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NORTH AMERICAN BEES OF THE GENUS *ANTHIDIUM*

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In the present paper are discussed those species, represented in the collections of the American Museum, that in the male sex have the lateral processes of the pygidium broad, their apices being rounded or truncate, or rather widely angulate, not narrowly produced. In a subsequent paper will be considered those species that are characterized by narrow and usually elongate, often rather finger-like or spine-like lateral processes, the distance separating these processes from the central spine being usually several times their width. Keys for the species discussed in both papers will be included in the second paper. Grateful acknowledgement is made to the authorities of the U. S. National Museum and to the Academy of Natural Sciences of Philadelphia for the privilege of examining their types and general material, and to Professor T. D. A. Cockerell for elucidation of doubtful points.

***Anthidium atriventre* Cresson and *Anthidium astragali* Swenk**

Four females and ten males, all caught at Green River, Wyo., July 2, 1920 by Dr. Frank E. Lutz, occupy a somewhat intermediate position between *atriventre* and *astragali* and, because of their own great variability, raise doubt as to whether *atriventre* and *astragali* should be regarded as specifically distinct. I have examined a paratype (female) of *astragali* at the National Museum and the type (female) of *atriventre* at the Academy of Natural Sciences in Philadelphia, and have compared with them the females from Green River. The Green River specimens have on the tegulae a broad rim of yellow surrounding a brownish, inwardly placed spot. In this respect they resemble *astragali* rather than *atriventre* (as represented by the type in which the maculation is confined to the anterior half). They are in accord with *astragali*, too, in having the abdominal bands more deeply and abruptly emarginated laterally above, but they agree with *atriventre* in the slightly more cream-colored hue of these maculations. On the other hand, *atriventre* and *astragali* resemble one another in having the tibial stripes long, while in the Green River specimens these stripes do not reach the middle of the joint.

Cresson speaks of *atriventre* as "clothed with pale pubescence; face, basal joint of tarsi and venter with fuscous or black pubescence." Swenk refers to *astragali* as having white hair on the face, black hair on the inner face of the tarsal joints, "the outer surface largely fuscous and black but considerably intermixed with silvery hairs on the bases of the basitarsi," and speaks of the ventral scopa as "pale golden brownish more or less mixed with blackish, sometimes wholly black." The pubescence of the specimens from Green River shows considerable variability. In three of the specimens blackish hairs are present in varying degrees on the lower half of the face, recalling the somewhat similar condition in *atriventre*. In the fourth specimen only light hairs appear in this area, in agreement with *astragali*. In addition to the black hairs on the basitarsi, two of the specimens have a snowy patch basally, suggestive of *astragali*. In the third specimen such snowy patches are scarcely evident; in the fourth absent, corresponding with *atriventre*. In all of them the ventral scopa is black.

This variability in the color of the pile is matched by differences in the abdominal maculations. In describing *atriventre*, Cresson states that sometimes, instead of lateral emarginations anteriorly, the "basal band on abdomen encloses a black dot on each side." This is the case in three of the four specimens from Green River, the fourth having neither spots nor emarginations on the band in question, and thus being in accord with *astragali*. Two of the specimens show a departure from the normal provided for neither in the description of Cresson nor that of Swenk: they have the sixth abdominal segment wholly black.

These rather marked differences within a comparatively small series would seem as fundamental as those which have separated *atriventre* and *astragali*. When we come to the male, equally striking diversity is shown. The male of *atriventre*, has, so far as I know, never been recorded. The description of the male of *astragali* might well be applied in detail to several of the bees of that sex taken at Green River, the only possible point of doubt being the color of the pile on the thorax above, which in the specimens at hand would scarcely justify the phrase, "strongly tinged with ochreous." But while this correspondence to *astragali* holds for some of the specimens, it does not hold for others. Indeed, one specimen that has the combination of maculations on the seventh segment and light pile on the venter is very suggestive of *montivagum* and makes one wonder whether possibly *montivagum* is merely an extreme phase of *atriventre*, or, to give priority its due, whether *atriventre* is merely the ultimate range of variability presented by *monti-*

vagum. The impulse to merge the two must, however, be held in abeyance on account of the female of *montivagum*, which offers several differences not to be reconciled even with so changeable a member of the sex as is demoiselle *atriventre-astragali*.

In the ten males from Green River the blackish hairs are confined to the inner side of the basitarsi and the venter, but variability in the color of the pile is noticeable also in this sex, two of the males having light hair and a third having hair of a neutral tint on the venter. As for the markings of the male, all of the specimens have the clypeus, sides of face up to the level of the insertion of the antennæ, mandibles except tips, mark above eyes, broad stripe on scape, tubercles, rim of tegulæ (as in female specimens), yellow. All save one have two lines on the scutellum, though often these are feebly developed. The maculation of the legs is also fairly constant, appearing as a broad stripe extending from the base of the tibiæ to the apex or nearly to the apex of the basitarsi, often narrowed and interrupted on the third pair of tibiæ. It is in the abdominal maculations that the greatest variability occurs, recalling the lack of consistency of the opposite sex in this respect. In one instance the first abdominal segment has no emargination, the black spot being imbedded in the yellow as in the female; in two instances the lateral emarginations are anterior; in another instance they are posterior; in six instances the emargination is so deep that four yellow spots, the inner ones smaller than the outer ones, have resulted. In seven of the specimens the apical segment is wholly black, in the remaining three instances there are two small maculations. While the maculations on the first and sixth segments are in all cases separated medially, those on segments two to five show all degrees of variability from complete separation to almost complete coalescence. While these differences constitute a wide range, they are so distributed as to make it difficult to separate any one of the insects from the group. For instance, one of the specimens with light scopa on the venter has four spots on the first segment of the abdomen, the other specimen thus distinguished has the first segment anteriorly emarginate, while it is one of the specimens with normal black pile on the venter that presents the abnormal posterior emargination laterally on the first segment of the abdomen.

In the U. S. National Museum are a male and two females from Colorado, and a male from Sprague, Washington, collected June 20, 1920 by Mr. M. C. Lane, which extend still farther the known range of this group, which probably represents only one species, Cresson's *atriventre*.

