INSECTA MUNDI A Journal of World Insect Systematics

0622

First record of the European cherry fruit fly, *Rhagoletis cerasi* (Linnaeus) (Diptera: Tephritidae), in North America

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Date of issue: April 27, 2018

Center for Systematic Entomology, Inc., Gainesville, FL

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Insecta Mundi 0622: 1–4
ZooBank Registered: urn:lsid:zoobank.org:pub:19F56B68-DC56-4F5A-B5E7-7D6F7BE3160F

Published in 2018 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
http://centerforsystematicentomology.org/

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Layout Editor for this article: Robert G. Forsyth

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Abstract. *Rhagoletis cerasi* (Linnaeus) (Diptera: Tephritidae) is reported from Mississauga, Ontario, Canada, and Niagara County, New York, United States for the first time, **new records**. Specimens from Ontario were collected in 2016, and New York in 2017. This fly is subject to regulatory control and poses a risk to cherry and honeysuckle in North America.

Key words. Ontario, New York, yellow sticky card, distribution.

Introduction

The genus *Rhagoletis* Loew contains over 60 species worldwide with 24 species in America north of Mexico (Foote et al. 1993; Stalažs and Balalaikins 2017). In North America, the genus contains a number of agricultural pests including orchard pests such as the eastern/American cherry fruit fly (ACFF) *Rhagoletis cingulata* Loew, the western cherry fruit fly, *Rhagoletis indifferens* Curran, and the apple maggot fly *Rhagoletis pomonella* Walsh.

The European cherry fruit fly (ECFF), *Rhagoletis cerasi* (Linnaeus) is widespread throughout Europe (Greece to Portugal and north into Sweden and Norway) and parts of western Asia (Georgia, Iran, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey, Turkmenistan, and Uzbekistan) (CABI 2016).

This pestiferous fly has a single generation per year with an obligatory overwintering period, which takes places underground (Daniel and Grunder 2012). The female fly oviposits a single egg into a fruit, typically one that is beginning to ripen, and then deposits a host marking pheromones to deter oviposition by other female flies. Larvae feed in the fruit making it unmarketable. They exit the fruit near harvest time to pupate nearby, and they may diapause for an additional year or more (Daniel and Grunder 2012).

ECFF's known host plants include cherries (*Prunus* (Rosaceae)) including black cherry (*Prunus serotina* Ehrhart), sour cherry (*Prunus cerasus* Linnaeus), sweet cherry (*Prunus avium* Linnaeus), and mahaleb cherry (*Prunus mahaleb* Linnaeus). Honeysuckles (*Lonicera* (Caprifoliaceae)), such as Tatarian honeysuckle (*Lonicera tatarica* Linnaeus) and dwarf honeysuckle (*Lonicera xylosteum* Linnaeus) are also known hosts (Jaastad 1998; Daniel and Grunder 2012).

Presented here are records of detection of ECFF in Ontario Province, Canada and New York State, United States; new biological associations, and discussion on the possible impacts of this introduction.

Materials and Methods

The first physical detection of ECFF was spurred by the photographing of a possible specimen in Riverwood Conservancy, Mississauga, Ontario in the winter of 2016. The Canadian survey was conducted at 40 sites starting in May 2016 by the Canadian Food Inspection Agency (CFIA). Surveys used Pherocon (Trece, Inc., Oklahoma) yellow sticky cards baited with ammonium acetate and hung approximately 2–6 m above the ground. Traps were a minimum of 15 m apart with up to 20 traps placed within a 500 m delimitation zone surrounding the site of the suspect photograph. Traps were serviced every week and hung primarily on cherry trees. Traps were placed prior to the flight period in early May with monitoring continuing into mid-July. Extensive sweep netting was utilized starting during early and mid-July, on *Lonicera* spp.

The New York survey was conducted by the United States Department of Agriculture Animal and Plant Health Inspection Service Plant Protection and Quarantine (USDA APHIS PPQ) in 2016 and 2017. Traps were placed along the United States / Canadian border in Niagara County, New York. The same yellow sticky cards were used and baited with trimethylamine HCl (2016) or ammonium acetate (2017) with collections taken every two weeks. Traps were then packaged and sent to the Pennsylvania Department of Agriculture (PDA) (Harrisburg, Pennsylvania) for screening of ECFF. All specimens of ECFF were sent to the United States Department of Agriculture Systematic Entomology Laboratory for confirmation by specialists using morphological characters.

