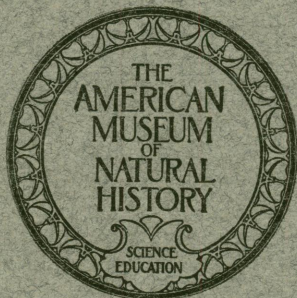


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No. 33

BEEES OF THE GENUS *PERDITA* FROM THE WESTERN STATES

By T. D. A. COCKERELL



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BEES OF THE GENUS *PERDITA* FROM THE WESTERN STATES

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The bees recorded below, with the exception of *Perdita wickhami*, were obtained by Dr. Frank E. Lutz and his associates during their exploration of the Western States for The American Museum of Natural History. They were collected by Dr. Lutz, except where the contrary is stated. The collection adds ten species and three races or varieties to the already long list of western *Perdita* and greatly extends our knowledge of distribution. The material of the *Cockerellia* group (*albipennis*, etc.; large forms, with stout, bent mandibles in the female) is particularly interesting and has suggested a discussion of the evolution of the species and races.

Perdita wootonæ Cockerell

COLORADO: 5 ♂, 4 ♀, Pueblo, vacant lots in town, August 9, 1920; 1 ♀, 2 ♀, La Junta, August 12, 1920, Mrs. F. E. Lutz, collector; 2 ♂, Wray, August 17-19, 1919; 1 ♂, Tennessee Pass, about 10,300 ft. alt., August 1, 1919, H. F. Schwarz, collector.

For the characters of this species, see 1907 Entomological News, XVIII, p. 57. The two Wray males differ greatly in the size of the head. The specimen labelled Tennessee Pass has an unusual amount of black pigment about the lateral ocelli, but the locality seems almost incredible, as the bee is an oligotropic visitor of *Nuttallia*, which is not likely to occur at such an altitude. Rydberg has recorded *N. speciosa* (Osterhout) from 10,000 ft., but this also seems improbable. It may be, however, that *Nuttallia* and *P. wootonæ* do occur at Tennessee Pass in a favorable exposure.

Perdita solitaria Cockerell

ARIZONA: 2 ♀, Sabino Basin, Santa Catalina Mts., about 3800 ft. alt., August 15-21, 1916.

Described from New Mexico.

Perdita callicerata Cockerell

ARIZONA: 1 ♂, southwest end of Coyote Mountains, about 3500 ft. alt., at flowers of *Baileya multiradiata*, August 4, 1916.

Described from New Mexico, where it visits *Baileya*.

***Perdita heliophila* Cockerell**

COLORADO: 2 ♀, Mesa Verde National Park, about 6000 ft. alt., at *Helianthus petiolaris*, July 4, 1919.

Described from New Mexico (1916).

***Perdita albipennis* Cresson**

COLORADO: 6 ♀, 1 ♂, Wray, most of the females at *Helianthus*, August 17, 1919, one collected by Pearce Bailey, Jr.; 1 ♀, Grand Junction, at *Helianthus*, July 17, 1919; 2 ♀, 1 ♂, Grand Junction, near town, August 3, 1920; 12 ♀, 10 ♂, La Junta, August 12, 1920, one ♀ collected by Mrs. Lutz, one ♂ from very arid hills, four of the males show yellow markings on the abdomen (var. *helianthi* Ckll.); 3 ♂, Glenwood Springs, at edge of town, July 22–29, 1919 and August. 5, 1920, one collected by Mrs. Lutz is var. *helianthi*; 1 ♂, Pueblo, vacant lots in town, August 9, 1920; 1 ♂, Montrose, July 19, 1919, H. F. Schwarz, collector.

***Perdita pallidipennis indianensis*, new subspecies**

♂ (Type).—Clypeus and sides of face wholly without light markings; anterior tibiae without a pale stripe; margin of stigma and end of marginal cell fuscous.

♀.—Not appreciably differing from the typical form.

INDIANA: 1 ♀, 1 ♂, Lafayette, August 16, 1920.

The female is easily known from *albipennis* by the dark hair on outer side of hind tibiae, and the dark, rounded apical plate of abdomen. The species *P. pallidipennis* Gränicher was described from Wisconsin.

***Perdita verbesinae* Cockerell**

ARIZONA: 1 ♂, Tucson, at *Helianthus*, August 14–17, 1916, collected by Mr. J. A. G. Rehn.

Compared with New Mexico specimens, it is more robust, with unusually large head; prothorax above flattened, with a pair of light stripes on hind border; mesothorax shining yellowish green, slightly coppery in middle.