***Anthidium emarginatum* Say and *A. emarginatum bilineatum*, new variety**

A female specimen from Cascade, Colo., taken Aug. 23, 1914 by Mr. D. M. Fiske, one from Boulder, Colo., collected June 27, 1922 by Dr. F. E. Lutz, and one from Florissant, Colo., taken June 19 by Mr. S. A. Rohwer and kindly donated by Prof. T. D. A. Cockerell, have, like Cresson's *atrifrons*, which that author later recognized as a synonym of *A. emarginatum*, an enclosed black lateral spot in the band of the first abdominal segment as well as similar spots near the basal edge of the maculation on the apical segment (not noted in Cresson's description). They depart from "*atrifrons*" in having the band on the first segment interrupted medially and those on the second, third, and fourth, continuous or only subinterrupted.

A male from Boulder and one from Jim Creek near Boulder, taken by Dr. Lutz, June 21-27, 1922, present no abnormalities. A male from Malta, Colo., caught Aug. 4, 1919, has a faint trace of yellow on the scutellum and a mere pin point of yellow on the tubercles. One is hesitant whether to accord recognition to these feeble earmarks of *emarginatum* or to look upon this insect as an aberrant specimen of *tenuifloræ*.

The most disconcerting specimens are, however, two males from Cascade, Colo., taken by Mr. D. M. Fiske: one on July 9, 1914, the other on Aug. 23, 1914. The latter, it will be noted, was captured on the same date as the female from Cascade. This specimen has the tubercles well maculated but lacks even a faint trace of maculation on the scutellum, agreeing in this respect with the extreme of suppressed maculation indicated for *angulatum*. With *angulatum* it accords, too, in having two small dark spots on the clypeus; but the bands connecting the inner with the outer maculations of the abdominal segments are not noticeably thinner than in *emarginatum*, nor is the color of the maculations lighter. The lateral lobes of the pygidium are angulate as in *emarginatum* and in *angulatum*.

A still greater departure from the normal is indicated in the case of the male specimen caught on July 9. Instead of being angulated, the lateral lobes in this specimen are evenly rounded, and on each side of the anterior margin of the mesoscutum is a conspicuous linear maculation. In respect to the angulation of the lateral lobes I find considerable variability even among the specimens of *emarginatum* before me, and the rounded lobes of this specimen, while exceptional, seem to represent merely an extreme. But the stripe on each side of the anterior margin of the mesoscutum is not bridged by any intermediate forms. While the maculations on the front and middle tibiæ accord with those of Cresson's

description and with those of the other specimens here assigned to *emarginatum*, the hind tibiæ present a reversal of the usual condition: there is a spot at the apex but none at the base. As it was caught six weeks earlier than the male and female from the same locality, it seems possible that this specimen is not a freakish individual but represents a true variety and so, as a basis for future discussion, I designate it *emarginatum bilineatum*. Like the male caught on Aug. 23, it has two small darkish marks near the base of the clypeus.

***Anthidium tenuifloræ* Cockerell**

Fifteen males (5 from Ridgway, Colo., 3 from Ward, Colo., 1 from Malta, Colo., 1 from Aspen, Colo., 1 from Florissant, Colo., 1 from Leadville, Colo., 1 from Golden, Colo., 2 from Jackson, Wyo.) have been placed here, though they all depart somewhat from the description by Cockerell and show individual variations. The stripe on the scape is in most instances confined to the apex, agreeing in this respect with certain males referred to *tenuifloræ* by Swenk. Normally the clypeus of the male is wholly yellow but four of the specimens from Ridgway, one of the specimens from Jackson, and one of the specimens from Ward have two distinct black marks near the base, suggestive of the corresponding marks in the closely related *titusi*. All of the specimens so distinguished differ from *titusi*, however, in having cream-colored (not lemon-yellow) maculations, in retaining the maculation (though much reduced) at the apex of the scape and in having the scutellum immaculate, and all save two differ from it likewise in the absence of the maculations at the apex of the middle tibiæ. The description of *tenuifloræ* calls for cream-colored maculations on "middle of anterior tibiæ and outer side of basal joint of all the tarsi." Swenk's key to the Nebraskan species speaks of the middle and hind tibiæ as black "except for the small yellow knee spots." In the fifteen specimens under consideration small linear maculations are present on all of the tibiæ (basally and apically on the front pair, forming usually a narrowly interrupted stripe, as Cresson indicates for *emarginatum*; basally and in ten instances apically as well on the middle pair, again suggestive of Cresson's description of *emarginatum*; and basally on the hind pair). In all of the specimens there are four spots on the first segment of the abdomen (agreeing in this respect with Swenk's key) and two on the sixth, but a median interruption on the bands of the other segments occurs in only about half of the specimens. Swenk says of the group that he identified as *tenuifloræ*: "The pygidial lobes, though variable, are usually broader than the space

between them and the central spine." This comment applies with equal accuracy to the specimens under consideration. Notwithstanding the fact that some of the specimens have apical markings on both front and middle tibiae, they cannot, it seems to me, be referred to *nebrascense*. These apical spots are relatively small, not "large triangular areas," while, perhaps even more important, all the specimens have the dorsal maculations distinct on the first segment and a laterally emarginate band instead of four spots on the second segment. They differentiate themselves from *emarginatum* in the absence of maculations on the tubercles and scutellum.

The male from Golden has an aureate sheen on the pile of its thorax and presents rather a contrast to the dull appearance of the other specimens. This male is also differentiated from the others through the absence of even the apical maculation on the scape, but agrees in this respect with what Swenk found rather characteristic of the specimens he had under examination.

The fifteen females (4 from Ward, Colo., 1 from Leadville, Colo., 1 from Florissant, Colo., 1 from Aspen, Colo., 1 from Sackville, Colo., 1 from Long's Peak Inn, Colo., 1 from Boulder, Colo., 1 from Ridgway, Colo., 2 from Jackson, Wyo., 1 from Yellowstone Park, Wyo., and 1 from Paris, Idaho) are in fairly close agreement with Cockerell's description. One of them has a maculation at the apex of the front tibiae, and the sepia-brown hair of the venter is in at least two specimens replaced by scopa of lighter hue. Variability in the color of the ventral scopa has been noted by Swenk in the case of Rocky Mountain and Plains specimens and is evidenced also in the Pacific coast representatives of this species, as recently pointed out by Cockerell. The female from Yellowstone Park has the hair on the vertex, on the thorax above, and on the venter tinged with golden, matching in the brightness of its coat the male previously referred to.

