Crop Protection Entomology in Tree Fruit and Grapes at the AHSAREC








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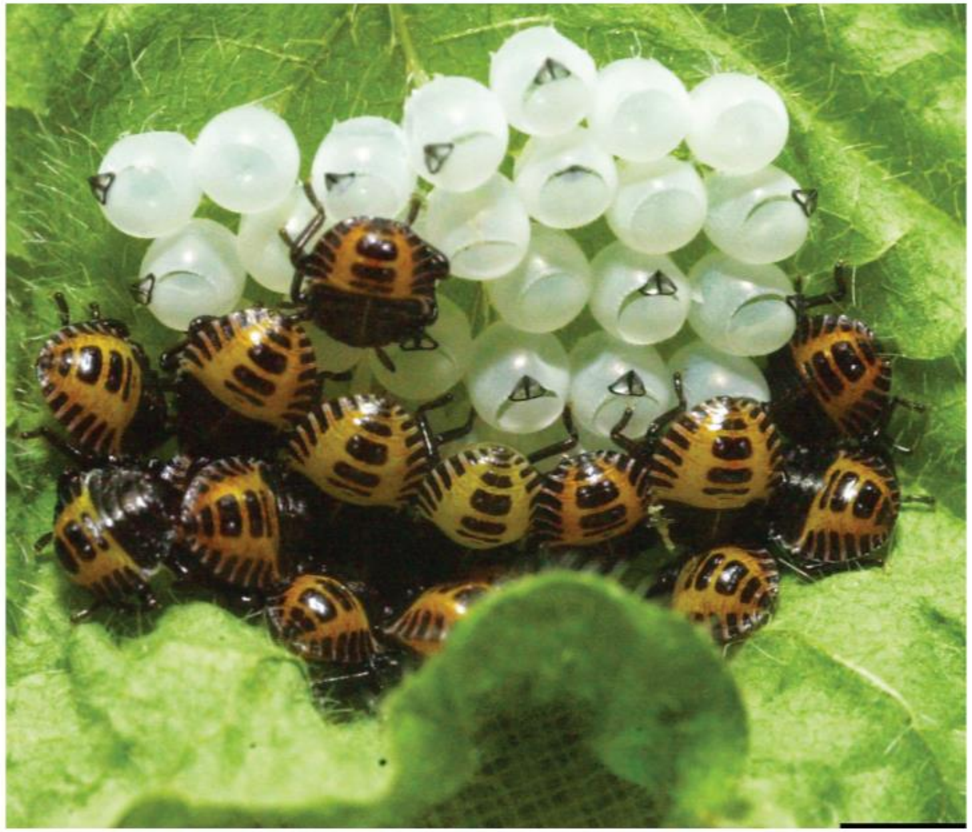
75% Research:25% Extension

Publication 456-419

2020 Spray Bulletin for Commercial Tree Fruit Growers

Virginia, West Virginia, and University of Maryland Extension



Virginia Cooperative Extension
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Home Grounds and Animals

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2020

PEST MANAGEMENT GUIDE

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Representative table from the Spray Bulletin for Commercial Tree Fruit growers showing insect and mite control options for apple orchards at Petal Fall

PETAL FALL SPRAY[1] (cont.)

Insects/Mites	Effectiveness
Redbanded leafroller (RBLR)[3]	E = 2, 24 G = 3, 4
Curculio (PC)[3]	E = 3, 16 G = 13, 25
Rosy apple aphid (RAA)	E = 5, 13, 20 G = 2, 8, 11
Oriental fruit moth (OFM)	E = 3, 24 G = 2, 4, 8, 9, 13, 16, 19, 21, 24
Mites (ERM)	E = 6, 7, 12, 14, 17, 27, 28, 29, 30 G = 11, 18, 23, 26
Green fruitworms (GFW)[4]	G = 2, 3, 4, 21, 24
Defoliating caterpillars[5]	E = 4 G = 2, 3
Tentiform leafminers (TLM)	E = 11, 12, 13 G = 8
White apple leafhopper (WALH)[6]	E = 2, 13 G = 11, 12, 19, 21, 25, 28
Codling moth (CM)	E = 31 G = 9
European apple sawfly (EAS)[10]	E = 3, 13, 16 G = 19, 21
Mullein bug (MB)	E = 13
Dogwood borer (DB)[12]	E = 1 G = 13, 22
San Jose Scale (SJS)	G = 5

Suggested Chemicals	100 gal Dilute	Acre Concentrate
1. [12]Lorsban Advanced, Nufos 4E or Yuma 4E or Lorsban 75WG	3 pt or 2 lb	-
2. [2]Lannate 90SP or Lannate LV	4 oz -	0.5-1 lb 1.5-3 pt
3. Imidan 70WSB	16-21 oz	3-4 lb
4. *Bacillus thuringiensis*	See label	See label
5. [18]Movento 2SC	–	6-9 fl oz
6. Apollo 42SC	–	4-8 fl oz
7. Savey 50DF or Onager Optek	–	3-6 oz or 12-24 fl oz
8. Aza-Direct or Neemazad	–	1 qt
9. Madex	-	0.5-3 fl oz
11. [7]Vydate L	1 pt	3 pt
12. [13]Agri-Mek, Abba or Temprano 0.15EC or Agri-Mek 0.7SC	2.5-5 fl oz or 0.5-1.0 fl oz	10-20 fl oz or 2.25-4.25 fl oz
13. [16]Assail 30SG	–	2.5-8.0 oz
14. Nealta	–	13.7 fl oz
16. Avaunt 30WDG	–	5-6 oz
17. [9]Nexter SC	–	11-17 oz
18. Vendex 50W	6 oz	18 oz
19. [11]Sevin 50W	2 lb	6 lb
20. Beleaf 50SG	-	2-2.8 oz
21. [11]Sevin XLR PLUS	2 pt	6 pt
22. Mating disruption	-	See label
23. [14]Ultra Fine oil	2 gal	
24. [15]Intrepid 2F	–	8-16 fl oz
25. Surround WP	-	25 lb
26. [8]Acramite 50WS or Banter SC	-	12-16 oz
27. Zeal 72WDG	-	2-3 oz
28. Portal 5EC	10 fl oz	2 pt
29. Kanemite 15SC	-	21-31 fl oz
30. Envidor 2SC	-	16-18 fl oz
31. Rimon 0.83EC	-	20-40 fl oz

Potential Insect and Mite Pests of Pome and Stone Fruit

Pome Fruit

Pest group	# of species
Aphids	3
Leafhoppers	2
Moths (larvae)	8
Flies (larvae)	1
Beetles	2
True bugs	3+
Scale insects	1
Sawfly	1
Thrips	1
Spider mites	2
Total	**24**

Stone Fruit

Pest group	# of species
Aphids	2
Moths (larvae)	3
Beetles	2
True bugs	4+
Scale insects	2
Thrips	1
Total	**14**

