CBB Efforts at PBARC

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KCFA Expo 2015

Topics

- **Area-wide CBB Program**
- **Summary of work at DKI-PBARC**
- **2014 data** ***(currently unpublished)***
- **Conclusions**

Area-wide CBB Program

- An area-wide mitigation and management program for CBB control was established by PBARC in August 2013 with funds received from ARS ($1M) in collaboration with the University of Hawaii at Manoa

- 2014, Federal Grant, $703,358

- Team: 13 members
  - (6 CTAHR, 6 DKI-PBARC, 1 ARS Ithaca)

Area-wide CBB Program

- **<u>Original Objectives</u>:**
  - Optimize the dose and use of commercial *Beauveria*
  - Map the area and extent of the infestation
  - Understand insect phenology
  - Synchronize coffee blooms for harvest and sanitation
  - Area-wide education and extension outreach
  - Economic analysis of CBB effects and cost/benefit of control measures
  - Analyze the CBB genome to better understand CBB biology

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Area-wide CBB Program

- **Additional Objectives:**
  - The use of more effective *Beauveria* strains
  - Reduce field populations of CBB using
    - Semiochemicals
    - Entomopathogenic nematodes (EPNs)
    - Predators
    - Pruning styles
  - Improved quarantine treatments
  - Implement preventative and/or management measures to additional islands

PBARC Scientists Involved With CBB

Lisa Keith
Tracie Matsumoto
Nicholas Manoukis
Eric Jang
Peter Follett
Roxana Myers
Steve Wraight (Ithaca, NY)

* Integrated Management for Control of Coffee Berry Borer (CBB)
* PBARC working cooperatively with CTHAR, HDOA and others
* Participation as key members of the CBB Task Force, SHAC and many farming groups

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Map the Area and Extent of the Infestation of CBB

- Developed a database for documenting and data sharing amongst CBB researchers
- Field work has included collection of preliminary ground-based spectral signature data from coffee plants
- Remote detection of coffee
- Working on a decision support tool for growers

- Dr. Nicholas Manoukis

Synchronize Coffee Flowering as a Harvest Management Tool

- Goal: to reduce crop losses for sanitation and reduce CBB populations in the field
- Plant growth regulator treatments have been applied; harvest data is being collected, and CBB infestation levels are being examined
- Presence of CBB in fallen cherries is being monitored

- Dr. Tracie Matsumoto

Develop and Deploy *B. bassiana*

- Improved efficacy data (rate of infection; correlation between efficacy and environment)
- Isolate and characterize naturally occurring isolates of *Beauveria* spp.
- Assess the activities of GHA vs. local strains

- Dr. Steve Wraight (ARS Ithaca)

Use of Entomopathogenic Nematodes (EPNs) as an Alternative to Sanitation

- A CBB colony was established on artificial diet in the laboratory
- *Heterorhabditis* strains were mass reared on mealworm beetle larvae

- Dr. Roxana Myers

Chemical Ecology Perspective of CBB Control Strategies

- Utilize semiochemicals to reduce field populations of CBB
- Work continues on the HS-GC-MS analysis of bioactive volatiles from coffee plant tissues and CBB at different development stages
- Use of repellents; “Push-Kill”

- Drs. Eric Jang & Yang Yu

Utilize Predators to Reduce Field Populations of CBB

- Square-necked grain beetle, *Cathartus quadricollis*
  - Dr. Peter Follett with Ms. Andrea Kawabata

An Introduction to Beetle Predators of Coffee Berry Borer (CBB) in Hawaii Workshop - Kona

Saturday, February 7, 2015 (2 sessions are available)
Morning: 9:30 AM – 12:00 PM
Afternoon: 2:00 PM – 4:30 PM
Sheraton Keauhou Resort & Spa – Bayview Rooms
(78-128 Ehukai Street; Kailua Kona, HI 96740)

Seating is limited. RSVP to Gina at ginab@hawaii.edu or 322-4892 by Thursday, February 5, 2015.

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Beauveria/CBB Research: Persistence & Efficacy Goals for 2014

- Determine how timing and frequency of commercial *Beauveria* applications effect persistence and efficacy
    - Elevation: 1869 ft, 1547 ft, 624 ft (shade)
- Strip Pick
- Compare 2014 to 2013
    - Dr. Lisa Keith

BioWorks

Coffee Data Collected

- Field plot maps/Strip pick
- Persistence: *Beauveria* GHA
- Efficacy (Destructive method)
  - % AB, % AB Dead, % CD, % Infestation
- Efficacy (Non-destructive method)
  - % Infestation, % Beauveria
- Environmental
  - Temp, % RH, Leaf moisture, Rainfall, UV
- Quality/Harvest

2014 Spray Schedule

Rate = 1 qt/100 gal

Spray late afternoon/ early evening

once/month spray (#1)
twice/month spray (#2)
strip pick + once/month spray (#3)

1st Beauveria spray
2013
Honaunau Low: 4/8
Honaunau High: 5/6
2014
Honaunau Low: 5/19
Honaunau High: 3/10

Sampling occurs before and after *Beauveria* sprays

Beauveria	Honaunau Low			Honaunau High			S
spray dates	#1	#2	#3	#1	#2	#3	#1
3/10/14				✓	✓	✓	
3/17/14				✓	✓	✓	3/20
3/24/14				✓	✓	✓	
4/7/14					✓		
4/21/14				✓	✓	✓	4/24
5/5/14					✓		
5/19/14	5/12	5/12	5/13	✓	✓	✓	
6/2/14					✓		6/1
6/16/14				✓	✓	✓	
6/30/14					✓		
7/14/14				✓	✓	✓	7/4
7/28/14	7/29	7/29	7/29		✓		
8/11/14				✓	✓	✓	8/4
8/25/14					✓		
9/8/14				✓	✓	✓	9/16
9/22/14	X	X	X		✓		
10/6/14				✓	✓	✓	10/9
10/20/14					✓		
11/3/14				✓	✓	✓	
11/17/14					✓		
12/1/14				✓	✓	✓	
12/15/14					✓		
12/22/15				✓	✓	✓	
12/29/15					✓		
1/5/15				✓	✓	✓	

Field Samples per Tree

Persistence

high

middle

low

1 subsample = 15 berries
10 trees

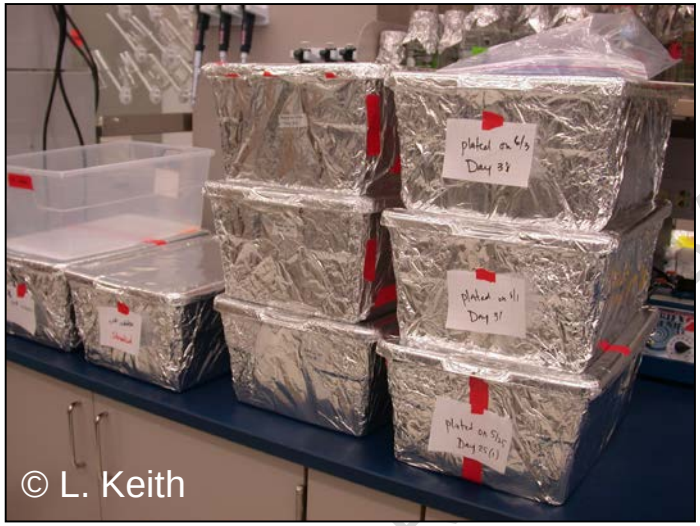
Efficacy: Destructive & Nondestructive

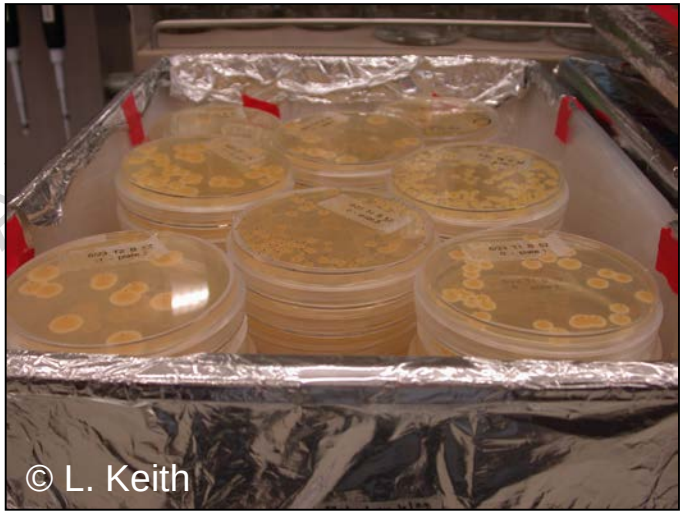
middle

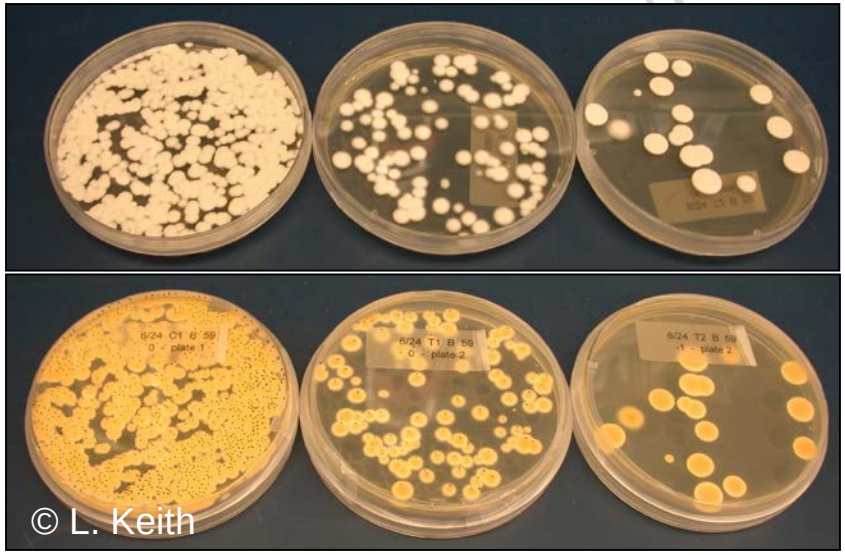
1 subsample = 10 green berries
4 trees

Laboratory Results - Persistence

Weigh
Wash
Dilute
Plate
Count *Beauveria*







Laboratory Results – Efficacy, Destructive Method

Dissect berries
Count beetles

AB alive/dead
CD
Beauveria

Data: Stripped

Honaunau Low

Stripped 2/20/14

14,619 sq ft; 13 people, 2 hours

weight (g)

	Hole	No-Hole	Unsorted	Total	**% Infested**
Raisin	-	-	1424.4	1424.4	
Red	736.9	61.4	-	798.3	92.3
Green	1424.4	3036.2	-	4460.6	31.9

