

Records of the Japanese beetle and its parasitoid *Istocheta aldrichi* (Mesnil) (Diptera: Tachinidae) in Québec, Canada

by Marie-Eve Gagnon and Marjolaine Giroux

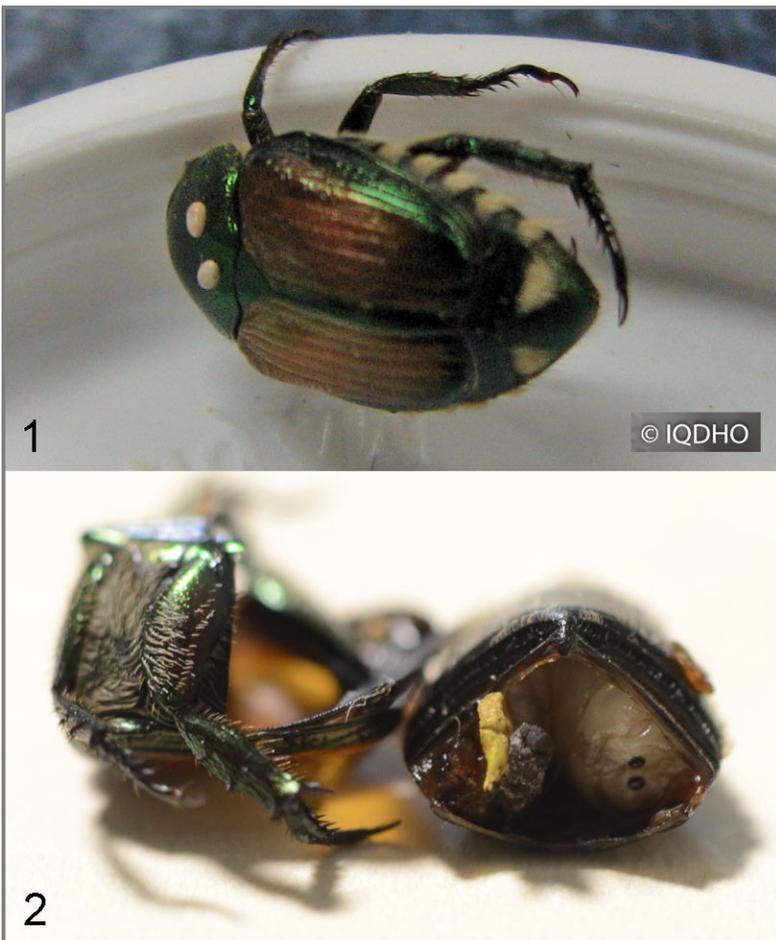
Collections entomologiques et recherche, Insectarium de Montréal, Espace pour la vie, 4581 rue Sherbrooke Est, Montréal, Québec, Canada H1X 2B2. E-mails: marie-eve.m.gagnon@ville.montreal.qc.ca, marjolaine.giroux@ville.montreal.qc.ca

The Japanese beetle, *Popillia japonica* Newman (Coleoptera: Scarabaeidae), was first discovered in North America in 1916 in New Jersey, USA (Clausen *et al.* 1927). The oldest known record in Canada is a specimen collected in 1929 from Simcoe, Ontario and housed in the Canadian National Collection of Insects in Ottawa (pers. comm., CNC

Collection Manager Owen Lonsdale). The Japanese beetle is now established throughout eastern Canada (from Ontario eastward) and has been found recently in the Vancouver area of British Columbia (CFIA 2017, 2019). Larvae of Japanese beetles feed on the roots of turf grass and other plants and adults feed on the foliage and fruit of many plants.

At the Jardin botanique de Montréal [Montréal Botanical Garden], the Japanese beetle has been a pest since 2010 (pers. comm., Stéphane Labelle). During the summer of 2017, a horticulturist at the Jardin botanique noticed small white eggs on the pronota of Japanese beetles and asked us if they could be from a parasite. This observation prompted us to investigate the source of these white eggs, and the results of this study are presented here.

Twenty adult Japanese beetles bearing white eggs on their pronota (similar to the beetle shown in Fig. 1) were collected for us at the Jardin botanique de Montréal from mid-July to the beginning of August 2017. These beetles were placed in rearing cages. After 5 or 6 days in captivity, individuals were dying. Two dead beetles were dissected and each had a fully grown fly larva in the abdomen (one shown in Fig. 2). The next day, one fly larva had formed a puparium. The remaining 18 beetles were left in the rearing container to allow the fly larvae to pupariate inside their hosts.



Figures 1–2. 1. A Japanese beetle collected in Granby (QC) in 2009 with tachinid eggs on its pronotum. (Photo courtesy of B. Mongeau, IQDHO.) 2. A dead and dissected Japanese beetle with an *I. aldrichi* larva in its abdomen. (Photo by M. Giroux, Insectarium de Montréal.)

In November 2017, the 18 remaining beetles were gently opened and we found a fly puparium in the abdomen of each one. The specimens were then placed in cold storage (4°C) for eight months. At the end of this period the specimens were returned to room temperature but no adults emerged from the puparia.

