Using buprestid monitoring tools for obtaining diverse collections of forest insects

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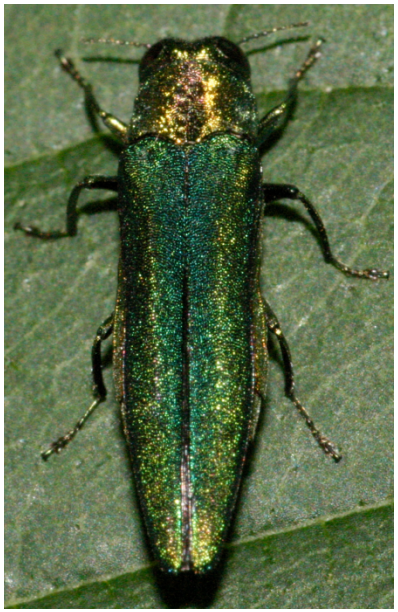
Emerald ash borer (EAB):



Buprestid detection tools developed for EAB

Large-surface colored traps

Green and Purple sticky prism traps

- most common traps used for agency monitoring

Multi-funnel traps (usually green)

Decoy-based traps

Sticky branch traps

Electrocution traps

Cerceris wasp nest collections

Prism and funnel traps

Joseph Francese

EAB in Paper Filter

Funnel trap captures

EAB in Collection Cup

Joseph Francese

Poland Woodborer Survey -- 2013

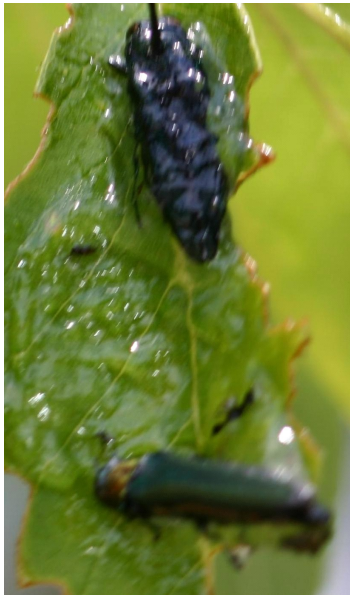
Family	Subfamily	Genus	Species	GMFB	GMFU	PMF	PPr
Buprestidae	Agrilinae	*Agrilus*	*angustulus*	40	97	0	0
Buprestidae	Agrilinae	*Agrilus*	*betuleti*	3	22	0	0
Buprestidae	Agrilinae	*Agrilus*	*biguttatus*	2	3	0	1
Buprestidae	Agrilinae	*Agrilus*	*convexicollis*	75	101	19	0
Buprestidae	Agrilinae	*Agrilus*	*graminis*	0	3	0	0
Buprestidae	Agrilinae	*Agrilus*	*laticornis*	174	807	5	0
Buprestidae	Agrilinae	*Agrilus*	*obscuricollis*	9	87	0	0
Buprestidae	Agrilinae	*Agrilus*	*olivicolor*	121	425	1	0
Buprestidae	Agrilinae	*Agrilus*	*populneus*	1	8	0	0
Buprestidae	Agrilinae	*Agrilus*	*ribesi*	1	0	0	0
Buprestidae	Agrilinae	*Agrilus*	*spp.*	0	0	0	3
Buprestidae	Agrilinae	*Agrilus*	*sulcicollis*	1	6	0	0
Buprestidae	Buprestinae	*Anthaxia*	*quadripunctata*	0	1	1	3
Buprestidae	Buprestinae	*Chrysobothris*	*affinis*	0	0	1	0
Buprestidae	Buprestinae	*Chrysobothris*	*igniventris*	0	0	2	0
Buprestidae	Buprestinae	*Phaenops*	*cyanea*	5	4	103	0
Buprestidae	Agrilinae	*Trachys*	*minuta*	2	0	0	0
Cerambycidae	Cerambycinae	*Plagionotus*	*detritus*	0	0	1	0
Cerambycidae	Lamiinae	*Brachyleptura*	*maculicornis*	0	0	1	0
Cerambycidae	Lamiinae	*Leiopus*	*linnei*	4	3	3	0
Cerambycidae	Lamiinae	*Monochamus*	*galloprvincialis*	0	0	1	0
Cerambycidae	Lamiinae	*Pogonocherus*	*fasciculatus*	0	1	0	0
Cerambycidae	Lepturinae	*Leptura*	*quadrifasciata*	5	2	1	0
Cerambycidae	Lepturinae	*Leptura*	*scutellata*	0	0	1	0
Cerambycidae	Lepturinae	*Stenurella*	*melanura*	6	1	1	0
Cerambycidae	Prioninae	*Prionus*	*coriarius*	0	0	2	0
Cerambycidae	Spondylidinae	*Arhopalus*	*rusticus*	5	2	5	0
Cerambycidae	Spondylidinae	*Spondylis*	*buprestoides*	9	4	2	0

