

NOTES ON THE ODONATA, OR DRAGONFLIES, OF BUMPING LAKE, WASHINGTON.

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The following paper is based on material obtained by the writer, on July 10 and 11, 1911, while collecting mussels for the United States Bureau of Fisheries. The specimens on which this paper is based are deposited in the United States National Museum.

Bumping Lake of the Cascades, which is called Lake Tannum on the older maps, is in the west end of Yakima County, Washington, at an elevation of 3,300 feet. It is roughly L-shaped, about 5 miles long and one-half mile wide. Its outlet, Bumping River, empties into the American River, which in turn empties into Naches River. The Naches River is the main tributary of the Yakima River.

Bumping Lake is a dark sheet of water hemmed in on all sides by great somber firs. To one who sees it for the first time it is a striking lake, for, while gazing across its quiet surface, with the fir-covered slopes rising for a thousand feet from the water's edge, and above these towering another thousand feet the rocky crags and snow-drifted slopes of the higher ridges, a distant tanager's call echoing through the firs breaks the silence, and one's impression is that of solitude. This impression is further carried out in a study of the fauna of the region, in most groups of which comparatively few species occur, and these few occur in small numbers.

The lake lies near the upper border of the Canadian zone. The coney, great northern shrike, varied thrush, and white-winged cross-bill of the Hudsonian zone are associated here with the coyote, pine squirrel, and Louisiana tanager of the Canadian. As in other groups but few species of dragonflies are found here, and but one of the four found, a mountain or northern species, appears to be at home and flourishing. Possibly this scarcity in the case of the dragonflies is due to some extent to the recent damming of the lake's outlet by the Reclamation Service to hold back water for late summer irrigation, for the lake surface is now raised each summer 40 feet above its

former level. This fluctuation of the surface level is especially disastrous to lake species of dragonflies, as it entirely prevents the formation of a shore vegetation of aquatic plants, or beaches, such as dragonflies usually frequent.

The water of the lake is very cold, as the lake is fed entirely by the torrents which rush down from the snow fields covering the surrounding heights. It is not clear for a mountain lake, but has a slight turbidity of a dark swampy nature, possibly due to the recent flooding of the burnt-over margins.

Of the four species of dragonflies found about the lake, only two occurred along the lake shore. Of these two, *Aeshna multicolor* patrolled the surface of the water, while *Sympetrum corruptum* caught Diptera among the bushes or rested in the sunshine, perched on some dead twig. Not more than 20 individuals of these two species were seen, and neither species was observed pairing or ovipositing. The other two species were found in a bordering swamp, several of which occur here. All except one were cedar swamps, which were dark and gloomy places, with the water completely shaded by the great trunks and pendulous limbs of the cedar trees, and were seemingly avoided by the light-loving dragonflies.

The single open swamp was known at the lake as "Cabin Swamp," because on its bank stood a log cabin used by the forest rangers, by whom the swamp itself had been fenced for a horse pasture. This "Cabin Swamp" was on the south shore and about 2 miles above its outlet. It was about 2 acres in extent, was covered with sedges and swamp grasses, and contained but two or three shallow pools. Toward the lake the swamp was bordered by a dense forest of black pines, while over its opposite border towered the snow-capped ridge, down the gullies of which roared the snow water which fed it. Numerous clumps of various species of mountain willows, one species only 12 inches high, dotted the grass, while everywhere over its surface were bright yellow splotches of senecio, clumps of a low purple flower, and many spikes of a white orchid.

Three species of dragonflies were found in this swamp, *Aeshna multicolor*, *Amphiagrion saucium*, and *Somatochlora semicircularis*.

Aeshna multicolor strayed in from the lake shore occasionally. Two or three individuals were seen here, though none were taken.

Amphiagrion saucium occurred here, though only three individuals were seen—a single male and a pair in copulation, the female of which was taken. This species hovered in the grass.

