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(Coleoptera: Chrysomelidae: Galerucinae: Alticini)  
established in North America

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## The Palearctic flea beetle *Epitrix pubescens* (Koch) (Coleoptera: Chrysomelidae: Galerucinae: Alticini) established in North America

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**Abstract.** The Palearctic flea beetle *Epitrix pubescens* (Koch) (Coleoptera: Chrysomelidae: Galerucinae: Alticini) is reported as established in North America. It is recorded in the United States from Illinois, Massachusetts, New Hampshire, New York, Oregon, and Wisconsin, and in Canada from the Provinces of Nova Scotia, Ontario, and Quebec. The oldest records are from 1975. The species has been reported feeding on *Solanum dulcamara* L. (Solanaceae). Full distributional information and reference photos for identification are provided. *Epitrix pubescens* may have avoided detection for such a long time due to its size, difficulty of identification, and affinity for a weed rather than agricultural crops. The more than 40-year lag between arrival and discovery of an immigrant species illustrates the importance of routine biodiversity monitoring efforts and taxonomic works.

**Key words.** Invasive species, Solanaceae, *Solanum*.

### Introduction

Flea beetles in the genus *Epitrix* Foudras (Coleoptera: Chrysomelidae: Galerucinae: Alticini) are associated with plants in the nightshade family Solanaceae, and some are agriculturally important pests. Larvae are root feeders and can stunt growth or damage tuberous vegetables, such as potato, *Solanum tuberosum* L. (Solanaceae). Adults are foliage feeders and can cause significant damage, especially to young plants (OEPP/EPPO 2011). The center of diversity, and origin of most of the pest species within *Epitrix*, is the New World, primarily the Neotropics (Konstantinov and Vandenberg 1996). Three exotic pest species have become established in the Palearctic, and other pest species are considered a high priority for detection and prevention in Europe (Boavida and Germain 2009). Despite this typical trend, here the first known incidence of a Palearctic *Epitrix* species becoming established in the New World is reported.

*Epitrix pubescens* (Koch, 1803) is widely distributed in the Palearctic across much of Europe and Russia (Döberl 2000). In its native range it feeds primarily on *Solanum dulcamara* L., although it has been reported to feed on other plant species, including recently potato (Highet and Pearson 2015). However, the observed feeding on potato was limited to adults feeding on foliage; so, it is still unknown if the larvae can complete development on this plant. The species is not currently considered to be a major agricultural pest or threat. The first published record of this species in North America was Bieńkowski and Orlova-Bienkowskaja (2016) citing data from the unpublished undergraduate thesis of the author. Rykken and Farrell (2018) additionally reported the species from Massachusetts based on specimens included in this paper.

### Materials and Methods

New World specimens of this species were found while surveying museums while revising *Epitrix* of America north of Mexico. Specimens came from the following collections: Monte L. Bean Life Sciences Museum, Brigham Young University, Provo, UT (BYU); Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, ON (CNC); California State Collection of Arthropods, Sacramento, CA (CSCA); Edward G. Riley Personal Collection, College Station, TX (EGRC); Montana Entomology Collection, Bozeman, MT (MTEC); and the University of New Hampshire Insect Collection, Durham, NH (UNHP).

Specimens of *E. pubescens* were identified using external morphology and genitalic characters discussed by Döberl (2000) and by comparison to specimens collected in Europe (CSCA). Habitus and aedeagal photos were taken using a Visionary Digital Passport II system with a Canon EOS 6D camera, using a 65 mm lens and a 1.4× TAMRON-F AF Tele-converter for some images. Female genitalic photos were taken using the same Canon EOS 6D camera on an Axioskop® compound microscope with a 10× objective. Images were stacked using Helicon Focus® and edited in Adobe Photoshop®. An image compilation was created using GIMP 2® software (version 2.8). A distribution map was made using ArcGIS ver. 10.6.1. The GEOLocate standard online client was used to obtain coordinates for specimens that lacked GPS data. The materials examined list was created using AUTOMATEX software (Brown 2013).