6683.3 g

14.7 lb

Honaunau High

Stripped 3/7/14

8,404 sq ft; 8 people, 6 hours

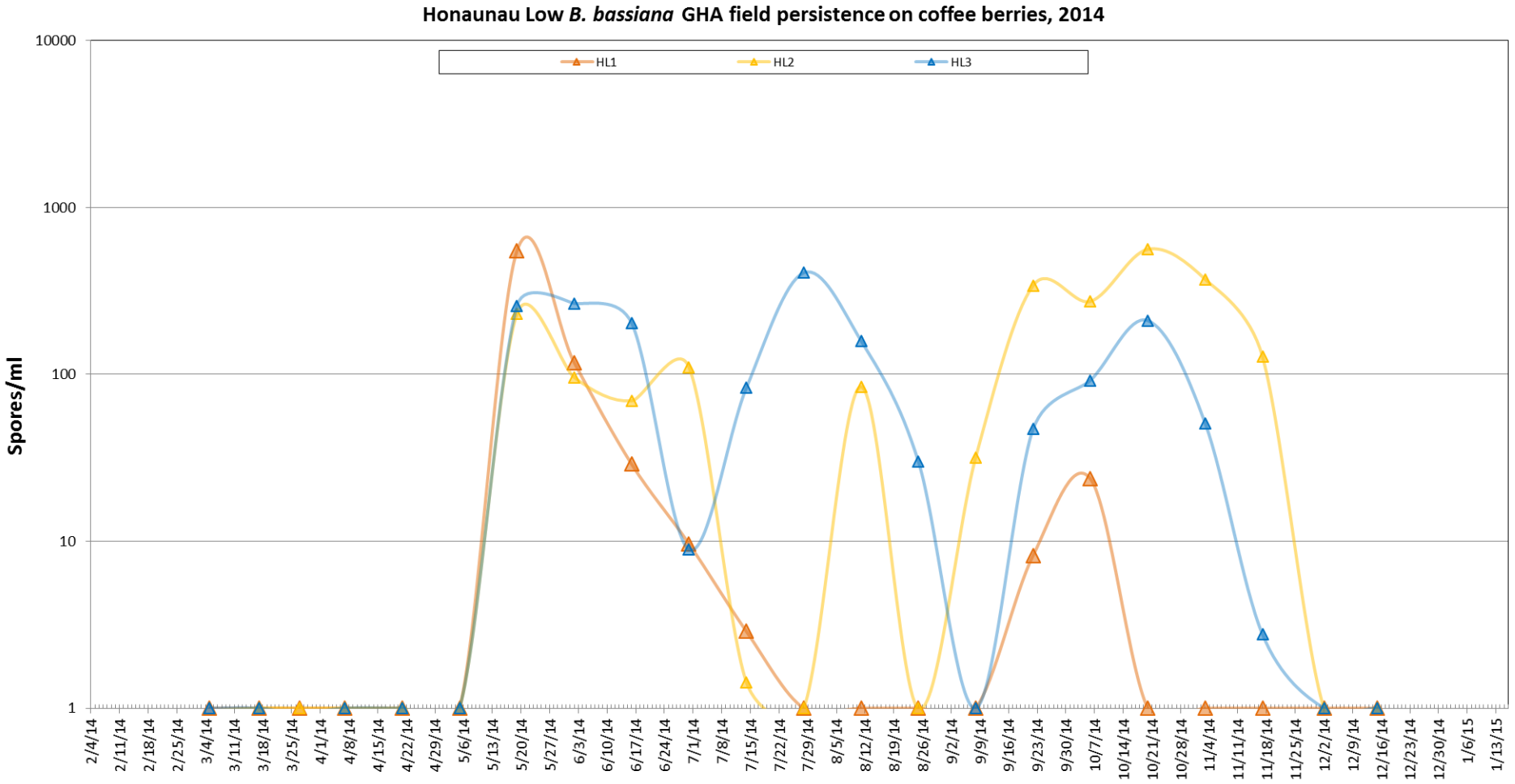
weight (g)

	Hole	No-Hole	Unsorted	Total	**% Infested**
Raisin	-	-	70.8	70.8	
Red	3008.7	1275.6	-	4284.3	70.2
Green	2907.6	4950.7	-	7858.3	37.0

12213.4 g

26.9 lb

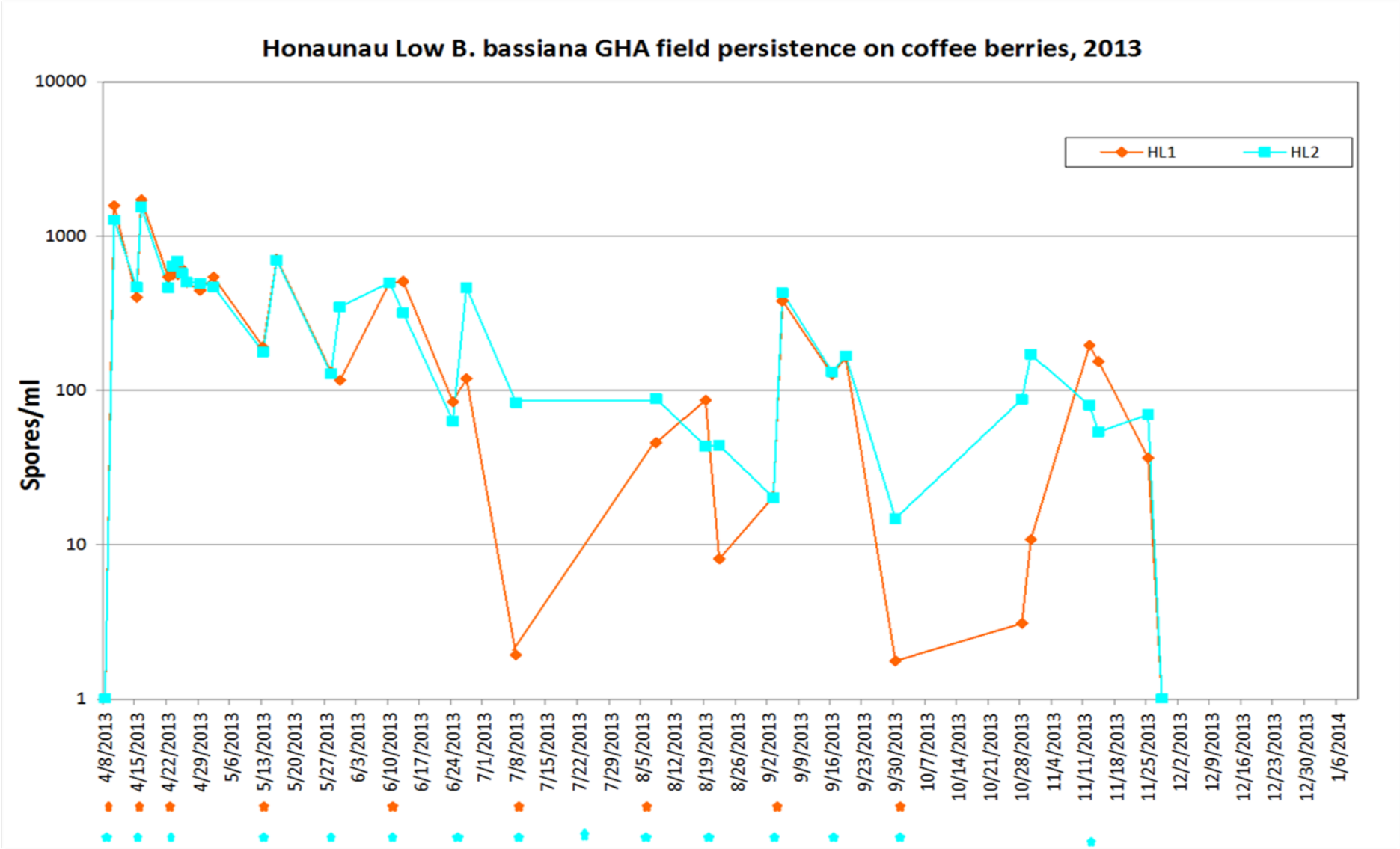
Persistence, 2014



2 or 3 sprays

strip pick (HL3)

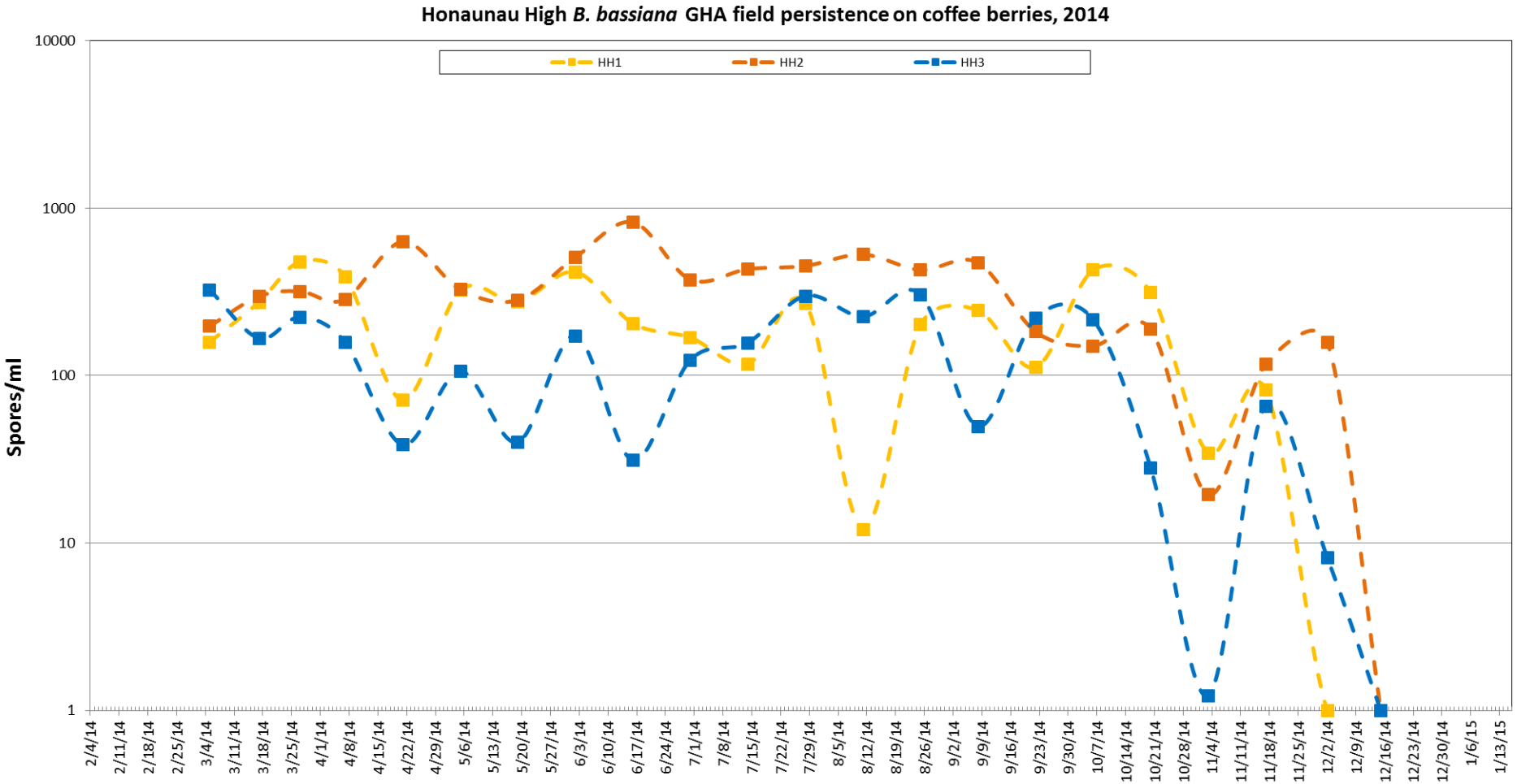
Persistence, 2013



9 or 15 sprays

once/month spray (HL1)
twice/month spray (HL2)

