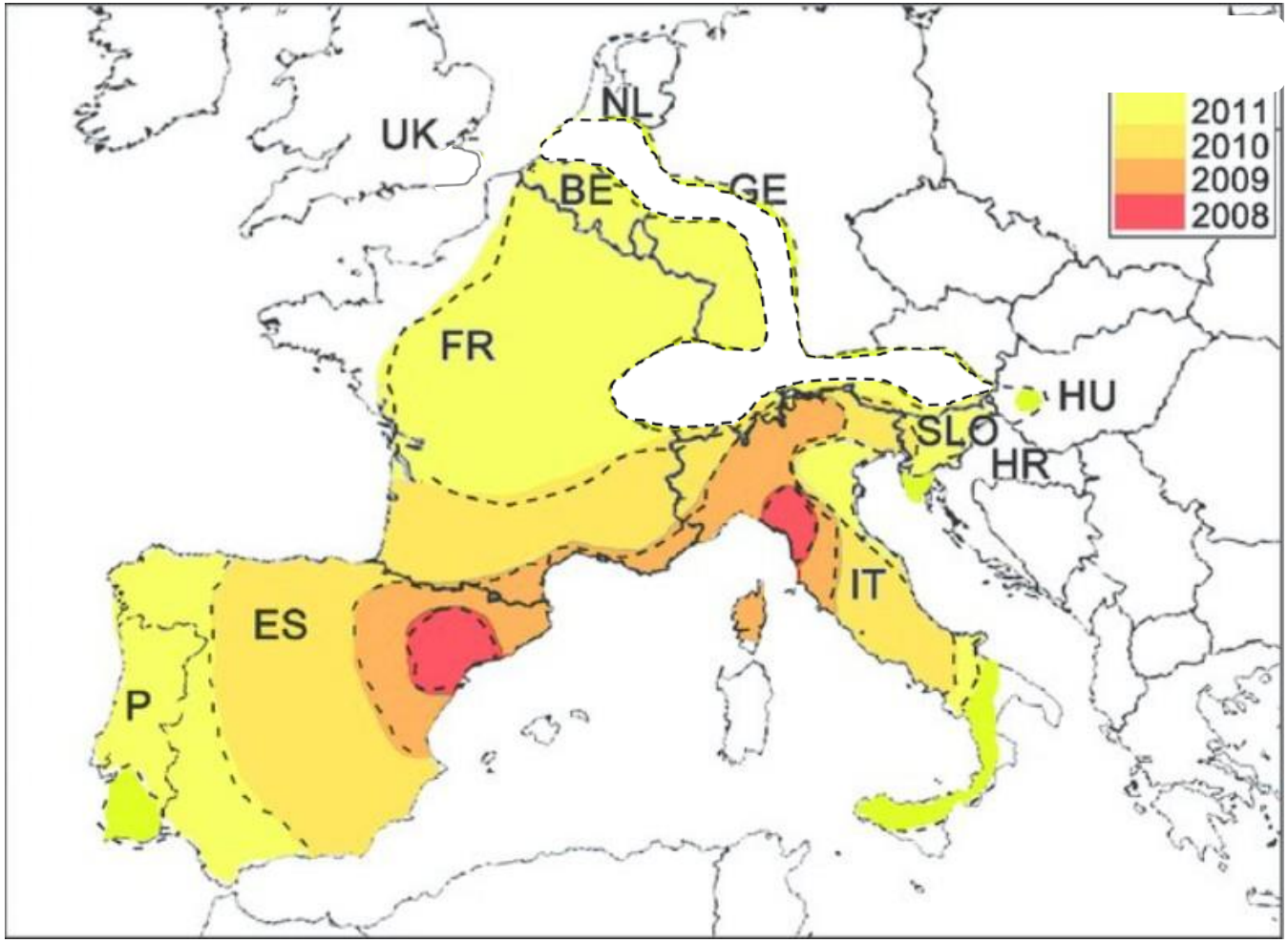
Spot it, Stop it

Spotted Wing Drosophila- experience in the UK

Bethan Shaw

2011



Lengyel, Gabor & Orosz, Szilvia & Kiss, Balázs & Lupták, Réka & Kárpáti, Zsolt. (2015). New records and present status of the invasive spotted wing drosophila, Drosophila suzukii (Matsumura, 1931) (Diptera) Drosophila suzukii (MATSUMURA, 1931) (DIPTERA) in Hungary. Acta zoologica Academiae Scientiarum Hungaricae. 61. 73-80. 10.17109/AZH.61.1.73.2015.

