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TWO NEW SPECIES OF *PROTONEURA* FROM SOUTH
AMERICA (ODONATA)

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IN connection with a study of *Protoneura tenuis* Selys made jointly with Mr. John Cowley (Cowley and Gloyd, 1938), the undetermined specimens of *Protoneura* in the Williamson collection were examined. Among them were two apparently undescribed species belonging to the *tenuis* group. One is represented by material from Brazil collected by Mr. J. H. Williamson and Captain J. W. Strohm in 1922, the other by material from Peru taken by Mr. Felix Woytkowski in 1936. Of the latter species Dr. Clarence H. Kennedy has a large series from Ecuador which he has generously allowed me to include in the present study, and Mr. Cowley has kindly loaned me his specimens, one from Peru and one from Bolivia, for the same purpose.

Protoneura scintilla, new species

(Pl. I, Figs. 1-6; Pl. II, Figs. 1-5)

When members of this genus hover over woodland streams they are said to be invisible except for the bright thoracic spots which appear like tiny flames above the dark water (Williamson, 1915: 622). This phenomenon as well as the shape of the thoracic markings in this species has suggested the name *scintilla*, a spark or glimmer.

HOLOTYPE MALE

HEAD (Pl. I, Fig. 1).—Labium cream; labrum glossy black, narrowly bordered anteriorly with cream; mandibles laterally black, mesal portion covered by the labium, cream; anteclypeus pale yellow with a large dorsolateral brown area on each side; postclypeus glossy black; frons black, with four yellow spots (two median and a lateral spot at the base of each antenna), each slightly larger than the median ocellus, across the anterior face; vertex black; dorsal surface of head entirely black except for a small triangular scarlet-tinted yellow area at the margin of the eye on a level with the posterior pair of ocelli; genae mostly yellow; antennae black with mesal surface and apical ring of scape and base of pedicel, yellow; rear of head entirely black; eyes brown above, yellow below.

PROTHORAX.—Front lobe black with a small orange spot on lateral margin; middle lobe with two large dorsal scarlet-orange spots narrowly separated by a black line, laterally entirely black; hind lobe black, posterior margin regular, convex.

PTEROTHORAX (Pl. I, Fig. 5).—Black with pale areas as follows: a narrow scarlet-orange stripe (about 0.1 mm. wide) on apical $4/5$ of middorsal carina; a broad scarlet-orange antehumeral stripe, $2/3$ as wide as each mesepisternum, touching the basal half of the suture below, dorsal portion longer and tapered apically but not reaching the antealar sinus; a small orange-tinted yellow area on the lateral margin of the antealar sinus; a small yellow spot in the upper apical corner of the mesepimeron; a yellow area in the lower posterior corner of the mes- and metinfraepisternum; a yellow stripe on the metepisternum in juxtaposition with the suture above, not touching the base, tapered apically, and narrowly separated from the pale area on the lateroalar carina; a pale yellow, median ventral area on the metepimeron, which has the black anteriorly extending across the pale yellow ventrum and continuous with the black from the other side.

LEGS.—Similar to *tenuis*: coxae pale yellow with a black basal spot on anterior surface, first pair also dark posteriorly; trochanters pale yellow; femora, first pair with anterodorsal sur-

face black except for a narrow basal pale yellow area, postero-dorsal surface with apical black area extending diagonally from base of black area on anterodorsal surface to base of black area on apical half of ventral surface, second and third pair black apically with basal $3/5$ and $2/3$, respectively, pale yellow divided by a broad dark gray band; tibiae and tarsi black or dark brown; tarsal claws dark amber with black tips.

ABDOMEN.—Black dorsally; segment 1 pale yellow laterally, the dorsal black continued along apical margin; segment 2 black with a large lateral pale yellow area at mid-length extending to ventral margin; segments 3–6 laterally brown blending with dorsal and apical black, narrow basal yellow ring obscurely divided middorsally on 4–6 and continued very narrowly along the ventral margin; segment 7 with basal dusky yellow ring broadly divided middorsally and continued along entire ventral margin; segments 8–9 black, 8 with a broad ventral border of dusky yellow, 9 only very narrowly pale; segment 10 entirely black. Sternites: segment 1 and base of 2 yellow; vesicle black with pale margin; segments 3–6 light brown or dusky yellow, 3 darker at base, 4–6 black at apex; 7–8 black, dusky yellow at base and at apex; 9 dusky yellow with obscure black areas; 10 entirely black.

PENIS (Pl. II, Figs. 4–5).—Terminal segment simple, narrowed toward apex, lateral lobes at mid-length small; internal fold large, well in front of the base of the third segment; shaft spines absent.

ABDOMINAL APPENDAGES (Pl. II, Figs. 1–3).—The superiors are shorter than the tenth abdominal segment but slightly longer than the inferiors; broad at base with mesal subbasal tubercle, and a conspicuous dorsolateral depression; mesal margin concave with an antepical tooth; apex smooth and rounded; ventral lamina large, light brown; coloration black mesally, brown laterally and ventrally. Inferiors broad at base, tapered at apex and curved laterad in apical third; coloration black except for pale ventral mesal portion.

