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Rediscovery of *Gnoriste macra* Johannsen in Wisconsin (Diptera: Mycetophilidae: Gnoristinae)

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Abstract

Gnoriste macra Johannsen (Diptera: Mycetophilidae: Gnoristinae) was described from Whitefish Bay, Wisconsin in 1912. The type locality is now a highly residential region a few miles north of the center of Milwaukee. Herein, collection events are reported for *G. macra* from Sauk County in southcentral Wisconsin. These new records, nearly a century after the only other literature record, indicate the species still thrives in Wisconsin though likely extirpated from the type locality. The specimens were recovered from unbaited Townes Malaise traps during mid- to late May, 2006 and 2020. Cranial anatomy and functional morphology of the head suggests *G. macra* may be a highly specialized pollinator and candidate plant species are hypothesized.

Keywords: Mycetophilidae, *Gnoriste macra*, distribution, Wisconsin, pollination

Of a dozen extant species of *Gnoriste* (Diptera: Mycetophilidae: Gnoristinae), four are recorded from North America. *Gnoriste macra* Johannsen (1912) was described on the basis of an unspecified number of males and females from Whitefish Bay, Wisconsin, collected in May. The species has also been recorded from New Hampshire and Maine (Stone et al. 1965).

Methods

Species identification. Generic determination was established from the key provided in the mycetophilid chapter of the Manual of Nearctic Diptera (Vockeroth 1981). The species was identified by the key in Johannsen (1912) and comparison with the species description therein. Further confirmation was provided by the key in Chandler (1976).

Specimen data and Specimens. The collection event label data reported below are presented verbatim. Line breaks on labels are denoted by a double slash (//); information presented in the data string that is not part of an original label is indicated in brackets ([]). The specimens were field collected into 70–80% ethanol. However, since most Diptera are prone to excessive tissue distortion during the normal dehydration process associated with pinning, the HMDS technique (Nation 1983) was used in preparation of a series of specimens (from 2006) to minimize exoskeletal collapsing and shriveling. Additional specimens (2020 material) were retained in 80% EtOH.

The specimens of *G. macra* reported herein are vouchered in the Insect Research Collection (WIRC) of the Department of Entomology, University of Wisconsin-Madison.

Figures. Images were captured as “.tif” files with a JVC® KY-F75U digital camera attached to a Leica® Z16 APO dissecting microscope with apochromatic zoom objective and motor focus drive using the Synchronoscopy® Automontage System and software. Multiple image stacks, generally 10–20 images each, were used to construct the final figures. Images were illuminated with gooseneck fiber optics systems and an LED ring light attached to the end of the microscope column. Prior to scanning, the subject was white balance corrected using the system software. The montaged images were edited using Adobe Photoshop® and Adobe Illustrator® to form the final figure plates.

As noted above, images were created from both HDMS prepared specimens and specimens retained in EtOH. For the latter, methods described by Young et al. (2016) were utilized. The specimen was: (1) removed from 80% EtOH vial, (2) placed in a small (30 mm diameter), glass crystallization dish, (3) covered with a viscous, water soluble medium (e.g., hand sanitizing gel), (4) then covered with a layer of 70% EtOH to correct for the optical distortion of the gel. After imaging, the specimen was rinsed in EtOH and returned to the storage vial. The specimen imaged by the EtOH-gel method (Figs. 1, 2) provided the best results.



Fig. 1

5 mm



Fig. 2

1 mm

Figures 1–2: Adult ♀, *Gnoriste macra* Johannsen. Figure 1. Habitus, left lateral view; Figure 2. Head, left lateral view. Focus-stacked digital images (EtOH-gel method): DKY.

Study Site: Habitat images (Figs. 3, 4), reference the specific Malaise trap sites where traps were set from which the specimens were captured. The images were taken when the traps were first set for the 2020 field season on 16 March. The sites

were located in the Baraboo Hills of Sauk County, within the Hemlock Draw State Natural Area Preserve (land currently held by The Nature Conservancy) in south-central Wisconsin. Hemlock Draw is a narrow gorge of sandstone and conglomerate rock



Fig. 3



Fig. 4

Figures 3–4. General habitats and Malaise traps where *Gnoriste macra* Johannsen specimens were collected. Digital images captured 16 March 2020: DKY.

that generally supports species with more northerly affinities. The Malaise traps were situated in a glade above Honey Creek, a springs/seepage area below the glade, along a streamlet feeding into the creek, and in a marsh near Honey creek, itself. Stands of hemlock and yellow birch line the stream and gorge; sedges, skunk cabbage, trout lily, and witch hazel among others also grow along the flat-bottomed draw. On the flanks of the draw, sugar maple, red oak, ironwood, and large-toothed aspen are predominant.

Results and Discussion

Nine specimens of *G. macra* were collected from an unbaited Malaise trap in 2006: [1st label] USA: WI: Sauk Co. // Hemlock Draw // 43°22'00"N/-89°56'44"W // WGS84; 17–22 May 2006 // Daniel K. Young; Malaise // trap; *Quercus/Carya* glade; [2nd label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young.

