

COLOR VARIATION IN THE AMERICAN SOCIAL WASP,
POLISTES CANADENSIS (LINNAEUS).

WITH DESCRIPTIONS OF TWO NEW FORMS
(HYMENOPTERA, VESPIDAE)

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In my introductory study of Nearctic *Polistes* (1940, JI. New York Ent. Soc., XLVIII, pp. 7-13), I proposed a tentative arrangement of the several color variations of *P. canadensis* (Linnaeus). I have since described one more variety and received two additional ones, the first from Mr. Pablo Anduze, in Venezuela, the second from Mr. F. Schade, in Paraguay. A more careful study of some of the forms, based on more abundant material, has led me to modify some of my earlier views and enabled me to fill in gaps in the known distribution.

Structural Specific Characters.—*Female and Worker:* *P. canadensis* is a medium-sized to large species, with a long and slender abdomen, elongate-fusiform and much pointed apically, the sixth segment compressed from the sides. First tergite elongate-triangular seen from above, narrower at apex than long in the middle, in profile gradually sloping and slightly convex toward the base. Head about as high as wide, moderately swollen, seen from above about twice as wide as long, the upper outer orbits as bulging as the eyes but much longer. Vertex and upper two-thirds of outer orbits (cheeks) separated from the occiput by a fine carina; edge of lower third

to two-fifths of outer orbit bluntly rounded to the gula. Oculo-malar space nearly one-fourth of the length of the eye. Clypeus irregularly heptagonal in outline, wider than high, contiguous to the eyes for a short distance (about two-thirds of the length of the oculo-malar space); two apical margins converging to a very obtuse angle, the apex scarcely projecting and broadly rounded off; upper, interocular portion about as long as lower, subocular part; surface moderately and uniform convex, with a few stiff hairs placed in larger punctures, the hairs longer and the punctures coarser over apical third. Eyes bare. Thorax much longer than high. Humeral margin of pronotum strongly raised into a sharp collar, almost lamellar dorsally, much lower and blunter on the vertical sides to near the fore coxae; humeral angles distinctly projecting, but broadly rounded off, not wing-like. Mesopleuron without even a trace of prepectal suture; mesepisternal suture complete and deep. Propodeum entirely covered with distinct striation, also in the deep and broad median concavity; striae very fine and close over upper third to half, much stronger and sharper over apical remainder and with some finer striae in the broader intervals. Body with a microscopic granular sculpture, not visible with a hand-lens; most of head, mesopleura and metapleura in addition with distinct, but scattered, fine to medium-sized punctures. The pubescence is very short, often somewhat velvety or slightly golden, more rarely silvery.

Male. Apex of abdomen depressed, bluntly rounded off; seventh sternite flattened or slightly concave, without median tubercle, the sides low and not projecting in profile. Eyes more bulging; upper outer orbits seen from above about as long as upper part of eye, but narrower than the eye in profile. Oculo-malar space nearly one-fifth of length of eye. Clypeus irregularly pentagonal, almost flat but not depressed,

nearly as long as wide, contiguous to the eyes for a longer distance (half or more of the length of the oculo-malar space); two apical margins converging to a very broad, bow-like apex; surface covered with dense, short, silvery pubescence, with a few evenly scattered stiff hairs. Antennae moderately slender throughout, very slightly thicker before the middle of the flagellum; all segments normal and (except for the second) longer than wide; third slightly longer than scape; thirteenth about one and one-half times as long as twelfth, nearly straight, scarcely narrowed beyond middle, broadly rounded at tip. Genitalia of the usual type; shaft of penis with a small, short oval, apical spoon; basal lobules broadly triangular and very bluntly rounded off. Remainder as is female.

Length (h. + th. + t.l + 2) of female and worker: 12 to 20 mm. (fore wing, 15 to 26 mm.); of male: 12 to 17 mm.

Distribution.—*P. canadensis* is the most widely distributed American *Polistes*, as it extends from close to the northern boundary of the United States to northern Patagonia. Its northern limit runs through northern Arizona, South Dakota, Iowa, Illinois, Indiana and Ohio to Connecticut. The most northern locality known at present is Springfield, South Dakota (in the valley of the Missouri River, close to 43° N.), for the var. *annularis*. In the Antilles it is found only in some of the Lesser Antilles. The species is unknown from the Dominion of Canada, the Rocky Mountains, the Pacific states and Chile.

Color Variation.—In the present paper I recognize by names nineteen color forms. I have attempted to separate these in a key; but it should be realized that some transitional specimens must be placed arbitrarily. On the other hand, I have united under typical *canadensis* specimens which differ markedly in general coloration, from black with a few ferruginous blotches to almost entirely reddish-brown.

Attempts to subdivide this aggregate have not given satisfactory results, owing to the many transitional specimens and the apparent lack of correlation with geographical distribution.

Key to Color Forms of *P. canadensis*

1. Abdomen extensively or mostly yellow, ivory-yellow or orange-yellow; either with several apical fasciae or with some of the tergites mostly yellowish 2

Abdomen light ferruginous, reddish-brown, mahogany-brown to black, either without yellowish markings or with only the first tergite partly or mostly yellowish 10
2. Head, thorax, abdomen, legs and antennae almost entirely pale yellow, with few ferruginous blotches. Wings pale russet, more yellowish over apical third. (Paraguay) var. *eburneus*.
Ground color of body more extensively light brownish-red to black... 3
3. Ground color of thorax mostly black or blackish-brown; hind tarsi yellow 4

