

THE LARVA OF *SOMATOCHLORA FILOSA*
(ODONATA:CORDULIIDAE)

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ABSTRACT

The larva of *Somatochlora filosa* (Hagen) is described from 3 males reared from the egg to the final instar. One male transformed to the adult 669 days after the egg was laid. *S. filosa* last instars have 9 palpal setae whereas all other described North American *Somatochlora* larvae with dorsal abdominal hooks have 8 or less palpal setae. The larva of *S. filosa* resembles that of *S. provocans* Calvert most closely but has a less acuminate epiproct and more numerous and longer hairs, especially on the vertex and tibiae. *S. provocans* has well developed ventral triangular sclerites at the antero-lateral corners of abdominal segments 3 and 7; in *S. filosa* these are absent or obscure.

The breeding habitat and larvae of *Somatochlora filosa* (Hagen) have not yet been found in nature, but the larvae can be described from several I reared from the egg. Eggs were obtained from 4 *S. filosa* females by repeatedly tapping their abdomens to the surface of water in separate jars. The eggs began hatching at room temperature in 21, 22, 24, and 32 days. The eggs were white when deposited, turning red-brown within a day, oval, and covered with a thin layer of jelly except over the projecting micropyle at 1 end. The mean longest diameter of 5 eggs was 0.64 mm. When the eggs hatched the pronymph skin remained attached and protruded from a slit in the chorion. The pronymph skin is covered with transverse rows of short, fine points which may help the hatching process. Eleven 2nd larval instars were separated into small jars of aged tap water and fed plankton from a pond. Water which evaporated was replaced with distilled water. The larvae, when they were large enough, were fed pieces of enchytreid worms and later the whole worms. The larvae were slow moving and non-aggressive with a small appetite, but in the last instar their appetite suddenly increased greatly. The 1st few instars sprawled on the bottom, but the later ones buried themselves to the depth of their bodies during the day. They slowly crawled about at night and usually cast their exuviae then. Some individuals preferred to cling to the wall of the jar rather than the bottom. Each rearing jar became a small ecosystem in which the larvae survived very well. Most died, however, when food ran out for about a month. This rearing system had 2 disadvantages. First, the larvae and thus their exuviae became covered with a flocculent epibiota that could not be removed with either H₂O₂ or NaOH solutions. The epibiota obscures morphological details and is very time consuming to scrape off. However, the mold which often kills odonate larvae in the laboratory did not develop. Second, although the rearing jars were examined almost daily, some exuviae were apparently destroyed by the microcrustaceans in the jars. I did not recover more than 7 exuviae from any of the jars.

I did not examine all of the exuviae obtained from early instars of *S. filosa*, nor did I quantify most characters. All the exuviae from the 3 larvae reaching the last instar were inspected. I interpret the results from this

limited growth study to mean that *S. filosa* has 13 larval instars including the pronymph. Data on total length, labial setae, and wing sheaths are given in Table 1. The average growth rate between instars based on total length was 1.27, close to the theoretical growth rate (Przibram factor) of 1.26 discussed by Bick (1951). The data obtained on *S. filosa* are essentially similar to the results of Miyakawa (1971) on *S. viridiaenea* Uhler. The latter also developed in 13 instars including the pronymph. I calculate an average growth rate of 1.28 between instars based on head width from his data.

TABLE 1. SOME CHARACTERS OF LARVAL INSTARS 2-13 IN *Somatochlora filosa*.

Instar	Number Examined	Total Length in mm	Theoretical Total Length in mm*	Palpal Setae	Premental Setae	Wings**
2	6	1.2-1.6	1.6	0-1	0	-
3	1	1.9	2.0	1	1	-
4	2	2.4-2.9	2.5	2-3	2-4	-
5	1	3.3	3.2	3	4	-
6	4	4.1-4.4	4.0	3	5-6	+
7	5	5.1-5.4	5.1	3-4	5-7	+
8	4	6.3-6.6	6.4	4	7-8	+
9	2	8.0-8.3	8.1	4	9	1
10	3	10.4-10.8	10.2	5-6	9-10	3
11	3	13.8-14.4	12.8	6-7	10-11	3-4
12	3	17.4-18.1	16.1	8	11-12	4-5
13	3	19.0-22.0	20.3	9	12-13	7-8

*Obtained by dividing the mean total length of instar 13, 20.3 mm, successively by 1.26.