VARIATION.—In male paratypes: the antehumeral orange stripe may extend along as much as the basal $2/3$ of the humeral

suture, and the metepisternal pale stripe sometimes has a narrow extension which almost reaches the base. The coloration of the abdominal segments is rather uniform although a slight variation in the extent of the pale areas is to be expected. Segment 10 is sometimes brown ventrally instead of black.

ALLOTYPE FEMALE

HEAD.—The pattern (Pl. I, Fig. 2) is very similar to that of the holotype except that the spots of the frons are much larger with the median ones extending on both anterior and dorsal surfaces and narrowly joined along the ridge to the subantennal spots.

PROTHORAX (Pl. I, Figs. 3-4).—Front and hind lobes creamy white, the former with a trilobed black area at base, the latter with a narrow median black area at base and on the posterior margin; middle lobe black with a large pale dorsolateral spot reaching the anterior margin but not quite touching the posterior one.

PTEROTHORAX (Pl. I, Fig. 6).—Glossy black with creamy white areas as follows: a narrow stripe on apical $8/9$ of mid-dorsal carina; a stripe on the mesepisternum along basal $2/3$ of humeral suture, about twice as wide as the pale stripe of the middorsal carina, and slightly expanded apically; ventral border and lower anterior corner of mes- and metinfraepisternum; a small spot at upper apical corner of mesepimeron; a stripe on the metepisternum extending from base to lateroalar carina, broad subbasally, tapered apically, and in contact above with the second lateral suture; a pale area laterally on approximately the lower half of the metepimeron. Ventrally, the meso- and metasternum, and basal and median areas of the otherwise pale metepimeron are black. Mesostigmal lamina black with a small lateral pale spot; posterior margin lateral to dorsolateral apical angle decidedly elevated so that the lateral half of the plate appears to be resting only on the anterior margin.

LEGS.—Coxae cream color with a large black or dark brown basal area on anterior surface; trochanters entirely pale; femora black apically, the pale area of basal $1/2$, $3/5$, and $2/3$ of first, second, and third pair, respectively, divided by a gray

band narrow on first pair, wider than the cream-colored band on either side of second and third pair; tibiae and tarsi black; tarsal claws dark amber with black tips.

ABDOMEN.—Slender, expanded at segment 6, which is twice as wide at apex as at base; segments 6–7 distended ventrally. Segments 1–9 black dorsally; a pale yellow or cream colored basal ring on 3–6, narrowly divided middorsally on 4–6, and represented by a pair of dorsolateral spots on 7. Laterally, segments 1–2 cream or very pale yellow; segment 1 black apically; segment 2 narrowly black at base, the black dorsal area expanded in apical half and tapered to ventral apical margin; segments 3–5 black apically, brown laterally, blending with pale yellow of basal rings and of ventral margin; segments 6–8 pale dusky yellow, 8 narrowly black apically; segment 9 with a large pale yellow spot touching ventral margin, the basal and apical black continuous with dorsal black. Segment 10 and superior appendages entirely black. Sternites: segment 1 entirely pale; segment 2 black, pale at base and apex; segments 3–5 pale, dusky apically; segment 6 pale yellow basally, dusky apically, black on mid-ventral carina, with a wide brown area on either side; segment 7 black, dusky yellow apically; segment 8 black with two large dusky yellow geminate spots basally and a broad band apically; segment 9, basal plate of ovipositor dusky yellow; valves of ovipositor mostly pale, dark ventrally in apical half, ventral margin finely toothed or serrated, styli black with amber tips; ovipositor pale at base, remainder dark.

VARIATION.—In paratype females: on the prothorax the median black area at base and posterior margin of the hind lobe is narrowly connected along the middorsal line in two paratypes; the basal area large and marginal area absent in one paratype. On the pterothorax the pale stripe of the metepisternum does not reach the base below in one specimen, and the portion between the base and the subbasal expansion is represented only by a very narrow, almost obscure, pale streak in two specimens, and is widely separated apically from the lateroalar carina in one specimen; the black area of the upper part

of the metepimeron is broadly continuous anteriorly with the black across the ventrum in all the paratypes.