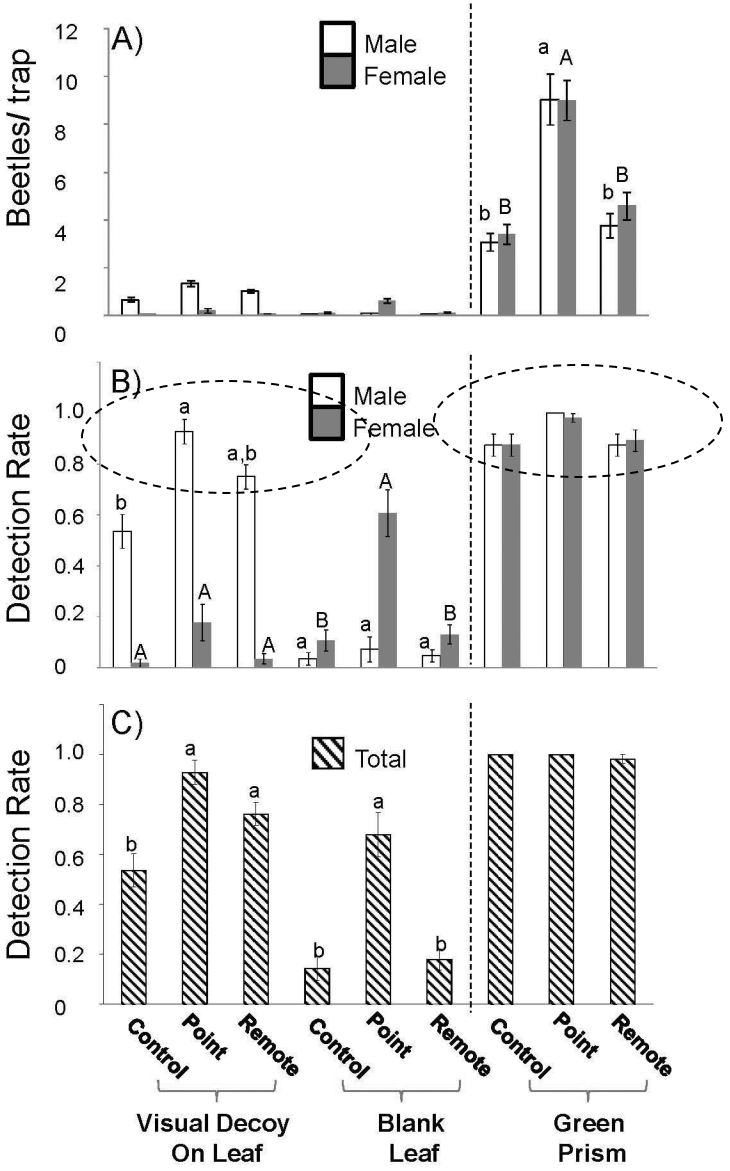
Decoy traps

Decoy-directed behavior:

Lelito et al., 2007
J. Insect Behav.

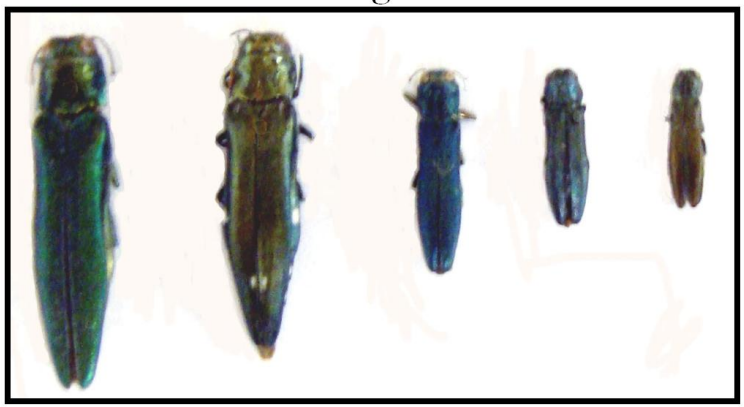
Decoy-based trapping



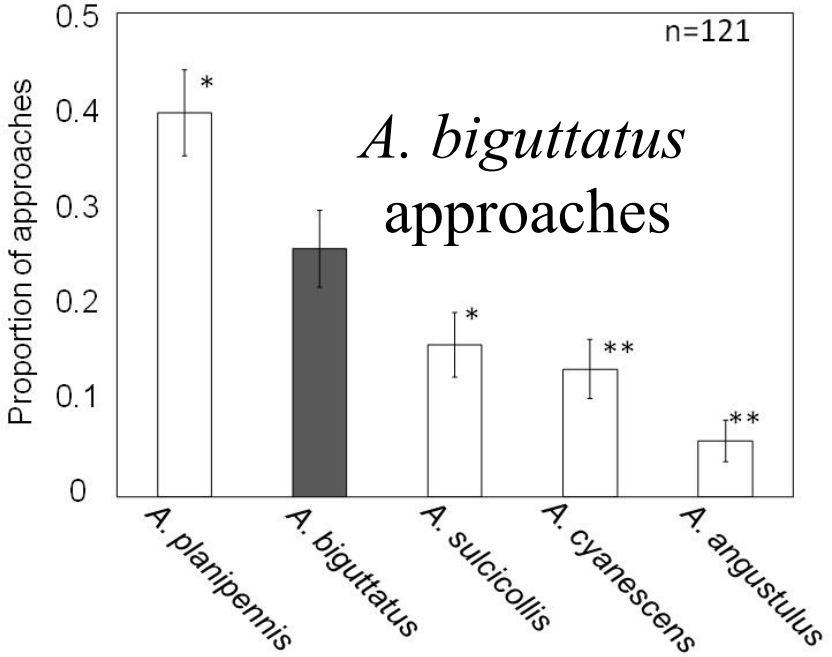


Domingue et al., 2013
J. Appl. Entomol.