Research

- Monitoring traps deployed July (yeast and sugar solution)
- Vulnerable areas- fruiting crops/wild hosts
- First male detected 3 weeks after deployment in wild blackberry
- First female detected 5 weeks after deployment in cultivated raspberry

Dipterists Digest 2014 21,

First record of Drosophila suzukii (Matsumura) (Diptera, Drosophilidae) in Great Britain

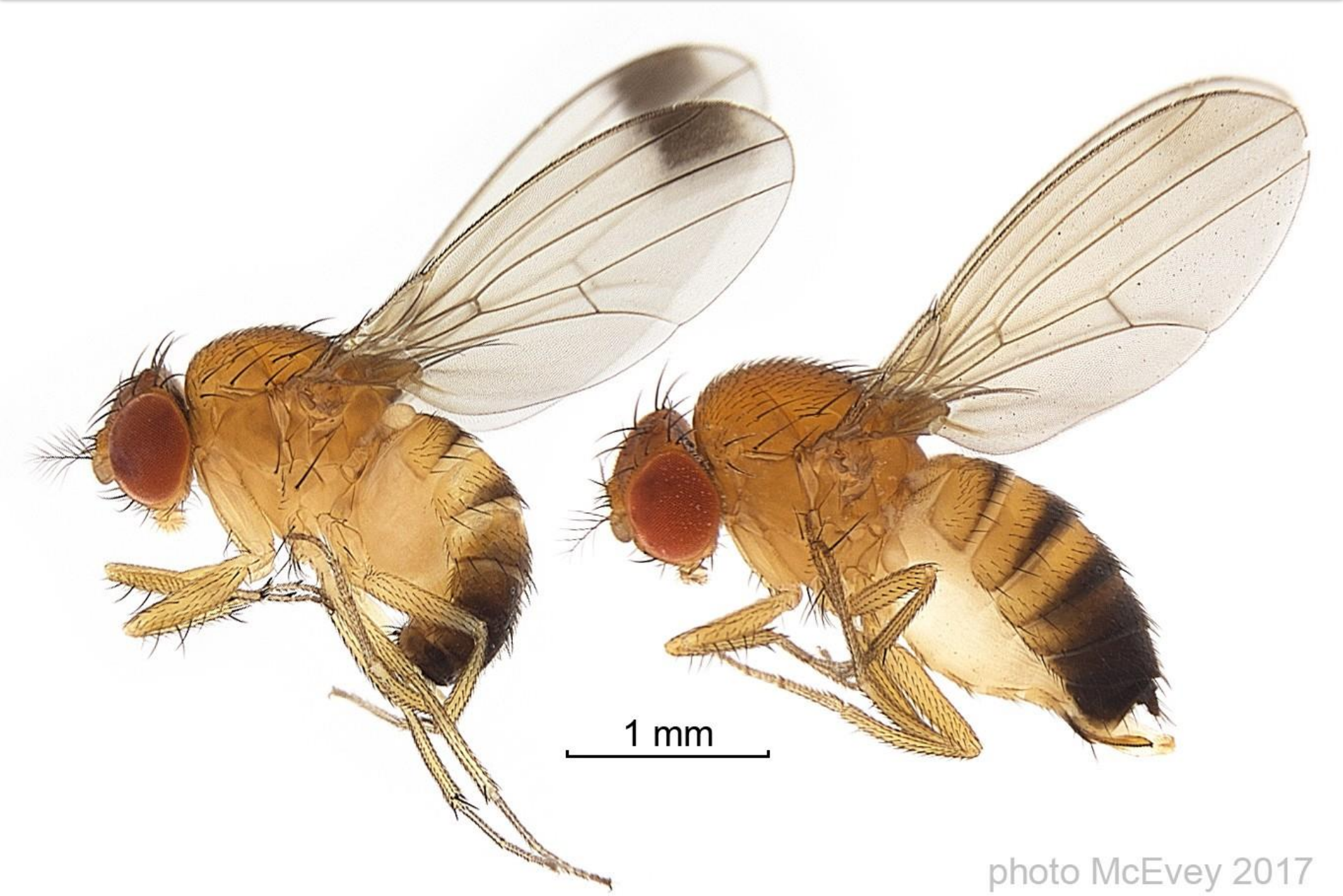
ADRIAN HARRIS and BETHAN SHAW
East Malling Research, New Road, East Malling, Kent, UK ME19 6BJ