Direct vs Indirect Pests of Pome and Stone Fruit

Crop	# of direct pests	# of indirect pests
Pome fruit	15	9
Stone fruit	8	5

Direct pests attack the fruit



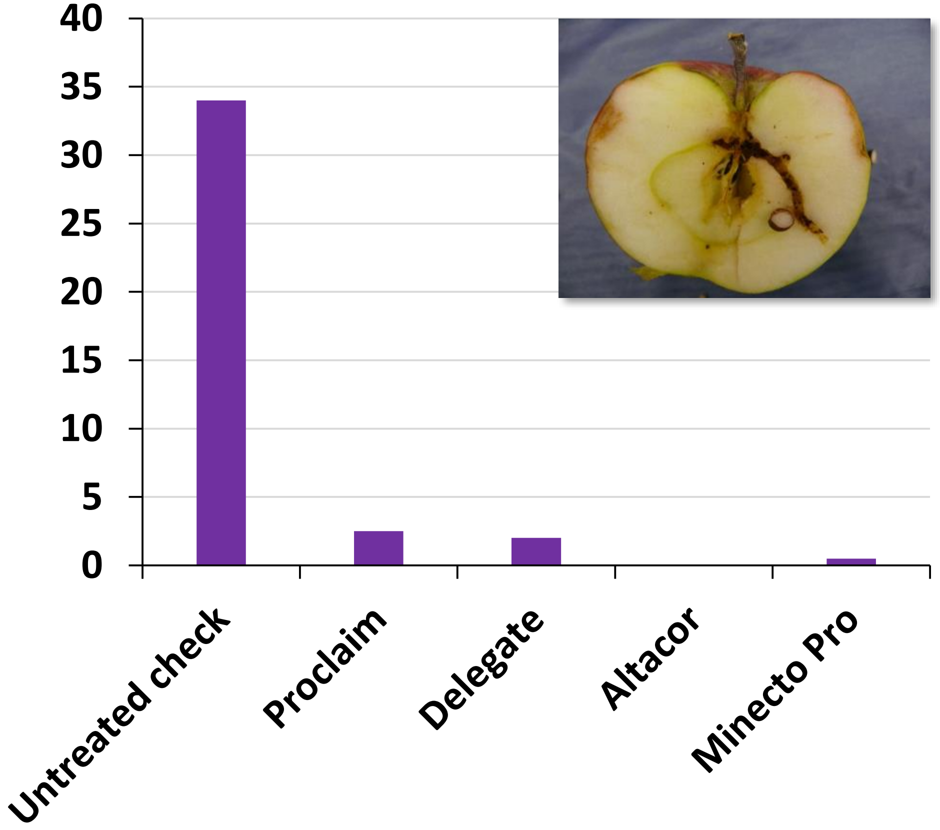

Indirect (or secondary) pests attack the leaves, branches, or trunk



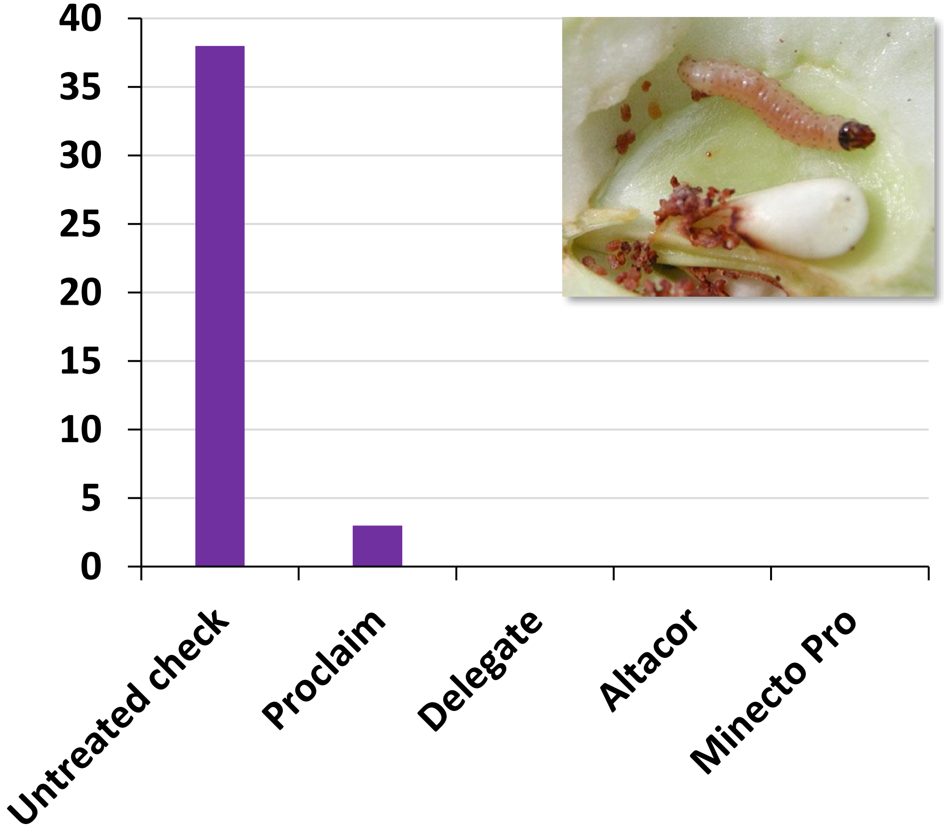

What can happen if a grower doesn’t manage orchard insect pests?

“Comparison of products for control of first generation codling moth in apples, 2020”

Average percentage of fruit with deep entries from internal-feeding larvae



Total number of live codling moth larvae found in fruit



Extension

My role is to assist growers with managing insect and mite pests via educational Extension programming that is informed by my research and that of colleagues at other institutions

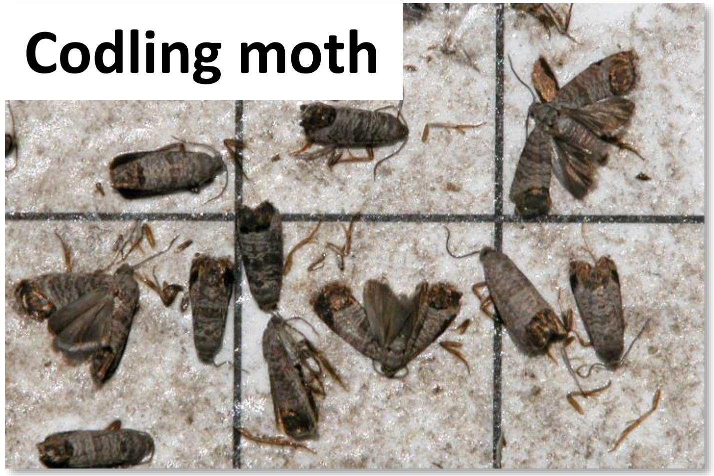
Off-season Extension meetings

In-season Extension meetings

Extension

https://blogs.ext.vt.edu/tree-fruit-pest/

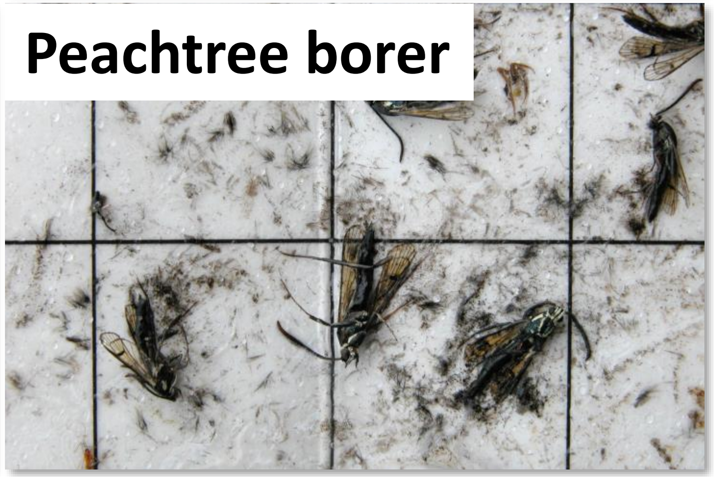
Traps baited with pheromone lures monitored weekly throughout the growing season