Somatochlora semicircularis was the species of dragonfly thoroughly at home in this high cold swamp. The metallic luster of its green body seemed in harmony with the icy water and cool bracing air, spicy with the delicate perfume of the mountain orchids. As compared with the other three species, *Somatochloras* were abundant, as

six or eight individuals were seen on the wing at times and one or two pairs in copulation, though occasionally none would be in sight. Being active on the wing, it seemed that the open swamp was merely the favorite spot of a wider range, though I did not succeed in checking this conclusion by finding *Somatochloras* flying elsewhere. Of the two sexes the males were the more active and the higher fliers. They usually flew about 2 feet above the sedges, but occasionally they would take high flights among the black pines growing about the swamp. The males were never at rest except when copulating, but the females, while usually flying low, frequently rested on the sedges and other plants. In mating the males captured the females while these rested. After capture followed a long nuptial flight in copulation, which usually lasted several minutes, following which the pair, while yet in copulation, settled on some tree or shrub, where they remained for a long time. One pair was timed 25 minutes for this resting period. The eggs were laid in masses on the surface of the water in the more open pools, whereupon the egg masses would immediately disintegrate and fall to the bottom. The females were unaccompanied by the males while ovipositing. A careful search for both larvæ and exuviae was made, but neither were found.

The following list gives the specimens collected. The dates of collection were July 10 and 11, 1911.

AMPHIAGRION SAUCIUM (Burmeister).

One female of this species was taken in "Cabin Swamp," and two males were seen.

ÆSHNA MULTICOLOR (Hagen).

One male of this species was captured on the north side of the lake near the spillway. Perhaps a dozen individuals were seen along shore, and three were seen in "Cabin Swamp."

SOMATOCHLORA SEMICIRCULARIS (Selys).

Nine pairs, 32 single males, and 6 single females of this species were taken in "Cabin Swamp." This number probably comprised a majority of the individuals living there, as they were much less numerous at the end of the second day's collecting than in the beginning. None were seen elsewhere. Because the females were more easily caught than the males, I believe that the foregoing numbers show the natural proportion of the sexes, especially as I found no frogs or toads in the swamp, and the water was not deep enough for fish; neither did I observe any birds capturing dragonflies.

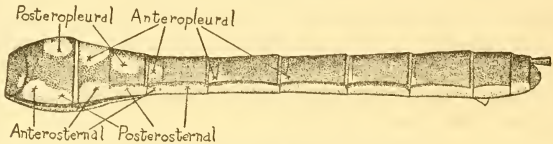
As *Somatochlora semicircularis* is a species not common in collections, especially in such large series, it seemed opportune to make careful descriptions and to publish notes and drawings based on the variations among the individuals.

Color of *Somatochlora semicircularis*, male, field No. 4.

Vertex metallic blue, finely and evenly punctate, evenly covered with yellow pile. Lateral ocelli yellow, central ocellus brown. Frons metallic blue, but with slightly more greenish tinge than vertex; each lateral face of frons with yellow triangle.¹ Antennæ black. Clypeus with center very pale yellow; wings of clypeus black; pile on lower edge yellow. Labrum black. Labium very pale yellow, coarsely punctate; pile white. Eyes brown above and gray below. Rear of head black, with submarginal row of white hairs.

Prothorax black, with anterior edge of dorsum white, and a diamond-shaped white "cushion" at posterior edge; this "cushion" covered with long white pile. Coxæ white on external surface, black on internal surface; legs black.

General color of mesothorax and metathorax metallic blue, with greenish reflections, thickly covered with long yellow pile, which is longer toward the ventral and posterior surfaces. Mid-dorsal carina



SOMATOCHLORA SEMICIRCULARIS.—ABDOMEN OF FEMALE SHOWING MARKINGS AND TERMS USED IN DESCRIBING THEM.

black. Ventral and antero-dorsal edges of mesepisternum and the antealar sinus yellowish. Mesepimeron with vertical, lenticular yellow spot. Metepimeron with much smaller elliptic yellow spot. Wings hyaline, except brown stigma, yellow anal triangle in hind wings, and white membranules, which are dusky on distal two-thirds in hind wing.

General color of abdomen black, with bluish reflections on segments 1-3.

