neighbor is desirous of inspecting her nest at the same time a fight ensues.

When the burrow has been completed a single egg is placed in the brood chamber at the extreme end. This is firmly fastened in an upright position in the sand of the floor of the brood chamber. The egg is white, cylindrical, and rounded at the ends. The eggs hatch in from two to three days, and the larvae at first remain with the posterior part of the body still attached within the egg shell, for the egg is always placed so that the head of the developing larva is uppermost, and it waves its anterior part about in search of food. No food, however, is placed in the burrow until the egg has hatched. In this respect *Microbembex monodonta* resembles *S. carolina* as reported by Hartman. *Microbembex monodonta* feeds its young on dead insects,

which it gathers up from the surface of the sands, instead of capturing and paralyzing living insects by stinging, as do other wasps of similar habits. The food is consequently exceedingly variable, but May-flies and midges were most used, probably because of their abundance on the sands and the consequent ease with which they could be secured.

When the wasp is storing her nest with food it is possible to induce her to take into it insects placed at the entrance while she is inside. In this manner I repeatedly succeeded in having newly-killed May-flies, midges, house-flies, and stable-flies taken into the nest. If a May-fly was disabled but still possessed of life enough to move its legs or wings the wasp invariably appeared afraid of it and refused to touch it when it was placed at the mouth of her burrow. I did not observe a single case in which a wasp attacked and carried off a living uninjured insect, but they did attack and carry off house-flies, stable-flies, and even May-flies that I cast upon the sand after having disabled them to such an extent that they could not fly. In seizing such an insect the wasp appears to sting it, but of this I can not speak with certainty. When one of these insects was seized the wasp invariably bent her abdomen forward, bringing the tip into contact with her victim, thus going through the performances that would be incidental to stinging; but this same performance may sometimes be seen when the wasp seizes a dead and dried insect lying on the sand. I am of the opinion, however, that the instinct to sting still remains, and that whether the prey be a disabled or a dead insect the wasp uses her sting upon it.

One of the most interesting questions met in this investigation is "How do these wasps find the entrance to their burrows?" The results of my observations force me to conclude that they do so through the sense of smell or some power similar to smell. When the wasp has completed her burrow and deposited an egg therein she closes up the entrance by digging the sand into the mouth of the burrow until it is filled. Not content with this she smooths the sand about the entrance and then beginning near it she proceeds outward first in one direction and then in another, throwing the sand behind her and scattering it loosely over the spot where the mouth of the burrow is concealed. When she has finished there is absolutely not a trace of the burrow to be seen. Nevertheless when the wasp returns two or three days later she is able after searching about over the sand for a little while to dig down directly into the mouth of the burrow as readily as if before filling it up she had inserted a stake into it to guide her in opening it again. She can do this no matter how greatly the appearance of the surface has been changed by wind, rain, or the trampling of animals since the time when she so carefully concealed the entrance. I repeatedly altered the appearance of the sand about the entrance to the nest between the visits of the wasp while she was busied in bringing in food, but I never succeeded in confusing her,

though I dashed buckets of water over the surface, placed a small pile of sand over the entrance, or changed the surroundings by placing paper, leaves, and rubbish about the entrance to the nest.

The following is an extreme case: I had been sitting on the sand for almost an hour observing a number of wasps on a day when the stable-fly was causing me great annoyance by biting my ankles, and as a result the sand about my feet had been trampled and disturbed. While fighting the flies I observed a wasp searching about my shoe, which at the time rested flat upon the sand. She flew round and round my foot, lighting first at one point and then at another, evidently trying to find a means of getting beneath it. I moved my foot aside and the wasp after searching the area covered by my shoe began to dig at a point that had been directly beneath it. She dugged down directly into her burrow. Presently she came out, closed the burrow and set forth in search of food. Here it does not seem possible that the sense of sight or the relation of surrounding objects could have been of any possible use in locating the entrance to the burrow, for my trampling had changed everything within 2 feet of the nest, and my foot was directly over the entrance at the time she began her search for her nest.

As stated above, no food is placed in the brood chamber until the egg is hatched, and even then sufficient is not provided at one time for the development of the larva. It is thus necessary for the wasp to open and provision the nest on two or more days. My investigations clearly established the fact that the nest is provisioned at least twice and possibly oftener. When the wasp brings food to the nest she holds it with her intermediate pair of legs tightly clasped beneath her and while resting upon her hind legs she digs open the nest with her front pair. This is neither the easiest nor the quickest way of accomplishing the work of opening the nest, but it is much the safest. If she releases her hold upon her booty it is almost sure to be carried off by another wasp in search of food for her young. Sometimes the dead insect is so large that the wasp is compelled to lay it aside while opening the nest, but this is never done until by trial the wasp finds she can not open the nest while retaining her burden. It is under such conditions that she is most likely to be robbed of her property. She is, however, just as likely to be assailed while holding it but with less danger of losing it. The struggles at the mouth of the burrow for the possession of a dead insect are frequent and furious, the contestants grappling and rolling over and over on the sand. Frequently it happens that the prey is dropped in the struggle and while the pair of contestants are rolling on the sand a third wasp comes along and settles the quarrel by quietly carrying off the coveted treasure. This fighting over food is not limited to struggles for possession at the entrance to a nest, but may occur at any time when two wasps may chance upon a dead insect on the sand at the same time, or when one

in possession of a dead insect is met by one empty-handed. I have frequently seen two wasps fight fiercely for the possession of a dead insect that the victor, after gaining possession of it, discarded as not worth carrying off.

When leaving her nest the wasp invariably closes the opening, but no very careful attempt is made to conceal the point of entrance save when the visits for that day are complete. This species is preyed upon by a number of parasites and this precaution of closing the nest is doubtless to safeguard the nest against these enemies. They do not, however, make any effort to close the entrance while within the nest—a precaution that is practiced by both *B. spinolae* and *B. nubilipennis*.