Codling moth

Oriental fruit moth

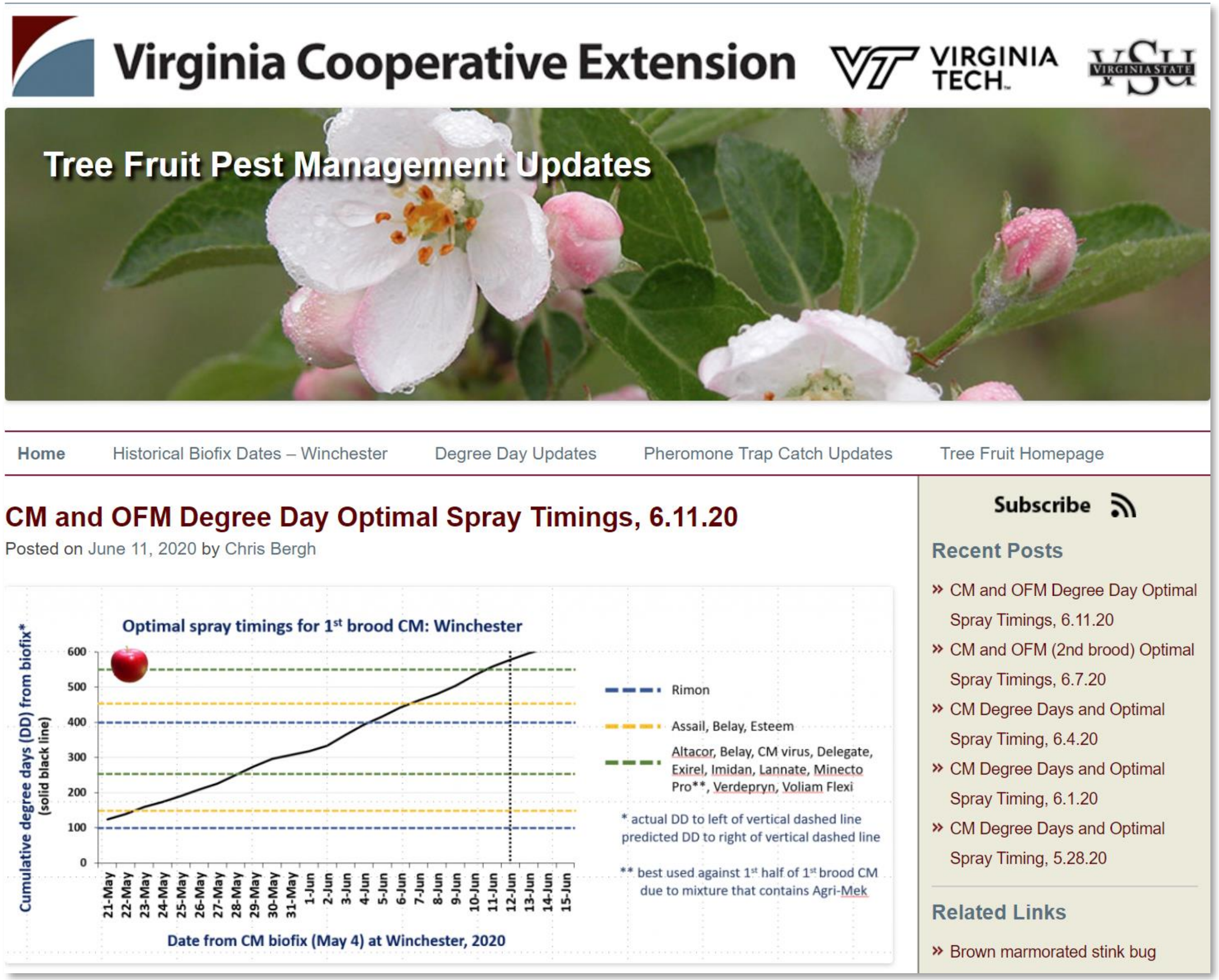
Tufted apple budmoth

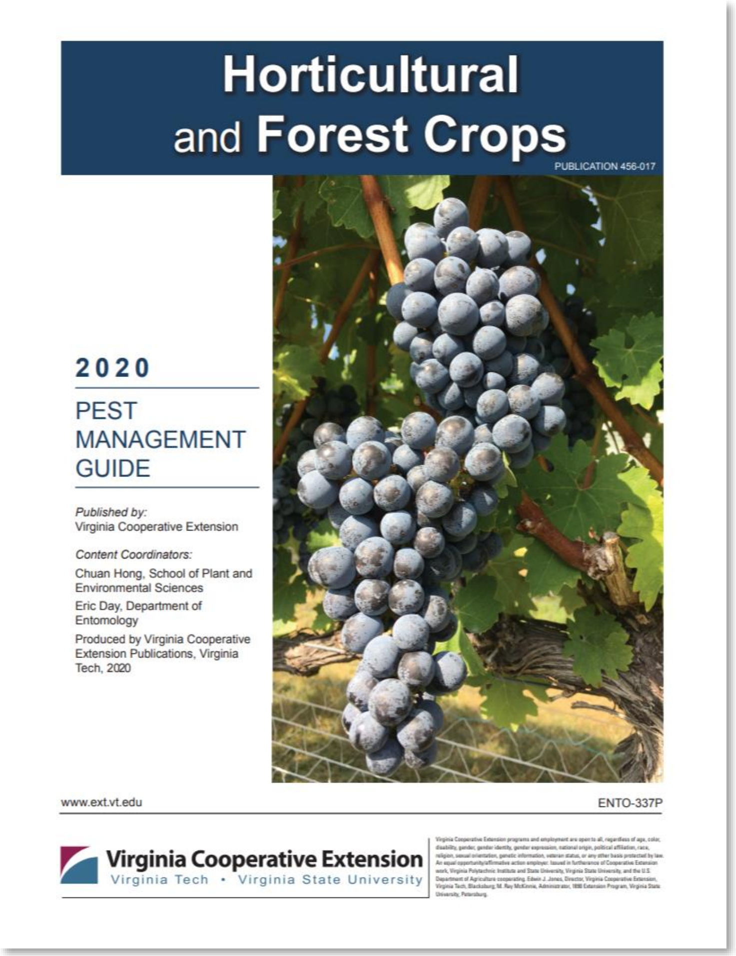


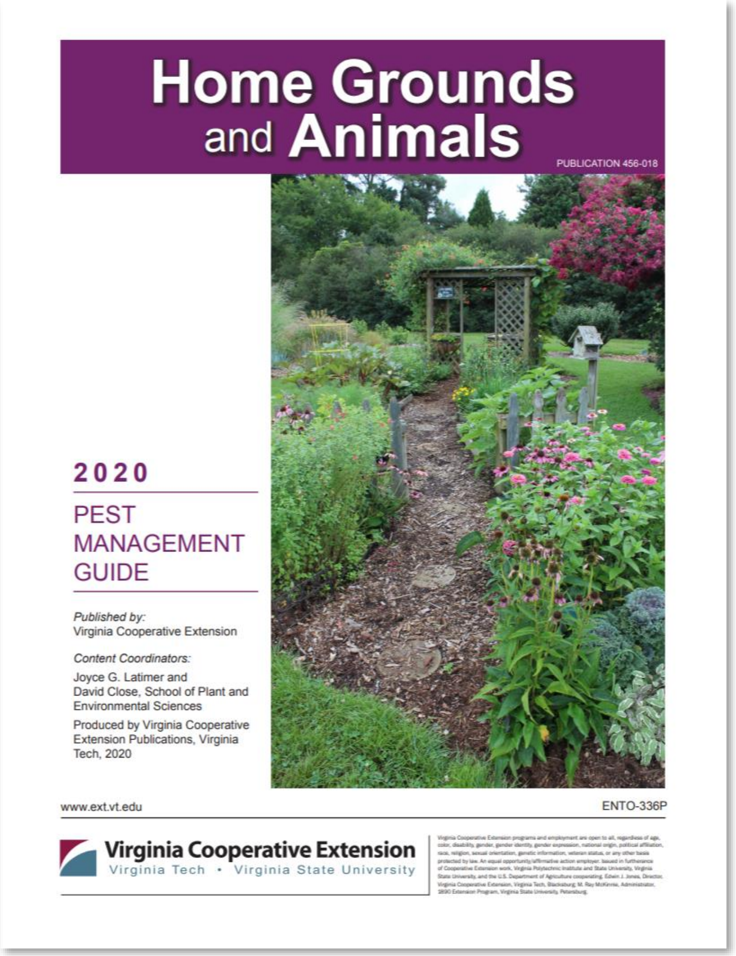
Peachtree borer

Extension

https://blogs.ext.vt.edu/tree-fruit-pest/







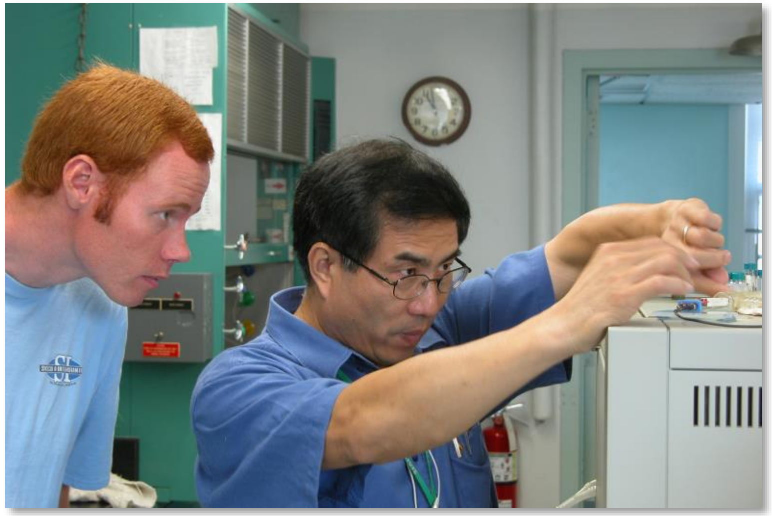
- Annual revisions to Pest Management Guides
- E-mail and telephone consultations
- Outreach activities and presentations

Research

Annual research station trials evaluating the effectiveness of individual insecticides and insecticide programs are critical to informing recommendations to growers

Grad students, summer students, colleagues



Applied ecology and behavior of pest and beneficial species that is relevant to fruit protection

- Alternative tactics
- Monitoring tools
- Insect biology
- Biological control





BioControl (2016) 61:155–165
DOI 10.1007/s10526-016-9714-7

CrossMark

Field evaluations of the contribution of predators and the parasitoid, *Aphelinus mali*, to biological control of woolly apple aphid, *Eriosoma lanigerum*, in Virginia, USA

J. Christopher Bergh · Jon W. Stallings

Environmental Entomology, 45(3), 2016, 663–670
doi: 10.1093/ee/nvw018
Advance Access Publication Date: 24 March 2016
Research article

OXFORD

Plant–Insect Interactions

Host Plant Effects on *Halyomorpha halys* (Hemiptera: Pentatomidae) Nymphal Development and Survivorship

Angelita L. Acebes-Doria,[1,2] Tracy C. Leskey,[3] and J. Christopher Bergh[1]