Ground color of body light reddish-brown, with many yellow markings, at least on head and abdomen 6
4. Head black, extensively marked with yellow; thorax black, pronotum partly, tegulae and scutellum orange-yellow; abdomen mostly yellow, elsewhere blackish, first and second tergites somewhat reddish at the limits of black and yellow areas. Wings mostly purplish-black, only extreme base and costal areas somewhat russet; veins and stigma black. (Arizona, northern Mexico) var. *navajoe*.
Abdomen either mostly orange-yellow or ferruginous with yellow markings. Wings ferruginous, very slightly purplish; veins and stigma russet 5
5. Form of Texas and northern Mexico. Head black, extensively marked with orange-yellow; thorax blackish-brown, only narrow margins of pronotum and tegulae orange; abdomen mostly yellow to orange-yellow, elsewhere ferruginous, only base of first tergite black.....
..... var. *comanchus*.
Form of northern Argentina. Head yellow with a few ferruginous blotches; thorax black and ferruginous, with many yellow markings (often two stripes on disk of mesonotum); abdomen ferruginous with very broad apical fasciae, the posterior segments mostly yellow var. *buyssoni*.

6. Forms of Arizona and Mexico 7
 Forms of southern Brazil, Uruguay, Paraguay and northern Argentina. 9
7. Head and thorax reddish-brown, with very few or no yellow markings.
 Wings purplish-black; veins and stigma blackish-brown. (Central Mexico) var. *mexicanus*.
 Head extensively yellow; thorax sometimes marked with yellow..... 8
8. From the Grand Canyon of Arizona. Wings uniformly russet; veins and stigma russet. Thorax without yellow markings.....
 var. *kaibabensis*.
 Form of northwestern Mexico. Wings somewhat purplish-black, tinged with russet basally and along costa; veins and stigma russet. Thorax somewhat tinged with yellowish var. *wheeleri*.
9. Thorax almost entirely reddish-brown, with very few yellow markings var. *cavapyta*.
 Thorax more or less blackish-brown, with ferruginous blotches and many yellow markings (often 2 stripes on mesonotum).....
 var. *buyssoni*.
10. Head extensively yellow or orange-yellow, the occiput and outer orbits mostly of that color 11
 Head, including occiput and outer orbits, mostly ferruginous, mahogany-brown or blackish; clypeus sometimes yellow 12
11. Body black, more or less blotched with mahogany-brown to ferruginous. First tergite with a broad apical yellow area. Wings purplish-black, slightly more russet over apical third. (Venezuela).....
 var. *anduzei*.
 Body chestnut-brown or dark ferruginous. First tergite either without yellow or with only a narrow apical fascia. Wings either uniformly purplish-black or slightly russet apically (British Honduras to Ecuador, the Guianas and Brazil) var. *infuscatus*.
12. Body, including hind tarsi, coal-black, except for the partly ferruginous flagellum. Wings subhyaline, slightly tinged with ferruginous. (Southern Brazil) var. *satanulus*.
 Not entirely coal-black; hind tarsi pale yellow, orange or ferruginous. Wings darker 13
13. Small form of the Lesser Antilles. Body reddish-brown. First tergite with a distinct, narrow, apical yellowish fascia. Wings yellowish-russet var. *cinctus*.
 Forms of the American continent, usually larger 14
14. Body black and mahogany-brown. First tergite with a broad apical yellow area. Wings purplish-black, with the apical third slightly more russet. (Venezuela) var. *weberi*.

- First tergite either without yellow or with only a narrow apical yellow fascia 15
15. Thorax and abdomen jet-black; head and antennae (except for median black ring of flagellum) bright or dull ferruginous. First tergite without apical fascia. Wings purplish-black throughout. (Central America to Brazil) var. *erythrocephalus*.
- Body more uniformly colored; ferruginous head not contrasting with thorax and abdomen 16
16. Body jet-black, scarcely with any ferruginous or yellowish markings. Antennae black, very slightly chestnut-brown at base and tip of flagellum. Mid and hind tarsi dirty-yellow to orange. First tergite without apical fascia. Wings purplish-black throughout. (Brazil, Colombia) var. *satan*.
- Body not uniformly jet-black. Flagellum with a median black ring. Wings often not purplish-black throughout 17
17. Wings fairly well divided into purplish-black basal two-thirds and pale russet apical third. First tergite usually without apical fascia. (Panama, Colombia) var. *panamensis*.
- Wings either uniformly colored or slightly and gradually more russet towards the tips 18
18. Small form of Uruguay and northern Argentina (fore wing 16 to 18 mm. long). Colored like typical *canadensis*, but wings paler russet throughout var. *ferreri*.
- Averaging larger (forewing 17 to 26 mm.) Wings darker, usually brownish or purplish-black 19
19. Form of the eastern United States. Head and thorax dark mahogany-brown, sometimes blotched with black. Abdomen usually black, sometimes with a few mahogany-brown blotches; first tergite always with a distinct apical yellow fascia var. *annularis*.
- Form of southern Arizona, Mexico, Central and South America. Body fairly uniformly light brown, ferruginous, dark mahogany-brown, or blackish. Apical fascia of first tergite more or less indicated or wanting typical *canadensis*.

1. *Polistes canadensis*, typical form.

Vespa canadensis Linnaeus, 1758, Syst. Nat., 10th Ed., I, p. 574 ("in America septentrionali").

Vespa latio Fabricius, 1775, Syst. Entom., p. 365 (no sex; Brazil).

Polistes unicolor Lepeletier, 1836, Hist. Nat. Ins. Hym., I, p. 521 (♂; Cayenne).

I have seen typical *canadensis* from extreme southern Arizona (Nogales; Ruby), Mexico, Guatemala, Republic of Honduras, Colombia, Venezuela, British Guiana, Trinidad, Brazil (as far south as Río Grande do Sul), northern Argentina (Iguazu Falls), Paraguay, Bolivia and Peru.

