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NOTES AND DESCRIPTIONS OF BEES.

BY J. C. CRAWFORD, JR., WEST POINT, NEBR.

The specimens on which this paper is based are in the collection of the University of Nebraska, unless otherwise stated. Especial acknowledgments are due to Prof. Cockerell for specimens and suggestions, to Prof. Titus for specimens, and to Prof. Bruner for overseeing my work.

Halictus montanus, n. sp.—Female: Black, head closely coarsely and deeply punctured on the vertex, coarser along the inner orbits, less closely on the face below the antennæ; clypeus sparsely and more coarsely punctured, fringed with golden hair at the apex; mandibles black, reddish at tips; antennæ black, flagellum dark brownish beneath towards tip; pubescence of head and thorax griseous, slightly tinged with ochraceous on the thorax, thin on the disc of mesothorax, dense on pleura and cheeks; thorax closely and rather coarsely punctured; base of metathorax enclosed and finely rugose, truncation finely roughened and with large punctures; tegulæ large, testaceous, and with punctures anteriorly; wings slightly yellowish, clouded apically; nervures and stigma bright testaceous; legs black, tarsi and hind tibiæ behind ferruginous; pubescence of legs slightly ochraceous, on inner side of tarsi and hind tibiæ golden; inner hind tibial spur with many short blunt teeth; abdomen black, very finely punctured, apical margins of segments with yellowish-white hair bands, bases of segments 2-4 also showing slight hair bands; pubescence at base of first segment griseous, on discs of other segments black, not showing plainly except from the sides. Length, 12-14 mm.

Male.—Similar to the female, but with the usual narrow form of the male. Most of mandibles and labrum and anterior half of clypeus yellowish-white, that on the clypeus produced to a tooth medially at rear; femora black, front and intermediate ones with a whitish stripe anteriorly, and all knees whitish; tibiæ yellowish white, with black stripes in front and behind; tarsi yellowish-white, apical joints tinged with reddish; antennæ long, reaching the metathorax, black, dull brownish beneath. In pubescence and punctuation like the female, the punctuation much closer, however. Length, about 12 mm.

Twelve female specimens: Big Horn Mts., Wyo.; Sioux Co., Nebr.; Logan, Utah; Laramie, Wyo.; Wawawai, Wash. (R. W. Doane, coll.); Wawawai, Yakima, and Almota, Wash. (C. V. Piper, coll.).

September, 1902

Ten male specimens: Wawawai, Wash. (C. V. Piper, coll.); East Wash.

Halictus Titusi, n. sp.—♀. Black, head shining, vertex, clypeus and supraclipeal space with sparse and large punctures; sides of face with close, large, oblique punctures or depressions; mandibles black; antennæ dark, flagellum slightly brownish; head with sparse long pubescence, on cheeks and vertex slightly tinged with ochraceous; mesothorax with a bluish reflection, smooth with sparse large shallow punctures, scutellum with similar but smaller punctures; tegulæ large, shining, punctured, dark, with a lighter centre and broad testaceous margin; base of metathorax enclosed, closely, rather finely, longitudinally striate; wings hyaline, tinged with yellowish; nervures and stigma testaceous; thorax with long griseous hair slightly tinged with ochraceous; legs black, apical joints of tarsi ferruginous; pubescence of legs slightly ochraceous; of tarsi decidedly so; inner spur of hind tibiæ with many short blunt teeth; abdomen dull, smooth, with a very few shallow punctures, almost imperceptible; apical half of segments depressed; basal margins of segments 2-4 with a broad thin band of appressed white pubescence; last segment almost covered with this pubescence. Length, about 10 mm.

Type from San Diego, Calif.

Dedicated to Prof. Titus, from whom it was received.

This species is close to *H. trizonatus*, Cress., in general appearance, but is slightly more robust, the abdominal bands thinner and more griseous, the thorax less densely punctured, the abdomen with fewer punctures, etc.

Halictus fulgidus, n. sp.—♀. Black, shining, head very closely and coarsely punctured above the level of the antennæ, more sparsely so below; clypeus and supraclipeal space sparsely punctured, the former fringed with golden hairs; mandibles black, rufous towards tips; antennæ black, toward tip dark reddish brown; pubescence of head griseous and rather scanty; mesothorax finely tessellate, densely punctured along the edges, more sparsely so on the disc; pubescence long, thin and griseous, denser on pleura; metathorax shining black, coarsely rugose, truncation with a few coarse rugæ, but very finely striate all over; tegulæ shining black, externally testaceous; wings hyaline, nervures and stigma testaceous; legs black, apical joints of tarsi ferruginous, basal joints more or less so; pubescence of legs griseous, slightly tinged with

ochraceous, on the tarsi golden ; inner hind tibial spur with four long teeth, outer pectinate ; abdomen shining, very finely tessellate, first segment sparsely and finely punctured, the remaining segments densely punctured at base, becoming more sparsely so towards rear ; bases of segments 2-4 with bands of appressed white pubescence ; abdomen with sparse white pubescence, more conspicuous at sides and at apex, where it is slightly golden ; very narrow apical margin of segments testaceous ; venter dark dull reddish-brown. Length, about 9 mm.