WINGS (♂ and ♀).—Hyaline, venation black or dark brown, pterostigma dark brown. The following data are based on 26 ♂ and 10 ♀ front and hind wings (13 ♂ and 5 ♀ specimens). Postnodals: front wing, 9 (♂ 23, ♀ 7^{**1}) or 10 (♂ 3^{**}, ♀ 3); hind wing, 7 (♂ 5) or 8 (♂ 21^{**}, ♀ 10^{**}). Postsubnodals: front wing, 8 (♂ 1) or 9 (♂ 25^{**}, ♀ 10^{**}); hind wing, 7 (♂ 11, ♀ 3) or 8 (♂ 15^{**}, ♀ 7^{*}). Pterostigma is 2 to 2 1/2 times as long as wide and covers less than 1 cell in front wing, ♂ 24^{**} ♀ 10^{**}, in hind wing, ♂ 17^{**} ♀ 9^{*}; 1 cell in the remainder. The superior sector (Cu₁) ends at the subnodal transversal in front wing, ♂ 26^{**} ♀ 6; hind wing, ♂ 25^{**} ♀ 6; extends beyond level of transversal, which does not extend to posterior wing margin in front wing, ♀ 3^{**}; hind wing, ♂ 1 ♀ 4^{**}; and definitely crosses the transversal in front wing, ♀ 1. The median sector (M₃) arises 1/3 to 1/2 (slightly more than 1/2 in 1 ♂ hind wing) cell length before the subnodus and ends distal to level of pterostigma in all ♂ wings except 1 in which it ends near distal margin, and in all ♀ wings. Subnodal sector (Rs) arises at subnodus in all except 1 ♂ hind wing in which it is slightly beyond. Nodal sector (M₂) arises in front wing 1/3 cell length beyond fourth postnodal in 1 ♂ wing, at fifth in all others, ♂ and ♀; in hind wing at fourth in all wings. The crigin of the postnodal sector (M_{1a}) is irregular, in front wing from 2 cells proximal to 1/2 cell beyond proximal end of pterostigma, and in hind wing from 1 cell proximal to 1/2 cell beyond proximal end of pterostigma. The greatest width of the hind wings is usually slightly greater than 1/8 of the length.

In this series the postsubnodal crossveins of the hind wing show greater variation than the postnodals. The study of *Protonneura tenuis* (Cowley and Gloyd, 1938) indicated that the postsubnodal series were slightly less variable.

MEASUREMENTS (in mm.).—Length of hind wing, ♂ 17.5–18.4 (holotype, 18.0), ♀ 18.8–19.4 (allotype, 19.0), average, ♂

¹ The asterisk indicates that the number includes data for each wing of holotype or allotype.

17.88, ♀ 19.1; abdomen (not including appendages), ♂ 33.4–35.4 (holotype, 35.4), ♀ 29.3–30.5 (allotype, 30.5), average, ♂ 34.0, ♀ 29.8; superior appendages, ♂ 0.3, ♀ 0.2–0.3; inferior appendages, ♂ 0.4–0.5 (holotype, 0.5), average, 0.436. The inferior appendages extend 0.05 to 0.08 mm. beyond the apex of the superiors.

MATERIAL EXAMINED.—Abuná, Matto Grosso, Brazil, March 19 (1 ♂ 1 ♀) and March 23, 1922 (12 ♂ 4 ♀, including holotype and allotype), J. H. Williamson and J. W. Strohm, collectors. The types are in the E. B. Williamson collection, University of Michigan, and also all paratypes except 3 ♂ (March 23), one of which is in each of the institutions which contributed to the funds of the expedition: Museum of Comparative Zoology, Carnegie Museum, and the Field Museum of Natural History.²

According to Mr. J. H. Williamson's field notes the specimens of *scintilla* were taken at a season of considerable rain. They were found in the darkest places on shallow creeks that were about one foot deep and four to six feet wide and in thick woods; while a few dragonflies were caught five feet or more from the ground nosing about among twigs, they were generally seen hovering and darting a few inches above the water.

Protoneura scintilla appears to be more closely related to *tenuis* and *calverti* than to other South American species of the genus which are known to me only from descriptions. In coloration the male is distinctive in having a dorsal pale triangular spot at the margin of each eye at the level of the posterior ocelli, a pale stripe on the middorsal carina dividing the black area, and a continuation of the second lateral thoracic black stripe across the ventrum; the female, by the more extensive pale areas of front and hind lobe of the prothorax, a shorter pale stripe which does not reach the base on the middorsal carina, a wider and shorter pale humeral stripe entirely above the suture, and a more extensive black area on the ventrum. The male differs from both *tenuis* and *calverti* in having

² The specimens from these museums were kindly sent to me through the courtesy, respectively, of Mr. Nathan Banks, Dr. Hugo Kahl, and Dr. W. J. Gerhard.

the superior abdominal appendages shorter than the tenth segment and extending slightly beyond the inferiors. *P. paucinervis* (Selys, 1886: 214) also has superior appendages shorter than the tenth segment, but the inferiors are "le double des superiors." The inferior appendages of *exigua* (Selys, 1886: 216) are shorter than the superiors, but the latter are "le double du dernier segment." The mesostigmal lamina of the female with its decidedly elevated lateroposterior margin easily distinguishes *scintilla* from *tenuis* and *calverti*, although the latter also has a slightly elevated posterior margin.

Protoneura woytkowskii, new species

(Pl. I, Figs. 7-15; Pl. II, Figs. 6-10; Text Figs. 1-3)

According to Mr. Felix Woytkowski, in whose honor this species is named, the dorsal thoracic markings of living specimens are "rich pastel-scarlet, of gorgeous beauty and tone," the two lower stripes blending from scarlet into yellow. Although the preservation of the type material is excellent, some of the scarlet tone has been lost in drying.