The name notwithstanding, no wasp agreeing with Linnaeus' description of *canadensis* is now known to occur in Canada or the eastern United States. Linnaeus gave as the collector P. Kalm, who travelled in the northeastern United States, but not in tropical America, so far as known. Possibly Linnaeus made an error and actually received his wasp from Degeer, who a few years later (1773) described this form from Surinam. In my earlier paper I recognized *lanio* as a distinct color form, but so many variants connect it with typical *canadensis*, even in same locality, that I am unable to segregate them. I have seen Fabricius' type of *lanio* at the British Museum (J. Bequaert, 1928, Bull. Brooklyn Ent. Soc., XXIII, p. 57).

Original Description of *V. canadensis*: "V. thorace squamis duabus, abdominis ferruginei segmento primo obconico".

Original Description of *V. lanio*: "V. fusca, capite ferrugineo, antennis medio nigris. - Statura praecedentis [*carnifex*]. Antennae ferruginae, ante apicem nigrae. Thorax fuscus, lobo antico subferrugineo. Abdomen fuscum. Alae nigricantes. Pedes ferruginei, femoribus fuscis".

Original Description of *P. unicolor*: "Entièrement d'un brun ferrugineux et partout d'une teinte uniforme. Corselet sans ponctuation distincte; méta-thorax à stries transversales fines. Ailes d'un brun ferrugineux, plus foncé vers la base. Milieu des antennes noir. Long 12 à 13 lig. [= 27 to 29 mm.]". This a literal translation of the Latin diagnosis, not copied here.

2. *P. canadensis* var. *infuscatus* Lepeletier.

Polistes infuscata Lepeletier, 1836, Hist. Nat. Ins. Hymn., I, p. 520 (♂; Cayenne).

Polistes canadensis amazonicus W. A. Schultz, 1905, Hymenopteren-Studein, p. 113 (♀; Belem do Pará, Brazil).

Lepeletier's account fits well specimens agreeing with Schulz's first description of his *amazonicus*, based on two females from Belem do Pará. Such specimens are common in the forests of British Guiana, Dutch Guiana and French Guiana (Cayenne), as well as of the Lower Amazon. In the Upper

Amazon, Colombia, Panama, Peru and Ecuador specimens with yellow occiput and upper outer orbits often have the wings markedly russet over the apical third, being transitional to var. *panamensis*, while others are only slightly yellowish over the back of the head. Schulz's specimens from Palmar, Ecuador and Popayan, Colombia, were evidently such intergrades.

Original Description of *P. infusata*: "D'un brun ferrugineux; antennes de cette même couleur; leurs premier, second et troisième articles de la base, et le bout, plus clairs, d'un jaune testacé. Derrière de la tête d'un jaune testacé, ainsi que la partie du vertex sur les côtés des ocelles. Corselet opaque; métathorax strié transversalement. Abdomen lisse, assez luisant, avec un léger reflet glauque, d'un ferrugineux moins brun que le corselet. Pattes de la couleur de l'abdomen. Ailes d'un roux noirâtre; les antérieures plus foncées à partir de la base jusque passé le milieu, ayant un faible reflet voilé. Long. 14 lig. [= 31.5 mm.]. This is a literal translation of the Latin diagnosis, not copied here.

Original Description of *P. c. amazonicus*: "Allgemeine Körperfärbung dunkelrotbraun, Mitte der Fühlergeißel, Brustseiten, Mittelsegment, Hüften, Schenkelringe, Schenkel und Schienenspitze schwarz; Scheitel beiderseits bis zum mittleren Wangenteile herab hellgelb; Flügel pechschwarz, mit matten, violetten Glanze, Kosta und Stigma rostrot. Körperlänge 21-22 mm."

3. *P. canadensis* var. (or subsp.) *anduzei*, new.

There is a remote possibility that the form here described as new is *Polistes urceolata* "Klug" Erichson (1848, in Schomburgk, Reisen in Britisch Guiana, III, p. 590; no sex; British Guiana), briefly described as follows: "Der vorigen [= *infusata* Lepeletier] sehr ähnlich, aber dunkler gefärbt, der erste Hinterleibsring hinten gelb, die Schenkel schwarz. Ist auch der *P. annularis* nahe verwandt". The description also fits *P. c.* var. *weberi*. The types, at the Berlin Museum, should decide the matter.

Female and Worker.—Body mostly black, with a faint brownish tinge over the abdomen; second tergite more ferruginous; most of head, dorsal aspect of pronotum, antennae (except for black ring of flagellum), and occasionally two blotches on mesonotum, mahogany-brown to ferruginous. Yellow markings as follows: occipital area of head; outer orbits (more or less orange); broad apical area of first tergite (more sulphur-yellow), notched medially and reddish-brown at the border of the black base; knees; basal half or more of all tibiae (somewhat rufous); and all tarsi. Wings strongly infusate, purplish-black over basal two-thirds, gradually fading to the more russet apical third.

Male unknown.

Holotype: Tabay, State of Merida, 1760 m. altitude, Venezuela, female (Pablo Anduze). *Paratypes*: ten females taken with holotype. All at Museum of Comparative Zoölogy, Cambridge, Mass.

Agreeing in most characters with var. *weberi*, but with the occiput and outer orbits yellow as in var. *infuscatus*; the latter has only a very narrow or no apical yellow fascia on the first tergite.

4. *P. canadensis* var. *annularis* (Linnaeus).

Vespa annularis Linnaeus, 1763, Centuria Ins. Rar., p. 30 (no sex; Pennsylvania). Degeer, 1773, Mém. pour Servir à l'Hist. des Ins., III, p. 583, Pl. XXIX, fig. 11.