**Number of abdominal segment to which the hindwing sheath extends.

Three male *S. filosa* larvae reached the last instar in 540, 591, and 603 days from egg laying. The 1st was allowed to transform 669 days after the egg was laid. Known time spent in other instars was 14 days in 5, 21-32 in 6, 22-67 in 7, 13-26 in 8, 48 in 10, 47-156 in 11, 73-151 in 12, and 130 in 13. Miyakawa (1971) reared 5 males and 3 females of *S. viridiaenea* to adult from the same egg batch. Beginning with *hatching*, the males required 176-280 days for development, the females 530-629. The male *S. filosa* that transformed remained just above the water surface on a stick for 3 days before climbing higher at 1137 on 16-VI-1976. He reached the top of the stick at a height of 0.3 m at 1200, and emergence began at 1247. He reached the full hanging out position with all legs free of the exuvia in 7 min, flexed up to stand on the exuvia in 18 more min, and the wings fully expanded in 16 additional min.

DESCRIPTION OF LARVA: Taken from 3 male last instar larvae. Total length 19-22 mm. Colors from life: In alcohol the green becomes brown. Antennae brown; 7 segmented; basal 2 segments much stouter, hairier, and darker; 4.7-5.0 mm long; ratio of segments from proximal to distal approximately 12:15:12:7:9:11:12. Rostral shelf brown, vertex and dorsal surface of head dull green. Compound eyes and a prominent mask-like marking anterior to them dark brown. Head width 6.2-6.7 mm, ratio of width to length 2.1-2.3. A row of bristles on front margin of rostral shelf, a short row of

hairs above median ocellus, a few setae on each side of the dorsal surface of the vertex, and a transverse row of long hairs between compound eyes along the rear margin of mask-like marking. Bristles on dorsal occiput increasing in number on sides and rear especially on postero-lateral corners, tending to be grouped in bands stretching posteriorly from compound eyes and in 2 groups medial to those bands. Labium with 9 setae on each palp, the most proximal shorter but set in a pigmented socket like the rest. Palps with 9 or 10 anterior crenations with about 6-7 setae on each, the most ventral seta usually the longest. Border of crenations, ventral margin of palps, and anterior margin of prementum serrate. Prementum as wide as long with 12-13 setae on each side, the inner 3 or 4 much shorter.

Thorax pale green with bilateral small dark brown spots at anterior margin of mesothorax and another above and behind the metathoracic spiracles. Sloping sides of synthorax smooth with a few hairs. Wing sheaths brown, darker at the base. Hindwing sheaths 5.4-6.7 mm long, extending to or over abdominal segment 7. Legs pale brown with a darker ring $\frac{3}{4}$ out from the base on the femora. Femora with an irregular row of setae dorsally, most numerous on the 1st. Tibiae with anterior and posterior rows of short setae dorsally. Hind femora 6.6-7.0 mm long, hind tibiae 7.6-8.3. Ratio of tibia to femur length for the 1st leg is 1.3-1.4, 2nd leg 1.1, and 3rd leg 1.1. Ratio of hind femur to head width is 1.0-1.1 and of hind tibia to head width 1.1-1.4.

