

**A NEW SPECIES OF *OPHIOGOMPHUS* FROM EASTERN NORTH AMERICA, WITH A KEY TO THE REGIONAL SPECIES
(ANISOPTERA: GOMPHIDAE)**

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O. acuminatus sp. n. (♂ holotype, ♀ allotype: Jacks Branch 12 km north of U.S. Route 64 along Natchez Trace Parkway, Lewis Co., Tennessee, USA) is described from adult and larval material and its affinities discussed. Photographs of the ♂ terminalia and secondary genitalia of *O. acuminatus* sp. n. and *O. edmundo* Needham are presented. A key to the adult *Ophiogomphus* of eastern North America is presented along with a summary of their known distributions.

INTRODUCTION

Through the kindness of Professor Minter J. Westfall, Jr. I was entrusted with completing his studies on the genus *Ophiogomphus*. Among the adult specimens loaned to me was a single large male of an undescribed species collected by W.H. Cross in Tennessee. Attempts to collect additional material in Tennessee have been unsuccessful until only recently when Mr Carl Cook, Dr Ken Tennessen, and Professor Westfall collected additional adults and larvae. These specimens are here described as *O. acuminatus* sp. n. Also included in the borrowed material was a male of *O. edmundo* Needham discovered by Professor Westfall at the Academy of Natural Sciences of Philadelphia. This specimen was apparently from the same lot as the holotype and includes the note "from this specimen I made my drawings, P.P. Calvert"; presumably these drawings accompanied the specimens sent to and later described by NEEDHAM (1951). Figures of the male terminalia and hamuli of *O. edmundo* are included for comparison with those of the new species.

OPHIOGOMPHUS ACUMINATUS SPEC. NOV.

DESCRIPTION

Material examined. — Holotype male: United States: Tennessee, Lewis Co., Jacks Branch 12 km N of U.S. Rt. 64 along Natchez Trace, K. Tennessen, 17 June 1981, deposited in the Ken Tennessen Collection to be eventually donated to the Florida State Collection of Arthropods (FSCA), Gainesville, Florida, USA. — Allotype female: same as for holotype. Paratypes: same locality as holotype: 1 ♂, 18-VI-1981 (C. Cook), 1 ♂ 17-VI-1971 (W. Cross), 3 larvae, 18-VI-1981 (C. Cook), 6 larvae, 9-V-1981 (K.J. Tennessen).

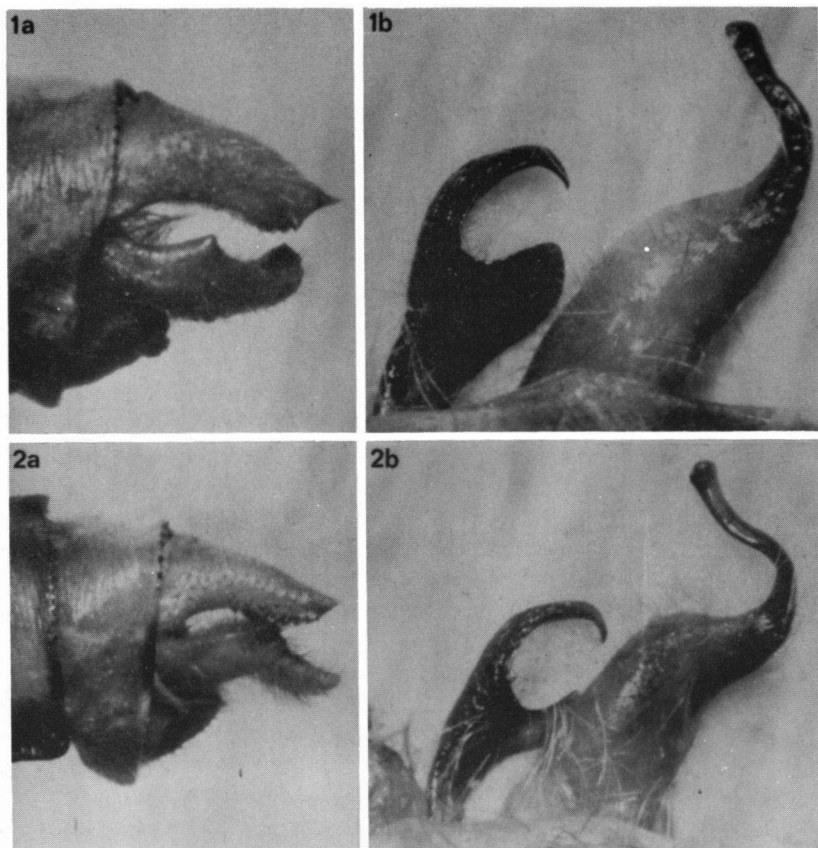
Male. — Total length 48.5 - 52.0 mm, abdomen including cerci 35.5 - 37.5 mm, cerci 1.6 - 1.8 mm, hind femora 5.7 - 6.0 mm, hind wings 28.5 - 30.0 mm, pterostigmata 2.8 - 3.0/3.1 - 3.4 mm.