The males were caught between July 10 and Aug. 10; the females, for the most part between July 8 and Aug. 10, though one of them (the Sackville specimen) was taken on June 13. With the exception of a female from Long's Peak Inn and a male and female from Florissant, contributed by Prof. T. D. A. Cockerell, of a male and female from Ward, a male and female from Aspen, and a female from Boulder, collected by Mr. Pearce Bailey, Jr., a female from Ward contributed by Miss Sara Branham, and a male from Golden taken by Mr. L. O. Jackson, all of these specimens were obtained by Dr. F. E. Lutz. The female from Florissant was caught visiting *Pentstemon secundiflorus*.

***Anthidium nebrascense* Swenk**

Two male specimens from Bear Lake, Idaho, taken July 9, 1920, by Dr. F. E. Lutz, are apparently this species, although the antennæ of one of them are chocolate-colored above and black-banded below, while the antennæ of the other only barely suggest such a demarcation and would be more correctly described by Swenk's phrase "wholly black." The specimen with more uniformly dark antennæ has a continuous band on the middle tibiæ instead of the usual basal and large apical maculations. Both of the specimens have two conspicuous black marks at the base of the clypeus but, as such marks have been noted in the case of males of other species the clypeus of which is normally wholly yellow, no varietal importance should be attached to them. The specimens have the somewhat exceptional faint marks on the anterior part of the tegulæ but are orthodox in lacking the discal spots on the first abdominal segment.

***Anthidium jocosum* Cresson, and allies**

Anthidium jocosum was described by Cresson from Ridings, Colo. The male has the apical segment "broadly, not deeply, emarginate on posterior middle, with a sharp central tooth, the lateral lobes very broad, rounded laterally and truncated posteriorly." Cresson supplements this description with a diagram. I have examined the type of *jocosum* and find that the entire venter and most of the dorsum of the abdomen is reddish-brown to reddish, strongly so on the apical rims and on the sixth and seventh segments. More recently Cockerell has described *fontis* from California, which has "the seventh segment entirely dark red, with very short lobes, much broader than distance between either and the median spine; last ventral segment with a deep median sulcus." Three males from Dulzura, Cal., taken May 15 and June 14, 1917 by Mr. William S. Wright, have a reddish pygidium of the low, broad shape indicated in Cresson's description, and more or less red on the venter. One of them has the pile on the vertex and thorax above whitish, as implied in Cresson's description; two of them have these parts covered with pile that is distinctly fulvous, as specified by Cockerell. One of them differs from the descriptions of both Cresson and Cockerell in having maculations above the tegulæ; the other two agree with both *jocosum* and *fontis* in having the mesoscutum immaculate. There is a stripe running along the posterior edge of the hind tibiæ in all of the Dulzura specimens; Cockerell speaks of only basal and apical spots. In all other respects the males seem to be identical with those that he examined.

The specimens from Dulzura have distinctly yellow maculations, the type of *jocosum* is cream-colored. Cresson speaks of a "line on base of all the tibiæ" in *jocosum*, but the maculation is rather more extensive than this description would seem to imply and differs little from that of the Dulzura specimens or from Cockerell's specification for *fontis*. There is some variability among the Dulzura specimens in the depth of the emarginations laterally on the abdominal bands, as well as in the degree of truncation of the lateral lobes of the pygidium and even in respect to the thickness of the median tooth of the pygidium. In all of them the band on the third segment is rather more decidedly emarginate than in *jocosum*, though there is general correspondence with *jocosum* in other respects. In spite of variability, the lateral lobes, too, are of the general type of *jocosum*, while the needle-fine median tooth of *jocosum* has its parallel in at least one of the specimens from Dulzura. The maculated seventh segment of *jocosum* and the distinctly lighter hue of its markings are perhaps the strongest points of separation between this species on the one hand and *fontis* and the Dulzura specimens, which are probably *fontis*, on the other.

The female of *jocosum*, so far as I am aware, has never been recorded. Cockerell, however, has given a description of the female of *fontis*. From Dulzura there are two females that are approximately $8\frac{1}{2}$ –9 mm., as against approximately 8 mm. in the case of the males, thus reversing the size relationship of the sexes as exemplified by the specimens examined by Cockerell. These Dulzura females depart somewhat from the description of *fontis*. Their lateral face marks end below the level of the antennæ, as called for in the description, but these marks are placed slantingly along the lateral margins of the clypeus and are, therefore, narrowly rather than broadly truncate. Instead of having a bent stripe on the mesoscutum, the insects have merely a line above the tegulæ—corresponding to that of one of the males—and they lack all maculations on the hind basitarsi. The sixth segment has two large maculations, which are separated from each other by a narrow longitudinal line of black. Each maculation has a single, not a double, notch above.

In addition to these specimens, there are two males from Dulzura, taken by Mr. Wright respectively on June 12 and June 14, 1917. Their pygidium too, is substantially like that of *jocosum* but in their markings as well as larger size (about 10 mm. as against 8 mm.) they are readily separated from the other three males. In 1904, Cockerell assigned doubtfully to *palliventre* certain males that had a pygidium of the general type

of *jocosum*. Later Swenk took males of this type with females other than *palliventre* and thus felt justified in erecting the new species *utahense*. The two above-mentioned specimens from Dulzura seem to the writer to have too much in common with *utahense* to be separated from it, yet they differ in some respects. Thus they have the apex of the hind tibiae maculated in addition to the apices of the front and middle tibiae. Although their mesoscutum is immaculate, their tubercles are yellow (the three males from Dulzura assigned to *fontis* also have maculated tubercles) and there is a very faint trace of yellow on their scutellum. The yellow of all of the maculations is deeper than in *utahense*. Only one of the specimens has the second segment four-spotted. One would perhaps be more hesitant in lumping these two males with *utahense* if the markings on the tubercles and scutellum were not in agreement with the markings of the female of that species.

