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DESCRIPTION OF THE NYMPH OF *EPITHECA (TETRAGONEURIA) SPINOSA* (HAGEN) (ODONATA:CORDULIDAE)

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ABSTRACT

The final instar nymph of *Epithec* (*Tetragoneuria*) *spinosa* (Hagen) is described based on reared specimens from Virginia and Maryland, with additional exuviae from Florida. It is most similar morphologically to *E. canis* (McLachlan), but is slightly larger. Mean cerci length was shorter in *spinosa* (0.85 mm vs. 0.99 mm in *canis*). Ratio of cerci length to epiproct length averaged 0.57 in *spinosa* compared to 0.70 in *canis*. Ratio of cerci length to length of lateral spine on abdominal segment 9 was less than 1.0 in *spinosa* and greater than 1.0 in *canis*. This ratio was the most reliable character found to distinguish the two species. Dorsal hooks in *spinosa* project posteriorly at a lower angle than in *canis*.

INTRODUCTION.

Epithec (*Tetragoneuria*) *spinosa* (Hagen) is an uncommonly observed species, distributed along the east coast from New Jersey south to Georgia (Needham and Westfall 1955), then west to northwest Florida (Dunkle 1992), with spotty occurrences in a northwest direction to western Kentucky and eastern Oklahoma (Fig. 1). Adults have been observed flying near lowland swampy areas, very early in the season (as early as March 16 in Florida; latest date is June 6 in New Jersey). However, the exact habitat of the nymphs was unknown until recently.

Needham (1901) presented a key to *Tetragoneuria* nymphs in which he included *T. spinosa* by supposition, but Kormondy (1959) correctly pointed out that Needham's nymphs were *T. canis* McLachlan.¹ The nymph had not been associated with the adult until 1978 when Frank Carle reared several individuals in southeast Virginia. His generous loan of exuviae provided the majority of

specimens for this description. Exuviae from Florida and Maryland were also studied.

Adult characteristics indicate that *E. spinosa* is most closely related to *E. canis* (McLachlan), and this relationship is corroborated by nymph characteristics. *E. canis* is a northern species, occurring across the northern United States and southern Canada (Kormondy 1959). However, in the eastern U. S., it has been recorded as far south as central Pennsylvania (Beatty, Beatty, and Shiffer 1969, 1970) and a nymph has been collected in Tucker County, West Virginia (unpubl., Florida State Collection of Arthropods). I examined *E. canis* nymphs from CT, ME, NY, VA, WV, and WI.

DESCRIPTION.

Measurements (mm): Total length 21.5 – 23.7; head width 5.6 – 6.2; abdomen length 12.1 – 14.8; abdomen width 8.7 – 9.9 (maximum at seg. 6); hind femur length 6.9 – 7.6.

Head: Widest across eyes, length only slightly more than half its maximum width (ratio 0.52–0.55). Relative lengths of antennal segments, from 1 to 7, approximately 22:28:31:21:30:33:31. Prementum 7/8 as long as maximum anterior width, with 6 or 7 long setae and 3 or 4 short setae on each side of median line; usually 6 or 7 palpal setae, rarely 8. Movable hook 0.8 – 1.0 mm long; distal margin of palpal lobe deeply crenulate, with 8 lobes bearing 4 to 6 stout setae.

Thorax: Tergite 1 3.5–3.9 mm wide across epaulets; dark brown middorsal spot and lateral spot separated by pale area; dark brown lateral band dorsad of supracoxal armature contiguous with lateral wide dark brown band on pterothorax. Femora with two dark brown bands, tibiae with one brown band.

Abdomen: Maximum abdomen width (at segment 6) about 0.71 abdomen length (range 0.63–0.78). Dorsal hooks (Fig. 2) present on segments 2–9; hook on 2 smaller than on 3; hooks slender on 1 to

¹The genus *Tetragoneuria* Hagen was synonymized with *Epithec* Burmeister by Walker (1966), although I accord it subgeneric rank.