HOLOTYPE MALE

HEAD (Pl. I, Fig. 7).—Labium cream; labrum glossy black, narrowly bordered anteriorly with cream; mandibles black with mesal margin and portion covered by the labium, cream; anteclypeus brown medially, pale laterally; postclypeus glossy black; frons rounded, anterior margin of dorsal face with a median pair of narrowly separated orange spots, each slightly larger than the median ocellus, and a smaller obscure spot at the base of each antenna; dorsal surface of head and vertex entirely matt black; ocelli pale yellow; genae ventrally, from a level of the postclypeus, pale greenish yellow; antennae black except for pale yellow apical ring on scape and exterior pale basal area on pedicel; rear of head entirely black; eyes bluish brown (?) dorsally, greenish yellow ventrally.

PROTHORAX (Pl. I, Fig. 8).—Dorsally bright orange with three small round spots in the depression between front and middle lobes, a fine middorsal line on middle lobe, and a narrow line between middle and hind lobes, black; laterally, with a

broad black band across middle and hind lobes, the former in posterior half narrowly bordered with yellow. Posterior margin of hind lobe regular, convex.

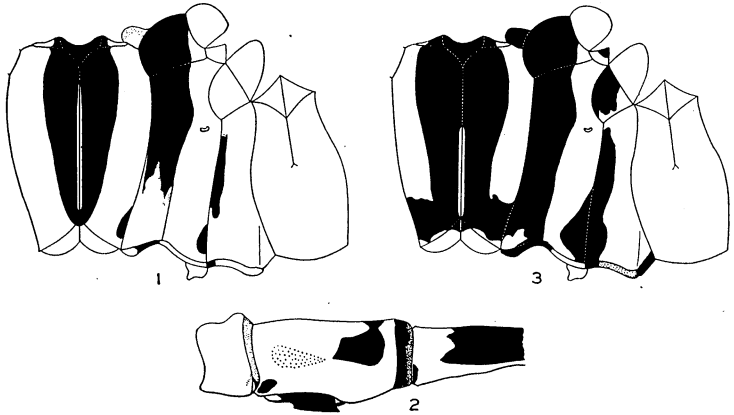
PTEROTHORAX (Pl. I, Fig. 12).—Mesepisterni scarlet-orange with a middorsal black stripe covering about half the total area, more than twice as wide at base as at apex, and divided in its upper two-thirds by a narrow scarlet-orange stripe on the middorsal carina; antealar sinus scarlet-orange. Mesinfraepisternum black, except for a small posteroventral orange area. Mesepimeron covered by a broad black band, not quite reaching the lateroalar carina, and slightly forked apically, the superior branch crossing the humeral suture but widely separated from the middorsal black stripe; the apical pale area orange, and a small anteapical subhumeral pale spot enclosed in the black area scarlet-orange. Metepisternum scarlet-orange dorsally and posteriorly, blending into yellow ventrally and anteriorly. Metinfraepisternum black in dorsal half, yellow ventrally and along posterior margin. Metepimeron yellow with a broad black stripe tapered below (anteriorly), broad above and extending across the suture in its upper third but not reaching the lateroalar carina. Under parts entirely yellow.

ABDOMEN.—Segment 1 brown dorsally, yellow laterally; segment 2 scarlet-orange dorsally, apical third black enclosing a narrow transverse anteapical bar, a dorsolateral black bar confluent with the apical black, laterally yellow; segments 3–6 dorsally dark brown becoming black apically, pale basal rings scarlet-orange on 3, yellow on 4–6, lateral margins obscurely yellow blending with dark area above and apical black; segment 7 black dorsally, anteapical ring separated mid-laterally from narrow lateral margin; segment 8 black dorsally, pale lateral area expanded at mid-length to half the height of the segment, orange in upper portion blending to yellow along inferior margin; segment 9 black with a broad anteapical orange ring, narrower dorsally, extending from base to apex laterally; segment 10 entirely black. Sternites: segments 1–2 yellow, hamules brown; segments 3–6 yellowish brown, blending to brown basally and to black apically; segment 7 black; 8 mostly

black, yellow basally and yellowish brown apically; segment 9 yellow; segment 10 dusky yellow medially, black laterally.

PENIS (Pl. II, Figs. 9-10).—Terminal segment narrowed and truncate at apex, lateral lobes at mid-length larger than in *scintilla*; internal fold large; shaft spines absent.

ABDOMINAL APPENDAGES (Pl. II, Figs. 6-8).—The superiors are black dorsally and apically, dark brown laterally; slightly longer than abdominal segment 10 and shorter than the inferiors; in dorsal view, subbasally widened, tapered to a



FIGS. 1-3. Palest and darkest color pattern of *Protoneura woytkowskii*, new species. Figs. 1-2. Paratype male, Buena Vista, Bolivia (Cowley collection), thorax (diagrammatic) and abdominal segments 1, 2, and part of 3. Fig. 3. Paratype male, Río Anzu, Ecuador (Kennedy collection), thorax (diagrammatic).

rounded inwardly curved apex, the mesal surface slightly concave; in lateral view, the apex decurved, the ventral dusky yellow laminar projection large, occupying approximately the median half and extending below the ventral margin a distance equal to the width of the appendage. The inferiors are pale dusky yellow at base, blending to black at the tip; slender, subcylindrical, directed slightly dorsad; base broad, apex slightly recurved.