Research Article

SCI

Received: 15 January 2018 Revised: 7 July 2018 Accepted article published: 31 July 2018 Published online in Wiley Online Library:
(wileyonlinelibrary.com) DOI 10.1002/ps.5156

Successful management of *Halyomorpha halys* (Hemiptera: Pentatomidae) in commercial apple orchards with an attract-and-kill strategy

William R Morrison III,[a*] Brett R Blaauw,[b] Brent D Short,[c] Anne L Nielsen,[d] James C Bergh,[e] Greg Krawczyk,[f] Yong-Lak Park,[g] Bryan Butler,[h] Ashot Khrimian[i] and Tracy C Leskey[c]

Environmental Entomology, 48(1), 2019, 173–180
doi: 10.1093/ee/nvy180
Advance Access Publication Date: 19 December 2018
Research

OXFORD

Behavior

Vertical Sampling in Tree Canopies for *Halyomorpha halys* (Hemiptera: Pentatomidae) Life Stages and its Egg Parasitoid, *Trissolcus japonicus* (Hymenoptera: Scelionidae)

Nicole F. Quinn,[1,5] Elijah J. Talamas,[2] Angelita L. Acebes-Doria,[3] Tracy C. Leskey,[4] and J. Christopher Bergh[1]

Sampling

Spatial Distribution of Grape Root Borer (Lepidoptera: Sesiidae) Infestations in Virginia Vineyards and Implications for Sampling

J. P. Rijal,[1,2] C. C. Brewster,[3] and J. C. Bergh[1]

Environ. Entomol. 43(3): 716–728 (2014); DOI: http://dx.doi.org/10.1603/EN13285

Crop Protection 89 (2016) 58–65
Contents lists available at ScienceDirect
Crop Protection
journal homepage: www.elsevier.com/locate/cropro