During the six weeks within which these observations in the field were recorded efforts were being made to rear the larval wasps, but the final results were far from satisfactory. At first I took small bottles filled with moist sand in which artificial cells were made wherein eggs and larvae of different ages were placed. These were put in a box and kept in the laboratory. While this work was in progress the weather was very hot and every attempt ended in failure, the larvae invariably dying before reaching maturity. This method was abandoned and a box filled two-thirds full of sand and provided with a removable top was sunk in the sand so that the top was 4 inches below the surface. In the sand within the box little pits were made and stocked with eggs and larvae of various stages. The cover was placed on the box and the whole apparatus covered to a depth of about 4 inches with sand. All went well for three days; conditions were apparently as nearly normal as need be, but the third day a colony of little red ants found my box and destroyed every vestige of my larval wasps. The box was moved to what was deemed a safe place and restocked. Things flourished for three days, when ants again found the box and left not a trace of the wasps. I next secured shell vials 25 by 80 mm. which I partially filled with sand in which pits were made for the reception of the eggs and larvae. A single egg or larva was placed in each vial and a cork was loosely inserted to keep out the ants and the vials were placed in the sunken box. This plan worked quite well and I succeeded in rearing to maturity several larvae taken at various stages of development and also in carrying two larval wasps through from the egg to maturity and encasement.

On July 17 a number of nests in process of construction were marked and at 5 p. m. of the same day all these nests were completed and closed, save one, which had been abandoned. On the morning of the 18th three of these marked nests were opened before the wasps were astir and each contained an egg in its characteristic position. These were placed in the breeding box. One was destroyed by minute worms, a second was accidentally crushed by a fall of the vial, but the third hatched. This egg was deposited on the afternoon of

July 17; was still unhatched on the morning of the 19th, but was hatched on the morning of the 20th. It was fed daily on freshly killed May-flies, the remains of the supply of food given on one morning being invariably removed before the fresh supply was given on the succeeding day. It completed its growth and began its encasement on July 25. On the 21st another of these marked nests was opened and a larva apparently about 24 hours old was secured. It had been provided with food, but whether on this date or on the 20th could not be determined. This larva was placed in the breeding box, and reared under conditions similar to the preceding. It likewise completed its growth on the 25th but failed to encase. On the 23d another of these marked nests was opened and a larva secured therefrom and placed in the breeding box. This one completed its development on the 26th but failed to encase—due to neglect on my part. In the case of the first two the time from the deposition of the egg to completion of the feeding of the larva was eight days and in the third nine. It is quite probable that the time normally required by the wasp is somewhat greater than this since the character and quantity of food supplied to the larvae in the breeding case was much superior to that usually furnished by the mother wasp.

When the period of feeding is complete the larva encases itself in an elongated egg-shaped cell or cocoon composed of grains of sand held together by threads of silk that are covered with some adhesive substance, probably furnished by glands in the mouth of the insect. My breeding experiments tend to show that the larvae can not encase unless they are buried in the sand. Many larvae brought to maturity in the vials simply spun a flat web of silk in their cells, and perished without forming cocoons whereas others burrowed down into the sand in the vials and readily encased. Others failing to burrow into the sand were covered loosely with sand by filling up the vials. These readily formed their cocoons.

The first encased larva found in the field was secured on June 28 and it is not probable that many mature earlier than this date. Two weeks later encased larvae were very frequently found when burrows were opened. It is not easy to distinguish a newly constructed cocoon from one formed the year before without opening the cocoon. If the cocoons are very carefully removed the newly constructed ones invariably have adhering to them loose silk fibers resembling the web of a spider; these are never present on a cell a year old. The old cells are also somewhat darker, but this is not a reliable criterion. In no instance was a cell found in a brood chamber or among the remains of food. It appears that the larva when it ceases feeding either advances from the brood chamber a short distance into the tunnel where its narrower diameter permits the larva to reach the sand on all sides or, more rarely, makes its way into the sand from the side of the brood chamber. In all these instances where the cell was

discovered before its situation had been disturbed and its relation to the burrow could be positively determined the cell was found in the tunnel of the burrow from one to three inches from the remains of the food left in the brood chamber. Whether the cells found in the sand at one side of the brood chamber (a circumstance that was observed several times) was formed there by the larva, or had been dislodged in the digging or was formed in another tunnel not associated with the brood chamber near it, are questions that I failed to settle to my own satisfaction. The fact that some of the larvae in my breeding vials burrowed for an inch or more into the sand shows that the larva can if it chooses make its way into the sand from the brood chamber without the aid of a tunnel.

After encasing the insect remains in the larval form until the following spring. Just when the change to the pupa state is made—that is, how long the pupa stage lasts—I have not determined, since all the cocoons secured from the sands after I took up my work on June 17, contained either the pupae of the wasp or larvae or pupae of parasites. When the wasp is ready to emerge it cuts off a circular cap from the end of the cell and comes out. All cocoons from which the wasp had emerged were found densely filled with sand, evidently digged back into them by the wasps at the time of emergence.

No very careful attempt to determine the parasites that prey upon *M. momodonta* was made. The most common one is a species of *Bombylid* fly, *Exoprosopa fascipennis* Say, which was repeatedly taken in the act of ovipositing in the sand at the entrance to the burrows of the wasp and a pupa of which was taken from a cocoon of this species. Another parasite taken from a cocoon is a species of *Mutillid* wasp, *Dasymubilla*, species? In addition to these a number of small parasitic flies, probably *Tachinids*, were always busy about the entrance to the burrows awaiting an opportunity to dash into the opening behind the wasp as she entered her nest and deposited an egg upon the food she carried in for her young. The little red ants that interfered with my breeding operations also tunneled through the sand and destroy the contents of every nest that they chance to find.

EXPLANATION OF FIGURES.