The apparently fully mature male from Bolivia has the dark areas of the thorax and abdomen (Figs. 1-2) much less developed than they are in other paratypes. On the thorax the mid-

dorsal carina is pale for almost its entire length; the mesepimeral black stripe extends only slightly more than halfway to the lateroalar carina, its upper branch not connected with the antepical black area above the humeral suture; the metinfraepisternum is pale yellow without any black marking; the metepimeral black stripe is narrow and separated from the subapical black area above, but in contact with the second lateral suture. Abdominal segment 1 is entirely yellow with only a slight darkening to indicate the normal black dorsal spot; segment 2 has no dark dorsolateral bar; the orange ring of segment 9 is wider than in the holotype and is as wide dorsally as the basal black band; segment 10 has a large orange dorsolateral spot on each side.

Paratype males from Peru and Ecuador show but slight variation from the coloration of the holotype, although a few from the latter locality have considerably more extensive black areas. On the head the paired median spots near the anterior margin of the upper surface of the frons are often a dark burnt-orange, and the lateral spot at the base of each antenna is obscured; sometimes all four of the series are entirely lacking. On the thorax the middorsal black stripe is wider apically in the darker specimens; the lower branch of the black mesepimeral stripe of forty-four specimens and another on one side only are in contact with the black of the lateroalar carina; the upper branch of the mesepimeral stripe is considerably reduced and only narrowly connected with the portion above the humeral suture in twenty-three specimens, is more extensive and approaches the middorsal black stripe in four specimens, and is more or less broadly connected with it in six specimens (Fig. 3); the black of the metinfraepisternum varies slightly in width; and the metepimeral stripe is somewhat reduced anteriorly in thirty-three specimens and is in closer contact with the lateroalar carina at the second lateral suture in twelve specimens. Variation in abdominal coloration is most conspicuous on segments 2 and 10, although the width of the orange band on 9 varies to some extent. On segment 2 the laterodorsal black bar is not connected to the apical black in four

specimens, and the apical black is constricted middorsally in eighteen specimens. Segment 10 of eight specimens has two oval, dorsolateral orange spots; these are small in all but one specimen in which they are of considerable size.

LEGS (Pl. I, Fig. 15).—Pale yellow banded with dark areas as follows: on femora a subbasal dusky band narrow and incomplete ventrally on first pair, broad on second and third pairs, and a dusky area shading into black on apical $1/3$, $1/4$, and $1/5$ to $1/4$ of first, second, and third pairs, respectively; on tibiae, a basal dusky band on basal third of first pair, a narrow basal black band and a broad subbasal dusky band on second and third pairs, and a dark band which shades to black at apex on apical $1/3$, $2/5$, and $3/5$, respectively, of first, second, and third pairs; tarsi entirely black in the holotype, but in most of the paratypes the second segment is brown or yellow with apex black, and the third segment is black in apical half only; claws yellow (holotype) or amber with black tips.

ALLOTYPE FEMALE

HEAD (Pl. I, Fig. 9).—Differs from the male in having the anteclypeus entirely creamy white; postclypeus glossy black with a small oblong pale area laterally near the base; genae and frons entirely pale except for a small triangular black area near the base of each antenna; antennae with base, scape except basal mesal area, and basal and external portion of pedicel, pale.

PROTHORAX (Pl. I, Figs. 10–11).—Front and hind lobes creamy white, the former with three disconnected round black areas at base, the latter narrowly black middorsally along the suture; middle lobe black with a large pale dorsolateral area extending from anterior to posterior margin and with a narrow pale area along the lateral margin.

PTEROTHORAX (Pl. I, Fig. 13).—Glossy black and creamy white. Mesepisterni black with a narrow pale stripe on apical $2/3$ of the middorsal carina, a comparatively wide pale antehumeral about $1/3$ as wide as each mesepisternum, reaching from base to $3/4$ the length, and a small rounded apical spot near the humeral suture; antealar sinus pale with a black finger-like area on each side extending mesad from the apical

margin but not quite touching the median black area across the basal angle. Mesepimeron and mesinfraepisternum entirely black except for the upper apical corner of the former and the ventral corner of the latter. Metepisternum and metepimeron pale, the latter with a broad band, tapered basally, expanded and extended across the suture apically for about $2/3$ the height of the metepisternum. Metinfraepisternum black with pale posterior and ventral margins. Ventrum entirely pale. Mesostigmal laminae with the lateral $2/3$ pale; simple, triangular, on a slightly higher plane than the mesepisterni; anterior margin with a low rounded elevation.

LEGS.—Pattern same as in the males.

ABDOMEN.—Slender, expanded at segment 5, which is twice as thick at base as at apex, segments 6–7 distended ventrally. Segments 1–9 black dorsally; a pale green or blue basal ring on 3–5, divided middorsally by a black line, and represented by a pair of dorsolateral spots on 6–7. Laterally, segments 1–7 pale, apex of 1–5 black; segments 8–9 with a large yellow area, on 8 extending from ventral margin to $1/3$ the height and on 9 to about $1/2$ the height of the segment. Segment 10 and superior appendages entirely black. Sternites: segment 1 entirely pale; segment 2 with a black band across the middle; segments 3–7 black on mid-ventral carina, gradually becoming wider on the posterior segments; segment 8 pale laterally and apically; segment 9, basal plate of ovipositor dusky yellow, valves of ovipositor mostly pale, ventral margin dark in apical half and finely toothed or serrated, styli dark, ovipositor entirely dark.