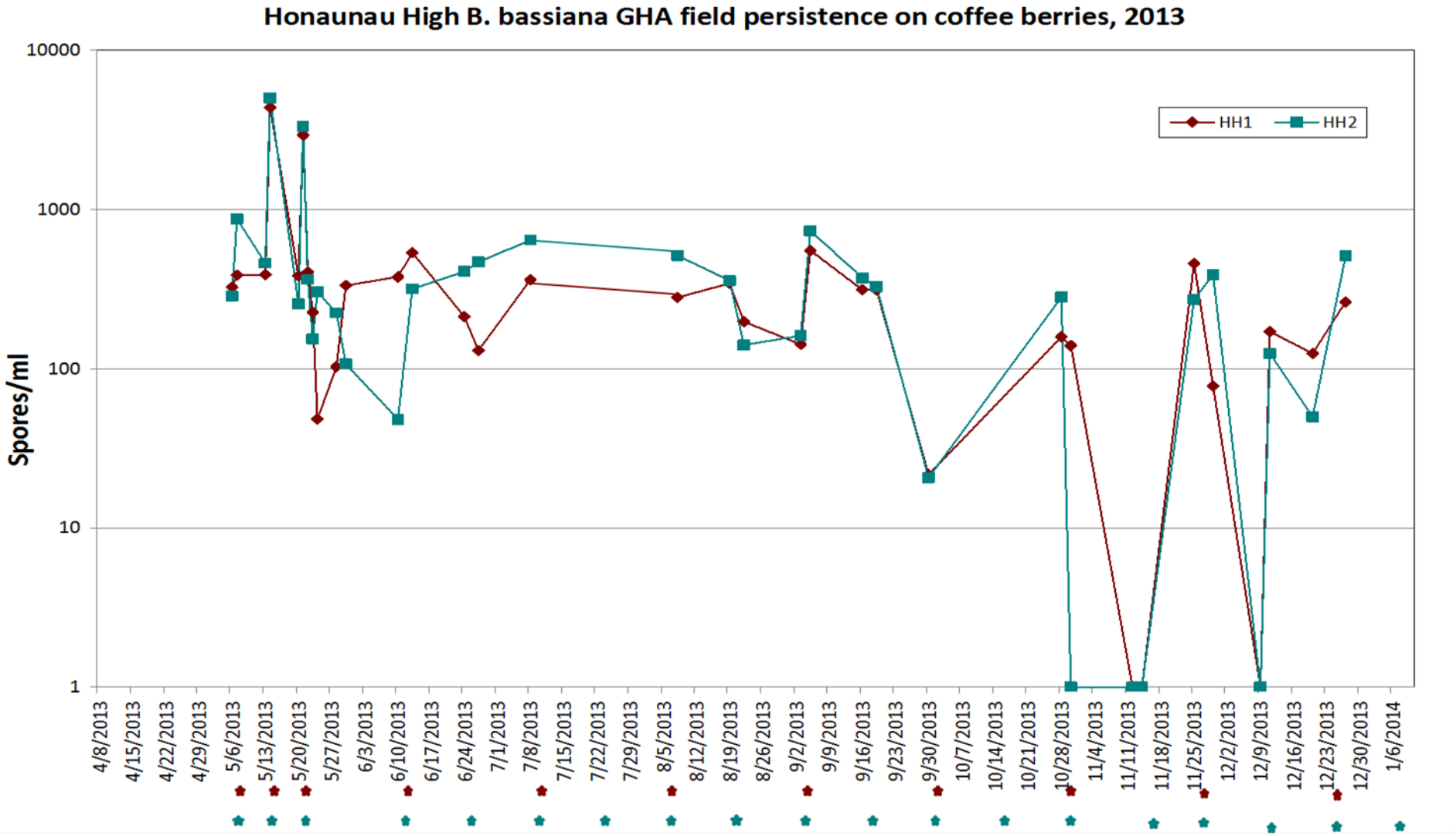
Persistence, 2014



14 or 25 sprays

once/month spray (HH1)
twice/month spray (HH2)
strip pick + once/month spray (HH3)

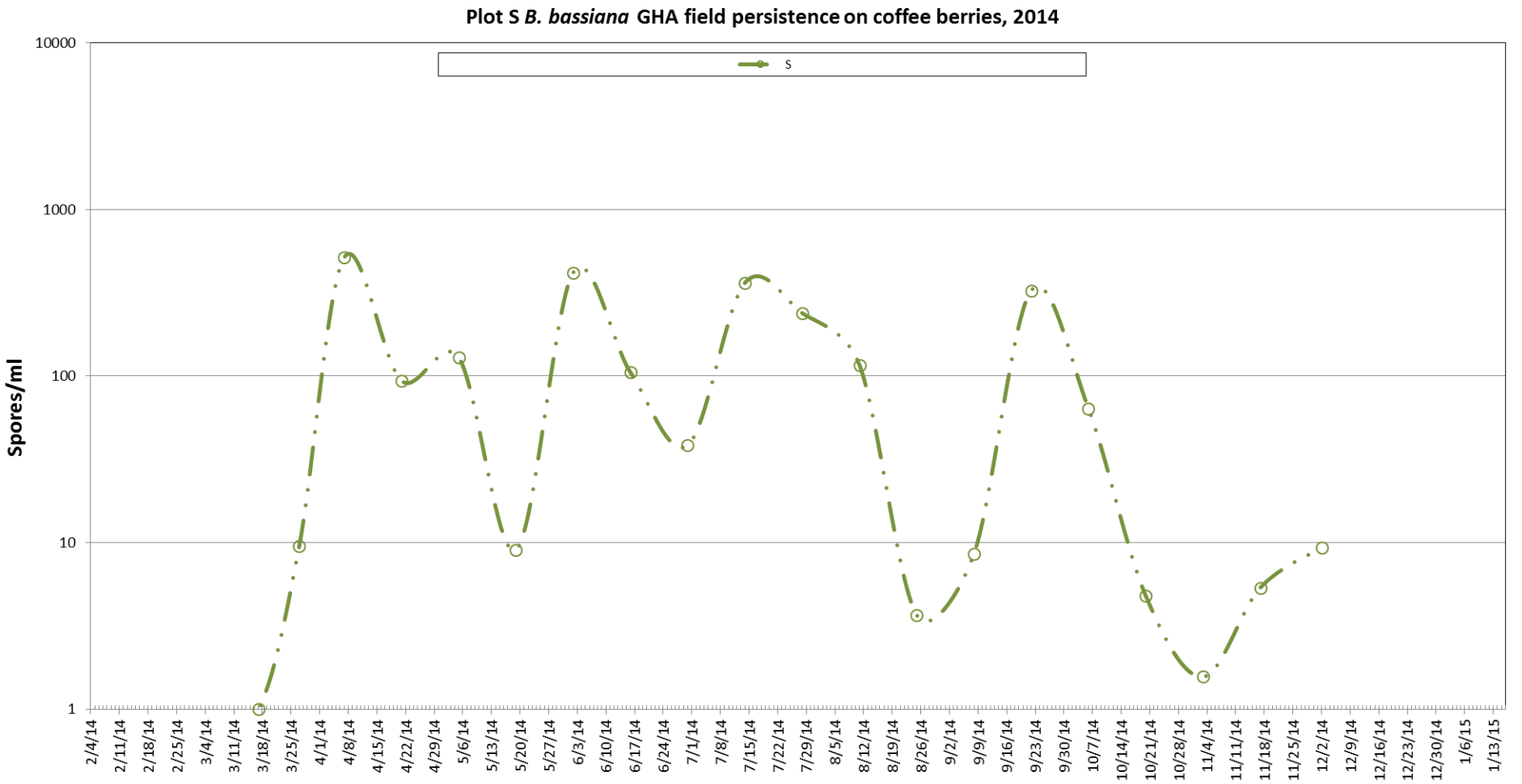
Persistence, 2013



11 or 19 sprays

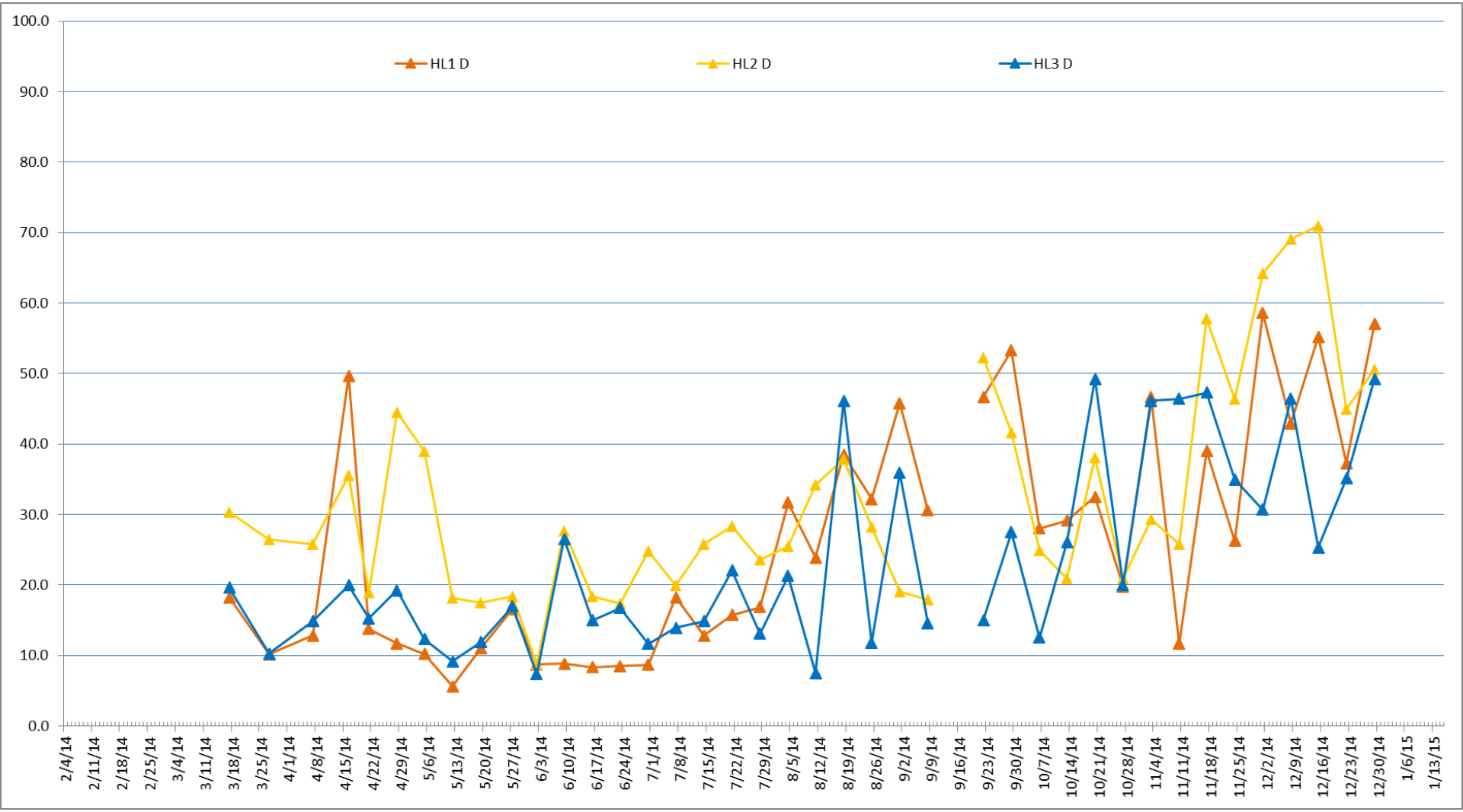
once/month spray (HH1)
twice/month spray (HH2)

