

First detection of *Agrilus planipennis* in Connecticut made by monitoring *Cerceris fumipennis* (Crabronidae) colonies

Claire E. Rutledge¹, Melissa K. Fierke², Philip D. Careless³, Thomas Worthley⁴

1 The Connecticut Agricultural Experiment Station, 123 Huntington St. New Haven CT 06511 **2** Dept. of Environmental and Forest Biology, SUNY College of Environmental Science and Forestry, 135 Illick Hall 1 Forestry Dr. Syracuse, New York 13210 **3** University of Guelph, Insect Systematics Laboratory, School of Environmental Sciences, 1216 Edmund C. Bovey Building, University of Guelph, Guelph, ON, N1G 2W1, Canada **4** University of Connecticut Middlesex County Cooperative Extension Center 1066 Saybrook Road, Haddam CT 06438-0070

Corresponding author: Claire E. Rutledge (Claire.Rutledge@ct.gov)

Academic editor: Jack Neff | Received 14 February 2013 | Accepted 26 February 2012 | Published 24 April 2013

Citation: Rutledge CE, Fierke M, Careless P, Worthley T (2013) First detection of *Agrilus planipennis* in Connecticut made by monitoring *Cerceris fumipennis* (Crabronidae) colonies. Journal of Hymenoptera Research 32: 75–81. doi: 10.3897/JHR.32.4865

Abstract

Smoky winged beetle bandits, *Cerceris fumipennis* Say, digger wasps in the family Hymenoptera: Crabronidae: Cercerini, provision their underground nests with adult metallic wood-boring beetles (Coleoptera: Buprestidae). Researchers, as well as engaged community volunteers, in several states have monitored female wasps returning to their nests as a means to detect invasive buprestid species. In this paper, we report the first detection of emerald ash borer (*Agrilus planipennis* Fairmore), an invasive beetle responsible for killing millions of ash trees in North America, in Connecticut by *C. fumipennis* and discuss its relationship to *A. planipennis* survey efforts by other modalities in the state. We also report detections of *A. planipennis* by *C. fumipennis* in Illinois, New York and Ontario; all of which were made after it was known the beetle was in the area. These findings support the use of *C. fumipennis* as a biomonitoring tool and bolster the use of engaged volunteers.

Keywords

Biosurveillance, *Cerceris fumipennis*, *Agrilus planipennis*, survey technique

Introduction

Emerald ash borer (*Agrilus planipennis* Fairemore) (EAB) is native to far eastern Asia, and was accidentally introduced to North America in the mid 1990's. It was first detected in 2002 in Detroit MI, and has spread to 18 US states and 2 Canadian provinces. North American *Fraxinus* spp. show little to no resistance to the beetle, allowing it to attack and kill trees regardless of tree condition (Rebek et al. 2008). One major concern has been locating new infestations of EAB. The average time from infestation to detection is 6–12 years (McCullough et al. 2011; MFK unpublished data), ample time for the beetles to become firmly established in a new location. Much research and resources have been devoted to developing survey techniques to shorten the time between infestation and detection (Francese et al. 2006; Poland et al. 2006; Crook et al. 2009; Francese et al. 2011; Grant et al. 2011; McCullough et al. 2011; Ryall et al. 2012).

A novel survey technique called biosurveillance has been developed as part of that effort (Marshall et al. 2005; Careless 2009). This technique takes advantage of the prey specialization of *Cerceris fumipennis* Say, 1837 (Hymenoptera: Crabronidae: Cercerini), a native solitary digger wasp. As is typical for digger wasps, females provision larval cells with paralyzed prey. A wide range of adult beetles in the family Buprestidae are utilized by *C. fumipennis* females (Marshall et al. 2005; Careless and Marshall 2010; Rutledge et al. 2011) to provision their nests. Included in that range are beetles in the genus *Agrilus*, the genus of the EAB. By monitoring the prey returning wasps bring to their nests, surveyors can sample the buprestid beetles in the area surrounding the colony, including EAB. Studies by Careless (2009) suggested that the majority of species in an area are sampled after collecting 50 beetles from a colony, and that further collecting yields diminishing returns. Thus, the goal of an EAB biosurveillance program is to collect at least 50 beetles from each colony (Carrier and Jackson 2012).