Head: labium, maxillae, and mandibles yellowish white, second palpal segment and mandibles brown; labrum and genae white tinted with brown; anteclypeus greenish white; postclypeus greenish yellow; antefrons greenish yellow, basal 1/5 of dorsal surface brown laterally; antennae and vertex (postfrons) brown, postfrons with small yellow area posterior to postocellar ridge, postocellar ridge bilobed; occiput (dorsal portion) greenish yellow, occipital crest brown laterally with sparse hair fringe; posterior surface of head yellow ventrally and brown dorsally with small yellow spots lateral to dorsal portion of occiput.

Thorax: prothorax brown, anterodorsal edge yellowish white, dorso-medial lobe with paired medial and lateral yellow areas. Pterothorax yellowish green with brown bands; dorsal mesanepisternal pale stripes broadly confluent with pale collar below and narrowly confluent with lateral mesanepisternal pale stripes above, dorsal stripes separated by narrow brown bands lateral to median carina; lateral mesanepisternal pale stripes separated from mesanepimeral pale stripes by brown bands along mesopleural sulci, these bands narrowed ventrally to ca. 1/2 width of lateral mesanepisternal pale stripes; katapisterna and ventral portion of epimera predominantly light brown; dorsolateral carinae and antealars brown.

Legs: coxae and trochanters light brown; femora brownish yellow with brown external streak and apical black area, tibiae black with basal portion of external surface and patalae yellow; tarsi black; leg spines black; prothoracic tibial keels pale ca. 1/6 length of tibiae.

Wings: venation dark brown, costa yellow with black spines; pterostigmata dark brown ventrally and dorsally; membrane hyaline, tinted with brown distally. Antenodal crossveins 12-13, 12-13/9-10, 9-11; postnodal crossveins 10-11/10-12; triangles and subtriangles without crossveins, supra-triangles 1 or 2-celled; basal subcostal crossvein absent; gaff 2/5-1/2 length of inner side of triangle; bridge crossveins 4-6/5-6; crossveins under pterostigma 4-5/4-5; anal loop 3-celled.



Figs. 1-2. *Ophiogomphus acuminatus* sp. n. (Fig. 1) and *O. edmundo* Needham (Fig. 2): (a) Lateral view of male terminalia (X 20); — (b) Lateral view of male hamuli (X 25).

Abdomen: brown marked with yellow and white; terga 1 and 2 yellowish white laterally and brown with median yellow band dorsally, auricles yellow with black denticles restricted to posterior edge, area posterior to auricle shaded with brown; terga 3-6 brown, white lateroventrally with posteroventral brown areas, white area divided by brown along antecostal suture, yellow middorsal areas acuminate 4/5 to as long as terga, constricted at antecostal suture and near apex; sterna 3-7 brown; tergum 7 brown, yellowish white laterally with posterolateral corners brown, pale area divided by brown along antecostal suture, dorsal yellow area lanceolate, narrower than on tergum 6; expanded lateral rim of terga 7-9 dark brown; tergum 8 brown, light yellow laterally with small posterolateral round brown spot,

dorsal yellow spot elongate, $1/2-7/10$ length of tergum; tergum 9 yellow with middorsal yellow spot oval and surrounded with brown; tergum 10 yellow with diffuse submedian basal brown areas and apical margin dark brown, sterna 8-10 yellow. Terminalia yellow with ventral denticles dark brown; cerci robust and distinctly longer than epiproct, acuminate apically, dorsal and lateral margins moderately convex (Fig. 1a); epiproct with narrow median cleft extended proximally to apices of paraprocts, each ramus with lateral obtuse spine at ca. $1/2$ length of epiproct.