## Results and Discussion

In total, 136 New World specimens of *Epitrix pubescens* were identified from museum holdings. In the United States, these involve the states of Illinois, Massachusetts, New Hampshire, Wisconsin, New York, and Oregon, and in Canada the provinces of Nova Scotia, Ontario, and Quebec (Fig. 1). The oldest specimens were collected during 1975—three from Montreal in Quebec and one from Wellington County in Ontario, 335 miles (539 km) apart—showing that the species had likely been well established with a significant distribution by that time. Two specimens collected in Lindgren Funnel traps in Portland, Oregon during 2014 and 2016 came as a shockingly large range expansion. The origin and status of this population is unknown. The species may have successfully spread overland to the west while avoiding detection, the Oregon specimens may represent a disjunct population caused by human transport from established areas, or they could represent a new arrival. Because much of the area between the currently known populations is generally not well collected, it is not impossible for the insects to have escaped detection. Surveys of the intervening areas and genetic analyses of the populations could potentially answer these questions, but are beyond the scope of this work.

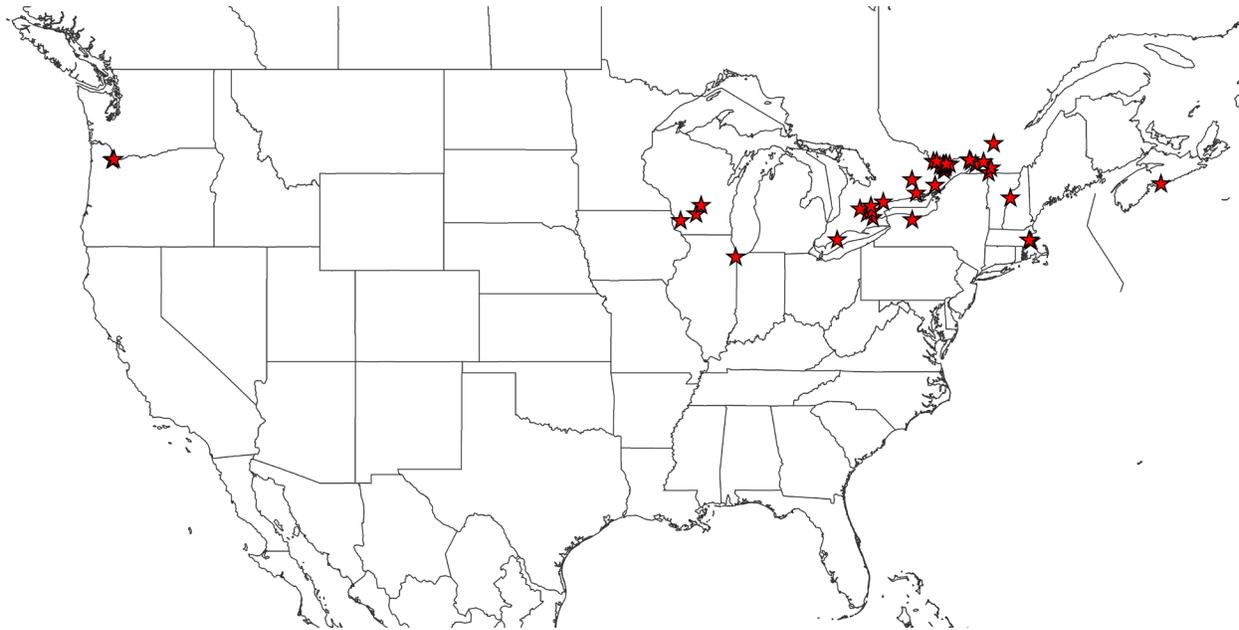
The only host plants recorded on label data for these specimens are *S. dulcamara* in Ontario and Wisconsin, and an unidentified *Solanum* sp. in Toronto. *Solanum dulcamara* is a common weed which was introduced into North America from Europe. Another Palearctic immigrant flea beetle species, *Psylliodes affinis* (Paykull), also feeds on this host plant and similarly spread across northern North America while largely avoiding detection (Shawn Clark, pers. comm.). Use of a weed, rather than an agricultural or garden crop, likely aided in *S. dulcamara* avoiding detection. Additionally, the affinity by *S. dulcamara* for disturbed habitats, often created by humans, could have helped its spread through plant and soil transport.