The markings on the abdomen fall into two distinct series, viz, a pleural or lateral series, and a sternal or ventral series. The relationship of these series is well shown on figure 47; also it is shown, but not so well, in figures 46, 48, and 52. It appears, from a study of the drawings, that in the highest development in these series there would be on each segment both an anterior and a posterior spot in each series. This occurs in the sternal or ventral series in both sexes. (It must be remembered that in the ventral series these two spots on each segment are confluent and so form a solid stripe

¹The yellow or orange on either side of the frons in *Somatochlora semicircularis* is variable in extent, generally not tending to meet from either side to form a transverse band separating the dark-colored frons from the dark-colored nasus. In one female specimen, however, this band is completely present, and in five males and two females it is nearly complete, being interrupted a short distance only at the middle. Dr. Philip P. Calvert states that in some male specimens of this species from Maine the band is complete in every case. In the material upon which the present paper is based the tendency is in the opposite direction; i. e., toward the obliteration of the band.

along the sterna from segment 2 to segment 9. This stripe does not show in the drawings, because of the shape of the abdomen. The pleural or upper series is much more interrupted. The spot on segment 1 probably belongs to the sternal series. The accompanying text figure shows the application of the terms used in describing these series of spots. I might note here that figures 30-57 were drawn from dried material 14 months old, but excellently preserved. I believe that the coloration is substantially the same as in life, but I have noticed, particularly in two steamed specimens, some slight changes in coloration.

The segments of the abdomen in the male (see figs. 30-43) show always the following yellow markings:

Segment 1. A lateral, vertical, elliptical spot.

Segment 2. A large, round, posteropleural spot; a large, pear-shaped, anterosternal spot; a large, L-shaped, posterosternal spot, the angle of which runs down onto the genital lobe; a narrow band around posterior end of segment.

Segment 3. Anterosternal spot large, triangular, confluent with the long, narrow, posterosternal spot.

Segment 4. No pleural spots. Sternal spots narrow and confluent.

Segments 5-8. A small, round, anteropleural spot next spiracle. Sternal spots confluent, forming a streak along ventral edge.

Segments 9 and 10. Sternum yellow. Appendages black.

Figures 30-43 show the variations in the abdominal markings of 14 males. Because of the shape of the abdomen, the sternal marking of segments 4-8 does not show, but except for slight variations in width of this sternal stripe, it is for all specimens, both male and female, as described above.

Pile on abdomen short, scanty, and yellow.

Figures 26-29 show the variations in the abdominal appendages in the male. This variation is slight as compared with the other variations in the male. The tips of the superior appendages in life are elastic, and so they frequently vary in their position and direction of curve from having dried while forced out of shape. The differences shown in the tips of the four figures are due to this distortion in drying.

The following condensed table gives the measurements in the males:

Number of males.	Length of abdomen.	Number of males.	Length of hind wing.
	<i>mm.</i>		<i>mm.</i>
4	34	2	28
11	35	7	29
17	36	19	30
6	37	9	31
3	38	4	32

The following tables give the variations in the venation of the wings of the males:

Number of males.	Number of antecubitals in fore wing.	Number of males.	Number of antecubitals in hind wing.	Number of males.	Number of postcubitals in fore wing.	Number of males.	Number of postcubitals in hind wing.
17	7	2	4	6	5	5	6
17	8	38	5	20	6	20	7
6	9	1	6	12	7	14	8
1	10			3	8	2	9

Number of males.	Number of veins in triangle of fore wing.	Number of males.	Number of veins in triangle of hind wing.	Number of males.	Number of veins in internal triangle of fore wing.
3	0	21	0	3	1
36	1	20	1	2	2
2	2			36	3

By selecting from each column of the foregoing tables the character held by the greatest number of individuals, the following general description is made up: Male, abdomen 36 mm., hind wing 30 mm., eight antecubitals and six postcubitals in fore wing, five antecubitals and seven postcubitals in hind wing, one vein in triangle of fore wing, no veins in triangle of hind wing, and three veins in internal triangle of fore wing. It is interesting to note that among the 41 males none had this particular combination.

Color of *Somatochlora semicircularis*, female, field No. 12.