An additional 106 specimens were recovered from unbaited Malaise traps during 2020: (18 specimens, including the female imaged in Figs. 1, 2): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3643°N/-89.9410°W // WGS84; 12–20 May // 2020; Daniel K. Young; [2nd label] Malaise trap: *Quercus, // Prunus, Symplocarpus, // Podophyllum* marsh; [3rd label] 20200512-1_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young. (34 specimens): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3643°N/-89.9410°W // WGS84; 20–26 May // 2020; Daniel K. Young; [2nd label] Malaise trap: *Quercus, // Prunus, Symplocarpus, // Podophyllum* marsh; [3rd label] 20200520-1_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young. (5 specimens): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3650°N/-89.9406°W // WGS84; 12–20 May // 2020; Daniel K. Young; [2nd label] Malaise trap: nr streamlet // in ravine, *Quercus/Prunus/ // Erythronium* habitat; [3rd label] 20200512-2_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young. (7 specimens): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3650°N/-89.9406°W // WGS84; 20–26 May // 2020; Daniel K. Young; [2nd label] Malaise trap: nr streamlet // in ravine, *Quercus/Prunus/ // Erythronium* habitat; [3rd label] 20200520-2_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young. (30 specimens): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3650°N/-89.9403°W // WGS84; 12–20 May // 2020; Daniel K. Young; [2nd label] Malaise trap: *Quercus, // Populus, Symplocarpus, // Podophyllum* habitat; [3rd

label] 20200512-3_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young. (11 specimens): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3660°N/-89.9466°W // WGS84; 12–20 May // 2020; Daniel K. Young; [2nd label] Malaise trap: seepage // below glade; *Populus, Quercus, Betula*; [3rd label] 20200512-4_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young. (1 specimen): [1st label] USA: WI: Sauk Co. // Hemlock Draw TNC// 43.3660°N/-89.9466°W // WGS84; 12–20 May // 2020; Daniel K. Young; [2nd label] Malaise trap: seepage // below glade; *Populus, Quercus, Betula*; [3rd label] 20200520-4_DKY_HemlkDraw; [4th label] *Gnoriste // macra // Johannsen // det.* Daniel K. Young.

Prior to the current discovery, the only literature record for *G. macra* in Wisconsin was from its original description (Johannsen 1912). The type locality, Whitefish Bay [as “White Fish Bay” in the description] in Milwaukee County is now a highly residential area approximately five miles north of the heart of Milwaukee. Thus, it is likely that *G. macra* is extirpated from the type locality. The Wisconsin records reported here are approximately 103 miles west-northwest of the historic location and the land between the two locations has become highly altered by human activity save for a few preserved areas, such as the southern unit of the Kettle Moraine State Forest, west-southwest of the type locality. Also noteworthy, this rediscovery comes nearly a century after the original description of *G. macra* from Wisconsin.

The extremely elongate, narrow frontoclypeal cranial region of *Gnoriste* spp., including *G. macra* (Figs. 1, 2) suggests a highly specialized pollinator role. Although nothing is known regarding the natural history of *G. macra*, *Gnoriste megarrhina* Osten Sacken has been observed at study sites in northwestern Oregon visiting the strongly protandrous flowers of *Tolmiea menziesii* (Pursh) Torrey and Gray (Saxifragaceae) (Goldblatt et al. 2004, McAlister 2017). Observations of other insects visiting the flowers of *T. menziesii* during the study led the authors to suggest *G. megarrhina* serves as the primary pollinator (Goldblatt et al. 2004). In another study, Okuyama et al. (2004) examined pollination in four species of the saxifrage genus *Mitella* in Japan. The two species with tubular flowers: *Mitella furusei* Ohwi and *Mitella stylosa* Boissieu were observed to be visited and pollinated almost exclusively by *Gnoriste mikado* Okada.

Given what is known about the observed specialized pollinator ecological services of *G. megarrhina* at study sites in Oregon, USA, as well as *G. mikado* in Japan,

it seemed fitting to speculate regarding the potential pollinator role of *G. macra* in Wisconsin. At the Hemlock Draw sites, two species of Saxifragaceae are most likely candidates (*M. Feist*, personal correspondence). The first, *Heuchera richardsonii* R. Brown, possibly has the most similar floral anatomy and aspect to *T. menziesii* (Oregon study): <http://wisflora.herbarium.wisc.edu/taxa/index.php?taxon=3844>. The second saxifrage species, *Mitella diphylla* Linnaeus, has very interesting and intricate flowers, albeit smaller: <http://wisflora.herbarium.wisc.edu/taxa/index.php?taxon=4267>. All records of *G. macra* in Wisconsin have come from mid- to late May and flowering times indicated for *H. richardsonii* are June-July, while those of *M. diphylla* have been recorded as May-June. Of course, it should also be noted that *M. diphylla* is congeneric with the two flowers pollinated by *G. mikado* in Japan. Thus, while both *H. richardsonii* and *M. diphylla* should be considered species of interest in establishing a possible pollinator role to *G. macra* at the Hemlock Draw sites in Wisconsin, it seems *M. diphylla* may be the most likely candidate species.

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