***Perdita lacteipennis* Swenk and Cockerell**

COLORADO: 3 ♀, 4 ♂, Wray, August 17–19, 1919; 14 ♀, 10 ♂, Mesa Verde National Park, at *Helianthus petiolaris*, July 3–7, 1919; 1 ♂, Grand Junction, at *Helianthus*, July 17, 1919; 2 ♀, 1 ♂, Grand Junction, near town, August 3, 1920; 4 ♂, La Junta, August 12, 1920; 1 ♀, Durango, at *Helianthus petiolaris*, July 2, 1919; 1 ♂ (abdomen marked with yellow, much as in var. *helianthi* of *albipennis*), Fruita, July 16, 1919. UTAH: 1 ♀, 1 ♂, Ogden, August 29, 30, 1916.

Females of *lacteipennis* from Ogden, Durango, Grand Junction, and the Mesa Verde National Park have the immaculate face of *Perdita canadensis* Crawford. A female *P. canadensis* collected by Professor Stevens at Sheldon, North Dakota, differs from these by the yellow

tubercles and very dark apical plate of abdomen. Crawford's description, however, indicates dark tubercles. Crawford notes that *canadensis* has the first recurrent nervure interstitial (or nearly so) with the transverse cubital, whereas in *lacteipennis* it enters the second submarginal cell some distance from the base. Our insects have the *lacteipennis* venation, but I observe that one of the Grand Junction females (though not the other) has the recurrent interstitial. The typical female *lacteipennis* has a pale vertical stripe or bar on the clypeus, but I have a cotype, from Niobrara, Nebraska, with the unmarked *canadensis* face and the *lacteipennis* venation. The Wray *lacteipennis* are typical. The males of *lacteipennis* vary in the size of the head and in the presence or absence of a yellow stripe on the scape. The original description cites a stripe on the scape, but a cotype lacks it. In four Wray males, it is present on two. Other sets of males vary similarly in the stripe.

I can only conclude that *canadensis* is a form of *lacteipennis* which occurs northward as a distinct subspecies (see Gräniche, 1914, Canadian Entomologist, XLVI, p. 52) and is represented in western Colorado and Utah by an insect which is neither pure *canadensis* nor typical *lacteipennis*. As *lacteipennis* varies in Nebraska to the dark-faced (♀) condition, it seems impossible to recognize two species.

The question next arises, whether *lacteipennis*, *canadensis*, and *heliophila* may not all be reduced to races of *albipennis*. At La Junta, males which could only be referred to *lacteipennis* occurred along with *albipennis* males. The only females to go with them were six in which the vertical light bar on the clypeus was very distinct, but the lower margin of the clypeus, instead of being pale right across, presented only lateral spots, these sometimes obsolete. One or two of these specimens could be referred readily enough to *lacteipennis*, but they certainly are all one thing, and others must be called *albipennis*. Indeed, Cresson's original description of *albipennis* (clypeus with a longitudinal yellow line down middle and a transverse yellow spot on each side) indicates just such an insect, and the more highly colored examples which seem best to typify the species (biologically speaking) are marked as is described for var. *lingualis* Ckll.

Swenk has investigated this matter in Nebraska and concludes that *lacteipennis* is a valid species, because it and *albipennis* occur together "and are yet perfectly distinguishable," while *albipennis* occurs alone in eastern Nebraska. In a similar manner, *albipennis* abounds in New Mexico, where it is not accompanied by *lacteipennis*; in southern New Mexico the *helianthi* form is the only one and hence assumes the char-

acter of a distinct race. Strictly speaking, typical *albipennis* (from the standpoint of nomenclature) is the insect of southeastern Colorado and northern New Mexico, which appears more or less intermediate between the more highly colored (*lingualis*) *albipennis* and *lactepennis*. The *lingualis* form ("clypeus yellow with two black blotches above, sufficient to mark out the yellow T"), described from Fort Collins, Colorado, stands as a race¹; but it is very variable, and its limits have not been defined. The character of its tongue mentioned in my description is probably of no value, depending on the condition of the organ; but the palpal character may be more significant. The differences in the form of the clypeus of these bees, to which Crawford calls attention, seem to be variable and of uncertain value.

I can only conclude that this group of *Perdita* is undergoing modification through the mutation of determiners, after the manner of *Drosophila*. These changes are not adaptive and are at least largely independent, so that after defining a species or race as possessing a particular series of characters one is confused by finding that in other localities these characters are not associated. So far as the *albipennis-lactepennis-heliophila-helianthi-lingualis* series goes, there has been no change in feeding habits, all being visitors of *Helianthus*. Whether the local distribution indicates any special adaptations to climate, we do not know. It appeared natural to find the more melanic form (*canadensis*) northward, but dark-faced insects in western Colorado and Utah were not to be expected. In New Mexico, evident offshoots from this group have become adapted to different flowers; such as *P. verbesinæ* Cockerell and *P. lepachidis* Cockerell. In Lower California there is a species (*P. sparsa* Fox) which flies in March instead of middle and late summer.

The processes leading to the formation of new species among these bees may probably be as follows.

- (1). Factorial mutations, usually independent of one another and having no adaptive significance.