Vertex metallic blackish green, finely and evenly punctate and covered with dark pile. Ocelli tan-colored. Antennæ black. Frons metallic green, slightly lighter in color and more brilliant than vertex, evenly but more coarsely punctate than vertex; each lateral face with a yellow triangle.¹ Clypeus with center yellow, its wings metallic green, covered with yellow pile. Labrum black. Labium yellow, coarsely punctate, and covered with yellow pile. Eyes gray. Base of head black, with submarginal row of white hairs.

Prothorax black, with anterior edge of dorsum yellow, and a diamond-shaped, yellowish, cushion-like marking at posterior edge. Coxæ yellow on external and posterior surfaces, black on internal surface. Legs black.

General color of mesothorax and metathorax metallic green, with faint yellowish reflections, thickly and evenly covered with long yellow pile. Middorsal carina dark brown. Antealar sinus and ridges yellowish. Mesepimeron with vertical, yellow, oval spot. Metepimeron with faint yellow, oval spot. (Some females do not show this second yellow spot.) Wings hyaline, except brown stigma, a yellow tinge at base of wings, and opaque membranules.

Abdomen black, with a faint greenish luster, except as follows:

Segment 1. Side with a vertical, elliptical spot of buff-yellow.

¹ See footnote, p. 114.

Segment 2. A circular posteropleural spot. The two sternal spots confluent in a large semicircular spot. A narrow band around posterior end of segment.

Segment 3. Anteropleural spot large and elliptical. The two sternal spots confluent in a large blotch covering the lower sides and sternum of this segment.

Segments 4 and 5. Pleural spots absent. Sternal spots confluent, but much more restricted than in segment 3.

Segments 6 and 7. A small, round, anteropleural spot present. Sternal marking a narrow ventral stripe, as in segments 4 and 5.

Segment 8. No pleural spots. Sternal marking as in segments 4-7.

Segments 9 and 10. Entire sternal area yellow. Vulvar lamina yellow. Appendages black.

Pile on abdomen short, scanty, and yellow.

Figures 44-57 show the abdominal markings of 14 females. Because of the shape of the abdomen, the sternal stripe of segments 4-8 does not show. It is in all specimens as described above.

Figures 14-25 show the variations in the vulvar lamina in 12 females. On the base of the lamina there is a black spot, which varies in size in the different specimens. Figure 20 is a ventral view of the same lamina as is shown in figure 5.

The following table gives the measurements of the 14 females:

Number of females.	Length of abdomen.	Number of females.	Length of hind wing.
	<i>mm.</i>		<i>mm.</i>
1	32	1	29
3	35	5	30
4	36	3	31
3	37	2	32
2	38	3	33
1	39		

The following tables give variations in certain characters of wing venation in the females:

Number of females.	Number of antecubitals in front wing.	Number of females.	Number of antecubitals in hind wing.	Number of females.	Number of postcubitals in front wing.	Number of females.	Number of postcubitals in hind wing.
4	7	1	4	1	5	1	6
6	8	12	5	5	6	8	7
4	9	1	6	8	7	4	8
						1	10

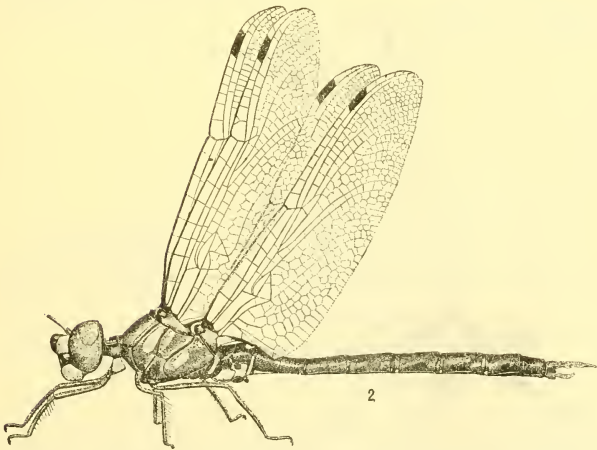
Number of females.	Number of veins in triangle of fore wing.	Number of females.	Number of veins in triangle of hind wing.	Number of females.	Number of veins in internal triangle of fore wing.
14	1	8	0	14	3
		6	1		

By selecting from each column of the foregoing tables the character held by the greatest number of individuals the following general description is made up: Female, abdomen 36 mm., hind wing 30 mm., eight antecubitals and seven postcubitals in fore wing, five antecubitals and seven postcubitals in hind wing, one vein in triangle of fore wing, no veins in triangle of hind wing, three veins in internal triangle of fore wing. No female had this combination of characters.