Vespa cincta Drury, 1773, Illustr. Nat. Hist., Index to Pt. I published with Pt. II); description without name in 1770, *Op. cit.*, I, p. 98, Pl. XLIII, fig. 6 (no sex; Virginia). Not of Degeer, 1773; nor of Fabricius, 1775.

Vespa virginiensis "Drury" Dalla Torre, 1894, Cat. Hym., IX, p. 122 (as a synonym of *Polistes annularis*; with reference to Drury's Pl. XLIII, fig. 6). Drury never used the specific name *virginiensis* for a *Vespa* and he called his Pl. XLIII, fig. 6, *V. cincta*.

Polistes annulata "Moebius" Dalla Torre, 1894, Cat. Hym., IX, p. 123 (as a synonym of *P. annularis*). In the paper cited by Dalla Torre, Moebius uses only the specific name *annularis* on pp. 322, 329 (not 330) and 332.

The var. *annularis* is a common wasp in the southeastern United States, reaching north to Connecticut and southern Iowa, west to South Dakota, Oklahoma, eastern Kansas and eastern Texas. The distribution is detailed in my earlier paper. I have since seen specimens from Arkansas and South Dakota (Springfield). All published records from outside the United States were based on misidentifications. Kriechbaumer's specimen from Caracas (1900, Berlin Ent. Zeitschr., XLV, p 98; repeated in 1904 by W. A. Schulz), was probably var. *weberi*; while that from Martinique was var. *cinctus*. Similar erroneous records were published by Stoner (from Barbados), Cheesman (from Panama), Schrottky (from Argentina), Brèthes (from Brazil), and others.

There is no difficulty about recognizing Linnaeus' *V. annularis* and Drury's *V. cincta* as the present wasp.

Original Description of *V. annularis*: "Fusca, genubus antennarum apicibus margineque primi segmenti abdominis flavis. - Media, Alae planae. Thorax maculatus, ante alas magis ferrugineus. Tibiarum bases flavescens".

Original Description (1770) of *V. cincta*: "A full inch in length. The head, is of a dark brown colour, like the rust of iron. The eyes, are large, oblong, and of the colour of horn. Between them, on the top of the head, are the three little eyes, as mentioned in some of the preceding species. The antennae, are shorter than the thorax, and dark brown, but yellow at their extremities; having a principal joint very near the head. The thorax, is dark brown, also with a black stripe on each side. The four wings, extending beyond the abdomen, are thin, membranaceous, and dark brown, not perfectly transparent, and doubled or folded lengthways together. The abdomen, is black, except the first ring next the thorax, which is dark orange, verged with yellow. The fore thighs [femora], are dark brown; the other parts of those legs, yellow. The other legs are dark brown; the shin [tibia] joints and bearers [tarsi], being yellow. The latter are composed of four articulations, besides the claws".

5. *P. canadensis* var. *buyssoni* Brèthes.

Polistes cavapyta var. *thoracica* R. du Buysson, 1906, Ent. Medd., Copenhagen, III, p. 19 (♀ ♂ ♂; Santa Rosa; Uspallata; Chacras de Coria; all in Mendoza Province, Argentina). Not *Polistes thoracicus* Fox, 1898.

Polistes cavapyta var. *buyssoni* Brèthes, 1909, An. Mus. Nac. Buenos Aires (3), X, p. 456 (new name for var. *thoracica* R. du Buysson).

The var. *buyssoni* is common in various localities or northern Argentina and the adjoining areas of Bolivia. It extends into northern Patagonia. It intergrades with var. *cavapyta*, which often occurs with it in the same locality.

Original Description of *P. c.* var. *thoracica*: "Semblable au type [= var. *cavapyta*] dont il se distingue par son corps plus petit, par une tache noire sur le vertex; par le thorax noir profond, avec le bord antérieur et le bord postérieur du pronotum, la marge antérieure de l'écusson, jaune clair et une tache rousse sur chaque côté du pronotum. Les hanches, les trochanters et la plus grande partie des cuisses sont noirs, ainsi que la base du 1er. et du 2e. tergite de l'abdomen. Les bordures apicales des segments abdominaux sont jaune-clair. Long 13-18 mill."

6. *P. canadensis* var. *cavapyta* H. de Saussure.

Polistes cavapyta H. de Saussure, 1853, Et. Fam. Vesp., III, p. 87, Pl. XI, fig. 8 (♀ ♂; Corrientes, Argentina).

?*Polistes opalinus* H. de Saussure, 1853, Et. Fam. Vesp., III, p. 89, Pl. XII, fig. 6 (♀; Brazil).

The var. *cavapyta* is the common form of the species in northern Argentina, Uruguay, southern Brazil and Paraguay.

R. du Buysson (1910, Zool. Jahrb., Abt. Syst., XXIX, p. 234) stated that the types of *P. opalinus* at the Paris Museum are two females of *cavapyta*; but de Saussure's figure does not agree with any *cavapyta* I have seen. I suspect that du

Buysson confused several forms or species of *Polistes* under *cavapyta*, as he says that it extends from Mexico and the Guianas to Buenos Aires. True *cavapyta*, as here understood, is not found north of Paraguay and southern Brazil.