4, stouter on 6, and very stout on 7 to 9; hooks on seg. 2 to 6 project posteriorly at an angle of approximately 40° (36° to 42°) from horizontal, on 7 to 9 decreasing from 25° to less than 10°; few stout setae on dorsal margin of hooks on seg. 2 to 5, numerous on 6 to 9. Lateral spines on seg. 8 from 0.42 to 0.60 mm long, on 9 from 1.07 to 1.29 mm long, slightly incurved, tips usually even with tips of paraprocts, although sometimes not extending that far; numerous stout setae along lateral margins of seg. 8 and 9 (Fig. 3). Cerci 0.77-0.93 mm long, epiproct 1.37-1.61 mm long; cerci 0.52-0.65 as long as epiproct (average 0.57); paraprocts project 0.18-0.30 mm beyond tip of epiproct (Fig. 3). Cerci 0.72 times as long as lateral spines on seg. 9, on average (range 0.64 - 0.84). Color pattern on exuviae very faint, but median dark brown pattern appears similar to other species of genus; pair of small dark brown spots on tergites 3 to 10.

COMPARISON WITH *E. CANIS*

The nymph of *E. spinosa* is very similar to that of *E. canis*, from which it differs in size and in several morphological characteristics. *E. spinosa* is larger than *E. canis*, with only very slight overlap in the specimens I studied regarding head width and abdomen width, hind femur length, length of lateral spine on abdominal segment 9, and ratio of cerci length to 1) epiproct length and to 2) lateral spine on 9 length (Table 1). On average, *E. spinosa* has a wider head, longer hind femur, greater total length and abdomen width, but shorter cerci and lower ratio of cerci length to epiproct length and to lateral spine on 9 length. Structural differences exist in the dorsal hooks, anal appendages and lateral spines, and prementum as follows.

Dorsal Hooks: The dorsal hook on segment 2 is smaller than the hook on segment 3 in *E. spinosa* whereas these hooks are approximately equally sized in *E. canis* (Fig. 2). The dorsal hooks on abdominal segments 2 through 6, in lateral view, project posteriorly at an angle approximating 36° to 42° in *E. spinosa* versus 55° to 60° in *E. canis* (Fig. 2). Also, the anterior portion of the dorsal hook on segment 7 is more gradually raised in *E. spinosa*, making it appear more rounded and shorter than in *E. canis*.

Anal Appendages and Lateral Spines: The paraprocts, in lateral view, are nearly straight in *E.*

spinosa, whereas they are slightly to moderately decurved in *E. canis*. In some *E. canis*, the epiproct is also decurved, as shown in Fig. 2. The lateral spines of abdominal segment 9 project posteriorly to the exact level of the tips of the paraprocts in *E. spinosa*, whereas they do not project this far in *E. canis* (Fig. 3). Walker and Corbet (1975) described *E. canis* segment 9 lateral spines as "not reaching quite as far back as tips of paraprocts, about as long as the length of the segment in mid-dorsal line". In two *E. spinosa* specimens from MD, the tips of the segment 9 lateral spines did not reach the tips of the paraprocts (short by about 0.25 mm), similar to *E. canis*. The comparison of the tips of the lateral spines and paraprocts depends on the degree to which segment 10 protrudes from segment 9. In some *E. canis*, if segment 10 is telescoped forward into segment 9, then the tips of the lateral spines of segment 9 will appear to extend nearly as far back as the tips of the paraprocts. A more reliable character is the ratio of cerci length to segment 9 lateral spine length, which was less than 1.0 in all 15 *spinosa* specimens, but greater than 1.0 in all *canis* measured.

Premmentum: The two species can not be distinguished by number of palpal setae, although a larger percentage of *E. spinosa* palpal lobes had 6 setae (43% had 6 setae, 53% had 7, and 4% had 8) than did those of *E. canis* (6% had 6 setae, 88% had 7, and 6% had 8). The number of premental setae appears to be about 90% reliable to separate the species. Most *E. spinosa* (83%) had 6 large premental setae and 3 or 4 smaller ones on each side of the median line (4 specimens had 7 large on one side, and 1 had 7 large setae on each side). *E. canis* usually had 7 or 8 large + 3 or 4 smaller ones per side (94%); only one exuviae had 6 + 4 on one side.