The recently erected *Anthidium brachyurum* Cockerell seems to run very close to *utahense* Swenk. Judging from the descriptions, the only important point of difference, so far as the male is concerned, is apparently the color of the maculations, which in the case of *brachyurum* are described as cream-colored and in that of *utahense* as of deeper yellow than in *tenuifloræ*. There may possibly be a slight difference, too, in the structure of the pygidium of the male, although the descriptions in this respect also run exceedingly close, *brachyurum* having "very broad low lateral lobes narrowly separated from the central spine" and *utahense* having "the lateral lobes very broad and rounded, the short and blunt central lobe arising from the middle of a rather shallow sinus." Moreover, variability in this structure has been noted by Cockerell in his comments on two other specimens, which nevertheless he associates with *brachyurum*. One of these, it is interesting to note, comes from Utah.

There are before the writer two male specimens from Huntsville, Utah, taken by Dr. F. E. Lutz, July 26, 1920, which, because of the fact that their maculations are cream-colored and of the same hue as those of *tenuifloræ*, are perhaps assignable to *brachyurum* rather than *utahense*, though the color distinction, as examination of a paratype of *utahense* has tended to show, is very slight. The specimens from Huntsville are larger than this paratype, which is about the size of the specimens from Dulzura assigned to *fontis*. Fortunately the Huntsville males are accompanied by three female specimens taken on the same day and at the same locality by Dr. Lutz. These differ somewhat from the described female of *utahense*. The lateral face marks, while contiguous to the marks on the sides of the clypeus, are not coextensive with them, being

slightly longer. Moreover, they are placed slantingly and barely attain the orbit of the eye at their lower extremity. One of the specimens has the mesoscutum and axillæ immaculate, as called for in the description of *utahense*, but its tibial markings are much reduced and interrupted. Indeed, the tibial markings in none of the female specimens quite deserve the characterization of "broad." They fail to reach the apex, being longest on the first pair of tibiae.

The two more highly maculated specimens have a spot between the lateral marks on the clypeus. This is suggestive of somewhat similar marks on the clypeus of *sagittipictum* Swenk and *divisum ornatifrons* Cockerell. In addition to the median clypeal mark, the two specimens thus ornamented agree with *sagittipictum* and *divisum ornatifrons*, it would seem, rather than with *utahense*, in the possession of a narrow stripe above the tegulæ and in the termination of the tibial stripes before the attainment of the apex. Like *divisum ornatifrons* they have marks on the axillæ that are lacking in *sagittipictum* and *utahense*. With *utahense* and *sagittipictum* the specimens agree in having for the most part pale pubescence, certainly not reddish on head and thorax above as described for *divisum*; yet the color of the pile is a very variable character even within a species of *Anthidium*. The hair on the basitarsi of *divisum* within is described as "light ferruginous," that of *utahense* as "reddish," that of *sagittipictum* as "pale reddish." In none of these descriptions is the color of the hair on the lower tarsal joints mentioned, which in the specimens from Huntsville are conspicuously blood-red and make the red of the basitarsi pale indeed by contrast.

The males of neither *divisum* nor *sagittipictum* are known. The markings of the *divisum* female seem rather like those of the specimens from Dulzura. The designation of the dorsal pile as "reddish" seems at first definitely to separate *divisum* from the Dulzura females. But two of the males from this region associated with these females have pile that is so strongly fulvous as to be only a step removed from reddish. I am inclined to think, therefore, that *divisum* may belong to the *jocosum* group. It is somewhat significant that it is reported from Utah and its variety *ornatifrons* from California.

***Anthidium angelarum* Titus**

Two females from Claremont, Cal., donated by Mr. C. W. Metz, belong to this species. One of them is in fairly close agreement with the type deposited in the U. S. National Museum; the other has, in place of two basal spots on the clypeus, a deep rectangle of black extending two-

thirds of the way to the apex, and lacks maculations above the tegulæ and on the axillæ. Both specimens are a trifle larger than the females here assigned to *fontis* and differ from these (1) in the fuller maculations on the side of the face which, while obliquely truncate, extend at their uppermost point slightly beyond the base of the antennæ, and (2) in the presence of a line on each side of the anterior margin of the mesoscutum.

***Anthidium mormonum* Cresson, and allies**

Under the above heading Professor Cockerell has recently discussed (Proc. Cal. Acad. of Sciences, Fourth Series, XIV, No. 15, pp. 345-367) the complicated relationships of this difficult group, and I know no better way of supplementing his painstaking study than by adopting a similar method. There are in the collections of the American Museum two female specimens—one from Starkville, Colorado, caught by Dr. F. E. Lutz on June 13, 1919, the other from Pagosa Springs, Colorado, taken by the same collector, June 21-23, 1919. Both of these specimens have fulvous pubescence on the vertex and thorax above, but variability in the color of the pile as well as in the maculations has been noted in the case of other species of *Anthidium*, and the points of difference between the Starkville and Pagosa Springs specimens, on the one hand, and Cresson's type of *blanditum*, on the other, do not seem of a sufficiently vital character to justify a separation from *blanditum*. The Colorado females differ from the type (from Nevada) in that they have on the clypeus two basal black marks, apparently like those mentioned by Cockerell as distinguishing a female from South Fork, Kings River, Fresno County, Cal.; similar abnormalities have been noted by Cockerell in the males of *angulatum* and are noted in the present paper in connection with males of *tenuifloræ*. In like manner the posterior emarginations laterally on the band of the first abdominal segment, which in the Colorado specimens replace the imprisoned black spots that characterize the type, are fairly common instances of variability in other species. On the other hand, the maculations of the legs, in the Starkville specimen at least, are identical with those of the type even to the inclusion of a yellow mark on the hind coxæ; while, as a further instance of minute parallelism, both of the Colorado specimens and the type have, penetrating the yellow of the last abdominal segment, two inward- and downward-slanting, hair-fine short black streaks that descend from the base about midway between the sides and the center.

There is also a male from Starkville that was caught by Doctor Lutz on the same day as the female from that locality. In its slender build and

punctuation, and for the most part in the character of its markings, it is like the female, and I am inclined to think that it belongs to the same species as that sex. It should be mentioned that, like the type of *pecosense fragariellum*, it has two cuneiform maculations with posterior emarginations on the first segment; but, as Cockerell has pointed out in the case of *fragariellum*, this peculiarity is not shared by other specimens of that species, and a similar departure from the normal may be assumed in the case of *blanditum*. The marks above the eyes are inward-pointed, not merely oval as described for *pecosense fragariellum*, and the marginal yellow of the mesothorax is feeble in contrast to the maculations of the legs, which consist of a long stripe on the under side of the front and middle femora, a more abbreviated stripe anteriorly on the under side of the hind femora, a yellow patch at the apex of the middle femora externally, and the entire outer surface of the tibiae and basitarsi. Except for the central spine and a narrow border of black (broadest at the apex of the lobes) segment 7 is wholly yellow. The hair on the thorax above is yellowish, in agreement with the coloration of the females mentioned.