- (2). Crossing between mutants and the formation of new heterozygous and homozygous genotypes.

- (3). The sorting out, in different localities, of certain characters or combinations of characters as dominant (in the sense of prevalent), possibly but not necessarily aided by natural selection or sexual selection (the latter implying preference only in the sense of recognition).

¹Cresson's *P. hyalina*, based on Colorado males, may be applicable to (and the prior name for) *lingualis*, but this is at present uncertain.

(4). The occasional coincidence of adaptive features (often physiological, or such morphological ones as size, length of tongue, etc.) which favor a change of habits or environment and permit the insects to escape from their former routine and, e.g, become attached to a different genus of plants. Observation shows that *P. albipennis*, a sunflower bee, strays to *Verbesina*. *P. verbesinæ*, a *Verbesina* (*Ximenesia*) bee, strays to *Helianthus*. When the normal flower is over, species of *Perdita* will visit other flowers. Thus there is a continual process of experimentation going on, and, if any group of bees has varied in such a manner as to make the new plant acceptable, it will readily become addicted to it and spread into those localities in which it grows. The color characters, or slight morphological differences, observed in the cabinet need not be adaptive but may only mark a race which has more subtle adaptive features. In some cases, the adaptation may be negative, the loss of some hindrance to the new mode of life.

(5). The new type having become isolated on a new plant, or geographically or seasonally, will eventually settle down to a new position of stability (aided by natural selection, which can just as well be a conservative force) which will be sufficiently remote from that of the parent species to maintain it as a distinct entity in nature, and usually prevent crossing. The complexity of the genitalia will cause comparatively slight modifications to result in physiological isolation.

Those who find it difficult to visualize these processes, should remember that, whereas variation is common and there is a continual pressure on the periphery of the environment, the development of a new species is a rare event like the winning of a prize in a lottery. The *albipennis* group of *Perdita* (Ashmead's genus *Cockerellia*) must have taken many thousands (probably hundreds of thousands) of years to produce the quite moderate series of known segregates.¹ This fact, so far from being contrary to the Darwinian hypothesis, shows the inadequacy of mutation ALONE to produce new species UNDER ORDINARY CONDITIONS OF LIFE. It is of course true that a mutating species may under experimental conditions give rise to a long series of materially different stable (homozygous) types, which when isolated will have the aspect of species. In nature, however, such isolation does not ordinarily occur unless aided by functional efficiency. This is no doubt peculiarly true of insects, the lives of which are relatively complex and full of special adaptations. In the case of some other organisms the functional side of specific char-

¹Allowance must be made for forms not yet described and for others which may have become extinct, but, even so, the number is probably not large. For a further discussion of this group, see Proc. Acad. Nat. Sci., Philadelphia, 1896, pp. 42-45.

acters is harder to explain. Thus, the island of Porto Santo, six miles long, has a marvellous series of diverse helicoid snails living under essentially the same environment. It is impossible to perceive any special adaptive significance in all this diversity, unless it lies in the attraction of like to like and consequent physiological isolation of divergent strains. Everything indicates that the snail fauna of Porto Santo is much older than the insects or plants (with rare exceptions) of the same island; the snails have survived because lacking in minute and complicated adaptive features. But, having thus survived, they have had longer to become diversified within the area.

If the above picture of bee-evolution is correct, it appears to follow that the actual segregation of a new species may occur in a relatively short time, so that the whole process might conceivably fall under human observation. It would only be noticed, however, in a region where the bees were very well known and where observations were minute and continuous. Even then, the chances of witnessing such an event would of course be remote. Much light may be thrown on the matter by careful and persistent experimental work, following such methods as those of Mr. F. C. Craighead, lately published in *Journal of Agricultural Research*, XXII, No. 4, pp. 189-220.

***Perdita snowii* Cockerell**

COLORADO: 1 ♀, Meadows, Estes Park, August 17, 1919, collected by Mr. Herbert F. Schwarz.

Originally described from Estes Park.

***Perdita sexmaculata* Cockerell**

COLORADO: 1 ♀, Regnier, at *Sphæralcea coccinea* in Gallinas Canyon, about 4400 ft. alt., June 6, 1919.

Originally described from Santa Fe, New Mexico. The specimen on *Sphæralcea* must have been a stray, as the species normally visits *Chamæsaracha*.

***Perdita ignota* Cockerell**

COLORADO: 1 ♀, Aspen, July 24-27, 1919, collected by Pearce Bailey, Jr.; 2 ♀, Tennessee Pass, about 10,300 ft. alt., August 1, 1919; 3 ♀, Boulder, two in town at *Grindelia*, one along canyon bottom toward Orodell, about 5600 ft. alt., August 7-12, 1919; 7 ♀, 31 ♂, Glenwood Springs, at edge of town, July 22-29, 1919, all except one male collected by Herbert E. Schwarz; 2 ♂, La Junta, August 12, 1920; 1 ♂, 1 ♀, Golden on top of Castle Rock, about 6200 ft. alt., August 6, 1919.