COMPARISON WITH OTHER TETRAGONEURIA SPECIES.

The nymphs of *E. spinosa* and *E. canis* differ from all other known species of *Epitheca* (*Tetragoneuria*) in having short lateral spines on abdominal segment 9, the tips extending posteriorly to the level of the tips of the paraprocts at most. These spines extend well beyond the tips of the paraprocts in the other species of the subgenus (Needham and Westfall, 1955). The similarities in the nymphs of *E. spinosa* and *E. canis* and the differences with the other species of

the subgenus indicate these species are closely related, a closeness suggested also by the shape of the adult male cerci. The lower number of palpal and premental setae and the longer lateral spines of segment 9 in *E. spinosa* indicate it has closer affinities to other species of the subgenus than does *E. canis*.

HABITAT NOTES

E. spinosa has been found in swamps and swampy lake margins with some movement of water (Dunkle and Westfall 1982; Daigle, pers. comm.; Orr, pers. comm.). *E. canis* occurs in dystrophic bog lakes and streams (Kormondy 1959).

ACKNOWLEDGMENTS

I am indebted to Frank L. Carle, Jerrell J. Daigle, Richard Orr, and M. J. Westfall, Jr. for loans of exuviae and habitat notes.

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TABLE 1. Mean measurements of nine mensurable characteristics of *Epitheca spinosa* (n=15) and *E. canis* (n=10) nymphs; ranges in parentheses

	<i>spinosa</i>	<i>canis</i>
Head width (mm)	6.0 (5.6-6.2)	5.5 (5.3-5.8)
Prothorax width (mm)	3.7 (3.5-3.9)	3.4 (3.2-3.7)
Hind femur length (mm)	7.2 (6.9-7.6)	6.7 (6.2-6.9)
Total length (mm)	22.8 (21.0-23.7)	21.0 (18.5-22.3)
Abdomen width (mm)	9.5 (8.7-9.9)	8.4 (7.6-8.9)
Cercus length (mm)	0.85 (0.77-0.93)	0.99 (0.91-1.03)
Lateral spine on seg. 9 length (mm)	1.18 (1.07-1.29)	0.84 (0.71-0.93)
Length cercus / length epiproct	0.57 (0.52-0.65)	0.70 (0.66-0.75)
Length cercus / length lat. spine 9	0.72 (0.64-0.84)	1.18 (1.05-1.34)