Five female *Agrilus* models:



A. planipennis *A. biguttatus* *A. sulcicollis* *A. cyanescens* *A. angustulus*



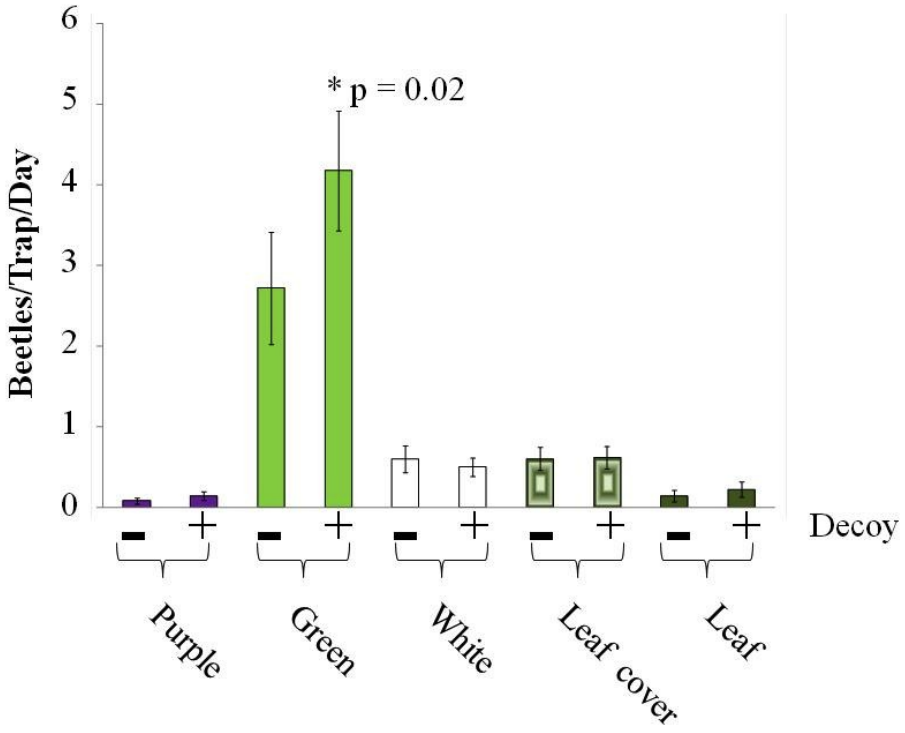
Domingue et al., 2010 Entomol. Exp. Appl

Agrilus biguttatus tries to copulate with other conspecifics or EAB.

Branch trap with decoy

Hungarian oak buprestids (14 species)

Visual Experiment: All *Agrilus*



Domingue et al., 2013
Entomol. Exp. Appl.