Persistence, 2014



7 sprays

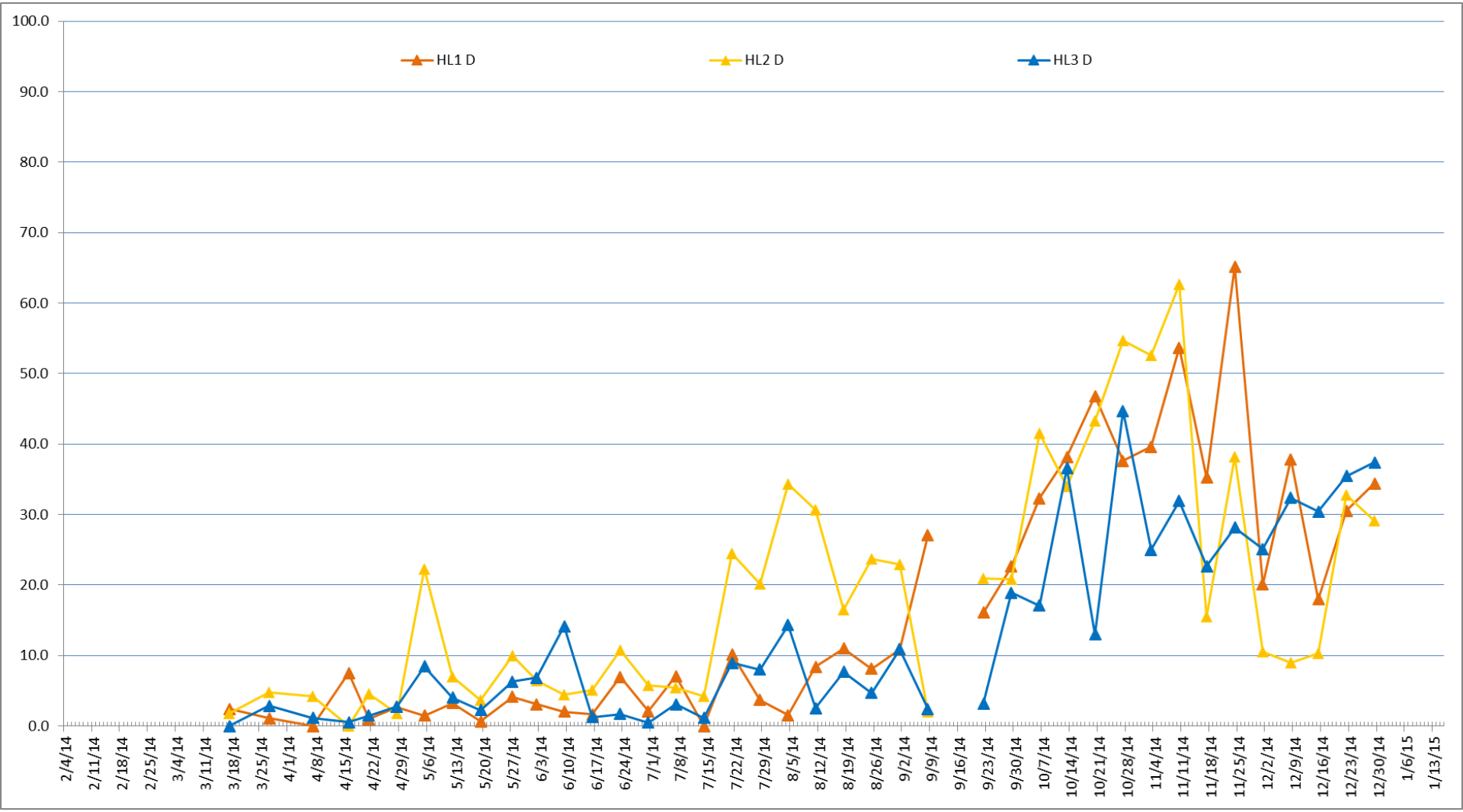
Efficacy: Destructive method, Honaunau Low, 2014



% AB = Alive + Dead + Absent (hole only)

strip pick (HL3)

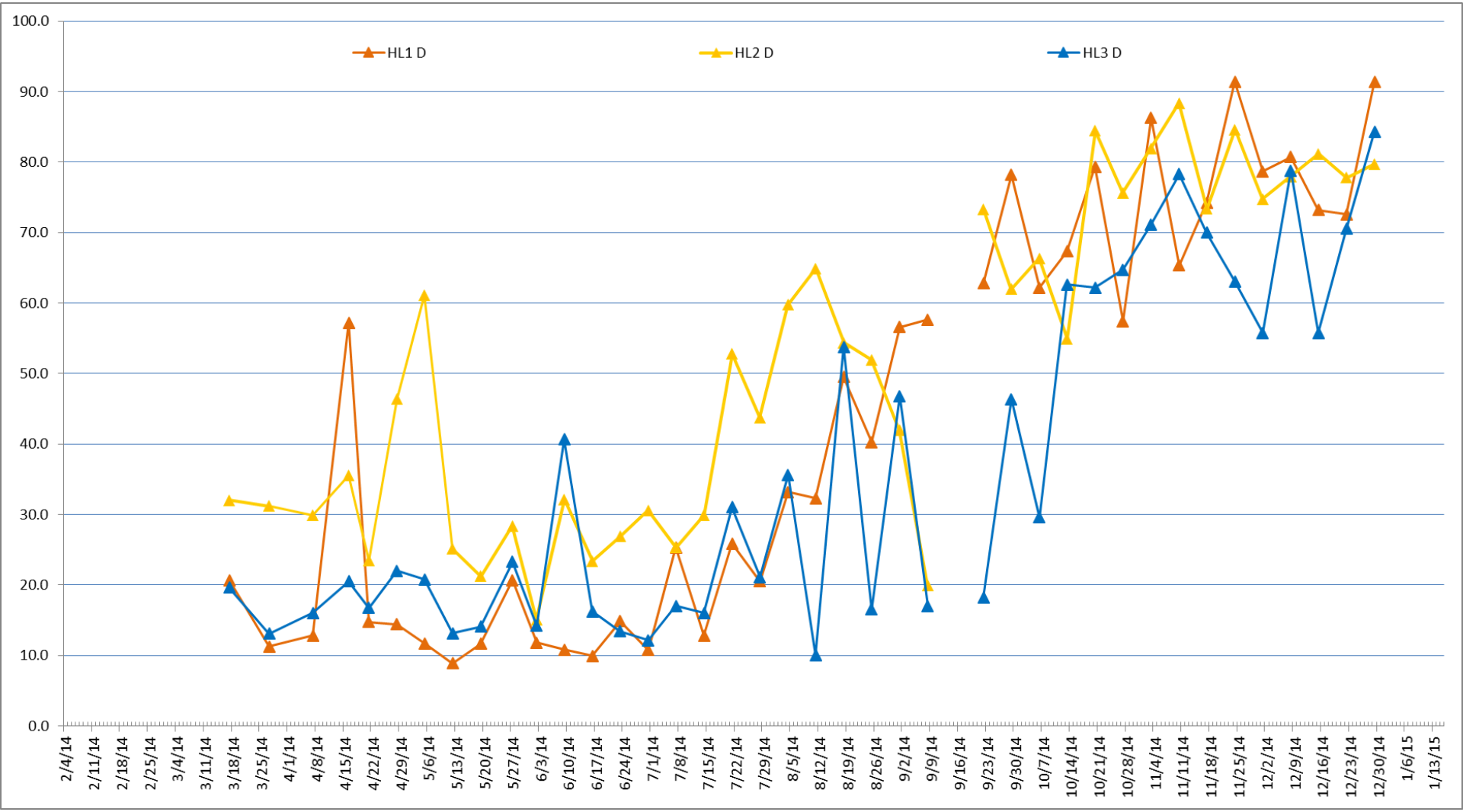
Efficacy: Destructive method, Honaunau Low, 2014



% CD

strip pick (HL3)

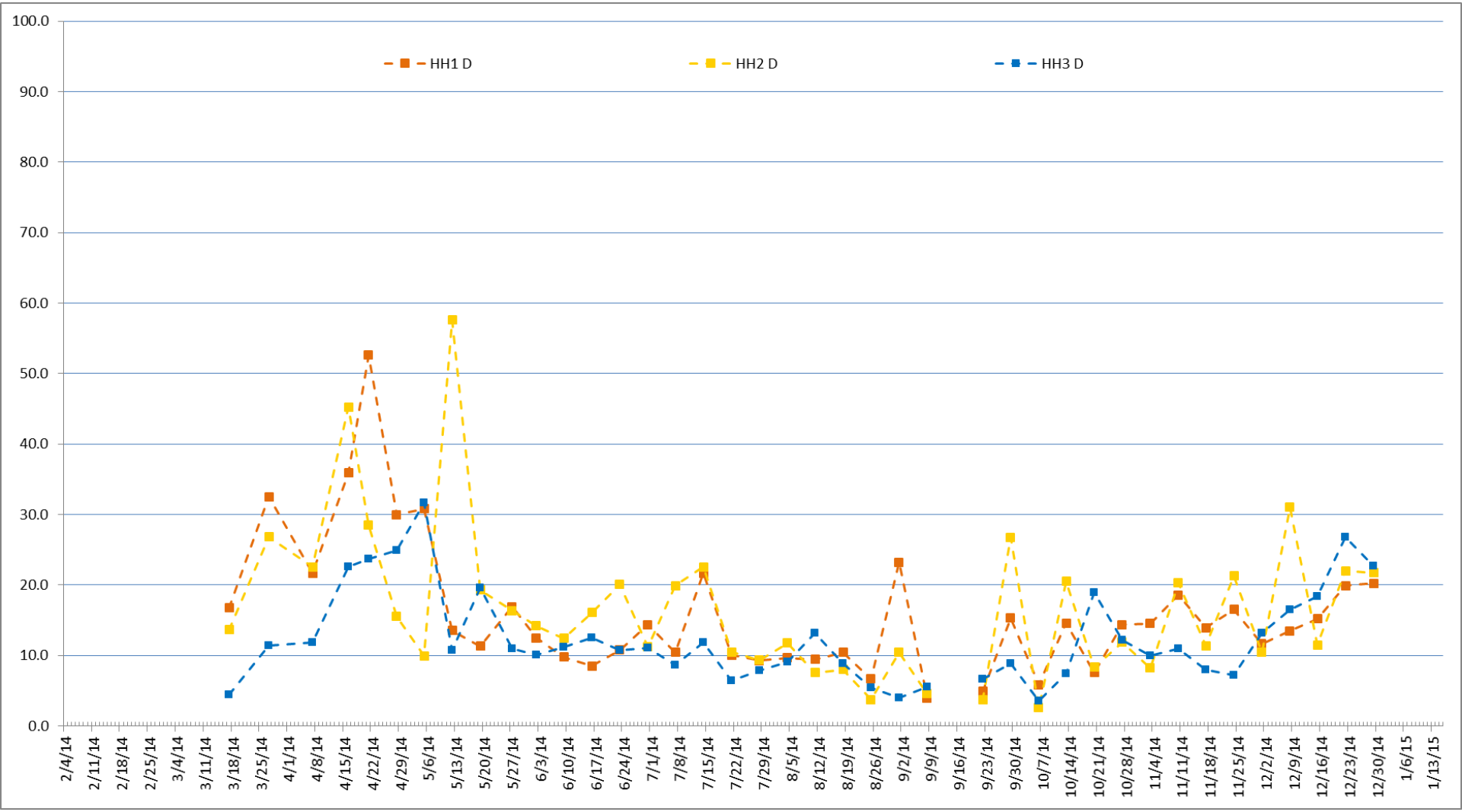
Efficacy: Destructive method, Honaunau Low, 2014