Original Description of *P. cavapyta*: "Ferrugineus; capite flavo, antennis medio nigris; abdominis segmentis 2-6 margine pallida; alis obscuris. Variat corpore fusco, lateribus nigris. Long. 20 mill.; env. 44 mill. *Fem.* Assez grand. Métathorax finement strié. Insecte un peu voluté, ferrugineux. Tête jaune clair; vertex et antennes ferrugineux; ces dernières noires au milieu. Les deux bords du prothorax souvent liserés de jaune clair; flancs un peu variés de noir; écaille jaunâtre. Abdomen soyeux, son premier segment entièrement ferrugineux, les autres assez irrégulièrement bordés de jaune clair, la première bordure la plus étroite; anus jaune clair; les bordures presque interrompues au milieu par un trait brun. Pattes ferrugineuses, genoux et tarsi jaunes. Ailes brunes, à peu près de la couleur du corps, sans reflet violet distinct. *Var. A.* Ecusson et le premier segment de l'abdomen bordés de jaune pâle. *Var. B.* Abdomen ferrugineux. *Var. C.* Métathorax brun. *Var. D.* Entièrement ferrugineux, ou brunâtre; taille assez variable. *Mâle.* Devant de la tête argenté. *Rapp. et diff.* Cette espèce est très difficile à différencier par une description, mais elle est bien distincte. On la reconnaît parfois au premier segment de l'abdomen, qui est sans bordure jaune, et à sa tête jaune; mais ses couleurs, si peu constantes, peuvent induire en erreur; elle est fréquemment entièrement ferrugineuse, alors il sera impossible d'arriver avec certitude à sa détermination. Cette espèce a l'abdomen conique, fusiforme, comprimé, surtout au bout, et se distingue par là de certaines variétés du *P. pallipes*, qui l'a au contraire déprimé; il est de l'Amérique du Sud, de l'Uruguay et du Brésil; le *pallipes* est, au contraire, de l'Amérique du Nord. Il a de plus les ailes d'un roux, sensiblement moins foncées que celles du *P. canadensis*, presque sans reflet et de plus foncées à la base qu'au bout; le *pallipes* a des ailes enfumées de gris et moins colorées que dans le *cavapyta*, mais d'une teinte plus obscure, quoique moins intense, c'est-à-dire moins rosse. Les ailes du *P. ferreri* ont exactement la même couleur que celle du *P. cavapyta*. Quoique d'une couleur différente, ce dernier en est peut-être une variété?"

Original Description of *P. opalinus*: "Capite et thorace rufis; metathorace antennisque medio nigris; abdomine nigro, opalino nitente, segmentis margine flavescente, secundo punctis duobus rufis submarginalibus, ultimis margine piceo; pedibus nigris, genibus tarsisque flavis; alis obscure brunneis. ♀, Long. 18 mill. env. 44 mill. *Fem.* Chaperon portant quelques petites punctuations distinctes. Prothorax rebordé; métathorax finement strié. Abdomen lisse, en fuseau régulier, presque en losange allongé, comprimé au bout. Tête d'un roux ferrugineux; antennes noires en dessus et en dessous, depuis le troisième jusqu'au bout du huitième article. Corselet roux; flancs et métathorax noirs; bord postérieur du prothorax, écaille et bord antérieur de l'écusson, très indistinctement jaunâtres; ces teintes souvent nulles, souvent plus distinctes. Abdomen lisse, luisant, d'un noir bleuâtre, avec un reflet glauque, bleuâtre, une teinte lactée. Bord du premier segment liseré de jaunâtre; celui du deuxième orné d'une bordure jaune-pâle, fondue avec la couleur foncière, bi-échancrée sur les côtés, et offrant de chaque côté, en avant des échancrures, un point rouge ou jaune. Les autres segments bordés de brun. Pattes noires, genoux et tarsi jaunes. Ailes d'un brun ferrugineux très intense, avec un faible reflet violet. *Var. probable.* Les points du deuxième segment fondus avec la bordure. *Rapp. et diff.* Très distinct par la couleur de son abdomen et par ses reflets opalins. Le corselet et les ailes sont exactement comme dans le *P. ferreri*".

7. *P. canadensis* var. *cinctus* Lepeletier.

Polistes cincta Lepeletier, 1836, Hist. Nat. Ins. Hym., I, p. 522 (♀; Martinique).

The var. *cincta* is peculiar to the Lesser Antilles: Martinique, St. Vincent, St. Kitts, the Grenadines, Barbadoes; also recently introduced into Monserrat and St. Lucia.

In my earlier paper I suggested that *Vespa (Polistes) dominica* Vallot (1802, Concordance Systématique, of Réaumur's "Memoires") might have been var. *cinctus*. I have not yet seen Vallot's work; but, according to de Saussure, the name was proposed for the wasp figured by Réaumur, 1742, Mém. Hist. Ins., VI, Pl. XIV, figs. 9-10, from Santo Domingo (see p. 207). This appears to represent *Polistes major* Palisot de Beauvois. No form of *P. canadensis* is known to occur in Santo Domingo.

Original Description of *P. cincta*: "Ferrugineuse: métathorax légèrement strié transversalement: milieu des antennes noir. Partie postérieure du premier segment de l'abdomen et tarsi jaunes. Long. 12 lig. [= 27 mm.]." This is a literal translation of the Latin diagnosis, not copied here.

8. *P. canadensis* var. *comanchus* H. de Saussure.

Polistes comanchus H. de Saussure, 1857, Ann. Soc. Ent. France, (3) V, p. 314 (no sex; New Mexico).

The var. *comanchus* is a typical wasp of the Upper Sonoran life zone in southwestern Texas, New Mexico and the State of Coahuilla, Mexico.

Original Description of *P. comanchus*: "Sat validus. Clypei margo rotundata, haud acute dentata. Abdomen aurantiacum; ejus segmentis flavo marginatis; primo basi nigro. Thorax ater, antice ferrugineo limbatus. Caput ferrugineum, vertice et antennarum medio atris. Alae ferrugineae".