VARIATION.—In paratype females: the color pattern of head, prothorax, and abdomen is uniform. On the thorax, the narrow middorsal pale stripe is slightly longer in two specimens, the lateral pale area basal to the carina of the antealar sinus is elongated and extends as far mesally as the pale area of the sinus in two specimens; the apical black area of the antealar sinus is united with the anterior black area in two specimens; and a small, round, pale, subhumeral spot, just apical to the broad antehumeral, is present in one female.

WINGS (σ and ♀).—Hyaline, venation black; pterostigma brown (slightly red in some males, smoky brown in the females).

The following data are based on 130 ♂ and 14 ♀ front and hind wings (65 ♂, 7 ♀ specimens). Postnodals: front wing (♂ 1 incomplete), 9 (♀ 1), 10 (♂ 31, ♀ 2), 11 (♂ 82*,³ ♀ 6*), 12 (♂ 16, ♀ 3), or 13 (♀ 2); hind wing, 8 (♂ 32, ♀ 1), 9 (♂ 89*, ♀ 11*), 10 (♂ 9, ♀ 1), or 11 (♀ 1). Postsubnodals: front wing, 9 (♂ 2), 10 (♂ 61, ♀ 5), 11 (♂ 65*, ♀ 7*), or 12 (♂ 1); hind wing, 8 (♂ 68, ♀ 5), 9 (♂ 60*, ♀ 9*), or 10 (♂ 2). Pterostigma is about twice as long as wide, covering a little less than 1 cell in front wing, ♂ 124*, ♀ 13*, in hind wing, ♂ 115*, ♀ 12*; 1 cell in front wing, ♂ 5, ♀ 1, in hind wing, ♂ 14, ♀ 2; and more than 1 cell in hind wing, ♂ 1. Superior sector (Cu₁) of triangle crosses the subnodal transversal in 92* ♂ 12* ♀ front wings, 15* ♂ 11* ♀ hind wings, is abnormal in 1 ♂ front wing and 1 ♀ hind wing, and in the remainder extends beyond the level of the transversal which does not cross to the wing margin. Nodal sector usually arises at or very near the fifth postnodal crossvein in the front wings and at the fourth in the hind wings, although in the front wing it may arise elsewhere between the fourth and seventh (12 wings) and in the hind wing between the third and fifth (5 wings). Greatest width of wings is usually slightly less than 1/6 of the length in the males and about 1/7 in the females.

The number of postnodal crossveins, unlike that of *P. tenuis* (Cowley and Gloyd, 1938: 14-15), has the same range of variation as has the postsubnodal series. The above data also show that in the postnodal series the majority of wings have 11 in the front wing and 9 in the hind wing, whereas in the postsubnodal series the greater number is about equally divided between 10 and 11 in the front wing and 8 and 9 in the hind wing. The combined data for *tenuis*, *scintilla*, and *woytkowski* on a total of 308 pairs of wings (154 specimens) seem to indicate no significant taxonomic advantage in the use of the postsubnodals instead of the customary costal postnodal series.

MEASUREMENTS (in mm.).—Length of hind wing, ♂ 16.6-20.4 (holotype, 20.4), ♀ 18.5-21.5 (allotype, 19.0), average,

³ The asterisk indicates that the number includes data for holotype ♂ or allotype ♀ wings.

♂ 18.19 ♀ 19.37; abdomen (not including appendages), ♂ 29.0–37.2 (holotype, 37.2), ♀ 27.6–31.8 (allotype, 28.4), average, ♂ 33.54 ♀ 29.0; superior appendages, ♂ 0.45–0.52 (holotype, 0.5), ♀ 0.23–0.3 (allotype, 0.27), average, ♂ 0.5 ♀ 0.26; inferior appendages, ♂ 0.6–0.9 (holotype, 0.8), average, 0.82. The inferior appendages of the male extend beyond the superiors from 0.04–0.2 mm., depending to a large extent upon the angle of their position.