Biosurveillance has been undertaken in several states and provinces where EAB is already known to occur and in areas, like New England, where the beetle had not yet been detected (Table 1). In Connecticut, a biosurveillance program was begun in 2008 by The Connecticut Agricultural Experiment Station (CAES) with surveys for *Cerceris fumipennis* colonies and the monitoring of nest sites, collecting 129 beetles. The program was expanded in 2009 the discovery of 40 additional colonies suitable for monitoring for EAB, biosurveillance of 36 sites and the capture of 315 beetles. To enhance colony survey efforts in Connecticut, a citizen-scientist program was initiated in 2010 modeled on a volunteer program in Maine (Rosenholm 2012; Teerling 2012) called 'Wasp Watchers' that assigns volunteers to specific colonies and trains them to monitor the wasps' prey for EAB. The 'Wasp Watcher' program in Connecticut has grown steadily, with 23 watchers in 2010, 29 in 2011 (12 returning) and 52 watchers in 2012 (19 returning), increasing the number of colonies monitored and beetles collected.

In 2010 and 2011, 1,605 beetles were collected by CAES volunteers and researchers. Maine, Vermont and Massachusetts also have flourishing 'Wasp Watcher' pro-

Table 1. Sites with known *Cerceris fumipennis* captures of emerald ash borer.

Site ¹	Collector ²	Year	#EAB collected ³	EAB known in State/Province?
Windsor, ON	University of Guelph	2006	48	Yes
LaSalle, ON	University of Guelph	2006	1	Yes
Walpole Is., ON	University of Guelph	2006	8	Yes
Wheatley, ON	University of Guelph	2007	1	Yes
Toronto, ON	University of Guelph	2008	31	Yes
Turkey Point, ON	University of Guelph	2009	107	Yes
Ottawa, ON	University of Guelph	2010	1	Yes
Lancaster, NY	SUNY ESF	2011	3	Yes
Cook County, IL	USDA APHIS PPQ	2011	present	Yes
DuPage County, IL	USDA APHIS PPQ	2011	present	Yes
Kane County, IL	USDA APHIS PPQ	2011	present	Yes
Lake County, IL	USDA APHIS PPQ	2011	present	Yes
Prospect, CT	CAES	2012	36	No
Beacon Falls, CT	CAES	2012	1	No

¹ Data obtained from APHIS PPQ surveys cannot not be identified below county level

² Collector refers to the institution for which the collector was working at the time of the find

³ Data obtained from APHIS-PPQ surveys only noted presence/ absence of emerald ash borer

grams (Rosenholm 2012). With the detection of EAB in Saugerties, NY in 2010, a collaborative effort between the USDA Animal Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) and CAES, with support of the U.S. Forest Service, was made to monitor as many colonies in Connecticut as possible. In 2011 and 2012, USDA-APHIS-PPQ personnel monitored colonies in the four western counties, while personnel from CAES monitored colonies in the four eastern counties, in addition to administering the 'Wasp Watcher' program. In the 2012 season, 2,139 buprestids were collected from 81 *C. fumipennis* colonies.

Emerald ash borers have been recovered from wasps in several areas with known EAB populations (Table 1), but this approach had not yet made the initial detection of emerald ash borer in a state or province where it had previously been undetected. However, on the morning of July 16, 2012, CAES personnel captured a wasp carrying a female emerald ash borer in the Town of Prospect in New Haven County, CT. A further six emerald ash borers were captured at that colony that same afternoon. Since EAB is a federal and state regulated pest, the USDA-APHIS-PPQ State Plant Health Director submitted the initial specimen to the PPQ identifier, James Zablotny, for identification. James Zablotny confirmed the state identification on July 17, 2012 and forwarded the specimen onto the Systematic Entomology Laboratory (SEL) in Beltsville, MD for confirmation as a new state record. Alexander Konstantinov, SEL, confirmed the identification on July 18, 2012. This represented the first new state detection using *Cerceris* biosurveillance for the detection of EAB. In subsequent days, an additional 26 EAB adults were captured, including EAB found on the ground near the entrance to nest holes (Fig. 1). As fewer *C. fumipennis* colonies were



Figure 1. Abandoned emerald ash borer next to the nest entrance of *Cerceris fumipennis* at a colony in Prospect CT.

being monitored in this area than in other parts of the state, additional colonies were located in Prospect and towns immediately adjacent to it (Beacon Falls, Cheshire, Naugatuck, Bethany, Seymour). Surveys of these colonies yielded two more EAB positive colonies. On July 17th, three EAB were captured at a Prospect site approximately one km due south of the first find. One additional EAB was caught on July 24th in the Town of Beacon Falls, about 11 km southwest of the colonies in Prospect. A ‘Wasp Watcher’ volunteer had caught nine EAB at the original Prospect colony in the first week of July, but did not recognize the beetles and so the finds were not reported until July 19th.