The Golden female is peculiar for having a transverse semilunar supraclypeal mark. A similar supraclypeal mark occurs in specimens of *P. xanthismæ sideranthi* Cockerell.

Perdita ignota was described from Mesilla, New Mexico, and appears to have a most unusual range in altitude and latitude for a species of this genus. There are three related forms, having no supraclypeal mark, the females of which differ thus:

Margin of stigma and adjacent nervures fuscous; abdomen without markings.

bishoppi Cockerell.

Margin of stigma and adjacent nervures wholly pale; abdomen nearly always with transverse white bands or marks.

Flagellum orange beneath.....*ignota* Cockerell.

Flagellum dull ferruginous beneath.....*crawfordi* Cockerell.

P. bishoppi, from Texas, is a good species but, after reviewing the available materials of *ignota* and *crawfordi*, I find that the described difference in the lateral face-marks is not constant and the antennal character is unimportant. On the antennal character, the specimen originally recorded from Lincoln, Nebraska, and those from Boulder, Colorado, and Texas, are *ignota*. It appears that *crawfordi* must fall as a slight variation of *ignota*, unless new characters for the separation of the northern and southern specimens can be found.

Another closely related species is *P. heterothecæ* Cockerell, from Arizona.

***Perdita melanochlora*, new species**

♀.—Length about 4.5 mm. Belongs to the *ignota* group. Wings clear, but margin of stigma and of marginal cell dusky; clypeus white with two short broad black bars; no supraclypeal mark; lateral face-marks broader than high (higher than broad in *P. heterothecæ*); face and front very hairy (much more so than in *heterothecæ*); flagellum dull brown beneath (orange in *ignota* and *heterothecæ*); mesothorax shining black, anteriorly and narrowly posteriorly green; metathorax blue; legs sepia brown; tarsi dilute sepia (not light as in *ignota*); segments 2 to 4 of abdomen with transverse cream-colored bands, the first two narrowly interrupted, the third deeply notched medially in front and behind; the bands are preceded by more or less evident pale brown bands.

ARIZONA: 1 ♀, about 3425 ft. alt. in the Santa Rosa Valley near the Comobabi Mountains, among mesquite and acacia with some pale verde and a few *Carnegiea gigantea*, August 10, 1916.

Closely allied to *P. ignota* and *P. heterothecæ*, but distinct.

***Perdita lutzi*, new species**

♀.—Length about 5 mm. Head and thorax green, the metathorax steel blue, mesothorax rather bluish green in front and yellowish green in middle; head broad, not enlarged, cheeks unarmed; front and vertex dullish, but mesothorax highly polished; mandibles straight; face-marks, labrum and mandibles (except reddened tips) dull yellowish white; clypeus light except two faint short bars; a small transverse supra-

clypeal mark; no dog-ear marks; lateral marks very broad below, narrowing (the inner margin beyond clypeus practically straight) to a very sharp point on orbit well above level of antennæ; malar space light, but cheeks dark; tubercles and two transverse marks on upper border of prothorax light; there is also a small light mark on each side of prothorax anteriorly; mesothorax with thin white hair; tegulæ hyaline; wings milky white, with colorless stigma and nervures; legs dark basally, but tibiæ and apices of femora pale yellow, tarsi white; abdomen apricot-color above and below the first two dorsal segments with straight very pale brownish bands, not reaching lateral margins.

ARIZONA: 1 ♀, southeast and of Coyote Mountains, about 3500 ft. alt., at flowers of *Baileya multiradiata*, August 5, 1916.

A distinct species closely resembling *P. mellina* Cockerell, but the latter is easily distinguished by the steel-blue, highly polished front. It is singular that this species is quite different from those which visit *Baileya* in Southern New Mexico, but one of the New Mexico *Baileya* species (*P. callicerata*) was taken with it.

***Perdita nebrascensis* Swenk and Cockerell**

COLORADO: 3 ♂, Wray, August 17-19; one collected by Pearce Bailey, Jr.

***Perdita affinis* Cresson**

COLORADO: 14 ♀, 9 ♂, Meeker, at *Grindelia serrulata*, July 20-21, 1919; 9 ♀, Estes Park, July 18, 1916, and August 18-19, 1919, collected by Mr. Albert E. Butler and Mr. Herbert F. Schwarz; 1 ♂ (on top of Castle Rock), 1 ♀, Golden, August 8, 1919; 1 ♂, Walsenburg, sabina and pinyon country, June 14, 1919.

Compared with the Meeker *affinis*, the Golden form is larger in the female and with longer white marks on abdomen, while the male has conspicuous yellow marks on the fourth abdominal segment, these in the Meeker males being small or absent.

