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***Macromia alleghaniensis* (Odonata: Macromiidae):
New For Michigan, with Clarifications of Northern Records**

Julie A. Craves^{1,2*} and Darrin S. O'Brien²

Abstract

An Alleghany River Cruiser, *Macromia alleghaniensis* Williamson (Odonata: Macromiidae), collected in Cass County, Michigan on 18 June 2014, represents the first record of the species for the state, as well as the northernmost unequivocal record in North America. Other records north of 40° latitude are clarified and discussed.

Macromia Rambur is a genus of medium to large (61–91 mm) dragonflies of 84 species worldwide (Garrison et al. 2006). The 7 species in North America are dark brown or black with yellow on the thorax and abdomen in patterns that vary, often subtly, between and among species, with multiple subspecies and hybrids recognized in the genus (Donnelly and Tennessen 1994, Cannings et al. 2006, Paulson 2011).

Macromia alleghaniensis Williamson (Odonata: Macromiidae), the Alleghany River Cruiser, is found most frequently in the central southeastern United States. Records extend west to southeastern Missouri, western Arkansas and nearby Oklahoma and Texas, and south to the Gulf coast along the Mississippi-Alabama border. Scattered records exist in Georgia, Florida, and South Carolina.

Macromia alleghaniensis is uncommon or rare in the northern part of its range. It is considered rare and a species of special concern in New Jersey (Barlow et al. 2009, NJDEP 2012), critically imperiled in Pennsylvania (PHNP 2014), uncommon and imperiled in Maryland (MNHP 2010, MAIFS 2014), rare in West Virginia (WVDNR 2012), and uncommon and a species of greatest conservation need in Ohio (Glotzhober and McShaffrey 2002, ODNR 2005). This species is listed as critically imperiled in Illinois by NatureServe (2015), but it is not listed in the most current state wildlife action plan or endangered and threatened species lists (IDNR 2005, Mankowski 2011).

Macromia alleghaniensis has not been recorded in New York, Delaware, Indiana, Wisconsin, or Ontario (Donnelly 1992, Curry 2001, White et al. 2010, Pratt 2012, NHIC 2014, WOS 2014, Abbott 2006–2015). Prior to our record (described below), it had not been recorded in Michigan (Byers 1927, Kormondy 1958, Donnelly 2004, MOS 2008–2014).

Macromia alleghaniensis is typically found on small to medium, slow flowing streams and rivers (Dunkle 2000, Garrison et al. 2006, Beaton 2007, Paulson 2011). The flight season in the northern portion of its core range (~ 38–39° latitude) is June to August (Paulson 2011).

On 18 June 2014, DO captured a male *Macromia* along Wood Creek in the Three Rivers State Game Area, Cass County, Michigan (41.861°, -85.763°).

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The creek at this location is 2 to 4 m wide and 0.25 to 0.5 m deep, clear, with a sandy/gravelly substrate and silty edges near the bank undercuts. Habitat along this ~ 120 m stretch of creek was fen or marsh with forbs, sedge hummocks, and areas of cattails interspersed with occasional shrubs. The stream corridor was 60 to 80 m wide and bordered by forest.

The voucher was deposited in the University of Michigan Museum of Zoology, Insect Division (cataloged by the Michigan Odonata Survey as MOS0035050) and a photograph was submitted to OdonataCentral (OC#423318, Abbott 2006–2015). It was initially identified as *Macromia illinoiensis* Walsh, the common *Macromia* species in the state. It was subsequently correctly identified as *M. alleghaniensis* by the abdominal markings (the combination of a nearly complete yellow ring on abdominal segment 7 and a yellow ring on abdominal segment 2 interrupted only dorsally) and the short keel on the middle tibia, which distinguish it from males of other species of *Macromia* (Williamson 1909, Donnelly and Tennessen 1994, Paulson 2011, Needham et al. 2014). This represents Michigan's first record of this species, and the northernmost unequivocal record in North America.