A male from Aspen, Colorado, caught July 24–27, 1919, corresponds in most respects with the male from Starkville, although it has gray pile on the thorax above, four spots (the inner ones tiny) on the first abdominal segment, and broader lateral lobes on the seventh segment. The similarity of the lateral lobes to those figured by Cresson for *mormonum* and the presence of minute marks on the disk of the first abdominal segment, as noted also for *mormonum*, induced me to believe that the specimen might be that species, and, after examining the type, I am still inclined to the belief, when allowance is made for variability, that they are indeed one. The type of *mormonum* has, however, merely a short line on each side of the anterior margin of the mesoscutum, whereas the specimen from Aspen agrees with that from Starkville in having L-shaped figures on the mesoscutum. In *mormonum* all of the abdominal bands are more or less interrupted; in the Aspen as well as the Starkville male, bands 5 and 6 are merely subinterrupted above, agreeing in this respect with the females here assigned to *blanditum* and with the type of *blanditum* itself. Variability in the lateral lobes has been noted in connection with other species and, as the lobes are the only structural feature on the basis of which the specimen from Aspen could be separated from that of Starkville, it seems reasonable to regard them both as one species. But, if this conclusion be valid, may we not assume as well, following the cautious lead of Professor Cockerell, that *blanditum* is

merely the female of *mormonum*? Certainly greater divergence from the normal maculation than is represented by the *mormonum-blanditum* complex can be shown in the case of other species and will be evidenced presently in discussing two specimens from Mesa Verde that are presumably to be regarded as *pecosense*.

A specimen caught by Dr. F. E. Lutz at Starkville, Colorado, on June 13, 1919, is presumably a close duplicate of that described by Swenk as *prædentatum trianguliferum*. At the time of its capture the bee was constructing its nest "in a cavity in a small stone," as the field-note states. The nest was built of the usual woolly plant material employed by *Anthidium*.

I say it is presumably a close duplicate, because it is in agreement with the specifications made by Swenk. In only one respect is there room for doubt, namely, as to the identity of the maculations on the legs. These Swenk does not mention in detail, but the implication is that they are like those of *placitum*. Swenk based his conclusions on the description of *placitum*, not on an examination of the type, and that part of Cresson's description that applies to the legs is unfortunately a little confusing and susceptible of misinterpretation. Swenk's limitation of the differences in the legs of *trianguliferum* and *poudreum* to the presence in the former of "broad yellow stripes" on the femora perhaps justifies the conclusion that his insect had legs much less maculated than those of *placitum*.

If this interpretation is correct, *trianguliferum* had better be considered, as was originally Cockerell's *prædentatum*, at most a subspecies of *mormonum* (*blanditum*), with which it agrees except for the triangular mark on the clypeus and the abbreviation of the marks above the eyes. Indeed, with these exceptions, the present specimen is the virtual duplicate of the specimen of *mormonum* (*blanditum*) caught on the same day and in the same locality. The affiliations with *placitum* would seem to be more remote, for the type specimen of *placitum* has, in addition to the more extensive maculation of the legs, rather decidedly individual maculations on the hind face of the metathorax.

The presence in the same locality of *mormonum* (*blanditum*) and a putative variety of *mormonum* (*blanditum*) raises the further doubt as to whether the latter may not be merely one extreme of variation within *mormonum* (*blanditum*), the specimens with two black cuneiform marks at the base of the clypeus serving as intermediates between the triangle-bearing form and the normal female with wholly yellow clypeus. A slight enlargement of these black marks would unite at the base their

slanting sides and produce such a W-shaped figure as Cockerell describes in *blanditum prædentatum*. This variety, it seems to me, may also be merely one of the gradations of variability in a species which in the past has been looked upon as particularly distinguished in the female by an immaculate or nearly immaculate clypeus.

The relationships of the complicated *mormonum* group are not simplified by two male specimens that Dr. F. E. Lutz took at Mesa Verde, Colo., July 3-7, 1919, one of which was visiting flowers of *Lupinus aduncus*. Structurally and in respect to the maculations on their head, legs, and abdomen both of these insects are substantially the same. But, while one of them has L-shaped marks on the mesoscutum and maculated axillæ and scutellum, the other has not a trace of yellow on the thorax except for the usual marks on the tegulæ and tubercles. Here are indeed extremes more difficult to bridge than those separating *mormonum* from the male specimens above discussed, and yet, alike in essentials, I cannot believe that the two specimens represent distinct species. These insects are much larger than the males from Aspen and Starkville assigned to *mormonum* (*blanditum*), being about 12 mm. in length. The inner maculations on the first segment of these Mesa Verde specimens are larger and more distinct than those of the type of *mormonum* or of the male specimen from Aspen, but not more so than the inner terminus of the lateral maculations on the first abdominal segment of the male specimen from Starkville. The hair of the thorax above is slightly yellowish, certainly of a deeper hue than the hair on the pleura. The yellow stripe on the tibiæ is continuous, not broken. The sinus between the lateral lobes of the Starkville specimen is fully as broad, if not broader, than that which separates the lobes of the Mesa Verde specimens. Nevertheless, these Mesa Verde specimens seem sufficiently close to Cockerell's *pecosense* to deserve designation as such. That they are very close to *mormonum* also, cannot be doubted and, in view of the at times overlapping variability shown, it would seem more probable that *pecosense* is a subspecies of *mormonum*, as already indicated by Cockerell, than that it is an independent species.