ELSEVIER

Injury to apples and peaches at harvest from feeding by *Halyomorpha halys* (Stål) (Hemiptera: Pentatomidae) nymphs early and late in the season

CrossMark

Angelita L. Acebes-Doria[a,*], Tracy C. Leskey[b], J. Christopher Bergh[a]

Entomologia Experimentalis et Applicata
DOI: 10.1111/eea.12539

Characterizing spring emergence of adult *Halyomorpha halys* using experimental overwintering shelters and commercial pheromone traps

J. Christopher Bergh[1]*, William R. Morrison III[2], Shimat V. Joseph[3] & Tracy C. Leskey[2]

Journal of Integrated Pest Management, (2020) 11(1): 4; 1–16
doi: 10.1093/jipm/pmaa001
Case Study

OXFORD

Invasion of the Brown Marmorated Stink Bug (Hemiptera: Pentatomidae) into the United States: Developing a National Response to an Invasive Species Crisis Through Collaborative Research and Outreach Efforts

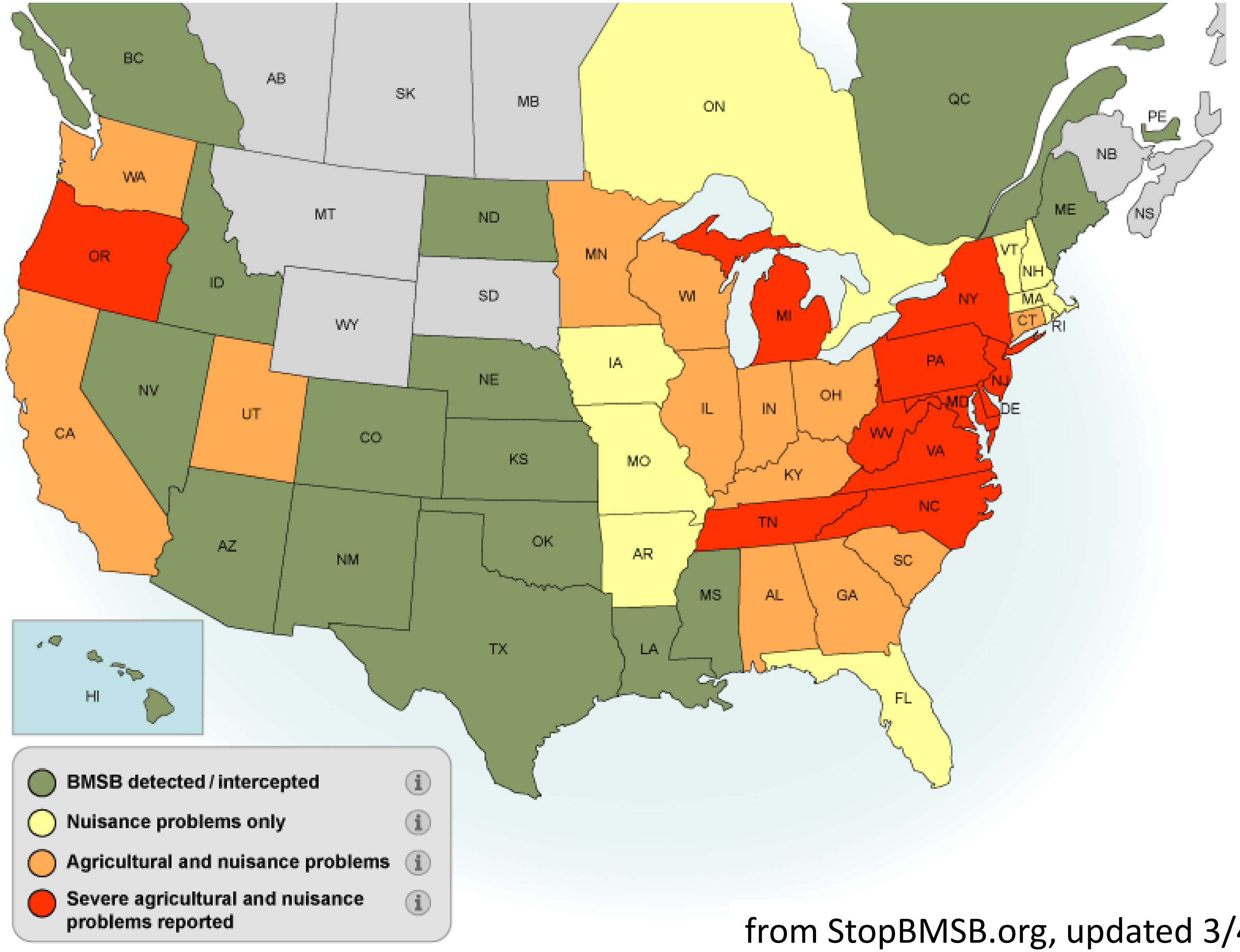
Dalton Ludwick,[1,†] William R. Morrison, III,[2,†] Angelita L. Acebes-Doria,[3] Arthur M. Agnello,[4] J. Christopher Bergh,[5] Matthew L. Buffington,[6] George C. Hamilton,[7] Jayson K. Harper,[8] Kim A. Hoelmer,[9] Gregory Krawczyk,[10] Thomas P. Kuhar,[11] Douglas G. Pfeiffer,[11] Anne L. Nielsen,[12] Kevin B. Rice,[13] Cesar Rodriguez-Saona,[14] Peter W. Shearer,[15] Paula M. Shrewsbury,[16] Elijah J. Talamas,[17] James F. Walgenbach,[18] Nik G. Wiman,[19] and Tracy C. Leskey[1,20]

Brown marmorated stink bug (BMSB) and prospects for its biological control via a non-native egg parasitoid

BMSB is also a significant nuisance pest




Current distribution and pest status of BMSB in the USA



from StopBMSB.org, updated 3/4/2020

Moves into crops throughout the season from nearby wild host plants, and from these plants to buildings during its autumn dispersal

Apple orchards in Frederick County, VA
adjacent to unmanaged woodlands

How to suppress BMSB populations throughout the landscape to reduce its impacts on crop producers and owners of homes and businesses?