Adults of *Epitrix pubescens* can be separated externally from all other black species of *Epitrix* in America north of Mexico by the presence of alutaceous microsculpturing between the punctures on the pronotum when viewed under high magnification (~at least 50x); all other black species are smooth. This species is most likely to be misidentified as *Epitrix fuscula* Crotch, but can be differentiated by the microsculpture mentioned above and by having less dense pronotal punctures, less dense elytral setae, and a less elongate head. It can be separated from *Epitrix cucumeris* (Harris) in the east and *Epitrix tuberis* Gentner in the west by the shape of the pronotum, which is more robust, convex, and produced in the anterior angles. *Epitrix pubescens* has less dense pronotal punctures than *E. tuberis*, but more dense than *E. cucumeris*. However, the most reliable way to identify the species is by use of genitalia, especially the spermatheca (Fig. 2b–f). The receptacle of the spermatheca of *E. tuberis* is distinctly smaller than the receptacle of *E. pubescens*, and the spermathecal spout of *E. cucumeris* is much thinner and longer than the spout of *E. pubescens*. A preliminary key to the *Epitrix* species north of Mexico, including plates of the similar species, is available online (Deczynski 2016).

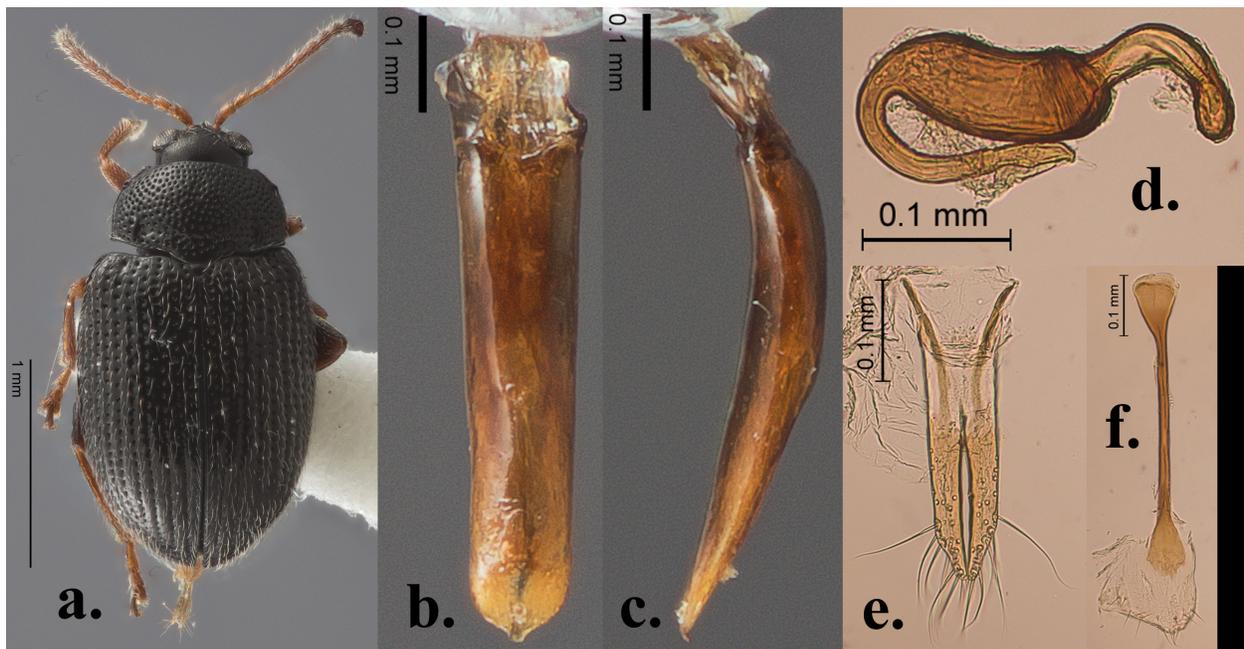
*Epitrix pubescens* does not likely constitute a significant economic or ecological risk in North America, but this species should not be disregarded. Although currently not known to be a major agricultural pest in its native range, behavioral changes could occur under different environmental pressures in the novel New World environment. Since the primary host is an invasive noxious weed, *E. pubescens* may serve a positive ecological role as a biocontrol agent. However, the full host range on New World solanaceous plants for *E. pubescens* is unknown, and the species could have detrimental effects on some

native nightshades. Thankfully, there is no indication, as yet, that *E. pubescens* is causing an economic or environmental impact.

However, a more pressing concern than the biology of the species is that it remained undetected for nearly half a century while it may have spread across an entire continent. There exists a great need for regular and thorough biomonitoring efforts, paired with taxonomic research, so that species of greater economic and ecological threat are identified sooner to facilitate necessary eradication and abatement measures. This should be accomplished through both the creation of new programs as well as increased support for programs already in progress.