In addition to the three colonies at which EAB were collected, 25 other *Cerceris fumipennis* colonies had 50+ beetles collected (Table 2A, B). By USDA-APHIS-PPQ criteria, collecting 50 beetles at a site is not an official ‘negative’ for EAB (Carrier and Jackson 2012), but it does suggest EAB is likely not present, or is present at very low densities. The minimum EAB density for *C. fumipennis* detection is not known, however, we do know that EAB was found at the first Prospect colony after only 15 beetles were collected in 2012. However, that same colony was monitored in 2011, with 68 beetles representing 11 species captured (and no EAB).

As part of Connecticut’s statewide EAB surveillance efforts, USDA-APHIS-PPQ purple-prism traps were deployed around the state in 2011 (940 traps) and 2012 (544

Table 2A. Colonies within New Haven County with 50+ beetles collected and/or colonies at which emerald ash borer was collected.

City	Date	Holes	Beetles	# EAB
Beacon Falls	24-Jul	70	25	1
Cheshire	18-Jul	100+	76	0
Middlebury	25-Jul	75	66	0
North Branford	29-Jun	100+	66	0
Orange	6-Jul	50	59	0
Prospect 1	16-Jul	100+	124	33
Prospect 2	17-Jul	50	42	3

Table 2B. Number of *Cerceris fumipennis* colonies per county in Connecticut at which 50+ buprestids were collected in 2012, but at which no emerald ash borer was found.

County	# Colonies
Fairfield	1
Hartford	3
Litchfield	11
Middlesex	2
New London	1
Tolland	2
Windham	1

traps) by the University of Connecticut with support from APHIS-PPQ. During routine trap monitoring, suspect specimens were collected from traps in Prospect on June 29th, 2012 and Naugatuck on July 9th, 2012 but had not yet been processed when EAB was first collected from *Cerceris fumipennis*. After confirmation of EAB was received from SEL, the EAB from the Prospect trap was identified by Claire Rutledge, the designated state-identifier, on July 18th. During the week following the initial find in Prospect, the purple-prism traps in the area were re-checked and additional suspect specimens were collected in Prospect, Naugatuck and Bethany (all New Haven County). Because Bethany and Naugatuck would represent new towns for EAB, the specimens collected from those traps were sent to PPQ identifier Bobby Brown for confirmation of identity, which was received on July 20th. An additional 29 traps were deployed in Prospect, Cheshire, Naugatuck and Bethany to help further define the extent of the infestation. One of these subsequently deployed traps, across the road from the second positive *C. fumipennis* colony in Prospect, also captured an EAB (Table 2A, B).

No purple-prism traps outside of the four towns mentioned above captured an emerald ash borer (Table 3). Ash trees with heavy EAB infestations were subsequently found in the Town of Prospect and a state quarantine for New Haven County was established on August 9, 2012 followed by a parallel federal quarantine on September 12, 2012.

Together, biosurveillance with *Cerceris fumipennis* and use of purple-prism traps provided the first detection of an EAB infestation in Connecticut. Subsequent *C.*

Table 3. Summary of purple prism traps in Connecticut in 2012.

County	# traps	# traps with EAB	# EAB captured
Fairfield	57	0	0
Hartford	74	0	0
Litchfield	171	0	0
Middlesex	55	0	0
New Haven	49	4	38
New London	43	0	0
Tolland	83	0	0
Windham	43	0	0

fumipennis colony identification and biosurveillance also provided an initial estimate of its extent. Delimitation surveys for infested trees will continue over the winter by peeling bolts. In summer 2013, multiple *C. fumipennis* colonies at the known limits of the infestation will be surveyed to further delimit the infestation.

Acknowledgements

We wish to thank the Wasp Watchers who volunteered their time and energy to monitor *C. fumipennis* nests this summer. In particular J. Kasinskas, who caught an EAB on his first outing. Thanks also to M. Scott, who caught the first recognized EAB in Connecticut, and to S. Ng. N. Carrier and E. Chamberlin of USDA PPQ carried out surveys in Connecticut, S. Blackwood, R. Van Duzor and T. Buck of APHIS-PPQ conducted the Illinois surveys. F. Afelumo collected the EAB in NY. This paper was greatly improved by the comments of K. Stafford, and L. Magnarelli and by an anonymous reviewer. This work was partly funded by grants from the USDA Forest Service #09-DG-11420004-175 and #10-DG-11420004-285.