Biological control can help achieve this goal

Biological control: The actions of natural enemies on pest populations

Predators
(feed on insects)





Parasitoid wasps
(lay eggs in insects)

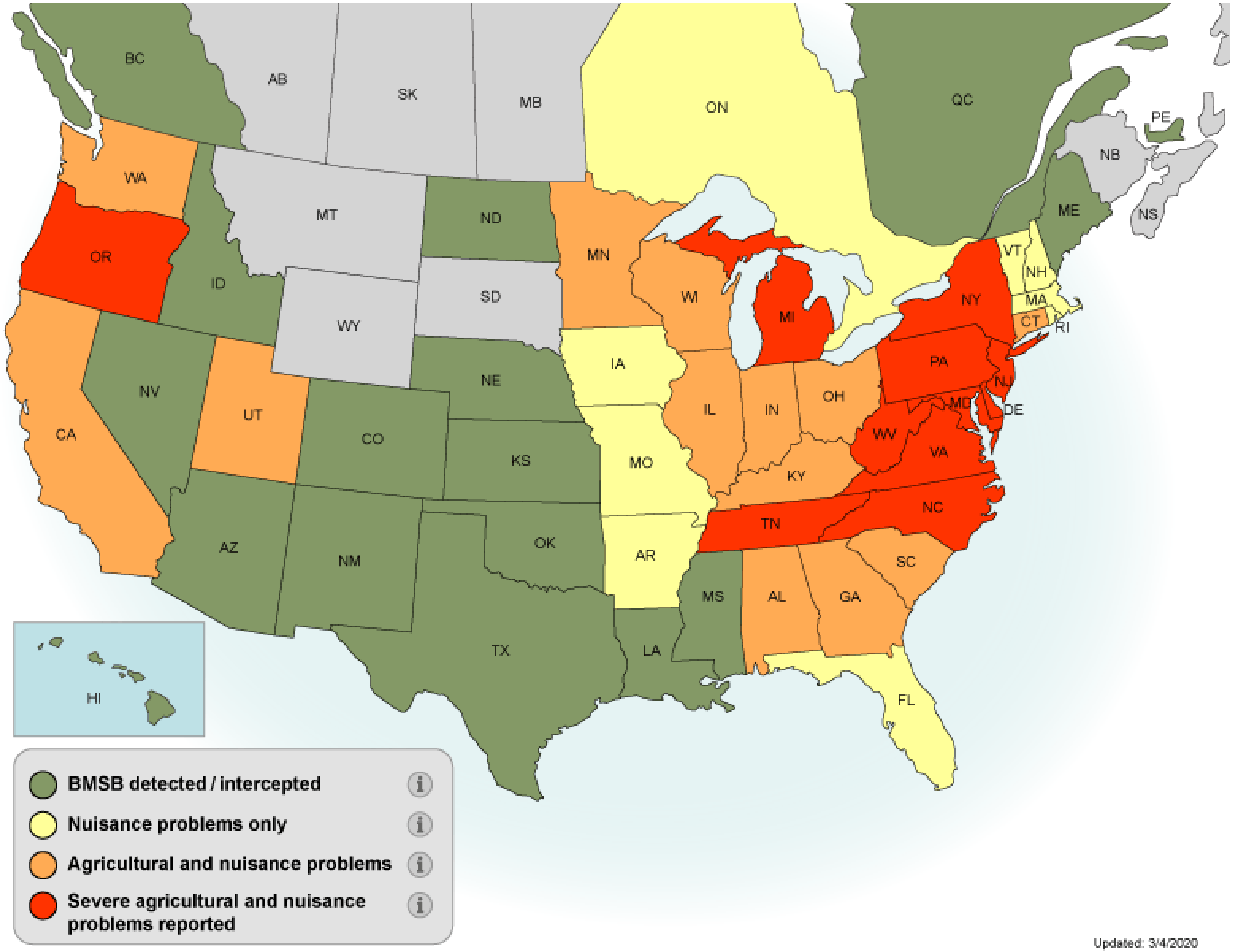
Invasive insects typically arrive in a new area without the biocontrol agents that suppress them in the native range

Native predators and parasitoids
in the USA do attack BMSB,
but so far at in sufficient levels