% infested = % AB + % CD

strip pick (HL3)

Efficacy: Destructive method, Honaunau High, 2014



% AB = Alive + Dead + Absent (hole only)

once/month spray (HH1)
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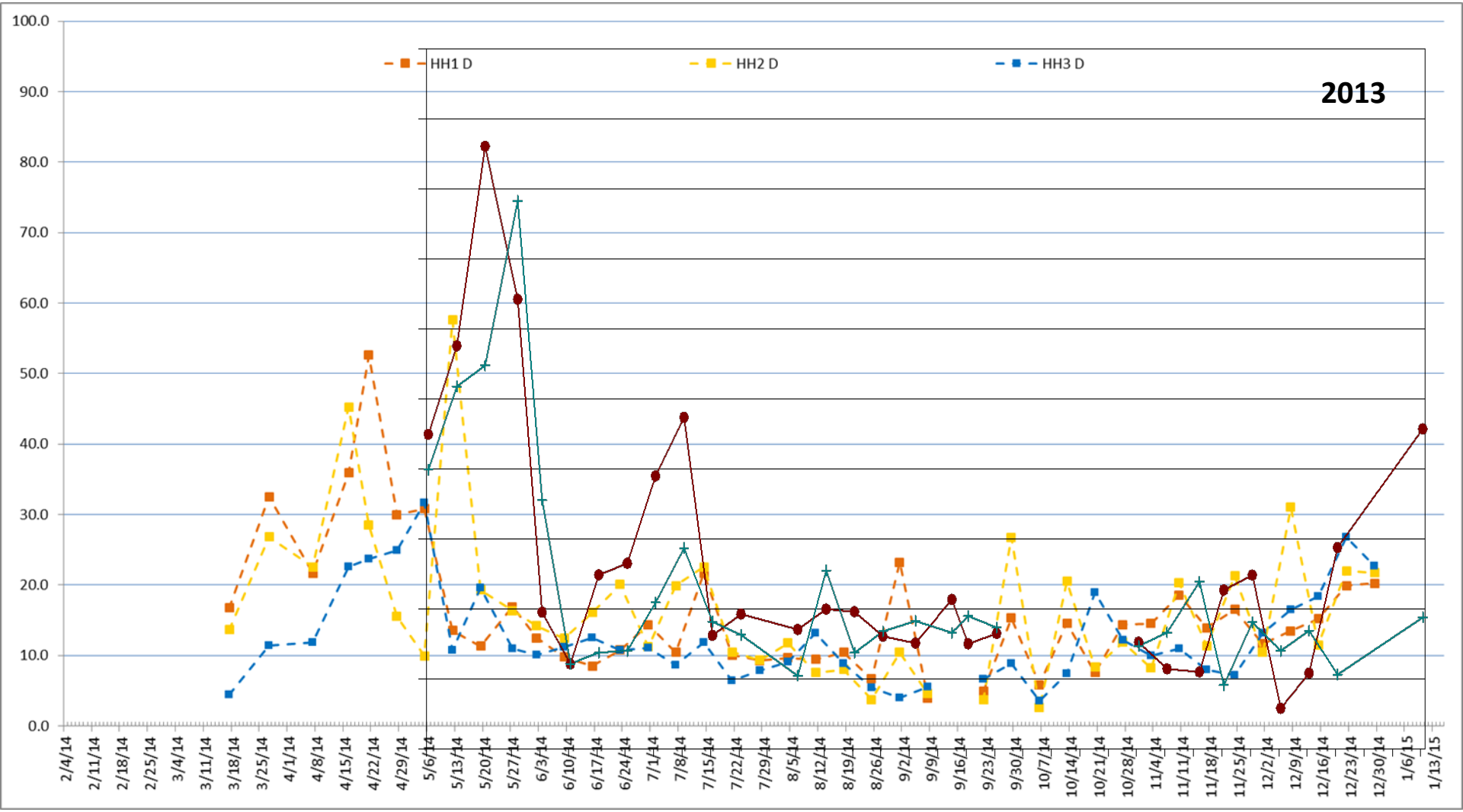
strip pick + once/month spray (HH3)

Efficacy: Destructive method, Honaunau High, 2014



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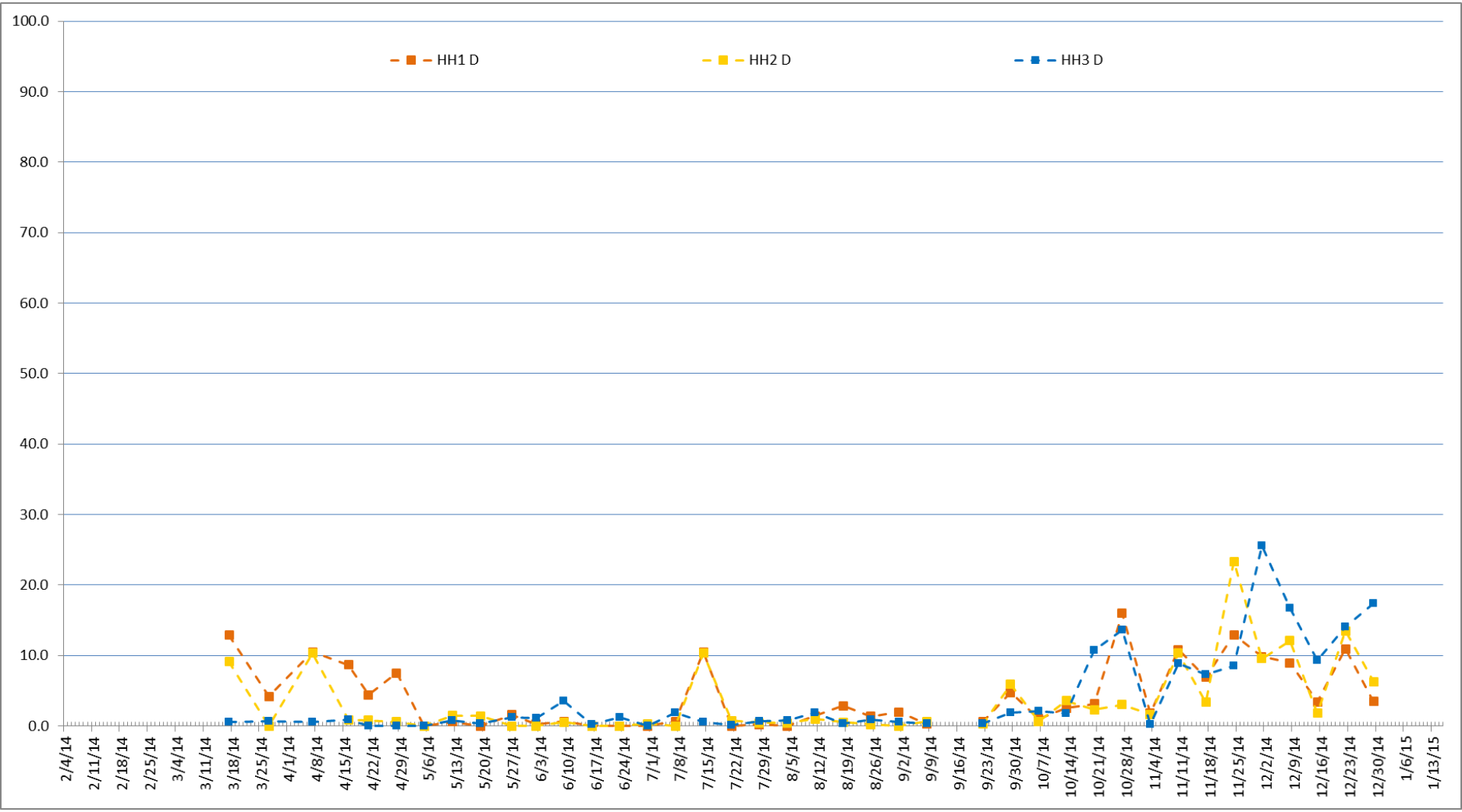

% CD

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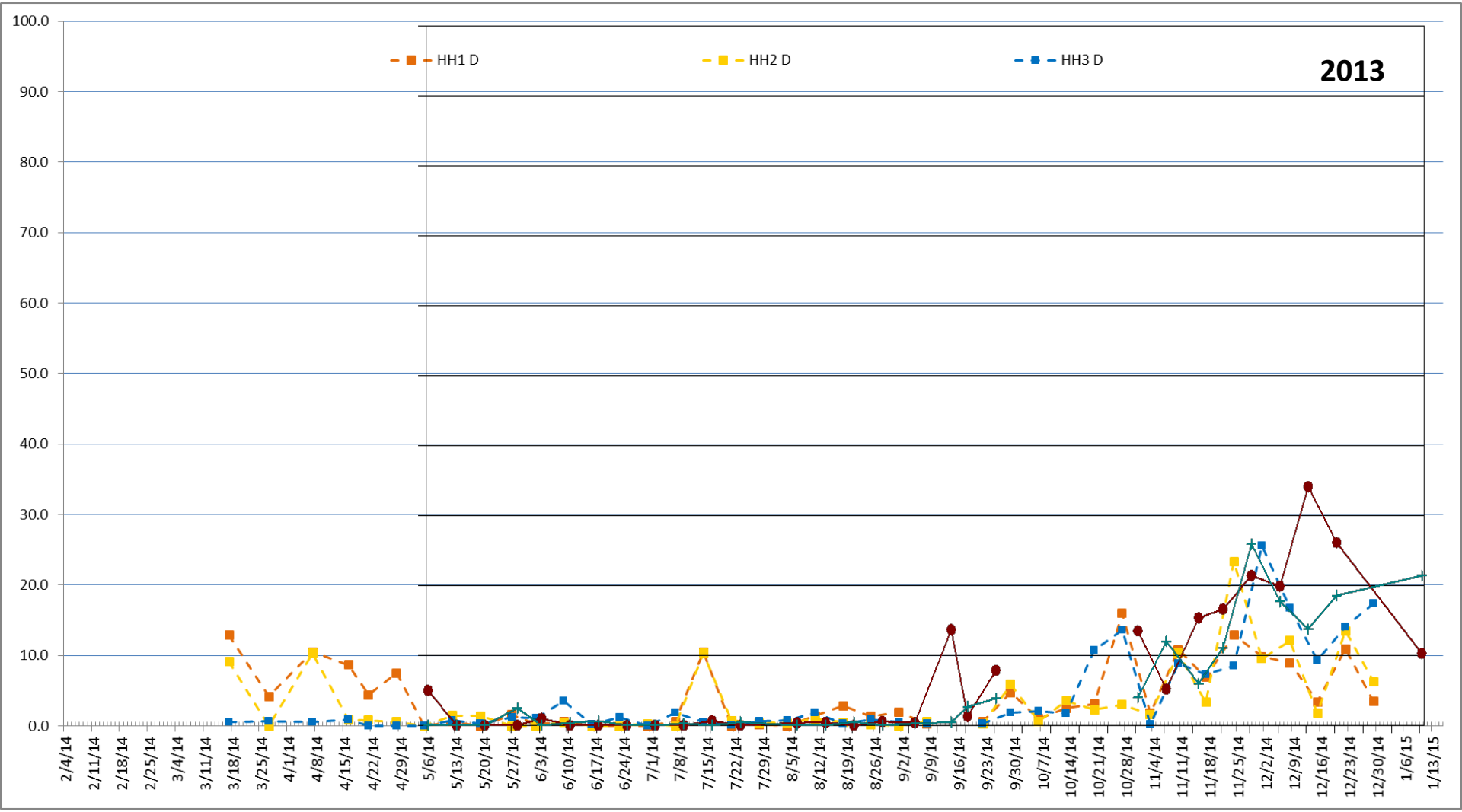

