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Author(s): T. D. A. Cockerell

Source: *Proceedings of the Academy of Natural Sciences of Philadelphia*, Vol. 48 (1896), pp. 25-107

Published by: [Academy of Natural Sciences](#)

Stable URL: <http://www.jstor.org/stable/4062171>

Accessed: 24/03/2014 15:13

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THE BEES OF THE GENUS PERDITA F. Smith.

BY T. D. A. COCKERELL.

In attempting to teach entomology to the students of the New Mexico Agricultural College, the difficulty was early felt, that there existed no work treating in an adequate manner of any group of insects obtainable in the vicinity. While it was possible to indicate the outlines of the subject without any very profound knowledge of the insects which were collected and studied, it appeared to the writer that this superficial method of work could not lead to the best results. It is quite true that an ordinary student has not time to master even the families of insects; but the writer has long felt persuaded that the plan of teaching the elements without entering into detail is essentially a vicious one, calculated in extreme cases, even to convey a totally false impression of the true lessons of biology.

In the first place, the main purpose of biological study in education is not so much to load the mind with information, as to prompt a habit of observation and deduction. Owing to the unfortunate trend of the present educational system, the students almost invariably come to the entomology class prepared to learn by heart any lessons that may be assigned to them, but very ill-prepared to notice what has not been actually pointed out. It is, perhaps, not an exaggeration to say that the average junior or senior student in a college possesses less inclination and ability to notice and compare than a child of from five to ten years of age.

The entomological studies, if successful, should tend to break down this acquired mental habit, and restore in some measure the inquisitiveness of childhood. Therefore, nothing can be worse than limiting the student's knowledge by what may be written in a textbook, and checking his budding interest in every direction by "I don't know," with the implication that it is no use trying to find out. The idea that *some* facts are to be regarded by the student, and all others ignored, is an entire perversion of the proper spirit of biological inquiry.

Another consideration is, that after all the cell, the individual and the species are the three natural units in biology, without a just conception of which, all reasoning must be futile. The orders, families, genera and other higher groups do not stand at all on the same plane, being essentially artificial arrangements for convenience in classification. Consequently a student who might be thoroughly acquainted with the higher groups and ignorant of species, would be very little prepared to form just conceptions of the phenomena of life.

When these ideas dawned upon the writer, he was somewhat disconcerted to reflect that in the whole range of zoology he possessed an intimate acquaintance with only two series, the slugs in Mollusca and the Coccidæ in Insecta. Of the former, which might have been used in zoological studies, there is but one species in New Mexico, and that not found in the neighborhood of the college; of the latter, the species are more numerous, but very unsuited for the purpose required, since they are exceptions to almost every ordinary entomological rule.

It is perfectly true, that there already exist many very admirable monographs of North American insects of different groups; but there are two reasons why even the best of these do not entirely serve our purpose. The first is, that comparatively little collecting has been done in southern New Mexico, so that many of our very common species are even unknown to science, and, therefore, not to be found in the monographs; the second, that very few of the published writings contain anything like a careful account of the habits of the species. One of the very first lessons that the student has to learn is that structure is as intimately related to environment, as lock to key, and a work which practically ignores one side of this question cannot be entirely satisfactory.

The nearest approximation to what is wanted is found among the higher lepidoptera, which are illustrated by such admirable works as those of Scudder and W. H. Edwards. Yet these insects are not very easily studied by a beginner, except in a superficial way, nor is their classification yet upon a perfectly sound basis. So finally, it was concluded to take up the bees and endeavor to work them up in such a manner that they might be used as desired. They are good typical insects, their principal structural characters are easily observed, their habits are most interesting, and they abound in New Mexico. Moreover, the bee-studies go very nicely hand-in-hand

with flower-studies undertaken in botany, the relations between bees and flowers being among the most fascinating phenomena in natural history.

The present essay on *Perdita* is the first step toward the realization of the above mentioned ideal. Imperfect as it undoubtedly is, it has grown like a mushroom under the hands of the writer; so that the probability of finishing the whole series of bee-genera seems remote indeed, if each is to increase in a similar fashion. Seventeen North American species of *Perdita* were known before the writer began to study them; of these, two are not considered valid, but 55 have been added, bringing the list up to seventy! Thus, in number of species described, *Perdita* becomes at a bound the largest of North American bee genera.

MATERIAL EXAMINED.

By far the greater part of the material studied has been collected by the writer in New Mexico. With great kindness, Mr. W. J. Fox loaned a series of specimens containing his Lower Californian types, and all the species of Cresson except *cephalotes*, as well as several herein described as new. In various other ways, such as comparing types, Mr. Fox has throughout the whole investigation given invaluable assistance. Mr. C. F. Baker was so good as to send me the specimens he and his wife had collected in Colorado, which included some new forms. Mr. C. Robertson has given some very valuable information regarding the habits of the two eastern species. Some interesting species have been found by students of the college, Miss Mae Gilmore, Miss J. E. Casad, Mr. Alfred Holt and Mr. C. Rhodes, as duly indicated below. My botanical colleague, Professor Wooton, found one new species.

The writer has seen all the species treated of, except *cephalotes*, *halictulus* and *bicolor*. Of the 70 species, 26 are known in both sexes, 26 only in the ♂, 18 only in the ♀. 23 are at present only known from uniques. The flower-visiting habits of 50 species are known. The nesting habits are as yet unknown.

CHARACTERS USED.

It is hoped that those who may have occasion hereafter to describe species of *Perdita* will read this section, as a study of the published descriptions shows that some important characters are almost always omitted.

The coloration of the head and thorax is black, green or blue; frequently the parts are not colored alike, the metathorax especially being usually bluer than the mesothorax and scutellum. The metallic color does not extend on to the abdomen, except to a slight extent in *interrupta*. The sculpture of the metallic portions differs, and a good character is found in the smoothness or otherwise of the mesothorax; in some it is very smooth and shining, in others granular or striatulate and comparatively dull. The dulness or otherwise of the front, and the punctation of the area close to the ocelli, may also be used.

The pale markings may be absent; when developed they are from pure white to deep yellow, never red, though the yellow of many males may be reddened by cyanide. The reddest color observed is in the bright orange-rufous of the latter end of the abdomen in *crotonis*, and the orange-rufous legs of *foxi*. The abdomen, as in *laticornis*, may be bright ferruginous. These colors are entirely different from the scarlet induced by cyanide. In some species which live on yellow flowers (*luteola*, *beata*, *larrea*) the whole body-color is deep yellow, the dark markings being reduced to a minimum. No species is known similarly white, nor is any species all rufous like some forms of *Nomada*.

The head may be comparatively small, round, or broader than long or longer than broad; in some species it is very large and subquadrate. The males may or may not have a conspicuous tooth or spine on the cheeks beneath; this character appears to be a valid specific one, but appears in species which are not closely allied, (e. g., *larrea* and *pulchrior*), while it distinguishes certain forms from their closest allies, as *pulchrior* from *pallidior*, the latter having unarmed cheeks. It is to be observed that in the Mutillid genus *Spherothalpa* a similar state of affairs occurs, only it is the females that possess the armed cheeks. Thus *S. montivaga* is extremely like *S. megacantha*, but lacks the spine on the cheeks. *S. toumeyi* also differs from its allies by its spinose head. The character is, therefore, one of those which has been termed "kaleidoscopic."

The mandibles may be bifid at the tip (*laticornis*, *texana*), or may be notched within (*sphaeralcea* ♀) or even present a distinct tooth on the inner side (*aneifrons*). They are, however, usually simple, and more slender in the males. In the females of the *albipennis* group they are very stout and strongly elbowed, quite different from the

males. There is also a marked sexual difference in the mandibles of *ventralis*. The tongue differs in length and in the degree of development of the hairs. As will be seen below, the tongue has on two or three occasions proved useful in distinguishing allied forms (as *affinis* and *senecionis*), but it has not been studied throughout the series. In one instance, a useful distinction was found in the relative lengths of the joints of the maxillary palpi.

The form of the clypeus differs very much both between the species and the sexes of the same species (e. g., *ventralis*). For convenience I have compared the shapes noted to the outlines of different kinds of hats.

The degrees of hairiness of the face and cheeks, as also of the thorax (especially of the mesothorax) offer useful characters. The hairs are usually white, but may in part be grayish or brownish, or even, in a yellow species (*beata*), yellow. They are very rarely (*albovittata*) dense enough on the face to obscure the markings.

The antennæ present different grades of color (usually paler beneath) from yellow and orange to black. In the *albipennis* group the color of the flagellum has served to distinguish the males of allied forms.

The face markings at first seem complicated and hard to describe, but are easily reduced to a simple system. The face may be wholly dark, but if the pale marks are much reduced they are generally seen to linger last upon the clypeus. An exception to this is found however in *semicærulea*, with its shining yellow mark on each side of a perfectly dark clypeus. The clypeus may be wholly light, usually retaining a black dot on each side near the margin. The clypeal dark markings appear frequently in the form of two longitudinal black bars, as in *numerata*.

The lateral light markings of the face are commonly triangular, the inner angle being about opposite the dot on the clypeus, and the upper angle usually on a level with the antennal socket on the orbital margin. Sometimes the lateral mark extends up along the margin of the orbit much further; and it may terminate variously, being either pointed or truncate. The shapes of the lateral face marks afford excellent specific characters.

Above the clypeus, between its upper border and the level of the antennæ, is the *supraclypeal mark*, which differs very much in its degree of development, and even in its shape in some allied species. It may be produced upward in the median line to an enlarged yel-

low mark on the front, the *frontal mark*, but this is not very common.

Finally, just below each antenna may be a small subtriangular mark, which I have called the *dog-ear mark*, because of its resemblance to the ear of a hound, first observed in the ♂ form described as *canina*.

In the males the face is frequently all yellow or white up to the level of the antennæ; and then good characters are found in the degree of its further upward extension, and in the form of its upper limit.

The face markings are nearly always conspicuously different in the sexes, but not so in *albovittata* and the *albipennis* group, nor in *luteola*, nor the *texana* group.

The pale markings of the thorax are confined to different degrees of yellow on the prothorax, often affording good characters, and occasional very characteristic yellow patches on the pleura, except in *mexicanorum*, which has a yellow postscutellum, and *luteiceps*, which has a little yellow on mesothorax and scutellum. Two species, *punctosignata* and *cephalotes*, have the thorax yellow with black markings; *marcialis* has it yellow with green markings, the mesothorax being green with yellow lateral margins.

The wings may be simply hyaline or milky-hyaline, or slightly smoky; never really dark and never spotted or banded. The nervures and stigma may be dark brown, light brown, yellowish or colorless; the stigma is usually hyaline centrally. In the *texana* group the stigma is hardly developed.

Very good characters are found in the venation. The marginal cell differs greatly in size and length, but I never saw one so long as to suggest the condition of *Calliopsis*. It may be obliquely or squarely truncate. It may have the portion below the stigma (*substigmatal*) longer than that beyond (*poststigmatal*), but usually they are about equal or the latter is longer. There are but two submarginal cells; and the shape of the second, whether triangular or how much narrowed to the marginal, should in each case be noted. The so-called second submarginal is morphologically the third, the true second of genera with three submarginals being absent. On one side of the type ♀ of *obscurata*, the true second submarginal actually appears, small, triangular and petiolate, much as in the Larrid genus *Plenoculus*.

The third discoidal cell may be very weak or even entirely wanting, according to the development of the second recurrent nervure.

The legs may be dark or yellow, or variously marked with these colors, and the proportions of dark and light, though variable, afford good characters within reasonable limits. The anterior tibiæ are usually yellow in front at least.

The abdomen differs somewhat in shape, and may be either wholly dark or variously banded or spotted. In every case it should be carefully described, and the color of the ventral surface should also be mentioned.

The ♂ genitalia differ in one or two species I have examined, but I have not studied them sufficiently to be able to introduce them into the classification.

In addition to the above structural and colorational characters, too much stress cannot be laid on the importance of noting the exact localities and the flowers visited. Without the assistance derived from such information, it would have been impossible to unravel the *mentzeliae* series, or satisfactorily arrange the forms allied to *affinis*. Further, facts of this kind are invaluable in the difficult task of correctly associating the sexes.

The time of flight should also be carefully noted. Some species are vernal, others (the great majority) fly in late summer and autumn.

GEOGRAPHICAL AND VERTICAL DISTRIBUTION.

The species of *Perdita* are characteristic of the arid region of North America. Of the 70 species, 49 are found in New Mexico, and of these, no less than 34 are in the Mesilla Valley, in the Middle Sonoran (= lower part of Upper Sonoran) zone, at 3,800 feet. Ascending the Valley of the Rio Grande, four species were taken at San Marcial, one at Socorro and nine at Albuquerque, but at none of these places was more than a few day's collecting done. One species was found at San Augustine, on the east side of the Organ Mountains, but has since been observed in the Mesilla Valley. There can be no doubt that *Perdita* abounds throughout the Upper Sonoran zone in New Mexico.

At Santa Fé, 7,000 feet, in the transition zone of New Mexico, a good deal of collecting was done in two seasons, but the species of *Perdita* do not appear to be so numerous as in the Upper Sonoran. Only seven species were taken, although one or two were very numerous in individuals. In the mid-alpine zone no species were seen, either in New Mexico or in the three years residence in Colorado.

In Colorado, species of *Perdita* have been found at La Junta, Fort Collins, Estes Park and Glenwood Springs. On August 12, 1887, I found a species at Cottonwood Creek, Pleasant Valley, Fremont County, Colorado; it was sent to Mr. Ashmead, but the species was not determined. In my note-book I recorded that it was $3\frac{1}{2}$ mm. long, head black, thorax gray, abdomen red-brown; surely it was a new species, different from any herein described. A few species of *Perdita* have been found in other parts of the west—three in Lower California, three in California, three in Nevada. Two are known from Texas, one from the State of Chihuahua, Mexico. Two vaguely from Mexico.

In the Eastern States, *Perdita* is represented by only two species, *octomaculata* of the northern region, from Illinois to New Hampshire; and *obscurata* in the south, Georgia and Florida. One of the Rocky Mountain species, *albipennis*, extends northeastward to South Dakota.

As regards vertical distribution, one species, *sphæralceæ*, extends from the Mesilla Valley to Santa Fé, but the Santa Fé form is an easily distinguishable race. *P. lepachidis* extends unaltered from Socorro to Santa Fé; and *zebrata* and *chamæsarachæ* extend from Albuquerque to Santa Fé. *P. austini* and *bigeloviæ* extend from the Mesilla Valley to Albuquerque.

THE FLOWERS VISITED.

It may be laid down as a general rule that each species of *Perdita* visits normally but one species of flower, but occasional specimens may be found on flowers to which they do not normally belong. The exceptions to this rule are found in *P. octomaculata* visiting *Solidago*, *Coreopsis* and *Aster*; *P. cladothricis* visiting various Compositæ as well as *Cladotrix*; *P. pectidis* visiting *Pectis*, *Tribulus* and *Wedelia*; *P. fallax* visiting *Bigelovia*, *Verbesina* and *Pectis*; *P. phymatæ* visiting *Bigelovia* and *Gutierrezia*; and *P. semicrocea* visiting *Solidago*, *Bigelovia* and *Gutierrezia*.

In the case of several uniques, it is not certain that they normally belong to the flowers on which they were found. Thus a single *P. pulchrior* was found on *Bigelovia* at Las Cruces, and it would have gone in as a *Bigelovia* species but for its previous discovery on *Mentzelia* at Albuquerque. In the Mesilla Valley, toward and at the base of the Organ Mountains, are many species of flowers which should by all analogy have their species of *Perdita*. But the oppor-

tunity has not offered to make excursions to determine this at the right season, and we can only surmise that some of the uniques taken on *Verbesina*, *Bigelovia*, etc., will be hereafter found abundantly attached to some other plant in the neighborhood.

The flowers visited are cited in their systematic order, following the arrangement of Engler and Prantl, as recently adopted in the A. A. A. S. list. The number of known *Perdita* flowers is 25, of which 13, more than half, are Compositæ. Twelve species of flowers have furnished more than one *Perdita* species, the greatest number (12) being from *Bigelovia wrightii*.

It is to be explained in reference to the names used for the flowers, that the writer is in favor of using the earliest generic name in every case, when not preoccupied by a valid homonym; and also the earliest specific name when not preoccupied by a valid homonym in the same genus. But he is entirely opposed to the practice of displacing names because antedated by synonyms, which are not and never were deserving of recognition; and he does not consider a varietal name invalid because previously used for a different species, or a variety of a different species, in the same genus. He thus objects to the substitution of *Chondrophora* for *Bigelovia* (or *Bigelovia*), or of *Covillea* for *Larrea*. Likewise of var. *pilosus* for var. *villosus* of *Aster ericoides*.

SALICACEÆ.

- (1). SALIX. The willow-frequenting bees at Las Cruces in May are *Perdita salicis*, *P. numerata*, *Andrena salicinella* Ckll., *Andrena* n. sp., *Halictus* sp., and *Prosopis* sp. *P. salicis* abounds, but of *numerata* only one was taken.

AMARANTHACEÆ.

- (2). CLADOTHRIX CRYPTANTHA S. Watson. *P. cladothricis* abounds on this; it was rather surprising to find so simple a flower so abundantly visited by a particular species of bee. The genus *Cladothrix* has cited in the Index Kewensis only two species, both from Western North America.

NYCTAGINACEÆ.

- (3). WEDELIA INCARNATA (L.) Kuntze. Visited by *P. pectidis*. The *Boerhaavia*, common at Las Cruces, is not visited by *Perdita*; while the large purple *mirabilis* is, of course, a moth flower, and is visited by *Deilephila lineata*.

CAPPARIDACEÆ.

- (4). *CLEOME SERRULATA* Pursh. This is not found growing wild at Las Cruces, but it abounds from Albuquerque to Santa Fé and northward into Colorado, being visited in great numbers by *Perdita zebrata*. There is a not uncommon white-flowered form (*C. albiflora*) which I observed at Watrous, N. M., and other places.

While *P. zebrata* is the only *Perdita* of the *Cleome*, it has to compete with numerous bees of other genera. At Santa Fé, on August 2d, I noted that *Nomia punctata* was in full force on the *Cleome*, its hind legs loaded with the green pollen. Other *Cleome* bees at Santa Fé are *Melecta miranda*, *Anthophora*, *Megachile*, *Melissodes* and *Bombus*. At Albuquerque a *Calhopsis* is common on the *Cleome*; and I saw at this locality on August 16th, a humming-bird visiting it.

LEGUMINOSÆ.

- (5). *PROSOPIS JULIFLORA* var. *GLANDULOSA* (Torrey). The mesquite furnishes *Perdita exclamans* and *P. punctosignata*. Mr. Alfred Holt has also taken an *Anthidium* on mesquite at Las Cruces.

It will be noted that the generic name of this plant is the same as that of a genus of bees. This inconvenience might be avoided by spelling the bee-genus *Prosapis*, as has already been done by Mr. Ashmead (Hym. Colo., p. 31). The botanical genus has priority. The mesquite extends in modified form to sea-level in the neotropical region; it is, in fact, essentially a neotropical type.

ZYGOPHYLLACEÆ.

- (6). *TRIBULUS MAXIMUS* L. Visited by *P. pectidis*. The plant cannot be other than *maximus*, but it does not agree in detail with published descriptions. I have found the plant (though not the bee) as far north as La Junta, Colorado.
- (7). *LARREA DIVARICATA* var. *TRIDENTATA* (DC.). At San Marcial were found on this *P. marcialis*, *P. larree*, *P. larrearum* and *P. semicærulea*. The *P. larree* is colored yellow like the flowers of the plant. The genus *Larrea* consists of four or five species, confined to the Mexican region and the Argentine Republic. Our species is a variety of one of the Argentine ones.

EUPHORBIACEÆ.

- (8). *CROTON TEXENSIS* (Klotzch) Muell. Arg. At Albuquerque I found numbers of *P. crotonis* on this. The same plant is

common at Santa Fé, but yields no *Perdita*. The constancy of *Perdita* spp. to their proper flowers was well illustrated at Albuquerque, where on the *Croton* was only *P. crotonis*, while on the *Cleome* only 8 paces distant was only *P. zebrata*. At Las Cruces, *Croton neomexicanus* is common, but I found on it no *Perdita*, or even bees, only Larridæ and especially *Philanthidæ*, including *Aphilanthops taurulus*. This was on September 25th, and only staminate flowers were to be found. *Croton* is a very large genus, with many neotropical species, but also found in the tropics of the Old World.

MALVACEÆ.

- (9). SPHÆRALCEA ANGUSTIFOLIA Spach. Abundant and variable from Las Cruces to Santa Fé, in the former locality furnishing *P. latior* and *P. sphæralceæ*; in the latter a distinct race of *sphæralceæ*. At Santa Fé the *Sphæralcea* is visited also by *Epeolus*, *Bombus*, *Colletes*, *Melissodes*, etc. At Las Cruces it is principally visited by *Diadasia*.

LOASACEÆ.

- (10). MENTZELIA NUDA (Pursh) Torr. and Gray. Visited at Santa Fé by *P. mentzelicæ*, and at Albuquerque by *P. pallidior* and *pulehrior*. It is a favorite *Bombus* flower. The genus goes south to Chili.

UMBELLIFERÆ.

- (11). HYDROCOTYLE UMBELLATA L. Mr. Robertson reports *P. obscurata* from this. I have never myself found any *Perdita* on an Umbellifer.

SOLANACEÆ.

- (12). CHAMÆSARACHA CORONOPUS (Dunal) A. Gray. *P. chamæsarachæ* abounds on this at Albuquerque, and was also taken on it at Santa Fé. The genus is a small one, the Index Kewensis cites 1 Texas, Mexico, 2 California (here including our *coronopus*), 1 Mexico, and 1 Japan. Thus it is not apparently of neotropical origin.

COMPOSITÆ.