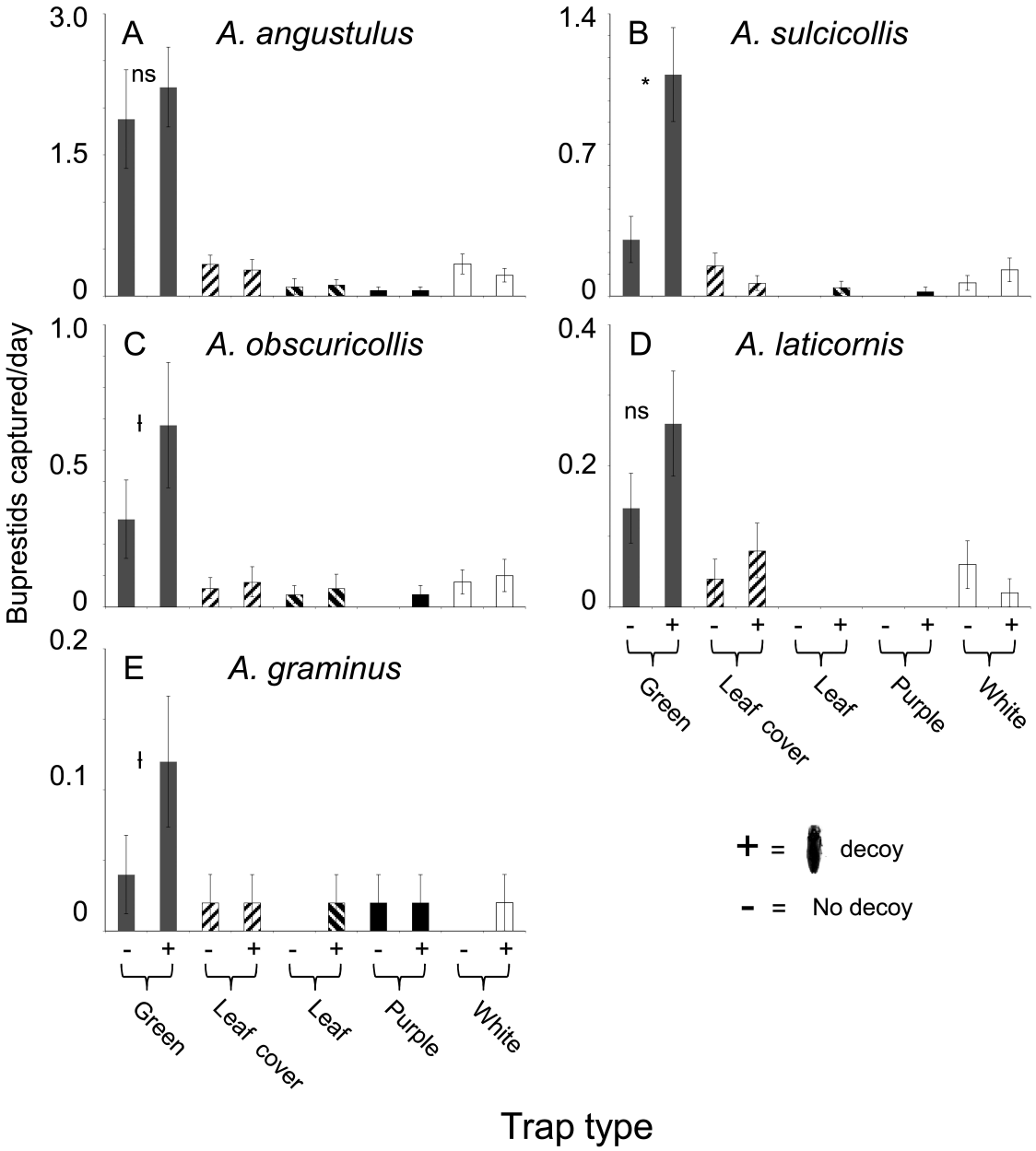
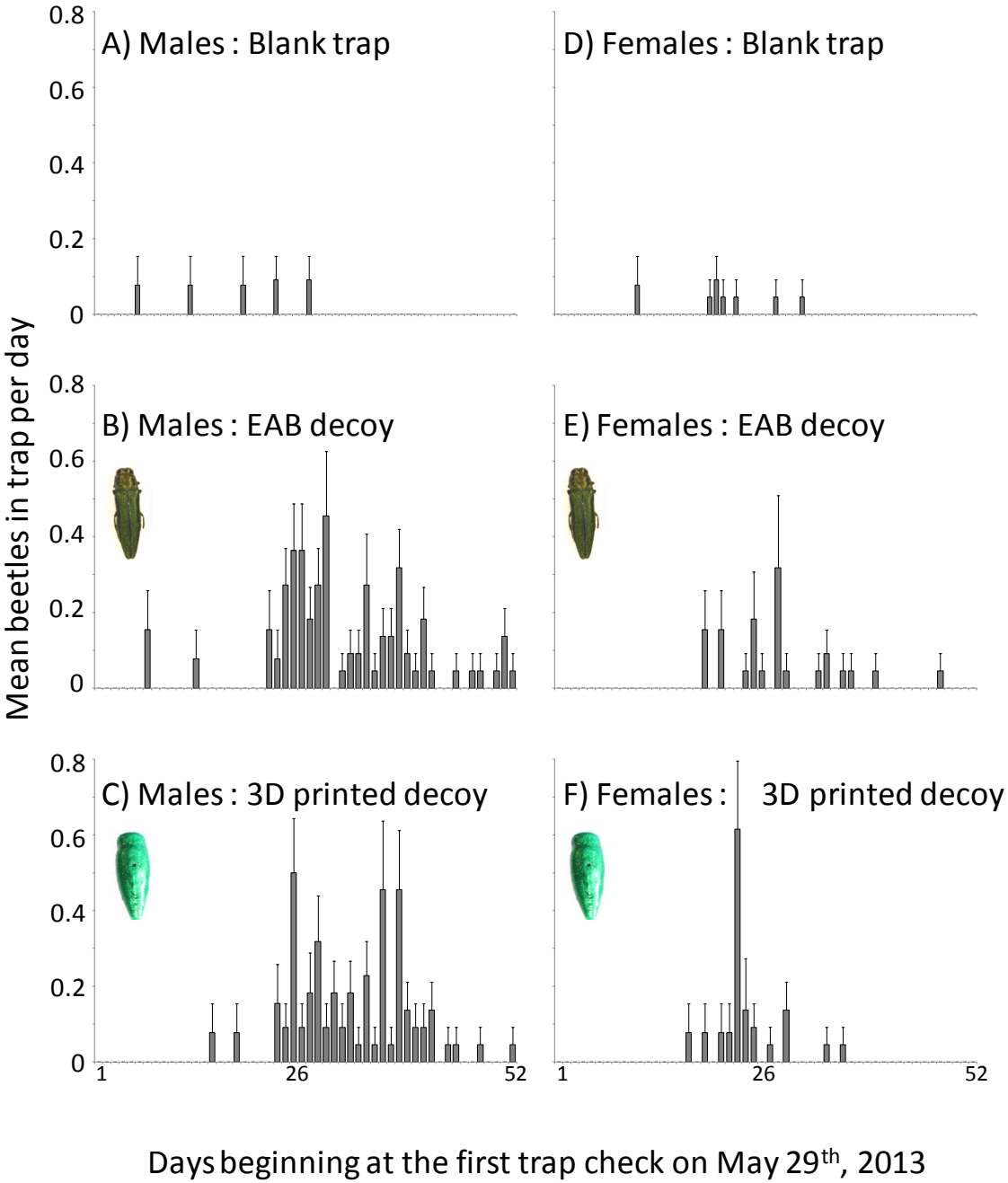

