

First Report of the Neophemeridae (Ephemeroptera) in Wisconsin

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Abstract

The mayfly family Neophemeridae was discovered in Wisconsin for the first time and is represented by the species *Neophemera bicolor*. Nymphs were collected from three sites in two rivers in northern Wisconsin. Adults were reared from nymphs. Some physical and chemical characteristics of the sample locations are discussed.

Mayflies (Ephemeroptera) in the family Neophemeridae are inhabitants of streams in eastern North America and are relatively uncommon or rare throughout their range. There are four described species in the genus *Neophemera* (Berner 1956, Bae and McCafferty 1998). *Neophemera compressa* Berner and *Neophemera youngi* Berner are southeastern species that occur in the coastal states. *Neophemera purpurea* (Traver) is another southeastern species that occurs as far northwest as southern Kentucky (Randolph and McCafferty 1998). The fourth species, *Neophemera bicolor* McDunnough, was described from adults collected in Quebec (McDunnough 1925). Subsequently, Berner (1956) described the nymphs of a species that he attributed to *N. bicolor* from nymphs collected in 1936 from the Rifle River along the eastern border of the lower peninsula of Michigan. Jacobus and McCafferty (2002) noted that nymphs of *N. bicolor* have never been reared to the adult stage, and that the nymphs that Berner described may be attributed to this species, or they may represent a new species. The authors also mentioned that the nymphs collected in central Missouri (Sarver and Kondratieff 1997) appeared to be conspecific with the nymphs from Michigan. Hilsenhoff (1995) did not believe that this family would be found in Wisconsin and did not include it in his publication.

In 2000, the lead author identified nymphs of *Neophemera* collected by one of the junior authors (TDL) from a river within the reservation lands of the Bad River Band of the Lake Superior Tribe of Chippewa Indians, in northern Wisconsin. Additional nymphs were collected during routine surveys by personnel of the Bad River Band's Natural Resources Department at the same site on several occasions from 2001-2009. Five additional nymphs were subsequently found in 2009 in another river within the tribal reservation. All of the nymphs appeared to agree with the descriptions of the characters for *N. bicolor* as presented in Berner (1956) and Bae and McCafferty (1998). [Note: the names and

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locations of these two sites within the tribal reservation are being withheld by request from the Bad River Band of the Lake Superior Tribe of Chippewa Indians, which can be contacted directly for further details.]

On 23 June 2009, 12 mature nymphs were found in the White River on State Highway 13 in Ashland, Co., Wisconsin (46°30'59.02" N, 90°50'38.55" W), which is a site outside of the tribal reservation land. The nymphs were clinging to aquatic vegetation (*Potamogeton* sp.) in shallow water (10-40 cm) near the shoreline. Due to the turbidity, the vegetation needed to be pulled from the streambed and rinsed in a pan in order to notice the attached nymphs. The nymphs were located at the base of the plant within or near the silt substrate. The nymphs were reared in aquaria for several weeks until they emerged as adults. Adult stages (subimago and imago) were allowed to live for several days. Voucher specimens exist in the collections of KLS and THK. These reared adults represent the first published records of reared specimens for *N. bicolor*.

Due to the rarity of *N. bicolor*, little is known about its biology and habitat preference. It is usually found in rivers and large streams with slow to moderate current, clinging to clumps of debris, branches, and roots of emergent vegetation (Berner 1956, Edmunds et al. 1976). The White River is a 5th order stream at our site with a mean monthly flow rate in the summer months ranging from 6-10 m³/s. The bottom substrates are predominantly gravel and fine sand, with silt and submerged wood near the shoreline. Water clarity is usually poor due to relatively high turbidity caused by erosion of the stream banks, which contain clay and fine sand. Turbidity ranges from 5 to 20 JTU (Jackson Turbidity Units). Summer temperatures fluctuate between 16°C and 25°C, while the pH value averages 7.8. Dissolved oxygen values range from 7.0 to 9.0 mg/L (unpublished water data courtesy of the Bad River Watershed Association for 2009 and 2010). The stream in which the species was first found has similar water data to the White River at Highway 13. The other stream in the tribal reservation in which nymphs were collected in 2009 is different in a few features. It is a 6th order stream with clear water (not turbid), colder temperature (8°C), greater dissolved oxygen (13 mg/L), and a more heterogeneous substrate consisting of sand (25%), coarse woody debris (25%), leaf snags (25%), clay (10%), silt (10%), and overhanging vegetation (10%).

The discovery of Neophemeridae, in particular *N. bicolor*, in northern Wisconsin is a considerable northwestern range extension for this family and species. The distance from the site in the White River in northern Wisconsin to the site in east-central Michigan (Rifle River in Omer) where *N. bicolor* was collected 75 years ago is about 500 miles. Wisconsin has been rigorously sampled for macroinvertebrates for several decades by the Wisconsin Department of Natural Resources, numerous other organizations and agencies, and individual researchers (e.g., William Hilsenhoff, University of Wisconsin-Madison). The fact that this family of mayflies could have escaped detection from this sampling effort, and the knowledge that the species has now been located at three separate nearby sites with differing stream characteristics, is remarkable.

Literature Cited

- Bae, Y. J., and W. P. McCafferty. 1998. Phylogenetic systematics and biogeography of the Neophemeridae (Ephemeroptera: Pannota). *Aquatic Insects* 20: 35-68.
- Berner, L. 1956. The genus *Neophemera* in North America (Ephemeroptera: Neophemeridae). *Annals of the Entomological Society of America* 49: 33-42.
- Edmunds, G. F., Jr., S. L. Jensen, and L. Berner. 1976. The mayflies of North and Central America. University of Minnesota Press, Minneapolis, 330 pages.
- Hilsenhoff, W. L. 1995. *Aquatic Insects of Wisconsin. Keys to Wisconsin Genera and Notes*

on Biology, Habitat, Distribution and Species. Natural History Museums Council, University of Wisconsin-Madison. Publication Number 3, 79 pages.

Jacobus, L.M. and W.P. McCafferty. 2002. Analysis of some historically unfamiliar Canadian mayflies (Ephemeroptera). *The Canadian Entomologist* 134: 141-155.

McDunnough, J. 1925. New Canadian Ephemeridae with notes, III. *The Canadian Entomologist* 57: 168-176.

Randolph, R. P., and W. P. McCafferty. 1998. Diversity and Distribution of the Mayflies (Ephemeroptera) of Illinois, Indiana, Kentucky, Michigan, Ohio, and Wisconsin. *Ohio Biological Survey Bulletin New Series* 13(1), vii-188 pages.

Sarver, R., and B. C. Kondratieff. 1997. Survey of Missouri mayflies with the first description of adults of *Stenonema bednarki* (Ephemeroptera: Heptageniidae). *Journal of the Kansas Entomological Society* 70: 132-140.