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# DESCRIPTION OF THE LARVA OF *SOMATOCHLORA INCURVATA* WALKER (ANISOPTERA: CORDULIIDAE)

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The last larval instar is described and illustrated from material collected in central and southeast Wisconsin, United States, and the larval habitat is described. The larva differs from related species in the *arctica* group of *Somatochlora* in having a greater head width and in the dorsolateral setal patterns on abdominal tergites VI-IX. Segment IX has distinct paired dorsolateral tufts, and VIII, VII, and VI have progressively less defined to absent paired tufts. These characters distinguish the species from the most similar species, S. *forcipata*, and all others of the *arctica* group.

## INTRODUCTION

The larva of *Somatochlora incurvata* Walker is among the last North American members of the genus to be described, despite being distributed in fairly well studied states (MA, ME, MI, NY, OH, PA, WI) and provinces (NB, NS, ON, QC) (NEEDHAM et al., 2000). In July, 1997, W.A. Smith (WAS) observed *S. incurvata* females ovipositing at two poor fens in Jackson County, WI. Six larval *Somatochlora* in the *arctica* group (WALKER, 1925) were collected at one of these sites by W. Steffens in October of 1997, which could not be determined using existing keys and descriptions. The larvae from this site were kept alive and reared by WAS. Four of the larvae emerged in February 1998 and were determined to be S. *incurvata*. The remaining two final instar larvae were sent to Dr Rick Purdue of the Illinois Museum (ISM) for mitochondrial DNA (mDNA) analysis. mDNA analysis provides tentative identification of larval specimens by comparing base

pair sequences to those of known *Somatochlora* species previously determined at the ISM (PURDUE, 1998). The analyses concluded that both larvae were *S. incurvata*. Several additional larvae and exuvia collected between 1993 and 2001 were also examined. The larva is described here and the diagnostic characters are compared with other species in the *arctica* group of *Somatochlora*.

## *SOMATOCHLORA INCURVATA* WALKER

Figures 1-2

Material. – UNITED STATES, Wisconsin: Jackson County, Staffon Marsh, 44.35°N, 90.67°W, 1-X-1997, 1 final instar (mDNA); 5-X-1997, 1 final instar (mDNA); 19-X-1997, 4 exuviae (reared); Juneau County, Necedah National Wildlife Refuge, 44.06° N, 90.25° W, 17-V-1999 1 final instar, 14-X-1998, 1 final instar; Ozaukee County, Cedarburg Bog State Natural Area, 43.68°N, 88.02°W, 26-VI-1993, 1 exuviae. Specimens are in the collection of the Wisconsin Department of Natural Resources, Bureau of Endangered Resources in Madison.

Larvae were collected by vigorously scraping the sides and undersides of submerged *Sphagnum* mosses and sedges with a standard aquatic D-net or by foot, allowing debris and larvae to fall into the net. Larvae were then reared to imagoes in small aquariums, and exuviae were preserved in ethanol. Larvae used for mDNA analyses were preserved in isopropyl alcohol.

DESCRIPTION. – The description is based on 5 exuviae (4 reared) and 4 last instars. The diagnostic dorsolateral setal characteristics are consistent with 64 additional *S. incurvata* larvae and exuviae collected in Wisconsin and examined by the authors since 1997. General form of the larva is consistent with the *arctica* group of *Somatochlora*, and closely resembles *S. forcipata* (WALKER, 1925). The larva is dark brown, the exuviae is light brown.

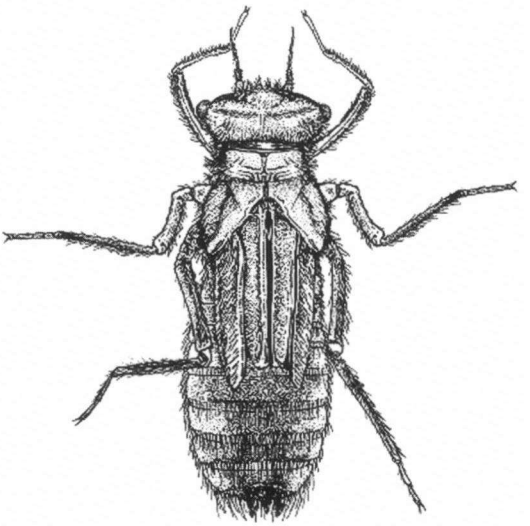


Fig. 1. *Somatochlora incurvata*, last instar.