MATERIAL EXAMINED.—PERU: Departamento de San Martin, vicinity of Rioja, Soritor (elevation about 2950 feet), September 13, 1936, 5 ♂, October 13, 1936, 1 ♂ (holotype); vicinity of Moyobamba (elevation about 2900 feet), December 26, 1936, 1 ♂, Felix Woytkowski; Williamson collection of the Museum of Zoology, University of Michigan; Rioja, 1 ♂, Dr. P. Martin; J. Cowley collection. BOLIVIA: Departamento de Santa Cruz, Buena Vista, February 1933, 1 ♂, F. Steinbach; J. Cowley collection. ECUADOR: Oriente Province, Río Napo watershed, January 1937, 3 ♂, November 20, 1935, 1 ♂; Río Jatun Yacu (elevation about 2200 feet), January, 1935, 11 ♂ 3 ♀ (including allotype), February 1935, 2 ♂, March 1937, 18 ♂ 1 ♀, March 20, 1937, 1 ♂, April 1, 1935, 1 ♂, April 10, 1935, 3 ♂, April 17, 1935, 2 ♂ 1 ♀, April 19, 1935, 2 ♂, December 27, 1936, 1 ♂ 1 ♀; Río Anzu (elevation about 3290 feet), April 1937, 2 ♂; Partidero, September 12, 2 ♂, September 19, 3 ♂, November 3, 1 ♂, November 11, 2 ♂, and November 14, 1935, 1 ♀; Río Chucapi, September 26, 1934, 1 ♂: all of this series were collected by William Clarke-Macintyre for Dr. Clarence H. Kennedy. The allotype as well as many of the paratypes from Ecuador have been deposited in the Williamson collection.

Mr. Woytkowski states that in the vicinity of Rioja specimens were taken on a small muddy brook in the shade of the jungle. On September 13 they were collected with comparative ease. A month later, however, they were "scarce and elusive." One more specimen was taken, and a mating pair was seen as it flitted past and disappeared in some high shrubs. In the hope of securing females he returned on four different days but saw none. A habit of this species is to hover for half a minute

or more close to the surface of the stream; the wings become invisible and only the scarlet thoracic spots reveal its presence against the dark water. Because of its delicate beauty and apparent ability to vanish as if by magic, Mr. Woytkowski called it "a true creature from fairyland."

The males of *Protoneura woytkowskii* are most conspicuously distinct from those of other species of the *tenuis* group in having the dorsum of all three lobes of the prothorax predominately scarlet-orange, the antealar sinus scarlet-orange, the pale-banded tibiae (Pl. I, Fig. 15), and a subapical orange band on abdominal segment 9, as well as in the shape of the abdominal appendages (Pl. II, Figs. 6-8) and genitalia (Pl. II, Figs. 9-10). In some respects *woytkowskii* appears to be similar to *exigua* and *paucinervis*, but, according to the original description (Selys, 1886: 214-16), *exigua* has no black lateral thoracic stripes, and its inferior abdominal appendages are shorter than the superiors, while *paucinervis* has an entirely black prothorax, and the superior appendages are shorter than the tenth segment.

In many species of Zygoptera the black pattern of the adult is only partially indicated in teneral specimens and gradually develops with age. If the evolutionary trend follows the same course and if relationships between closely related species can be traced through the medium of color patterns, then the one with the least extensive black areas may be considered the most primitive in this character. In the *Protoneura* series of *calverti*, *tenuis*, *scintilla*, and *woytkowskii*, the color pattern of the last is the simplest and palest. From it the others can theoretically be derived (compare Figs. 1-3 and Pl. I with Cowley and Gloyd, 1938: Pls. II-V). For example, in the males, the thoracic color pattern of *scintilla* may be derived from that of *woytkowskii* by extending the black apical dorsal projection of the humeral so that it joins the middorsal stripe—as actually happens in some of the darkest specimens (Fig. 3)—and covers the antealar sinus, and by increasing the width of the second lateral black stripe apically to touch the humeral narrowly near the lateroalar carina and basally across to the ventral surface. *P. tenuis* shows a further development of the

black areas with a loss of the red stripe on the middorsal carina and a slight narrowing of the black area on either side; *calverti* has the greatest extension of all. The thoracic color patterns of the females show the same order of relationship. A corresponding sequence in structural characters, however, is not manifest. The superior appendages and genitalia in the males and the mesostigmal lamina in the females of these four species have the same general features and are, more or less, simple in form.

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Leonora K. Gloyd

PLATE I
COLOR PATTERNS

Protoneura scintilla, holotype ♂ and allotype ♀. Abuná, Matto Grosso, Brazil, March 23, 1922, J. H. Williamson and J. W. Strohm.

FIGS. 1-2. Dorsofrontal view of the head, ♂ and ♀.

FIGS. 3-4. Prothorax of ♀ in dorsal and lateral views. Magnification about twice that of the head.

FIGS. 5-6. Pterothorax (diagrammatic) of ♂ and ♀, showing dorsum, right side, and ventrum.

Protoneura woytkowskii, holotype ♂. Vicinity of Rioja, Soritor, San Martin, Peru, October 13, 1936, Felix Woytkowski. Allotype ♀, Río Jatun Jacu, Oriente, Ecuador, January 1935, William Clarke-Macintyre.

FIG. 7. Dorsofrontal view of the head, ♂.

FIG. 8. Prothorax of ♂ in lateral view.

FIG. 9. Dorsofrontal view of the head, ♀.

FIGS. 10-11. Prothorax of the ♀ in dorsal and lateral views.

FIGS. 12-13. Pterothorax (diagrammatic), ♂ and ♀.

FIG. 14. Lateral view of abdominal segments 1, 2, and part of 3.

FIG. 15. Diagrammatic drawing of first, second, and third pair of legs of the ♂ showing the ventral, anterodorsal, and posterodorsal surfaces of each.