Twenty-three specimens, Lincoln, Nebr., Apr., on willow, plum and apricot.

Halictus Cockerelli, n. sp. — ♀. Black, head closely and finely punctured ; large and sparse on the clypeus, which is fringed with golden hairs ; flagellum of antennæ ferruginous beneath, apical joints entirely so ; face and cheeks densely clothed with white appressed pubescence ; mandibles, except tips, ferruginous ; mesothorax rather closely and very finely punctured, the surface finely roughened ; median and parapsidal grooves plain ; metathorax with fine rugæ proceeding from the base, but not reaching the apex ; wings hyaline, splendidly iridescent ; nervures, stigma and tegulæ testaceous ; second submarginal cell greatly narrowed to marginal ; third not much narrowed ; legs brownish, knees, apices of tibiæ and tarsi entirely, testaceous ; pubescence of legs griseous, of tarsi golden ; inner hind tibial spur with about four or five short, blunt teeth ; abdomen shining, finely punctured and finely transversely striate, brownish, the apical margins broadly depressed and testaceous ; basal margins of segments 2-4 with bands of appressed white pubescence ; venter dull testaceous. Length, about 5-5½ mm.

Described from five specimens collected by Prof. Cockerell at Santa Fe and Mesilia, N. M., Apr. 22nd to July, on old flower clusters of Virginia Creeper and on flowers of yellow *Sisymbrium*.

Dedicated to Prof. Cockerell for his many kindnesses and aid in various ways.

Halictus pictus, n. sp. — ♀. Head and thorax brassy-green ; head very strongly and closely punctured on the vertex, below the antennæ the punctures large and coarse ; clypeus and supra-clypeal space sparsely punctured, the former purplish black at apex, fringed with golden hairs ; mandibles ferruginous, dusky at base and near apex at times ; sides of face with appressed white pubescence ; antennæ with scape and flagellum above black, flagellum beneath ferruginous ; mesothorax with strong

punctures sparser on the disc, closer at the edges, tessellate all over; scutellum with smaller and sparser punctures; pleura with long white pubescence; metathorax with a few fine rugæ on base, not reaching apex; tegulæ testaceous; nervures and stigma honey colour; femora dark brownish; tibiæ more or less, and tarsi entirely, ferruginous; their pubescence white tinged with golden, inner spur of hind tibiæ with two or three long teeth; abdomen ferruginous, shining, apical segments dusky at times; the first two segments naked on the disc, other segments covered with whitish pubescence; venter ferruginous. Length, $4\frac{1}{2}$ -6 mm.

Twenty-seven specimens: Sioux Co., and West Point, Holt Co., Nebr., on wild and cultivated Rose, and *Mentzelia*, June 10th to July 8th

Differs from *H. Kunzei* in the mesothorax, not smooth centrally, the abdomen not black apically, and well clothed with pubescence, etc.

Halictus Bruneri, n. sp.—Head and thorax brassy green, pleura more olive green; head coarsely and closely punctured; clypeus with coarser and sparser punctures and black apically; mandibles ferruginous anteriorly; antennæ black; sides of face and cheeks with thin whitish pubescence; mesothorax anteriorly coarsely rugose, elsewhere very coarsely and rather closely punctured; pleura coarsely rugose; metathorax coarsely rugose, truncation with a salient rim and rugose; legs black, hind with ferruginous; all tarsi ferruginous and apices of tibiæ and knees ferruginous; wings hyaline, very slightly dusky, nervures and stigma dark testaceous: tegulæ dark brown, anteriorly punctured; abdomen black, shining, covered with appressed ochraceous pubescence, except discs of segments one and two.

Four ♀: West Point, Nebr., June 7-10, 1901, on rose and honeysuckle. Types in the author's collection.

Halictus rugosus, n. sp.—♀. Head and thorax greenish blue, thinly clothed with pale pubescence, slightly ochraceous on the vertex and dorsum of mesothorax, and longer on the cheeks and pleura; head behind the eyes finely roughened, in front coarsely and confluent punctured and also tessellate; less closely punctured below the antennæ; clypeus sparsely and very coarsely punctured, blackish anteriorly; supra-clypeal space finely punctured and tessellate; mandibles black, reddish medially; antennæ black, the flagellum dull brownish beneath apically; mesothorax finely roughened, the disc very coarsely and rather sparsely punctured, the sides and rear very coarsely reticulated, as is also the

scutellum; pleura of mesothorax coarsely reticulated, of metathorax coarsely striated; metathorax coarsely longitudinally striate, bordered apically by a rough irregular carina; tegulae dark, shining, with a light centre and a testaceous border; wings slightly dusky, stigma and nervures brown; legs black, the pubescence griseous, that on the inside of the tarsi golden, and more or less so on the outside; outer hind tibial spur pectinate, the inner one with three teeth, the last one small; abdomen black, polished, first segment impunctate, second finely punctured at base, that and the remaining segments finely transversely striate on the depressed apical margins; segments two and three with slight basal lateral spots of pale pubescence; all segments but first covered with sparse pubescence, more dense apically; pubescence along the anal rima slightly ochraceous; venter black, the segments tessellate, with large punctures, each bearing a hair; margins of ventral segments testaceous. Length, 6 mm.