- (13). GUTIERREZIA SAROTHRÆ (Pursh) Britt. and Rusby. At Albuquerque were found on this, one each of *P. austini*, *gutierrezicæ* and *pallidior*—the last doubtless accidental.
- (14). GUTIERREZIA SAROTHRÆ var. MICROCEPHALA (Gray) Coulter. This is common at Las Cruces, and has furnished *P. austini*, *semicrocea*, *luteola*, *phymatæ*, *tarda* and *cladothericis*. On September 25th, a single ♀ *verbesinæ* was also taken on

it, but this was undoubtedly accidental, as *verbesinae* was extremely numerous on *Verbesina* close by, and if it had anything to gain by visiting *Gutierrezia*, it would be seen there more than once.

The genus *Gutierrezia* goes south to the Magellan Strait region. It is moderately numerous in species in the Mexican (Sonoran) region and arid region of the U. S., and again in in the southern part of the neotropical region, as far north as Chili.

- (15). *SOLIDAGO CANADENSIS* L. Fig 1. This common Golden-rod has a wide range over the continent, and extends from Las Cruces to Santa Fé, being usually seen on or about the acequia banks. Mr. Robertson records it as one of the plants visited by *P. octomaculata* in Illinois; in Colorado Mr. Baker has taken from it *bakeræ*, *affinis*, *sexmaculata* var. and *rectangulata*. At Las Cruces it furnished fair numbers of *semicrocea*, and a single *grandiceps*. It is worthy of note that it is not at all visited by *luteola*, or indeed any of the *Bigelovia* species except *semicrocea*.

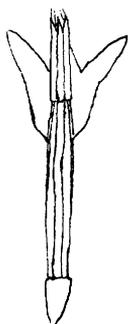


FIG. 1.

- (16). *BIGELOVIA WRIGHTII* Gray. Fig. 2. This is the very abundant *Bigelovia* of comparatively dry sandy ground between the river bottoms and the benches at Las Cruces and Albuquerque, N. M. Hitherto it had been confounded by us with *B. rusbyi*, owing to a specimen, apparently quite identical with our plant, having been so named at the California Academy of Sciences. As I was somewhat uneasy about this determination, Professor Wooton at my request sent a specimen to Columbia College, and word comes back that it is assuredly *wrightii* and not *rusbyi*. This explanation is needed, because I have sent out various insects labelled as from *B. rusbyi*.

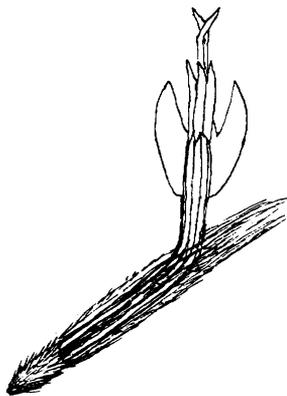


FIG. 2.

Besides being most prolific in *Perdita* species, this plant is wonderfully attractive to many kinds of insects. At Albuquerque I got from it *P. bigeloviae*, and among other things the ant, *Tapinoma anale* André, and quanti-

ties of a pretty Chalcidid, *Orasema viridis* Ashmead (Det. Dep. Agric.). The latter is new to the U. S. Fauna, having been only lately described from a specimen found at Tepic, Mexico (Proc. Cal. Ac. Sci., 1895, p. 553).

At Las Cruces I found on *B. wrightii* plenty of *P. luteola* especially, accompanied by *semicrocea*, *æneifrons*, *phymatæ*, *fallax*, *bigeloviæ*, *nitidella*, *austini*, while *cladothricis*, *pulchrior*, *maculipes* and *pellucida* were occasional. Here the flowers are peopled by the same species of ant, *Tapinoma anale* André (det. Ernest André) as was found on them at Albuquerque; its color is such as to render it inconspicuous. Three species of beetles are particularly noticed on the flowers, *Chauliognathus scutellaris* Lec., *Crossidius pulchellus* Lec., and *Clerus abruptus* Lec. (det. Wickham), of which the first two are yellow like the flowers, with some black; and the last (appearing in October) is beautifully marked with red, resembling at a glance *Sphærophthalma heterochroa*, which is found in the same vicinity, though never on flowers. Sundry Coccinellidæ, Chrysomelidæ and Bruchidæ also frequent the flowers. Some Heteropterous insects found on the flowers are colored yellow to escape observation; one of these, *Phymata fasciata*, is predaceous, and a serious enemy of the bees. So there are also yellow or yellowish Thomisidæ, and certain Bombyliidæ and Trypetidæ among the Diptera which visit the *Bigelovia* flowers are more or less strongly yellow—more especially the beautiful little *Phthiria sulphurea* Loew (see Psyche, January, 1895, p. 188). Among Hymenoptera, besides various bees, are found several Philanthidæ, Scoliidæ, Eumenidæ, Chalcididæ, Chrysididæ, etc., some of the species being new or rare in collections, for example, *Aphilanthops taurulus* Ckll., *A. quadrinotatus* Ashm. (heretofore only known from a specimen found at Denver, Colo.), *Acanthochalcis nigricans* Cam., and *Chrysis mesillæ* Ckll. The genus *Bigelovia* belongs especially to the arid region, but there are two species in Ecuador.

- (17). *CHRYSOPSIS VILLOSA* (Pursh) Nutt. This is properly a mountain plant (abundant, for example, in the mid-alpine of Colorado), but several vigorous plants are growing in a dry watercourse near the N. M. Agricultural College, the seeds having doubtless been washed from the Organ Mountains. On one of these I caught the unique of *P. vespertilio*. At Santa Fé I watched some *Chrysopsis villosa*, but only got one specimen of an *Anthophora*.
- (18). *ASTER ERICOIDES* var. *VILLOSUS* (Michx.) Torr. and Gray. Mr. Robertson reports this as visited by *P. octomaculata*.

- (19). *ASTER CANESCENS* var. *VISCOSUS* (Nutt.) Gray. Fig. 3. At Las Cruces this is freely visited by *P. asteris*. Two species of *Aster* which are common at Las Cruces, *A. spinosus* and *A. hesperius*, have produced no *Perdita*. The former is a weed of waste grounds, the latter occurs on the acequia banks, so they may not be natives of the immediate region. It has occurred to me that by watching the bees on a flower, some evidence might be obtained as to the length of time the flower has grown in the locality. Thus, to take an extreme class of cases, garden exotics are visited by comparatively few bees, and of course have none peculiar to them, as *P. asteris* to *Aster canescens* var.



FIG. 3.

- (20). *LEPACHYS TAGETES* (James) Gray. Visited by *P. lepachidis*; also, at Santa Fé, by *Melissodes*, *Agapostemon*, *Halictus* and *Bembex*.

- (21). *HELIANTHUS ANNUUS* L. Fig. 4. The sunflower is the flower of *P. albipennis*; very rarely a *verbesinæ* may also be found upon it. Other sunflower bees are *Panurgus*, *Melissodes* and *Andrena*, all at Las Cruces. *Phymata fasciata* also occurs on the sunflower heads. It is to be noted that the *Andrena* found on sunflowers at Las Cruces is not the same as Mr. Robertson's Illinois *A. helianthi*.



FIG. 4.

- (22). *VERBESINA ENCELIOIDES* (Cav.) Gray. Fig. 5. At Las Cruces this produces commonly *P. verbesinæ*, rarely *beata*, *perpulchra* and *albovittata*, and occasionally or accidentally *albipennis*, var. *vagans*, *laticeps* and *fallax*. In October I noticed *Apis mellifica* visiting the flowers in numbers; the honey-bee flies longer and visits more species of flowers than any wild bee I know, and must surely prove rather a serious competitor of the wild species. The competition would be most severely felt, of course, in those years when, owing to unfavorable weather, the flowers were less numerous than ordinary.

The yellow bug *Phymata fasciata* Gray, abounds on the *Verbesina*; on September 28th, I found one which had caught a *P. verbesinæ*. This *Phymata* not only preys on bees, but the butterfly, *Lycæna exilis*, the house fly, *Musca domestica*, and doubtless many other insects. Another enemy of bees which is found on *Verbesina* is a Thomisid spider; on September 22d, I found one of these had caught a *P. verbesinæ*.

There are various other *Verbesina* bees, including the pretty *Agapostemon melliventris*, which also appears in the spring, then visiting *Sisymbrium* and *Streptanthus*.



FIG. 5.

- (23). *BIDENS ARISTOSA* (Michx) Britt., (= *COREOPSIS ARISTOSA* Michx). Mr. Robertson cites this as visited by *P. octomaculata*.
- (24). *SENECIO DOUGLASHII* DC. On this Professor Wooton found *P. senecionis*, as also an *Andrena* and other bees.
- (25). *PECTIS PAPPOSA* Gray. This is visited by *P. pectidis*, but *cladotrichis*, *fallax* and *biparticeps* have also been taken on it, while once only a *luteola* was seen in the net after sweeping *Pectis*. The flowers are frequented by an ant, *Dorymyrmex pyramicus* Rog. (det. André). One also finds upon them *Panurgus* (commonly) and *Epeolus* (rarely), as well as sundry Philanthidæ and Bombyliidæ, etc. The genus *Pectis* has many neotropical species, extending even south to the Argentine Republic. It has also West Indian representatives in Cuba, San Domingo and Curaçoa.

In reviewing the above list of plants, it will be readily seen that *Perdita* does not usually frequent the boreal types of flowers, but rather those which extend northward from the neotropical region. This, taken with the known distribution of the genus, strongly suggests that in the main we have to do with an austral series of types, which have spread northward and become largely differentiated into species since the glacial epoch. *P. octomaculata*, however, must be looked upon as a survival from preglacial times; and here it is especially significant that *affinis* and *senecionis*, which more especially represent *octomaculata* in the west, are the very ones which visit boreal flowers, *Solidago* and *Senecio* to wit. Further, *bakeræ* which does indeed visit *Solidago* also, shows every indication of being a recent derivative from the *Cleome* type *zebrata*; an in-

stance, in fact, of the neotropical immigrants adapting themselves through modification to subboreal conditions.

Another thing that deserves notice is the relationship between the size of the bees, the length of their tongues, and the kinds of flowers. It would appear that a longer tongue is not always developed independently to meet requirements, but that the total size of the bee may be increased, and with it the tongue. Or conversely, the size of the bee may be reduced. Speculations of this kind are, perhaps, not very profitable, but it will be advantageous to give the facts which suggest them.

Close to the N. M. Agricultural College *Verbesina encelioides* and *Bigelovia wrightii* grow in the utmost profusion. In September collections were made off both, the plants being but a few yards from one another, with the following results:—

VERBESINA:—*Perdita*, *Calliopsis*, *Panurgus*, *Melissodes*, *Cælixys*, *Andrena*, *Epeolus*; but on October 5th when the *Bigelovia* was getting over, *Halictus ligatus*, *H. pectoraloides* and *Agapostemon melliventris*.

BIGELOVIA:—*Perdita*, *Agapostemon*, *Anthophora* (small species), *Megachile* (one), *Colletes*, *Halictus* ♂, *Halictus stultus* ♀, *Prosopis*, *Nomia nevadensis*.

Thus it will be seen that the bees of these two plants were almost entirely of different genera in September, those on the *Verbesina* being Apidæ with few exceptions, those on the *Bigelovia* largely Andrenidæ. But as the *Bigelovia* began to be over, the large Andrenidæ visited the *Verbesina*, which had given a second crop of flowers. Now although *Perdita* appears equally in both lists, the species are different, and if we except unique specimens, as we justly may, those on the *Verbesina* are of larger size, those on the *Bigelovia* comparatively small. The abundant larger *verbesinæ* is never seen on *Bigelovia*, nor the not less abundant smaller *luteola* on *Verbesina*.

And when we come to look at the *Perdita* spp. of the *Gutierrezia*, they average still smaller than those of the *Bigelovia*.

I am fortunate in being able to present some figures of the flowers of some of the *Perdita* Compositæ, drawn by Miss Mae Gilmore under the supervision of Professor E. O. Wooton. As they are all on the same scale, (diam. x 5) the reader will be able to form his own conclusions by studying them in connection with the facts above cited. "The honey . . . in Compositæ is secreted by a ring surrounding

the style at the base of a narrow tubular corolla, and as it accumulates it rises up into the wider part of the corolla where it is accessible to the most short-lipped insects, and where the anthers shelter it from rain."—(Hermann Müller). In the *Bigelovia*, *Aster* and *Solidago* the tube is seen to be narrow, permitting the rapid rise of the nectar, and probably preventing the insertion of the tongue of large bees. Hence, these flowers are visited only by the smaller species of *Perdita*, with other small Apidæ and Andrenidæ. In *Verbesina* and *Helianthus* the tube is wider, doubtless permitting the larger bees to readily insert their tongues; but it is narrower at the neck than *Bigelovia* or *Solidago*, preventing small insects from so readily thrusting their heads inward to stretch for the nectar. The wider tube also may prevent the nectar from rising so far, while in *Helianthus* there is a large bulb to contain it.

Solidago canadensis is commonly cultivated in gardens in Europe and there H. Müller mentions only flies as visiting it (Fertilization of Flowers, p. 321), though he gives a further reference to a paper which I have not seen. With us, as has been shown, it is native and visited by several bees.

THE NATURE OF SPECIFIC DIFFERENCES.

It is a commonplace observation that specific characters are of all kinds, and may be either strongly marked or difficult to discern. A very small amount of study teaches us that there is no essential difference between those characters called specific and those called varietal; in fact, the very same kind of difference which marks species in one group, may only mark varieties or mutations in another. Thus we come to see that the essential distinctions between species are physiological, the morphological ones being only valid for diagnostic purposes just so far as they happen to coincide with the physiological.

There are even what I have termed "physiological species," i. e., species separated only by habit; not at all, so far as we can judge, by structure, or if at all, in only a very slight degree. I have elsewhere cited examples of this kind in Coccidæ, but in Hymenoptera we find many instances in which the tangible characters are reduced to a minimum. Thus, Schmiedeknecht cites the case of *Bombus silvarum* var. ♂ *nigrescens* Perez, a submelanic mountain form, which is only to be separated from *B. pratorum* by an examination of the genitalia. Among the European *Sphécodes* also, a study of

microscopical characters has led to a remarkable increase in the number of recognized species. Only the other day, I received a new part of Marshall's Monograph of British Braconidæ, in which the following paragraph is sufficiently significant:—

“Nearly a dozen species [of *Aspilota*] have been indicated or described; their inconstant characters render precise definition extremely difficult, and tabulation almost impossible. . . . Accident has brought to light some facts relative to one species, *nervosa* Hal., from which it appears that the varieties mentioned by that author [Haliday] belong almost certainly to several distinct species. The *fuscicornis* Hal., requires to be elucidated in a similar way, for the capture and examination of isolated examples of unknown origin, lead to very uncertain results.” (Tr. Ent. Soc. Lond., 1895, p. 375).

Now in *Perdita* precisely the same state of affairs occurs, and it will thus be found that while certain species (e. g., *crotonis*, *luteola*) are very easily recognized, some others (e. g., *bakeræ*, *verbesinæ*) are almost as well to be called races or varieties as species. In the opinion of the writer, we have indeed the process of evolution going on under our eyes, the puzzling forms being those which have only lately segregated themselves, and have not yet developed striking peculiarities.

Take for example *bakeræ*, the closest ally of the *Cleome* species *zebrata*. It does not appear to differ more from *zebrata* than the mutations of the latter do from one another, and in the female is practically identical with it so far as outward signs go. But the ♂ *bakeræ* has a slight but constant difference in its wider supraclypeal mark, and it also differs in its genitalia. These differences would never have been noticed, in all probability, had not *bakeræ* been observed to differ in its habits from *zebrata*, to frequent not the *Cleome*, but Golden-rod. In fact, the similarity is so great that Mr. Fox, after seeing specimens, expressed the opinion that *bakeræ* was a synonym of *zebrata*.

Another case, not less perplexing, is found in the *albipennis-verbesinæ-lepachidis* series. The males of this series, placed in a row, readily separate into those which have narrow yellow bands on the abdomen and those which have not. Those with the bands separate into a series with the flagellum orange, and one with it blackish, and it is seen that the former are from *Verbesina*, the latter from *Helianthus*.

Now the females of this series (that of *lepachidis* being unknown) separate at once into those with broad distinct yellow abdominal bands, and those with the abdomen only spotted. The former are from *Helianthus* (rarely from *Verbesina*), the latter very abundant on *Verbesina*. But now we find, to our surprise, that some of the males with yellow on the abdomen belong to the spotted females, and come from *Verbesina*; while others (with the dark flagellum) belong to the well banded *Helianthus* females. Further than this, other males without the yellow belong to other well banded *Helianthus* females from a different locality. Thus among the *Helianthus* forms (*albipennis*) the females from two localities (La Junta and Las Cruces) are hardly at all different, while their males are decidedly different; and the male of the Las Cruces form more resembles the ♂ of *verbesinæ*, which is common on *Verbesina* in the same locality. But the Las Cruces males differ from *verbesinæ* in the color of the flagellum; while the La Junta males, differing from *verbesinæ* in the abdomen, resemble it in the antennæ! The difficulty is still further increased by the occurrence of individual varieties presenting other combinations of the "specific" characters. In such a case as this we should be hopelessly adrift without biological observations. There is no apparent reason why the variations in clypeal markings should not be just as "specific" as those in the color of the flagellum, or (as in *lepachidis*) in the color of the head and thorax. Mr. Fox, after examining a series, concludes that we do not know the ♂ of *albipennis*, and that my *albipennis* ♂, *verbesinæ* and *lepachidis* are all varieties of *hyalina*. But all this is contradicted by actual observation of the insects on the flowers. The characters which I have used occur uniformly in series from the same flowers, except in the case of widely separated localities, where they are still uniform for a given flower in a given locality. There will be very rarely an individual proper to one flower found on another, as one or two *helianthi* on *Verbesina*, but such exceptions do not vitiate the general rule. Some characters, as the difference in clypeal markings, belong especially to no one of these series, and hence have no specific value.

If, as believed, evolution is in progress among the species of *Perdita*, we are naturally led to seek for evidence of natural selection. In some cases, as of the yellow *luteola*, *beata* and *marcialis*, all on yellow flowers, we note at once the utility of the peculiarity; and when we see the yellow predaceous bug *Phymata* also on the flow-

ers, the whole matter seems clear. Yet it must be confessed that on *Verbesina* the yellow *beata* is extremely rare, while the dark *verbesinæ* abounds.

The face-markings, so distinctive of species, differ greatly as a rule in the sexes, and in most species are very constant. There is every probability that they serve as recognition marks; and it is here significant that when they are very variable, as in ♀ *zebrata*, there is no other species of *Perdita* on the same flowers that could be confused with the varying one.

The species appear to be all single brooded, but the great resemblance between the vernal *numerata* and the late summer *bigeloviæ*, suggested the possibility of double-brooded seasonally dimorphic species. The strongest fact, however, that militates against this idea is that there are so many more late summer and autumn species than vernal ones, while the eastern *octomaculata* is represented by no congener at all in the spring.

Another question arose as to the possibility of dimorphism in the males of some species; references to this matter, which deserves further study, will be found under the species concerned.

It will be observed that the grouping of the species is arbitrary, those being associated which the student is likely to meet with on the same flowers, or in the same part of the country. This was done because it was felt that no natural arrangement could yet be arrived at, and a purely artificial one, based solely on considerations of convenience, was better than one which might give a false idea of relationships. The difficulty arises in many cases from the so-called "kaleidoscopic" characters, the possession of which by two species does not necessarily imply descent from an ancestor exhibiting them. Thus *luteola* and *beata* are colored alike in almost every detail (except the black on the pleura of *beata*), and are extremely different from any other *Perdita*. But *beata* in its size and hairy mesothorax approaches the *albipennis* group and departs widely from *luteola*. The character of armed cheeks has already been referred to, and several others might be cited. How strangely the several "specific" characters may appear or disappear, is shown well in the series of *albipennis* and *verbesinæ*.

There is, however, one natural group, that of *texana* and *latior*, which is very distinct and may ultimately be regarded as forming a distinct genus. F. Smith's generic name *Macrotera* has been used for *texana*, but perhaps incorrectly.

Summing up, the writer has to express the opinion that variations in *Perdita* certainly do not occur indefinitely in all directions, but that they do occur independently, so that the several species differ from one another hardly so much in absolute characters, as in the various combinations presented of similar or identical characters. Furthermore, it is apparent that the earliest distinctions between species are at least often of a very subtle character, so that the workings of natural selection during the actual process of segregation are anything but easy to observe. And this need not surprise us when we reflect that among ourselves constitutional characters, not easily identified by any coincident structural features, play so large a part in determining our ability to reach manhood and beget offspring.

ARTIFICIAL KEY.

(Note.—The numbers before the specific names coincide with the numbers of the same in the descriptive portion.)