Wide range of attractants and traps

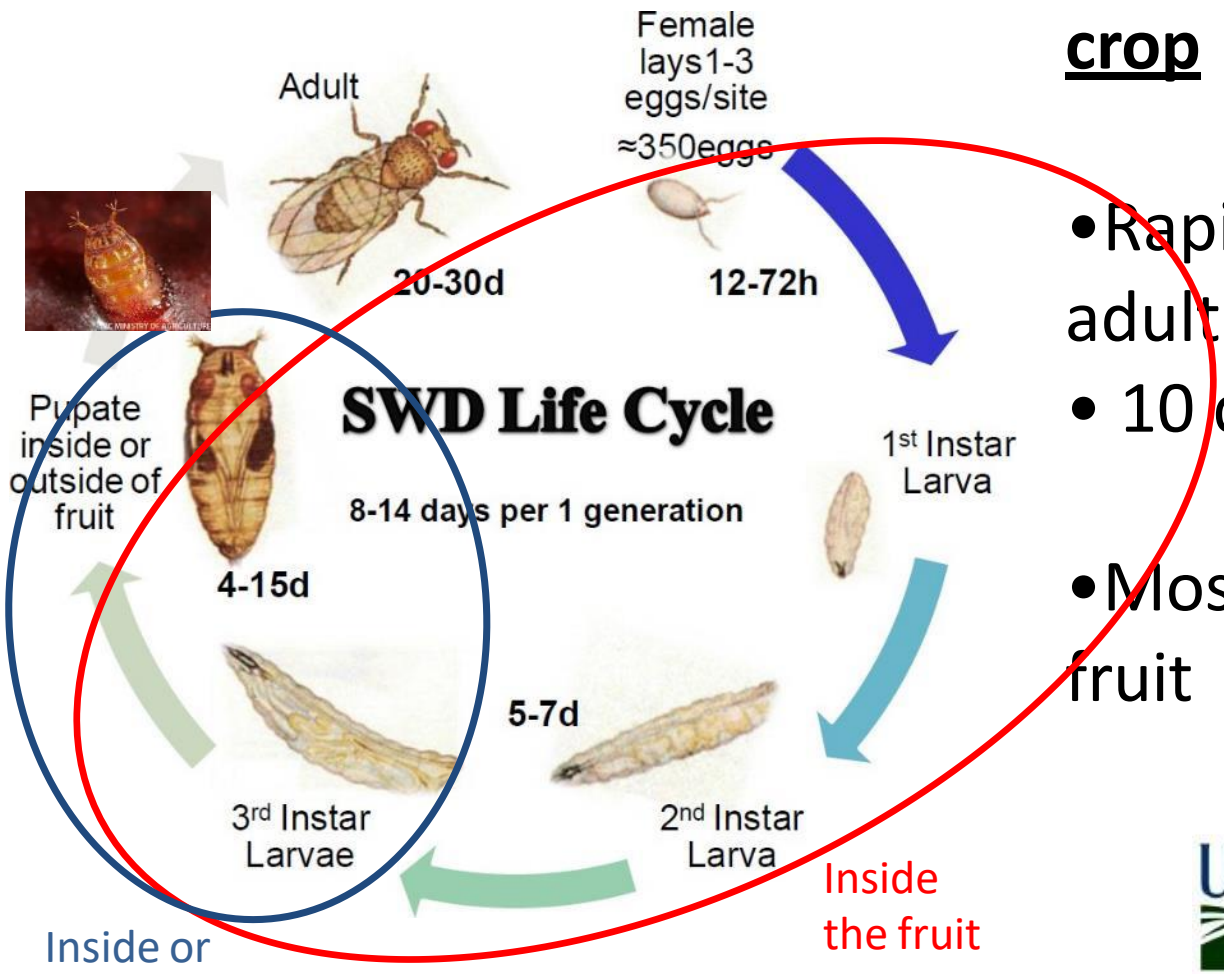
Attractants and traps

- Attractants based on fermenting fruit volatiles = feeding
- A drowning solution killing agent
- Traps typically red in colour
- Smaller holes reduce large bi-catch