♂.—Similar to the female in colour and sculpture, but the face more brassy, the reticulations of the mesothorax finer and the punctures sparser; head much broader than in the female and the clypeus cocked-hat shaped, with fine punctures; mandibles long, slender, ferruginous except the black base; antennae long, testaceous beneath the flagellum; cheeks produced to a spine beneath; wings and nervures darker; legs black, tarsi and base of hind tibiae testaceous; abdomen lacking the hair patches of the female. Length, 7 mm.

One female, two male specimens, Nebraska City, Nebr., Sept. 12th, 1901, on *Solidago*. (M. A. Carriker, Jr., coll.) Three females, Nebraska City, May 19th, 1901.

Although the male differs so markedly from the female in having the cheeks armed and in the different shape of the head (the inner orbits parallel), yet they are so like in other respects that they appear to be the same species.

Types in the collection of M. A. Carriker, Jr., and University of Nebraska.

Exomalopsis Bruneri, n. sp.—♀. Black, shining; head sparsely punctured, vertex almost impunctate, clypeus with larger, sparse punctures and narrowly testaceous anteriorly; mandibles black, reddish medially; antennae, the scape slightly reddish, flagellum ferruginous more or less dusky above; pubescence of face whitish, on the vertex brownish; sides of face with dense white decumbent pubescence, elsewhere the

pubescence of head sparse; mesothorax rather coarsely and sparsely punctured, rather densely clothed with brownish pubescence, longer and whitish on the pleura; on the disc posteriorly sparse; the scutellum bare, fringed posteriorly with brown hair; postscutellum similarly fringed posteriorly; the base of the metathorax with sparse punctures, the truncation smooth and polished; tegulæ brownish; nervures and stigma honey-colour; legs black, apical joints of tarsi ferruginous; legs clothed with brownish pubescence, that on the inner side of two anterior pairs of tarsi reddish; scopa of hind legs: on tibia whitish, tinged with yellow, on tarsus dusky reddish within; abdomen with the first two segments shining, smooth, apparently punctured only at the insertion of the hairs, which are sparse; the first segment truncate basally and the edge marked by a transverse carina; apical margins of segments with bands of brownish plumose pubescence, that on the first segment reduced to two lateral spots, slightly oblique; rest of segments in front of bands with dark pubescence; pubescence at the apex of abdomen more golden; ventral segments dark, apically ferruginous. Length, 7-8 mm.

♂.—Similar to the female, but with dense hair on the face and with the clypeus and labrum yellowish-white; pubescence lighter in colour; tarsi ferruginous. Length, 7-8 mm.

In old specimens the pubescence fades out and in the male becomes a silvery-white. Many specimens taken at Lincoln, Nebr., on *Helianthus annuus*.

Stelis pulchra, n. sp.—♀. Head greenish, bluish on the vertex, coarsely and confluent punctured on the face, on the vertex less closely and not confluent; thorax blue with greenish and purplish reflections, strongly but not closely punctured; abdomen greenish; pubescence on face light mixed with blackish and brownish hairs; on dorsum of thorax light; on pleura dark brown; on abdomen black; scape of antennæ greenish, punctured; flagellum dark testaceous, last three joints flattened on one side; tegulæ bluish with a light centre, punctured; legs same colour as the thorax, tarsi with dark brown hair; wings slightly dusky; abdomen with yellowish-white colour bands on segments 1-4; that on segment one bent backwards laterally; that on segment three attenuated laterally; that on segment four not reaching the sides of the abdomen and attenuated laterally; all narrowed medially; beneath bluish. Length, about 11 mm.

One specimen, Warbonnet Canyon, Sioux Co., Nebr., June 28th, 1901.

Epinomia triangulifera, Vachal.—Specimens of *E. persimilis*, Ckll., were sent to Mr. Vachal, and he writes that they are identical with his species. This name, having priority, must take the place of the one given by Prof. Cockerell.

Calliopsis verbenæ, var. *Nebraskensis*, n. var.—♀. Differs in having base of mandibles whitish and the apical margins of abdominal segments very pronouncedly testaceous; tegulæ entirely black and very polished.

♂.—Basal joints of tarsi blackish, apical ones testaceous; abdominal segments as in ♀.

This form was found at Lincoln, Nebr., July 4-7, and none of the typical form were taken.

The first part of the paper is devoted to a general
discussion of the problem. It is shown that the
problem is equivalent to the problem of finding
the minimum of a certain functional. This
functional is defined as the sum of the
squares of the differences between the
observed values and the values calculated
from the model. The minimum of this
functional is found by the method of
least squares. The method of least squares
is based on the assumption that the errors
are normally distributed. The method of
least squares is the most common method
for solving the problem of finding the
minimum of a functional. The method of
least squares is based on the assumption
that the errors are normally distributed.