A
A. angustulus
ns
3.0
1.5
0
B
A. sulcicollis
*
1.4
0.7
0
C
A. obscuricollis
1.0
0.5
0
D
A. laticornis
ns
0.4
0.2
0
E
A. graminus
0.2
0.1
0
Buprestids captured/day
- + - + - + - + - +
Green
Leaf cover
Leaf
Purple
White
+ = decoy
- = No decoy
Trap type

Table 2 Total numbers of Buprestidae caught in the branch and leaf traps deployed in June 2011 in Matrafured. All Buprestids were identified to species, with percentage abundance amongst buprestids indicated. There was no significant difference in the distribution for the 7 most common *Agrilus* species in the visual-attraction-only versus the odor-added experiments (X^2 = 8.30, d.f= 13, p = 0.824).

Taxon	Visual-only experiment	Odor-added experiment	Total Number	Percentage of total
Buprestidae	489	1473	1962	
Agrilus angustulus	281	823	1104	56.3
Agrilus sulcicollis	86	237	323	16.5
Agrilus obscuricollis	66	172	238	12.1
Agrilus laticornis	30	136	166	8.5
Agrilus graminus	14	62	76	3.9
Agrilus olivicolor	3	15	18	0.9
Agrilus biguttatus	3	11	14	0.7
Agrilus hastulifer	1	3	4	0.2
Agrilus convexicollis	0	2	2	0.1
Anthaxia nitidula signaticollis	2	5	7	0.4
Anthaxia salicis	2	3	5	0.3
Anthaxia fulgurans	0	2	2	0.1
Chrysobothris affinis	0	2	2	0.1
Coraebus florentinus	1	0	1	0.1

EAB: Average daily captures on branch traps (n = 22)

Domingue et al., 2014
J. Pest Sci.



Nanofabricated Decoys

EAB attached to glass

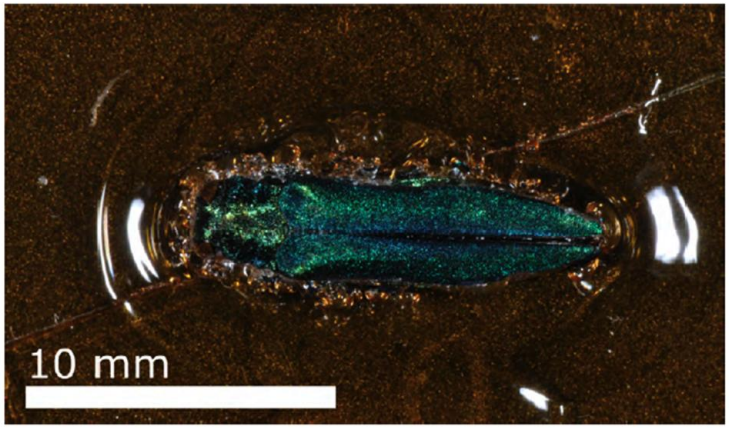


Figure 1. Photograph of an EAB specimen mounted on a glass slide with PDMS. The PDMS mounting allows for a smooth transition between the surface of interest and the glass slide.

Nickel-coated EAB

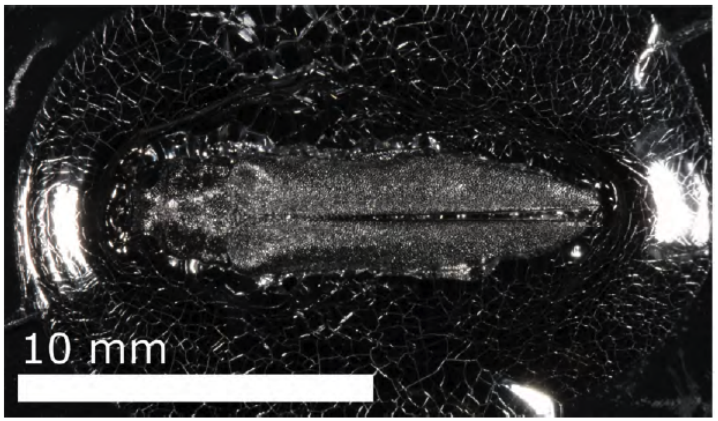


Figure 2. Photograph of the slide-mounted EAB specimen from Fig. 1 after being coated with $\sim$ 500 nm of nickel in two successive CEFR runs.