Identification - adults



Lifecycle

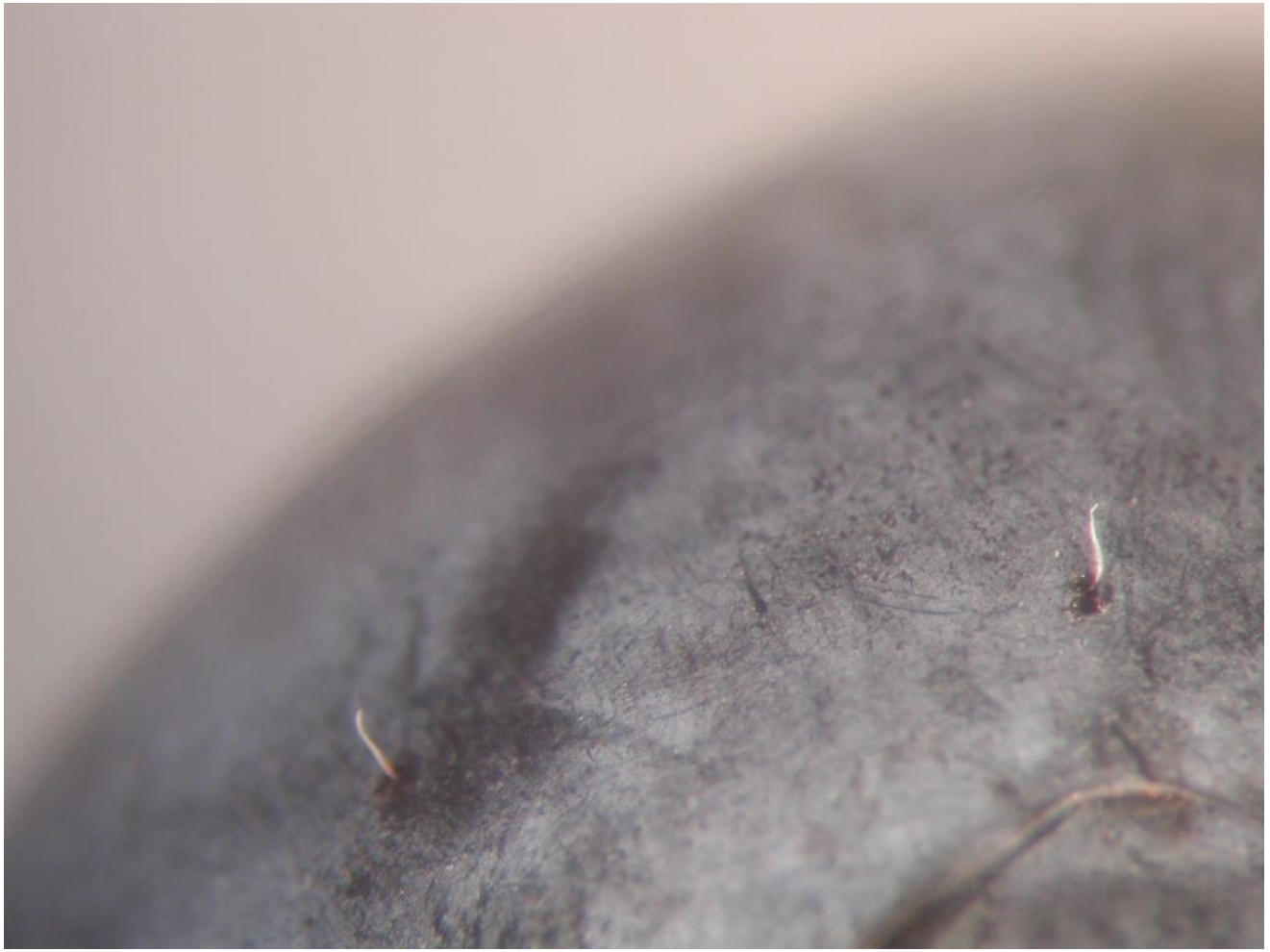


- **<u>Ripening fruit- still on crop</u>**

- Rapid lifecycle - egg to adult
- 10 d @ 28°C

- Mostly protected in the fruit

Fruit imports and undetected

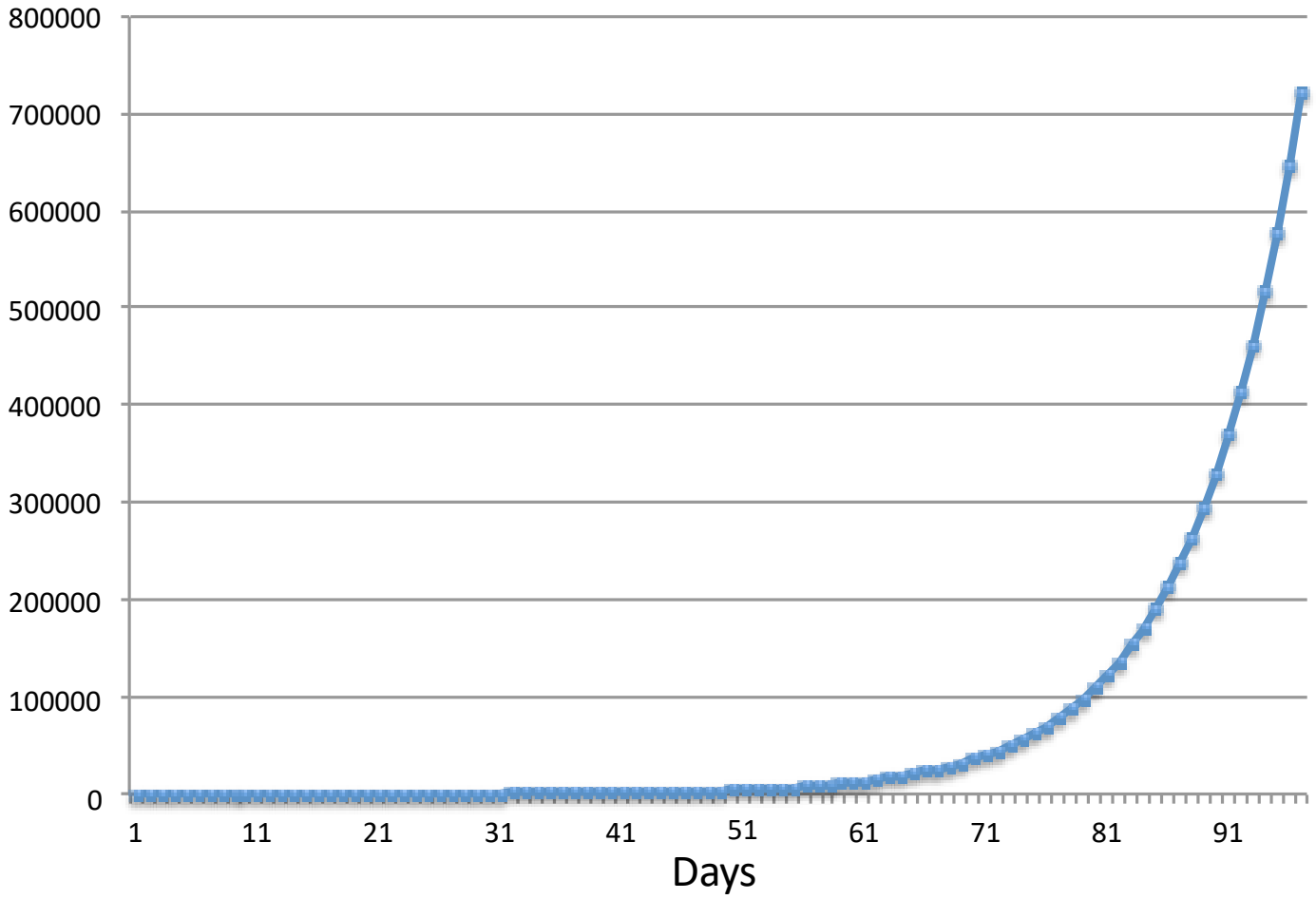


Egg filaments protruding from blueberry epicarp

Population growth

Population estimation on Blueberry at 22°C

(Assumption: starting population = 3 ovipositing females)