Figures 1 to 6, inclusive, were made from microscopic projections of balsam mounts of the wings. They are, therefore, exact in outline and proportions and since all were drawn on the same scale of magnification the relative sizes are shown. No other drawings were made from balsam mounts; they were made directly from the naked objects. In preparing the genital stipites the wasps were relaxed and the genitalia exerted and allowed to dry either attached to the abdomen of the wasp or more frequently detached and mounted on strips of paper placed on the pin. All figures except those of the wings are camera lucida drawings made with a Bausch & Lomb microscope, using a 48 mm. objective and 10× ocular, except in the case of figure 80, where a 16 mm. objective and 5× ocular were used, and in the case of figures 218 to 230, inclusive, where a 48 mm. objective and 15× ocular were employed. Wherever

possible two drawings of the genital stipites of each species were made, an outline drawing of the dorsal aspect of the pair of stipites and a more careful drawing of a single one of the same individual, the stipes being shifted so that the view falls vertically upon its broad expanse. Drawings of a single stipes of a species are of the more careful kind. In a few cases stipites of several individuals of one species are figured to show variation.

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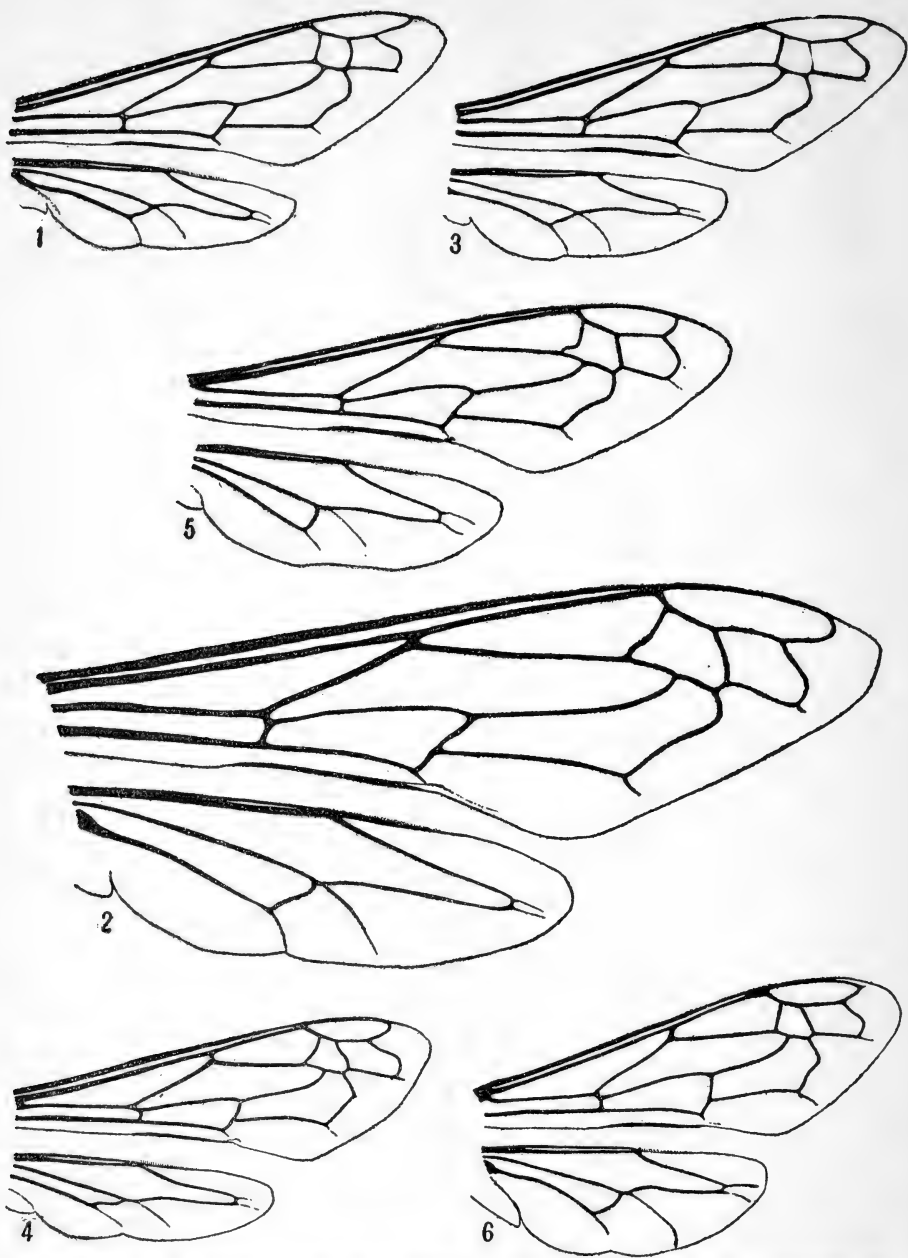
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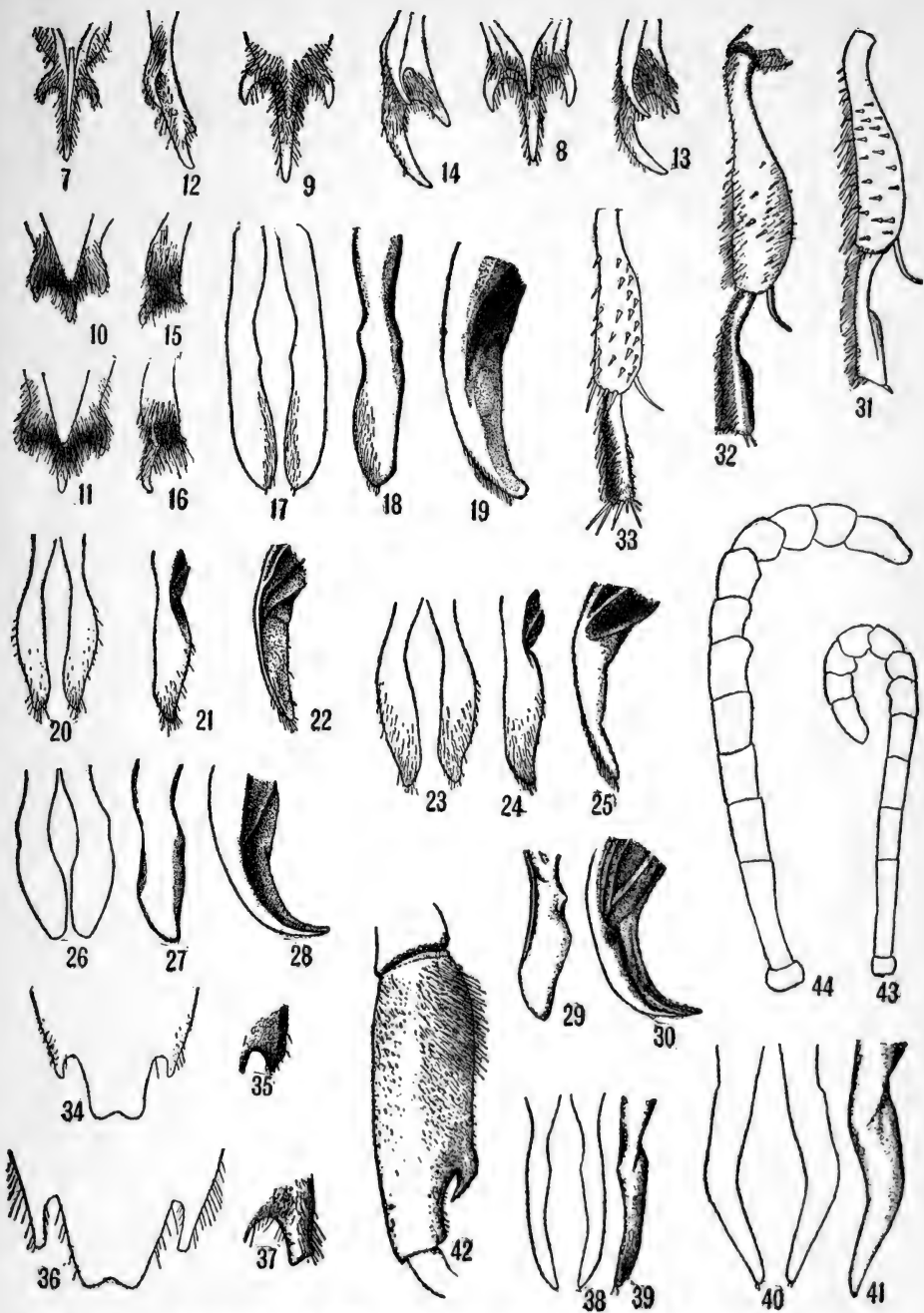
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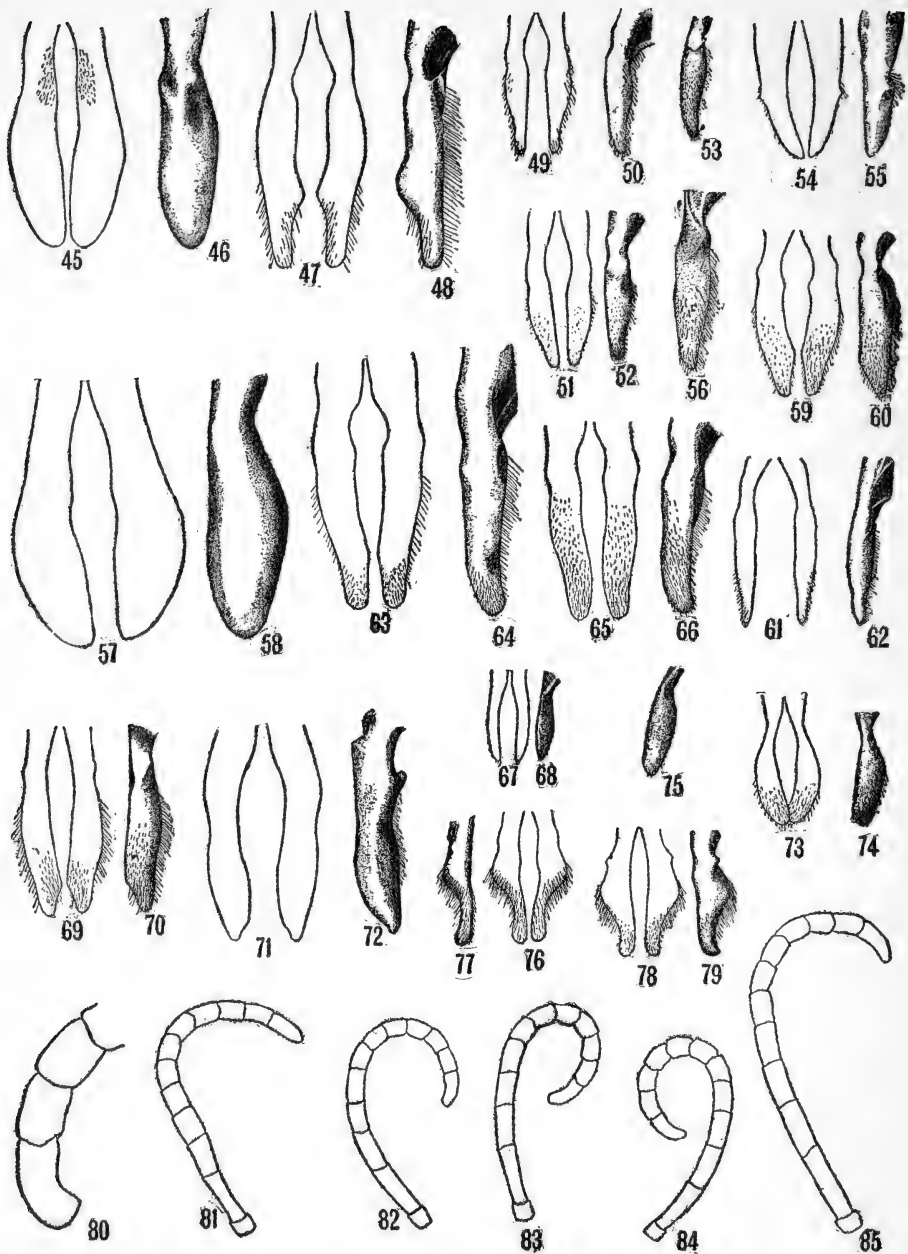
