Managing Spider Mites in Almonds

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Major influences on spider mites

- Spider mite biology
- Biological control
- Host and environment
- Chemical controls

Spider Mite Biology

- Feeds primarily on the leaves
- Reproduces very quickly
- Can cause defoliation
- Results in sunburn
- Effects on yield assumed but not well documented

Biological Control

Sixspotted thrips

Stethorus (ladybird beetles)

Predatory mites

Minute pirate bugs

Lacewing larvae

Sixxpotted thrips

Scolothrips sexmaculatus

- Larvae yellowish, cilindrical
- Adults with 6 spots
- Both are predacious on mites
- Can provide compete control of spider mites
- Often arrive late, since no alternate food source in the spring

Spider Mite Destroyer

Stethorus picipes

- Adults and larvae each consume about one-half dozen mites per day
- At warm temperatures the spider mite destroyer can complete one generation from egg to adult in about three weeks.
- Females typically live one to three months, during which they lay about 100 to 200 eggs

Western Predatory Mite

Galendromus (Metaseiulus) occidentalis

- Teardrop shaped, clear to red
- Most dependable predator
- Can complete life cycle in 7 days
- Can provide compete control of spider mites
- Often arrive late, since no alternate food source in the spring

Release recommendations *Galendromus occindentalis*

- For most crops
  - Survive between 60 and 120 F
  - Tolerate how humidity
  - Release between 2,500 and 5,000 mites per acre at first sign of mites
  - Release more if later in the season
  - Repeat applications may be necessary
  - Usually come on bean plants or in a bottle with a carrier
  - Mites should be spread out evenly
    - Therefore it takes time to do releases, and mites are delicate

Host and Environment-

Growing conditions favorable to mites

- Average almond yields ~3,000 lbs/ac
- Dusty conditions
  - ~6-10 inches rain per year
  - No rain May to harvest
- Deficit irrigation at harvest
- Hot conditions
  - Average high of 99°F in July and Aug

Integration- IPM Strategy

- Monitor for spider mites weekly
- Monitor for natural enemies weekly
  - Don’t starve them, don’t kill them
- Evaluate treatment thresholds
  - 25% presence if no predators
  - ~40% presence if predators are present
- Take into account other considerations
  - Temperature, plant stress, free rides, time of year
  - Comparison to previous week
- Treat if needed
  - Conserve biocontrol, avoid abamectin if sixspotted thrips is present
  - Good coverage, 2 mph, 100-200 gpa, 1% oil

www.ipm.ucdavis.edu

Almonds—Webspinning Spider Mites Sampling

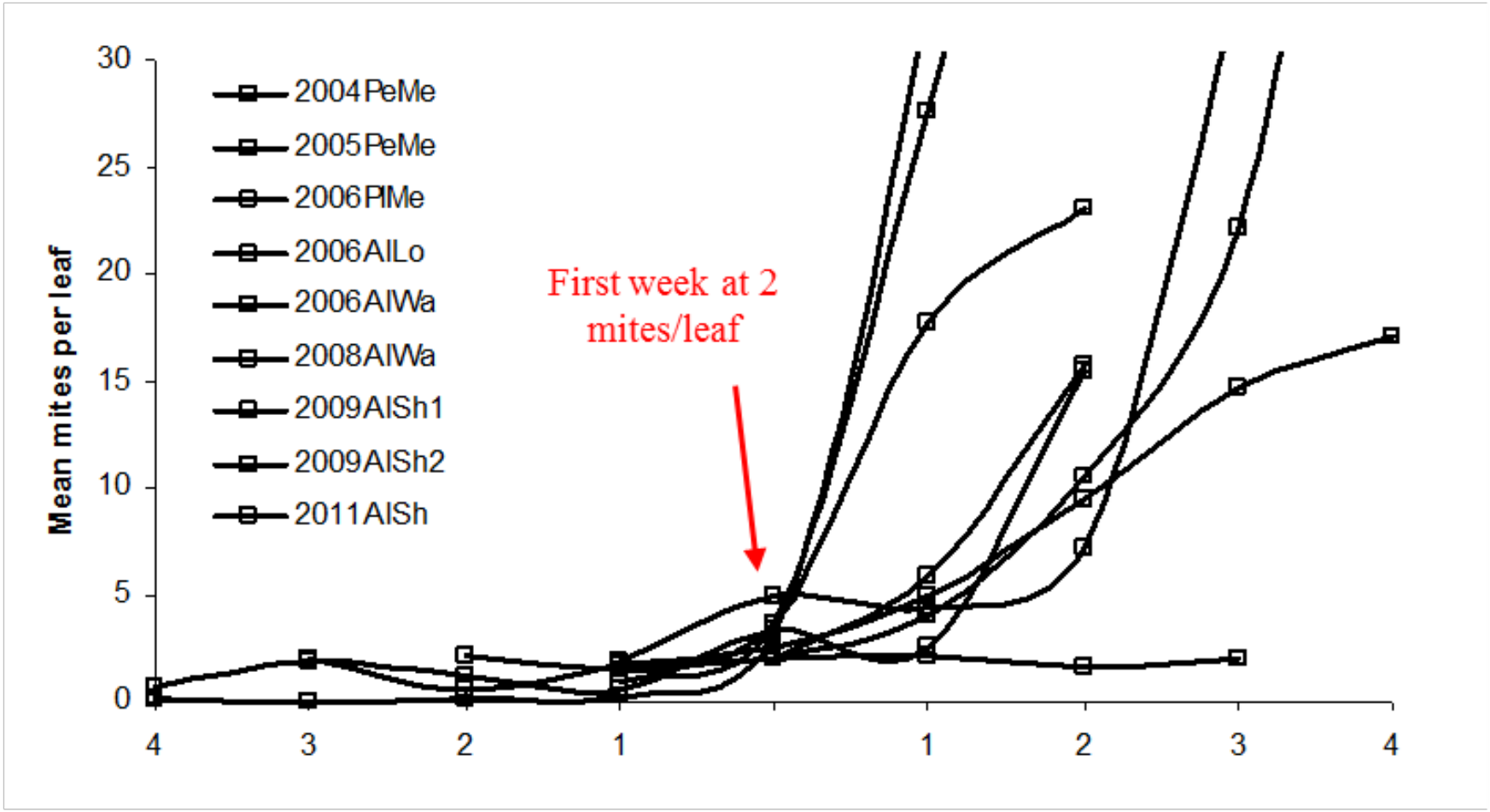
Supplement to UC IPM Pest Management Guidelines: Example Form