Vaughn Walton

Exponential growth

Using: Carey J. R., 1993. Applied Demography for Biologists, Ch 3, Reproduction, J. R. Carey, Oxford University Press 1993

Cost to UK fruit production

Cost of managing SWD in UK estimated £20-£30/$36-54 m pa

- Monitoring SWD: c. £1 million pa
- Additional pesticide applications: 5-7 pesticides per season
- Compromise IPM: increased costs to control other pests
- Additional interventions: e.g. fine mesh
- Loss of yield: shorter harvesting intervals
- Increased labour costs: frequent picking, waste fruit disposal

Cost of management is less than the cost of doing nothing

Doing nothing can result in 100% crop loss

National monitoring farms and crops

Total 130 traps

2 traps per crop/wild,

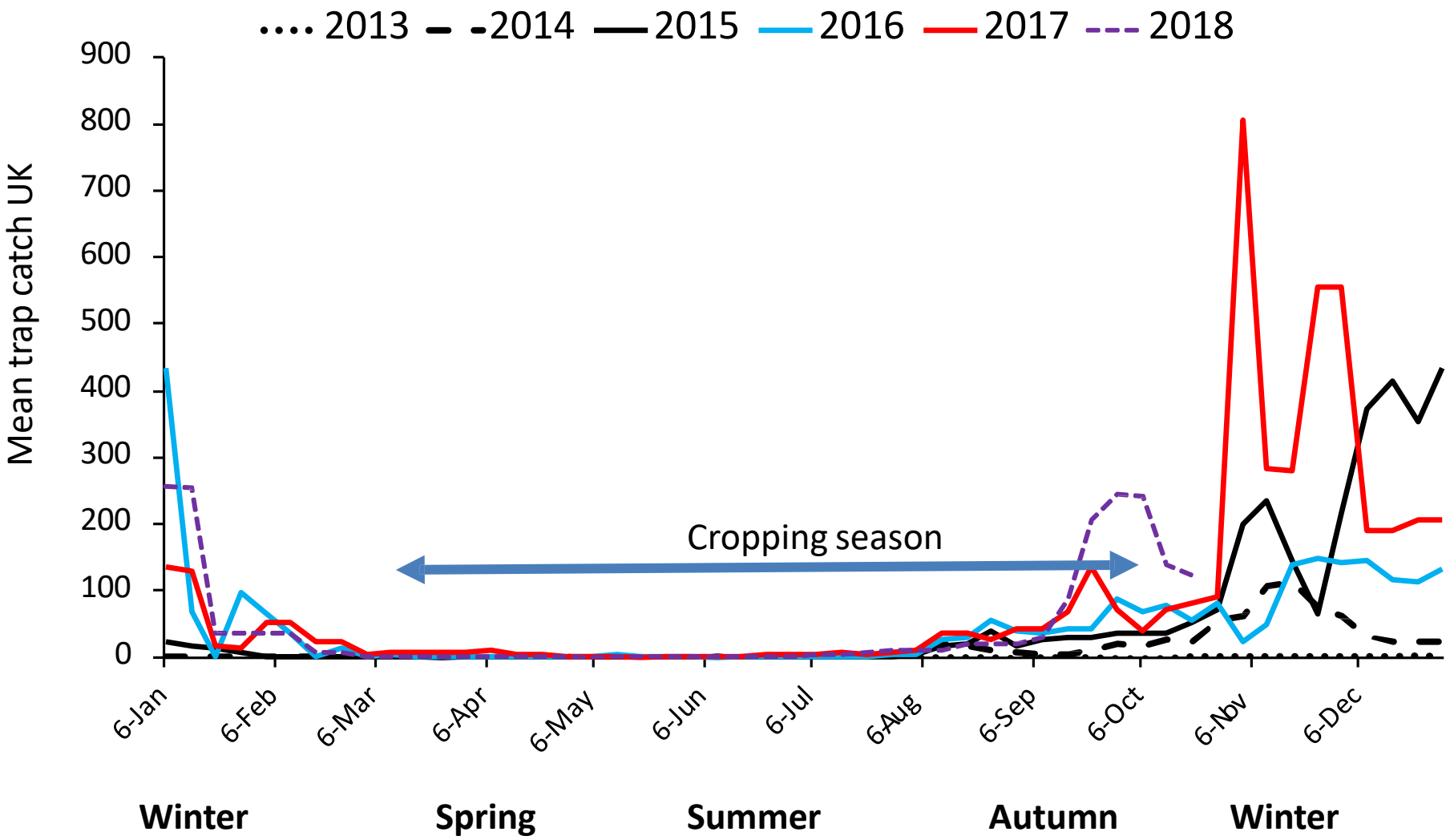
(1 at edge, one inside)

Monitored:

