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Note

Japanese Chaff-flower, *Achyranthes japonica* (Amaranthaceae), on the Erie islands, an invasive plant new to Canada

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Abstract

Japanese Chaff-flower, *Achyranthes japonica* (Miquel) Nakai (Amaranthaceae) was found growing on two islands in western Lake Erie: East Sister Island and Middle Island. These are the first documented reports for this species in Canada, and these locations are approximately 300 km north of the nearest reported observations in southern Ohio. Japanese Chaff-flower is a non-native plant from Asia, which is highly invasive in the United States and has the potential to become so in Canada.

Key words: Japanese Chaff-flower; *Achyranthes japonica*; East Sister Island; Middle Island; Ontario; non-native invasive plant; range extension

During a visit to East Sister Island Provincial Nature Reserve in Lake Erie (Essex County, Ontario) on 27 September 2018, I found a small population of Japanese Chaff-flower, *Achyranthes japonica* (Miquel) Nakai (Amaranthaceae) in the shade of moist deciduous forest co-dominated by American Elm (*Ulmus americana* L.) and Common Hackberry (*Celtis occidentalis* L.; Figure 1). The location was at 41.81230°N, 82.85764°W in the island's interior, at least 100 m from the Lake Erie shoreline. The population consisted of 15 plants, up to 50 cm tall. One specimen was collected.

Two larger and taller stands of the plant were encountered on East Sister Island at ~41.8117°N, 82.8587°W in a small gap in a similar type of forest and at 41.8120°N, 82.8582°W. These were ~50 m from the shoreline. Both stands were more robust and dense than those at the first location, each consisting of several dozen plants over 60 cm tall. They were growing on moist, level ground that may receive seasonal inundation and were partly shaded by Common Elderberry (*Sambucus canadensis* L.) and associated with Stinging Nettle (*Urtica dioica* L.), Common Pokeweed (*Phytolacca americana* L.), Spotted Jewelweed (*Impatiens capensis* Meerburgh), and Dwarf Clearweed (*Pilea pumila* (L.) A. Gray).

On 5 October 2018, I visited Middle Island, part of Point Pelee National Park, also in Lake Erie and situated ~20 km southeast of East Sister Island. I observed two patches of Japanese Chaff-flower on the west end of that island within 15 m of the shoreline. Five plants were at the base of a limestone shingle berm in shade under a moist deciduous forest dominated by Common Hackberry at 41.68366°N, 82.68593°W. There were few other plants in the ground layer. The second larger nearby patch, at 41.68358°N, 82.68620°W, consisted of several dozen individuals. This patch was in semi-shade under forest dominated by Common Hackberry, associated with Stinging Nettle and Common Pokeweed. The island was surveyed quite comprehensively and no other patches of Japanese Chaff-flower were found. T. Dobbie (pers. comm. 3 December 2018) reported finding and photographing a plant that she did not recognize while conducting a plant survey on Middle Island on 8 June 2018. The plant was nondescript with no fruit or flowers because it was early in the season. She sent the photo to me, as I was now familiar with the species, and I confirmed that it was Japanese Chaff-flower, making that the earliest documentation of the species in Canada. Discussions with leading field botanists, the Canadian Food Inspection Agency (C. Wilson pers. comm. January 2019) and a check of the records and specimens available at the herbaria of the Canadian Museum of Nature, Agriculture and Agri-Food Canada, the Database of Vascular

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FIGURE 1. Japanese Chaff-flower (*Achyranthes japonica*) observed on East Sister Island, 27 September 2018. The plant was growing in partial shade. Photo: James Kamstra.

Plants of Canada (VASCAN 2019), and the Ontario Ministry of Natural Resources and Foresty revealed no previous reports of this species in Canada.

Japanese Chaff-flower is native to Japan, Korea, and China, where it is known for its medicinal properties (Jung *et al.* 2007). The first North American record of Japanese Chaff-flower was from Martin County in eastern Kentucky, in August 1981 (Medley *et al.* 1985). Within a decade, the plant had dominated the floodplains in the area where it was first discovered and, within 15 years, had spread over 500 km along the Ohio River valley (Evans and Taylor 2011). The first documentation in Ohio was from 1992 (Vincent and Cusick 1998). In Flora of North America, Robertson (2003) indicated the plant's presence in Kentucky, West Virginia, and Ohio. Evans and Taylor (2011) mapped the distribution in the United States at the time showing that, by 2011, it had been confirmed in every county along the Ohio River from West Virginia to Illinois, with isolated populations in Georgia and Tennessee.

Japanese Chaff-flower is on the watch list for several states including Michigan (Michigan Invasive Species 2018) and Wisconsin (Wisconsin DNR 2018), both states where it has not yet been reported. None of the available mapping shows Japanese Chaff-flower to be currently present near Lake Erie. Both EDDMapS (2018) and iNaturalist (2018) show that the nearest reported observations are in the vicinity of Cincinnati, Ohio, ~300 km south of the Erie Islands. R. Gardner (pers. comm. 22 January 2019), confirmed that, currently, Japanese Chaff-flower has been recorded only from the southern counties bordering the Ohio River in that state.