Directions:

1. Before July 1, monitor hot spot areas where mites develop first. After July 1, monitor the whole orchard by dividing it into sampling areas that can be treated separately.
2. Within each sampling area, sample a minimum of 5 trees. Select 15 leaves from each tree, randomly picking leaves from both the inside and outside of the canopy as you walk aroun it.
3. Using a hand lens, examine both sides of each leaf carefully. Look for spider mites and eggs, western predatory mites and eggs, sixspotted thrips, and other predators. Look closely since there may be only 1 to 2 mites or predators on a leaf.
4. Count the number of leaves on each tree with pest mites or their eggs, and the number of leaves with predators, and record below. Do not count individual mites or predators.
5. As you move from tree to tree, keep a running total of leaves with mites on the form. Once you have sampled 5 trees, compare your total to the numbers in the "Don't Treat" and "Trea columns below.
6. If your numbers are the **SAME OR LESS** than the "Don't Treat" column, you can stop sampling. If your numbers are **AS MUCH OR MORE** than in the "Treat" column, stop sampling and treat. If your numbers are **IN BETWEEN**, continue sampling until a decision can be reached.

Date _____ **Grower/Orchard** _____

Tree number	Total number of leaves sampled	Number of leaves with mites (on each tree)	Total number of leaves with mites (on all trees)	Number of leaves with western predatory mite and/or sixspotted thrips	*If predators are present*		*If predators are absent*	
					Don't treat if total leaves with mites is:	**Treat** if total leaves with mites is:	**Don't treat** if total leaves with mites is:	**Treat** if total leaves with mites is:
1	15							
2	30							
3	45							
4	60							
5	75				≤ 27	≥ 40	≤ 12	≥ 24
6	90				≤ 33	≥ 48	≤ 15	≥ 28
7	105				≤ 39	≥ 55	≤ 18	≥ 31
8	120				≤ 45	≥ 62	≤ 21	≥ 35
9	135				≤ 51	≥ 69	≤ 23	≥ 39
10	150				≤ 57	≥ 76	≤ 26	≥ 43
11	165				≤ 63	≥ 83	≤ 29	≥ 46
12	180				≤ 70	≥ 90	≤ 32	≥ 50
13	195				≤ 76	≥ 97	≤ 35	≥ 54
14	210				≤ 82	≥ 104	≤ 38	≥ 57
15	225				≤ 88	≥ 111	≤ 41	≥ 61
16	240				≤ 94	≥ 118	≤ 45	≥ 65
17	255				≤ 101	≥ 125	≤ 48	≥ 68
18	270				≤ 107	≥ 132	≤ 51	≥ 72
19	285				≤ 113	≥ 139	≤ 54	≥ 75
20	300				≤ 119	≥ 146	≤ 57	≥ 79