- Weekly from spring to autumn
- Fortnightly from autumn to spring

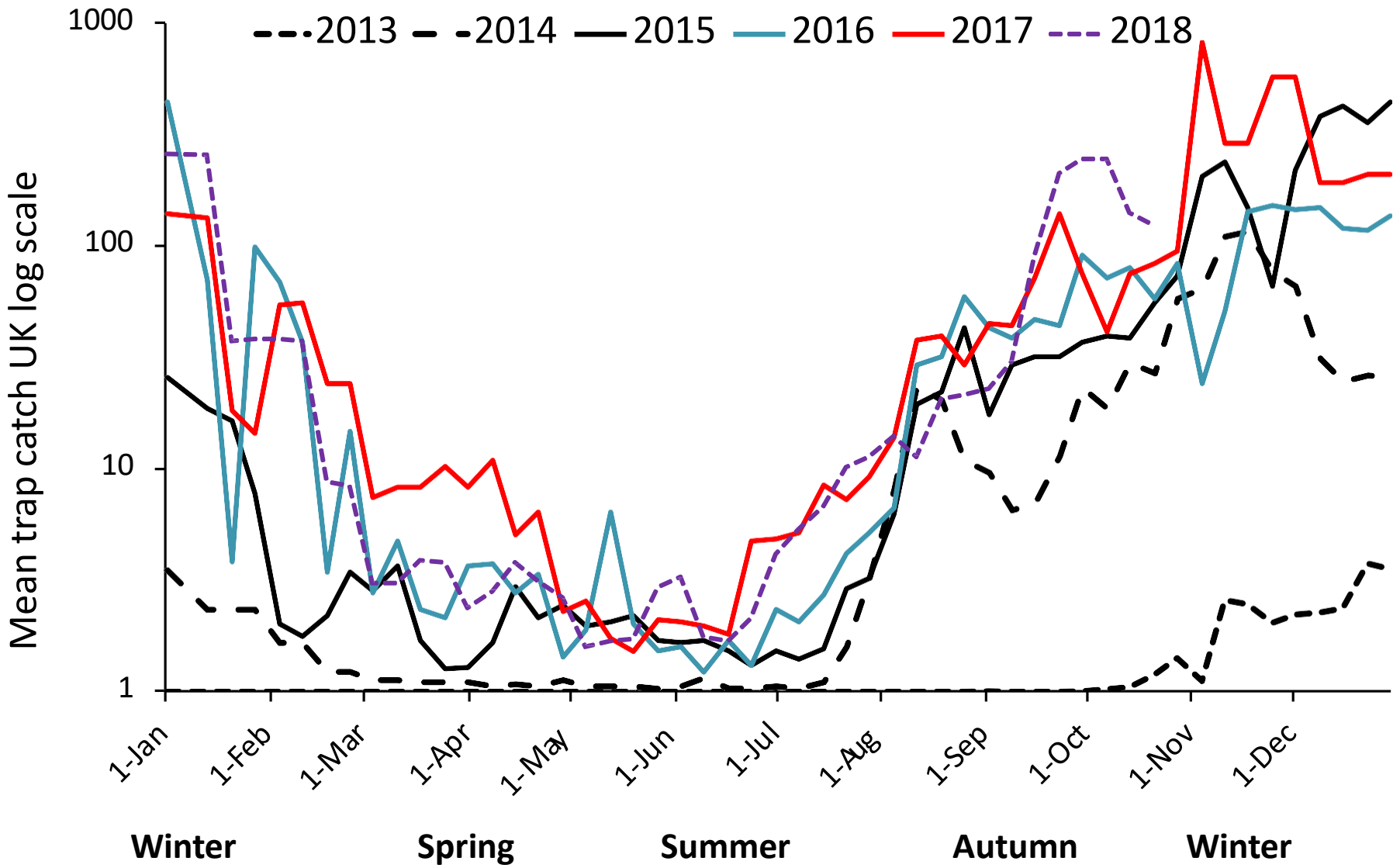
National Monitoring

Average max trap catch	2013	2014	2015	2016	2017	2018
	2.8	113.3	414.2	434.2	805.9	256.7