- | | |
|--|---------------------------|
| Entirely yellow, with no conspicuous markings | 1 |
| Yellow or orange, with dark markings | 3 |
| Head and thorax dark | 5 |
| 1. 8 mm. long, mesothorax pubescent, pleura with a black patch | 63 <i>beata</i> ♀ |
| About 4 mm. long, head very large, cheeks armed | 15 <i>larrea</i> ♂ |
| Over 5 mm. long, head ordinary, cheeks unarmed, mesothorax not pubescent | 2 |
| 2. Antennæ dark above, a black line before the eyes, | 55 <i>luteola</i> ♀ |
| Antennæ not dark, a black dot before the eyes . | 55 <i>luteola</i> ♂ |
| 3. Extremely small, cheeks armed, mesothorax mostly green, | 16 <i>marcialis</i> ♂ |
| Not so small, vertex with a black band from eye to eye, thorax with black markings | 4 |
| 4. Size 6 mm., head very large, abdomen without distinct bands | 34 <i>cephalotes</i> ♂ |
| Size 4½ mm., head not very large, abdomen with distinct bands | 35 <i>punctosignata</i> ♂ |
| 5. Abdomen orange, or orange-brown, or ferruginous; not banded, unless at base | 6 |
| Abdomen dark brown, or black, or spotted, or banded . . | 13 |
| 6. Head large, abdomen short and broad, ferruginous, marginal cell obliquely truncate, mandibles bidentate . . . | 7 |
| Not so | 8 |

7. Head brown, thorax black 1 *texana* ♂
 Head and thorax dark green 2 *latior* ♂
8. Cheeks toothed beneath, legs entirely yellow . 14 *pulchrior* ♂
 Cheeks unarmed 9
9. Face all dark 10
 Face partly pale 11
10. Nervures colorless, abdomen orange 54 *semicrocea* ♀
 Nervures fuscous, abdomen dark testaceous, 32 *halictoides* ♀
 Nervures ferruginous, abdomen ferruginous . . 33 *bicolor* ♂
11. The pale color confined to clypeus and triangular marks at
 side of face 20 *chamæsarachæ* ♀
 Face all light below antennæ; length 3½ mm 12
12. Area between eyes and ocelli smooth and shining like meso-
 thorax, 2d segment of abdomen with a dark band, vertex
 and mesothorax not blue 54 *semicrocea* ♂
 Area between eyes and ocelli distinctly granular, much
 duller than the shining mesothorax, 2d segment of abdo-
 men without a band, vertex and mesothorax dark blue,
 20 *chamæsarachæ* ♂
13. Clypeus entirely dark 14
 Clypeus not entirely dark 24
14. Abdomen piceous with yellow spots or dots, legs with yellow
 markings 15
 Abdomen not spotted 16
15. Length about 6 mm., abdomen with only 4 pale dots . .
 26 var. *punctata* ♀
 Length about 5 mm., abdomen with 6 pale yellow spots or
 blotches 26 *sexmaculata* ♀
16. Abdomen black with pale yellowish bands 17
 Abdomen not banded 20
 Abdomen dark brown, with a short white band on 2d seg-
 ment; size very small, less than 4 mm. . 41 *cladotrichis* ♀
 Abdomen testaceous with suffused bands, mesothorax
 smooth, shiny 6 *ventralis* ♀
17. Stigma brownish, mesothorax hairy, size larger, 7 mm. or
 over 18
 Stigma entirely pallid, mesothorax practically nude, size
 smaller, not over 6 mm. 19
18. Nervures almost colorless 22 *sphæraleceæ* ♀
 Nervures dark brown 22 v. *alticola* ♀

19. Anterior femora mostly black, abdomen with heavy dark bands 12 *mentzelix* ♀
 Anterior femora entirely pale, abdomen with evanescent bands 13 *pallidior* ♀
20. Head and thorax piceous, marginal cell obliquely truncate, abdomen ovate, size rather large 1 *texana* ♀
 Thorax black except the green metathorax; head green, front æneous 53 *æneifrons* ♀
 Thorax black except the blue metathorax; head blue; a yellow spot on each side of clypeus . . . 18 *semicærulea* ♀
 Head and thorax green 21
21. Females 22
 Males, size small, nervures and stigma testaceous, fore tibiæ yellow in front 4 *arcuata* ♂
22. Abdomen broad, mandibles bidentate, marginal cell obliquely truncate 2 *latior* ♀
 Not so 23
23. Small, about 4½ mm. long, nervures brown . . . 52 *phymate* ♀
 Larger, nervures nearly colorless 68 v. *nigrrior* ♀
24. Face below level of antennæ all yellow or white, except clypeal dots in some. Males 25
 Face below level of antennæ not all pale 43
25. Face below antennæ white 26
 Face below antennæ yellow 28
26. Last three segments of abdomen rufous, the other banded
 19 *crotonis*.
 Abdomen yellowish-white, banded, face below antennæ pellucid white, first 4 legs all dull white except a dark streak on middle tibiæ 50 *pellucida*.
 Abdomen dark brown with white markings 27
27. Abdomen with about 6 white marks, or fewer yellowish spots 42 *pectidis*.
 Abdomen with two more or less developed white bands,
 41 *cladothricis*.
28. Legs black with a little yellowish 25 *affinis*.
 Anterior and middle femora marked with black, cheeks unarmed 29
 Anterior femora all yellow, the 4 anterior tibiæ not all yellow 33
 First 4 legs all yellow, or at least not marked with black or brown 34

29. Nervures pallid 22 *sphaeralceæ*.
 Nervures dark 30
30. Face and disc of mesothorax nearly bare, face below antennæ bright yellow 31
 Face and disc of mesothorax hairy 32
31. Very small, abdomen yellow with pale suffused brown bands 43 *biparticeps*.
 Larger, abdomen dark with clean-cut interrupted light bands 27 *rectangulata*.
32. Head broader than long, distal band on 2d abdominal segment broadly continued to lateral margin, dog-ear marks with more or less of a dark border below . 22 v. *alticola*.
 Head round, distal band of 2d abdominal segment failing some distance before lateral margin 38 *hirsuta*.
33. Face all yellow (except the anteorbital spots) up to middle ocellus 29 *luteiceps*.
 Face not all yellow up to middle ocellus 49 *maculipes*.
34. Legs entirely orange-rufous, abdomen black, nervures brown 21 *foxi*.
 Legs not orange-rufous, abdomen banded 35
35. The yellow extending above antennæ in median line 36
 The yellow not extending above antennæ in median line 41
36. The yellow extending above across the face 37
 The yellow extending above only at sides and middle line 39
37. Larger, about 5 mm. long, face-markings resembling *gutierrezie* 48 *bigeloviae*.
 Smaller, about 4 mm. long 38
38. Face yellow up to anterior ocellus 37 *martini*.
 Face not yellow up to anterior ocellus 45 *gutierrezie*.
39. Upward extension of yellow in median line narrow, shaped like a spear-head, abdomen above with only 3 or 4 bands, 40 *salicis*.
 Upward extension of yellow in median line broader 40
40. Incursion of blue downward terminating at a right angle; pleura dark 47 *nitidella*.
 Incursion of blue terminating at an acute angle; pleura largely yellow 36 *exclamans*.
41. Cheeks armed, abdomen heavily banded 12 *mentzelie*.
 Cheeks unarmed 42

57. Larger (4½ mm.), face less hairy, lateral face-marks shaped like the main-sail of a schooner 66 *vagans* ♂
 Smaller (4 mm.), face more hairy, lateral face-marks triangular 59 *vespertilio* ♂
58. Abdomen with 6 or 8 white marks 59
 Abdomen with yellowish markings 60
59. Mesothorax shiny; clypeus dark with a light spot; face-markings white 42 *pectidis* ♀
 Mesothorax dull; clypeus light with dark spots or bars; face-markings yellowish 51 *fallax* ♀
60. Face-markings white, 1st segment of abdomen largely blue, 5 *interrupta* ♂
 Face-markings yellowish or yellow 61
61. Postscutellum yellow 7 *mexicanorum* ♂
 Postscutellum not yellow 62
62. Nervures dark brown, lateral face-marks truncate above, clypeus light marked with dark, mesothorax dullish, abdominal marks very pale 25 *affinis* ♀
 Nervures colorless, lateral face-marks pointed above, clypeus dark marked with light, mesothorax shining, abdominal marks yellow 10 *obscurata* ♀
63. Larger species, length over 6 mm. 64
 Smaller species, 6 mm. or less 68
64. Males, abdominal bands narrow, inconspicuous, dull yellow, emarginate at sides 65
 Females, bands conspicuous 66
65. Front comparatively shining, flagellum blackish 69 var. *helianthi* ♂
 Front dull, flagellum orange 68 *verbesinæ* ♂
66. Abdomen white with black bands, clypeus white with two black dots 64 *perpulchra* ♀
 Abdomen dark with yellow bands 67
67. Nervures dark 67 *sparsa* ♀
 Nervures colorless 69 *albipennis* ♀
68. Clypeus hairy, legs black, face-markings and abdominal bands white 65 *albovittata* ♀
 Not so 69
69. Yellow at sides of face extending above level of insertion of antennæ: size very small 44 *austini* ♂
 Yellow or whitish at sides of face only extending to level of insertion of antennæ; size not so small 70

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70. Abdomen dark with light bands	48 <i>bigeloviae</i>	♀
Abdomen light with dark bands		71
71. Mesothorax very shiny, dark blue-green	47 <i>nitidella</i>	♀
Mesothorax dull, hairy, brassy-green	28 <i>snowii</i>	♀
72. Dog-ear marks absent		73
Dog-ear marks present, or at least represented by dots		83
73. Abdomen with the last two segments bright rufous, the others white with black bands	19 <i>crotonis</i>	♀
Not so		74
74. Bands of abdomen at least mostly entire		75
Bands of abdomen all interrupted		80
Abdomen dark without bands		82
75. Stigma solid dark brown or black, clypeus with two broad black bars, lateral pale areas of face pinkish, 39 <i>numerata</i>		♀
Stigma hyaline, at least centrally		76
76. Anterior legs entirely yellow, mesothorax dull, sides of face broadly yellow up to level of antennæ, then for a short way suddenly very narrowly	27 <i>rectangulata</i>	♀
Anterior legs partly black		77
77. The black bands of abdomen not united on lateral margin, anterior tibiæ all yellow, lateral pale triangle of face coming to a point above, face-markings lemon-yellow	8 <i>zonalis</i>	♀
The black bands of abdomen more or less united on lateral margin, anterior tibiæ with a black mark behind		78
78. Lateral triangle of face obliquely truncate above; a bluer species	48 <i>bigeloviae</i> ♀ var.	
Lateral triangle of face coming to a point above, but nar- rower than in <i>zonalis</i> , face-markings pallid; a greener spe- cies		79
79. Supraclypeal mark broad, notched in middle	24 <i>bakeræ</i>	♀
Supraclypeal mark narrower, or reduced to two spots	23 <i>zebrata</i>	♀
80. Female, flagellum only pale testaceous beneath	25 <i>affinis</i> ♀ var.	
Males		81
81. Flagellum dark; species of eastern U.S.	11 <i>octomaculata</i> .	
Flagellum mostly yellow; species of Lower California	67 <i>sparsa</i> .	
82. Head large, quadrate, face very hairy	62 <i>laticeps</i>	♂

- Head ordinary, face not so hairy . . . 57 *asteris* ♀ var.
83. Abdomen black or dark brown, without pale marks . . . 84
 Abdomen not banded, but with yellow marks . . . 86
 Abdomen distinctly banded . . . 87
84. Cheeks armed, head large, clypeus with a narrow median
 line and broad anterior border yellow, two yellow spots
 above clypeus . . . 60 *grandiceps* ♂
 Cheeks unarmed, clypeus all pale except the usual dots . . 85
85. Lateral corners of clypeus reaching base of mandibles, mar-
 ginal cell shorter . . . 3 *californica* ♂
 Lateral corners of clypeus not reaching base of mandibles,
 marginal cell longer . . . 61 *crassiceps* ♂
86. The yellow abdominal marks oblique, dog-ear marks rep-
 resented by dots only . . . 9 *nevadensis* ♀
 The yellow abdominal marks small and straight . 46 *tarda* ♂
87. Males . . . 88
 Females . . . 92
88. Cheeks armed . . . 6 *ventralis*.
 Cheeks unarmed . . . 89
89. Mesothorax granular, abdominal bands without lateral
 bulgings on proximal margin, face-markings deep yellow,
22 sphaeralceæ var.
 Mesothorax smooth and shining . . . 90
90. Middle and posterior femora yellow, without black patches,
 abdominal bands regular, though with sublateral bulg-
 ings on proximal margins, marginal cell longer, 30 *dubia* ♂
 Middle and posterior femora with black spots or patches,
 marginal cell shorter . . . 91
91. Supraclypeal mark very little broader than long, 23 *zebrata* ♂
 Supraclypeal mark nearly twice as broad as long . . .
24 bakeræ ♂
92. Nervures colorless; pale stripe along anterior orbits not
 extending to level of middle ocellus . . . 40 *salicis*.
 Nervures dark; pale stripe along anterior orbits extending
 to level of middle ocellus . . . 36 *exclamans*.

Species of Texas and Mexico, with the mandibles bifid at tips, the head large, the stigma subobsolete, the abdomen broad, rufous in the ♂, black or piceous in the ♀.

1. *Perdita texana* (Cr.) Cr., Cat. Hym., 1887, p. 296.

♀ *Macrotera texana* Cr., Tr. Am. Ent. Soc., 1878, p. 70. (Hab., Texas).

♂ *Macrotera megacephala* Cr., l. c., p. 71. (Hab., Texas).

This species was discovered by Mr. L. Heiligbrodt, who took three

of each sex. I know of no other specimens, and nothing is known of the exact locality or habits. The dark chocolate-brown head and black thorax at once separate this species from *P. latior*. In both species the marginal cell is obliquely truncate.

2. *Perdita latior* n. sp. Fig. 6, (part of wing).

♂ ♀, length $5\frac{1}{2}$ –6 mm., broad, head large, broader than long; head, thorax, legs and tip of abdomen with pubescence consisting of dull white erect hairs; punctuation of vertex, mesothorax and scutellum very fine and close; upper surface of metathorax bare, shining, minutely granular; dorsum of abdomen very minutely punctured, the punctures on



FIG. 6. first segment very sparse. Tegulae pale testaceous; wings hyaline, nervures pale brown, stigma little developed, 3d discoidal present, marginal about as long as 1st submarginal, 2d submarginal narrowed more than half to marginal.

♂.—Clypeus prominent, with a minute tooth on each side. Head and thorax dark green, metathorax strongly tinged bluish. Mandibles except their dark tips, clypeus, lower corner of face, and a broad transverse band between antennae, dull testaceous. The punctuation, which is close before the ocelli, becomes sparse behind them. Antennae dull testaceous, more or less suffused with blackish. Legs dark piceous, the front of the anterior tibiae and all the tibial spurs, dull testaceous. Abdomen shining, ferruginous; first segment more or less suffused with blackish.

♀.—Head and thorax dark green, face almost black, dorsum of mesothorax and scutellum purplish, dorsum of metathorax bluish.

Antennae dark brown, the last 7 joints of flagellum beneath becoming dull testaceous or ferruginous. Mandibles yellowish-ferruginous, dark at tips. Legs colored as in ♂. Abdomen brown-black, the margins of the segments subttestaceous.

Hab.—Las Cruces, N. M., middle of August, 1895, on flowers of *Sphaeralcea angustifolia*, 3 ♂, 3 ♀. (Ckll., 4,806, 4,809, 4,814, etc.) It was associated with *Diadasia* and *Halictus*.

Obs. *P. arcuata* Fox, the description of which reads rather like *latior*, is of a different group, viz. that of *californica*, etc.

Species of California and Mexico, with the clypeus in the ♂ narrowly produced at the sides to the bases of the mandibles, resembling in shape a panama hat.

3. *Perdita californica* (Cr.) Cr., Cat. Hym., 1887, p. 296.

♂ *Macrotera californica* Cr., Tr. Am. Ent. Soc., 1878, p. 71. (*Hab.*, California).

Three specimens are known, collected by Edwards and Crotch.

5. *Perdita interrupta* Cr., Tr. Am. Ent. Soc., 1878, p. 70. ♂ (Hab., California).

Three specimens were found by Crotch; we have no information as to exact locality or habits. From one of the types I noted the following:

Cheeks unarmed, quite densely (for a *Perdita*) white pubescent. Face more hairy than usual. Clypeus with two black dots. Lateral pale patches of face forming nearly right-angled triangles, the upper angle being the right angle. Mesothorax granular, dull. Wings distinctly smoky, nervures dark brown. Marginal rather long, sub-stigmatal portion equal to poststigmatal. Second submarginal narrowed about or hardly one-half to marginal. Third discoidal distinct. First segment of abdomen, except its distal margin, blue, granular, in strong contrast with the piceous remaining segments. *P. fallax*, which presents a certain superficial resemblance to *interrupta*, differs as follows:

(1). Its clypeus is shaped like a felt hat, not like a panama hat as in *interrupta*.

(2). The upper angle of lateral face-marks is a very acute angle.

(3). The poststigmatal portion of marginal cell is distinctly longer than the substigmatal.

(4). The head and thorax are green, whereas they are blue in *interrupta*.

6. *Perdita ventralis* Fox, Proc. Cal. Acad., 1893, p. 17. ♂ (as ♀ ex. err.); Proc. Cal. Acad., 1894, p. 116 ♀.

The original types, three specimens, were found by Mr. Haines on Margarita Island, L. Cal., in March. Later, the same collector obtained numerous examples including females, on Magdalena Island, also in March. These islands are close together, a little south of the 25th parallel of latitude.

The ♂ has the cheeks armed, and the clypeus panama-hat shaped. In the ♀ the cheeks are unarmed, and the clypeus differently shaped. In the ♂ the mandibles are very slender, pointed; in the ♀ stout, notched within. In view of these differences, it is at first hard to believe that they are sexes of one species, for all that they agree in the abdomen with its suffused banding, in the mesothorax, etc.

P. ventralis is smaller than *mentzelia* and *pallidior*, and differs by the suffused banding of abdomen. *P. mentzelia* and *pallidior* have the mesothorax microscopically tessellate, with distinct sparse punctures; *ventralis* has it very shiny, smooth, hairless except the

anterior third, which is sparsely hairy and punctured. The thorax shines distinctly blue in *ventralis* ♂, but in the ♀ it hardly goes off a pure black. The ♂ resembles *californica* in its face-markings, but is so much smaller, and the dog-ear marks are much more prominent. The vertex is minutely roughened in the same way in ♂ and ♀.

The face in the ♀ is all dark, not so in the ♂. The ♂ has the lateral face-marks much broader than long, the dog-ear marks well-developed, but the supraclypeal mark represented only by a dot adjacent to each dog-ear mark.

It is to be regretted that *ventralis* is the only undoubted member of the *californica* group of which we know the ♀. The sexual differences in *Perdita* are very unequal in the different species, whether occurring as face-markings or as structural characters. In the undoubted sexes of *P. verbesinæ*, the clypeal differences are not so great as in *ventralis*, but the difference in the mandibles is actually much greater.

7. *Perdita mexicanorum* n. sp.

♂.—Length about 5½ mm. Head and thorax dark blue. Head rather large, cheeks unarmed, clypeus panama-hat shaped, glossa very long and unusually hairy. Cheeks and face very sparsely hairy with short hairs. Vertex strongly granular, and with rather close but shallow punctures. Antennæ entirely sepia-brown, the same color above as below. Mandibles yellowish, subtestaceous, dark at tips, simple, not particularly slender. Face-markings sulphur-yellow; clypeus yellow with the usual two black dots very small and near the edge, and its proximal margin (the crown of the panama-hat) broadly dark, the edge of the yellow somewhat irregular and medially emarginate. Supraclypeal and dog-ear marks absent. Sides of face with large squarish yellowish patches, their upper margins truncate and rather irregular, about level with the top of the clypeus. Inwardly, these patches do not join the clypeal margin, but leave a thin wedge of dark color between.

Thorax dark blue, the mesothorax slightly inclined to greenish. Prothorax and tubercles entirely dark; postscutellum sulphur-yellow. Mesothorax moderately shining, but distinctly granular and punctuate, median groove distinct. Metathorax shining but very distinctly granular.

Tegulæ testaceous; wings slightly smoky, nervures and stigma dull brownish-ochreous, stigma not centrally hyaline. Marginal

cell rather long, very distinctly appendiculate, poststigmatal portion a little longer than substigmatal. Second submarginal rather large, narrowed hardly one-half to marginal, the narrowing more proximal than distal. Third discoidal distinct. Cubital and subdiscoidal nervures produced almost to wing-margin.

Legs sepia-brown; anterior tibiæ in front, and a stripe on middle tibiæ, yellow.

Abdomen shining, sepia-brown, darker toward the apex; venter nearly the same. There are well-defined yellow marks at sides of segments 2-5, partly passing over to the venter.

Hab.—Mexico, one example sent by Mr. Fox. Unhappily we know nothing of the exact locality or habits of this interesting species. It is the only *Perdita* I know with a yellow postscutellum.

Two species from Nevada, known only in the ♀; exact locality and habits unknown.

8. *Perdita zonalis* Cr., Tr. Am. Ent. Soc., 1879, p. 202. ♀ (Hab., Nevada).

Ten specimens were collected by Morrison. From one of these I have noted as follows:

Clypeus low cork-helmet type, reaching base of mandibles. Mesothorax excessively shiny, dark brassy-green, very sparsely but distinctly punctured. Face markings pale yellow. Upper margin of clypeus medially truncate, not rounded. Clypeus all yellow except two dark dots. Supraclypeal patch well-developed, broad, but not twice as broad as long. No dog-ear marks. Sockets of antennæ narrowly ringed with yellow. Lateral face marks triangular, rather broad, coming to a point at level of insertion of antennæ. Upper margin of face marks not forming a W but V V. Stigma and nervures pale testaceous, stigma large, marginal cell with poststigmatal portion longer than substigmatal. Second submarginal large, narrowed one-half to marginal. Third discoidal distinct.

Abdomen above yellow with four black bands, and a black mark on each side of first segment. The abdomen is peculiar for the black bands being very distinct, neither notched nor interrupted in the middle, and narrower than the yellow between them.

From *zebrata* and *bakera* it may be known by the black bands of abdomen not being united on lateral margin, the anterior tibiæ all yellow, the lateral triangle of face broader and the face markings lemon-yellow. From *salicis* ♀ it is distinguished at once by the very much broader lateral face-marks.

- C. (1). Larger, clypeus higher, supraclypeal mark absent, lateral marks notched within, *octomaculata* ♀.
 (2). Smaller, clypeus lower, supraclypeal mark present, lateral marks not notched within, = *nevadensis* ♀.

Species found east of the 95th meridian.