Head. – Very similar to *S. forcipata*. Antennal segments I-II moderately setose, with small lateral and medial tufts of longer setae. Long, fine setae scattered elsewhere on antennae. Several (2-3) small, intraocular tufts of setae near medial line. Posterior margin of head gently concave, lateral margins convergent. Linear fringes of setae between antennae, between eyes, and along posterior margin of head, posterior fringe diminishing or terminating mesad. Fringes along lateral margins

of head connect the posterior fringe to the fringe between eyes. Dorsal surface of head with very short setae and small bare patches. Prementum length usually equal to or greater than width. Premental setae 12-14, the fourth to sixth from the outside being longest. Lateral setae 8-10, usually 9. Palpal crenations 7-9, each with 4-5 spiniform setae.

T h o r a x. – Tufts of setae on pronotal and protopleural processes, thoracic ridges fringed with setae. Wing pads reaching middle or posterior margin of VI. Perimeter of hind wing pads and ventral margin of forewing pads fringed with fine setae. Legs brown, very setose.

A b d o m e n. – Long-ovate, widest at V-VI, dorsal hooks absent. Small lateral spines present on IX only. Venter of abdomen densely setose with lateral bare spots. Posterior margin of sternites fringed with longer setae. Posterior margin of sternite IX fringed with very long setae, extending posteriad beyond the tips of the caudal appendages. Dorsum of abdomen clothed in short setae, with bare spots. Lateral and posterior margins of tergites fringed with setae. Paired dorsolateral tufts of longer setae on posterior of margin of IX and usually VIII distinct and separated by a zone of much shorter setae. Dorsolateral tufts less distinct and median gap progressively narrowing anteriad from IX. On VII, tufts may be indistinct or confluent, but long setae are still present in the confluence zone. On VI tufts indistinct or absent, represented only by a few long setae. In lateral view, dorsolateral tufts arch away from dorsum and curve posteriad.

Caudal appendages. – Cerci usually slightly longer than epiproct, epiproct of female narrowing rapidly on distal third, male much less so. Lateral margins of cerci arcuate. Distal margins of superior appendages setose. Paraprocts densely setose, extending slightly farther caudad than superior appendages in dorsal view.

M e a s u r e m e n t s (in mm). – Total length 21 (18-22); maximum width of head 6.2 (6.0-6.5); hind wing sheath 6.6 (6.3-6.9); hind femur 5.8 (5.7-6.4); hind tibia 6.4 (6.3-6.8); prementum length (from articulation to tip of medial "tooth") 4.4 (4.3-4.5); greatest prementum width 4.3 (4.2-4.4); abdomen length 11.5 (11.3-13); abdomen width 6.9 (6.4-7.6); epiproct 1.2 (1.2-1.3); cerci 1.3 (1.2-1.4); paraprocts 1.4) 1.3-1.6; lateral spine on IX 0.3 (0.2-0.4); tufts on dorsum of IX 1.5 (1.3-2.0); posterior margin fringe on sternite IX 1.5-2.2.5.

BREEDING HABITAT. – *S. incurvata* adults have been reported from northern bogs (NEEDHAM et al., 2000), sphagnum pools (WALKER & CORBET, 1975) and "sphagnum choked pools in a large bog... females oviposited singly in the sphagnum pools" in Maine (WHITE, 1969). In Pennsylvania a mature female was seen ovipositing alone in a small pool beneath leatherleaf, *Chamaedaphne calyculata* (L.) Moench bushes, in a tamarack (*Larix*) bog (SHIFFER, 1969). Our observations on habitats in Wisconsin are consistent with these sources.

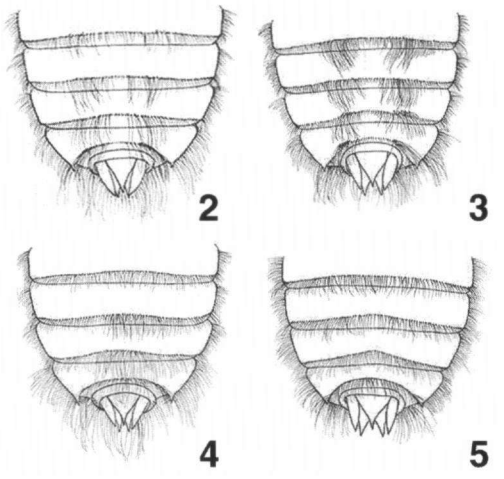
Larvae were found in shallow (10-40 cm) water pools, in deer trails, and shallow moats that form at the interface of poor fens and adjacent uplands. These poor fens are dominated by *Sphagnum* mosses and wire-leafed sedges, *Carex*. *C. oligosperma* Michx. is present at all sites, and *C. lasiocarpa Ehrh.* and/or *C. ros-*

*trata* Stokes are usually present. Two larvae were collected in a pool immediately surrounded by sedges only, with no *Sphagnum,* but *Sphagnum* was present at the other sites. Larvae apparently cling to poorly decomposed peat debris that camouflages them extremely well. The pH of one pool where larvae were collected was 5.6. This is probably typical of the habitats in Wisconsin. However, we have also collected adults and observed females ovipositing in shallow trickles with pH near 8.0 in the open portions of marly, rich fen-conifer swamp complexes in the Upper Peninsula of Michigan.