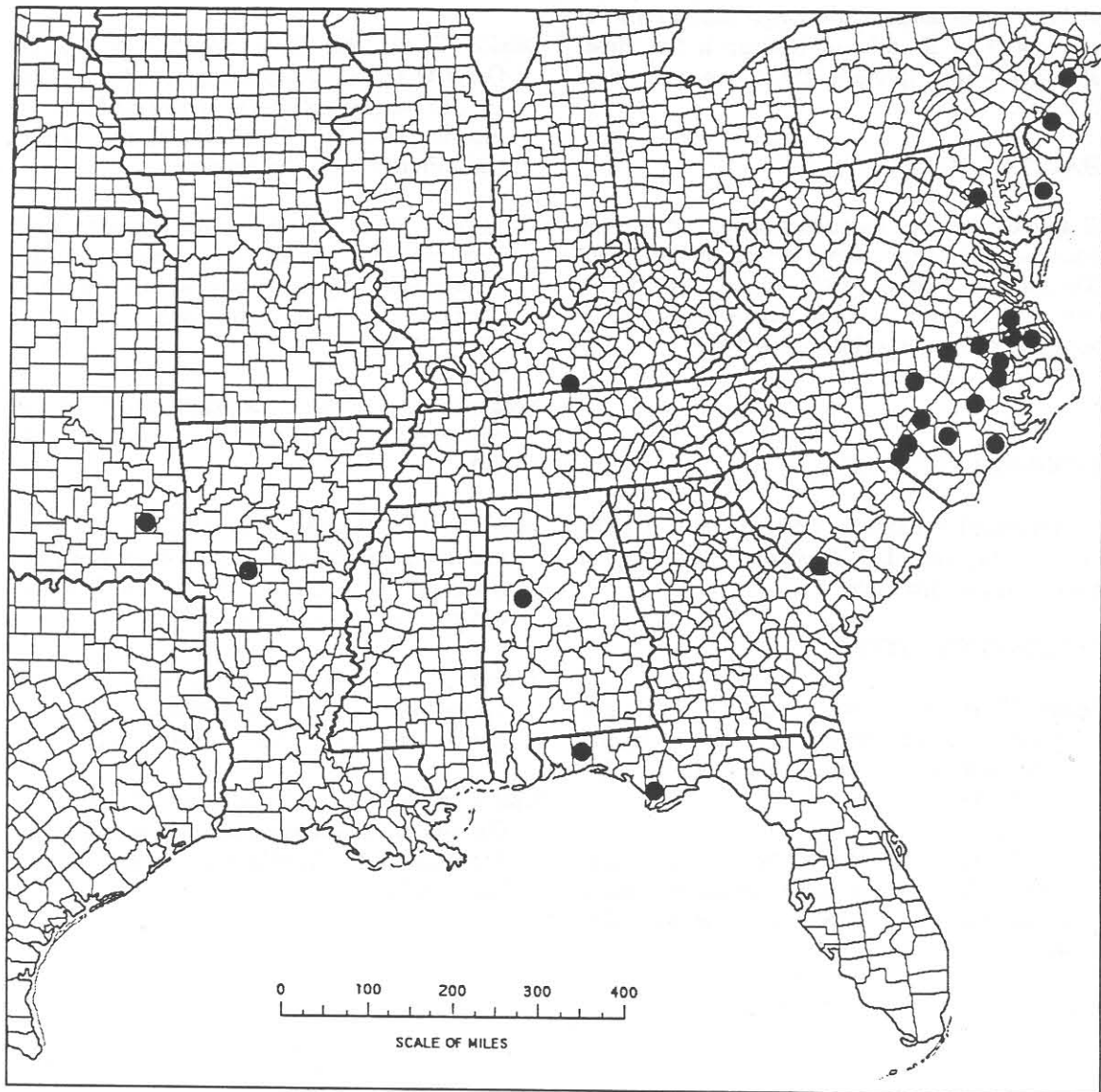
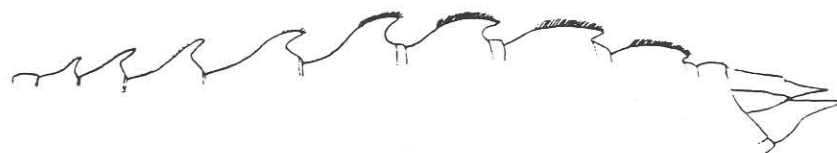
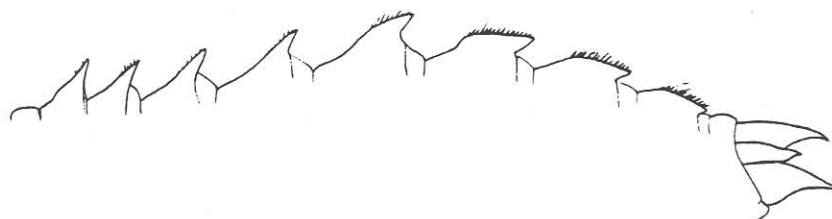


Figure 1. Map of eastern United States showing known distribution by state and county of *Epitheca spinosa* (Hagen).