10. *Perdita obscurata* Cr., Tr. Am. Ent. Soc., 1878, p. 70. ♂ ♀ (Hab., Georgia).

One male and one female were found by Morrison. I have made the following description from the female; the student will observe that in some points it disagrees with that of Cresson, notwithstanding that it is from the same specimen.

♀.—Head and thorax dark bluish-green. Clypeus broad, not much attenuate at sides, reaching base of mandibles. Face-markings pale yellow, lateral marks very narrow, inversely club-shaped, reaching as far as level of insertion of antennæ. Clypeus without marks, except a very distinct central one, shaped like an inverted egg-cup with the egg in it, the base at posterior clypeal border, the apex not reaching anterior border of clypeus. Mandibles except tips pale yellow. Mesothorax shiny. Tubercles rather pale brownish. Hind margin of prothorax with two small yellow spots. Wings hyaline, stigma very large, pale yellowish, veins colorless. Marginal cell with the substigmal portion a little longer than the post-stigmal. First submarginal very long, longer than marginal. Second submarginal short, suboval and high, narrowed about one-half to marginal. On one side there is a small petiolate submarginal cell between normal 1st and 2d submarginals, it receives the first recurrent nervure, and is approximately an equilateral triangle. Third discoidal distinct. The broadly interrupted narrow fasciæ on abdomen are not obscure or suffused, but clean-cut and distinct. It differs from the ♀ of *affinis* by the lateral face-marks being pointed above, the clypeus dark marked with light, the mesothorax shiny, the nervures colorless, and the abdominal marks yellowish.

The ♂ I have not seen; Mr. Fox has kindly sent me a sketch of the face-markings, showing the face entirely yellow below the level of the antennæ, the yellow not extending upward at all in the median line, but obliquely extending upward at the sides from the antennal socket to the orbital margin, where it ends at an angle of about 50°. The cheeks, Mr. Fox informs me, are not armed.

Mr. Charles Robertson tells me that at Orlando, Florida, on March 16th, he captured a ♂ *obscurata* on flowers of *Hydrocotyle umbellata*.

11. *Perdita octomaculata* (Say). Cr., Cat. Apidæ, 1879, p. 216.

Panurgus 8-maculatus Say, Long's 2d. Exped., ii, p. 350, 1824. ♂ ♀ (Hab., U. S.).

I have a ♀ from New York State, sent by Dr. Skinner, and a ♂ from southern Illinois, sent by Mr. Roberston. Mr. Fox informs me that he has seen specimens from the White Mts., N. H., collected by Mrs. Slosson, New York, New Jersey and Virginia. He has taken it in southern New Jersey, but sparingly. Prof. J. B. Smith reports it from Westville, N. J., on Cresson's authority. Of its habits, nothing has been recorded, but Mr. C. Robertson informs me that he has taken it from Aug. 13th to Sept. 20th, on flowers of *Solidago canadensis*, *Coreopsis aristosa* and *Aster ericoides* var. *villosus*.

Three allied species found on Mentzelia in New Mexico.

12. *Perdita mentzeliae* n. sp.

♂.—About 5½ mm. long. Head rather large, quadrate, broader than thorax, mandibles simple, cheeks beneath with a prominent tooth, lower margin of clypeus nearly straight; vertex finely rugulose, with sparse feeble punctures between the ocelli and the antennæ; eyes narrow. Color very dark blue-green, with the whole of the face beneath the antennæ, and the lower half of the cheeks, including the spines, orange-yellow. On each side of the face the yellow extends upward, narrowing to a point on the orbital margin about two-thirds the length of the scape above the level of the insertion of the antennæ. Mandibles yellow with ferruginous tips. Antennæ yellow, becoming deep orange toward their tips; the flagellum slightly marked with blackish above.

Thorax shiny, very dark blue-green, becoming black on the scutellum and hind part of mesothorax, metathorax tinged with blue. Collar, tubercles, under side and part of hind border of prothorax orange-yellow. Mesothorax with only a few scattered indistinct punctures. Metathorax minutely granular. Pleura, anterior border of mesothorax and sides of metathorax with scattered white hairs.

Tegulæ hyaline; wings hyaline, nervures very pale yellowish. Marginal cell about or hardly as long as stigma. Second submarginal not narrowed one-half to marginal. Third discoidal hardly perceptible.

Legs orange; posterior femora with a brown patch behind; posterior tibiæ and tarsi mostly brown. Abdomen orange-yellow, first segment almost all black, segments 2, 3 and 4 with broad suffused

black bands. Venter orange, immaculate. Quite as often, perhaps more frequently, the abdomen is shining black above, except the terminal segment which is testaceous, and the more or less obviously testaceous distal margins of the other segments.

♀.—Somewhat larger; head rounder, not broader than thorax. Punctures of mesothorax distinct but scattered. The pale markings all yellowish-white instead of yellow. Face dark, clypeus black contrasting with the green upper part of face. An irregularly triangular yellowish-white patch on each lower corner of face between clypeus and orbit. Coxæ black, their ends whitish. Femora black, their tips whitish. Tibiæ whitish, middle and hind tibiæ largely suffused with black. Dorsum of abdomen with the black nearly covering the segments, leaving transverse white areas or bands, not continued to lateral margin, on segments 2–4. Venter whitish, not banded.

Hab.—Santa Fé, N. M., close to the Denver & Rio Grande depot, at flowers of *Menzelia nuda*, Aug. 3, 1895, many specimens. They were associated with *Bombus* (abundant) and *Andrena* (rare).

13. *Perdita pallidior* n. sp.

♂.—Resembles the ♂ of *mentzelia*, but differs in the cheeks being unarmed beneath, in the smaller head, the second submarginal cell more narrowed above, the legs entirely yellow, the abdomen above orange-yellow, with the first segment nearly all dark brown or black, and a dark brown band on segments 2 and 3, that on 3d failing some distance before the lateral margin.

♀.—Resembles the ♀ of *mentzelia*, but differs in the legs being all yellowish-white, except a dusky shade on inside of anterior femora, and outside of middle and posterior tibiæ. The white subtriangular marks on sides of face are rather more produced upward along the orbital margin. The abdomen above is yellowish-white, the first segment with a broad brown-black ring, the second and third segments with dark bands, the fourth segment with a pair of dark spots, suffused in outline.

Hab.—Albuquerque, N. M., close to Prof. Hadley's house, abundant on flowers of *Mentzelia nuda*, Aug. 15, 1895. A single ♀ was also swept from *Gutierrezia sarothræ* (det. E. O. Wootton) at the same time and place. No other bees were then found upon the *Mentzelia*, except *Perdita pulchrior*. On the *Gutierrezia* were found also *Perdita gutierrezia* and *P. austini*, one each.

14. *Perdita pulchrior* n. sp. Fig. 7, (part of wing).

♂.—Resembles the ♂ of *pallidior*, but rather larger and stoutly built, with the cheeks armed below with a prominent spine. Head large and subquadrate. Second submarginal not so much narrowed above. Legs entirely yellow. Abdomen above shiny pale orange-yellow, the first segment mostly black, second with a pair of dark spots; no dark bands. The second



segment may have its lateral margins also dark, and the third segment may show spots.

Hab.—Albuquerque, N. M., on *Mentzelia nuda*, same time and place as *pallidior*, two males (Ckll., 4,537, 4,538). On Sept. 12th, I was surprised to take another example, also a male, on *Bigelovia wrightii* close to the Agricultural College, Las Cruces, N. M. This species may possibly represent a dimorphic ♂ of *pallidior*; the ♀ is either unknown, or not to be separated from those presumably referable to *pallidior*.

Four species found on Larrea in New Mexico.

15. *Perdita larreae* n. sp. Fig. 8. (stigma etc).

♂.—Hardly 4 mm. long, bright orange-yellow, smooth and shiny; pubescence consisting of sparse white hairs on vertex, cheeks beneath, mesothorax, pleura, tibiae, tarsi, apex and venter of abdomen. Head very large, considerably larger than the small thorax, subquadrate; clypeus produced into a spine at each lower corner, cheeks with a stout spine beneath, eyes rather small and narrow.



FIG. 8.

Wings small, hyaline, nervures white, stigma hyaline in middle.

Marginal cell narrow but hardly produced beyond stigma, not quite as long as first submarginal, appendiculate. Second submarginal very small, triangular, coming to a point at its junction with marginal. First recurrent joining, first transverse cubital. Third discoidal cell wanting.

The mandibles are elongate, simple, dark at tips. The ocelli are more or less dark, with some dark marbling about them. Tongue about as long as head.

Hab.—San Marcial, N. M., close to Mr. Shope's house, at flowers of *Larrea divaricata* var. *tridentata*, June 28, 1895. Five specimens.

16. *Perdita marcialis* n. sp.

♂.—Size and form of *P. larreae*. Anterior margin of clypeus not so broad, with the spines longer and parallel; whereas in *larreae*

they are divergent. Wings as in *larrea*, but the marginal cell rather more produced beyond stigma. A keel between antennæ, giving place to a groove running upward to middle ocellus. Color deep orange, with dark markings. A black spot before the upper part of each anterior orbital margin; a large green-metallic patch on vertex, enclosing the two posterior ocelli, but just escaping the anterior one or only partly enclosing it; mesothorax shiny metallic olive-green, except rather broad yellow lateral margins; dorsum of metathorax dark green; a large round dark patch on sides of thorax beneath. Abdomen above more or less suffused with brown, which is dark at base of first and apex of second segments, and becomes reddish on last two segments. Hind legs tinged with brown. Mandibles simple as in *larrea*.

Hab.—San Marcial, N. M., on *Larrea* at the same time and place as *P. larrea*. One specimen.

17. *Perdita larrearum* n. sp.

♀.—4 mm. long. Head dark brassy-green, thorax black, pleura and metathorax bluish, abdomen dark sepia-brown. Head rounded, rather large, vertex conspicuously roughened, cheeks and occiput with a rather dense fringe of white hairs, clypeus and sides of face very narrowly pale yellowish-ferruginous, the pale color continuing along orbital margin some distance above level of antennæ, but so thin that its termination is difficult to trace.

Antennæ blackish above, yellowish beneath.

Tubercles and hind border of prothorax narrowly, yellowish. Anterior portion of mesothorax curiously ornamented with appressed pure white hairs. Mesothorax appearing granular, microscopically reticulate, with very sparse shallow punctures.

Legs brown, anterior tibiæ and tarsi dull yellow. Tegulæ yellowish-hyaline. Wings hyaline, nervures white or colorless. Marginal cell with its substigmatal portion fully twice as long as the post-stigmatal. Second submarginal triangular, bulging without, narrowing to a point at marginal. Third discoidal distinct.

Abdomen above sepia-brown, the proximal ends of the first two segments slightly yellowish. Venter dull brownish-yellow.

Hab.—San Marcial, N. M., on *Larrea* at the same time and place as *P. larrea*. Three specimens.

There are three possibilities regarding the last three species :

- (1). That they are three distinct species.
- (2). That the males represent two valid species, and *larrearum* the ♀ of one of them.

(3). That there is only one species, *larreæ*, *marcialis* being the dimorphic ♂ and *larrearum* the normal ♀ of the same.

While I incline to one of the latter suppositions, the difference between the three forms is very great, so that in the absence of further evidence they must be provisionally regarded as species.

18. *Perdita semicærulea* n. sp.

♀.—Length 6 mm. Unusually hairy, the pubescence erect and white. Head of ordinary size, dark greenish-blue, bluer at sides of face, more brassy-green between antennæ. Vertex finely rugulose, punctured. Clypeus high, pitch-black, smooth with large moderately close punctures. The only face-markings consist of a shining, hairless, bright sulphur-yellow oval patch on each side of the clypeus, separated from the eye margin by a distance at least equal to its own diameter.

Antennæ dark-brown, scape black, last joint of flagellum becoming pale. The antennæ are rather conspicuously enlarged toward their ends.

Mesothorax and scutellum smooth and shining, but with deep, large and rather close punctures. Thorax all black, except the metathorax which is blue. Pleura with quite long white hairs.

Tegulæ hyaline. Wings milky-hyaline, stigma very pale yellow, hyaline in middle, nervures colorless, costal nervure black. Marginal cell rather short, appendiculate, poststigmatal portion hardly longer than substigmatal. Second submarginal large, narrowed about one-half to marginal. Third discoidal distinct.

Legs brown-black, a little yellow on anterior tibiæ and knees.

Abdomen shining, brown-black above and beneath. Sides of first segment, and in a less degree those of the others, with tufts of white hairs. Dorsum of last three segments more or less hairy, that of the last one considerably so.

Hab.—San Marcial, N. M., on *Larrea*, at the same time and place as *P. larreæ*. One specimen. (Ckll., 3,077). This species is easily recognized by the dark clypeus, with a shining, smooth, yellow spot on each side of it. It is not nearly related to *P. larreæ*, but rather to *P. phymatæ*, which, however, has not the yellow spots.

A species with the end of the abdomen rufous, found on Croton.

19. *Perdita crotonis* n. sp.

♀.—About 5 mm. long. Head rather broad, shining, dark blue or greenish-blue; clypeus except two black dots, a transversely

elongate mark adjacent to hind border of clypeus, narrowing medially, and a triangular patch on each side of face, not quite reaching to level of insertion of antennæ, white. Mandibles white with rufous tips. Cheeks rather densely white-hairy. Antennæ with the scape black above, white beneath; funicle and flagellum black or very dark brown, last joint of latter pale at tip. Thorax shiny, rather densely pubescent for a *Perdita*, mesothorax very dark bottle-green, median groove very distinct. Tubercles and posterior median border of prothorax white. Tegulæ brownish, with a white spot on anterior half. Scutellum quite brassy-green. Metathorax dark blue, distinctly rugulose. Pleura smooth, dark blue.

Legs white; with the femora except ends, most of hind coxæ, a patch behind each of the four anterior tibiæ, the hind tibiæ except basal third, and the hind tarsi, black. Wings hyaline, nervures fuscous, stigma margined with fuscous. Marginal cell with the post-stigmatal portion about or hardly as long as the substigmatal; second submarginal narrowed about one-half to marginal; third discoidal distinct.

Abdomen above and below with the last two segments entirely rufous, without markings. Segments 1-3 above white, with black bands at proximal and distal margins of segments, those on proximal margins of segments 2 and 3 very narrow, and that on distal margin of 3d represented only by a line of mottling. (Ckll., 3,262, etc.)

Mut. ♀.—Clypeus with two longitudinal black lines or bands in addition to the marks above described. (Ckll., 3,259).

♂.—The whole of the face beneath the level of the antennæ white, except the two black dots on clypeus. Along the orbits the white is further produced a short distance, rapidly narrowing to a point. Second submarginal narrowed distinctly more than half to marginal. Last three segments of abdomen rufous. Cheeks unarmed. (Ckll., 3,261).

Hab.—Albuquerque, N. M., June 30, 1895, in numbers at flowers of *Croton texensis*. In August, Miss Myrtle Boyle found a single specimen at La Tenaja, near Santa Fé. I looked for it at Santa Fé, but failed to find it, though the *Croton* is abundant.

A small species with orange or orange-rufous abdomen found on Chamæsaracha.

20. *Perdita chamæsarachæ* n. sp.

♂.—3½ mm. long. Head and thorax shining dark blue, abdomen

brownish-orange. Vertex granular. Head rounded. Face below antennæ yellowish-white, the upper border of the pale color coincident with the lower level of the insertion of the antennæ, except that on each side of the dog-ear plate there is a notch formed by an incursion of the dark color. Clypeus with a small black spot on each side. Mandibles rufous at tips. Antennæ dark above, below dirty yellowish, the scape whiter. Sides of face with appressed white hairs. Cheeks unarmed, rather densely clothed beneath with erect white hairs. Sides of metathorax, and postscutellum, with similar hairs. Tubercles yellowish-white, tegulæ hyaline. Wings hyaline, nervures very pale straw-yellow, third discoidal very weak, second submarginal narrowing about one-half to marginal. Legs pale yellow, a dark patch on anterior femora, and middle and posterior femora and tibiæ largely dark. Abdomen above bandless, first segment dark at base. Venter entirely orange. (Ckll., 4,568, etc.).

♀.—Closely similar, but the dog-ear marks and pale mark above clypeus wanting, i. e., the pale color on face is confined to the clypeus and triangular marks at sides of face. (Ckll., 4,573).

Hab.—Albuquerque, N. M., in the old town at flowers of *Chamæsaracha coronopus*, Aug. 16, 1895, abundant. Also at Santa Fé, in the capitol grounds, on flowers of *C. coronopus*, Aug. 2, 1895, two specimens. At Santa Fé it was associated on the flowers with *Halicetus* ♂ and *Colletes*. This species resembles *P. semicrocea*, but that has the face dark in the ♀.

A species from the transition zone in New Mexico, habits unknown.

21. *Perdita foxi* Ckll. Proc. Phila. Acad., 1895, p. 18. ♂ (*Hab.*, Santa Fé, N. M.)

The unique type, taken on June 25th, is only known. The species may be known by its orange-rufous legs, and black unbanded abdomen.

A species found on Sphæralcea, very different in the sexes, ranging in modified form over 3,200 feet altitude.

22. *Perdita sphæralcææ* n. sp.

♀.—Length $7\frac{1}{2}$ mm. Head and thorax dark greenish, abdomen black with three light bands. Head rather small, rounded, somewhat broader than long, vertex and occiput dark olive-green, granular; a shining brassy prominence between the antennæ; clypeus black, shining, sparsely punctured toward the sides. No pale marks on face, except a small yellow spot on extreme lower corner. Mandibles brownish, ferruginous at apex, sharply and squarely

notched on inner side near end, but not actually bifid. Cheeks quite densely hairy. Antennæ dark brown, almost black above.

Tubercles, and hind border of prothorax more or less, very pale yellowish. Mesothorax bulging in front, not very shiny, dark brassy, hardly green, quite pubescent with erect whitish hairs. Sides of metathorax with tufts of hairs, but postscutellum not conspicuously hairy.

Tegulæ hyaline. Wings hyaline, nervures very pale yellowish, almost colorless, stigma margined with brown. Marginal cell rather long, poststigmatal portion distinctly longer than substigmatal. First submarginal not nearly so large as first discoidal. Second submarginal large, narrowing hardly one-half to marginal. Third discoidal quite distinct.

Legs black; anterior knees, anterior tibiæ in front, middle tibiæ at tip behind, dull yellow. Abdomen rather narrow, black; second, third and fourth segments at base with a broad pale yellowish band, slightly notched in middle behind. Venter dark brown. The abdominal bands have a slightly greenish tint, so that when the insect is alive on the flowers it rather suggests a miniature *Nomia* similar to *N. punctata*.

♂.—Length 6 mm. Cheeks unarmed. Light markings all deep saffron-yellow, instead of pale greenish-yellow. Mandibles simple, yellow with ferruginous tips. Face beneath antennæ all yellow, except two black dots on clypeus, the yellow moreover extending upward at sides of face, coming to a point at an angle of about 50°, not quite so far up as the length of the scape above level of insertion of antennæ. Antennæ yellow; funicle, flagellum and end of scape above, dark brown.

Yellow hind margin of prothorax connecting with yellow tubercles. Legs yellow; part of middle coxæ, posterior coxæ except ends and a spot behind, a large patch on anterior and middle femora behind, a patch on both sides of hind femora, a large patch on middle tibiæ, and outer side of hind tibiæ and tarsi, black. Pleura with a round yellow patch, not very conspicuous, in front.

Abdomen above shining, dark brown, with rather broad yellow bands at proximal margins of segments 2–5, that on 4 narrowest, that on 5 broadest, and notched behind medially. Sixth segment dull rufous with a brown rather suffused band. Venter dull orange.

Hab.—Las Cruces, N. M., common at flowers of *Sphaeralcea angustifolia*, middle of August to middle of September, 1895.

P. sphaeralceæ, race *alticola*.

♀.—Nervures dark brown. A light spot on each side of 5th abdominal segment. (Ckll., 3,850). The spots on 5th segment may be absent as in the type.

♂.—Nervures dark, as in the ♀. The dog-ear marks have more or less of a dark border below.

Mut. *SUFFUSA*. ♂.—Abdomen above suffused with brown, only the yellow bands on segments 2 and 3 remaining. Dog-ear marks reduced, their lower half often wanting.

Mut. ♀.—Only 6 mm. long. Abdominal bands narrow, that on segment 5th present though interrupted in the middle. (Ckll., 3,849). This may be the proper ♀ of mut. *suffusa*.

Hab.—Santa Fé, N. M., common at flowers of *Sphaeralcea angustifolia*; the males much more frequent than the females. The species was first taken in Mr. Boyle's garden on July 25, 1895; 2 normal ♂ *alticola*, 2 ♂ *suffusa*. On July 27th were taken several males, about equally divided between *alticola* proper and *suffusa*, and also two females. The latest date I have is Aug. 8th, a ♀ taken by Miss Myrtle Boyle. The ♂ differs from *zebrata* ♂ by its very dark (not bluish) thorax, much yellower light markings, darker stigma, and rather differently shaped face-markings.

A species found on Cleome serrulata (C. integrifolia).

23. *Perdita zebrata* Cr., Tr. Am. Ent. Soc., 1878, p. 69. ♀ (Hab., Colorado).

♂ *Perdita canina* Ckll., Proc. Phila. Acad., 1895, p. 17. (Hab., Santa Fé, N. M.).

Figs. 9, 10, (face-marks and ♂ genitalia).

Originally described from seven specimens taken by Ridings and Morrison. The ♂ was not known until described by me as *canina*. My No. 1,270 (l. c., p. 18) proves to have been the true ♀, and is identical with at least some of Cresson's types of *zebrata*, though it is possible that under this name more than one species was included. The matter is complicated from the variability of ♀ *zebrata* on the one hand, and the discovery of *P. bakeræ* on the other, the latter species being easily distinguished in the ♂, but only with extreme difficulty in the ♀.