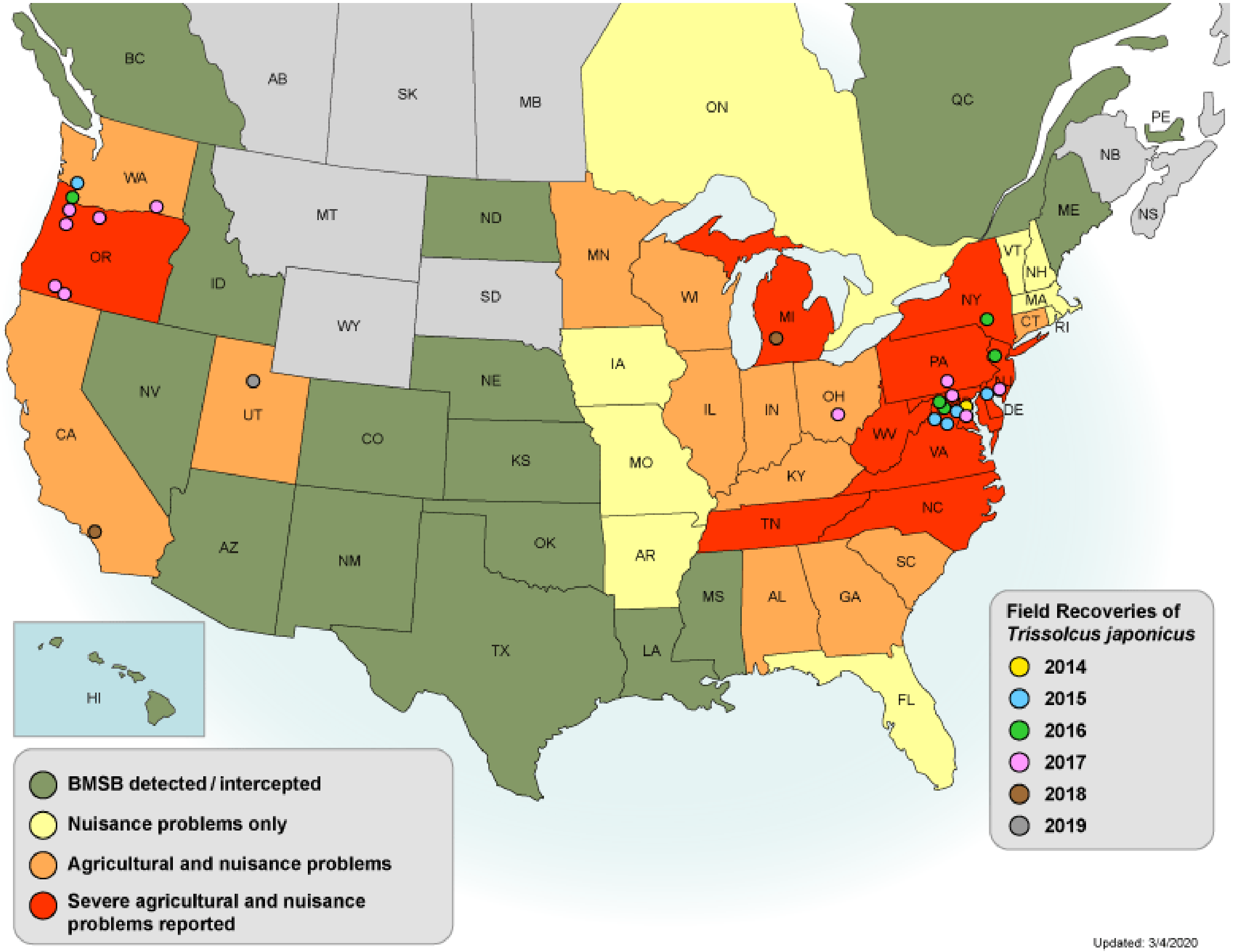
Samurai wasp

- native to Asia
- effective BMSB egg parasitoid
- 1st USA detection in 2014

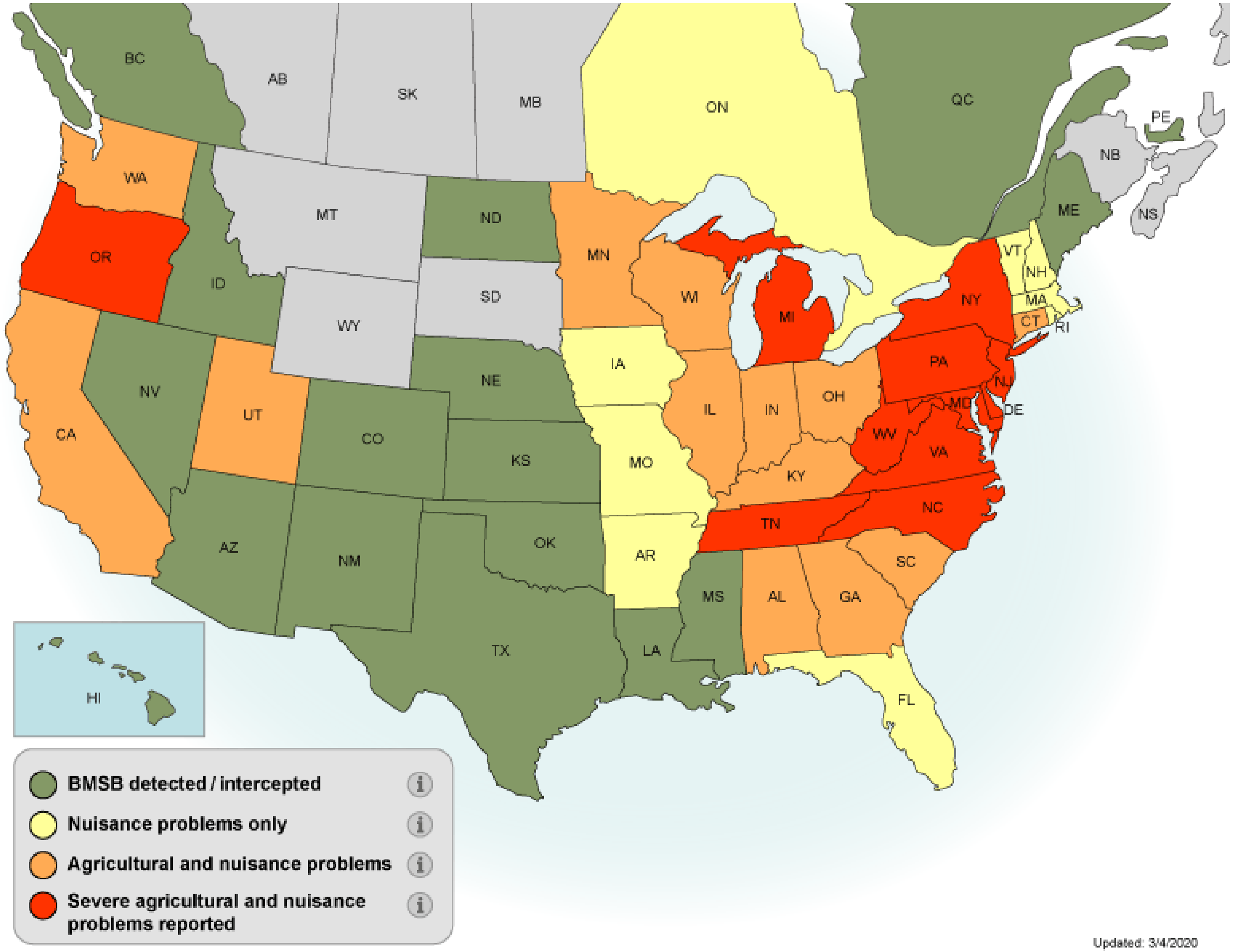
Current distribution of BMSB



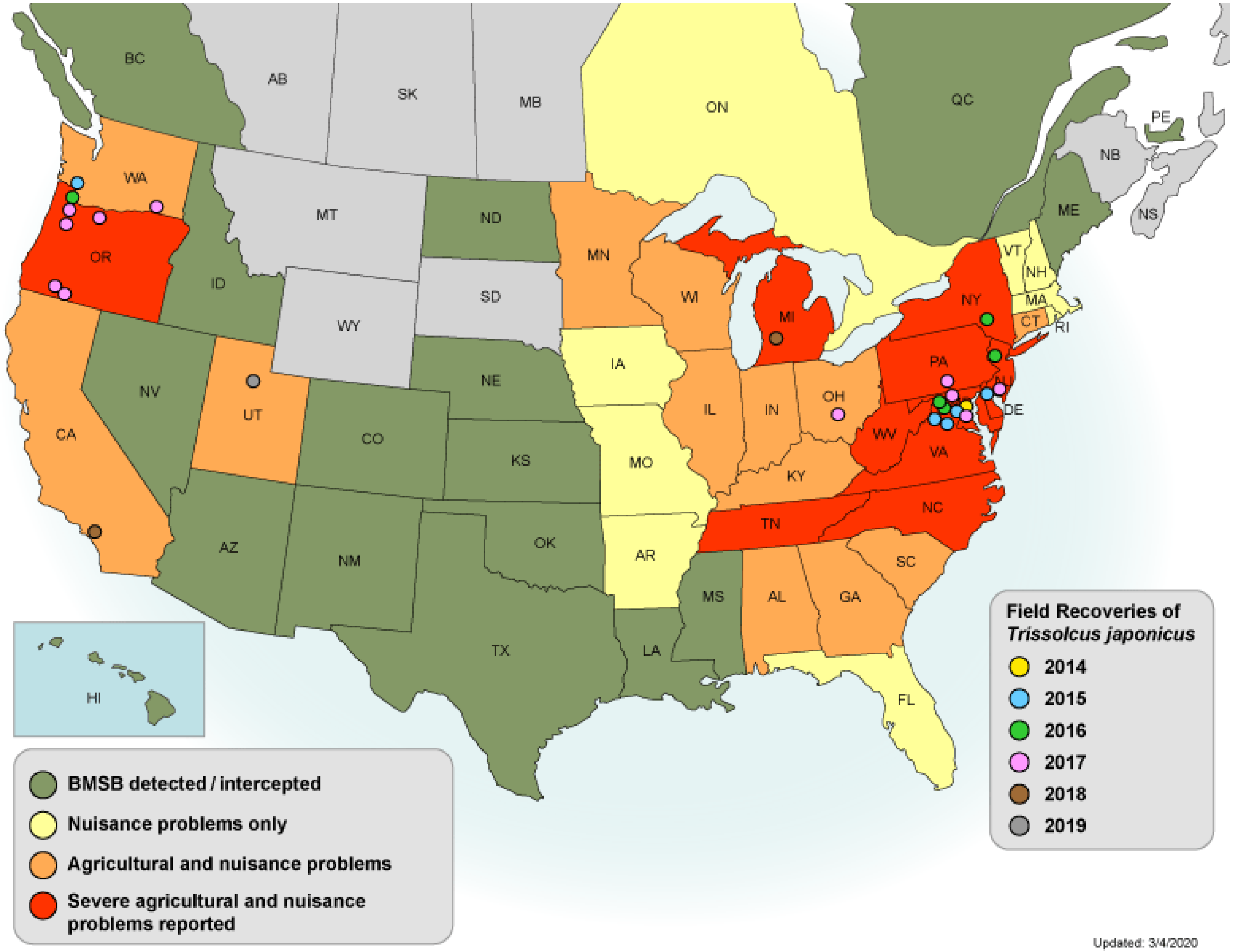
Current distribution of Samurai wasp



Current distribution of BMSB



Current distribution of Samurai wasp



Much interest in tracking the spread of Samurai wasp and its impact on BMSB in the USA