Discussion

The majority of published records of *Macromia alleghaniensis* are from south of 40°. Table 1 lists records north of that latitude that are equivocal, invalid, or unconfirmed. Other than our Michigan record, the only records confirmed by specimens north of 40° are from 3 counties in Pennsylvania—Huntingdon, Bucks, and Chester—with the Huntingdon County location being the farthest north at 40.580° (Shiffer and White 2014). Our Michigan location is roughly 140 km north of that latitude.

Because their habitats tend to be less ecologically stable or persistent, lentic species have a higher capacity for dispersal and are more prone to move long distances, especially due to climate-related events such as drought (Arribas et al. 2012, Hof et al. 2012, Grewe et al. 2013). This may explain the occurrence of several southern lentic dragonfly species in northern states in the past decade (Craves and O'Brien 2007, Mauffray 2008, Craves and O'Brien 2011).

Conversely, lotic species like most *Macromia* are less apt to disperse. At the Michigan collection site, we saw several other *Macromia*, possibly also *M. alleghaniensis*. This possibility, combined with the scarcity of records north of 40°, even in areas well-covered by dragonfly enthusiasts, suggests that the Michigan location perhaps represents an established disjunct population.

Accurate demarcation of species distributions is an important component in understanding how best to conserve biodiversity, especially in the face of climate change (Bush et al. 2014, Preuss et al. 2014). Historical records and their locations should be verified to provide accurate baseline data for future biogeographic comparisons. Care should be taken to record precise locations for new records, as the county-level data that is common in invertebrate databases tends to over-estimate geographic ranges (Collins 2014).

The lower dispersal rates of lotic species also promote genetic differentiation between populations, which in turn may advance adaptation to local conditions or foster speciation (Hof et al. 2006, Marten et al. 2006). Securing vouchers of out-of-range individuals and from disjunct populations, especially of taxa most reliably identified by structural characters or in which hybridization is common such as in *Macromia*, will not only confirm identification and validate records but can further our understanding of gene flow, adaptation, and evolution in these populations.

Table 1. Equivocal, unconfirmed, and invalid records of *Macromia alleghaniensis* north of 40° N latitude.

Latitude	State	Location	Date	Notes and Sources
42.32° (county center)	Illinois	McHenry County	Unknown	OdonataCentral record OC#229282 (Abbott 2006-2015). This and the next record are county-level records (Donnelly 2004). There are no associated vouchers or published data on these records, and details are unknown to state experts (ISM 2006, T. Cashatt and T. Vogt, pers. comm.).
42.06° (county center)	Illinois	Carroll County	Unknown	OdonataCentral record OC#229280 (Abbott 2006-2015). See above.
41.658°	Ohio	Ottawa County, Put-in-Bay	1934	Two males taken by C. H. Kennedy in 1934 (not 1937, as stated in Glotzhober and McShaffrey 2002) at the "Put-in-Bay Lake Laboratory" were discovered at the University of Michigan Museum of Zoology and designated as the first Ohio records (Kormondy 1956). Originally located on South Bass Island, this Lab (operated by the Ohio State University) was relocated to Gibraltar Island in 1925 and renamed the Stone Laboratory (Anon. 1925). Kennedy taught at each location from 1920-1938; it is unclear why he would use the incorrect name and not provide complete dates on the specimens, as he did with most of his material. These inconsistencies and the lack of stream or river habitats on these Put-in-Bay islands make the provenance of these specimens uncertain. It has been speculated they were raised in the lab (Glotzhober and McShaffrey 2002) or brought to Kennedy from elsewhere and mixed in with his own collections (C. Trisler, pers. comm.).
40.41° (county center)	Illinois	Hancock County	Unknown	County-level record shown online (Konratieff 2000) is apparently a transcription error, as the data reference is the Illinois State Museum database (ISM 2006) which does not have a record for Hancock Co., but does have one for Hardin Co., which was omitted on the map.
40.119°	Ohio	Franklin County Olentangy River, 0.5 mi N of I-270	23 May 1991	This very early instar nymph is noted as "ID ?" (Glotzhober et al. 1995, OHC 2015). Most Odonata larval keys are for use with mature nymphs, and the <i>Macromia</i> key typically used at the time this nymph was collected (Needham and Westfall 1955) was later found to be unreliable (Donnelly and Tennesen 1994).

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