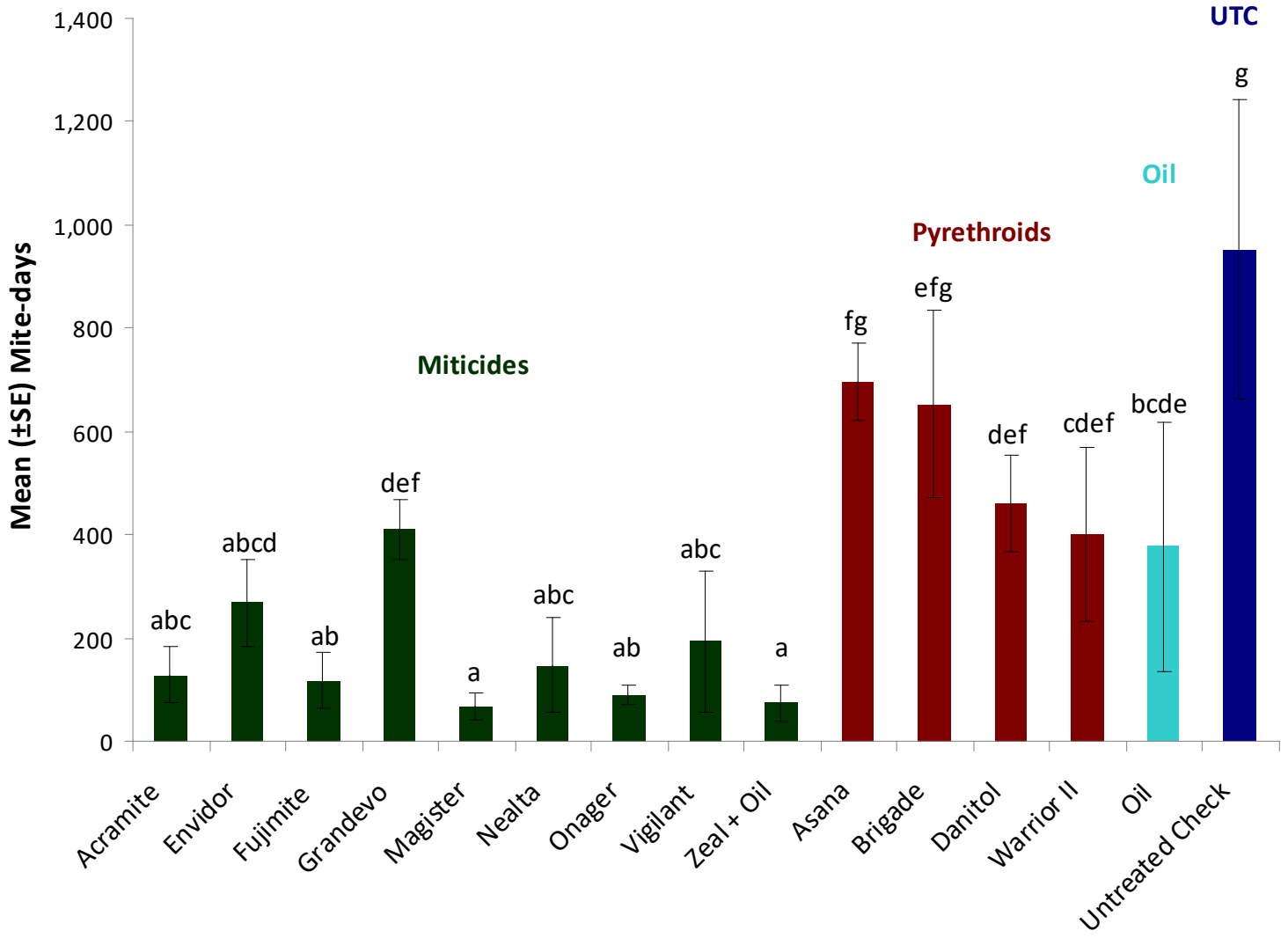

Mean mites per leaf
30
25
20
15
10
5
0
2004PeMe
2005PeMe
2006PlMe
2006AlLo
2006AlWa
2008AlWa
2009AlSh1
2009AlSh2
2011AlSh
First week at 2 mites/leaf
4
3
2
1
1
2
3
4

Chemical Control- principal miticides

IRAC #	a.i.	Name	Mode of action
6	abamectin	Agri-Mek	Avermectin – contact or ingestion toxin that paralyzes juveniles and adults; death by starvation
10A	hexythiazox clofentezine	Onager Apollo	Growth Regulator – growth regulator of mite eggs and some nymphs, adults lay sterile eggs
10B	etoxazole	Zeal	Growth Regulator – contact toxin on eggs; inhibits molting of juveniles; adult females produce sterile eggs
12C	propargite	Omite	Energy metabolite- contact toxin to juveniles and adults by inhibition of ATP synthesis
20D	bifenazate	Acramite Vigilant	METI III – contact toxin on all stages; inhibits electron transport in the mitochondria
21A	fenpyroximate fenazaquin	Fujimite Magister	METI I – contact toxin on all stages; inhibits electron transport in the mitochondria
23	spirodiclofen	Envidor	Lipid Synthesis Growth Regulator – contact on all mite stages by inhibiting lipid biosynthesis; most effective on juveniles
25A	cyflumetofen	Nealta	METI II - contact toxin on all stages; inhibits electron transport in the mitochondria

Almond Trial- hull split

2013- Shafter, CA



All miticides included 1% 415 oil

Plum trial, Kern County, Trial treated mid-June, photo taken mid-July 2006

Coverage

- Drive speed- affects air displacement in the tree
  - 2 mph is desireable
- Water volume-
  - 100 (early season) to 200 (late season) GPA
- Fan speed
  - Enough to displace air in tree, but not blow product through to the next row (wind sheer and boundary layer issues)
- Nozzle types
  - Consider air induction nozzles for higher elevations