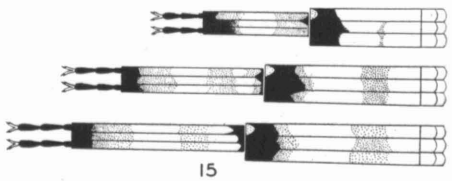
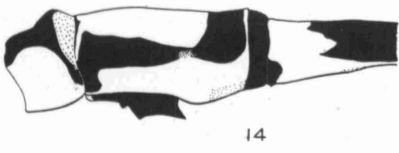
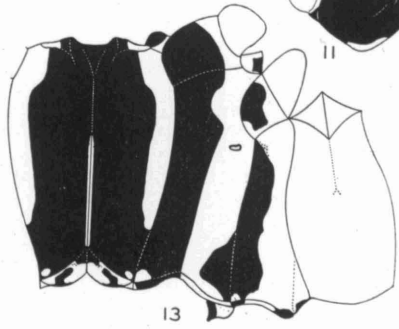
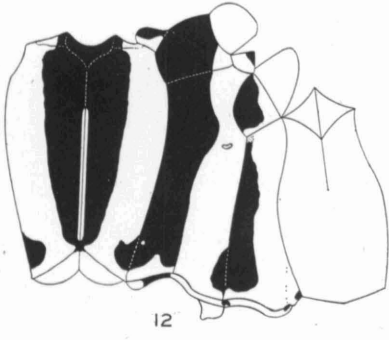
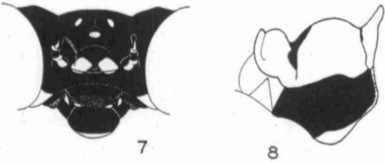
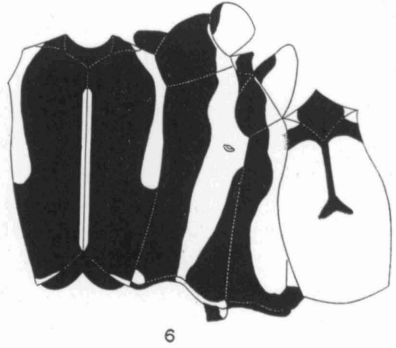
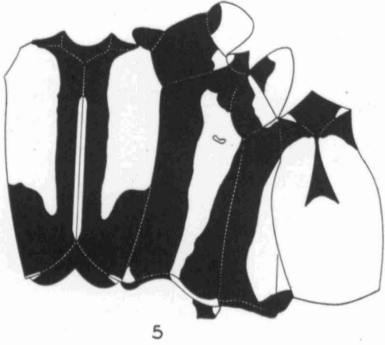
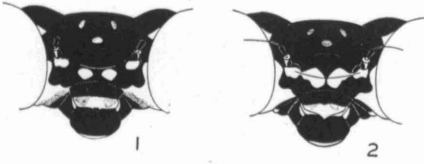


PLATE II

Protoneura scintilla

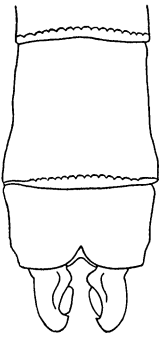
FIGS. 1-3. Holotype ♂, abdominal segments 8-10 and appendages in dorsal, lateral, and ventral views, respectively.

FIGS. 4-5. Paratype ♂, Abuná, Matto Grosso, Brazil, March 23, 1922. Penis (fully expanded in water) in dorsal and lateral views.

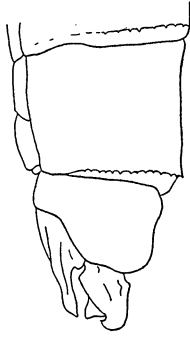
Protoneura woytkowskii

FIGS. 6-8. Holotype ♂, abdominal segments 8-10 and appendages in dorsal, lateral, and ventral views, respectively.

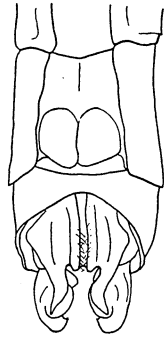
FIGS. 9-10. Paratype ♂, vicinity of Rioja, Soritor, San Martin, Peru, September 13, 1936. Penis (fully expanded in water) in dorsal and lateral views.



1



2



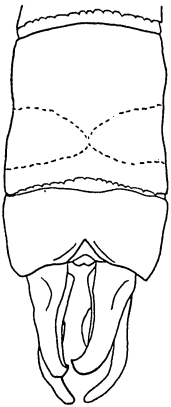
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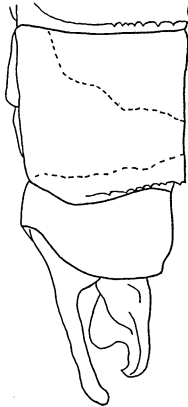
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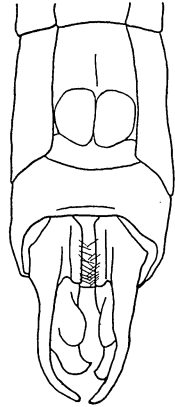
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