References

- Careless PD (2009) Biosurveillance: utilizing a beetle hunting wasp (*Cerceris fumipennis*, Hymenoptera: Crabronidae) to detect infestations of emerald ash borers (*Agrilus planipennis*, Coleoptera: Buprestidae). MS University of Guelph, Guelph, Ontario.
- Careless PD, Marshall SA (2010) Working with the smoky-winged beetle bandit. Entomological Society of Canada Bulletin 42(1): 25–29.
- Carrier N, Jackson LD (2012) *Cerceris* wasp survey protocol. Edited by USDA-APHIS-PPQ. 8 pp.
- Crook DJ, Francese JA, Zylstra KE, Fraser I, Sawyer AJ, Bartels DW, Lance DR, Mastro VC (2009) Laboratory and field response of the emerald ash borer (Coleoptera: Buprestidae), to selected regions of the electromagnetic spectrum. Journal of Economic Entomology 102(6): 2160–2169. doi: 10.1603/029.102.0620

- Francese JA, Fraser I, Lance DR, Mastro VC (2011) Efficacy of multifunnel traps for capturing emerald ash borer (Coleoptera: Buprestidae): effect of color, glue, and other trap coatings. *Journal of Economic Entomology* 104(3): 901–908. doi: 10.1603/ec11038
- Francese JA, Fraser I, Oliver JE, Youssef N, Lance DR, Mastro VC (2006) Effects of trap height, location and design on capture of the emerald ash borer, *Agrilus planipennis* Faimaire (Coleoptera: Buprestidae). Entomology Society of America Annual Conference, Indianapolis IN.
- Grant GG, Poland TM, Ciaramitaro T, Lyons DB, Jones GC (2011) Comparison of male and female emerald ash borer (Coleoptera: Buprestidae) responses to phoebe oil and (Z)-3-hex-enol lures in light green prism traps. *Journal of Economic Entomology* 104(1): 173–179. doi: 10.1603/ec10197
- Marshall SA, Paiero SM, Buck M (2005) Buprestid sampling at nests of *Cerceris fumipennis* (Hymenoptera: Crabronidae) in Southern Ontario: The first Canadian records of three buprestids (Coleoptera: Buprestidae). *Canadian Entomologist* 137(4): 416–419. doi: 10.4039/n05-016
- McCullough DG, Siegert NW, Poland TM, Pierce SJ, Ahn SZ (2011) Effects of trap type, placement and ash distribution on emerald ash borer captures in a low density site. *Environmental Entomology* 40(5): 1239–1252. doi: 10.1603/en11099
- Poland TM, Pureswaran D, McCullough DG, De Groot P, Grant GG (2006) Emerald ash borer, *Agrilus planipennis*, attraction in field trapping experiments employing combinations of visual, olfactory, tactile, and canopy position cues. Entomological Society of America Annual Conference, Indianapolis, IN.
- Rebek EJ, Herms DA, Smitley DR (2008) Interspecific variation in resistance to emerald ash borer (Coleoptera: Buprestidae) among North American and Asian ash (*Fraxinus* spp.). *Environmental Entomology* 37(1): 242–246. doi: 10.1603/0046-225X(2008)37[242:IVIRTE]2.0.CO;2
- Rosenholm GE (2012) Qualitative analysis of wasp watchers. Social Science Research Network. doi: 10.2139/ssrn.2181538
- Rutledge CE, Hellman W, Teerling C, Fierke MK (2011) Two novel prey families for the buprestid-hunting wasp *Cerceris fumipennis* Say (Hymenoptera: Crabronidae). *Coleopterists Bulletin* 65(2): 194–196. doi: 10.1649/072.065.0223
- Ryall KL, Silk PJ, Mayo P, Crook D, Khirman A, Cosse AA, Sweeney J, Scarr T (2012) Attraction of *Agrilus planipennis* (Coleoptera: Buprestidae) to a volatile pheromone: Effects of release rate, host volatile, and trap placement. *Environmental Entomology* 41(3): 648–656. doi: 10.1603/en11312
- Teerling C (2012) Information for Volunteers. [online] Available from <http://www.maine.gov/doc/mfs/fhm/pages/CercerisVolunteers.htm> [accessed December 19, 2012].