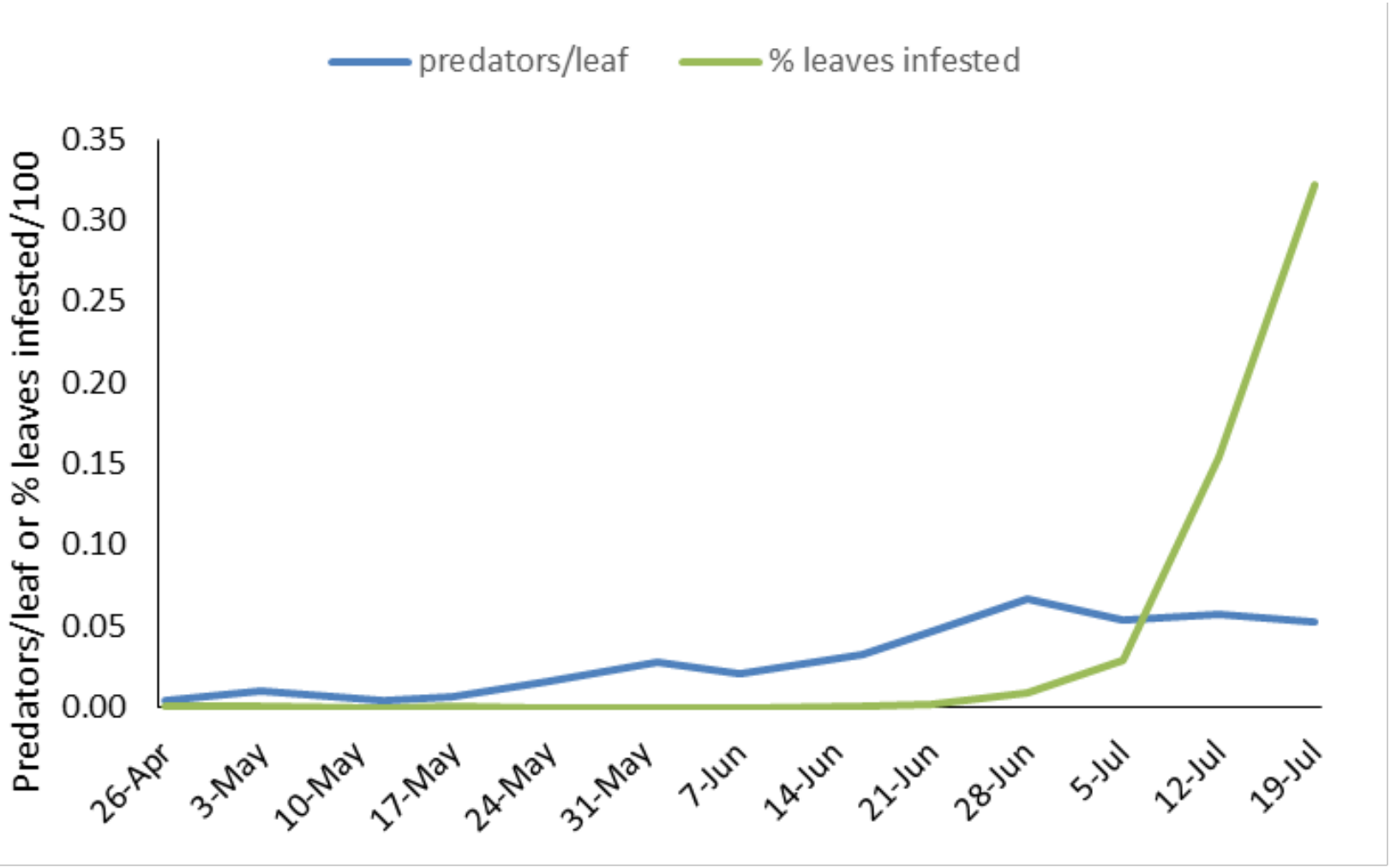
Effects of miticides on predators

general statements (verdict still out on some)

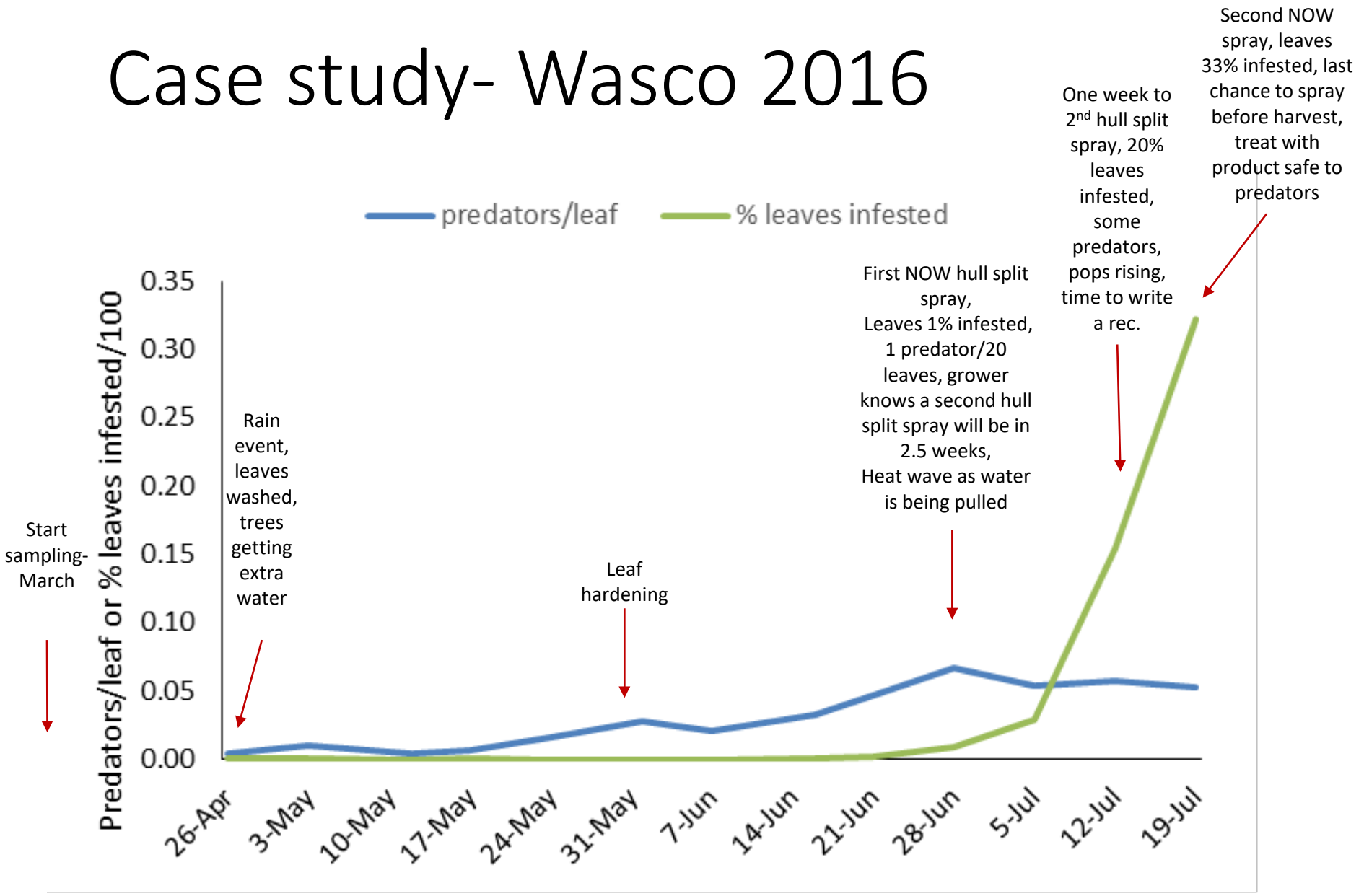
- Thrips
  - Agri-Mek →Agri-Mek very toxic