9. *P. canadensis* var. (or subsp.) *eburneus*, new.

Male.—Entirely pale sulphur-yellow without any black markings. Blotches on upper side of antennal segments 3 (at tip), 4, 5, and 6, on lower part of mesopleura and metapleura, on sides of propodeum (close to spiracles), near base and sides of tergites 1 and 2, and on upper part of coxae and femora, light russet; tibial spurs yellow. Teeth of mandibles blackish-brown. Wings yellowish-russet with purplish sheen, paler over apical third; veins and stigma light russet. Short pubescence silvery-white, frosty. Fore wing 16 mm. long.

Female and Worker unknown.

Holotype: Villarica, Paraguay, male (F. Schade).

This is the most xanthic American *Polistes* seen thus far. It would be of interest to know the ecological conditions under which it lives, as the color is that usually found in wasps of an extremely dry or desertic environment. Structurally the holotype agrees with other males of *P. canadensis*, and, although the specific characters of *Polistes* are best defined in this sex, I am unable to separate it as a species.

10. *P. canadensis* var. *erythrocephalus* Latreille.

Polistes erythrocephala Latreille, 1813, in Humboldt and Bonpland, Recueil d'Observations de Zool. Anat. Comp., II, p. 96, Pl. XXXVIII, fig. 3 (♀; South America).

I have seen var. *erythrocephalus* from Nicaragua, Costa Rica, Panama, Colombia and southern Brazil. It is sometimes found in collections under the incorrect name *P. rufidens*.

In my earlier paper I gave the date of publication of *P. erythrocephala* as 1817, on the authority of D. MacGillavry (1931, Ent. Ber. Nederl. Ent. Ver., VIII, N° 177, p. 179). I am now adopting the date given by C. D. Sherborn (1899, Ann. Mag. Nat. Hist., (7) III, p. 428), who says that the part of Humboldt and Bonpland's work containing p. 96, appeared in 1813.

Original Description of *P. erythrocephala*: "Noire, avec la tête ferrugineuse et les ailes bleues; sommet des antennes, genoux et tarse d'un roussâtre jaunâtre; anus brun. Nigra, capite ferrugineo, alis cyaneis; antennarum apicibus, genubus tarsisque flavido-rufescentibus; ano brunneo. Longueur du corps, 0m.021. On doit placer cette espèce près de celles que Fabricius nomme *lanio*, *annularis*, etc.; sont corps est proportionnellement plus étroit que celui de la plupart de ses congénères, d'un noir peu luisant, avec la tête d'un rougeâtre obscur, les yeux cendrés, et les ailes d'un bleu foncé et luisant. Les antennes sont roussâtres, plus pâles à leur extrémité, avec le dessus des articles de leur milieu noir. Le corcelet est noir et sans taches. L'abdomen est en forme de fuseau allongé, pédiculé, plus luisant que les autres parties, d'un brun roussâtre, et pointu à son extrémité. Les pattes sont noires, avec les genoux et les tarse d'un roussâtre tirant sur le jaune".

11. *P. canadensis* var. *ferreri* H. de Saussure.

Polistes ferreri H. de Saussure, 1853, Et. Fam. Vesp., II, p. 77 (♀; from Uruguay to Misiones, Argentina).

The var. *ferreri* is restricted to Uruguay and northern Argentina. It is really no more than a dwarfed form of typical *P. canadensis*, with which it seems to intergrade in Paraguay.

Original Description of *P. ferreri*: "Capite thoraceque rufis, metathorace abdomineque nigris, alis ferrugineo-fuscis. ♂. Long. 17 mill.; env. 40 mill. *Ouvr.* Chaperon terminé en angle obtus. Métathorax strié en travers. Abdomen comprimé au bout. Tête d'un roux ferrugineux; antennes noires au milieu en dessus et en dessous. Corselet noir: prothorax, écaille, mésothorax en dessus et écussons, de la couleur de la tête. Abdomen noirâtre, petit bord des segments brunâtre, se fondant avec le noirâtre. Pattes d'un brun noirâtre, tarses, articulations et tibias antérieurs, jaunâtres; crochets des tarses noirs. Ailes d'un brun foncé, plus claires vers le bout. *Var. A.* Abdomen noir; prothorax indistinctement liseré de jaunâtre le long de ses deux bords. *Var. B.* Abdomen brun, passant au ferrugineux. *Rapp et diff.* Il ressemble assez au *P. canadensis*, mais il s'en distingue par les couleurs parfaitement tranchées du corselet, et par ses ailes bien moins brunes. Il a les ailes colorées comme dans les *P. cavapyta*, et voisins. Il faut pour le distinguer, surtout lorsque ses couleurs ne sont pas parfaitement nettes, un œil exercé".

12. *P. canadensis* var. *kaibabensis* Hayward.

Polistes canadensis var. *kaibabensis* Hayward, 1932, Proc. Utah Ac. Sci., IX, p. 89, Pl. IX, figs. 4, 12, 13 and 16 (♀ ♂; northern and southern Rims of the Grand Canyon of the Colorado River, Arizona).

The var. *kaibabensis* is known only from the type locality, where it is common.