Bio-substrate removed

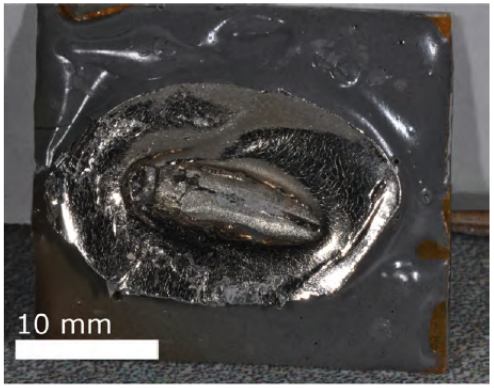
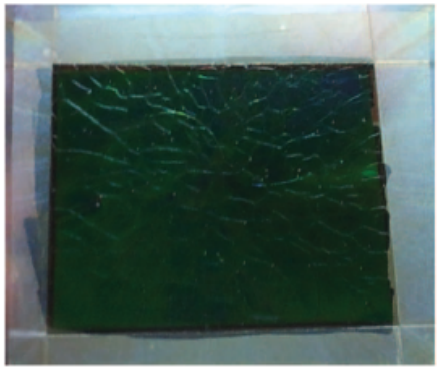


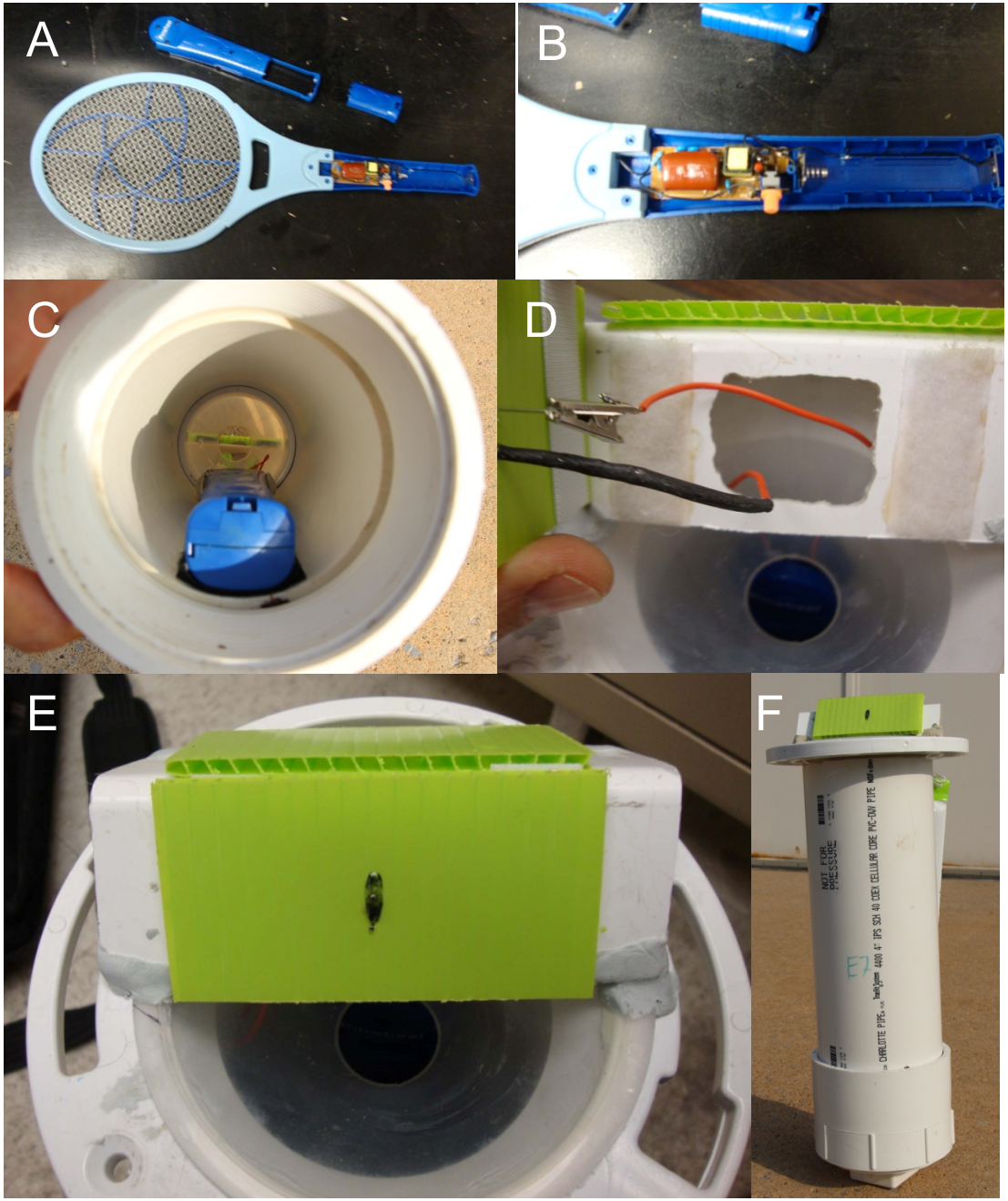
Figure 4. Photograph of the electroformed negative die—from Fig. 3—embedded in a layer of epoxy and mounted on a glass slide.