**Figure 1.** Known records of *Epitrix pubescens* (Koch) from North America.



**Figure 2.** *Epitrix pubescens* (Koch). **a)** Habitus. **b)** Aedeagus ventral. **c)** Aedeagus lateral. **d)** Spermatheca. **e)** Vaginal palpi. **f)** Tignum.

**Material examined. CANADA: Nova Scotia:** Pt Pleasant Park, 44.6235°N, 63.5685°W, 1♂, 23-Jun-2001, C. Majka (CNC); same location, 1♀, 28-Jul-2001, C. Majka (CNC). **Ontario:** Britannia, shore Ottawa River, 45.3667°N, 75.8000°W, 1♂, 16-Apr-1986, A. Davies (CNC); Carillon Park, 45.5695°N, 74.3746°W, 1♂, 21-Jul-1983, E. J. Kiteley (CNC); Chaffeys Locks Bio. Stn., 44.5675°N, 76.3249°W, 1♂, 26-Oct-1986, A. Davies (CNC); Crieff bog, 3 K. W. Puslinch, 43.4242°N, 80.1515°W, 1♀, D. Blades (CNC); Halton Region, Milton, 43.5167°N, 79.8833°W, 1♂, M. Sanborne (CNC); Hamilton Census Division, Hamilton, 43.2500°N, 79.8333°W, 1♀, M. Sanborne (CNC); Honeywell, 44.2431°N, 77.3808°W, 1♂, 28-Jul-1984, L. LeSage, Sweep Netting (CNC); HWY. 62, 4 Km. S, Gilmour Jct., 44.7805°N, 77.6201°W, 2♀, 21-Jul-1996, B. F. & J. L. Carr (CNC); Kanata, 45.3333°N, 75.9000°W, 2♂, 1♀, 22-Jun-1995, B. F. & J. L. Carr (CNC); Mud Lake, Britannia, 45.3725°N, 75.7940°W, 1♀, 6-May-1993, LeSage & Davis (CNC); Nepean, NCC Log Farm, 45.2969°N, 75.7907°W, 2♂, 1-Nov-1985, A. Davies & T. W. M. Davis (CNC); Ottawa Census Division, 10 Km W. North Gower, 45.153°N, 75.8103°W, 2♀, 9-Apr-1987, A. Davies, Berlese Trap (CNC); Ottawa Census Division, 10kmW North Gower, Marlborough Forest, 45.153°N, 75.8103°W, 1♂, 2♀, 18-Nov-1986, A. Davies (CNC); Ottawa Census Division, Hardwood Plains, 45.3500°N, 76.0333°W, 3♂, 3♀, 2-Jul-1981, L. LeSage & D. Ward (CNC); Ottawa Census Division, Mer Bleue, 45.4008°N, 75.4997°W, 7♂, 6♀, 9-Jun-1982, L. LeSage (CNC); Ottawa Census Division, Nepean, 45.2687°N, 75.7668°W, 1♀, 13-Jun-1980, J. E. Hollebone (CNC); same location, 1♂, 11-Aug-1998, B. F. & J. L. Carr (CNC); Ottawa Census Division, Ottawa, 45.4167°N, 75.7000°W, 1♂, 28-Jun-1982, L. LeSage (CNC); same location, 1♀, 28-Jun-1995, B. F. & J. L. Carr (CNC); same location, 1♀, 31-May-1985, M. Davis (CNC); same location, 5♀, 8-Aug-1984, L. LeSage (CNC); same location, 1♂, L. Masner, Malaise Trap (CNC); Ottawa Census Division, Ottawa, Merivale Park, 45.3275°N, 75.7218°W, 2♂, 1♀, 17-Aug-1984, L. LeSage (CNC); Rondeau Park, 42.3278°N, 81.8436°W, 5♂, 3♀, 1-May-1985, L. LeSage, Sweep Netting (CNC); Toronto, Reesor Park, 43.888°N, 79.242°W, 1♀, 20-May-2017, H. Douglas, Sweep Netting, *Solanum* sp. (CNC); Waterloo District, Elmira, Salem Creek, 43.6022°N, 80.5561°W, 1♀, 2-Jun-1982, L. LeSage, Sweep Netting (CNC);, Wellington County, Terra Cotta, 43.7191°N, 79.9352°W, 1?, 2-Jul-1975, R. H. Parry, On *Solanum dulcamara* (CSCA). **Quebec:** Argenteuil Region, ?le de Carillon, 45.5108°N, 74.2961°W, 1♂, 