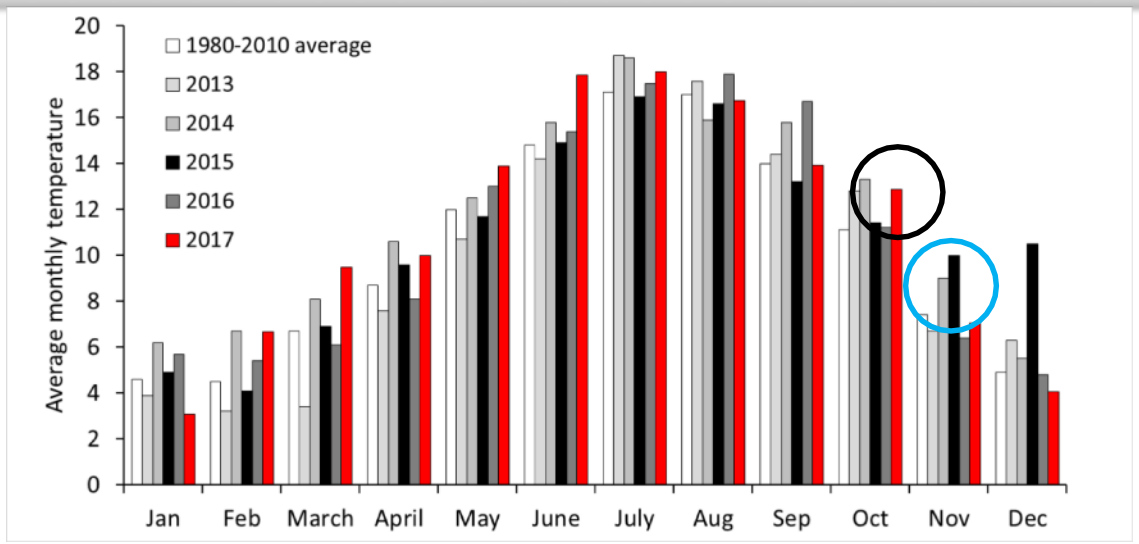


National Monitoring

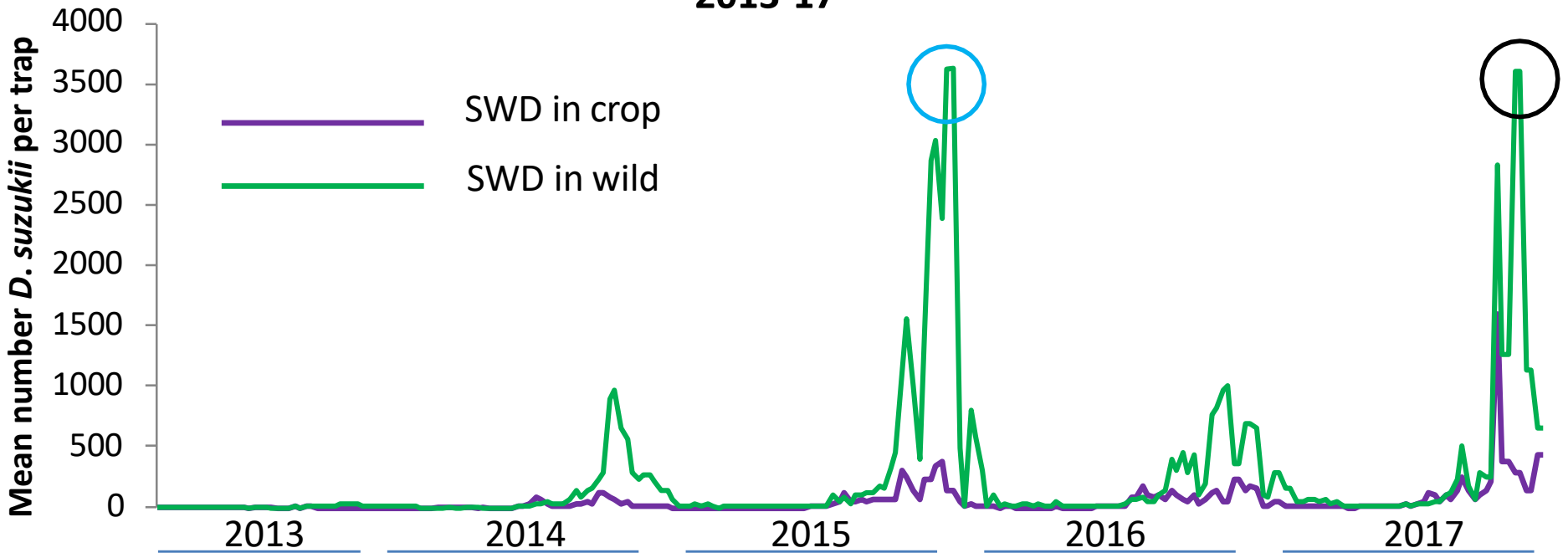
Remember: this shows trap catch NOT overall population numbers