To determine the identity of the fly parasitoid, we sent half of two puparia to LifeScanner (<http://lifescanner.net/>) for DNA COI barcoding (code numbers BOLD-CK5 and BOLD-KW5; the remaining halves of the puparia are deposited in the Collection Insectarium de Montréal). LifeScanner is a DNA barcoding service for Citizen Scientists that consists of a standardized sampling kit, mobile app, and standardized laboratory workflow. Taxonomic identifications are generated through the Barcode of Life Data (BOLD) Systems ID Engine (Ratnasingham & Hebert 2007). The barcoding results identified the fly species as the tachinid *Istocheta aldrichi* (Mesnil).

Istocheta aldrichi was introduced into the United States for control of the Japanese beetle in 1920 (Potter & Held 2002). It was first reported from Canada by O'Hara (2014), who caught a single adult in Nepean (Ottawa, Ontario) in 2013. Eggs had been seen on adult Japanese beetles in Canada prior to this time but their identification as *I. aldrichi* had not been confirmed.

An Internet search by us found reports of Japanese beetles in Québec with eggs on their pronota and presumably parasitized with *I. aldrichi*. In one report, a horticulturist noted parasitized beetles in her nursery in Becancour in 2017 (<http://www.vivaces.net/ScarabeeParasitoide.html> [in French]). She also observed parasitized beetles in the Montérégie and Cantons de l'Est regions of Québec that same year. Parasitized beetles were also observed in Gatineau in 2017 (by senior author) and the Citizen Science website <https://www.inaturalist.org/> reported observations of parasitized Japanese beetles in the area of Joliette (2015) and Sherbrooke (2017). In 2018 we received a picture (Fig. 1) of a parasitized Japanese beetle caught on 21 July 2009 in Granby, Québec. Since no tachinid other than *I. aldrichi* is known to parasitize the Japanese beetle, these observations of tachinid eggs on Japanese beetles at various locations in Québec over

Table 1. Earliest records of *Popillia japonica* at locations in Québec based on a survey of entomological collections.

Locality	Year(s)	No. of specimens	Collection
Saint-Hubert	1938	1	QMOR
Farnham	1972	12	QMOR
Hull	1998	2	CMNC
Saint-Armand	1998	1	SLTC
Saint-Jean-sur-Richelieu	1999	16	SLTC
Joliette	2000	9	SLTC
Trois-Rivières	2004	1	CPTO
Laval	2007	1	CPTO
Saint-Armand	2007	4	QMOR
Mont-Saint-Hilaire	2008	2	SLTC
Saint-Armand	2008	14	IMQC
Contrecoeur	2010	1	SLTC
Portneuf	2014	1	CIQ
Ste-Foy	2014	1	CIQ
Montréal	2015	41	SLTC
Rive-Sud de Québec	2015	1	CIQ
Terrebonne	2017	10	SLTC
Laval	1975–1997	17	SLTC
Frelighsburg	1994–1996	18	SLTC
Berthierville	1997–1998	31	SLTC
Longueuil	2001–2011	205	SLTC
Montréal	2001–2013	17	IMQC
Aylmer	2005–2016	26	CMNC
Contrecoeur	2008–2010	10	IMQC
Capitale nationale	2015–2017	3	CIQ
Sainte-Marthe-sur-le-Lac	2016–2017	29	SLTC

Collection acronyms:

- CIQ – Collection d'insectes du Québec, Québec, QC, Canada.
- CMNC – Canadian Museum of Nature's Insect Collection, Ottawa, ON, Canada.
- CPTO – Pierre De Tonnacour collection, Ile-Perrot, QC, Canada.
- IMQC – Collection Insectarium de Montréal, Montreal, QC, Canada.
- QMOR – Collection Entomologique Ouellet-Robert, University of Montréal, Montreal, QC, Canada.
- SLTC – Stéphane Le Tirant collection, Terrebonne, QC, Canada.

the past ten years suggest that *I. aldrichi* has been in the province for some years before its presence in Canada was formally confirmed and reported by O'Hara (2014).

We started a survey of *I. aldrichi* across Québec in 2018. We plan to document the presence of this tachinid with the help of Citizen Science participants and submitted images of parasitized beetles. We are also collecting information on the Japanese beetle itself. We have already surveyed a number of collections to document their earliest records of the beetle in Québec (Table 1). The earliest specimen of a Japanese beetle in Québec that we have recorded was collected in St-Hubert by Joseph Ouellet in 1938 (1 male, QMOR).

Researchers at Agriculture and Agri-Food Canada are developing a project to survey the Japanese beetle and *Istocheta aldrichi* across Canada. We are collaborating with these researchers by surveying for this pest and its tachinid parasitoid in the province of Québec, where we will also monitor parasitism rates to evaluate the efficiency of the parasitoid. The Japanese beetle is very unpopular, but quite noticeable, and we hope to gather as much information as we can on this natural biological control agent.

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