% CD

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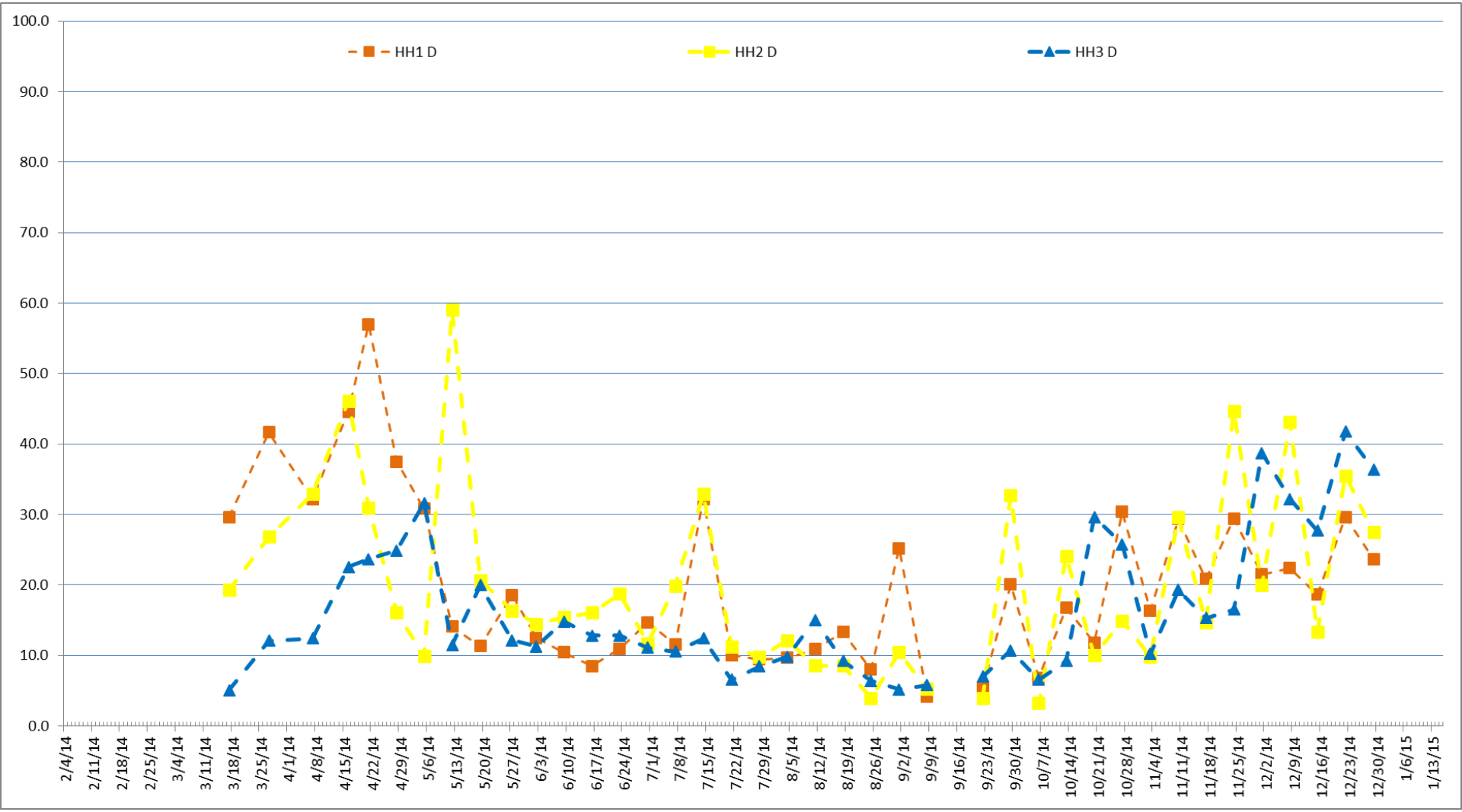
Efficacy: Destructive method, Honaunau High, 2014



% infested = % AB + % CD

once/month spray (HH1)
twice/month spray (HH2)
strip pick + once/month spray (HH3)

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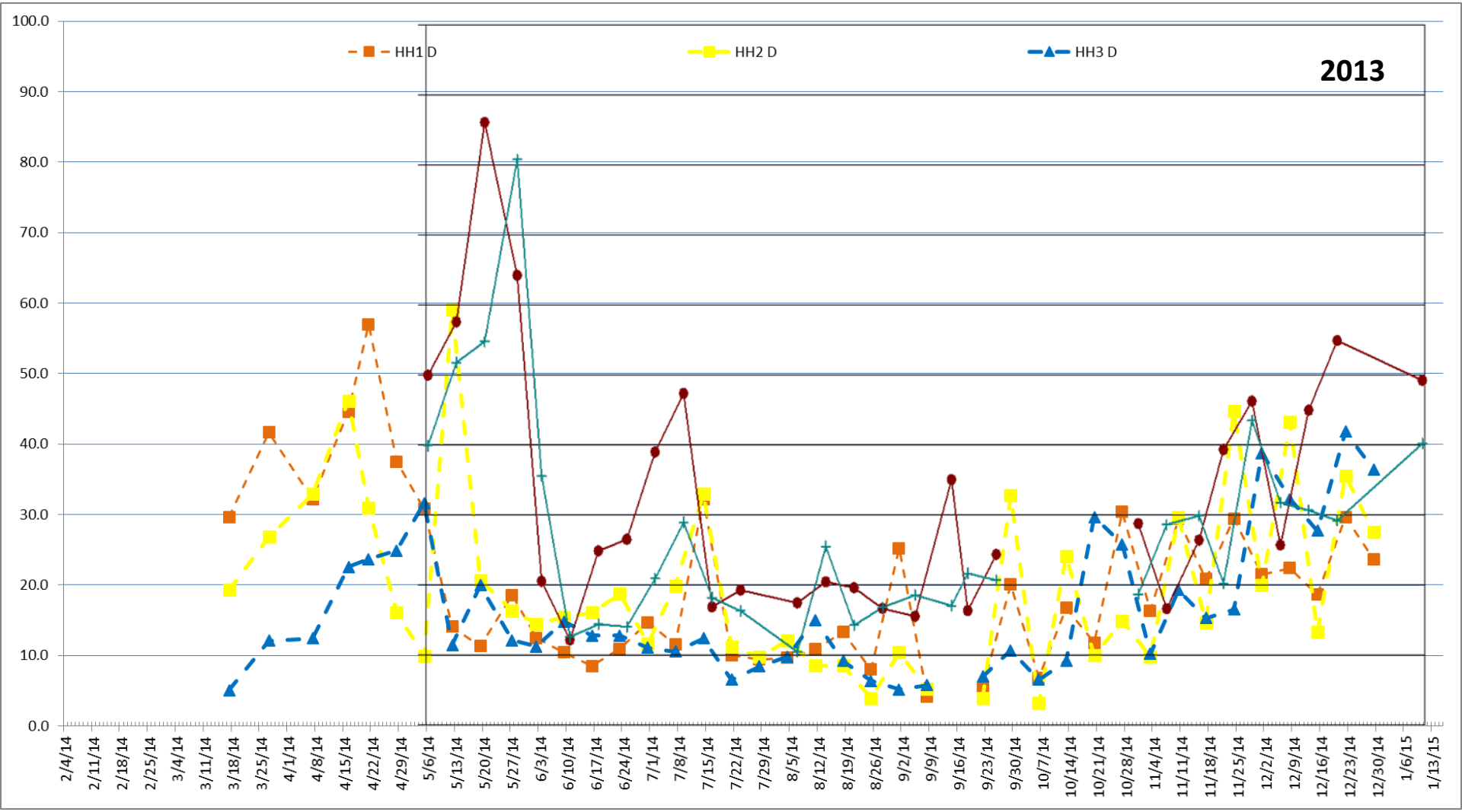
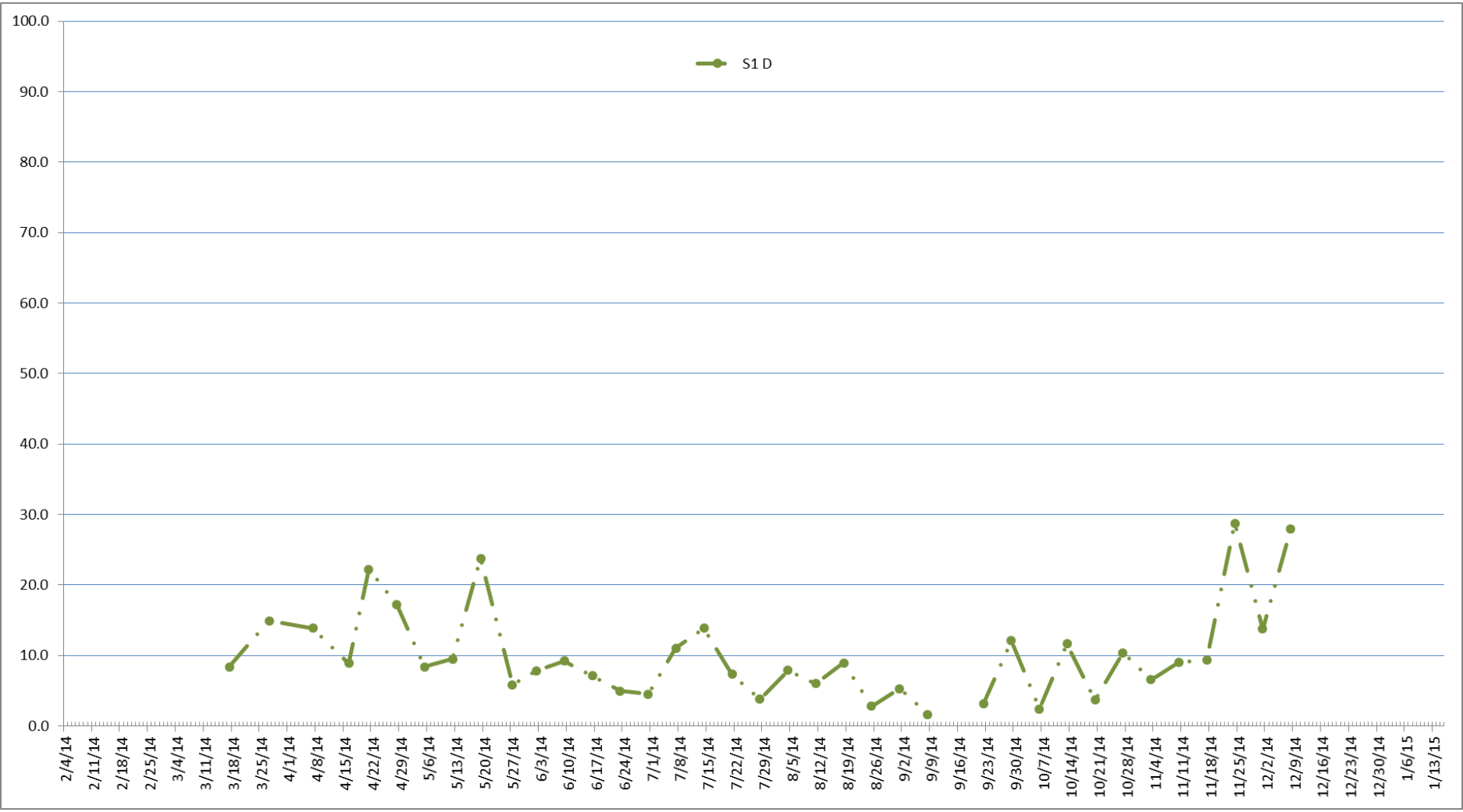
Efficacy: Destructive method, Honaunau High, 2014