Genitalia: anterior hamuli brown each with proximal lobelike portion and distal hooklike portion (Fig. 1b), apex of distal portion abruptly decurved and directed toward proximal portion, enclosed gap ca. two times width of distal portion; posterior hamuli greenish yellow each with narrow distal portion dark brown (Fig. 1b), distal portion bent anteriorly with portion distal to bend slightly undulate, flattened apically, and ca. $1/2$ length of proximal portion; shoulder poorly developed. Penis brown, penile hood with diffuse yellow lateral area, filament and membranes translucent: segment 1 with penile hood erect, in lateral view width at middle ca. $1/3$ length, apex cleft with two lateral lobes ca. 2 times as long as wide, penile vesicle wide-troughlike, thinly expanded laterally with distal edge rounded and proximal edge acute in lateral view; segment 2 "J"-shaped, length 2.1-2.3 mm, distal portion globose with well-developed retractor spine; segment 3 1.5-1.7 mm long excluding prepuce and strongly constricted basally, prepuce elongate and extended to middle of segment 4; segment 4 ca. 1.1 mm long, filament divided ca. 0.4 mm of length, outer surface of segment with medial decurved lobe.

Female. — Total length 53.0 mm, abdomen including cerci 39.0 mm, cerci 1.5 mm, hind femora 5.9 mm, hind wings 33.5 mm, pterostigmata 3.6-3.7/4.1-4.2 mm.

Head: colored as in male; occipital crest with two anteromedially directed horns separated basally by, and ca. as long as, $1/3$ length of postfrontal suture; median portion of occiput troughlike; posterior surface of dorsal portion of occiput slightly bilobate and without lateral horns.

Thorax: colored as in male.

Legs: colored as in male, inner spines of hind tibiae longer than in male, prothoracic tibiae without keels.

Wings: venation, membrane, and pterostigmata colored as in male. Antenodal crossveins 13-14, 14/9-11, 10-11; postnodal crossveins 11-12/11-12; triangles, subtriangles, and supratrangles without crossveins; basal subcostal crossvein absent; gaff ca. $2/5$ length of inner side of triangle; bridge crossveins 5/4, crossveins under pterostigma 5-6/5; anal loop 3 or 4-celled.

Abdomen: colored as in male with dorsal pale areas more extensive; middorsal pale stripe of terga 1-6 extended to posterior carinae; pale

middorsal stripe of terga 7 and 8 ca. $9/10$ and $4/5$ length of terga, respectively; tergum 9 yellowish orange dorsally.

Genitalia: vulvar lamina light tan, ca. 1.1 times length of sternum 9, ca. 2.6 mm long and cleft for ca. $2/3$ length, width at base ca. $4/9$ length, lateral lobes narrow, apically raised and recurved, lateral subapical margins not expanded.

Larva (immature, with wing pads extended to base of fifth abdominal segment). — Total length 23.0-25.5 mm, abdomen 14.0-16.0 mm, hind femora 3.0-3.5 mm, prementum 3.7 mm.

Head: prementum gradually narrowed in basal $1/3$ to $7/8$ apical width, apical $1/2$ distinctly convergent anteriorly; ligula strongly convex, ca. $3/10$ apical width of prementum with fringe of moderately long setae and 20-24 dark brown toothlike denticles; first segment of labial palps rounded distally each with 9-11 teeth in gently curved row, apical tooth of each palp sub-acute, third antennal segments elongate-elliptical each ca. 2.7 times as long as wide with inner distal portion directed anteroventrally, fringed with long hairlike setae, and each dorsally with papilliform setae sparse; fourth antennal segments each ca. $2/3$ as wide as base of segment 3, base ringed with short papilliform setae; dorsal surface of head with papilliform setae, scattered setae dark brown.

Thorax: tibiae with long, black external spines.

Abdomen: acuminate-ovoid in shape, widest at segments 5 and 6, lateral taper gradually increasing on segments 7-9, covered with lightly pigmented granules, and scattered black, scale-like setae; wing pads divergent extended to base of fifth segment; middorsal tubercles robust, slightly extended beyond posterior margin of segments, those of segment 2 slightly appressed, those of 3-7 each slightly more appressed, those of 8 and 9 only slightly elevated in lateral view; segments 7-9 with lateral spines, relative lengths 0.5-0.7 : 0.8-1.2 : 1.0 respectively; cerci ca. 1.8 times middorsal length of segment 10 and ca. $3/4$ length of epiproct, apex of epiproct slightly decurved, paraprocts slightly longer than epiproct, male epiproctal tubercles at approx. $3/5$ length of epiproct.