Original Description of var. *kaibabensis*: "Female: Total length 24 mm.; length of thorax, 8 mm.; length of abdomen, 13 mm.; length of fore wing, 20 mm. Head light ferruginous with the genae behind the compound eyes, the clypeus except in the center, the lower part of the frons, and the mandibles yellow, tinged with ferruginous. Small areas of black occur on the head as follows: teeth, condyle, and cephalic edges of the mandibles; a narrow strip along the epistomal suture beneath each compound eye; small area about the ocelli; and occiput. Antennae light ferruginous at base and tip, black in middle. Frontal furrow lacking. Thorax with rather large, broadly separated punctations on the mesopleurites. Propodeum with rather coarse, transverse striations. Color of thorax almost entirely light ferruginous except for dark pigmentation along the sutures. Wings ferruginous, about the color of the thorax. Legs ferruginous, becoming lighter at the apex of the femur. Abdomen slender and elongate with the first three segments mostly ferruginous but with yellowish apices. Segments four, five, and six light yellow tinged with ferruginous. Male: Size and general coloration similar to female except that there are indistinct yellowish markings on the venter of the thorax and the entire face is yellowish. Genitalia slender; aedeagus slender and without conspicuous teeth".

13. *P. canadensis* var. *mexicanus* J. Bequaert.

Polistes canadensis var. *mexicanus* J. Bequaert, 1940, Jl. New York Ent. Soc., XLVIII, p. 10 (♀ ♂; Cuernavaca, Morelos, Mexico).

The var. *mexicanus* is known from Central and Southern Mexico (States of Morelos, Mexico and Oaxaca).

Original Description of var. *mexicanus*: "Female and Worker. Body and legs bright reddish-brown, only the sutures of the thorax, a median line over anterior half of mesonotum and a narrow stripe in concavity of pro-

podeum (widened below), black; middle of flagellum infuscated; the following markings are yellow: apical fasciae on all tergites and second to last sternites (reduced on first and second, very extensive on the others and more or less divided on each side by a wavy reddish line or sometimes emarginate) and the knees and hind tarsi more or less. Wings very strongly infuscate, purplish-black. *Male*. Colored exactly like the female”.

14. *P. canadensis* var. *navajoe* Cresson.

Polistes navajoe Cresson, 1868, Trans. Amer. Ent. Soc., I, p. 383 (♀; from Fort Wallace, Colorado, to Fort Craig, New Mexico; also in Arizona).

The var. *navajoe* is a characteristic wasp of the Upper Sonoran life zone of Arizona and the adjoining parts of New Mexico (Silver City, etc.) It is also found in Northern Mexico (States of Sonora and Sinaloa).

Original Description of *P. navajoe*: “*Female*. Head pale yellow, the venter, occiput and tips of mandibles, black; a yellow spot, confluent with the orbits, on each side behind the ocelli; clypeus rounded and ciliated anteriorly, sparsely punctured and pubescent; cheeks tinged with fulvous; antennae fulvo-ferruginous, the middle of flagellum black; thorax velvety-black; posterior margin of the prothorax, broader in front, tegulae and scutellum ferruginous; the mesothorax has sometimes a faint reddish stain on each side; metathorax pubescent, obliquely striated, with a deep central, longitudinal channel; wings fuscous, ferruginous along the costa and at base, subviolaceous, nervures and stigma ferruginous; legs black, tips of all the femora, the four anterior tibiae, basal half of the posterior pair, and all the tarsi, tinged with fulvous; abdomen longer than the head and thorax, sericeous, the first and second segments above and beneath, except apical margins, broader on the second segment, and the basal margin of the third segment above and beneath, black; the remainder lemon-yellow; the anterior half of the apical margin of the second segment above is fulvous, shading gradually into the yellow, sometimes this margin is entirely fulvous; the third and remaining segments have a faint, central, longitudinal, fulvous streak and a lateral spot of the same color, that on the third segment sometimes very distinct. Length 9-10 lines [= 20 - 22 mm.]”.

The holotype selected by E. T. Cresson (1916, Mem. Amer. Ent. Soc., I, p. 106), now at the Academy of Natural Sciences in Philadelphia, is from New Mexico.

15. *P. canadensis* var. *panamensis* Holmgren.

Polistes panamensis Holmgren, 1868, Kongl. Svenska Freg. Eugenies Resa, Vetensk. latagg., II, Zool., pt. 1, Ins., Hymen, p. 439 (no sex; Panama),

The var. *panamensis* is a common wasp in Panama and parts of northern Colombia. Farther south it intergrades with var. *infuscatus*.

The types at the Stockholm Museum, where I saw them in 1913, are four females; one was selected as the holotype.

Original Description of *P. panamensis*: "Fusco-castaneus, incisuris thoracis ventrequae ex parte nigricantibus; antennis rufis, flagello medio nigro, apice fulvo; ano ferrugineo; alis flavescenti ferrugineis basin versus saturatius fuscis; pedibus nigris, femoribus apice, tarsis tibiisque fulvescentibus, his posterioribus apice nigris. Long. 20-22 mm. Caput pone oculos vix angustatum, a fronte visum subquadrangulare, alutaceum, parce punctulatum. Clypeus majusculus, perparum convexus, margine apicali hirtio. Genae infra oculos late descendentes. Mandibulae subaequilatae, denticulis tribus apice instructae. Oculi oblongi, paullo supra basin antennarum profunde incisi, nudi. Ocelli 3, triagulum formantes. Antennae validiusculae fractae; scapo elongato, paullulum curvato; articulo accessorio minuto; primo flagelli longiusculo, cylindrico, secundo latitudine perparum longiore, 3-5 subquadratis, ultimo subconico, apice obtuso. Thorax capite angustior, alutaceus, opacus; prothorace ante marginem anticum linea vel carina sat elevata instructo; pleuris linea impressa, furcata infra alas notatis; scutello transverso; metathorace apicem versus sensim declive, in medio longitudinaliter canaliculato, apice laminato, foveolato, lateribus transversim striatis, spiraculis prope basin sitis, elongatis. Abdomen fusiforme; segmento primo conico; secundo majusculo; sequentibus apicem versus magnitudine sensim decrescentibus; ventre convexo. Alae modice latae, convolutae; cellula radialis lanceolata, ab apice alae remota; cubitali secunda quinqueangulari nervos duos recipiente; tertia oblique quadrangulata. Pedes mediocres; tibiis anticis uni posterioribus bicalcaratis; unguiculis tarsorum simplicibus. Haec species *Pol. canadensi* primo intuitu sat similis, colore tamen totius corporis dilutiore et pictura alarum ab hoc diversa videtur".