Where are BMSB and its egg masses in the tree canopy?
Where is the Samurai wasp? How to sample for Samurai wasp?

Vertical transects of BMSB pheromone traps

Felled and inspected the foliage of BMSB host trees for egg masses

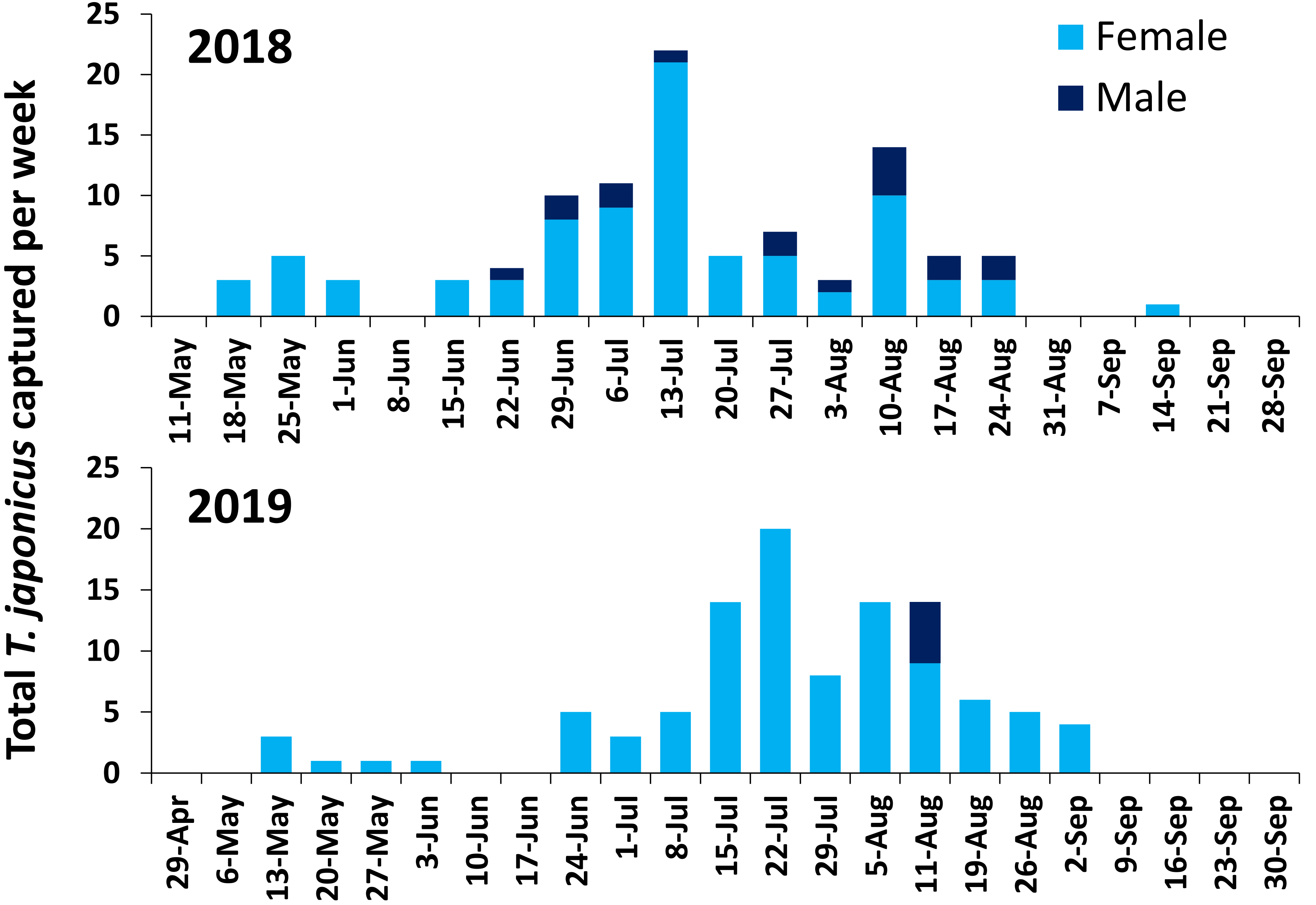
BMSB captures increased with increasing trap elevation

Most BMSB egg masses in mid-canopy

Samurai wasp detected only from mid- and upper-canopy

Quinn, NF, EJ Talamas, TC Leskey, and JC Bergh. 2019. Vertical sampling in tree canopy for *Halyomorpha halys* life stages and its egg parasitoid, *Trissolcus japonicus.* Environmental Entomology 48: 173-180

Quinn, NF, EJ Talamas, TC Leskey, and JC Bergh. 2019. Sampling methods for adventive *Trissolcus japonicus* in a wild host tree of *Halyomorpha halys.* Journal of Economic Entomology 112: 1997-2000


Total T. japonicus captured per week
2018
Female
Male
0
5
10
15
20
25
11-May
18-May
25-May
1-Jun
8-Jun
15-Jun
22-Jun
29-Jun
6-Jul
13-Jul
20-Jul
27-Jul
3-Aug
10-Aug
17-Aug
24-Aug
31-Aug
7-Sep
14-Sep
21-Sep
28-Sep
2019
29-Apr
6-May
13-May
20-May
27-May
3-Jun
10-Jun
17-Jun
24-Jun
1-Jul
8-Jul
15-Jul
22-Jul
29-Jul
5-Aug
11-Aug
19-Aug
26-Aug
2-Sep
9-Sep
16-Sep
23-Sep
30-Sep

Our recent and on-going research on Samurai wasp, using yellow traps as a sampling tool

1. Do tree species or habitat type affect Samurai wasp detections?
2. What is the relationship between captures of BMSB and Samurai wasp?
3. Do chemical stimuli associated with BMSB increase Samurai wasp captures?
4. Can we promote the establishment of Samurai wasp in Virginia?

Our recent and on-going research on Samurai wasp, using yellow traps as a sampling tool

Optimize the efficiency and effectiveness of Samurai wasp surveillance, toward a better understanding of its spread and abundance, its impact on BMSB populations, and its establishment throughout Virginia