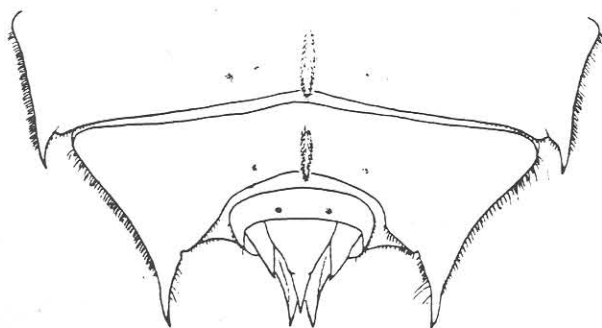


A *spinosa*

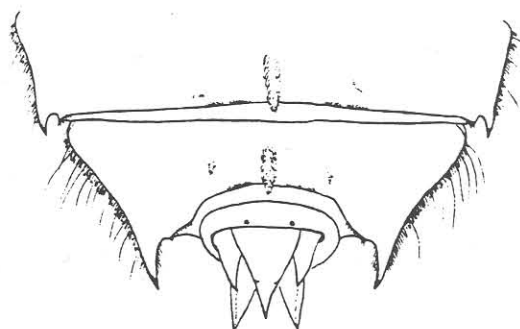


B *canis*

Fig.2. Profile of dorsal hooks and anal appendages (lateral view). Fig. 2A. *Epitheca spinosa*. Fig 2B. *E. canis*.



A *spinosa*



B *canis*

Fig.3. Abdominal segments 8-10 plus anal appendages, dorsal view. Fig. 3A *Epitheca spinosa*. Fig. 3B. *E. canis*.

THE LARVA AND ADULT MALE OF *SOMATOCHLORA GEORGIANA* WALKER (ODONATA: CORDULIIDAE)

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INTRODUCTION

Recently, I discovered the previously unknown larva of *Somatochlora georgiana* Walker in Florida. This report includes the larval description plus a description of the previously undescribed male (taken from Carle, 1982), bionomics, distribution records, and characteristics separating *S. georgiana* larvae from similar species. In the future, we hope to update this report as we uncover more records and information about *Somatochlora georgiana*.

ADULT DESCRIPTION

Root (1924) described a female *Somatochlora* collected in Lee County, Georgia, but did not name it. Walker (1925) redescribed the female and named it *S. georgiana*, and suggested it belonged to the *linearis* or *tenebrosa* group. Needham and Westfall (1955) repeated the female description.

The most striking aspect of the male insect is that it lacks metallic green coloration. The color is brown grading to red-brown on the distal end of the abdomen, and with yellow thoracic markings. Carle (1982) described the adults, including the previously undescribed male as such: "Length 46-49 mm; abdomen 33-37 mm; hind wings 31-34 mm. Labrum yellowish brown; postocular margin of head brown; lateral thoracic spots bright yellowish white; outer surface of tibiae yellowish white; fore wings each with 6 or 7 antenodal crossveins, and with maximum of 2 cell rows in trigonal interspace; abdominal segments 5-7 without laterobasal yellow spots; male cerci each with apices curved dorsally (Figure 3), lateral carinae well developed in basal 1/2 without basal tooth or angulation, ventral carinae extended to apex and evenly convex in basal 1/2, and without ventroapical spine. Female vulvar lamina directed ventrally (Fig. 4); female cerci 1.7-2.1 mm long."

LARVAL DESCRIPTION

Material (5 exuviae): Uniformly brown, not very hairy.

Head: typical for genus; hairs distributed as follows: a group of 10 to 15 long hairs over the posterolateral convexities and a few lateral ones below these; a thin fringe of slightly shorter marginal hairs on the frons, and a row of even shorter hairs on the lateral half of the postocular suture. Folded labium reaching posteriorly to base of middle coxae; prementum about as broad as long, constricted near the base; premental setae 12-13, the inner 3 much shorter than the others; palpal setae 7; low crenations of distal margins of palpus with a group of spiniform setae in a graded series, usually 6-8, the longest about 4x as long as one of the shallow crenations.