***Perdita octomaculata terminata*, new subspecies**

I find that the supposed *P. affinis* recorded from West Point, Nebraska, at *Solidago rigida*, collected by J. C. Crawford, is without dog-ear marks in the male and represents a western race of *P. octomaculata* Say. It differs from true *octomaculata* in the cream-colored (colored as in *affinis* but shaped as in *octomaculata*) marks on abdomen of female, and in the large quadrate (notched above) supraclypeal mark of male. It may be known as *Perdita octomaculata terminata*. The male is the type.

***Perdita zebrata* Cresson**

COLORADO: 1 ♂, White Rocks, near Boulder, at *Cleome serrulata*, August 13, 1919; 5 ♂, Wray, August 17-19, 1919; 11 ♀, 6 ♂, La Junta, August 12, 1920, three ♀ collected by Mrs. F. E. Lutz; 3 ♀, 3 ♂, Pueblo, vacant lots in town, August 9, 1920; 7 ♂, 22 ♀, Rifle, some from edge of swamp along railroad and the rest from an

almost bare sandy place used as a playground,¹ July 19–21, 1919; 4 ♀, 3 ♂, Grand Junction, two near town, one male remarkably small and slender, little more than 3 mm. long, August 3, 1920, the other along irrigated land, July 17, 1919; 1 ♂, Meeker, July 21, 1919; 2 ♂, 1 ♀ (with pale abdominal bands), Glenwood Springs, at edge of town, July 22–29, 1919 and August 5, 1920; 1 ♀, Ridgway, July 10, 1919. UTAH: 1 ♂ with white face-markings and more black on abdomen than usual, Huntsville near Ogden, July 26, 1920. WYOMING: 3 ♂, 2 ♀ (1 ♂ along the river, the rest on dry slopes near the river) Green River, July 2, 1920; 8 ♂ (one at *Cleome lutea*, which was practically the only bee-flower in the locality), 5 ♀, Rock Springs, June 29, 1920.

The Wyoming females have the bands on the abdomen lemon-yellow; those in New Mexico and many parts of Colorado (e.g., at Rifle) have the bands white or yellowish white. Cresson's type had yellow bands; the more southern form, which is sexually dichroic, could be called *P. zebrata canina* (*P. canina* Cockerell). However, of four females from Grand Junction, one has lemon-yellow bands, one has them yellowish white, and two have them pale yellow.

***Perdita bruneri* Cockerell**

WYOMING: 1 ♂, Sheridan. C. W. Metz collection.

This exactly agrees with a male of *P. cockerelli* Crawford, received from Crawford. Crawford later decided that this was the true male of *P. bruneri* and described what had been called male *bruneri* as *P. swenki*.

***Perdita fallax fontis*, new subspecies**

♀.—Clypeus with a very large cream-colored or yellowish-white triangular area, the apex directed upwards, the sides considerably longer than the base; rest of clypeus black, except a small oblique (parallel with sides of triangle) stripe on each side; mesothorax yellowish green; wings not quite so clear; pale marks on first three abdominal segments smaller.

COLORADO: 1 ♀, Glenwood Springs, at edge of town, August 5, 1920.

P. fallax Cockerell was described from New Mexico and is known to extend north to Nebraska. *P. fallax fontis* is a submelanic form, probably racial, but possibly an individual variation.

***Perdita miricornis*, new species**

♂ (Type).—Length a little over 4 mm. Head and thorax green, the front dull and bluish green, the mesothorax and scutellum brassy green, highly polished; face, cheeks, mesothorax, pleura and anterior femora with long white hair; mandibles (except red ends), labrum and face-marks cream-color, the face nearly all pale below level of antennæ; clypeus light with two dots; supraclypeal mark large, notched above; dog-ear marks present; lateral marks large, cuneiform, ending acutely on

¹Three of the females (two from the damper and one from the drier spot) have the supraclypeal mark divided into two spots and the clypeus black with light markings.

orbits at about level of antennæ; cheeks wholly dark; antennæ pale yellow below (in front) and black behind, but last two joints of flagellum entirely black, giving the antennæ a very unusual appearance; tubercles cream-color, upper border of prothorax with indistinct pale lines; metathorax green; knees, anterior tibiæ except a large dark patch behind, middle tibiæ in front, and hind tibiæ at base, pale yellow; tarsi white, the hind ones dark apically; tegulæ pale; wings perfectly clear, stigma yellowish white, nervures colorless, poststigmatal part of marginal cell shorter than substigmatal; abdomen shining black, with bright lemon-yellow markings, consisting of two spots on first segment, and broad entire bands on 2 to 6, on 2 failing laterally, on 4 and 5 sometimes interrupted sublaterally.