Remarks. — *Ophiogomphus acuminatus* is a rather distinctive member of the mainensis species group. The adults are readily distinguished from other species of the group by the narrow middorsal thoracic band. In addition the male exhibits the most acuminate epiproct in the group, and the female is distinguished by the vulvar lamina longer than sternum 9 and the occiput with a median trough. The larva is distinctive in the narrow strongly convex ligula of the prementum.

The male terminalia and hamuli of a recently discovered second male of *O. edmundo* are presented in Figure 2. The terminalia are similar to the photograph of the holotype in NEEDHAM & WESTFALL (1955: fig. 61),

and the hamuli which were not adequately described by NEEDHAM (1951) show it to be distinct from its nearest relatives *O. carolus* Needham and *O. aspersus* Morse. Unfortunately the locality label of the new specimen reads only "N.C." as in the holotype. The only other clue which could help in the rediscovery of *O. edmundo* is the apparent close affinity between *O. edmundo* and *O. carolus*; this would indicate that *O. edmundo* may occur in the small streams of western North Carolina.

Etymology. — *O. acuminatus* [a-cu-mi-na'tus] (L. Part. "furnished with a sharp point", referring to the pointed adult male cerci.)

BIOLOGY

The rarity of *O. acuminatus* is apparently related to habitat requirements during the larval stage, although low vagility and short flight season of the adult may explain the apparent extreme rarity of the species. Carl Cook (personal communication) writes that the larval habitat is "sparse gravel pockets in the fissures of the rock stream bed". Jacks Branch is a small (2-3 m wide) stream located in the Interior Low Plateaus physiographic province of Tennessee indicating that the new species may also occur in northern Alabama and western Kentucky; the elevation of the type locality is 230 m. Larvae of *O. acuminatus* have also been collected from the nearby Brush and Little Swan Creeks. The density of the larval population is low; for example despite considerable effort I have collected only the larvae of *Stylogomphus albistylus* (Hagen) from the type locality. The only other Odonata collected from near Jacks Branch are *Tachopteryx thoreyi* (Hagen) which supports the observation that the stream is largely spring fed.

The only information known concerning adult behavior is contained in the following quote (C. Cook, personal communication): "Ken got his [specimens] from the grass along side the gravel road at the underpass just south of the picnic area. Mine was taken on the rock ledge at the ford across Jacks Branch at the same underpass. They were taken early in the morning (about 8:30 A.M.) and I saw one other which may have been a female flying over the stream but was unable to get near enough to it to be sure, this was also in the morning hours — we saw no activity from adults at any time after mid morning. In the late afternoon I walked the stream until nightfall to see if there was a "dusk flight" as there is with many of the other species of the genus. There was none at least on the part of the stream I walked."

DISTRIBUTION OF AND KEY TO THE *OPHIOGOMPHUS* SPECIES OF EASTERN NORTH AMERICA

DISTRIBUTION

All eastern North American *Ophiogomphus* with the exception of *O. colubrinus* are limited to this region. Their known distributions are as follows: *acuminatus*: U.S.A.: TN: — *anomalus*: U.S.A.: ME, NY, WI; Canada: Ont., Que.; — *aspersus*: U.S.A.: CT, KY, ME, MI, NH, NY, NC, VT, VA, WI; Canada: N.B., N.S., Que.; — *carolinus*: U.S.A.: AL, GA, KY, MD, NC, TN, VA, WV; — *carolus*: U.S.A.: ME, MI, NH, NY, PA, VT, VA, WV, WI; Canada: N.B., N.S., Ont., Que.; — *colubrinus*: U.S.A.: ME, MI, NH, WY; Canada: Alta., B.C., Man., Nfld., N.W.T., Ont., Que., Sask.; — *edmunds*: U.S.A.: NC; — *howei*: U.S.A.: KY, MA, NY, NC, PA, VA; — *mainensis*: U.S.A.: CT, ME, MA, NH, NJ, NY, NC, PA, SC, TN, VT, VA, WV; Canada: N.B., Que.; — *rupinsulensis*: U.S.A.: CT, IL, IN, KS, KY, ME, MD, MI, MN, MO, NH, NJ, NY, ND, OH, PA, TN, VT, VA, WV, WI; Canada: Man., N.B., Ont., Que., Sask.