Mr. Fox has sent me a ♀ of *zebrata* from the Magdalena

Mts., N. M., Aug., 1894, collected by Snow. Mr. C. F. Baker sends

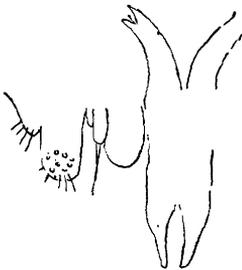


FIG. 10.



FIG. 9.

it from Fort Collins, Colorado, where it was collected in August; this is the most northern locality known for it. The most southern locality is Alma, Socorro Co., N. M., where it was found by Mr. Alfred Holt. I have myself collected it as follows:

(1). Albuquerque, June 30th and Aug. 16, 1895. (2). Lamy, N. M., July 2d and July 13th. (3). Santa Fé, N. M., July 5th to Aug. 3d. (4). Watrous, N. M., July 13th. (5). Las Vegas, N. M., July. (6). La Junta, Colo., July.

Everywhere it is found in great abundance on flowers of *Cleome serrulata*, and on nothing else; whereas the closely allied *P. bakeræ* is found on *Solidago*. On July 12th, at Santa Fé, I saw them settle on the stamens of the *Cleomé*, climb to the top, and collect the pollen. At Watrous I saw one inserting its tongue in the base of the flower, running down the inner surface of the petals.

In the ♂s the face-markings are very constant, but frequently the light bands of the abdomen will be interrupted on segments 3 and 4. The ♀s vary much in the clypeal marks, from no marks on the clypeus but the usual pair of dots, to two black bars or even an almost wholly black clypeus. These variations do not seem to have any reference to the environment.

Mr. Fox has examined for me all Cresson's type specimens of *zebrata* (♀) and reports that they have the supraclypeal spot notched above, except one, which has it divided in two. This last was the one Cresson actually had in hand when describing, as may be seen from his description. The clypeus in four specimens is bi-spotted with black, in one entirely yellow.

A species very like P. zebrata, found on Solidago in Colorado.

24. *Perdita bakeræ* n. sp. or race. Figs. 11, 12, (head and ♂ genitalia).

♂.—Like the ♂ of *P. zebrata*, but seems to average smaller, the pale bands of the abdomen are small and interrupted, at least on the third and fourth segments, and the supraclypeal mark is nearly twice as broad as long. Sometimes the abdominal bands are entire, but the supraclypeal mark still affords a distinguishing character.

♀.—Seems to differ only from ♀ *zebrata* in its broader supraclypeal mark, notched in the middle.

Hab.—Fort Collins, Colorado, 12 ♂, 3 ♀, sent by Mr. C. F. Baker. They were collected as follows: (1). On *Solidago canadensis*, Aug. 8, 1895, both sexes. (2). On *Solidago canadensis*, Aug. 15, 1895, a ♂. (3). On sticky flower-buds of *Helianthus annuus*, Aug. 20, 1895, two ♂s.

When Mr. Baker sent me this species, with the statement that it was found on *Solidago*, I could hardly believe there had not been some mistake, as it so nearly resembled *P. zebrata*, which I have

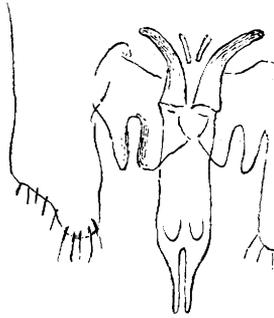


FIG. 12.

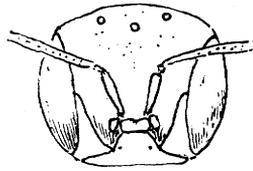


FIG. 11.

found always on *Cleome*, never on *Solidago*. Mr. Baker, however, assures me that there has been no mistake; and on re-examining the series I find that it differs from *zebrata*, in the males at least, by the average greater reduction of the pale bands of the abdomen, and constantly in the broader supraclypeal mark. We thus appear to have a species in the early stages of differentiation, perhaps hardly to be regarded as more than a race of *zebrata*. I have taken the liberty of naming it after Mrs. Baker, who has collected part of the material received from Fort Collins.

Since the above was written, I have examined the ♂ genitalia of *canina* (*zebrata*) and *bakeræ*, and find apparently good distinctions. See fig. 12.

Three species found on Solidago in Colorado, one being also found at Santa Fe, N. M.

25. *Perdita affinis* Cr., Tr. Am. Ent. Soc., 1878, p. 69. ♂ ♀ (Hab., Colorado).

Five specimens were collected by Ridings; I have examined one of the types. Mr. Baker sends me two ♀s taken at Fort Collins, Colo., one on Aug. 8th, the other on Aug. 15, 1895. The latter was on *Solidago canadensis*.

Cresson's description is not entirely satisfactory. The nervures and stigma (except the hyaline centre) are dark. The clypeus in Mr. Baker's examples has two black bars; in the type specimen examined these bars are present, though not so much developed.

The vertex and mesothorax are dark green, granular, dull. The clypeus is not hairy. The wings are slightly smoky; the marginal

cell has the poststigmatal portion appreciably longer than the sub-stigmatal, the third discoidal is distinct.

From *P. pectidis*, it differs thus:

- (1). Larger, mesothorax dull, granulated, markings of face and abdomen yellowish, = *affinis* ♀.
- (2). Smaller, mesothorax smooth, very shiny, markings of face and abdomen white, = *pectidis* ♀.

In its face-markings, dull mesothorax and dark nervures *P. affinis* ♀ agrees precisely with *octomaculata* ♀, but it differs thus:

- (1). Larger, markings of abdomen chrome-yellow, wings tinged smoky or yellowish, = *octomaculata* ♀.
- (2). Smaller, markings of abdomen creamy or yellowish-white, wings clear or nearly so, = *affinis* ♀.

I have not seen the ♂ of *affinis*. Mr. Fox kindly sends me a sketch of the face-markings, showing the face all yellow below the level of the antennæ, the yellow extending above in the median line as a small rounded projection, and at the sides obliquely from the antennal sockets to the orbital margin, where it ends at an angle of about 50°. Thus the face-markings of *affinis* ♂ differ at once from those of *octomaculata* ♂, which has the yellow confined to clypeus and sides of face, except a couple of small spots or streaks in the place of the supraclypeal mark.

26. *Perdita sexmaculata* Ckll., Proc. Phila. Acad., 1895, p. 12. ♀ (Hab., Santa Fé, N. M.).

The unique type was taken on July 25th; it could hardly have been on *Solidago*, which would not, I think, be in flower at Santa Fé at that time. I have a note in my diary that on Aug. 2, 1895, *Solidago canadensis* was only beginning to flower, and was visited by a few *Haliectus*. The form found on *Solidago* in Colorado represents a variety, as follows:

Var. *punctata* ♀.

Length about 6 mm.; abdomen with only 4 pale dots, on segments 3 and 4. As it is possible that this will prove to be a distinct species when a good series is collected, the following additional particulars are offered:

Head and thorax greenish-black, metathorax blue-black. Mandibles yellowish with rufous tips. Face and mesothorax very little hairy. Vertex and mesothorax granular, quite distinctly dark greenish. Clypeus black, minutely granular, sparsely and irregularly punctate. Scutellum with the granulations becoming obsolete

on the shining disc. Wings slightly smoky, nervures and stigma dark brown, stigma not hyaline in middle. Marginal cell short, distinctly appendiculate, the poststigmatal portion shorter than the substigmatal. Recurrent and transverse cubital nervures broken by hyaline dots. Third discoidal distinct. Cubital and subdiscoidal nervures produced far beyond the cells, the latter to the margin of the wing. Four middle tarsi rufotestaceous, as also the anterior knees, and anterior tibiæ before. The light dots on abdomen are inconspicuous, so that it appears at first sight immaculate brown-black.

Hab.—Fort Collins, Colorado, Aug. 8, 1895, on *Solidago canadensis*; one example, sent by Mr. Baker. The head is shorter than in *affinis*, and the pale face-marks are wanting; the marginal cell is also shorter.

27. *Perdita rectangulata* n. sp. Fig. 13, (face-marks).

♀.—About $5\frac{1}{2}$ mm. long. Head and thorax dark brassy-green, granular, dull; metathorax bluish. Head of ordinary shape and size. Clypeus, supraclypeal mark, lateral face-marks, and spot midway between antennæ and middle ocellus, lemon-yellow. Between the supraclypeal mark and the frontal spot, the usual facial keel is well-developed, slightly intruding into the spot. The supraclypeal mark is approximately rectangular, clear cut, about twice as broad as long. The dots on the clypeus are obscure. The lateral face-



FIG. 13.

marks are broad at base, reaching the point on the clypeus next to the dot, gradually narrowing upward, until at a point about level with the upper edge of the antennal sockets they are squarely truncate nearly to the orbital margin, but still are continued upward along the latter as a narrow stripe a little longer than the width at the truncation. The clypeus is rather of the Panama-hat type, with the lateral narrow prolongation to the base of the mandibles, but the central portion (crown of the hat) is higher. The face is nearly hairless. Mandibles stout, simple, curved, pale yellow with dark tips.

Antennæ with the scape entirely yellow; funicle and flagellum dark brown above, yellow below.

Mesothorax moderately hairy for a *Perdita*. Collar, hind border of prothorax and tubercles connecting with it, yellow. Tegulæ yellowish-hyaline. Wings hyaline, nervures and stigma pale yellow; marginal cell with the poststigmatal portion longest; 3d sub-

marginal large, narrowed more than half to the marginal; 3d discoidal distinct. Legs yellow, tarsi pale testaceous; spot on middle femora and tibiæ, a large blotch on hind femora, and hind tibiæ except basal third, black.

Abdomen above lemon-yellow, the last segment slightly orange. First segment with two black spots; rather broad black bands at hind margins of segments 1-4, intruding a little, especially at sides, on the base of the segment following, not at all notched, nor joined together. Venter yellow without bands.

♂.—Differs as follows: Scape with a small black stripe above. Face below antennæ all yellow, owing to the space beneath the antennæ being filled in by well-developed dog-ear marks, and to the supraclypeal mark being higher. The lateral face-marks are rather obliquely (not squarely) truncate, and are scarcely at all produced along the orbital margin above the truncation. The frontal pale spot is wanting. The collar is not yellow, and the yellow border of prothorax is reduced to two marks, the tubercles also remaining yellow. The nervures and stigma are dark brown, the marginal cell is longer, and the second submarginal less narrowed above. Legs black, with the knees and anterior femora and tibiæ in front, yellow. The abdomen is black, with orange or yellow clean-cut interrupted bands on segments 1-4. Venter dark. The cheeks are unarmed.

Hab.—Fort Collins, Colorado, Aug. 15, 1895, on *Solidago canadensis*; one ♀, one ♂, sent by Mr. Baker. The ♂ is so different from the ♀, that it may be a distinct species; but the face-markings are exactly such as might belong to the sexes of a species, and there are several points of similarity in structure. In a case of this sort, one decides partly by the circumstances of the capture, the two sexes having been taken from the same flowers on the same day.

Three other species from Colorado, habits unknown.

28. *Perdita snowii* n. sp.

♀.—Length $5\frac{1}{2}$ mm. Head and thorax dark brassy-green, dull and granular, metathorax bluish and more shining. Head fairly large, approximately round; face very little hairy, although the mesothorax and other parts of thorax are quite hairy, the hairs being of a pale brownish color, dirty white on the under parts. Mandibles stout, simple, yellowish with rufous ends. Antennæ dark brown, scape pale beneath. Clypeus, and sides of face rather nar-

rowly up to level of antennæ, dull pale yellowish. The face-marks at sides are abruptly truncate at their upper end, the truncation a little oblique. Supraclypeal and dog-ear marks wanting. Tubercles and two spots on hind border of prothorax, pale yellowish or substestaceous. Wings dull hyaline, iridescent, nervures and stigma rather dark yellowish-brown, stigma centrally subhyaline. Marginal cell large, appendiculate, poststigmatal portion longest. Second submarginal large, narrowed more than one-half to marginal; 3d discoidal distinct. Tegulæ hyaline.

Legs brown-black, hairy; anterior femora at ends, and anterior tibiæ, except a patch behind, yellow; anterior tarsi, middle and hind knees, and much of middle tibiæ, yellowish testaceous. Hind tibiæ in the type specimen with a mass of dull orange pollen.

Abdomen above dull brownish-white; first segment black at base; segments 1-4 with broad brown-black bands on their hind halves, these bands not at all interrupted, those on segments 2-3 conspicuously thickest in the middle, those on 1-2 joined laterally by a longitudinal line; 5th segment hairy, with a rudimentary band. Venter brown.

Hab.—Estes Park, Colorado, August, 1892 (F. H. Snow, No. 210). One specimen, sent by Mr. Fox. The abdomen may have been more brightly colored in life. *P. snowii* differs from *nitidella* ♀ at once by its dull hairy mesothorax; from *bigeloviae* ♀ it differs in shape of lateral marks of face, as well as in abdomen.

29. *Perdita luteiceps* n. sp.

♂.—Length about 5 mm. Cheeks unarmed. Head moderately large, rounded, somewhat broader than long, deep yellow with dark green markings. There is a spot close to each anterior orbital margin above the level of the antennæ (as in *punctosignata*), the ocelli are situated on an irregular transverse dark patch, and the occiput is dark, from it also coming a narrow dark stripe toward, but not reaching, the upper end of the eye. Labrum and mandibles yellow.

Antennæ yellow, funicle with a black patch above, joints of flagellum slightly darkened above.

Thorax dark bronzy-green, very granular, moderately dull, metathorax a bluer green. Prothorax yellow except a transverse dark stripe. A transverse yellow patch near hind border of mesothorax, and a little yellow along hind border of scutellum. Pleura hairy, dark with a moderately small yellow patch. Mesothorax hairy in front, nearly hairless behind.

Tegulæ yellowish hyaline. Wings hyaline, nervures and stigma (except its hyaline centre) very pale yellow. Marginal cell rather long, substigmatal portion about as long as poststigmatal; a linear appendiculate nervure longer than the marginal itself; 2d submarginal rather large, narrowed a little more than half to marginal; 3d discoidal distinct.

Legs yellow; a blackish patch on middle femora and tibiæ behind, hind legs blackish except knees.

Abdomen above yellow; first segment narrowly dark at base; at the sutures of all the segments is a narrow black band, which takes the form of two transversely elongate spots on the hind margin of each segment, adjacent to a narrow entire band on anterior margin of the next. None of the bands are united laterally. The yellow is much more developed in proportion to the black than in *martini*. Venter yellow, immaculate.

Hab.—Glenwood Springs, Colorado, Aug. 24, 1894. Collected by Prof. Gillette; sent to me by Mr. Fox. The unique specimen is unfortunately reddened by cyanide. *P. luteiceps* is very near *martini*, but differs by the brassy-green (not blue) thorax, the vertex with a transverse yellow band above the ocelli, and in the greater development of yellow on the abdomen. It is to be added that *martini* is a spring species, while *luteiceps* was caught in late summer. It is curious that among the numerous late summer species of *Perdita* at Las Cruces, the locality of *martini*, none resemble it so closely as *luteiceps*.

30. *Perdita dubia* n. sp.

♂.—About or slightly over 5 mm. long, Very like the ♂ of *bakeræ* or *zebrata*, resembling them in the shining mesothorax, color of head and thorax, face-markings, etc. The mesothorax is a rather yellow-green. The supraclypeal mark is heart-shaped with the apex cut off, thus differently shaped from that of *bakeræ* or *zebrata*, but nearest to *zebrata*. The dog-ear marks are a little reduced, leaving a perceptible amount of dark color between them and the clypeus. The lateral face-mark, formed as in *zebrata*, presents an obscure dark streak on its upper portion. The sides of the face are more hairy than in *zebrata* or *bakeræ*. The cheeks are very hairy. The labrum presents a conspicuous pit. The thorax is rather more hairy than in *bakeræ* or *zebrata*. The posterior and middle femora are entirely yellow, except for the slightest indication of black on the posterior ones; otherwise the legs resemble those of *bakeræ*.

Wings hyaline, nervures sepia-brown, stigma hyaline in middle. The marginal cell is distinctly longer than in *bakeræ* or *zebrata*, and has the poststigmatal portion longest. Second submarginal large, narrowed one-half to marginal; 3d discoidal absent.

Abdomen above with nearly equally broad bands of yellow and black. First segment all black; then follow four black bands at the junction of the segments, none interrupted, nor joined at the middle or the sides. Tip blackish. Venter yellow, with a little black along the sutures.

Hab.—Glenwood Springs, Colorado, Aug. 24, 1894. Collected by Prof. Gillette, sent by Mr. Fox. Like the last, taken at the same time, it is reddened by cyanide. It is unfortunate that we know nothing about the habits of this species, and have only a single specimen. It will be recognized by the regular entire abdominal bands, the coloration of the legs, etc.

A species from California, habitat unknown, ♂ unknown.

31. *Perdita trisignata* n. sp. Fig. 14, (face-marks).

♀.—Length about $5\frac{1}{2}$ mm. Head and thorax blue-black or greenish-black, the tint difficult to define. Head of ordinary size, nearly round, somewhat depressed on vertex; face very sparsely hairy, cheeks not so hairy as in many species. Vertex dull and very distinctly granulose. Middle ocellus in a distinct depression. Mandibles stout, yellowish, with rufous tips and bases. Clypeus brown-black, contrasting with the distinctly green face above it; in shape high, something like a cocked-hat. Face-markings pale lemon-yellow, consisting of a longitudinal median stripe on clypeus, starting from its hind-border but not reaching its anterior border; and the lateral marks, elongate-pyriform, with the upper end pointed and level with the sockets of the antennæ. The clypeal mark suggests that of *obscurata*. Antennæ dark brown. Mesothorax only sparsely hairy, distinctly granular and punctured, the punctures sparse but distinct. Metathorax granular, very dull, duller than scutellum and postscutellum. Pleura hairy, with white hairs. Tubercles and two spots on hind margin of prothorax yellow. Tegulæ testaceous, subhyaline.



FIG. 14.

Wings rather small, yellowish-hyaline, nervures and stigma testaceous. Stigma small and narrow; marginal cell very large, poststigmatal portion noticeably longest. Second submarginal large, narrowed more than one-half to marginal; 3d discoidal distinct.

Legs dark brown with the tarsi testaceous; anterior and middle tibiæ in front, and corresponding knees, dull yellow. Abdomen above and below dark reddish-brown, without markings.

Hab.—California, collector and exact locality unknown; sent by Mr. Fox. One specimen, known by the yellowish wings, abdomen without markings, etc.

Two species described by F. Smith, exact locality and habits unknown.

32. *Perdita haliotoides* Sm., Br. Mus. Cat., Vol. I, p. 128, (1853). ♀ (Hab. North America).

The description indicates that this species is similar to *P. semicrocea*, but differs in having the nervures fuscous (in *semicrocea* they are colorless), the abdomen dark testaceous, and the legs rufotestaceous with the tarsi pale.

33. *Perdita bicolor* (Sm.).

Macrotera bicolor Sm., Br. Mus. Cat., Vol. I, p. 130, (1853). “♀” (Hab. Mexico).

The description shows that this species is twice as large as the last, the head and thorax black and the abdomen ferruginous, more or less fuscous at base. It might, perhaps, be confused with *M. texana*, but the abdomen is elongate-ovate and the mandibles are rounded at their apex, simple. The wing nervures are ferruginous. *P. texana* has a ferruginous abdomen only in the ♂.

As the description of this insect did not enable me to ascertain definitely whether it belonged to the group (or genus) of *P. texana* = *megacephala* and *P. latior*, I applied to Mr. E. A. Smith, of the British Museum, asking him to kindly examine his father's type, and report on certain points specified. He handed my letter to Lt. Col. Bingham, who very kindly examined the typical specimen, and reported as follows:

“1. The type is a ♂, not a ♀. It has the two basal segments fuscous, the 3d and following segments ferruginous, with the apical one, which is very small and somewhat hidden by the fimbria of pale hairs on the posterior margin of the 6th segment, black.

“2. The mandibles are deeply grooved on the outside from near the base to the apex, which, however, does not appear to be bifid.

“3. The figure of the marginal cell given in Part I, pl. V, f. 22, of Smith's Catalogue, is fairly good, the cell may be a little more obliquely truncate at apex, perhaps.

“4. From Cresson's description of *M. megacephala* ♂, Smith's type of *bicolor* differs as noted above in the basal segments of the

abdomen being fuscous, and in the posterior tibiæ being clothed with a 'a thin scopa' of pale yellow pubescence, as Smith described, which has now faded to a dirty white."

While I am not yet certain, I am decidedly inclined to suppose that we may after all recognize *Macrotera* as a valid genus, with these species, *M. bicolor* Sm., *M. texana* Cr., and *M. latior* (Ckll.).

A species from Nevada, yellow with black markings, habits unknown, ♀ unknown.

34. *Perdita cephalotes* (Cr.) Cr., Cat. Hym., 1887, p. 296.

Macrotera cephalotes Cr., Tr. Am. Ent. Soc., 1878, p. 71. ♂ (Hab. Nevada).

Described from a single specimen, collected by Mr. Hy. Edwards. It has a very large head, after the manner of *grandiceps* and *crassiceps*, but the markings are very like those of *punctosignata*.

Two specimens were obtained by the Death Valley Expedition in the Panamint Mountains. (N. Amer. Fauna, No. 7, 1893, p. 246).

Two species found on mesquite in New Mexico.

35. *Perdita punctosignata* Ckll., Suppt. to Psyche, Sept., 1895, p. 6. ♂ (Hab. Las Cruces, N. M.).

Two specimens are known, both from mesquite; one taken by Miss J. Casad, the other by Mr. Alfred M. Holt. The latter specimen has a large yellow patch on dorsum of metathorax, instead of two spots. The eyes are pale coffee-color with a purplish tint.

36. *Perdita exclamans* (Ckll.).