♀.—Similar to the ♂, but clypeus black with a median creamy-white stripe, narrowing to a point above; no dog-ear or supraclypeal marks; lateral face-marks broad-triangular, the lower and outer sides much shorter than the inner; apical part of mandibles with a black stripe; antennæ narrowly pale beneath to apex; anterior and middle tibiæ clear pale yellow, the middle ones sometimes with a dusky mark behind; spots on first abdominal segment large and transverse; bands pale yellow, very broad, the hind margins of those on third and fourth segments irregular or undulate.

WYOMING: 20 ♀, 11 ♂, Green River, on dry slopes near the river, about 6100 ft. alt. (type locality), July 2, 1920. COLORADO: 1 ♀, Grand Junction, near town, about 4500 ft. alt., August 3, 1920.

The male runs near *P. zebrata* in the tables but is easily distinguished by the antennæ and other characters. The female runs to the vicinity of *obscurata*, *bigeloviae*, or *nitidella*, but is very distinct from these. The variety *leucorhina* (see below) runs in the tables near *nitidella*, *alborittata*, *callicerata*, and *mentzeliarum*, but is quite different from all these.

***Perdita miricornis leucorhina*, new variety**

♀.—Clypeus yellowish white except the usual dots and two black spots on upper part.

WYOMING: 1 ♀, Green River with typical form.

***Perdita wunderi*, new species**

♀.—Length about 7 mm. Head oblong, facial quadrangle much longer than wide; front, vertex, mesothorax and scutellum dull olive-green; prothorax, mesopleura and metathorax bluish green, but the region just below and behind the wings is yellowish, almost brassy; clypeus very pale yellow, with a very large thick black horseshoe-shaped mark, the middle part on the lower margin; no supraclypeal mark; lateral marks L-shaped, with the lower part very thick; face not hairy; cheeks entirely yellowish green, distinctly shining; labrum piceous, depressed in middle; mandibles slender, gently curved, pale yellowish, broadly ferruginous apically; flagellum dull pale ferruginous beneath except at base; mesothorax with short hair; no light color on thorax; wings milky hyaline, nervures rather dilute fuscous, stigma hyaline with a fuscous margin; first recurrent nervure meeting first transversocubital; legs piceous, with anterior knees and tibiæ in front light yellow; abdomen piceous, first

three segments each with a pair of obscure slender transverse yellowish lines, representing rudimentary bands. Maxillary palpi 6-jointed. Claws cleft.

COLORADO: 1 ♀, Wray, August 1, 1919.

Differs from *P. nebrascensis* Swenk and Cockerell by the green metathorax, marking of clypeus, absence of supraclypeal mark, shape of lateral marks, scape black with obscure reddish ends, color of flagellum, dark tubercles, etc. In the tables it runs near *P. verbesinæ*, but is easily separated by the dull thorax.

It is dedicated to Mr. Chas. Wunder, who with extraordinary skill and patience mounted the whole collection, making it available for study.

***Perdita bisignata*, new species**

♀.—Length about 4.5 mm. Head and thorax dark bluish green, the mesothorax posteriorly black, the metathorax (dull above) dark blue; labrum, base of the slender gently curved mandibles, and face-marks lemon-yellow; clypeus yellow with the usual dots, and two black cuneate marks above, their base on the upper margin, supraclypeal area with a pair of elongated spots or bars; lateral marks shaped like a shoe with very slender toe and flat sole, based on orbit, the very acute upper end at level of antennæ; cheeks entirely dark; flagellum pale ochreous beneath; front dull, vertex shining; mesothorax dullish; wings dusky, stigma and nervures dark brown, the outer recurrent pallid; legs black with pale knees, anterior tibiæ broadly and middle ones more narrowly pale yellowish in front, anterior and middle tarsi pale reddish; abdomen shining black, with a small yellow spot at each side of third segment.

INDIANA: 2 ♀, Lafayette, about 550 ft. alt., August 16, 1920.

Runs near *P. asteris* in the tables, but very distinct.

***Perdita nolinæ*, new species**

♀.—Length about 5 mm. Head and thorax (including front) shining green; face blue-green; mesothorax olive-green, the posterior disc black; metathorax bluish green, very shining; the following parts yellow, labrum, mandibles (except tips), clypeus (except the usual dots and two spots above, varying to distinct bars), minute transverse lateral face-marks (just above lateral extensions of clypeus), anterior border of prothorax above and a pair of minute spots on posterior border, and tubercles broadly; head broad; face not hairy; scape reddish at ends and dark in middle; flagellum dusky yellowish (or reddened by cyanide) beneath; mesothorax with very thin short hair; wings clear hyaline, nervures colorless, substigmatal portion of marginal cell much longer than poststigmatal; legs yellow, with the hind tibiæ and tarsi dark brown, and the anterior femora black on basal half in front, and more than half behind; abdomen black with broad entire yellow bands at bases of segments 2 to 4 not continued to lateral margins and an apical band on fifth segment; venter yellow.