In commenting on the females of *mormonum* (*blanditum*) attention was directed to the fact that the specimens of that sex from Starkville and Pagosa Springs agreed with Cresson's type in the possession of two hair-fine streaks of black invading the yellow of the last abdominal segment. A female specimen acquired with the Henry Edwards collection is similarly distinguished but has, in addition, a yellow maculation on the mesopleura, similar to that noted by Cockerell in the case of a female

from Meadow Valley, Cal., which he assigned to *fragariellum*. The Edward's specimen is slightly more robust than the slender specimens of *mormonum* (*blanditum*) from Colorado and is presumably assignable to *pecosense* or its variety *fragariellum*. The locality of its capture is given as "Summit Sierra Nevada." This is a little vague—one would like to know the particular peak—but it has interest in that it brings *fragariellum* (if *fragariellum* it be) very close to Nevada, from which the type of *blanditum* was secured. In the "Catalogue of the Hymenoptera, Orthoptera—etc." kept in long-hand by Henry Edwards, or someone working under his supervision, this insect is designated "*blanditum*."

There are two male specimens from Mt. Lowe, near Los Angeles, Cal., taken Aug. 24, 1916, by F. E. Lutz. One of them checks up pretty closely with Cockerell's type of *bernardinum* deposited in the U. S. National Museum, except for its immaculate scape and the gray rather than yellow pile on the thorax above. The second specimen from Mt. Lowe has the scape maculated and the pile on the thorax above yellow, and agrees with Cockerell's cotype in the National Museum in having, instead of the L-shaped figure on the thorax, merely disconnected maculations on the anterior margin and above the tegulæ. In the paper previously alluded to that is published by the California Academy, Cockerell speaks of certain males of *bernardinum* taken at Mill Creek Canyon, Cal., which "are variable: hair on thorax above white or fulvous; scape practically all black, or with a large yellow mark." The males from Mt. Lowe fall within the limits of variation there set down.

With some hesitation I am indicating as a variety of *bernardinum*, to be designated ***bernardinum mesaverdense***, new variety, a male and two females, taken by Dr. F. E. Lutz at Mesa Verde, Colorado, July 3-7, 1919. They share with *bernardinum* the rich orange markings, but they are conspicuously larger and more robust than the corresponding sexes of *bernardinum*, the male measuring about 15 mm. against 13 mm. for the type, the females more than 13 mm. as against 10½ mm. for the females from Bear Valley, Wilson's Peak, and Los Angeles that Cockerell originally associated with his male specimens of *bernardinum*. These California females, Cockerell compared with *placitum*. The specimens from Mesa Verde have been compared with the type of *placitum* and the following notations will serve to bring out the points of resemblance and of difference:—The Mesa Verde specimens are more robust than *placitum* but in several respects seem allied to that species. The structure of the clypeal margin, the formation of the mandibles and their marking, the median black stripe on the clypeus (broader in the Mesa Verde speci-

mens), the truncation of the lateral face marks at the level of the insertion of the antennæ, the bands above the eyes (in the Mesa Verde specimens they extend only to the lateral ocelli, in *placitum* considerably beyond, being only very narrowly interrupted), the identity of the thoracic markings,—all of these indicate the close affiliation of the two. The abdominal markings, too, are very similar, but in the Mesa Verde specimens all of the bands are medially interrupted, in *placitum* only on segments 1, 2, 3, and 6. *A. placitum* has a faint stripe on the scape and two half-moon marks on the posterior face of the metathorax, absent in the Mesa Verde specimens. The black on the legs of the Mesa Verde specimens is replaced in *placitum* by reddish brown, and the yellow maculations on the tibiæ and femora are even more extensive than in the Mesa Verde specimens, in which the maculations are confined to broad stripes on the inside of the femora, the apex of the femora externally, the entire tibiæ externally. The front and middle basitarsi of the Mesa Verde specimens are concealed beneath a heavy thatch of snowy to brown pubescence; the hind basitarsi are yellow. The hind coxæ of both the Mesa Verde specimens and *placitum* have a yellow maculation. The Mesa Verde specimens are larger and more robust than *placitum*—a third to a half broader.

Instead of broad L-shaped bands on the mesothorax, which characterize the female of *bernardinum mesaverdense* and which in that sex almost unite with the wholly yellow axillæ that are in turn confluent with the broad linear bands on the scutellum, there are in the male only short narrow stripes above the tegulæ, while the marks on the axillæ are reduced and broadly separated from the bands on the scutellum. In these respects the male from Mesa Verde differs not only from the two females from the same locality but also from Cockerell's description of *bernardinum*. Other departures from the description are: the absence of a stripe on the front femora and the presence of only narrow apical stripes on the middle and hind femora (in the female broad stripes are present on all the femora), the interruption of all of the abdominal bands medially as in the female—the interruptions, as in that sex, being rather broad (but decreasingly so) on segments 1-2-3,—the great predominance of black on the apical segment, the yellow maculation being confined to two small spots, and the replacement of ferruginous by black on all the ventral segments except the first. The pubescence of the vertex and thorax above is in this male from Mesa Verde gray to white, not fulvous as in the females and in Cockerell's description of *bernardinum*. In the male specimen from Mesa Verde the pygidial lobes are more broadly rounded, approaching the truncate, and there is a total absence of angulation.

The points of difference between the female specimens assigned to *bernardinum mesaverdense* and the type of *placitum* have been mentioned. Three females taken August 14, 1917, at Descanso, San Diego County, Cal., and kindly placed at the disposal of the American Museum by Dr. J. Bequaert, should, I think, be regarded as *placitum*, notwithstanding a few negligible differences in respect to which the specimens show variability even among themselves. Thus the reddish brown that replaces black on the legs of the type of *placitum* is duplicated in only one of the females. In one of them the band on segment 4 is interrupted, in two of them the band on 6 as well as that on 5 is entire. On the other hand, they agree with *placitum* in having a narrow median band of black down the clypeus, extensive yellow marks above the eye that, pointed inward, almost join one another, maculations on the scape (lacking in one specimen), L-shaped marks on the mesoscutum, practically continuous with the confluent maculations on axillæ and scutellum, and the rather unusual maculations on the posterior truncation of the thorax, which, however, show variability in shape. As in the type of *placitum*, yellow has to a great extent replaced black on the legs, such parts as the coxæ (largely), the trochanters (largely), the entire under side of all of the femora, and to some extent the upper side, especially on the middle and hind pairs of legs, all of the tibiæ above and also encroachingly within, and the hind basitarsi, being strongly maculated. The front and middle basitarsi, like those of the specimens assigned to *bernardinum* are concealed beneath a heavy thatch of snowy to brownish pubescence.