Perdita nitidella var. *exclamans* Ckll., Suppl. to Psyche, Sept., 1895, p. 5. ♂ (Hab. Las Cruces, N. M.).

This and the last are spring species, found in May. *P. nitidella*, which frequents *Bigelovia* in the late summer and early autumn, is unquestionably distinct from *exclamans*. Of the latter we know four specimens, 3 ♂, 1 ♀. Prof. Townsend took a ♂ some years ago; this is the specimen formerly reported in error as *nitidella*. Miss Casad found the type specimen, and the other two were obtained at the same locality by Mr. A. M. Holt in 1895, a ♂ on a young cottonwood tree, not in flower, and near some mesquite bushes, May 9th, and a ♀ on mesquite, May 13th.

The ♀ may be described as follows:

♀.—Larger, about 6 mm. long. Antennæ dark brown above, yellow beneath. Clypeus cocked-hat shape, flattened above, very pale yellowish with the usual two dark dots. Supraclypeal yellow mark well developed, produced above into a narrow stripe widening

into a large frontal patch, so that the whole has the shape of an hour-glass. The frontal patch is separated by a moderately wide interval from the anterior ocellus. Dog-ear marks present but small, their tips about level with the top of the clypeus. Lateral face-marks receding from the clypeus close to the dark dots, leaving a wide band of dark color between them and the upper part of the clypeus, etc. ; at the level of the antennal sockets they are suddenly narrowed, ascending the orbital margin as a thin band, rather suddenly widening opposite the middle of the frontal patch, and terminating roundly and abruptly at the level of the hind margin of the anterior ocellus. Lower part of cheeks pale yellow.

Prothorax and narrow lateral borders of mesothorax yellow. Pleura entirely dark. Metathorax blue, rugulose, contrasting with the scutellum, postscutellum and mesothorax, which are brassy-greenish, very smooth, shining, polished, the scutellum with distinct sparse punctures. The vertex is green, but rugulose and punctured. Legs as in ♂, but hind tibia and tarsus all brown. Wings with 3d discoidal cell distinct; 2d submarginal narrowed less than half to marginal.

Abdomen above yellow; markings dark sepia, first segment dark at base, connecting with a blotch on each side, hind margins of segments 1-4 with dark bands, connecting laterally with a spot on proximal margins of 3 and 4, but these spots lacking on fifth segment, while the bands on 1 and 2 are broadly confluent along lateral margin. Vertex yellow, immaculate.

This is very different from the ♀ of *nitidella*.

Two species found in spring in the Mesilla Valley, N. M., habits unknown, ♀ unknown.

37. *Perdita martini* Ckll., Proc. Phila. Acad., 1895, p. 14. ♂. (Hab. Las Cruces, N. M.).

The unique specimen was taken on April 26th.

38. *Perdita hirsuta* n. sp.

♂.—Length about 5 mm. Head and thorax blue, granular, unusually hairy with white hairs, but the disc of metathorax, and yellow face below antennæ, bare. Head of ordinary size, rounded, a little broader than long; cheeks unarmed. Face just above the level of the antennæ conspicuously hairy, the hairs arranged so as to appear to radiate from the antennæ. Antennæ black above, yellow beneath, the scape with only a black blotch above. Mandibles very

straight, very pale yellowish with rufescent tips. Clypeus rather cocked-hat shape, flattened above, with the sides very rapidly descending and the prolongation to the base of mandibles very narrow. Face below antennæ all lemon-yellow, except the usual clypeal dots. Above the antennæ the yellow extends only as a small projection in the median line, and a little along the orbits, so that the upper angle of the yellow with the orbital margin is about 50° instead of a right angle. Lower half of the cheeks with a yellow band along orbital margin.

Collar and hind margin of prothorax connecting with tubercles but failing in the middle line, yellow. Tegulæ hyaline. Wings hyaline, nervures sepia-brown, stigma margined with brown. Marginal cell moderately long, appendiculate, the poststigmatal portion about as long as substigmatal. Second submarginal not narrowing quite one-half to marginal; 3d discoidal fairly distinct. Legs yellow, anterior and middle femora and tibiæ with a black patch behind, hind femora and tibiæ black with a yellow stripe in front, hind tarsi blackish.

Abdomen above with about equally broad bands of black and yellow. First segment basally black. The five dark bands are not interrupted, nor joined medially or laterally. Sixth segment with three dark spots. Venter yellow, immaculate.

Hab.—Las Cruces, N. M., on the College Farm, May 2d, 1895. One specimen collected by A. M. Holt.

Two species found on willow in the Mesilla Valley, N. M.

39. *Perdita numerata* Ckll., Tr. Am. Ent. Soc., 1893, p. 296. ♀. (*Hab.* Las Cruces, N. M.).

One specimen is known, taken on May 2d, associated with *P. salicis*. It resembles most the ♀ of *bigeloviae*, but the stigma is entirely dark and the clypeus has two broad black bars. The marginal cell is short, appendiculate; the 2d submarginal is large, very broad below, narrowed considerably more than half to marginal.

40. *Perdita salicis* n. sp.

♀.—Length 5 mm. Head and thorax shining dark green; head bluish-green, mesothorax and scutellum brassy-green, metathorax dark blue. Head rounded, of ordinary size; vertex minutely roughened, cheeks only sparsely hairy; clypeus except two black dots, the area between clypeus and antennæ, and sides of face narrowly terminating in an acute point about half the length of the

scape above the level of insertion of antennæ, dull pale yellow. In the median line the pale color is sometimes carried upward as a narrow stripe about two-thirds of the distance between insertion of antennæ and middle ocellus. Mandibles simple, unusually stout, blunt at tips, dull pale yellowish with rufous ends. Mouth parts only moderately elongated. Antennæ black above, yellow beneath, the yellow predominating on scape, the black on flagellum.

Mesothorax very shiny, sparsely punctured. Prothorax including tubercles either entirely yellow, or the anterior and posterior borders broadly yellow, leaving a narrow transverse dark band. Legs entirely yellow, except hind tibiæ and tarsi, which are brownish. The middle tibiæ sometimes show a brown patch.

Tegulæ yellowish hyaline. Wings hyaline, costal nervure and margin of stigma dark brown, the other nervures practically colorless. Marginal cell rather obliquely truncate, the substigmatal portion about as long as poststigmatal; 2d submarginal not or hardly narrowed one-half to marginal, the degree of narrowing variable; 3d discoidal distinct. Abdomen above black, with five very regular yellow bands, the first slightly interrupted. The black and yellow are nearly of equal width, so that the abdomen might be said to be alternately black and yellow-banded. Venter entirely yellow with an orange tinge.

♂.—Length 4 mm. Cheeks unarmed. More pubescent, antennæ more yellow. Mandibles pointed but not slender, the shining rufous tips very distinctly separated from the yellowish portion.

Face all pale yellow up to level of antennæ, the yellow extending further upward, in the median line as a narrow mark of the shape of a spear-head, scarcely the length of the scape, and at the sides about the length of the scape along orbital margin, but very obliquely truncate, and notched on its inner side below the truncation. Prothorax with more black. Mesothorax and scutellum bluer. Hind femora with a dark brown patch near the end. Nervures brown; 3d discoidal very indistinct.

Abdomen above with only four bands; these narrower, and divided or deeply notched in middle. Sometimes the abdomen has only three bands.

Hab.—Las Cruces, N. M., in the town, numerous at flowers of narrow-leaved willow and another species of willow, May 2, May 3, May 5, 1895. They are associated on the willows with *Halictus*, *Andrena* and *Prosopis*.

*The small species of the Pectis and Cladothrix.***41. *Perdita cladothricis* n. sp.**

♀.—Length $3\frac{1}{2}$ – $3\frac{2}{3}$ mm. Head and thorax shining, very dark æneous, face entirely dark, clypeus and metathorax black. Abdomen dark sepia-brown, with a transversely elongate mark or band of white at base of second segment. Legs dark brown, the anterior knees and the tarsi, pale or whitish. Antennæ dark brown. Vertex very minutely sculptured. The usual pale hairs are very little developed anywhere, except at sides of end of abdomen; the post-scutellum and the sides of the metathorax are bare and shining. Wings hyaline, beautifully iridescent, nervures fuscous, stigma pale brown, 3d discoidal cell distinct, marginal with the substigmatal portion longer than the poststigmatal, 1st submarginal broad, 2d submarginal small and triangular, narrowing to a point at junction with marginal.

♂.—Length $2\frac{1}{2}$ –3 mm. Cheeks unarmed. Differs from the female at once by the face, which (with the mandibles except their reddish tips) is entirely ivory-white below level of antennæ, the white moreover extending a short distance above the antennæ, in the form of a narrow line between them, and a broad prolongation on each side between the antennæ and the orbits, not quite as long as the scape, and ending in an abrupt truncation. The antennæ are mainly white beneath. The tubercles, and the border of prothorax adjacent and in front, and a portion of the anterior part of the pleura, are white. The coxæ, a considerable portion of the anterior and middle femora, and part of the anterior tarsi, are white.

The abdomen, in addition to the white band of the ♀, usually shows a longer and narrower white band at base of 3d segment. Venter dirty whitish, becoming brown at base and apex.

Hab.—Las Cruces, N. M., very abundant on *Cladothrix cryptantha* (det. E. O. Wooton), Sept. 15, 1895. On this occasion I took 6 ♂, 12 ♀; I do not think the males were really less numerous, but owing to their small size and incessant activity they were less easily caught than the females. The earliest date I have for this species is a ♂ taken on *Cladothrix*, associated with a new *Oxybelus*, in the beginning of September. Stray examples will be found at times on other plants. On September 17th, four ♀ were obtained by sweeping from *Pectis papposa*, but *Cladothrix* was growing within a few feet of the *Pectis*. On September 23d, a ♀ was obtained from *Bigelovia*

wrightii. On September 25th, a few ♀ were caught on *Gutierrezia sarothræ* v. *microcephala*.

42. *Perdita pectidis* n. sp.

♀.—Head and thorax black, vertex greenish. Head of moderate size, rounded, somewhat depressed on vertex. Sides of clypeus and sides of face adjacent to orbital margin with sparse but large and deep punctures. Vertex minutely rugulose, with sparse small punctures. Cheeks less hairy than usual. Mandibles rufescent, whitish at base, with dark tips. Clypeus with three rather large white marks, the central one longitudinally oval. Sides of face with an irregularly subtriangular white patch, narrowing to a point above, about the upper level of the sockets of the antennæ. Antennæ with the scape black, the flagellum sepia-brown.

Mesothorax smooth, sparsely punctured, very shiny. Metathorax blue-black. Collar, tubercles, and a couple of small spots on hind border of prothorax, white. Tegulæ hyaline subtestaceous. Femora black, knees whitish. Tibiæ and tarsi brown; anterior tibiæ in front, and a stripe on middle tibiæ pale yellow.

Wings smoky, nervures and stigma sepia-brown. Poststigmatal portion of marginal cell hardly as long as substigmatal; 2d submarginal narrowed more than half to marginal; 3d discoidal distinct.

Abdomen above very dark brown, segments 1-4 each with an oblique white stripe on each side. Pygidial area dark subrufescent. Venter dark brown.

♂.—Wings clear. Metathorax quite blue. Mandibles white with rufescent tips. White markings of face as in *cladothricis* ♂. Pale marks of abdomen reduced, sometimes to 4 or 5 small spots, which are then pale yellowish.

Hab.—Las Cruces, N. M., in numbers on *Pectis papposa*, Sept. 17, 1895. It is closely allied to *cladothricis*, but differs at once by the face of the ♀ not being all dark, and the different abdominal markings.

On September 20th, I took four ♀ *P. pectidis* from flowers of *Tribulus maximus*, and two, also ♀, from flowers of *Wedelia incarnata*.

With the *P. pectidis* on *Pectis papposa* were a few *P. fallax*, ♀ which I at first supposed to be a variety of it. *P. fallax* is, however, distinguished by its greenish head and thorax (or at least the mesothorax more or less greenish), scape pale yellowish below or with a yellow stripe, face-markings tinged distinctly yellowish, clypeus pale, sometimes with two black bars, diverging below, and the usual black

dots, wings clear, abdominal markings inclined to be smaller, or wanting on 4th segment.

43. *Perdita biparticeps* n. sp.

♂.—Length $3\frac{1}{2}$ mm. Head and thorax very dark blue; thorax practically black, except the metathorax. Head large in comparison with the small thorax, rounded, somewhat broader than long, cheeks unarmed. Face below antennæ, labrum and mandibles except their slightly rufescent tips, lemon-yellow. The yellow extends above the antennæ a short distance (and equally) in the median line and at the sides, almost exactly as in the ♂ of *affinis*, the limit of the lateral extension marked by a small pit close to the ocular margin, where the yellow forms an angle of about 55° . Cheeks yellow below, the yellow extending furthest upward along the orbital margin. Antennæ sepia above, yellow below, the scape all yellow except end above. Vertex granular. Mandibles simple. Mesothorax shining but noticeably sculptured, the surface lineolate rather than granular. The mesothorax, as also the face, is very free from hairs; and even on the pleura and sides of metathorax there are comparatively few. The upper part of the cheeks, however, exhibits conspicuous white hairs.

Tegulæ hyaline; wings slightly smoky, nervures and stigma sepia-brown, the latter pallid in middle. Marginal cell rather large, appendiculate, substigmatal portion about as long as poststigmatal; 2d submarginal rather large, narrowed one-half to marginal; 3d discoidal distinct.

Legs yellow, anterior and middle femora and tibiæ with a dark brown patch behind; posterior femora brown with yellow ends and an obscure yellow stripe in front, posterior tibiæ brown with the proximal fourth pallid, tarsi whitish.

Abdomen above pale sepia-brown, shining, with rather obscure and suffused yellow markings, namely a patch on disc of 1st segment, and bands at bases of segments 2-4, the last two of these shorter and emarginate posteriorly. Venter dull yellow, brownish toward tip.

Hab.—Las Cruces, N. M., on *Pectis papposa*, Sept. 17, 1895, one example.

Differs from *rectangulata* by its small size and shiny mesothorax, as well as the markings of the abdomen. The pleura has not the yellow patch seen in *maculipes*.

Small species found on Gutierrezia, ♀ unknown.

44. *Perdita austini* Ckll., Proc. Phila. Acad., 1895, p. 13. ♂. (Hab., Las Cruces, N. M.).

The type was taken in September. The cheeks are unarmed, the mandibles simple, the clypeus of the Panama-hat type, with the crown higher, more like a Puritan's hat. The mesothorax is shiny, it and the face nearly bare; but the cheeks and pleura, as well as the thorax beneath generally, with conspicuous white hairs. The marginal cell is rather long, but the substigmatal portion is noticeably longer than the poststigmatal; the second submarginal is narrowed nearly to a point above.

I took one specimen at Albuquerque, N. M., on *Gutierrezia sarothræ*, Aug. 15, 1895. At Las Cruces it is quite rare so far as observed. Mr. C. Rhodes took one on *Bigelovia wrightii*, toward the end of September. I took it on *Gutierrezia sarothræ* var. *microcephala* on Sept. 25th. The ♀ is unknown.

45. *Perdita gutierrezæ* n. sp. or variety.

♂.—About 4 mm. long, size and appearance of *nitidella* ♂. Cheeks unarmed, but projecting at base of mandibles so as to simulate a small tooth. Face entirely yellow up to nearly the length of scape above level of insertion of antennæ, the yellow enclosing a black spot on each side at its extreme upper border close to margin of eye. On each side, midway between the eye and the median line, the yellow is depressed by a slight invasion of the blue, which forms thereat an angle considerably greater than a right angle. Lower half of cheeks broadly yellow, pleura with a yellow patch, which is wanting in *nitidella*; 2d submarginal cell more narrowed above than in *nitidella*; 3d discoidal distinct. Veins dark brown. The rest much as in *nitidella*.

Hab.—Albuquerque, N. M., one specimen on *Gutierrezia sarothræ*, August 15th. This is certainly distinct from *nitidella*, but it may be only a variety of *bigeloviæ*; see below under *maculipes*.

46. *Perdita tarda* n. sp.

♂.—Length 4½ mm. Head and thorax dark blue. Head moderately large, distinctly broader than long, cheeks unarmed, vertex rugulose and punctured. Face very free from hairs, except sides near antennæ, where they are rather conspicuous; cheeks thickly clothed with long white hairs. Antennæ dark brown above, yellowish beneath, the scape all yellow beneath and at base above.

Mandibles very little curved, yellow, rufescent at ends. Clypeus approximately cocked-hat shaped, the lateral prolongations broad. Face below antennæ all lemon-yellow except a notch of the dark color distad of each dog-ear mark, and not quite so large as it. The supraclypeal mark is roundly emarginate above. The clypeus has the usual two dark dots. Along the orbital margins the yellow ascends about half the length of the scape above the level of the antennæ, and ends in an oblique truncation; this upward band of yellow is a little wider than the scape. The cheeks are entirely dark. Mesothorax smooth and shining, though minutely lineolately sculptured, nearly black; mesothorax finely sculptured, very distinctly blue. Pleura all dark. Tubercles yellowish.

Tegulæ pale brown; wings slightly smoky, nervures and stigma sepia-brown, the latter pale in middle. Marginal cell large, appendiculate, poststigmatal portion longest; 2d submarginal narrowed less than half to marginal; 3d discoidal distinct. Transverse cubital nervures more or less broken by hyaline dots. Legs black, all the knees, anterior and middle tibiæ in front, and base of hind tibiæ yellow; tarsi pale brownish, the anterior ones yellowish.

Abdomen above piceous, with narrow whitish bands, interrupted in the middle, rather obscurely indicated on disc of 1st segment, and at base of segments 2 and 3. The markings are in the form of narrow straight stripes, not oblique ones as in some species. Venter dark brown.

Hab.—Las Cruces, N. M., one specimen on *Gutierrezia sarothræ* var. *microcephala*, Sept. 23, 1895. Allied to *P. biparticeps*, from which it differs at once in the face-markings, the abdomen, etc. From *austini* it differs radically in the face-markings.

Small species found on Bigelovia wrightii, having the abdomen banded.

47. *Perdita nitidella* Ckll., Proc. Phila. Acad., 1895, p. 16. ♂. (*Hab.*, Las Cruces, N. M.).

On *Bigelovia wrightii* at Las Cruces, several males on September 2d, one ♀ on September 11, 1895. The latter is herewith described:

♀.—Length 5 mm. Face-markings creamy-white. Clypeus white with two black dots, the anterior margin narrowly brown, and traces of the two longitudinal bars in brown. Sides of face with an irregularly subtriangular white mark, the upper obliquely truncate end of which is level with the insertion of the antennæ. Cheeks quite

densely white-hairy. Prothorax with less pale marking, the tubercles not connected with yellow of margin of prothorax. Nervures dark brown; 3d discoidal distinct. Legs about as in *austini*, but anterior femora partly black in front, and middle femora with less black. Abdomen banded as in ♂, but the banding yellowish-white.

48. *Perdita bigeloviae* n. sp.

♂.—About 5 mm. long. Resembles *nitidella* ♂, but larger; face-markings as in *gutierreziae* ♂, but the black spots close to eyes above are not enclosed, but only produce a notch in the yellow; and the yellow is in the middle-line rather more produced upward, not reaching the ocellus, but terminating some distance before it in an emarginate truncation. Venation as in *nitidella*, with 3d discoidal cell very indistinct. Pleura largely yellow, the amount of yellow on it variable. Legs and abdomen as in *nitidella*. Cheeks unarmed. (7 ♂s examined.)

♀.—Length 6mm. Similar to *nitidella* ♀, the pale marks of face rather inclining to pinkish-brown; and the marks of sides of face distinctly notched on inner side, and sometimes also at end. Sometimes there are two pale spots above the clypeus; 3d discoidal cell distinct. Abdomen brown-black, with creamy-white bands on segments 1-4, that on 1 interrupted; 5 with a rudimentary linear broken band, or frequently with a distinct broad band.

Hab.—Albuquerque, N. M., several of both sexes between the old and new towns, on *Bigelovia wrightii*, Aug. 16, 1895. The males of this lot were unfortunately reddened by the cyanide; but the females, collected in the same bottle at the same time, were not so affected. On September 11th, a specimen of each sex was taken on *Bigelovia wrightii* close to the Agricultural College at Las Cruces. The ♀ is very similar to that of *P. numerata*.

49. *Perdita maculipes* n. sp., or variety.

♂.—A small form, 4 mm. long, similar to *nitidella*, anterior and middle femora all yellow, anterior and middle tibiæ each with a black patch.

From *nitidella* it is readily separated, thus:

- (1). Median and lateral upward extensions of yellow on face irregularly truncate; anterior and middle tibiæ with a black patch; pleura with a large yellow patch; bands of abdomen united at sides; lower part of cheeks broadly yellow,
= *maculipes* ♂.

- (2). Median and lateral upward extensions of yellow on face not truncate, or lateral ones notched and subtruncate; anterior and middle tibiæ all yellow; pleura without a large yellow patch; bands of abdomen not united (or only the first two or three united) at sides; lower part of cheeks very narrowly yellow = *nitidella* ♂.

From *biparticeps* it is thus distinguished: .

- (1). Size smaller, abdomen suffused; pleura without yellow patch,
= *biparticeps* ♂.
- (2). Size larger, abdomen not suffused; pleura with a large yellow patch; median face-marks more developed above antennæ,
= *maculipes* ♂.

It is very much like *gutierrezia*, but differs from that in its longer marginal cell, the abdominal bands joined laterally, and the upper margin of the yellow of face much more distinctly trifid, besides the marks on the tibiæ. It resembles *gutierrezia* in the broadly yellow lower part of cheeks, and the yellow blotch on pleura.

From small examples of ♂ *bigelovia* it is distinguished by the abdominal bands being united at the sides, the face-markings as already mentioned, and the tibiæ with dark marks—though the middle tibiæ of *bigelovia* sometimes show a small spot. The marginal cell is as in *bigelovia*.