ARIZONA: 2 ♀, Sabino Basin, Santa Catalina Mountains, about 3800 ft. alt. Type, among river-bottom vegetation, July 8–20, 1916; cotype, at flowers of *Nolina microcarpa*, July 8–12, 1916. The cotype has pale lateral dots on sides of face.

The nearest relative seems to be the Californian *P. rhois* Cockerell. In my table in Proc. Acad. Nat. Sci., Philadelphia, 1896, *P. nolinæ* runs out at 69.

***Perdita calloleuca*, new species**

♂.—Length about 3 mm. Dark parts of head and thorax shining dark bluish green; the following parts white, tinged with yellowish dorsad, as on front and upper part of prothorax, face up to level of facial foveæ (with a further short broad extension in middle), labrum, mandibles (except tips), large quadrate or triangular area on lower part of cheeks, prothorax including tubercles, and large patch (emarginate posteriorly) on anterior part of mesopleura; head large, quadrate, facial quadrangle broader than long; cheeks simple; mandibles long, slender and curved; mesothorax small, highly polished, not conspicuously hairy; scape very pale yellow; flagellum light yellow beneath, above reddish, more dusky at base; wings clear hyaline, nervures colorless, except margins of stigma and marginal cell, which are fuscous; legs pale lemon-yellow, hind tibiæ and tarsi brown behind; abdomen with broad entire lemon-yellow bands on all the segments, broader than the black intervals between them; venter yellow.

COLORADO: 2 ♂, Grand Junction, along irrigated land near town, about 4600 ft. alt., July 17, 1919.

Allied to *P. pellucida* Cockerell, but differs by shining vertex, and ornamentation of cheeks and abdomen.

***Perdita solidaginis*, new species**

♂.—Length, 5 mm. or a little over. Head and thorax bluish green, the mesothorax a yellow-green, shining but not polished; mandibles (except tips), labrum, face below level of antennæ, and lateral marks forming acute angles on orbits about half-way up front, all pale yellow; posterior orbits with a very narrow yellow line more than half-way up cheeks; cheeks, vertex and pleura with long white hair, but face not hairy; scape pale lemon-yellow, with only a small dark spot behind; flagellum dark brown above with the suture darker, pale yellow below, the last joint brown; narrow anterior border and two large cuneiform marks on hind border of prothorax above, tubercles and a zigzag line below, yellow; tegulæ hyaline with a pale yellow spot; wings clear hyaline, nervures and stigma very pale brown; substigmatal part of marginal cell about as long as poststigmatal; legs yellow, all the femora mainly black behind, the hind ones yellow only above and at ends; anterior and middle tibiæ with a large black mark behind, hind tibiæ black with a yellow stripe in front; anterior and middle tarsi whitish, hind tarsi dark; abdomen black with narrowly interrupted transverse lemon-yellow bands on first five segments; venter yellow, brownish subapically, and with four round brown spots subbasally.

COLORADO: 1 ♂, White Rocks near Boulder, at flowers of *Solidago*, August 13, 1919. Collected by Mrs. W. P. Cockerell.

Allied to *P. sphæralceæ*, but face considerably longer, etc. Very close to *P. erigeronis* Cockerell, but larger, face-marks much more narrowly cuneate, and legs differently colored. *P. rectangulata* Cockerell was described from the male and female taken at *Solidago* at Fort Collins, Colorado. The female is the type, and it is now known that the male supposed to belong with it is *P. affinis*. It may be that *P. solidaginis* is the real male of *P. rectangulata*, but, as the probabilities seem to be against it, I describe it as distinct.

***Perdita wyomingensis*, new species**

♀.—Length 5 mm. or rather more. Robust, with wide abdomen; head and thorax dark bluish green, front and vertex dull, mesothorax and scutellum highly polished, with very little hair; head broad; labrum pallid, with a deep dark pit; mandibles pallid, black at apex and red subapically; cheeks hairy, entirely dark; clypeus and triangular lateral face-marks very pale yellowish, the clypeus with two broad black bars, straight on inner side and convex on outer, not reaching upper or lower margin; no supraclypeal mark; upper border of prothorax entirely dark, but tubercles pale yellow; metathorax bluish, the upper surface shining but not polished; tegulæ pale brown; wings clear hyaline, nervures almost colorless, stigma very pale yellowish; marginal cell unusually long; legs black, the anterior and middle tibiæ in front, and knees, yellow; abdomen with yellow markings, consisting of a spot at each side of first segment, and interrupted bands on segments 2 to 5, these bent downward at the thick outer ends, that on second segment very widely interrupted, on fifth slightly; apex of fifth segment pale reddish; apical plate pale reddish basally, apically prolonged into a narrow piceous almost spine-like process; venter piceous, with a yellow spot in middle of third segment, fourth narrowly edged with yellow, and sub-emarginate in middle, margin of fifth segment and all of sixth pale ferruginous.

WYOMING: 1 ♀, Jackson, moderately moist pasture land, about 6300 ft. alt., July 1, 1920.