Thorax: Hind femur averages about one-fifth longer than width of head, each with 2 to 4 scattered dorsal hairs and no ventral hairs; length of hind tibiae about 1/2 as wide as abdomen; tibial setae numerous. Hind wing sheath usually reaching the middle of abdominal segment 6.

Abdomen: widest between segments 5 and 6; dorsal hairs nearly absent; lateral marginal hairs forming a fairly dense fringe which is short and inconspicuous, on 9 about equal to one-half the lateral length of the segment (excluding the spine), and twice as long as basal width, those of 8 about one-half as long as those of 9. Well-developed dorsal hooks on segments 5-9 increasing in size with segment 5 the smallest and segment 6 the highest (Fig. 2). In lateral view, dorsal hooks on 7-9 slightly decurved. Lateral abdominal spines less than one-half as wide as long, segment 9 spine longer than segment 8 spine. Anal appendages as long as mid-dorsal lengths of segments 9 + 10, the epiproct acuminate with a slender tip (Fig. 1). Epiproct distinctly shorter (male) or nearly the same (female) length as cerci; paraprocts equal to the cerci in length.

Measurements (mm): total length 18.0-20.0; abdomen 10.0-11.0; width of abdomen 7.5-8.0; hind wing 6.0; hind femur 7.0-8.0; width of head 5.5-6.0.

BIONOMICS

Resembles a small *Somatochlora walshii* Scudder or *S. provocans* Calvert in the field. However, *S. walshii* has a dorsal hook on segment 4 while the epiproct is longer than the cerci in *S. provocans*. The larvae of *Somatochlora georgiana* apparently inhabit pools of clear, tannic forest streams. At the Florida Gum Creek site, two emerging males and other exuviae were clinging to blades and stems of the emergents, Bur-weed (*Sparganium americanum*) and Giant Sedge (*Carex gigantea*). Water Star-grass (*Heteranthera dubia*) covered the sand and gravel bottom. Exuviae of *Somatochlora linearis* were also found at the site and a few teneral *S. linearis* adults were patrolling over the road. No adults of *S. georgiana* have yet been seen here. Adults are most often encountered in the early to late afternoon. They feed at from 10-20 cm above dirt roads and over forests. At the Whittle Road site (Florida), two mature males were collected within minutes of each other at 12:30 pm while hanging up in pine trees along a sandy forest service road. They were flushed from one pine tree and they immediately sought to hang up in the next pine tree. Their behavior was very similar to an owlfly. Other *Somatochlores* flying at the Whittle Road site were *S. calverti* (numerous), *S. filosa* (common later in the year), *S. provocans* (uncommon), and *S. tenebrosa* (rare).

Carle (1982, pers. comm.) reported that males patrol 1-3 meters high over unshaded sections of small piedmont streams in a somewhat undulating flight. Adults fly erratically when apparently drinking at forest pools. Oviposition occurs at midstream while females fly in a very erratic manner characterized by short fast runs, dips, and abrupt turns, all within 1 meter over the water surface.

DISTRIBUTION RECORDS

Specimens of *Somatochlora georgiana* Root have been verified for Alabama, Florida, Georgia, Louisiana, Massachusetts, Mississippi, New Jersey, North Carolina, South Carolina, Texas, and Virginia (Fig. 5). Further collecting should reveal additional populations in coastal plains states.

ALABAMA Tuscaloosa County, "Moody Swamp", "Fuller Farm", 4 males 8 females, 18 June-31 July, late 1930's, Smith and Hodges

Collection

FLORIDA Gadsden County, Clark Branch, Whittle Road, west of Greensboro, 2 males, 27 July 1992, Jerrell J. Daigle; Leon County, Gum Creek, Hwy. 154, east of Tallahassee, 2 emerging males, several exuviae, 18 May 1991, Jerrell J. Daigle; Okaloosa County, Blackwater State Forest, Holt, 2 males "feeding along tips of pine branches", 28 July 1974, Sidney W. Dunkle; Blackwater State Forest, Holt, "sand road to Fish Hatchery", 2 males, 27-28 July 1975, Ken J. Tennessen; Santa Rosa County, Blackwater River State Forest, 3 Aug 1973, K.W. Knopf