% infested = % AB + % CD

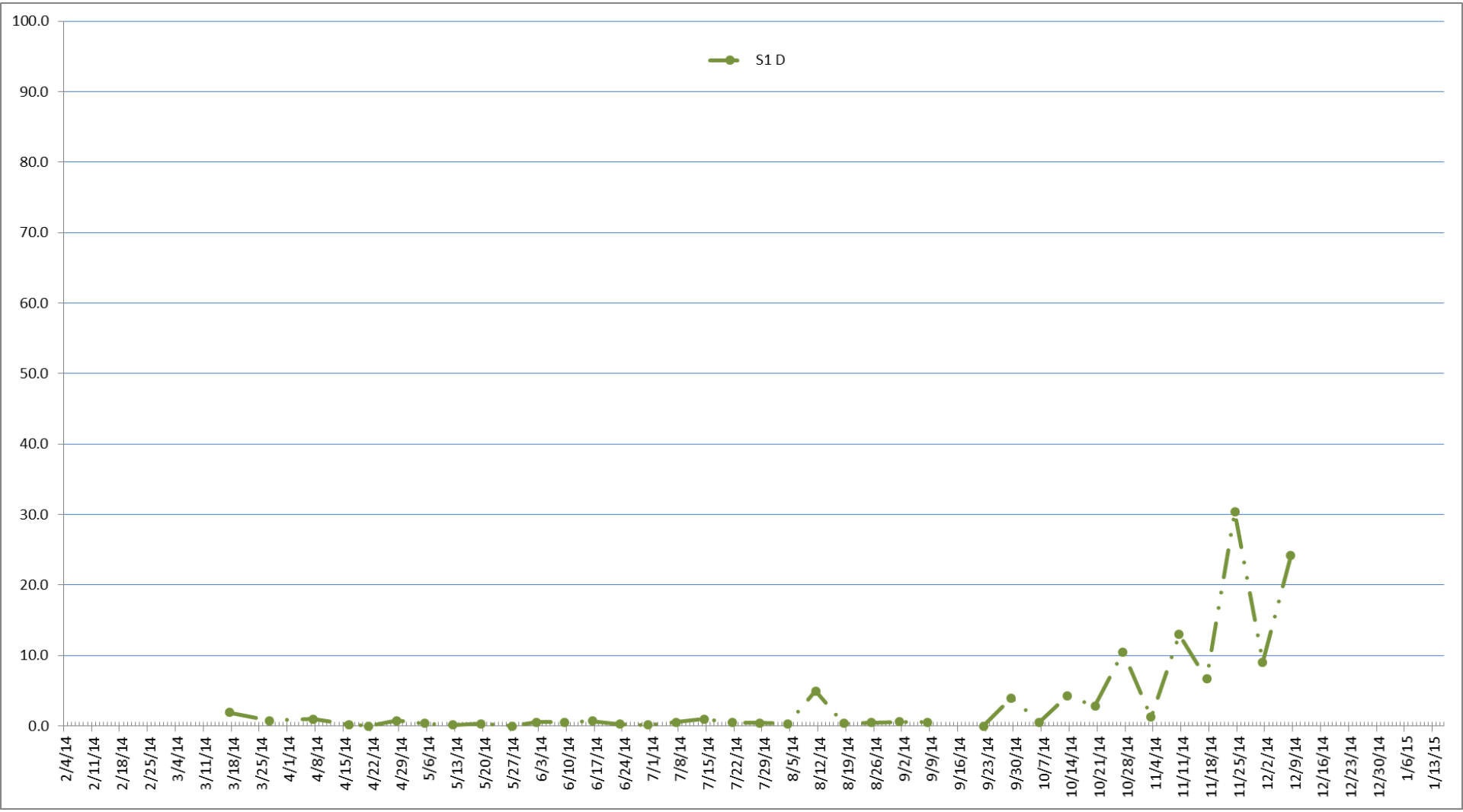
once/month spray (HH1)
twice/month spray (HH2)
strip pick + once/month spray (HH3)

Efficacy: Destructive method, Plot S, 2014



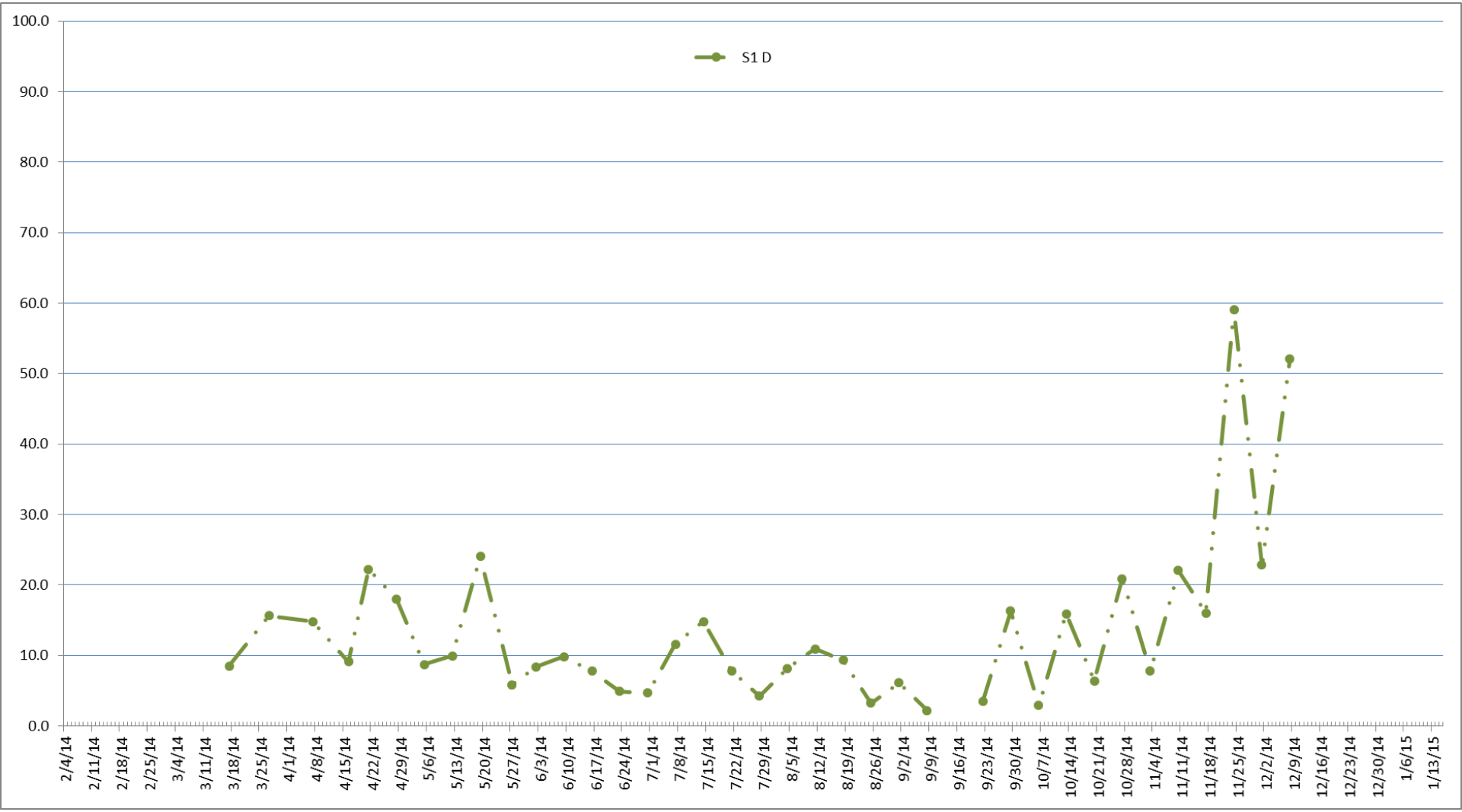
% AB = Alive + Dead + Absent (hole only)