SPECIES KEY TO THE ADULTS

- 1 Antefrons and postclypeus transversely striped with black 2
- Antefrons and postclypeus not transversely striped with black 3
- 2 Metanepisterna each with transverse brown band; male epiproctal rami widely separated apically, apex of anterior hamuli directed posteriorly; vulvar lamina with lateral flange well developed, apices directed posterolaterally *anomalus* Harvey
- Metanepisterna each without transverse brown band; male epiproctal rami contiguous apically, apex of anterior hamuli directed ventrally; vulvar lamina with lateral flange vestigial, apices directed posteriorly *colubrinus* Selys
- 3 Middorsal brown band of mesanepisterna vestigial or absent 4
- Middorsal brown band of mesanepisterna well developed 5
- 4 Tibiae with external surface predominantly black; male cerci acuminate (Fig. 1a); lateral spine of epiproct at ca. 1/2 its length; female without postoccipital horns, vulvar lamina longer than sternum 9 *acuminatus* sp. n.
- Tibiae with external surface predominantly yellow; male cerci not acuminate; lateral spine of epiproct at ca. 4/5 its length; female with postoccipital horns, vulvar lamina shorter than sternum 9 *rupinsulensis* Walsh
- 5 Basal 2/3 of hind wings tinted with yellow; male epiproct abruptly angled dorsally near base, ca. 1/2 length of cerci; female occipital crest with small erect horns separated by ca. 4/5 length of postfrontal suture, vulvar lamina ca. as long as wide *howei* Bromley
- Basal 2/3 of hind wings not tinted with yellow; male epiproct not abruptly angled dorsally near base, at least 4/5 as long as cerci; female occipital crest without small erect horns separated by ca. 4/5 length of postfrontal suture, vulvar lamina longer than wide 6
- 6 Male cerci inflated, each wider at midlength than at base, longer than epiproct; female with postoccipital horns *aspersus* Morse¹

¹ The female of *O. edmunds* is not positively known and may key here; cf. couplet 8.

- Male cerci not inflated, each not wider at midlength than at base, slightly shorter than epiproct; female without postoccipital horns 7
- 7 Tibiae each with yellow streak along external carinae; basal 2/3 of femora yellow; thorax without brown bands along metapleural sulci *carolinus* Hagen²
- Tibiae each without yellow streak along external carinae; basal 2/3 of femora not yellow; thorax with brown bands along metapleural sulci 8
- 8 Dorsal mesanepisternal pale stripes parallel-sided, separated by ca. 4/5 their maximum width; gap of anterior hamuli subcircular (Fig. 2b); lateral flange of penile hood ca. 1/4 as wide as long *edmundo* Needham
- Dorsal mesanepisternal pale stripes widened ventrally, separated by ca. 2/5 their maximum width; gap of anterior hamuli subcircular (Fig. 2b); lateral flange of penile hood ca. 1/4 as wide as long *edmundo* Needham
- 9 Distal margin of labrum black; male epiproct with apical cleft more than 3 times as long as wide, anterior hamuli each with apical branch less than 2 times as long as basal branch; female occiput bilobate posteriorly, with large contiguous horns anteriorly; vulvar lamina constricted near base, apices directed posteriorly *mainensis* Packard
- Distal margin of labrum not black; male epiproct with apical cleft ca. 2 times as long as wide, anterior hamuli each with apical branch more than 3 times as long as basal branch; female occiput level posteriorly, without or with small widely separated horns anteriorly; vulvar lamina parallel-sided, apices directed posterolaterally *carolus* Needham

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REFERENCES

- NEEDHAM, J.G., 1951. A new species of *Ophiogomphus* (Odonata). *Ent. News* 62: 41-43.
 NEEDHAM, J.G. & M.J. WESTFALL, Jr., 1955. *A manual of the dragonflies of North America (Anisoptera), including the Greater Antilles and the provinces of the Mexican border*. Univ. Calif. Press, Berkeley - Los Angeles.

² The original description of *O. carolinus* does not seem to fit the species currently identified as this species.