- Mites
  - Agri-Mek →Moderate+
  - Onager →Moderate
  - Zeal →Toxic (sterilized)
  - Envidor →Moderate +
  - Acramite →Soft to Moderate
  - Fujimite →Toxic (contact)
  - Kanemite →Moderate
  - Desperado →Toxic (contact)
  - Ecotrol →Unknown

Case study- Wasco 2016

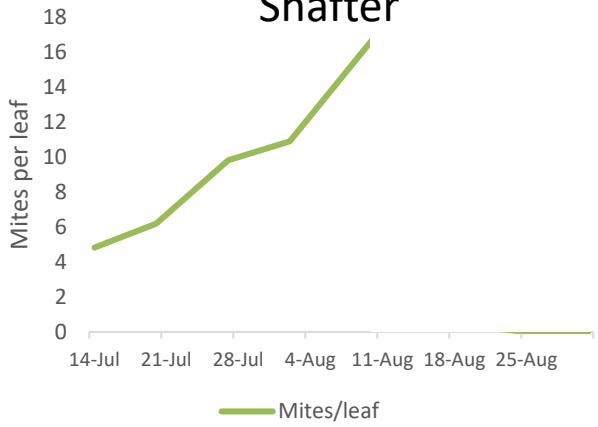


Case study- Wasco 2016



2016 Case Studies

Shafter



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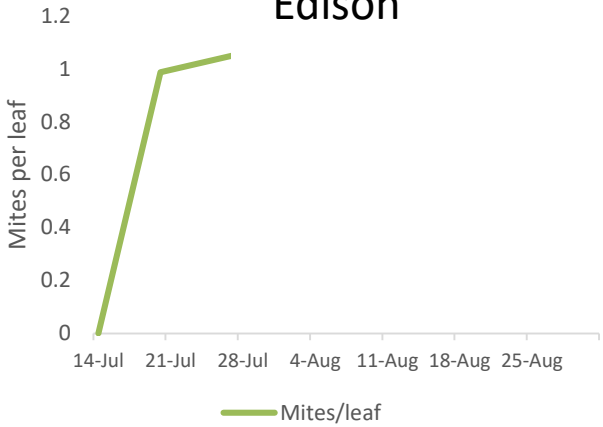

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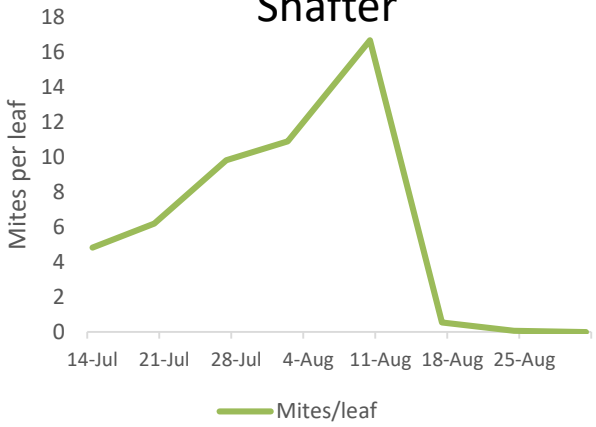

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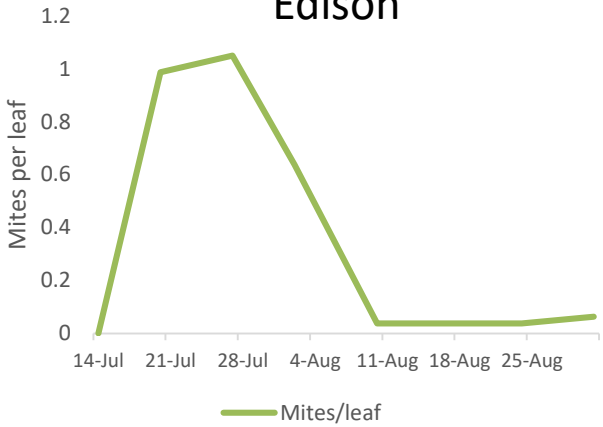

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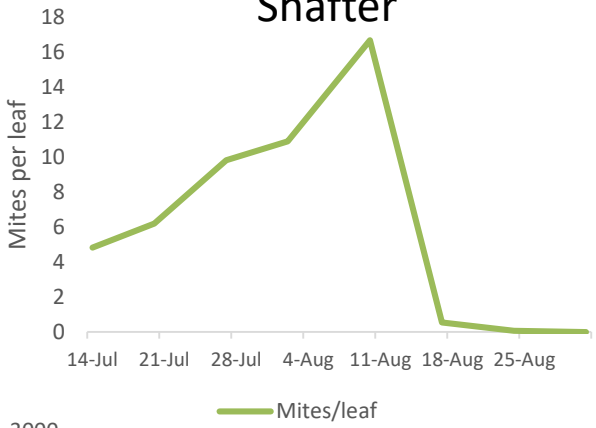