Hab.—Las Cruces, N. M., one example on *Bigelovia wrightii*, Sept. 5, 1895. (A. M. Holt.) The above form allies itself very closely with *bigelovia* and *gutierrezia*, which have the cheeks more or less broadly yellow and the yellow patch on the pleura. The more one studies these forms the more apparent does it become that *nitidella*, with its dark pleura and narrow yellow line only on the cheeks, is distinct; while *bigelovia*, *gutierrezia* and *maculipes* run each other so close that they seem to be varieties of one species. Yet I leave them as they stand, not because I think that they are what would be called good species, but rather to draw attention to the divergence which may represent an early stage in species-formation. It will be noted that *maculipes*, while retaining the essential characters of *bigelovia*, departs in its face-markings toward the condition of *nitidella*.

50. *Perdita pellucida* n. sp.

♂.—Length about 5 mm. Head very dark blue, thorax black except the dark blue metathorax. Head of ordinary size, rounded, broader than long; cheeks unarmed, mandibles moderately stout, simple. Vertex granular. Face with rather conspicuous but very

scattered hairs, a tuft of erect hairs behind the ocelli being most noticeable. Cheeks with long white hairs. Face below antennæ semitransparent dull white, the clypeus prominent and shining. The upper margin of the white is not very clearly defined, but it ends abruptly in the median line at the lower level of the antennal sockets, while at the sides of the face it ascends rather broadly not quite the length of the scape above the level of the antennæ. Thus the pale color of the face is distributed as in *obscurata* ♂, except that it perhaps ascends a little higher at the sides. (In *bigeloviae* and *nitidella* it ascends above the level of the antennæ in the median line). Clypeus narrowly produced at sides to bases of mandibles, but higher than in the Panama-hat type. Mandibles white with rufous tips. Antennæ pale testaceous; flagellum, funicle and end of scape becoming dark brown above. Lower half of cheeks narrowly white along orbital margin, thus recalling the cheek-marking of *nitidella*.

Thorax with sparse but rather conspicuous hairs. Mesothorax shining, appearing slightly bluish in some lights, very finely lineolately sculptured, median groove distinct. Metathorax microscopically reticulate. Part of collar, and whole hind margin of prothorax, connecting with tubercles, but very narrowly interrupted in median line, white. The margin of the prothorax below the tubercles is broadly white. Pleura hairy, dark except a white spot about as big as a tubercle, anteriorly. Tegulæ hyaline. Wings hyaline; costal nervure, margin of stigma, and marginal nervure, sepia-brown, the other nervures colorless. Marginal cell unusually long, poststigmatal portion considerably the longest, minutely appendiculate. (In *nitidella* and *bigeloviae* the marginal is conspicuously shorter.) Second submarginal narrowed more than one-half to marginal; 3d discoidal very weak.

Four anterior legs yellowish-white, tarsi becoming testaceous, middle tibiæ with a dark brown line behind. Hind legs with the basal two-thirds of coxæ above, most of distal half of femora above and behind, and tibiæ except anterior margin, dark brown; the tarsi brownish.

Abdomen above with nearly equally broad bands of dull white (becoming pale brownish toward tip) and dark sepia-brown; these bands not interrupted, nor united at sides or in the middle, nor notched. First segment all brown-black except the hind margin narrowly. The dark bands are four in number, the sixth segment

having no band. Venter pale yellowish, slightly orange toward the tip.

Hab.—Las Cruces, N. M., one specimen on *Bigelovia wrightii*, close to the Agricultural College, Sept. 12, 1895. (Ckll. 5,100). The type specimen may be a little immature, but it is clearly distinct.

Small species found on Bigelovia wrightii, the abdomen not banded.

51. *Perdita fallax* n. sp., or race.

♀.—5 mm. long. Head and thorax dark green, dullish, rather hairy but the hairs short, face below antennæ bare and shining. Head of ordinary size, rounded, not broader than long, occiput and cheeks well fringed with short hairs, vertex granular. Clypeus moderately high, flat above, with the sides very narrowly produced. Face-markings yellowish-white; clypeus all pale except the two usual dots, and two dots near the upper margin, representing the ends of the bars seen in some species, or the bars may be even fairly well-developed. Supraclypeal mark absent, though there may be a pair of scarcely perceptible pale specks close to upper border of clypeus. Dog-ear marks absent. Pale lateral marks at first rapidly narrowing, and then gradually, ending in a narrow truncation at the level of the antennæ. Cheeks dark, mandibles rufous at tips. Antennæ dark brown, yellow beneath, the sutures of the flagellar joints dark.

Mesothorax minutely lineolately sculptured. Pleura all dark. Tubercles and two spots on hind border of prothorax white. Tegulæ hyaline subtestaceous. Wings hyaline, nervures and margin of stigma sepia-brown. Marginal cell appendiculate, poststigmatal portion a little the longest. Second submarginal large, narrowed a little more than one-half to marginal; 3d discoidal distinct. Legs brown-black; anterior knees and anterior tibiæ in front pale primrose-yellow. Middle and hind knees whitish.

Abdomen rather broad and flat; above piceous, with an oblique white mark on each side of segments 1–3, those on 1 very narrow and closely approximating in the median line. Tip orange, or to be more precise, the pygidium is orange with the border colorless and hyaline, the tip emarginate, as is also the case in *affinis*. Venter piceous.

Hab.—Las Cruces, N. M., on *Bigelovia wrightii*, Sept. 23, 1895, two specimens (Ckll.). This is, in all respects, very closely allied to *P. affinis*, but it is smaller, the abdominal markings are white and

the abdomen is not so conspicuously marked. Yet in all essential particulars it agrees so nearly with *affinis* that it might well be deemed a southern race of it. The clypeal markings vary as in *affinis*. On Sept. 20th, I took one example of *P. fallax* on flowers of *Verbesina encelioides*, and on Sept. 17th, three on *Pectis papposa*.

52. *Perdita phymatæ* Ckll., Proc. Phila. Acad., 1895, p. 12. ♀. (Hab., Las Cruces N. M.).

In the original description the legs are described as dark brown without markings, but in the normal form of the species the knees are all pallid and the anterior tibiæ are yellow in front, as in *fallax*. The original type specimen, now in Coll. Am. Ent. Soc., was examined for me by Mr. Fox, who reports that the yellow is represented by pale testaceous.

The mesothorax is minutely sculptured, though shining. The second submarginal cell is large, and narrows more than half to marginal; 3d discoidal distinct. The clypeus is strongly punctured, and frequently presents a small yellow median spot. Glossa not hairy.

This species was common on *Bigelovia wrightii* at Las Cruces, Sept. 23, 1895, but the ♂ has not been observed. It was also taken on *B. wrightii* on Sept. 2d, together with *P. nitidella*, *P. luteola*, *Halictus stultus* and *Prosopis*. On Sept. 25th, it was taken on *Gutierrezia sarothræ* var. *microcephala*, together with *P. semirocea*, etc.

53. *Perdita æneifrons* n. sp.

♀.—Length 5 mm. Head dark green with the front very distinctly brassy, and the clypeus black; thorax pitch black, with the metathorax dark green. Abdomen black, shiny, without bands or spots, venter dark subolivaceous brown.

Head rounded, of ordinary size, not broader than long, vertex minutely rugulose and very sparsely punctured. Clypeus shining, prominent, high, but not produced laterally to bases of mandibles, very sparsely punctured on its lower portion. Mandibles pale yellow at base, rufescent otherwise, with a distinct tooth on inner side. Face all dark, medially free from hairs, laterally with short hairs. Cheeks moderately hairy. Antennæ dark brown.

Mesothorax shining, perfectly smooth, bare; except its anterior border, which presents short hairs and is very feebly sculptured, and even presents in some lights a vague greenish tinge. Scutellum bare, postscutellum with a thin fringe of white hairs.

Metathorax granular. Prothorax, even including tubercles,

wholly dark. (In *phymatæ* the tubercles are more or less pallid.) Tegulæ hyaline. Wings milky hyaline, nervures and stigma almost colorless, the latter yellowish. (In its pallid wings it resembles *semicrocea*.) Stigma large; marginal cell short, substigmatal portion longest, 2d submarginal narrowed about one-half to marginal; 3d discoidal distinct.

Legs black, knees pallid, anterior tibiæ in front, anterior tarsi and an obscure stripe on middle tibiæ, yellow. Tip of abdomen rounded or subtruncate, not emarginate. (It is emarginate in *fallax*.)

Hab.—Las Cruces, N. M., on *Bigelovia wrightii*, Sept. 23, 1895, in some numbers with *P. phymatæ*. Its superficial resemblance to *phymatæ* is such that when catching the specimens I thought I had only one species, but a careful examination shows striking differences in the head, thorax and wings. The ♂ was not found.

54. *Perdita semicrocea* Ckll., Proc. Phila. Acad., 1895, p. 13. ♀. (*Hab.*, Las Cruces, N. M.).

In 1895 this species has been taken commonly at Las Cruces; on *Bigelovia wrightii*, Sept. 2d and Sept. 12th; on *Solidago canadensis*, Sept. 3d; on *Gutierrezia sarothræ* var. *microcephala*, Sept. 25th. The original specimen was taken in October. *P. semicrocea* is less strictly limited to one flower than most of the genus, being taken rather freely on all the plants mentioned—perhaps most freely on the *Solidago*. The ♂ differs in having the face below the level of the antennæ entirely yellowish-white, except the clypeal dots. The pale color does not extend further upward, but is slightly notched on each side of the antennæ, the outer margin of the notch being a little higher than the termination of the pale color on the orbital margin. The cheeks are unarmed. The narrow tip of the abdomen is very narrowly truncate, not emarginate. The anterior and middle legs are yellow, except a dark patch on the femora behind.

55. *Perdita luteola* Ckll., Ent. News, 1894, p. 328. ♂. (*Hab.*, Las Cruces, N. M.).

Very abundant on *Bigelovia wrightii*, Sept. 2d, etc. On Sept. 23d, I caught several on *Gutierrezia sarothræ* var. *microcephala*. I have found them on no other flowers, except that once I saw one in the net after sweeping over *Pectis papposa*.

The ♀ differs in having a black line in place of a black spot before the eyes, being really the groove usually seen in that situation, wholly black; a similar black line placed longitudinally on each side of the anterior half of the second segment of the abdomen; and

the antennæ brown-black or dark brown above. The ♂ has the cheeks unarmed.

When left too long in a damp cyanide bottle the ♂ turns a brilliant crimson all over.

A species found in New Mexico, habits and exact locality unknown.

56. *Perdita nuda* n. sp.

♀.—Length $7\frac{1}{2}$ mm. Head and thorax green, legs and abdomen dark chocolate-brown. The body in general is remarkably free from hairs; the face is bare but the occiput and cheeks present scattered short hairs; the thorax is practically bare, even including the pleura and sides of metathorax; the tip of the abdomen has a fairly dense fringe of hairs; the tibiæ and tarsi are quite hairy, the hairs of a dull whitish color.

Head of ordinary size, a little broader than long, dark green, the face very flat, vertex granular, clypeus punctured. There are no face-markings except an oblong dull yellow spot on the clypeus. Basal portion of mandibles yellow with a large dark spot. Glossa not hairy. Antennæ brown-black; flagellum whitish, scape and funicle testaceous beneath.

Thorax dark olive-green, metathorax bluish; the whole rather dull and finely sculptured. The pleura is quite shiny, but still sculptured. There are no pale marks on the thorax, but the tubercles, quite prominent, are dark brown.

Tegulæ hyaline with an opaque spot in front. Wings milky-hyaline, nervures and stigma dark brown, the latter pallid in middle. Marginal cell with the poststigmatal portion as long or a little longer than the substigmatal. Second submarginal large, narrowed more than one-half to marginal. Third discoidal distinct. Anterior knees, and anterior tibiæ in front, pale yellow. Abdomen above and below dark brown, without any pale markings. Tip emarginate.

Hab.—New Mexico, one specimen sent by Mr. Fox. Locality, etc., unknown. It resembles *P. phymatæ*, but is much larger than that or *asteris*. *P. asteris* has a hairy mesothorax; *phymatæ* has a nude mesothorax, but is much more shiny as well as being so much smaller. *P. semicærulea* has a hairy mesothorax.

A species found on Aster canescens.

57. *Perdita asteris* n. sp.

♀.—Length about or hardly 6 mm. Head very dark blue,

thorax very dark green, metathorax dark blue. Both head and thorax are very hairy, with short hairs; the disc of metathorax bare, and the disc of clypeus seeming bare, but seen, when sideways, to have a fine down. Head rather large, rounded, about as broad as long. Vertex very finely granular, punctate; sides of clypeus punctate. Mandibles with the basal two-thirds very broad, whitish, becoming rufescent; the terminal third black, comparatively slender, coming to a point. Antennæ dark brown above, yellowish beneath. Pale markings of face yellowish-white, restricted to clypeus and sides of face. Clypeus high, pale with the usual dots, but with a dark blotch on each side above, so that the yellowish-white color rapidly narrows, but instead of coming to a point, broadens a little to an abrupt truncation on the upper clypeal margin. Lateral marks of face broadly triangular, the inner angle of the triangle being opposite to the point on the clypeus where the pale color suddenly narrows, and the upper angle (of about 30°) on a level with the antennal sockets.

Thorax with a very narrow yellow line on hind border of prothorax, and a very small yellow stripe on tubercles. Mesothorax dullish, granular.

Tegulæ pale, testaceous; wings milky-hyaline, nervures and stigma very pale yellow, nearly colorless, the latter centrally hyaline. Marginal cell moderately long and narrow, with its poststigmatal portion a little the longer. Second submarginal rather large, narrowed more than half to marginal, being not far from an equilateral triangle. Third discoidal distinct.

Legs pubescent, black; the tarsi all white with a testaceous or yellowish tinge; hind margin of first joint of hind tarsi blackish, anterior knees and anterior tibiæ in front pale yellow. Abdomen above shining piceous without markings, the hind margins of the segments a little rufescent. Venter dark brown.

Mut. ♀.—Clypeus all yellowish-white except the usual dots and two ill-defined brown spots above. A semilunar dull yellowish supra-clypeal mark. One specimen.

Hab.—Las Cruces, N. M., Sept. 19, 1895, four specimens on flowers of *Aster canescens* var. *viscosus*. Prof. E. O. Wooton took one on the same flowers as late as the middle of October.

A species found on Senecio douglasii.

58. *Perdita senecionis* n. sp.

♀.—Length about 7 mm. Head and thorax dark, dull olive-

green, even including the metathorax; conspicuously granular. Head a little longer than broad; face practically hairless, cheeks and occiput with short whitish hairs. Vertex depressed between ocelli and orbits. Mandibles stout, simple, gradually tapering, blunt at tips, pale yellowish with the apical half rufescent. Antennæ very dark brown, dull pale yellowish beneath. Face-markings cream color, very distinct, restricted to clypeus and sides of face. Clypeus high, flattened above, prominent, cream color with broad black bars. Supraclypeal region dark, elevated, convex. Lateral face-marks club-shaped, rapidly narrowing and continuing upward to a subtruncate termination on a level with the antennal sockets.

Thorax nearly hairless, as in *P. nuda*; the greater part of tubercles, and a broadly triangular patch on each side of hind margin of prothorax, shining pale yellow. (In *nuda* these pale markings are lacking.) Tegulæ hyaline, with a kidney-shaped pale yellow opaque patch. Wings slightly smoky, nervures and stigma dark brown, the latter pallid in center. Marginal cell rather long, appendiculate, its poststigmatal portion a little the longest. Second submarginal large, subtriangular, narrowed more than half to marginal. Third discoidal distinct. Legs black, knees pallid, anterior tarsi testaceous, anterior tibiæ yellow in front, middle tibiæ with a yellow stripe in front.

Abdomen above black, with eight creamy-white marks, just like those of *affinis*. Venter piceous.

Mut. ♀.—The abdominal pale marks reduced to six, the last two failing, one specimen.

Hab.—Las Cruces, N. M., six examples on flowers of *Senecio douglasii*, collected by Prof. E. O. Wooton, Oct. 9, 1895.

This interesting species is extremely close to *affinis*, and would be taken for it upon superficial examination. It differs, however, by the somewhat longer head, the narrower lateral face-marks, the larger size, and especially by the glossa presenting only a small patch of hairs near its tip, whereas in *affinis* it is strongly hairy for a considerable distance. *P. octomaculata* has the glossa also more hairy than in *senecionis*.

A small species found on Chrysopsis villosa.

59. *Ferdita vespertilio* n. sp.

♂.—Length about 4 mm. Head and thorax shining black. Cheeks unarmed. Head rather large, especially in comparison with

the small thorax, when seen from the front almost precisely circular. Front quite hairy, with white hairs; cheeks hairy. Antennæ dark brown above, pale yellowish beneath. Clypeus rather cocked-hat-shaped. Pale markings of face cream color, confined to clypeus and sides of face, with, of course, the labrum and basal portion of mandibles. Seen all together, they suggest the head of one of the long-eared bats, whence the specific name. The darkened upper portion of the labrum represents the bat's mouth. Clypeus cream-color, with the usual dots obscure. Lateral face-marks broadly triangular, the inner angle opposite the clypeal dots, the upper one (of about 45°) on a level with the antennal sockets. Thorax shining, smooth, tolerably hairy. Prothorax, including tubercles, dark, the tubercles brownish. Tegulæ hyaline; wings hyaline, iridescent, nervures colorless, stigma margined with very pale yellowish. Marginal cell fairly long and narrow, the poststigmatal portion a little the longer. Second submarginal subtriangular, narrowed a little more than half to marginal. Third discoidal absent.

Legs dark brown with the tarsi brownish-white; anterior tibiæ yellowish except a suffused brownish patch behind, middle tibiæ pallid in front.

Abdomen short and broad, above dark brown without pale markings, but the distal margins of the segments more or less pale. Venter brown.

Hab.—Las Cruces, N. M., Oct. 5, 1895, one specimen on *Chrysopsis villosa*. No more could be seen. The locality is about a mile southeast of the Agricultural College. This little species has some resemblance to *californica* and its allies, but a glance at the face will distinguish it.

Three species with large heads, from New Mexico, found on Compositæ.

60. *Perdita grandiceps* n. sp.

♂.—Length about 5 mm. Form stout; head quadrate, extremely large, larger than the thorax, eyes narrow, cheeks armed with blunt teeth. Face flattened, very sparsely and inconspicuously hirsute, cheeks hairy beneath. Color of head very dark bottle-green; vertex granular, it and front looking almost silky, cheeks much more shiny. Mandibles stout, curved, scimitar-shaped, base pale yellowish, end rufescent, blackish on inner side. Antennæ blackish above, yellowish-brown beneath; scape piceous, with a light yellowish spot at base in front. Clypeus rather low, anterior

margin not produced into spines. Face-markings dull sulphur-yellow. Clypeus with a yellow longitudinal band, uniting with the broadly yellow anterior portion—or one might say, clypeus yellow with a pair of large triangular dark patches, the triangles having one side coincident with the hind margin. The extreme anterior edge of the clypeus is bordered with a black line. The supra-clypeal mark is represented by a pair of squarish yellow patches; the dog-ear marks, on each side of these, are not much larger. The lateral yellow face-marks would form nearly equilateral triangles, but that the innermost angle is narrowly produced. The upper angle scarcely reaches the level of the antennal sockets.

Thorax not very shiny, the surface granular. No pale markings. Prothorax with prominent shoulders. Color of thorax black with a slight metallic tinge, becoming distinctly brassy-green on anterior half of mesothorax; metathorax blue-black. Pleura and sides of metathorax with white hairs; mesothorax with sparse hairs. Tegulae hyaline subtestaceous. Wings milky-hyaline, nervures (except the dark costal nervure) practically colorless; stigma very pale yellowish. Marginal cell obliquely truncate, submarginal portion a little the longer. Second submarginal narrowed hardly one-half to marginal, third discoidal excessively weak.

Legs shining black, with white hairs. Anterior coxæ with a very noticeable tuft of white hairs. Tarsi becoming brownish. Anterior knees, and anterior tibiæ in front, yellow.

Abdomen oval, shining piceous without light markings. Margins of the segments a little rufescent. Venter brown.

Hab.—Las Cruces, N. M., on *Solidago canadensis*, Sept. 3, 1895, one specimen (Ckll., 4,746). It was associated on the flowers with *Melecta maculata*, *Anthophora maculifrons*, *Perdita semicrocea*, *Colletes*, *Heriades*, *Prosopis* 2 spp., *Oxybelus* 2 spp., *Philanthus* and *Odynerus*.

61. *Perdita crassiceps* n. sp. Fig. 15 (head.)

♂.—6 mm. long. Smooth and shiny; head and thorax so dark green as to seem black, metathorax very dark blue. Head quadrate, extremely large, eyes comparatively small and narrow. Vertex minutely granular, but nevertheless shining, with a transverse ridge behind the ocelli. The punctuation is sparse. Cheeks unarmed; mandibles rather long, scimitar-shaped, blunt at tips, pale yellowish becoming rufescent distally, the tips blackish. Antennæ dark brown above, yellow beneath. Clypeus wholly pale

yellowish, except the usual black dots, and a pair of obscure suffused brownish spots adjacent to hind margin. Supraclypeal mark wanting. Dog-ear marks present. Lateral face-marks white, broad, subquadrate, the lower border occupied by a black line, the upper border passing somewhat obliquely from the point on orbital margin opposite the antennal sockets, to slightly below the upper end of the dog-ear marks.

Thorax smooth and shining, mesothorax sparsely punctured; hairs on thorax above sparse, brownish, those on pleura white. No light markings except that the tubercles are pale yellow with a dark spot, and the collar shows a little yellow.