16. *P. canadensis* var. *satan* J. Bequaert.

Polistes canadensis var. *satan* J. Bequaert, 1940, Jl. New York Ent. Soc., XLVIII, p. 11 (♀ ♂; Lassance, Minas Geraes, Brazil).

The var. *satan* is known from Colombia (Dept. Cundinamarca) and Brazil (State of Minas Geraes).

Original Description of var. *satan*: "Female and Worker. Head, thorax and abdomen jet-black, scarcely with any ferruginous or yellowish markings; a very narrow inner border of the eyes, outer orbits, lower portion of clypeus, mandibles, hind margin of pronotum and a blotch on tegulae, very slightly suffused with reddish-brown. Antennae black, base and apex more or less tinged with chestnut-brown. Legs black; base of tibiae, outer side of fore tibiae, and fore tarsi more or less ferruginous; mid and hind tarsi dirty yellow to orange. Wings uniformly bluish-black, with black veins and costa; stigma dark brown. Male. Almost exactly like the female; very narrow inner orbits dirty yellow".

17. *P. canadensis* var. *satanulus* J. Bequaert.

Polistes canadensis var. *satanulus* J. Bequaert, 1940, Ent. News, LI, p. 82 (♀; Joinville, Santa Catharina, Brazil).

The var. *satanulus* is known only from the type locality.

Original Description of var. *satanulus*: "Female. Entirely shiny coal-black, except for the flagellum which is mostly ferruginous, darker above. Wings subhyaline, slightly suffused with ferruginous, somewhat darker anteriorly; veins of basal two-thirds and stigma brownish-black, those of apical third pale ferruginous".

18. *P. canadensis* var. *weberi* J. Bequaert.

Polistes canadensis var. *weberi* J. Bequaert, 1940, Jl. New York Ent. Soc., XLVIII, p. 12 (♀; Macuto near La Guaira, Venezuela).

The var. *weberi* is known only from northern Venezuela.

Original Description of var. *weberi*: "Female and Worker. Mostly black, with brownish tinges over some of the abdominal segments; most of head, most of pronotum, tegulae, a small spot in upper corner of mesopleura, and antennae (except for median black area of flagellum), mahogany-brown. Pale sulphur-yellow markings restricted to the large apical margin of first tergite (emarginate in the middle and separated from the black base by a reddish-brown area), the knees, the basal half or more of all tibiae, and all tarsi. Wings strongly infuscated, purplish-black in basal two-thirds, more russet in apical third. Male unknown".

19. *P. canadensis* var. *wheeleri* J. Bequaert.

Polistes canadensis var. *wheeleri* J. Bequaert, 1940, J. New York Ent. Soc., XLVIII, p. 12 (♀; Bochibampa Bay, Guayamas, Sonora, Mexico).

The var. *wheeleri* is known only from northwestern Mexico (State of Sonora).

Original Description of var. *wheeleri*: "Female. Body and legs bright reddish-brown; only the ocellar area, sutures of the thorax, a median line over anterior half of mesonotum and a narrower stripe in concavity of propodeum (widened below), black; middle of flagellum infuscated. The following markings are yellow: clypeus, lower half of face, most of outer orbits and mandibles, under side of scape, apical fasciae on all tergites and on second to last sternites (reduced on first and second, very extensive on the others and more or less divided on each side by a wavy reddish line), the knees, the basal third of all tibiae, and most of all tarsi. Wings moderately infuscated, somewhat purplish-black and tinged with russet basally and along anterior margin. Male unknown".

RESUMEN

Polistes canadensis es la especie de *Polistes* del continente americano que tiene mayor distribución, pues extiende su radio desde cerca de la frontera Norte de Estados Unidos de América hasta el Norte de Patagonia. La variedad *annularis* se conoce en Dakota del Sur cerca de Lat. 43° N. En las Antillas, se ha encontrado solamente en las Antillas Menores. El autor reconoce 19 variedades que ha tratado de colocar

en clave pero reconoce que algunos ejemplares que son formas de transición han de colocarse en forma arbitraria. Por otra parte ha colocado bajo *canadensis* típica, ejemplares que difieren en coloración general, desde negro con algunas mancha ferruginosas hasta el rojo castaño. Los ensayos que se han hecho para separar ese grupo no han dado resultados satisfactorios debido a las muchas formas de transición y la aparente falta de correlación con su distribución geográfica. Además describe la subespecie nueva *P. canadensis anduzei*, procedente de Tabay, Estado Mérida a los 1.760 mts. de altitud. Se parece a la variedad *weberi*, pero con el occipucio y órbitas exteriores amarillo como en la variedad *infuscatus*; esta última no tiene fascia amarilla apical en la primera tergita y si la tiene es muy delgada. También se describe la variedad nueva *P. canadensis eburneus* procedente de Villarrica, Paraguay. Esta es la más amarilla de cuantas *Polistes* se han visto. Sería interesante conocer bajo qué condiciones ecológicas vive, pues el color es el que corrientemente se encuentra en avispa que viven en lugares extremadamente secos o en zonas desérticas. Estructuralmente el holotipo se parece a los otros machos de *P. canadensis* y aunque las características específicas de los *Polistes* se reconocen mejor en este sexo, no se la puede separar como especie.