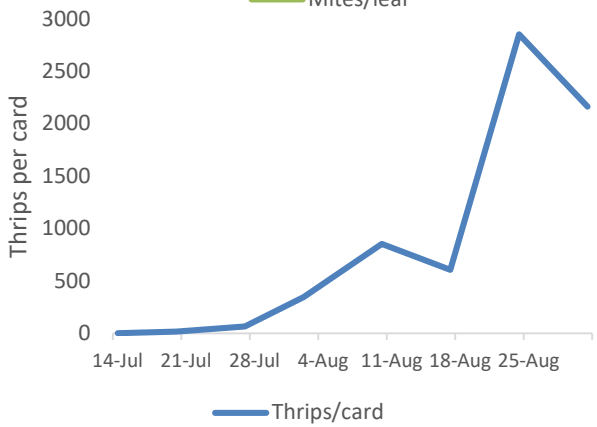

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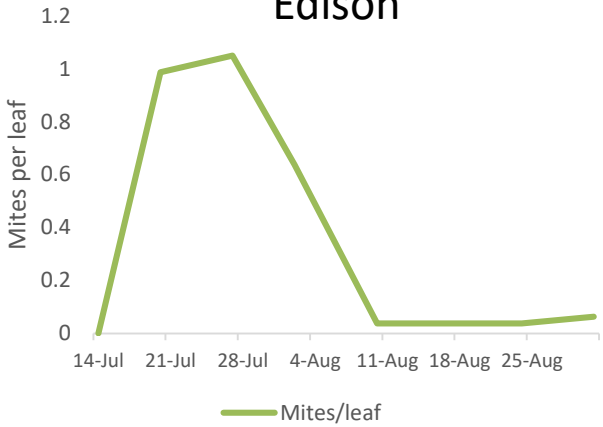

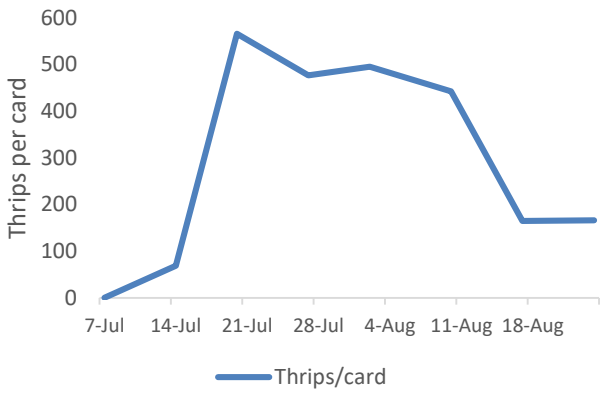

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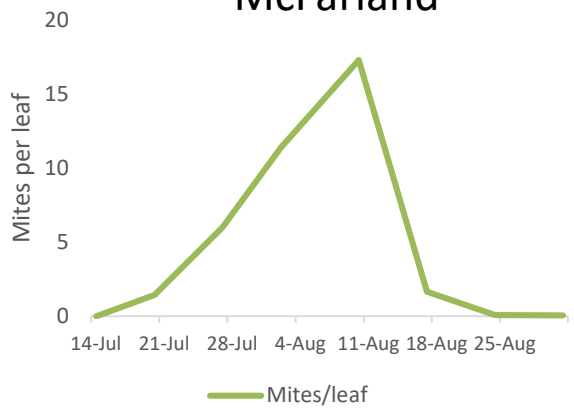
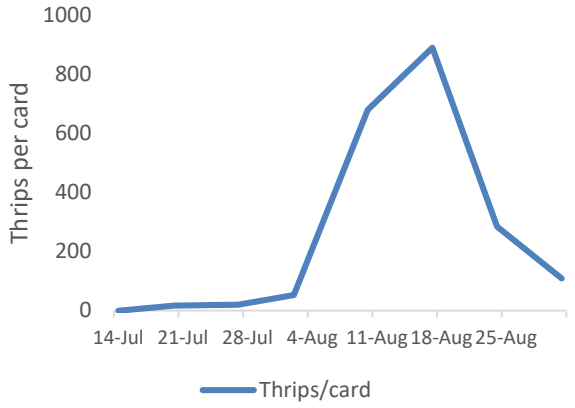
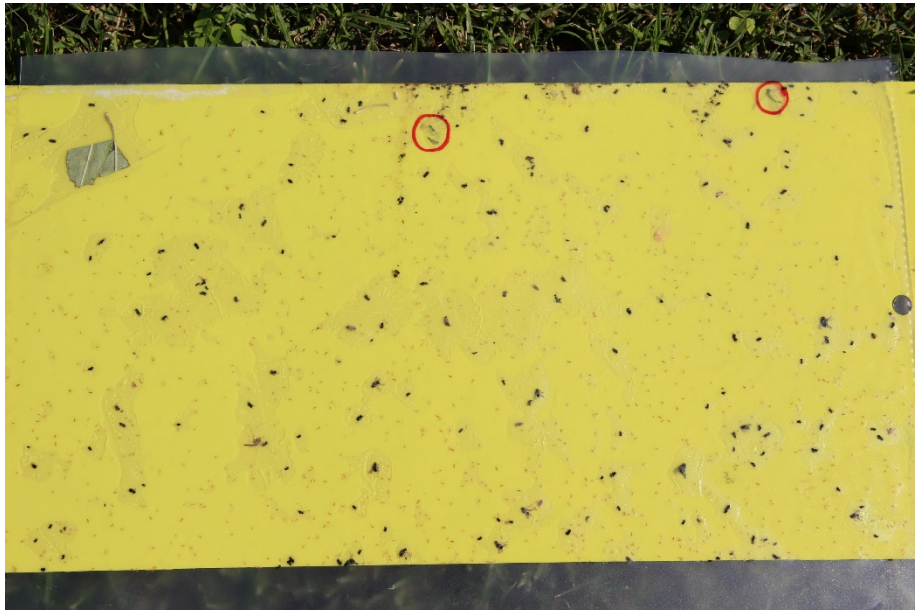
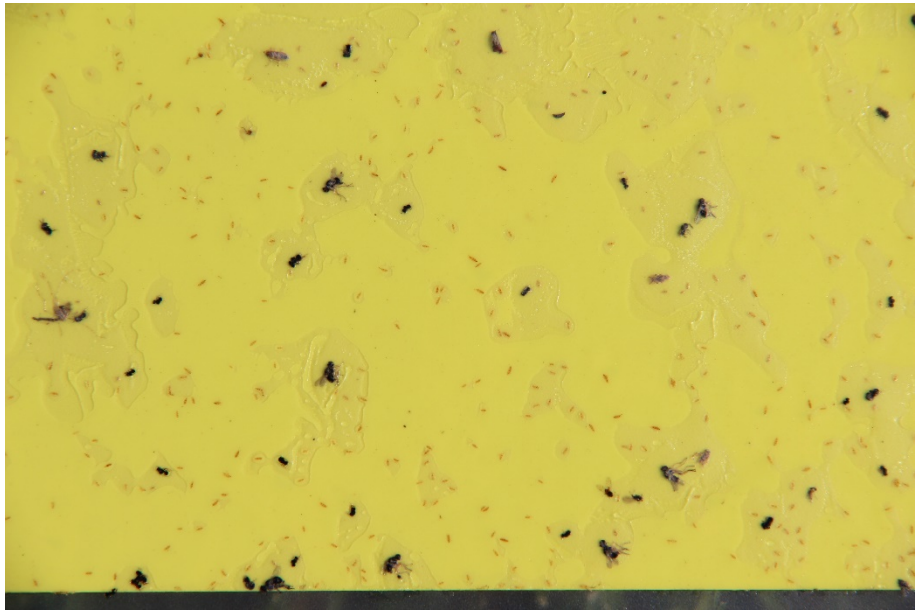