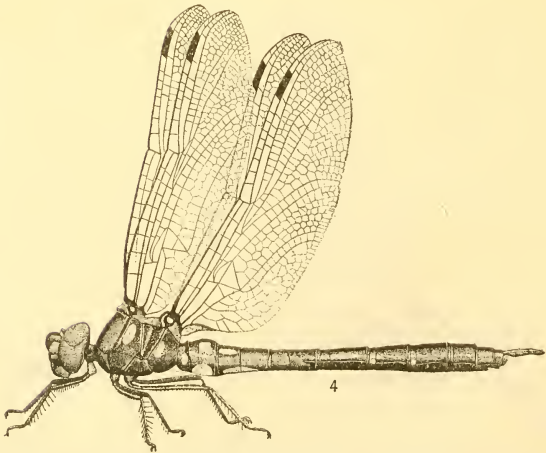
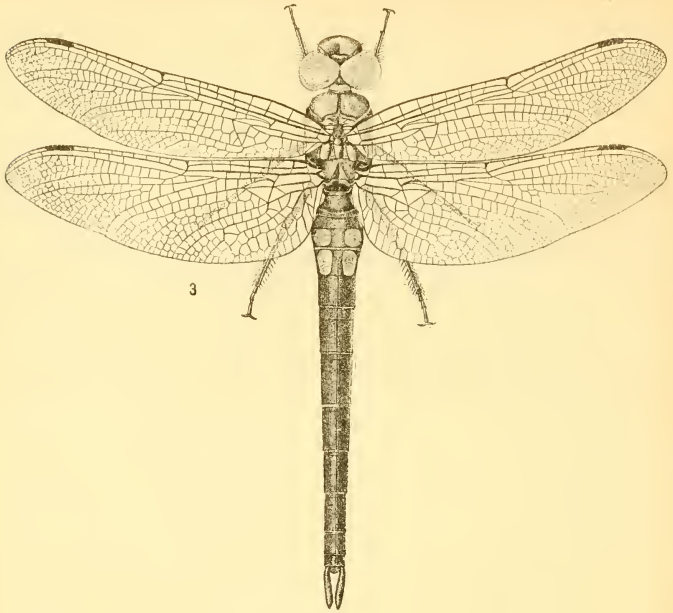
SYMPETRUM CORRUPTUM (Hagen).

One female belonging to this species was taken 1 mile above the outlet, on the south shore, and 8 or 10 individuals were seen along the lake shore.

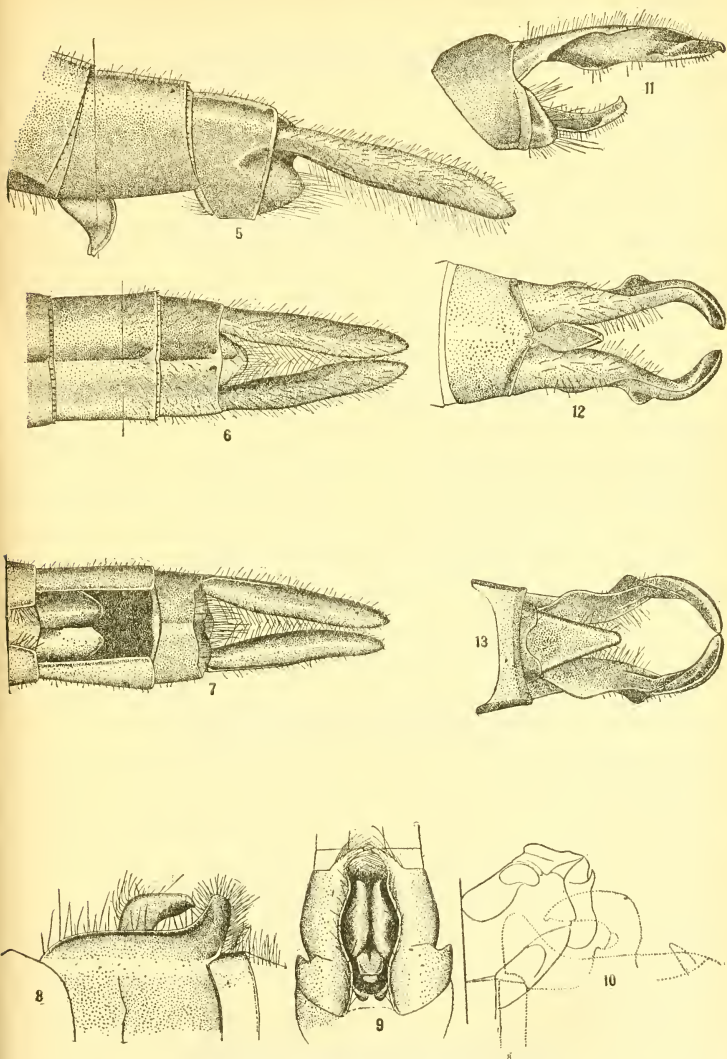
These species are widely distributed over North America, and of the last three, each in its own genus is an exceptionally vigorous and wide flier.