Efficacy: Destructive method, Plot S, 2014



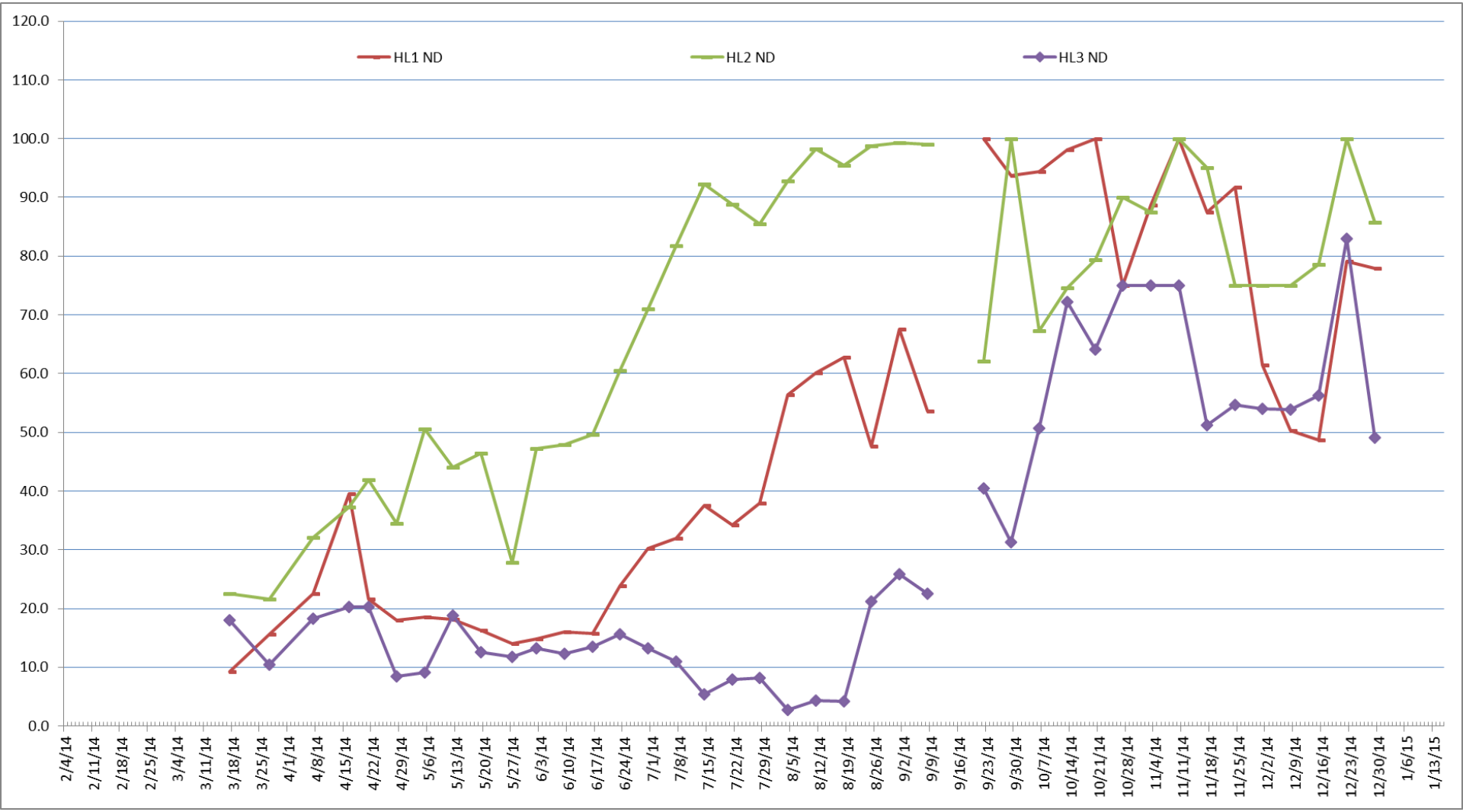
% CD

Efficacy: Destructive method, Plot S, 2014



% infested = % AB + % CD

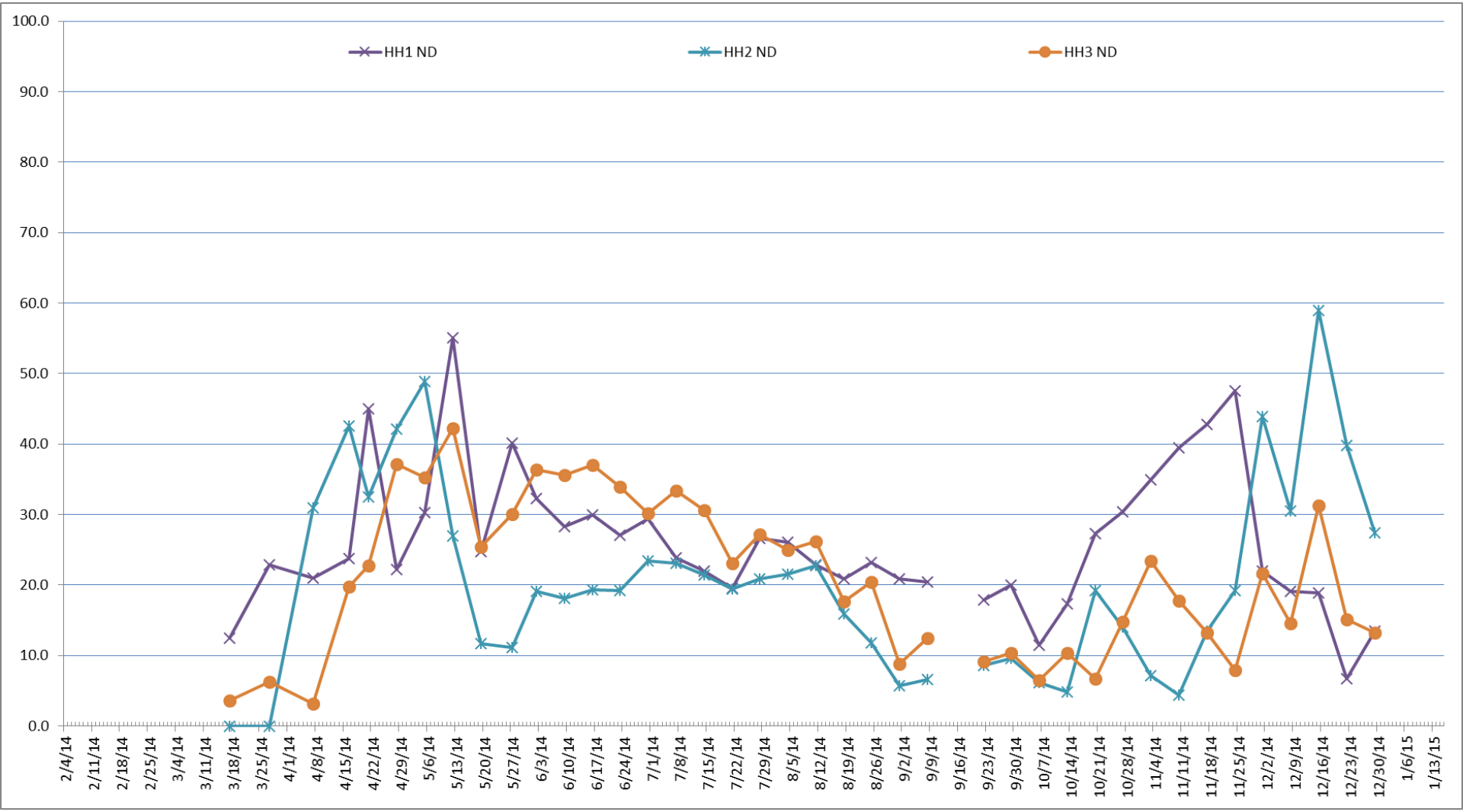
Efficacy: Non-destructive method, Honaunau Low, 2014



% infested = a hole

strip pick (HL3)

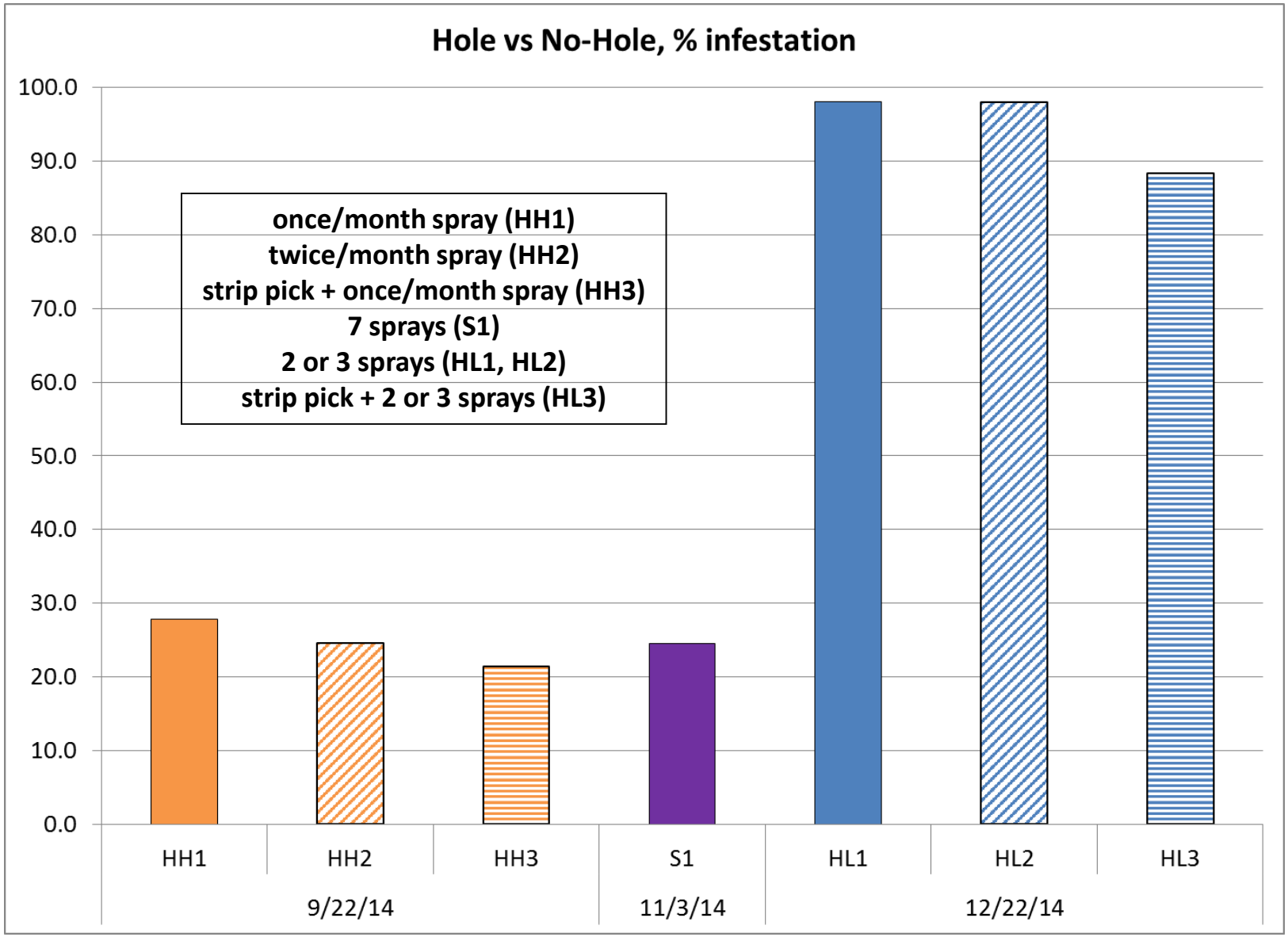
Efficacy: Non-destructive method, Honaunau High, 2014



% infested = a hole

strip pick (HL3)

Data: Harvest, 2014



Conclusions/Observations

- Difficult to give a precise recipe for success
- Only *Beauveria*: Not the silver bullet
- Only stripping: Not the silver bullet
- Timing versus number of applications
- Location specific for persistence and efficacy
- Environmental Data:
  - Locations are unique
  - Seasons can vary
- All data necessary for CBB Model

(Thanks to Nicholle, Lionel, Jim, Glenn and John for excellent technical help)

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What Does The Data Tell Us?

- Knock back the existing CBB population early (strip; *Beauveria*)
- Spray in the late afternoon
- *Beauveria* doesn't persist as much during the harvest months
- *Beauveria* sprays: monitor visually; spray when necessary
- "% infested" doesn't necessarily mean you have a high % of damaged beans

Thank You Field Cooperators!