9-Jun-1984, Larochelle & Lariviere (CNC); Aylmer, 45.40°N, 75.85°W, 1♂, 7-Jun-1991, L. LeSage (CNC); Iberville (St-Jean), Vignoble: Dietrich-Jooss, 45.2500°N, 73.1667°W, 1♀, 27-May-1999, ECORC/CRDH/Ag-Cord (CNC); Maskinonge County, Maskinonge, 46.2167°N, 73.0167°W, 1♂, 26-Aug-1986, L. LeSage (CNC); Missisquoi Co., Noyan, 45.0667°N, 73.3000°W, 1♂, 1♀, 3-Jun-1984, Larochelle & Lariviere (CNC); Montreal, 45.5000°N, 73.5833°W, 2♀, 18-May-1975, E. J. Kiteley (UNHP); same location, 1?, 18-May-1975, E. J. Kiteley (CSCA); same location, 2♀, 10-Jul-1982, E. J. Kiteley (CNC); same location, 3♀, 27-Aug-1979, E. J. Kiteley (CNC); Montreal, Montreal, 45.5000°N, 73.5833°W, 1♂, 27-Aug-1979, E. J. Kiteley (CNC); same location, 1♂, 28-Jun-1981, E. J. Kiteley (CNC); Norway Bay (Pontiac), Silver Creek, 45.5167°N, 76.4167°W, 1♀, 9-Jul-1993, L. LeSage, Sweep Netting (CNC); Pointe-Fortune (Vaudreuil), 45.5633°N, 74.3808°W, 1♂, 2♀, 18-Jun-1992, L. LeSage (CNC); Quyon (Pontiac), 45.5167°N, 76.2333°W, 1♀, 21-Apr-1992, L. LeSage & Hutchinson (CNC); same location, 4♂, 3♀, 21-May-1992, L. LeSage (CNC); Vaudreuil-Soulanges Region, Vaudreuil, 45.4000°N, 74.0333°W, 3♂, Larochelle & Lariviere (CNC). **USA: Illinois:** Cook Co., Sand Ridge Nature Center, 41.61°N, 87.57°W, 1♂, 1♀, 9-Jun-2016, S. M. Clark & R. J. Barney (BYU); **Massachusetts:** Norfolk Co., Grape Island, 42.2687°N, 70.9208°W, 1♂, 2♀, J. Rykken, Pitfall Trap Single (UNHP); Suffolk Co., Thompson Island, 42.3157°N, 71.0095°W, 1♀, 6-Jul-2009, M. Churchill & B. Farrell, sweep netting (UNHP); same location, 1♀, E. Hill, Malaise Trap (UNHP); Suffolk Co., Thompson Island, 42.3172°N, 71.0086°W, 1♀, 6-Jul-2009, M. Churchill & B. Farrell, sweep netting (UNHP); same location, 1♀, E. Hill, Malaise Trap (UNHP). **New Hampshire:** Grafton Co., Bedell Bridge S. P. @ Oliverian Brook, 44.0474°N, 72.0638°W, 3♂, 2♀, 22-Jun-1992, D. S. Chandler, sweep netting (UNHP); same location, 2♀, 2-Aug-1992, D. S. Chandler, sweep netting (UNHP); same location, 3♂, 2♀, 7-Jul-1992, D. S. Chandler, sweep netting (UNHP); same location, 1♂, 1♀, 3-Jul-1992, D. S. Chandler, sweep netting (UNHP); same location, 1♂, 25-Aug-1992, D. S. Chandler, sweep netting (UNHP). **New York:** Monroe Co., Rochester, 43.1547°N, 77.6158°W, 1♂, 19-Mar-1983, W. B. Muchmore, litter nr. RR tracks & sycamore (MTEC). **Oregon:** Multnomah Co., Portland, 45.5745°N, 122.752°W, 1♀, collector unknown, Lindgren Funnel Trap (BYU); Multnomah Co., Portland, 10200 NE 6th Dr., 45.5965°N, 122.6620°W, 1♂, collector unknown, Lindgren Funnel Trap (BYU). **Wisconsin:** Grant

Co., West Sime Bald, 2.5 km. SE Boscobel, 43.1269°N, 90.6813°W, 1♂, 11-Jun-2016, E. G. Riley (EGRC); Marquette Co., Summerton Bog, 43.75°N, 89.521°W, 3♂, 1♀, 12-Jun-2016, S. M. Clark (BYU).

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