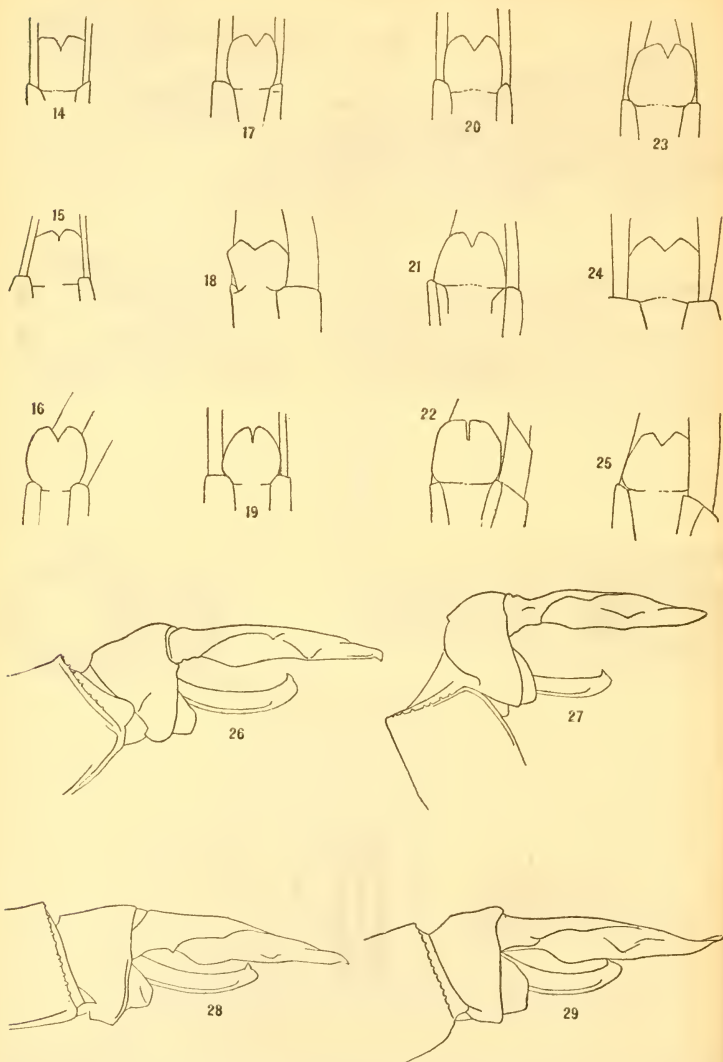
FIGS. 1-2.—*SOMATOCHLORA SEMICIRCULARIS*, MALE. 1. DORSAL VIEW. 2. LATERAL VIEW.



FIGS. 3-4.—*SOMATOCHLORA SEMICIRCULARIS*, FEMALE. 3. DORSAL VIEW. 4. LATERAL VIEW.