Results

CFIA had positive detections at five of the 40 sites surveyed in 2016. Flies were collected at three localities using sweep netting between June 29 and July 11, and at two sites using sticky trap cards between June 16 and July 15, 2016. The ECFF collected in Ontario were collected in areas with the recorded honeysuckle host *L. tartarica* and found associated with *Lonicera morrowii* A. Gray (Morrow's honeysuckle), and *Lonicera* ×*bella* Zabel [*morrowii* × *tatarica*] (Erin Bullas-Appleton, Canadian Food Inspection Agency, pers. comm.).

No specimens were collected from New York in 2016. Fifty specimens (23♂, 25♀, 2 undetermined) were collected from August 8th to September 5th in 2017. These were trapped in both production and non-production landscapes for cherries, but similar to the Canadian results, were found only in areas with *Lonicera* species present.

Discussion

ECFF has the potential to be a pest of major concern in both managed and unmanaged systems (PPQ 2016). The low tolerance for damage in cherries may cause problems for cherry production and trade in the United States and Canada. In the United States, cherry exports and production are valued at over $700 million with exports accounting for over $430 million (NASS 2016). Left uncontrolled, ECFF has the potential to affect up to 100 percent of sweet cherry crops and up to 30 percent of sour cherries (Daniel and Grunder 2012). The ECFF lifecycle requires an overwintering period when it pupates in the soil, with approximately 180 days below 5 °C for maximum adult emergence. This obligate overwintering period restricts ECFF to northern regions, but covers most of the major cherry production in the United States (PPQ 2016).

Populations that develop on *Lonicera* sp. or *Prunus* sp. have shown preference for returning to oviposit on hosts from which they emerged (Boller et al. 1998, Daniel and Grunder 2012). As Canada has not yet reported damage or sightings in cherry production areas where ECFF is present, this population may be targeting wild populations of *Lonicera* instead. However, population density pressures could displace ECFF from its preferred hosts into cherry production areas, causing periodic outbreaks or host shifts in portions of the population. A risk of hybridization between ECFF and ACFF, as documented in European populations, could also influence host selection and shifts (Johannesen et al. 2013). This potential hybridization could also cause changes in flight periods, biology, and life cycle which could render current treatments for ACFF less effective. Hybridization could also affect any synergistic effects against ECFF.

Control of ECFF is possible in orchard settings; current European management methods can result in infestations of less than 0.1 percent (Kovanci and Kovanci 2006). Backyard growers and feral host populations may only see incidental benefits from orchard control methods, however. ECFF may also affect populations of native *Prunus* and *Lonicera* by reducing fruit set, dispersal, and seed viability, particularly when combined with the presence of other nonnative flies. *Drosophila suzukii* Matsumura (Drosophilidae), an already established pestiferous fly that targets *Prunus* in Pennsylvania, is implicated in impacting the regeneration of black cherry (*P. serotina)* in the High Allegheny Plateau (Turcotte et al. in press).

Spread of ECFF in North America is governed by a variety of factors. Within the United States several states already have regulations in place for the importation of host commodities potentially infested by other *Rhagoletis* species, including no-tolerance policies in some states (Yee et al. 2013). Natural spread of ECFF is limited as dispersal flights are likely to occur only in areas of heavy infestation pressure and limited host availability (Daniel and Grunder 2012). Larvae pupate in soil near the host tree, so only the movement of fruit trees from infested orchards would transport larvae or pupae. Most orchard plant material is shipped as dormant bud stick or bare root limiting this method of anthropogenic dispersal. The transport of infected fruit is more problematic as the fruit does not always show signs of infection until fully grown larvae are present (Caruso and Cera 2004).

ECFF in Canada is currently under increased phytosanitary requirements. These requirements aim to limit the spread of the fly from infected regions (Ontario province) to British Columbia (Canada's main cherry production region) and the United States entirely (CFIA 2017).

Acknowledgments

The author is grateful to S. Spichiger (Pennsylvania Department of Agriculture), Erin Bullas-Appleton (Canadian Food Inspection Agency), Margaret Kelly (New York Department of Agriculture), and Mafalda Weldon (USDA APHIS PPQ) for use of their data and verifying collection methods and records. The author also recognizes the efforts of Claire Ciafré and Matthew S. Wallace for revisions to the manuscript.

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Received February 15, 2018; accepted March 7, 2018.
Review editor Gary J. Steck.