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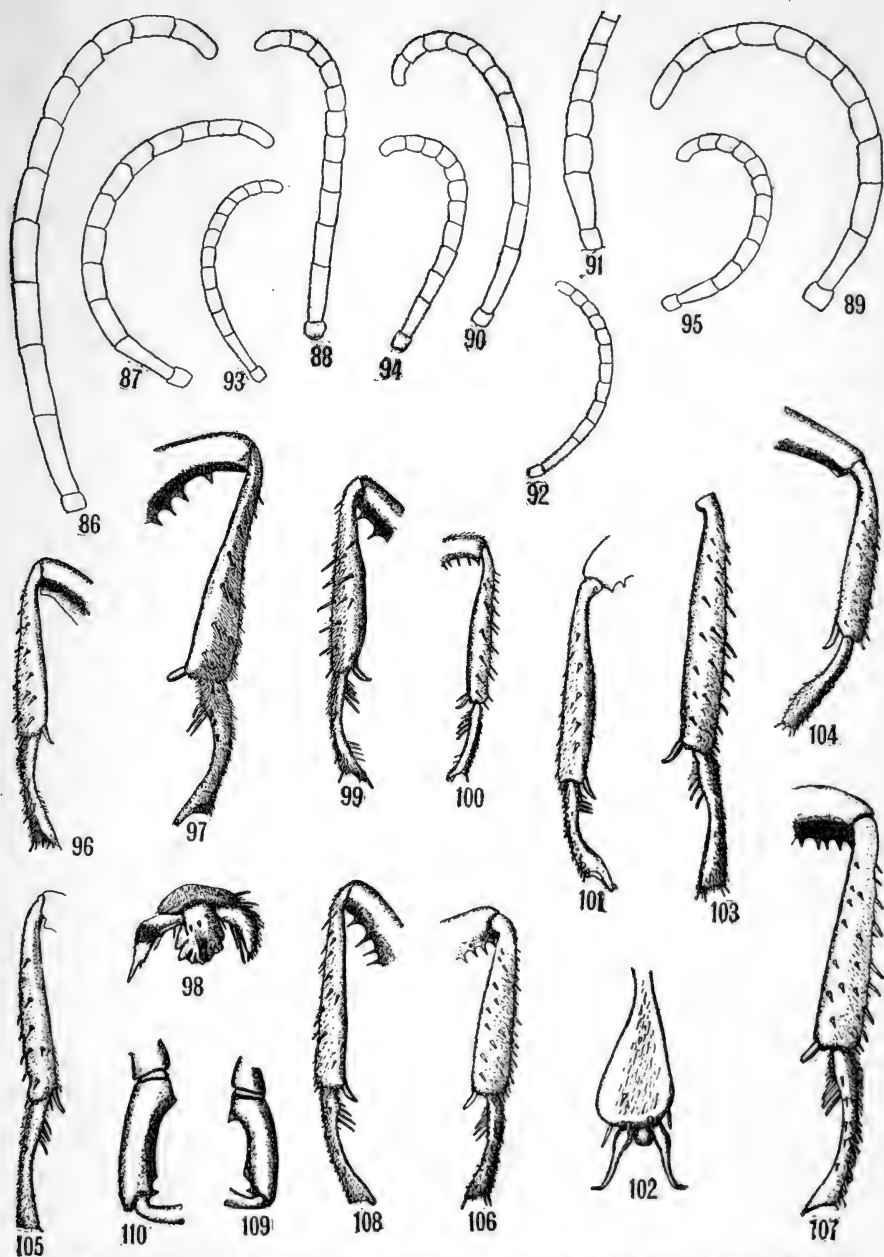
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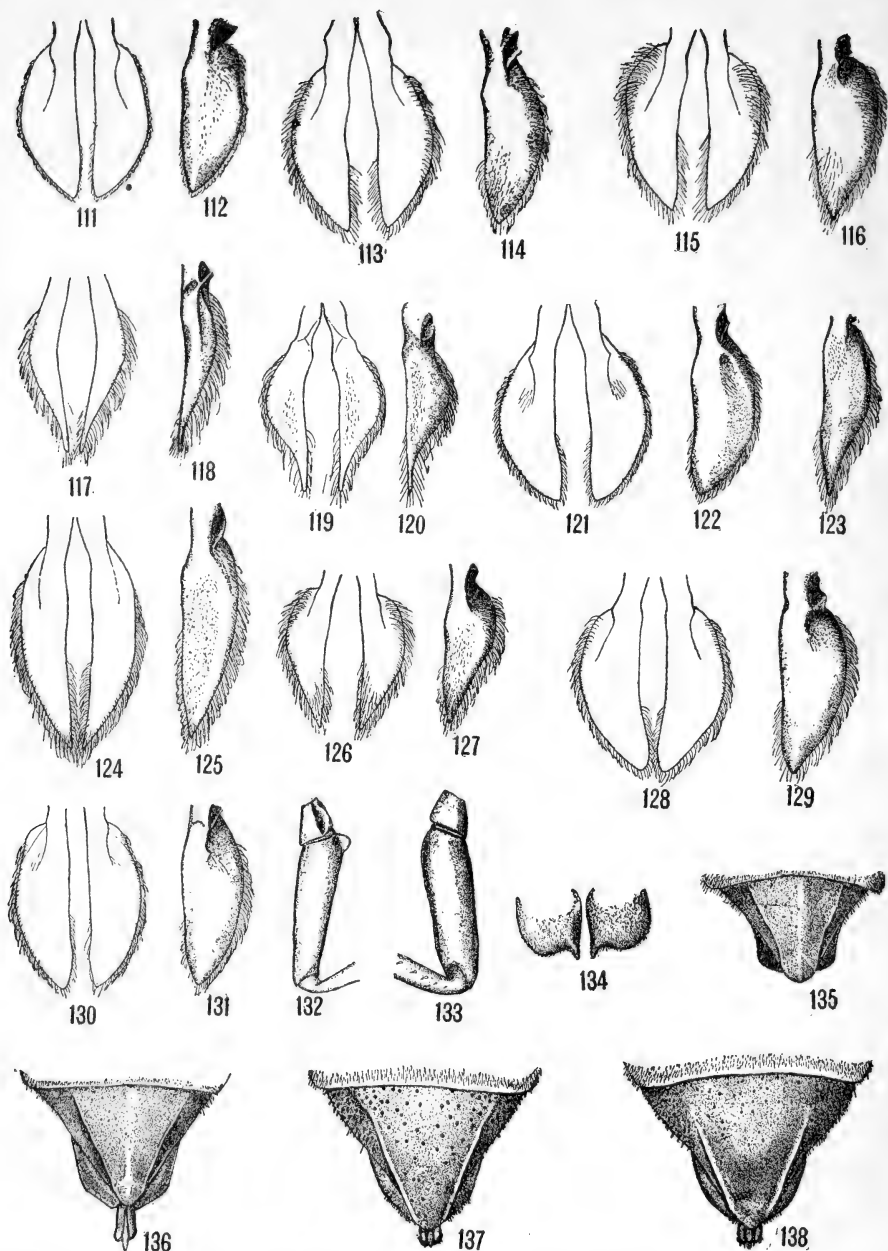
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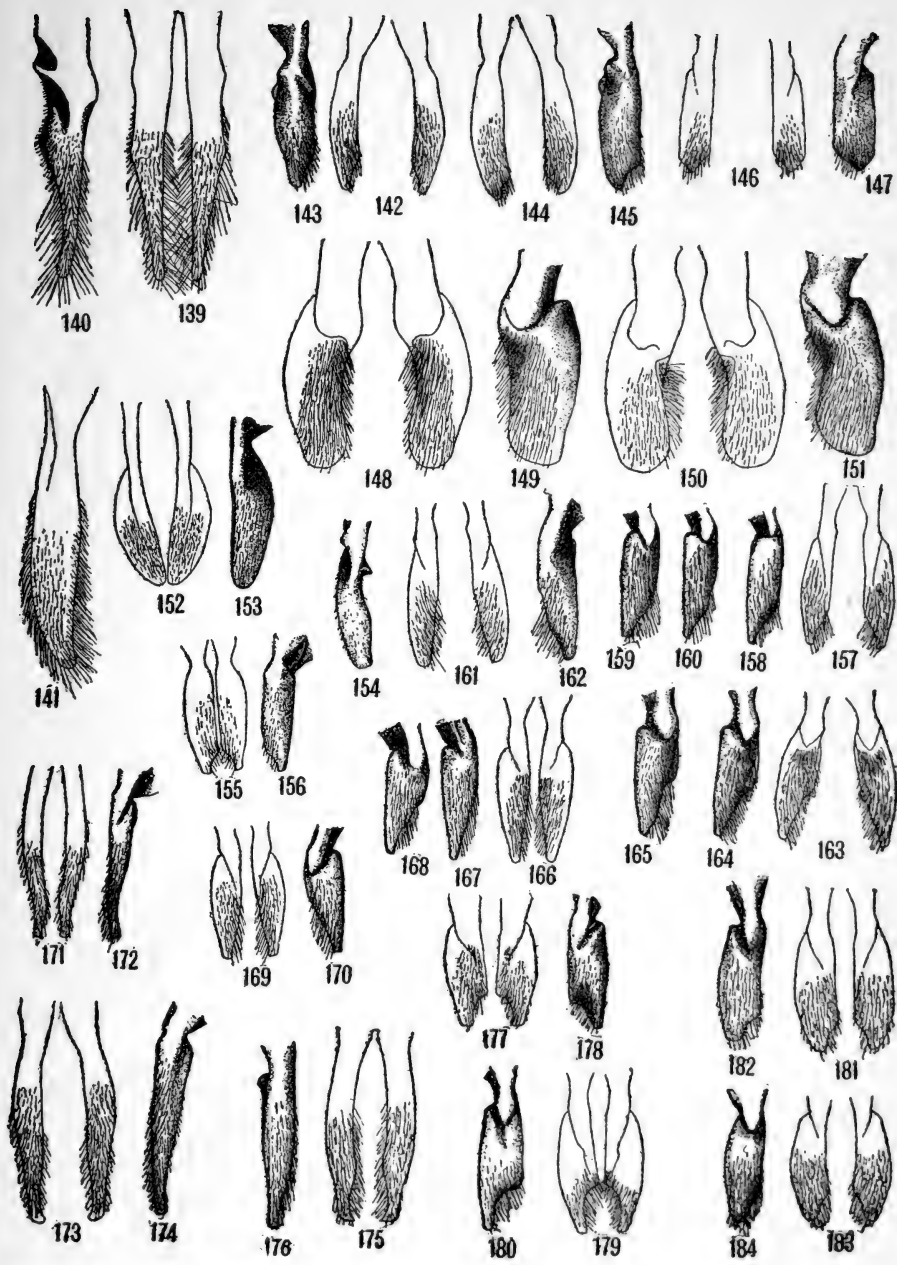
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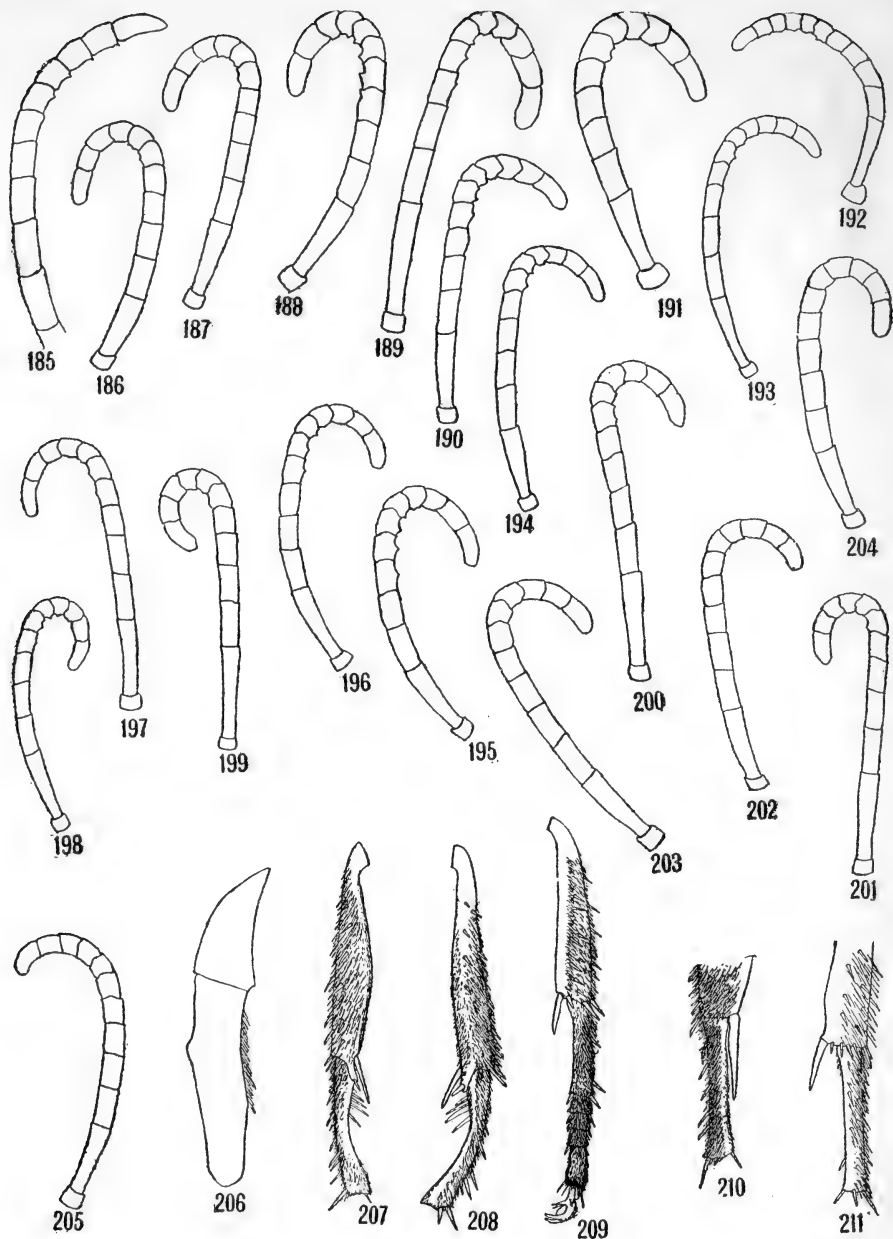
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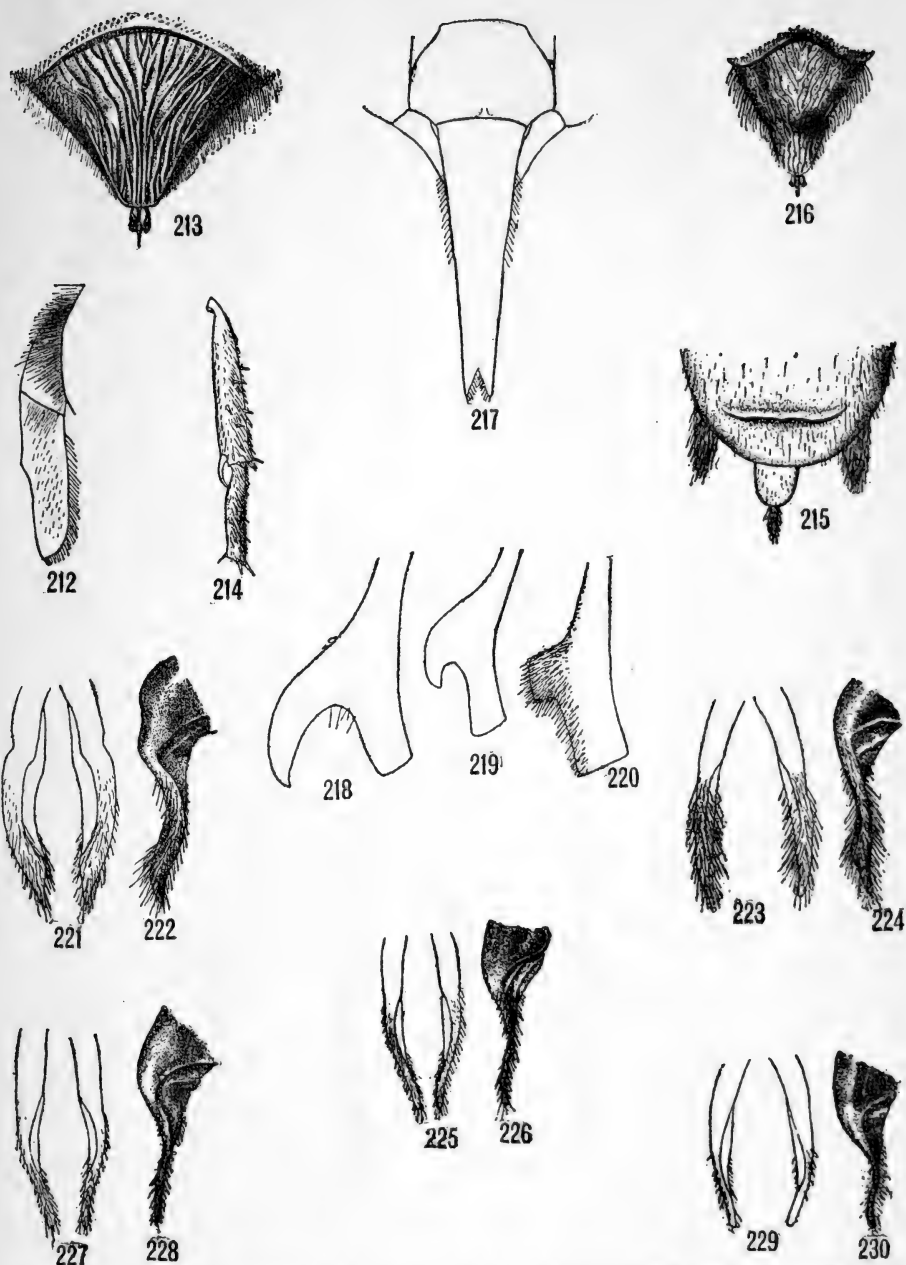
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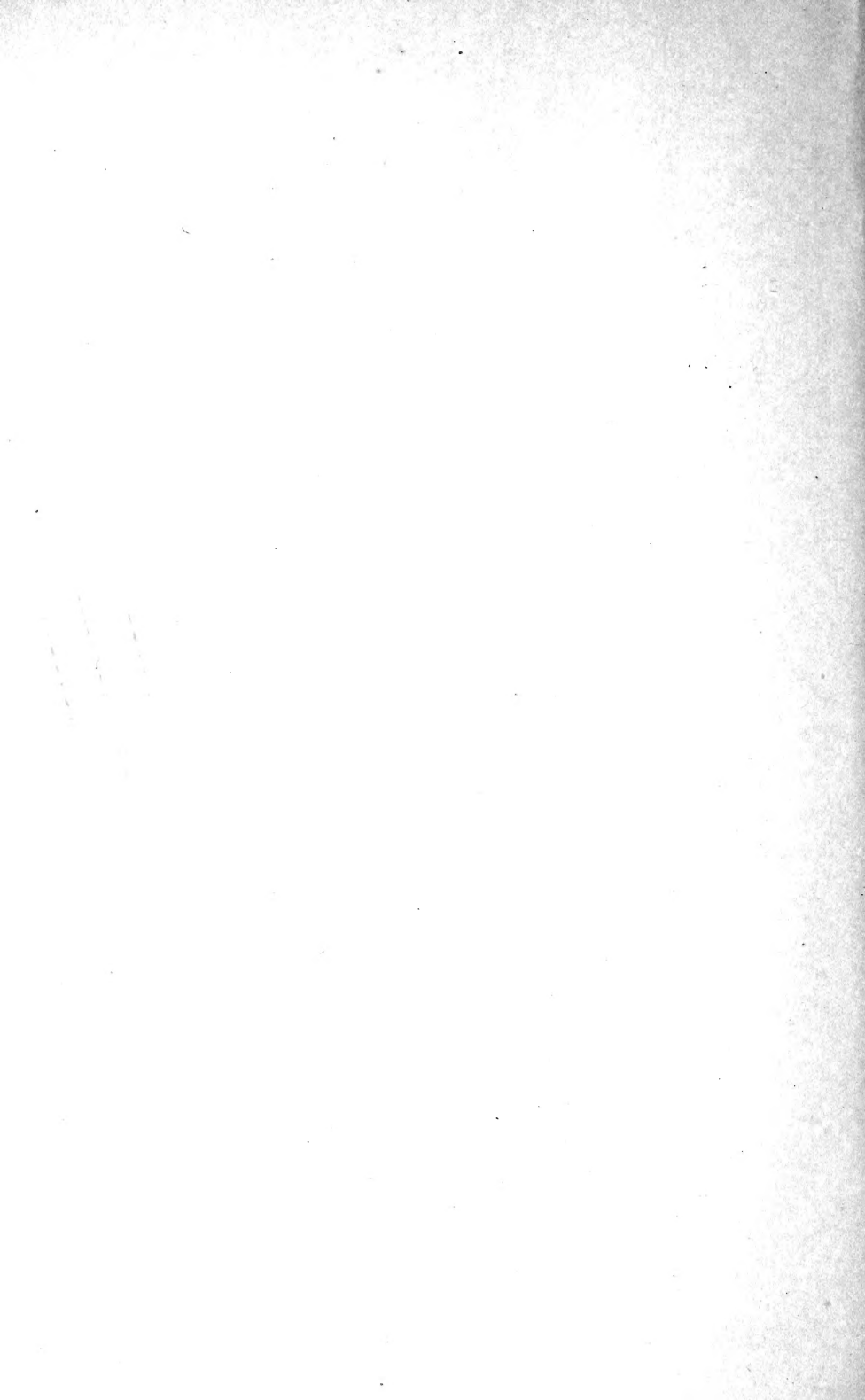
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AUTOBIOGRAPHY

I, John Bernard Parker, was born near Danville, Ohio, September 24, 1870. My early education was obtained in a rural school. From 1886 to 1888 I attended a normal school at Danville, Ohio, and from 1888 to 1894 I taught in the rural schools in that vicinity, at the same time keeping up my studies in preparation for college. In 1894 I entered the College of Arts, Philosophy and Science of the Ohio State University, and in 1898 received the degree of Bachelor of Arts. From 1898 to 1900 I was Fellow and Assistant in the Department of English at the Ohio State University, and in June, 1900, I received the degree of Master of Arts. From 1900 to 1906 I was a teacher in the South High School of Cleveland, Ohio; from 1906 to 1908, a graduate student at Ohio State University; 1908 to 1910, Assistant Entomologist, Kansas State Agricultural College, Manhattan Kansas; and since 1910 I have been in charge of the Department of Biology, Catholic University of America, Washington, D. C.





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