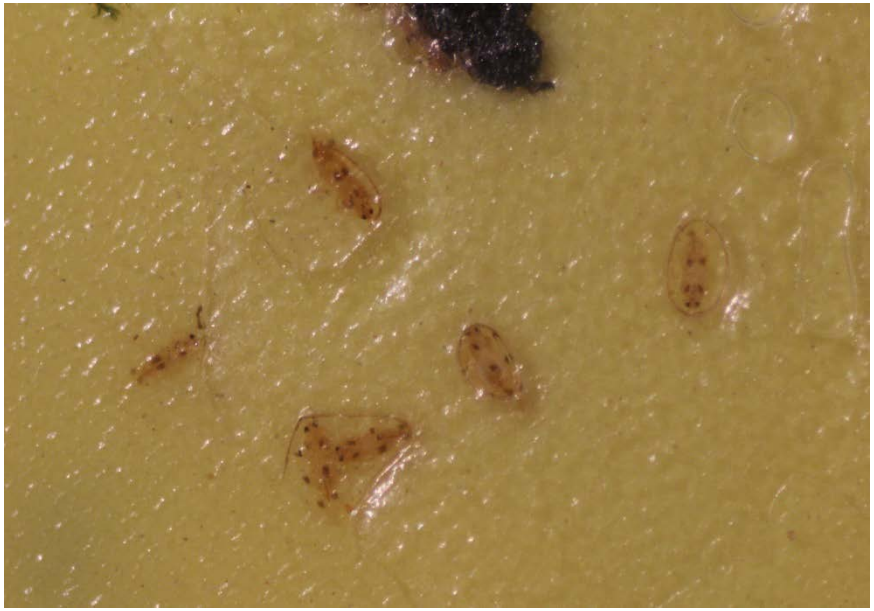




Sixspotted thrips

7 days
1740 thrips





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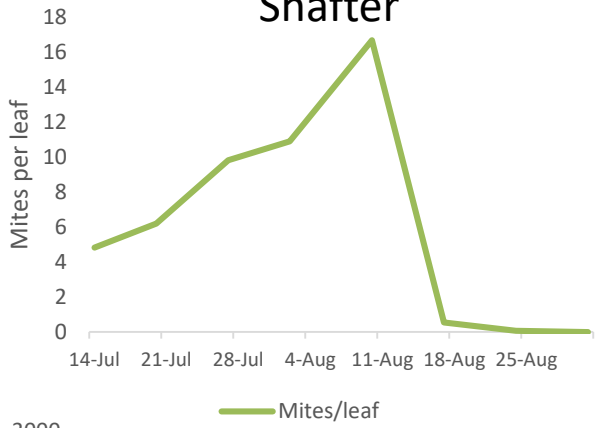