GEORGIA Lee County, Leesburg, 1 female (type locality), 6 July 1923, F. M. Root; Telfair County, river at Hwy. 441, 3.5 miles north of Jacksonville, 13 June 1965, Dennis R. Paulson

LOUISIANA Vernon Parish, Bayou Anacoco river, West of Pinewoods(?), 1 female, 6 August 1954, S. M. Russell/G. H. Beatty Collection

MASSACHUSETTS Essex County, Ipswich, Rantoul Pond, 1 female, 6 August 1972, C. W. Leahy; Ipswich, Willow Dale State Forest, 3 males, 3 females, 18 August 1973, C. W. Leahy

MISSISSIPPI Jackson County, Big Cedar Creek, 7 miles N of Wade on SR-63, 1 female, 29 June 1968, W. Walther and W. F. Mauffray; Wayne County, small stream 3 miles east of Buccatunna, 1 male, 11 August 1977, Sidney W. Dunkle; Thompson Creek sw of Clara, 1 female, 12 August 1977, Sidney W. Dunkle

NEW JERSEY Burlington County, Wharton State Forest, Hampton Road near Atsion ranger station, 1 male, 12 July 1984, Mike L. May

NORTH CAROLINA Caswell County, County Line Creek, Hwy. 86, S of Yanceyville, 1 male, 2 July 1974, R. Duncan Cuyler; Chatham County, Rocky River, Route 64, E of Siler City, 1 male, 2 July 1973, R. Duncan Cuyler; Cumberland County, Cape Fear River, Pope Park, Fayetteville, 1 male, 28 June 1979, R. Duncan Cuyler; Duplin County, Kornegay, 4 males, 5 females, 30 June 1970, R. Duncan Cuyler; Durham County, SW Durham, 1 male- 5 July 1958, 1 female- 11 July 1960, 1 female- 29 June 1964, 1 male- 29 June 1974, 1 female- 29 June 1974, 1 female- 26 June

1978, 1 male- 3 July 1978, 1 male- 26 June 1989, 1 female- 3 July 1993, R. Duncan Cuyler; **Edgecombe County**, Fishing Creek, Route 97, E of Leggett, 1 male, 30 July 1975, R. Duncan Cuyler; Sec. Road #1216, 2 miles W of Tarboro, 2 females, 17 August 1984, R. Duncan Cuyler; **Franklin County**, Route 98, 1 mile W of Bunn, 1 male, 19 July 1989, R. Duncan Cuyler; **Greene County**, Snow Hill, 1 female, 19 July 1978, R. Duncan Cuyler; **Johnston County**, county line at Route 701, N of Newton Grove, 1 female, 22 July 1974, R. Duncan Cuyler; **Martin County**, west of Plymouth, Route 64 near Washington County Line, 1 female, 3 August 1991, R. Duncan Cuyler; **Moore County**, Mill Creek off Route 1 at Vass, 1 male- 27 June 1964, 1 female- 30 June 1965, 1 male- 7 July 1970, 5 males- 7 July 1972, 3 females- 7 July 1972, R. Duncan Cuyler; Cabin Creek at Route 211, 1 male, 28 June 1980, Frank L. Carle; Nash County, Sec. Road #1910, 1 mile S of Route 64A, east of Momeyer, 2 males, 2 females, 6 August 1980, R. Duncan Cuyler; **Orange County**, Duke Forest; Korstian Division, 1 female, 12 July 1960, R. Duncan Cuyler; **Sampson County**, county line at Route 701, N of Newton Grove, 1 female, 22 July 1974, R. Duncan Cuyler; Additional sight records by R. Duncan Cuyler from the following North Carolina counties: **Beaufort, Bladen, Brunswick, Columbus, Harnett, Lee, Northampton, Pender, Pitt, Richmond, Robeson, and Scotland.**