A female from Mesa Verde, Colo., caught by Dr. F. E. Lutz, July 3-7, 1919, is of deeper hue than the specimens designated *niveumtarsum* (p. 18) and differs from these, too, in having above the eyes large cuneiform marks that nearly reach the lateral ocelli, broad stripes running almost the full length of the under side of the front and middle femora, a distinct but short apical stripe on the hind femora, and yellow on the hind coxæ. The black band that bisects the clypeus longitudinally, as in *hesperium*, branches out at its basal end into two spear-shaped extensions that are thrust downward along the lateral edges of the clypeus, imparting to the figure the semblance of an inverted anchor. The yellow on the clypeus of *hesperium dentipygum* is "reduced to large spots at the sides which are nearly confluent with the facial spots." While there may thus be a slight difference between the American Museum specimen and the type in the maculation of the clypeus, their resemblance to one another is evidently very close in practically all other respects. The spots on each lateral half of segment 1 are connected in the specimen from Mesa

Verde, a condition that sometimes occurs in *hesperium dentipygum* and, it might be added, in *hesperium* itself, as pointed out by Cockerell (Proc. Cal. Acad. of Sciences, XIV, No. 15, pp. 345-367). The specimen under discussion has, like *dentipygum*, distinct teeth on the sides of the pygidium, recalling the structure of *niveumtarsum*. In the opinion of the writer this structural feature is rather a barrier to the designation of *dentipygum* as a subspecies of *hesperium*, which has, I believe, been reported only from California whereas *dentipygum* is from Wyoming. Its affiliations are, it seems to me, with the *mormonum* group.

***Anthidium hesperium* Swenk**

Five females from California have been kindly loaned by the U. S. National Museum. Three of these are from Lindsay, taken Aug. 5, 1911 by Mr. J. C. Faure on tarweed, one is from Stevens Creek, Santa Clara County, secured Aug. 5, 1915 by Mr. R. Stinchfield on *Adenostegia pilosa*, and one is from Los Angeles County. All of these specimens have an interrupted band on the first segment instead of the four spots mentioned in Swenk's description. In one of them—that from Los Angeles County—the maculations above the eye extend to the lateral ocelli, and this specimen as well as two of those from Lindsay depart from the normal in yet another respect, namely, in the extension of the lines over the tegulæ, L-shaped fashion, along part of the anterior margin of the mesoscutum. The date of capture of these insects is of interest as it fills a gap in the dates previously known, indicating that the species flies in all of the months from June to October inclusive.

***Anthidium niveumtarsum*, new species**

FEMALE.—Length 10 mm.; stout; black with pale lemon yellow markings. Pubescence generally pale, strongly tinged with gold on vertex and thorax above; front and middle basitarsi outwardly with concealing snowy patches that give way abruptly near the apex to patches of golden brown like those on the inner side; ventral scopa glittering silvery white. Yellow markings as follows: mandibles except tips, a spot on each side of the clypeus extending about half-way up, the contiguous lateral face marks with a slightly oblique truncation of somewhat wavering outline that extends from the inner margin of the eye at the level of the insertion of the antennæ toward the angle made by the junction of the side and base of the clypeus but fails quite to reach it, small marks above eyes, the carinated tubercles, tegulæ broadly in front, splash behind, spot on wing base, line above and about coextensive with tegulæ, line on axillæ about half their width continued unbroadened on the scutellum, all the tibiæ externally except for slight apical intrusions of black, a faint streak on the hind basitarsi, four spots on segment 1 of abdomen that are suggestive in their configuration of a medially interrupted band the two halves of which had in their turn been sundered

by an unusually deep posterior emargination, medially interrupted bands on segments 2-4, the interruptions becoming progressively smaller from segment to segment, the band on segment 5 with a deep triangular notch medially, and two large pear-shaped spots on segment 6 separated from one another by a narrow median line. The bands, very similar to those of *bernardinum mesaverdense* (see "*Anthidium mormonum* Cresson, and allies") are laterally emarginate above, the emarginations being subtriangular rather than square and, deep at first, become progressively shallower and more rounded, imparting to the bands on 4 and 5 a sinuous outline above. The sixth segment with strong lateral angles, similar to those of *blanditum*.

The description is based on a specimen from Jackson, Wyo., caught July 13-17, by Dr. F. E. Lutz. Three other specimens taken by Dr. and Mrs. Lutz—one from the same locality as the above and of corresponding date, the second from Bear Lake, Idaho, July 9, 1920, and the third from Giveout, Idaho, July 7, 1920—may be assigned to the same species although differing in certain details. The second specimen from Jackson has faint, very abbreviated stripes at the apical end of the under side of the front and middle femora,—maculations barely discernible also in the specimen from Bear Lake, which has the further distinction of posterior emarginations on the medianly interrupted band of segment 1 instead of the four-spotted arrangement that characterizes this segment in the other three specimens. The specimen from Giveout is slightly more robust than the others, attaining 11 mm., and lacks all trace of yellow on the hind basitarsi.

With the females I associate a male from Trout Creek, Juab County, Utah, taken July 6, 1922 by Mr. Tom Spalding. It is marked like the female described with the following exceptions:

Clypeus wholly yellow, maculations on axillæ and scutellum not confluent, all basitarsi externally yellow, the hind coxæ maculated, the hind femora with a spot at the apex, abdominal bands beyond segment 2 not interrupted, though with deep median emarginations above, each of the lateral lobes of the pygidium with a rather linear maculation placed slantingly along the inner side. The lateral lobes separated from the median tooth by about their own width, and slightly angular rather than broadly and evenly rounded at the apex.

These specimens have been designated as a new species, but it is very possible that they are not entitled to such rank, having perhaps merely varietal importance. They are apparently very closely allied to *permaculatum* (described by Cockerell from Oregon) but seem to differentiate themselves by the absence or obsolescent character of the stripes on the femora, by the relatively smaller, rather than larger, size of the median spots on the first segment when compared with the outer spots, and by the bisection of the maculation on the sixth segment, resulting in two completely independent pear-shaped spots. The marks on the sides

of the clypeus of *permaculatum* are described as elongate; the corresponding marks of *niveumtarsum* extend about half-way from the apex to the base, being notably shorter than those of *hesperium*. "Very pale yellow" is the designation of the maculations of *permaculatum*; those of *niveumtarsum* are considerably paler than the maculations of *hesperium* but do not quite attain the cream color of *tenuifloræ*. The wholly immaculate or well-nigh immaculate condition of the femora serves to differentiate *niveumtarsum* not only from *permaculatum* but also from *hesperium*. All the females differ from *hesperium*, too, in having the fore and middle basitarsi externally black in so far as the color of the chitin is traceable under the close and well-nigh concealing pubescence. The distinct lateral angles on the pygidium constitute yet another departure—and in my opinion the most important—from *hesperium*, although this structural feature corresponds with that of Swenk's subspecies, *hesperium dentipygum*.