FIG. 15. Tegulæ pale testaceous; wings hyaline, nervures practically colorless, stigma very pale yellowish. Marginal cell rather long and narrow, its poststigmatal and substigmatal portions about equal. Second submarginal subtriangular, narrowed more than half to marginal. Third discoidal very weak.

Legs black with the knees and tarsi testaceous; anterior and middle tibiæ testaceous in front. Abdomen above shining dark brown, the hind margins of the segments a little pale; no light marks. Venter light brown.

Hab.—Albuquerque, N. M., June 30, 1895, one specimen on a yellow-flowered species of Compositæ not identified. (Ckll., 3,253.)

62. *Perdita laticeps* n. sp.

♂.—5½ mm. long. This greatly resembles *crassiceps*, in fact I had regarded them as the same until a close examination was made when writing the description of the latter. *P. laticeps* differs from *crassiceps* as follows:

The head is a little larger, the face is much more hairy, the sides of the cheeks are covered with short hairs (whereas in *crassiceps* they are bare and shining), the clypeus is distinctly panama-hat-shaped, the supraclypeal mark is represented by a narrow transverse line, adjacent to the upper border of the clypeus, the dog-ear marks are absent, the antennæ are dark brown above and below, the mandibles are stouter, the anterior and middle tibiæ are not testaceous in front, the hind tibiæ are more hairy, the abdomen is considerably shorter and broader, with the hind margins of the segments broadly hyaline. The tip of the abdomen is narrowly but abruptly truncate. There is no transverse ridge behind the ocelli, but this area shows strong punctures, which are wanting in *crassiceps*. The wings are as in *crassiceps*.

Hab.—Las Cruces, N. M., one collected by Mr. A. M. Holt on *Verbesina encelioides*, Sept., 1895. This species is allied to *interrupta* and *californica*.

Species found on Verbesina encelioides in the Mesilla Valley, N. M.

63. *Perdita beata* n. sp.

♀.—Length 8–8½ mm. Entirely bright canary-yellow; except the flagellum blackish above, the usual clypeal dots, an obscure black line round the lower part of the dog-ear marks, especially on the inner side; a black band, not quite as long as the scape, before each orbit; a short black line on each side of second abdominal segment; a dark shining pit on the hind part of the metathorax; and the lower (ventral) half of the pleura black. Wings hyaline, nervures and stigma very pale yellow. Marginal cell large, poststigmatal portion longest. Second submarginal narrowing hardly one-half to marginal. Third discoidal distinct. Hind tibiæ and tarsi very hairy. Mesothorax, scutellum and postscutellum with short dense erect yellow hairs. Ocelli dark. Ends of mandibles dark, the mandibles being quite abruptly bent before the dark portion. Terminal portion of glossa not hairy.

Hab.—Las Cruces, N. M., on flowers of *Verbesina encelioides*. The first was taken in September, 1895, by Mr. A. M. Holt. On Sept. 20th I took one, and again another on Sept. 28th.

This lovely insect is a sort of gigantic *P. luteola*; but the mesothorax of *luteola* is bare, while that of *beata* is very bristly; *luteola* also does not show the black on under part of pleura.

64. *Perdita perpulchra* n. sp.

♀.—Length 8½–9 mm. Head and thorax bronzy-green, densely covered (except the smooth disc of metathorax and middle of face) with short erect pale yellowish hairs, which become longer on the pleura and cheeks beneath, and sparse on the vertex. Head of ordinary size, subtriangular or broadly subcordiform; vertex dullish, granular; clypeus approximately cocked-hat-shaped. The conspicuous white hairs on face are arranged so as to seem to radiate from the antennæ; but the disc of the clypeus, and the area above it and between the antennæ, are bare. Mandibles abruptly bent before their dark ends. End of glossa with a conspicuous brush of hairs. Antennæ yellow; flagellum, funicle and end of scape black above. Clypeus (except the usual pair of dots) and lateral face-marks yellowish-white. No supra-clypeal or dog-ear marks. Lat-

eral pale marks subtriangular, the inner angle next to clypeal dot, the upper one (of about 30°) on a level with the antennal sockets. Mesothorax dullish, finely punctured as well as very bristly. Disc of metathorax bare and shining, with very fine striatulate sculpture. Prothorax (including tubercles) yellowish-white, except a transverse dark line widening centrally into a large dark patch.

Tegulae hyaline. Wings hyaline, nervures and stigma very pale yellowish.

Stigma small; marginal cell long, its poststigmatal part much the longest. Second submarginal large, subtriangular, narrowed considerably more than half to marginal. Third discoidal distinct. Legs yellowish-white, posterior tibiae very hairy; anterior femora below, except at distal end, a patch on anterior tibiae behind, middle femora below, a patch on middle tibiae behind, hind femora with a band above and an oblique streak near base within, hind tibiae, except proximal fourth and middle and hind tarsi, black.

Abdomen above white with black bands. First segment with two black spots in front, and a large broad black triangle, having for its base the whole distal margin of the segment. Segments 2-4 each with a distal black band, which is swollen in front sublaterally, and behind laterally, the swelling or patch in the latter case being on the next segment. Tip of abdomen dark brown, the pygidial area smooth and shining, though microscopically subpunctate, extreme tip rather broadly truncate, subemarginate. Venter mostly black, with a white spot on hind margin of each segment, and the sides largely whitish.

Mut. ♀.—The dark triangle on first abdominal segment with a small central light triangle. Abdominal bands broader, and continuously invading the segment following.

Hab.—Las Cruces, N. M., on flowers of *Verbesina encelioides*, one taken by Mr. A. M. Holt in the fall of 1895, and one by myself on Oct. 5th. A very beautiful and distinct species. It differs at once from *albovittata* by its larger size, non-hairy clypeus, lateral face-markings narrowing above, etc.

65. *Perdita albovittata* Ckll., Proc. Phila. Acad., 1895, p. 15. ♀. (*Hab.*, San Augustine, N. M.).

The two specimens taken at San Augustine on Aug. 29th are both females, not ♂ and ♀, as formerly stated. Miss Mae Gilmore took a ♀ in the Mesilla Valley, close to the Agricultural College, Sept. 23d, on *Verbesina encelioides*.

On Oct. 4th, at the same locality, Mr. C. Rhodes was so fortunate as to find a ♂ on *Verbesina encelioides*. The glossa of the ♀ shows two brushes of hairs, separated by an interval; that of the ♂ is bare.

The ♂ is only about $4\frac{1}{2}$ mm. long (♀ $5\frac{1}{2}$), and differs at once by the abdomen, which is short and broad, black, with the margins of the segments appearing broadly whitish because hyaline. The sides of the first three segments show obscure whitish marks—all that is left of the bands of the ♀. The venter resembles the upper surface. The tip is rufous, produced, narrowly truncate.

The face-markings, differently from most species, are as in the ♀. The antennæ are entirely brown-black. Cheeks unarmed.

There is a singularly close resemblance between the ♂ of *albovittata* and *laticeps*, so that the idea suggests itself that *laticeps* may be a dimorphic large-headed ♂ of *albovittata*. But this could not be taken as proven without positive evidence, or at least some analogous case in the genus to guide us. Cresson has referred to a ♂ specimen of *texana (megacephala)* in which the head was unusually large, but it may have been a different species.

66. *Perdita vagans* n. sp.

♂.—Length $4\frac{1}{2}$ mm. Head and thorax shining, blue-black, with sparse hairs which are quite long behind the ocelli. Head moderately large, rather broader than long, cheeks unarmed, vertex shiny though feebly microscopically granular; clypeus panama-hat-shaped, with the crown rather high. Cheeks wholly dark; labrum and mandibles pale yellowish. Clypeus pale yellow with the usual black dots. Dog-ear and supraclypeal marks wanting, though the former are represented by hardly noticeable pallid specks. Lateral pale yellow face-marks subquadrate, nearly the shape of the mainsail of a schooner, though shorter, the upper outer angle (of about 50°) about on a level with the antennal sockets. Antennæ sepia-brown above, yellowish beneath. Thorax smooth and shining. Tubercles, and a couple of small spots on hind margin of prothorax pale yellow. Pleura not very hairy. Tegulæ hyaline. Wings hyaline; stigma pale yellow, nervures colorless. Marginal cell rather long, its poststigmatal portion a little the longest. Second submarginal nearly triangular, narrowed more than half to marginal. Third discoidal absent.

All the femora, and the hind tibiæ, black with the ends subtestaceous yellowish. Anterior and middle tibiæ yellowish with a dark patch behind. Tarsi all pale yellowish testaceous.

Abdomen rather broad, dark sepia-brown, without light markings, the distal margins of the segments more or less pallid. Venter pale brown. Tip pale testaceous.

Hab.—Las Cruces, N. M., one on *Verbesina encelioides*, Sept. 28, 1895.

I had considered the possibility that this might be the ♂ of *asteris*, but it differs too much from it for this to be likely, I think.

Group of P. albipennis.

67. *Perdita sparsa* Fox, Proc. Cal. Ac. Sci., 1893, p. 16. ♂ ♀ (Hab., Margarita and Magdalena Islands, L. Cal.)

Collected by Mr. Haines in March, being, therefore, distinct from the other members of the group by its vernal appearance. I have examined a ♀ from Magdalena I., March, 1889, one of the types. It is very near to *albipennis*, and the difference of punctuation, mentioned by Mr. Fox, is not a very satisfactory character. It is, however, readily distinguished thus :

<i>P. sparsa</i> ♀ .	<i>P. albipennis</i> ♀ .
Nervures dark.	Nervures colorless.
Stigma margined with brown.	Stigma not so margined.
Size a little smaller.	Median mark broadening above to a T-shape.
Median mark of clypeus broad, lance-head-shaped, going to a point above.	
Three yellow bands on abdomen, first entire, the other two with a linear interruption.	

68. *Perdita verbesinæ* n. sp.

♀.—Length 7 mm. Head and thorax green, abdomen black, wings milky-hyaline. Head rounded, moderately small, unusually pubescent, especially on occiput and cheeks, the hairs on occiput pale fulvous, those on face and cheeks white. Face and vertex brassy-green, vertex rather strongly rugulose, and sparsely punctured. Mandibles rufescent, yellowish at base, simple but strongly elbowed; clypeus black, punctured, with a longitudinal central yellow line, not always produced to the margins, and a more or less developed yellow patch on each side at anterior margin. Sides of face below, adjacent to clypeus, with a yellow patch. These face-markings are of essentially the same pattern as those of *albipennis*.

Antennæ blackish, a yellowish spot at base of scape beneath, and flagellum yellowish below. Mouth-parts much elongated, glossa almost naked, or with the terminal half hairy.

Thorax shining brassy-green, pubescent as in *albipennis*, and with the yellow also more or less developed on collar and hind border of prothorax, but not on tubercles, except in the form of a very small spot, which may be absent. Metathorax dark green, sometimes a little bluish.

Legs dark, pubescent, the hairs on posterior tibiæ especially long and dense, as in *albipennis*; tips of anterior femora, upper two-thirds of anterior tibiæ in front, yellow. Tegulæ yellowish-hyaline. Stigma very pale yellowish, nervures almost colorless, the portion of marginal cell beyond stigma conspicuously longer than that below it; second submarginal narrowed about one-half to marginal, third discoidal distinct.

Abdomen above black, nearly naked, except the last segment, which is densely fringed with white hairs. Fourth segment with two yellow spots, absent in specimens lacking the face-markings (mut. *nigrior*). Pygidial area conspicuously rufous. Venter dark.

Mut. ♀, *nigrior*.—Stigma colorless, pale marks of head and thorax absent, pubescence of mesothorax white instead of yellowish, vertex a slightly bluer green, metathorax tinged with blue above, last joint of antennæ with a slight hook, abdomen without yellow spots. (Ckll., 4,908.)

Mut. ♀, *intermedia*.—Stigma pale yellow; vertex rather more brassy, lateral pale marks of clypeus absent. Abdomen with segments 2–4 each with a pair of yellow marks, those on 2 and 3 transversely elongate, those on 4 larger and rounder. First taken by C. Rhodes on *Verbesina*. Sometimes the spots on segment 2 are lacking. The lateral pale marks of clypeus may also be more or less developed.

♂.—Head larger and broader, cheeks strongly bulging below, but not spined; antennæ with the scape and funicle black above and yellow beneath, flagellum orange with the first two joints black or blackish above. Lower corners of face, and clypeus, yellow, the clypeus with two longitudinal black marks, and a black dot on the outside of each, after the manner of *P. numerata*. In some examples the clypeus is black with a median longitudinal yellow line, and the lower corners broadly yellow, the yellow sometimes enclosing a black spot near its upper limit. (Ckll., 4,906, 5,054.) Pro-

thorax without any yellow, except on collar above. Tarsi mostly pale, in addition to the pale leg-markings of the ♀. Ends of middle tibiæ also pale.

Abdomen without the two spots of the ♀, but the distal margins of the segments hyaline, with narrow dull yellowish bands, broadly emarginate on each side proximally.

Mut. ♂, *maculata*.—Hind margin of prothorax with two small yellow marks. (One on *Verbesina encelioides*, Sept. 28th.)

Mut. ♂, *cyarella*.—Size small. Metathorax blue. (One on *Helianthus annuus*, Sept. 21st). This agrees with true ♂ *verbesinæ* in the dull front, orange flagellum, absence of spots on hind border of prothorax, etc.

Hab.—Las Cruces, N. M., abundant on flowers of *Verbesina encelioides*, Sept. 11th to 20th of October. On Sept. 28th, after wet weather, they were freely copulating on the flowers. One had been caught by a *Phymata*. On Sept. 21st, a ♀ of mut. *intermedia* and the ♂ mut. *cyarella* were taken on *Helianthus annuus*.

69. *Perdita albipennis* Cr., Tr. Am. Ent. Soc., 1868, p. 386. ♀ (Hab., New Mexico, Colorado).

♂. *Perdita hyalina* Cr., Tr. Am. Ent. Soc., 1878, p. 68. (Hab., Colorado).

The original type of *albipennis* was taken in 1867 by Dr. Samuel Lewis, on a journey from Fort Wallace, Colo., to Fort Craig, N. M. The types of *hyalina* were taken by Messrs. Ridings and Morrison. In the latter part of July, 1895, I took the typical form, in both sexes, on flowers of *Helianthus annuus* at La Junta, Colorado. The males have the flagellum mostly orange, spots on hind margin of prothorax, front shiny. *P. hyalina* is apparently a slight variety. Var. *helianthi*.

♂.—Differs from *verbesinæ* ♂ by its comparatively shining front, blackish flagellum, and two spots on hind border of prothorax. Differs from *albipennis* ♂ by having the yellow marking on abdomen as in *verbesinæ*, and the dark flagellum.

♀.—Abdomen striped as in *albipennis*, from which it is hardly to be distinguished. In *helianthi* the stigma, when well colored, is lemon-yellow, while in *albipennis* it becomes pale orange, and is quite large. From *verbesinæ*, the ♀ *helianthi* differs by its well-striped abdomen, and the head is a little larger.

The var. *helianthi* is occasionally taken (at least the ♀s) on *Verbesina encelioides* (Oct. 5th, etc.), at Las Cruces, N. M., but it is the usual form in that locality on *Helianthus annuus* (Sept. 22d, etc.).

Of 46 ♀s from *Verbesina*, 43 are *verbesinæ* and 3 *helianthi*. The earliest date for *helianthi* is July 29, 1893. (Ckll., 339, a ♂.) On Aug. 26, 1893, I took both sexes at Juarez, Mexico; these were recorded as *albipennis* and *hyalina* in Ann. Mag. N. Hist., Feb., 1895, p. 206.

Mut. ♂, *pasonis*.—Length $8\frac{1}{2}$ mm. Resembles *verbesinæ* in its dull front and the absence of spots on hind margin of prothorax. Resembles typical *albipennis* by the absence of yellow on the abdomen. Resembles *helianthi* by the dark flagellum which is black above, dull testaceous below. Maxillary palpi with the last four joints practically equal. Front and mesothorax olive-green, cheeks and metathorax greenish-blue or prussian-green, in strong contrast. Tip of abdomen unusually broad. Marginal cell somewhat longer than usual.

I took one specimen of this at El Paso, Texas, Aug. 25, 1893. I was a little perplexed whether to refer it to *verbesinæ* or *albipennis*. Mr. Fox named it *hyalina* Cr., and indeed it must come very near the form so named by Cresson, which had the dark flagellum, though the head and thorax were bluish-green.

Var. ♀ *lingualis*.

Length about 10 mm. Abdomen above with yellow bands on segments 2–4, the first two narrowly interrupted in the middle, the last two failing some distance before the lateral margin. Metathorax dark blue, head dark blue-green, mesothorax and scutellum dark olive-green. Front moderately shiny. Hind border of prothorax marked with yellow. Stigma inclining to pale orange. Second submarginal cell not narrowed half to marginal. Flagellum dark. Clypeus yellow with two black blotches above, sufficient to mark out the yellow T.

The above characters are probably, in part, individual ones, but the glossa is very conspicuously hairy all along, thus differing from that of *helianthi*, *albipennis* type, and *verbesinæ*, in which it is comparatively naked, except the terminal half in some examples of *verbesinæ*. When using a compound microscope to more accurately determine the character of the glossa, I was surprised to find also a difference in the maxillary palpi. In *lingualis* the last two joints of these palpi are short and of equal length, while the two before them are long and also equal. In *helianthi* the last joint is long, the two before it short and equal, and the two before them long and equal to one another and to the last.

The var. *lingualis* is founded on a single ♀ from Fort Collins, Colorado, Aug. 8, 1895. (Baker.)

The known range of *P. albipennis* is greatly extended by a ♀ sent to me by Mr. Fox, caught in Nowlin Co., South Dakota. The name of the collector does not appear on the label. The clypeus is marked practically as in *lingualis*, but the glossa is not hairy. Stigma pale orange. Second submarginal cell narrowed fully one-half to marginal.

Since the above was written, Mr. Fox has examined for me Cresson's types of *hyalina* (♂), and reports that one has the abdominal marks as in *verbesinae* and *helianthi*; but the other must be held to be the true type, as Cresson does not mention the marks. The form above, described as *pasonis*, has only a very small clypeal mark, so it is in all respects very similar to what we must call *albipennis* var. *hyalina* (Cr.).

Many years ago, *P. albipennis* was taken by Belfrage in Bosque Co., Texas. (Cresson, Tr. Am. Ent. Soc., 1872, p. 261.) This is a little east of the 98th meridian.

70. *Perdita lepachidis* n. sp., or race.

♂.—Length about 6½ mm. Resembles the ♂ of *albipennis*, but head and thorax brassy-green, not at all bluish-green. Vertex quite densely and deeply punctured. Clypeal markings reduced to a yellow median line and yellow lower corners, occasionally the whole anterior margin of clypeus yellow, connecting with the longitudinal line. Mandibles simple. Metathorax rather inclined to bluish. Wings and abdomen as in ♂ *albipennis*.

The flagellum is orange, the two spots on the hind margin of prothorax are feebly developed, the front is fairly shiny, not nearly so dull as in *verbesinae*.

Hab.—On flowers of *Lepachys tagetes* (James), Santa Fé, N. M., July 30, 1895, and Socorro, N. M., June 29th. I do not know how late it flies, but the *Lepachys* is over sooner than the *Verbesina* or *Helianthus*. The characters of this species or race are slight, but constant in the specimens examined. The ♀ is unfortunately unknown.

Appendix: Species received since the above paper was written.

Perdita utahensis n. sp.

♀.—Length 8 mm. Head dark blue-green, thorax brassy-green; *Metathorax green, not blue*, but so dark as to be almost black. Head of ordinary size, about as broad as long; face and cheeks hairy, the hairs dull white, those on occiput gray. *Front strongly granular, with moderately close punctures; facial ridge with a median*

linear groove, extending down on the ridge as far as the level of the antennal sockets. Clypeus cocked-hat-shaped, but rounded and broad above, and unusually high, *entirely pale yellow except the usual two dots*. Lateral pale yellow face-marks triangular, the inner angle opposite the clypeal dot, the upper angle (of about 40°) level with the antennal sockets, on the orbital margin. The inner side of the triangle is straight or nearly so, not notched as in *bige-loviæ*. Supraclypeal and dog-ear marks absent. Mandibles simple, with the basal three-fifths very broad and pale yellowish; and the terminal two-fifths strongly bent inward, dark rufous-brown, slender, coming to a point. Antennæ with the *scape all yellow*, funicle yellow with a brown blotch above; flagellum brown, dark above, pale below, first joint all yellow below.

Thorax, including mesothorax and pleura, *quite hairy*, disc of metathorax bare. The abundant short bristles on the mesothorax have a yellowish tinge. Pleura all dark. *Collar and hind border of prothorax broadly, connecting with tubercles, pale yellow*. The prothorax is thus practically all yellow except a large wedge-shaped portion on each side. Mesothorax shiny.

Tegulæ hyaline, with a yellowish opaque subreniform mark. Wings hyaline, *nervures and stigma pale brown*, the latter not centrally hyaline. Marginal cell long and rather narrow, squarely truncate, its poststigmatal portion much the longest. Second submarginal large, not narrowed half to marginal. Third discoidal distinct, rather narrower below than is usual. Legs hairy; femora yellow, middle femora with a little brown at base below. Tibiæ and tarsi pale brown; anterior tibiæ yellow in front and with a yellow streak behind.

Abdomen above with *about equally broad dull yellow and black bands*, the latter five in number, but the last not so well-defined. First segment with an oblique black mark on each side before the band. The first band touches on each side a black longitudinal groove such as is seen on the side of the second segment in *luteola* ♀. The second and third bands present a small lobe on each side below. The fourth band below has a median projecting tongue. Venter pale dull yellow, broadly mottled with brown medially.

Hab.—Southwest Utah, collected by Mr. Palm, sent by Mr. C. F. Baker, one specimen. Type in coll. Baker.

This, the first *Perdita* recorded from Utah, belongs near *albipennis*, etc., but will be readily recognized by the characters I have italicized.