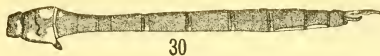


FIGS. 5-13.—*SOMATOCHLORA SEMICIRCULARIS*. 5. LATERAL VIEW OF SEGMENTS 9 AND 10 OF ABDOMEN OF FEMALE, FIELD NO. 7. 6. DORSAL VIEW OF SEGMENTS 9 AND 10 OF ABDOMEN OF FEMALE, FIELD NO. 12. 7. VENTRAL VIEW OF SEGMENTS 9 AND 10 OF ABDOMEN OF FEMALE, FIELD NO. 12. 8. LATERAL VIEW OF SEGMENT 2 OF MALE, SHOWING GENITAL LOBE AND ANTERIORE HAMULE. 9. VENTRAL VIEW OF SEGMENT 2 OF SAME MALE AS FIGURE 8. 10. LATERAL VIEW OF SEGMENT 2 OF MALE, SHOWING GENITAL LOBE AND ANTERIORE HAMULE. 11. LATERAL VIEW OF SEGMENT 10 AND APPENDAGES OF MALE. 12. DORSAL VIEW OF SEGMENT 10 AND APPENDAGES OF MALE. 13. VENTRAL VIEW OF SEGMENT 10 AND APPENDAGES OF MALE.

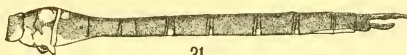


FIGS. 14-25.—*SOMATOCHLORA SEMICIRCULARIS*. VULVAR LAMINA OF 12 FEMALES, SHOWING SLIGHT VARIATIONS DUE LARGELY TO DISTORTION IN DRYING.

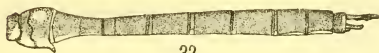
FIGS. 26-29.—*SOMATOCHLORA SEMICIRCULARIS*. LATERAL VIEWS OF SEGMENT 10 AND APPENDAGES OF 4 MALES, SHOWING VARIATIONS IN TIP DUE TO DISTORTION IN DRYING.



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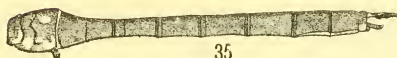
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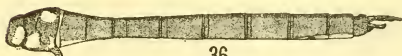
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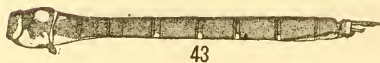
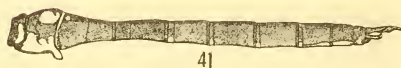
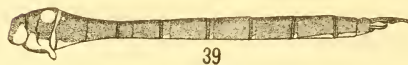
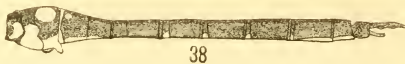
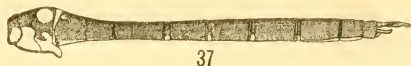


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FIGS. 30-36.—*SOMATOCHLORA SEMICIRCULARIS*. LATERAL VIEWS OF ABDOMEN IN 7 MALES, SHOWING DIFFERENCES IN COLOR PATTERN.



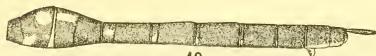
FIGS. 37-43.—*SOMATOCHLORA SEMICIRCULARIS*. LATERAL VIEWS OF ABDOMEN IN 7 MALES, SHOWING DIFFERENCES IN COLOR PATTERN.



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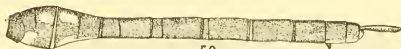
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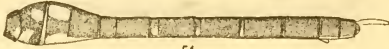


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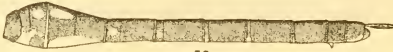


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FIGS. 44-50.—*SOMATOCHLORA SEMICIRCULARIS*. LATERAL VIEWS OF ABDOMEN IN 7 FEMALES, SHOWING VARIATION IN COLOR PATTERN AND LENGTH.



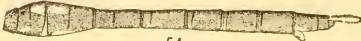
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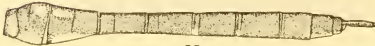
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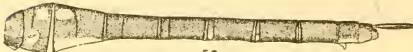
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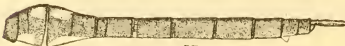
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FIGS. 51-57.—*SOMATOCHLORA SEMICIRCULARIS*. LATERAL VIEWS OF ABDOMEN IN 7 FEMALES, SHOWING VARIATION IN COLOR PATTERN AND LENGTH.