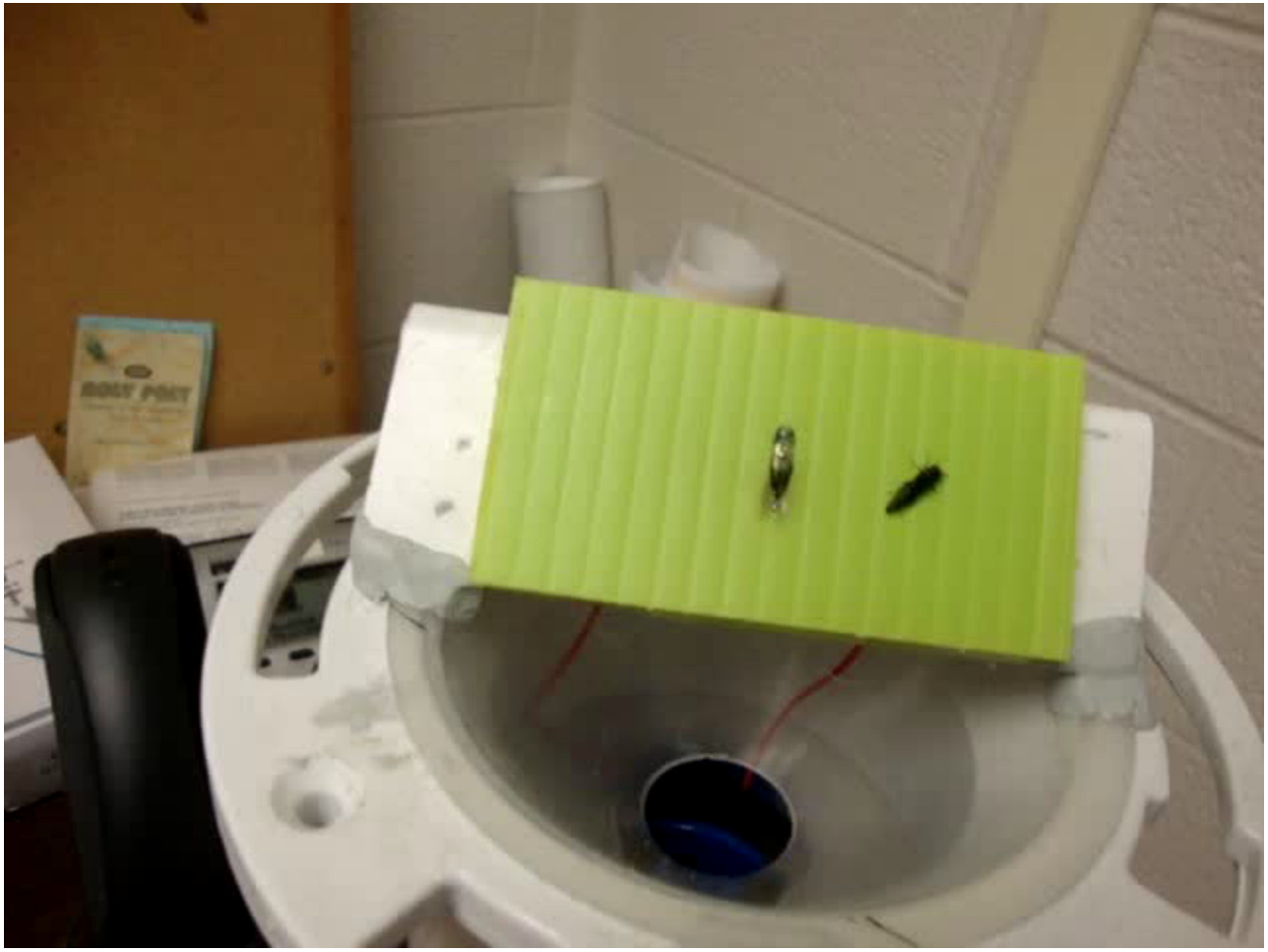
Polymer to be stamped



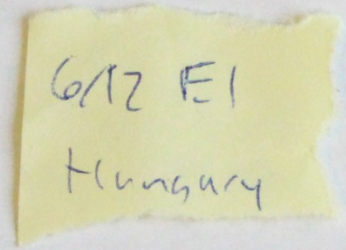
Domingue et al., 2014, PNAS

Electrocution Traps






CAMERA 03


6/12 E1
Hungary

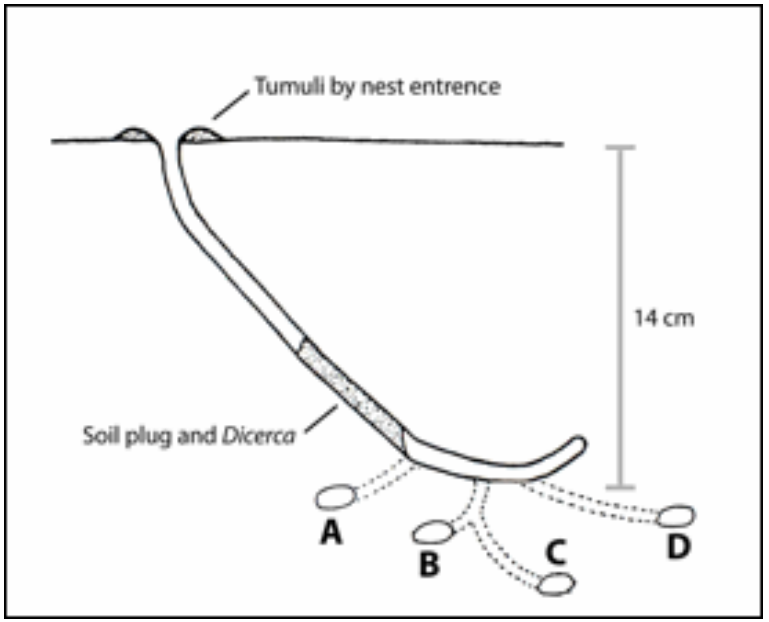

Solar-powered electrocution trap

Cerceris wasps

Peter Rzasa

First detection of EAB in Connecticut

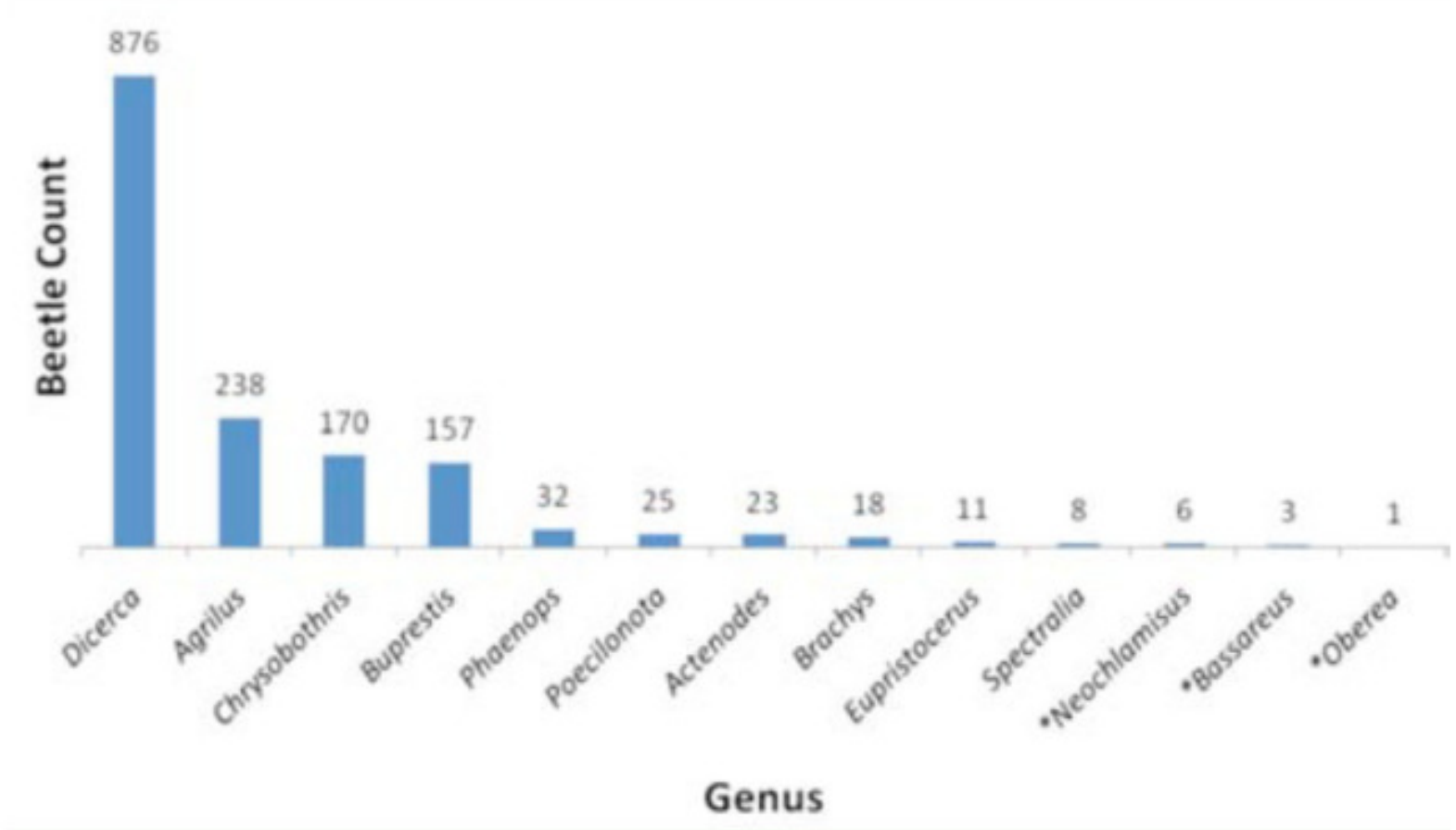
Rutledge et al., 2013 J. Hymen. Res.


Tumuli by nest entrence
14 cm
Soil plug and *Dicerca*
A
B
C
D


Phillip Careless

Translocated colonies

Cerceris fumipennis catches at 5 NY colonies by genera



Hellman et al., 2014 J. Insect Sci.

Cerceris fumipennis catches at 5 colonies by genera

Table 3.

A comparison of buprestids collected from five *Cerceris fumipennis* colonies in New York State in 2009 and 2010 to buprestid collections from four New York State museums. Museum collection dates ranged from 1902 to present.

County	Wasp-collected	Museum records	No. wasp-collected species	No. museum species
Onondaga	407	181	19	19
Jefferson	202	6	20	5
Saratoga	480	8	29	8
Westchester	480	72	24	26
Overall Total	1569	267	41	42

Hellman et al., 2014 J. Insect Sci.