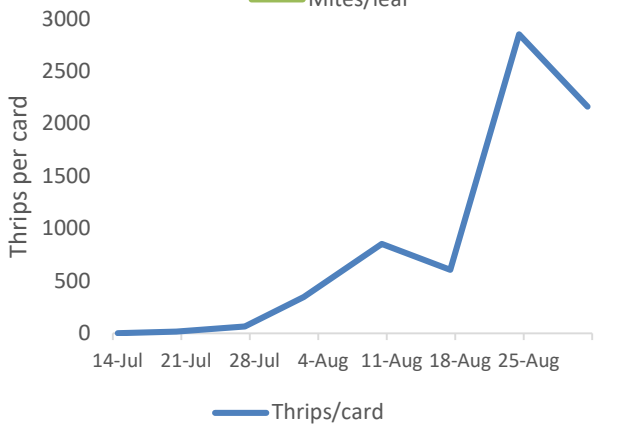

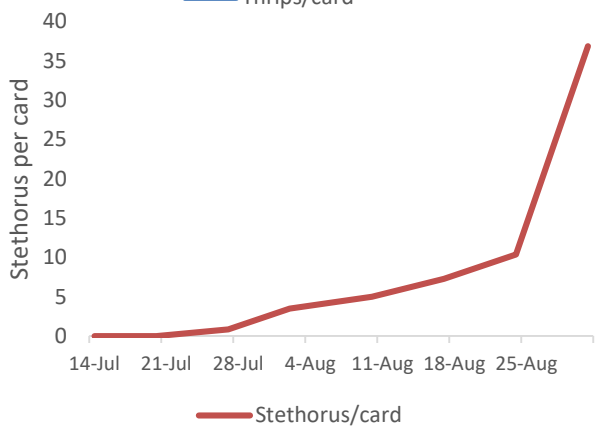

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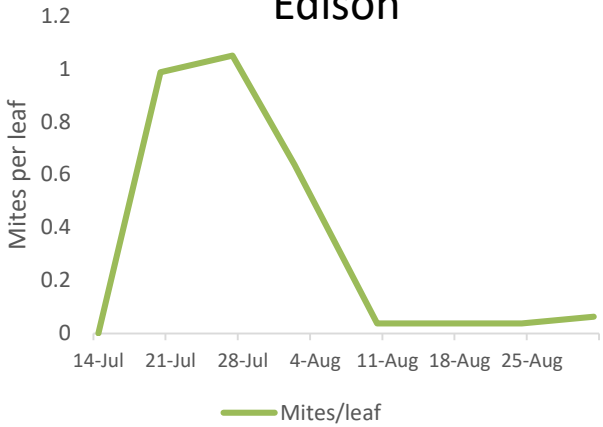

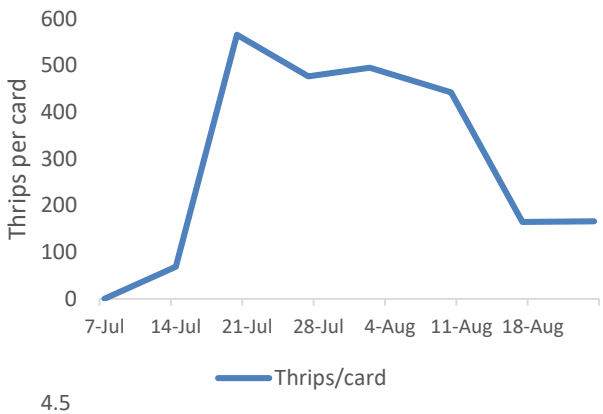

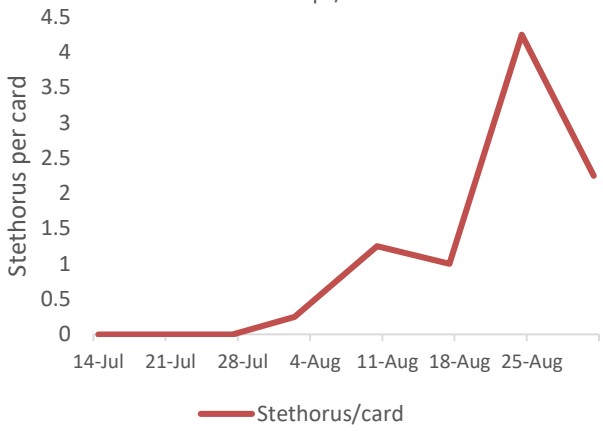

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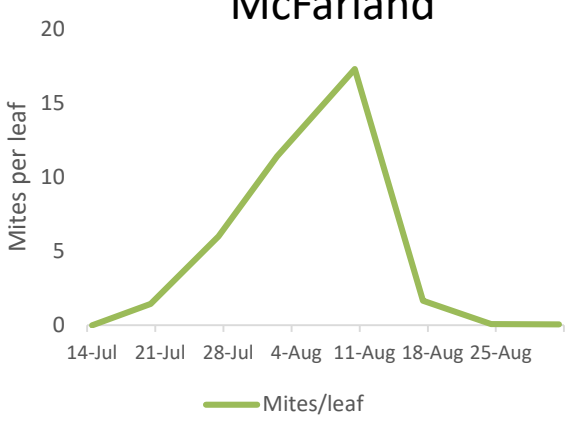

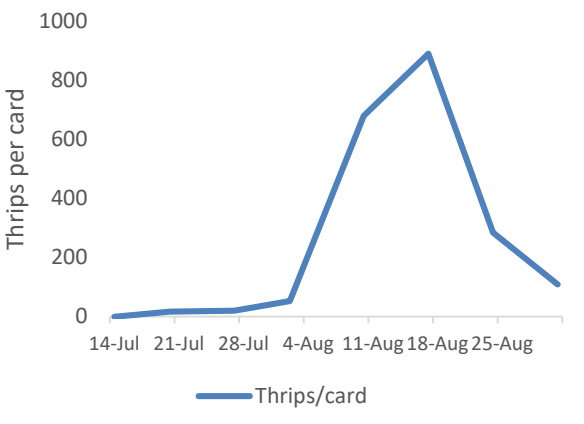

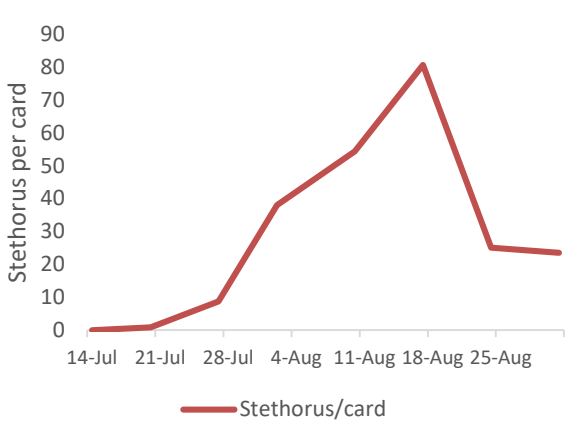

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