At first glance, Japanese Chaff-flower superficially resembles Lopseed (*Phryma leptostachya* L.) because of the narrow erect spikes crowded with deflexed fruits and opposite leaf arrangement. However, the flowers of Japanese Chaff-flower have five deflexed tepals, and the ovate-elliptical leaves are glabrous and lack teeth (Robertson 2003). The fruits hang tightly on the spike; each one contains a pair of spiny bracts that adhere to fur and feathers. The seeds are mainly spread by animals or water transport (Evans and Taylor 2011). Japanese Chaff-flower is typically 0.75–1.5 m tall (Robertson 2003), but can reach 3 m (Schwartz *et al.* 2016). Throughout its introduced range in the United States, it most frequently grows in semi-shaded moist soils, but can also occur in drier and sunny sites (Schwartz *et al.* 2016) and is, therefore, capable of colonizing a variety of habitats.

The origin of the plants on the two Erie islands can only be speculated. Middle Island is ~18.5 ha in area and located 4.5 km south of Pelee Island, the

nearest land mass. East Sister Island is ~13 ha in area and more remote at 10 km north of North Bass Island, Ohio, the nearest land mass of more than 2.5 ha. Both East Sister and Middle Islands support large nesting colonies of Double-crested Cormorants (*Phalacrocorax auritus*) numbering in the thousands (McGrath and Murphy 2012) as well as smaller numbers of nesting Herring Gulls (*Larus argentatus*), Black-crowned Night-herons (*Nycticorax nycticorax*), Great Blue Herons (*Ardea herodius*), and Great Egrets (*Ardea alba*; IBA Canada 2018). Because the seeds of Japanese Chaff-flower can readily attach to fur or feathers, the plants may have been carried to both islands by cormorants or other birds. Cormorant nests were present in trees in the vicinity of Japanese Chaff-flower patches on both islands.

Choi *et al.* (2010) examined nearly 4000 birds for the presence of plant propagules on a remote island off Korea. Three species of migratory birds were found to have seeds of Japanese Chaff-flower attached to their feathers, including two marsh species: Eurasian Bittern (*Botaurus stellaris*) and Swinhoe's Rail (*Coturnicops exquisitus*). Choi *et al.* (2010) suggest that birds may have been responsible for the spread of Japanese Chaff-flower to offshore islands in Korea where it has become highly invasive.

Considering the relatively intense floristic survey of the Lake Erie Islands (Duncan *et al.* 2010), it seems likely that Japanese Chaff-flower is a recent arrival. Given that Japanese Chaff-flower is not known from the south shore of Lake Erie (R. Gardner pers. comm. 22 January 2019), it seems likely that birds were the means for its spread onto East Sister and Middle Islands. The sheer abundance of cormorants, which nest all over both islands, make them a likely vector. Japanese Chaff-flower also spreads by water, but the plant is not known to be present elsewhere along the Lake Erie shore. Furthermore, the plants found on East Sister Island were inland and not along the immediate shoreline.

Japanese Chaff-flower has the potential to become an aggressive invasive plant in southern Ontario. Because of the seriousness of this new threat, several fact sheets have been produced to inform the public about control methods and encourage them to report sightings (Evans and Taylor 2011; Rathfon and Eubank 2013; Schwartz *et al.* 2015). The plant has spread rapidly along river systems in the United States and has been identified as a high priority invasive in Indiana (Rathfon and Eubank 2013). A single large plant can produce more than 1000 seeds and 94% of the seeds have been shown to be viable (Evans and Taylor 2011). Infestations can attain densities of more than 70 plants/m^2, which will shade out all other plants below them (Evans and Taylor 2011). They also have the ability to invade undisturbed forests that have not been previously impacted (Schwartz *et al.* 2016).

The United States Department of Agriculture (USDA 2014) has evaluated the plant's weed risk potential and, based on its native range, determined that it can survive in hardiness zones 5–10. Consequently, it has the potential to spread to all of Ontario south of the Canadian Shield, as well as parts of Quebec, the Maritimes, and even parts of British Columbia. The Canadian Food Inspection Agency, Canada's national plant protection authority, is conducting a full risk assessment of the Japanese Chaff-flower to determine its invasive potential in the country (C. Wilson pers. comm. January 2019). Control, research, and ideally eradication should be high priorities before the plant gains a strong foothold, although this may not be possible given its spread in the USA.

Voucher specimens

Canada, Ontario: Essex County, Pelee Township, East Sister Island. 41.81230°N, 82.85764°W. About 15 plants growing in moist soil in deciduous forest co-dominated by American Elm and Common Hackberry, 27 September 2018, *CAN-10091002* (CAN).

Canada, Ontario: Essex County, Pelee Township, Middle Island, Point Pelee National Park. 41.68358°N, 82.68620°W. About 35 plants growing in moist soil near shoreline in deciduous forest dominated by Common Hackberry, 5 October 2018, *CAN-10091001* (CAN).

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