SOUTH CAROLINA Aiken County, Beulah Fork below Beulah Pond, 1 male- 23 July 1952, 1 female- 30 July 1952, W. M. Cross; **Sumter County**, 1 female, 9 July 1974, D. Laist

TEXAS Titus County, Mount Pleasant, 1 male, June 1950, L. E. Stone, det. L. K. Gloyd, G. H. Beatty Collection

VIRGINIA Charlotte County, Twittys Creek, Route 642 between Saxe City and Drake's Branch, 1 female- 12 July 1974, 2 males- 14 June 1975, 2 females- 22 July 1978, Frank L. Carle

EMENDED KEY TO NORTH AMERICAN SOMATOCHLORA LARVAE

(Couplet numbers refer to Walker, 1925) The following excerpt from the *Somatochlora* larva key presented in ARGIA (Daigle, 1991) will separate *Somatochlora georgiana* from other known

similar species. The previously unknown larvae of *S. brevinata* and *S. hineana* have been discovered recently, and taxonomic descriptions by other odonatologists are forthcoming.

11. Dorsal hooks present on segments 3 to 9; dorsal hook on segment 4 in lateral view about 0.75 length of dorsal hook on segment 5.....*S. minor*

Dorsal hooks present on segments 4 or 5 to 9; dorsal hook on 4, if present, less than 0.5 length of hook on segment 5.....12

12. Epiproct longer than the cerci; dorsal hooks on abdominal segments 7 to 9 nearly straight in lateral view.....*S. provocans*

Epiproct distinctly shorter (male) or nearly same length (female) as cerci; dorsal hooks on segments 7 to 9 slightly decurved in lateral view.....13

13. Dorsal hooks 5 to 9, premental setae 12.....*S. georgiana*

Dorsal hooks 4 to 9, premental setae 9 to 10.....*S. walshii*

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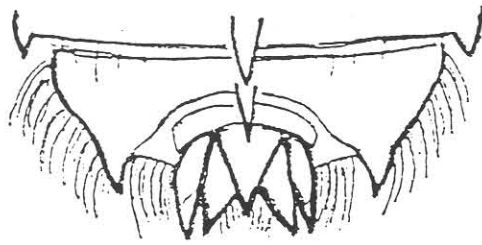


Fig. 1 Dorsal view of end of abdomen of *Somatochlora georgiana*

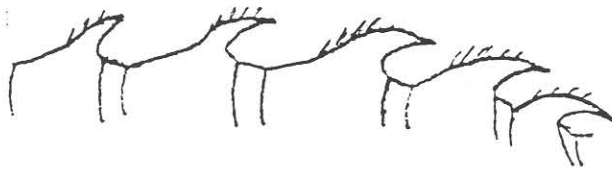


Fig. 2. Lateral view of abdomen of larva of *Somatochlora georgiana*

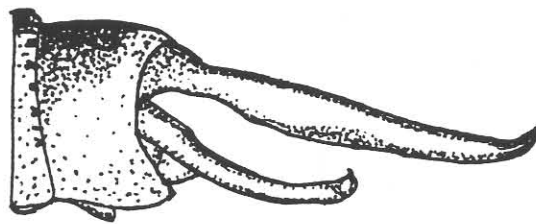


Fig. 3 Lateral view of male abdominal appendages of *Somatochlora georgiana*

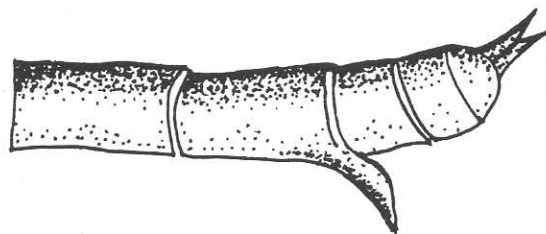


Fig. 4 Lateral view of female abdominal appendages of *Somatochlora georgiana*



Fig. 5 Map of the eastern United States showing counties from which *Somatochlora georgiana* has been recorded.