Differs from *P. affinis* Cresson by the polished mesothorax, and from *P. obscurata* Cresson by the clypeus, etc. The abdominal characters are very distinctive.

***Perdita (Cockerellia) wickhami*, new species**

♀.—Very close to *P. albipennis* Cresson, and at first sight appearing identical, but readily distinguished by the following characters. Mandibles dark red, blackened at base; clypeus with large yellow spots at lower corners, a square yellow mark in middle apically, and above and barely separated from the last a vertical yellow stripe, bulbous at base, then linear, and ending above like the head of a nail viewed laterally; scape yellow in front; flagellum bright deep ferruginous beneath, except basally; front entirely dull, without evident punctures, only the narrow orbital margins shining; tegulæ blackened anteriorly, pale red posteriorly; wings clear, but not strongly milky as in *albipennis*, stigma and nervures pale ferruginous, outer recurrent and transversocubital weak; disc of mesothorax more distinctly punctured; apical plate

of abdomen broad, piceous with a broad ferruginous apical margin, strongly emarginate. The abdomen has four broad chrome-yellow bands, and yellow spots at sides of first segment. The last two joints of the maxillary palpi are of equal length.

OKLAHOMA: 1 ♀, South McAlester, June 11. (H. F. Wickham). From Zabriskie collection.

In *P. albipennis helianthi* Cockerell, ♀, the apical plate is entirely pale ferruginous and is not emarginate.

The following key separates the new species of *Perdita*, and compares them with several others.

1. Abdomen orange, without distinct bands or markings. *lutzi* Cockerell.
Abdomen dark, or distinctly banded. 2.
2. Face without light markings, but labrum light, and mandibles largely lemon-yellow. *pallidipennis indianensis* Cockerell, ♂.
Face with light markings, or all light. 3.
3. Face below antennæ wholly or mainly pale, the dog-ear marks present; males. 4.
Face below antennæ mainly or partly dark, the dog-ear marks absent. 10.
4. Mesothorax highly polished. 5.
Mesothorax dullish. 7.
5. Larger; flagellum beneath pale yellow, with the last two joints black. *miricornis* Cockerell.
Smaller; antennæ not so colored. 6.
6. Head large, quadrate; face white. *calloleuca* Cockerell.
Head small; face yellow. *zebrata* Cresson, small male (Grand Junction).
7. Lateral face-marks cuneate above, the inner margin above antennæ straight. . 8.
Lateral face-marks with inner margin above antennæ angulate or not straight. 9.
8. Middle femora thickened; mesothorax dull. *bruneri* Cockerell (*cockerelli* Crawford).
Middle femora ordinary; mesothorax more shiny. *solidaginis* Cockerell.
9. Larger; four interrupted yellow bands on abdomen. *affinis* Cresson, male (Golden).
Smaller; three interrupted yellow bands on abdomen. *affinis* Cresson, male (Walsenburg).
10. Abdomen with at least three broad entire light bands. 11.
Abdomen without such bands. 14.
11. Clypeus nearly all light. 12.
Clypeus dark with a light band, and sometimes spots. 13.
12. Lateral face-marks larger, pyriform, *miricornis* var. *leucorhina* Cockerell.
Lateral face-marks rudimentary. *nolinæ* Cockerell.
13. Larger species; clypeus with large lateral spots. *wickhami* Cockerell.
Small species; clypeus without such spots; mesothorax polished. *miricornis* Cockerell.
14. Supraclypeal mark or marks present. 15.
Supraclypeal mark absent. 16.
15. Wings milky white; face-marks white. *ignota* Cockerell, variety, ♀.
Wings dusky; face-marks yellow; abdomen black with two small yellow spots on third segment. *bisignata* Cockerell.

16. Mesothorax dull or dullish; clypeus with two black bars 17.
Mesothorax shining..... 18.

17. Abdomen with four interrupted white bands..... *affinis* Cresson, ♀.
Abdomen with minute inconspicuous pale marks; mesothorax yellowish green.
wunderi Cockerell.

18. Large male (*Cockerellia*); flagellum light above and below, except basally;
hind margins of abdominal segments broadly hyaline.. *verbesinae* Cockerell.
Small species, not of *Cockerellia* type..... 19.

19. Nervures dark..... *fallax fontis* Cockerell.
Nervures pale, or margin of stigma may be somewhat dark..... 20.

20. Abdomen with very distinct, interrupted light bands 21.
● Abdomen not thus banded..... *ignota* Cockerell, male.

21. Abdominal bands yellow; clypeus with two black bars .. *wyomingensis* Cockerell.
Abdominal bands white..... 22.

22. Tarsi brown; clypeus with two black bars..... *melanochlora* Cockerell, ♀.
Tarsi white; clypeus without bars. *ignota* Cockerell, ♀. (Glenwood Springs).

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