Abdomen pale green on sides shading to brown dorsally, 13-14 mm long, 7.5-8.8 mm wide at segment 6. Each tergite has a transverse row of hairs on the posterior margin plus other scattered hairs. Lateral carinae have a fringe of hairs, becoming longer posteriorly, the fringe on 9 is 2-3X longer than the fringe on 8 and sweeps back to the tips of the anal appendages. A dense fringe of long brown hairs on the posterior margin of 9 also extends to the tips of the anal appendages. Dorsal hooks on 4 or 5-9, shown in Fig 1. One male had a very fine setaceous spine on 4, in the other 2 males only 2 or several setae marked this site. Hook on 5 blunt, 0.14-0.27 length of tergite 5. Hooks on 6-9 each extend to rear of their tergite or beyond in dorsal view, hook on 9 about to middle of 10. Hooks appear blunt in dorsal view, sharp in lateral view with dorsal margin slightly arcuate and ventral margin straight. Lateral spines on 8 and 9 curve slightly inward and are well set off from lateral margin in dorsal view by an indentation. The ratio of length to width of the spine on 8 is 1.0-1.8, the same for the spine on 9 is 1.1-2.0. Ratio of length of spine on 8 to spine on 9 is 0.7-0.9. Ratio of whole margin of 8 including spine to length of spine of 8 is 5.0-6.0. Same ratio for 9 is 4.5-4.8. The ratio of the margin of 8 excluding the spine to the length of the spine is 4.0-5.0. The latter ratio for 9 is 3.5-3.8. In dorsal view the cerci, epiproct, and paraprocts appear progressively longer in that order. Epiproct of male scarcely acuminate with a small anteapical tubercle shown in Fig 1. Ratio of length to width of epiproct 1.1-1.3. Ratio of length of epiproct to length of tergites 9 plus 10 is 0.9-1.3. Cerci straight edged laterally with incurving tips, $\frac{1}{6}$ shorter than epiproct. Ratio of length to width of cerci 3.9-4.2. Ratio of length of cerci to length of tergites 9 plus 10 is 0.8-1.1.

COMPARISON WITH OTHER SPECIES: Walker (1925), in his monograph on *Somatochlora*, placed *S. filosa* and *S. provocans* Calvert together on the basis of adult structure to form his group 4. Three other species described