Habitats in central Wisconsin are found in large wetland complexes on the lakebed of extinct Glacial Lake Wisconsin, adjacent to ancient sandy beach ridges forested with *Pinus banksiana* Lamb., *P. resinosa* Aiton, *Quercus velutina* Lam. and *Q. ellipsoidalis* Hill. Other Odonata found in the same pools with *S. incurvata* include *Aeshna verticalis* Hag., *Leuchorrhina hudsonica* (Sel.), *Libellula quadrimaculata* L., *Williamsonia fletcheri* Wllmsn, and *W. lintneri (Hag.).*

## DISCUSSION

*Last instar larvae of S. incurvata* (Figs 1-2) can potentially be confused with those of others in the *arctica* group, but can be distinguished as follows. In *S. forcipata* (Scudder), the paired dorsolateral tufts on abdominal segments VI-IX are quite distinct, and separated medially by a zone of shorter setae (Fig. 3). The medial zone may be somewhat narrow as in the individual illustrated here, or the width of the medial zone may approach or equal the tuft width as illustrated by WALKER (1925). In *S. incurvata*, the dorsolateral tufts are distinct and well-separated on IX, and sometimes VIII, but on VII and VI the tufts are always progressively less distinct, closer together, or absent. The head width of *S. incurvata* is greater than 5.9 mm, while the head width of *S. forcipata* is ≤ 5.9 mm. *S. kennedyi* Walker (Fig. 4) has medial dorsal tufts that are not arranged in lateral pairs. The abdominal dorsum of *S. franklini* (Sel.) lacks tufts of any kind (Fig. 5). *S. semicircularis* (Sel.) also lacks tufts and the posterior setae on the tergites are even




Figs 2-5. Dorsolateral setal patterns on abdominal segment VI-IX of: (2) *Somatochlora incurvata*; – (3) *S. forcipata*; – (4) *S. kennedyi*; – (5) *S. franklini.* – [Setae on general surface of tergites and caudal appendages are omitted for clarity]

shorter than those of *S. franklini*, with only a few scattered long setae (WALKER, 1925). *S. semicircularis* is a western species; its range and that of *S. incurvata* do not overlap.

CASHATT & VOGT (2001) provided a key for all known larvae of North American *Somatochlora*, incorporating our measurements and comparisons of *S. incurvata* and other species in the *arctica* group. Dorsolateral setae can break off sometimes, making positive identification of some *arctica* specimens a challenge. However, presence of setae on posterior margins of abdominal segments can often be confirmed by the presence of definite insertion pegs, even if setae are missing.

Although time-consuming and tedious to pick through partially decayed vegetation looking for larvae, determined efforts can pay off. Properly times searches for exuviae can also be productive. We have now used these collecting techniques to document over 20 *S. incurvata* breeding sites in Wisconsin. The techniques are simple, and can be used to document breeding occurrences and larval habitats of an elusive and little-known species that is of conservation concern in many areas.

## ACKNOWLEDGEMENTS

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## REFERENCES

CASHATT, E.D. & T.E. VOGT, 2001. Description of the larva of Somatochlora hineana with a key to the larvae of the North American species of Somatochlora (Odonata: Corduliidae). *Int. J. Odonatol.* 4(2): 93-105.

NEEDHAM, J.G., M.J. WESTFALL & M.L. MAY, 2000. *Dragonflies of North America.* [Revised edn]. Scient. Publishers, Gainesville.

PURDUE, J.R., 1998. *Identification of Somatochlora larva by genetic analysis.* Report from the Illinois State Museum to the Authors, Jan 23, 1998. 2pp.

SHIFFER, C.N., 1969. Occurrence and habits of Somatochlora incurvata, new for Pennsylvania (Odonata: Corduliidae). *Mich. Ent.* 2(3/4): 75-76.

WALKER, E.M., 1925. The North American dragonflies of the genus Somatochlora. *Univ. Toronto Stud.* (Biol.) 26: 1-202, pls 1-35 excl.

WALKER, E.M. & P.S. CORBET, 1975. *The Odonata of Canada and Alaska.* Vol. 3. Univ. Toronto Press, Toronto.

WHITE, H.B., 1969. Two species of Odonata previously unreported from New England. *Ent. News* 80: 88.