***Anthidium wyomingense*, new species**

FEMALE.—Length $7\frac{3}{4}$ mm.; slender; black with yellow markings. Pile in general yellowish white, rather darker on lower half of face than on upper, the inner sides of the basitarsi golden brown, the ventral scopa glittering. Closely, finely, and somewhat indistinctly punctated on head, thorax, and abdomen, the abdominal punctures being most crowded but relatively more distinct on the apical rims. The maculations lemon yellow, relatively few except on the abdomen. Those on the head confined to two rather small spots of vague outline about midway between the clypeus and the inner edge of the eye, their centers about on a level with the basal margin of the clypeus (the clypeus itself being wholly black) and a small roundish mark above each eye. The thoracic markings are limited to a line of yellow traversing the summit of the otherwise black tubercles, which are obtuse, a faint trace of yellow near the outer margin of the tegulæ in front, and two short lines on the scutellum. All of the tibiæ have a stripe running from the base nearly to the apex, and interrupted in the case of that on the fore and hind pair very close to the base; other parts of the legs black. Segment 1 of the abdomen with a diamond-shaped spot at each lateral extremity and two pin points of yellow toward the middle of the segment. Medially interrupted bands on segments 2–6, the interruption being widest on the basal segments and thence narrowing progressively. The bands on 2 and 3 laterally with a small squarish emargination above; the bands on 4 and 5 of slightly sinuous outline above, that on 5 being rather broader at its inner extremities, where the interruption occurs, than at its outer extremities in contrast to the other bands (especially those on 1 and 2), which taper off somewhat toward the middle. Segment 6 with two pear-shaped spots, their more attenuated end pointed away from the center; a fairly broad line of black separates these two spots, its width being greater than that of the interruption on segment 5 and almost that of the interruption on segment 4. The apical segment laterally toothed.

This description is based on a single specimen from Jackson, Wyo., caught by Dr. F. E. Lutz, July 13-17, 1920. The combination of markings on the sides of the face with an immaculate clypeus and mandibles is relatively rare. Such a condition is reported in the case of *porteræ personulatum* but there is no chance of confusion with that insect, which is conspicuously larger and in many other ways notably different. *A. wallisi* from British Columbia also has similar facial markings. But in that species the marks above the eye are large, "the tegulae and thorax wholly without yellow," the tibial markings confined largely to the apex, the posterior basitarsi yellow, and segment 2 is four-spotted. Finally, *wallisi* is $2\frac{1}{4}$ mm. larger than the present specimen.

This species has been tentatively placed in the group that in the male sex has broad rather than elongated lateral lobes but, until the male is known, there can, of course, be no assurance that it has been correctly assigned.

***Anthidium porteræ* Cockerell**

Five males (two from La Junta, Colo., caught on Aug. 12, 1920, one from Mesa Verde, Colo., taken some time between July 3-7, 1919, two from Eldorado Springs, Colo., June 23, 1918) and six females (two from La Junta, Aug. 12, 1920, one from Regnier, Colo., June 6-9, 1919, one from Wray, Colo., Aug. 17-19, 1919, one from White Rock, near Boulder, Colo., June 30, 1922, and one from Boulder itself, June 30, 1922) belong to this group. With the exception of the two specimens from Eldorado Springs, collected by Mr. L. O. Jackson, and the specimen from Boulder, kindly donated by Prof. T. D. A. Cockerell, all of these insects were collected by Dr. F. E. Lutz. The specimen from Mesa Verde was caught on *Pentstemon coloradensis* and that from Boulder on *Petalostemon*.

The two males from La Junta and one of the males from Eldorado Springs have the ground color of the abdomen red and in this respect agree with Cockerell's variety *amabile*. The dorsal side of the abdomen of the specimen from Mesa Verde and of the second specimen from Eldorado Springs is rather more sparingly suffused with reddish, but the ventral side in both of these specimens is of the same brownish red as the last segment. One of the specimens from La Junta and the specimen from Mesa Verde lack the mark on each side of the thorax in front. The second specimen from La Junta, although it has the thoracic marking just mentioned, is in other respects less orthodox. The maculation on the scape is more developed in this specimen and the stripe on the hind tibiae

is not confined to a basal spot but extends narrowly to the apex, where it again broadens. The spines of segment 6 are yellow almost to the tips in this highly maculated specimen and there are two light yellow spots on the otherwise ferruginous apical segment. All of these male specimens have the following maculations not mentioned in Cockerell's description: tubercles, posterior part of tegulæ, wing bases, and basal joint of front tarsi. One of the specimens from Eldorado Springs lacks the maculation on the scape.

The female from Ward, Colorado, is of particular interest in that its abdomen is reddish, a peculiarity which Cockerell believed was confined to the male of *porteræ amabile*. Among the specimens examined by Swenk, too, only the males are referred to as having the ground color of the abdomen red. The five remaining females have the abdomen black. One of them lacks the marks on each side of the mesoscutum in front. All the females, the red one included, have immaculate basitarsi and yellow tubercles. Only two of the dark females have the maculations on the clypeus united briefly on the anterior margin—as called for in Cockerell's description. Two others have well-formed unconnected spots on each side of the clypeus. In the fourth "dark lady" these spots are very much reduced, adumbrating the immaculate condition to which Cockerell gives the varietal name *personulatum*. In the U. S. National Museum there is a female *porteræ* (from Colorado) that is even more closely linked with *personulatum*, having a faint, barely traceable spot on one side of the clypeus—the other side being wholly dark—and rather narrow lateral face marks. The lateral marks on the mesothorax are, however, not rudimentary, as called for in *personulatum*, but of average size.