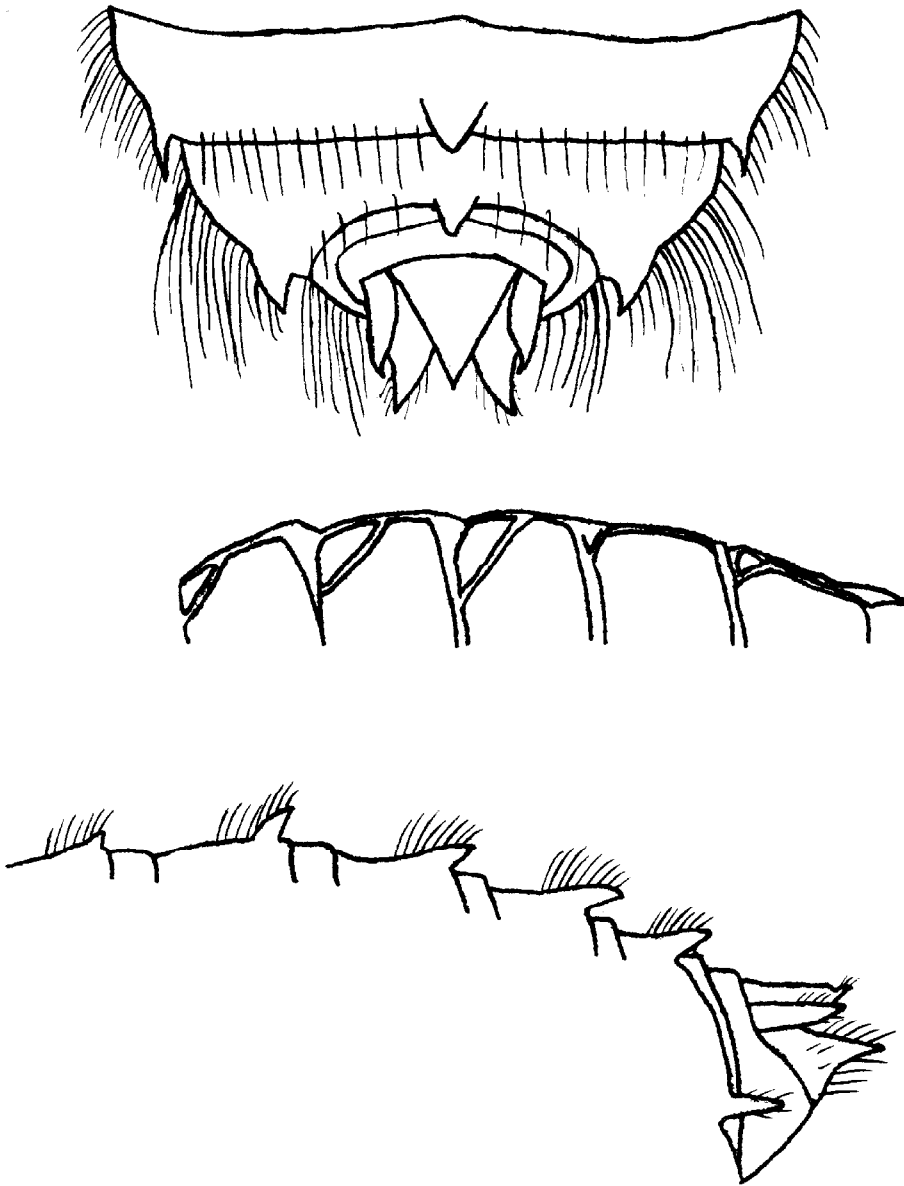


Fig. 1. *Somatochlora filosa*, last instar from Gainesville, Alachua Co., Florida. Top to bottom: Dorsal view of abdominal segments 8-10, ventral view of abdominal segments 4-8, and left lateral view of abdominal segments 5-10.

after 1925 would also fit in Walker's group 4: *S. calverti* Williamson and Gloyd, *S. margarita* Donnelly, and *S. ozarkensis* Bird. The larva of *S. ozarkensis* was characterized by Pritchard (1936). Tennessen (1975) described the larva of *S. provocans*. The larvae of *S. calverti* and *S. margarita* have not been described.

The 3 described larvae of group 4 all have the cerci shorter than the epiproct. They can be separated as follows: Last instar *S. filosa* has 9 palpal setae, the other 2 species 8 or less. *S. ozarkensis* has low, blunt, dorsal

hooks, the others long, sharp hooks in lateral view. *S. filosa* resembles *S. provocans* most closely but has a less acuminate epiproct and more numerous and longer hairs, especially on the vertex and tibiae. All other described North American *Somatochlora* larvae which have dorsal hooks have 8 or less palpal setae, and the cerci equal or exceed the epiproct in length.

Schmidt (1951) found considerable variation among European species of *Somatochlora* larvae in the triangular sclerites of the abdomen. These sclerites are formed by a suture dividing off the antero-lateral corner of the ventral surface of certain segments of the abdomen. In *S. filosa*, the triangular sclerites are present on 4-6 and 8, shown in Fig 1. One male has small and obscure triangular sclerites on 3 and 7. In 1 *S. provocans*, these sclerites were present on 3-8, in 1 *S. tenebrosa* (Say) on 4-6, and in 1 *S. linearis* (Hagen) on 3-6 and 8. Thus the triangular sclerites may have some taxonomic value.

In Needham and Westfall's key to *Somatochlora* larvae, (1955), *S. filosa* keys out with *S. linearis* in couplet 5. The following emendation adds *S. filosa* to the key. Tennessen (1975) added *S. provocans* to this key at couplet 7.

- 5—Lateral abdominal spines at least 1/2 as wide as long, epiproct not acuminate 5a
 —Lateral abdominal spines less than 1/2 as wide as long, epiproct acuminate with a very slender tip..... 6
 5a—Palpal setae 9, cerci 1/6 shorter than epiproct, prominent fringe of hairs on rear edge of abdominal tergites..... *filosa*
 —Palpal setae 6-8, cerci equal to epiproct, no posterior fringe of hairs on abdominal tergites *linearis*

The emerged male *S. filosa* with associated series of exuviae is in the Florida State Collection of Arthropods at Gainesville; the remainder are in the author's collection.

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