Crop vs. wild habitat



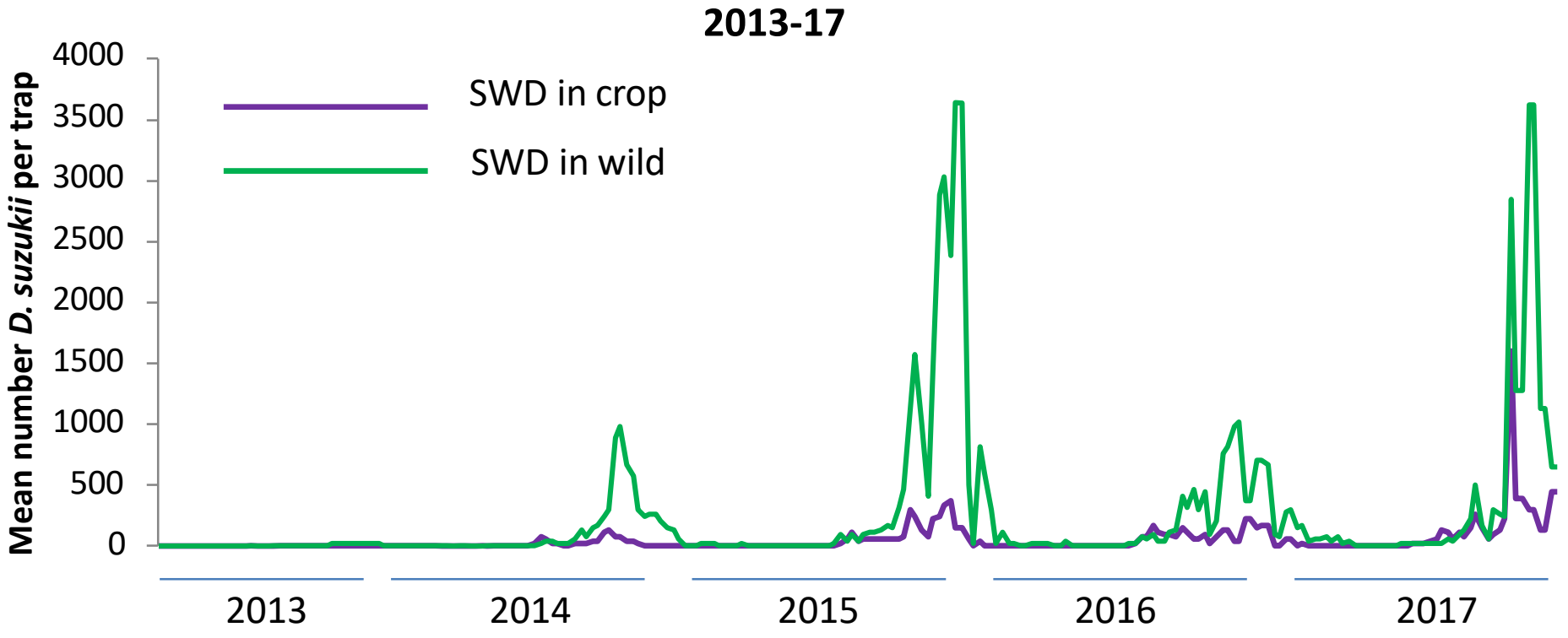
2013-17



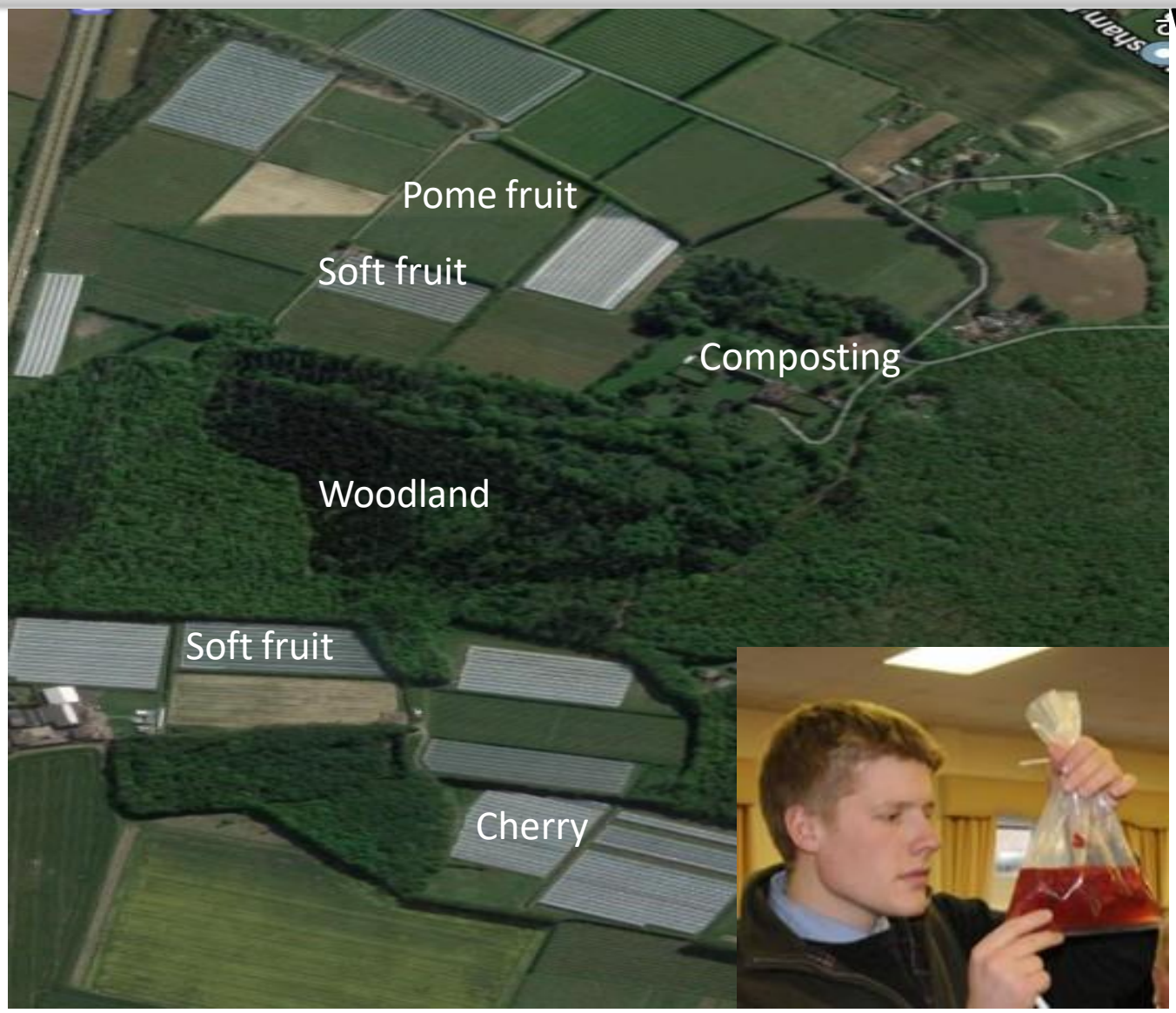
Crop vs. wild habitat

Variability between years in autumn catches possibly due to temperature affecting fly activity

Lower trap catches in crop due to competition with fruit and pesticide application



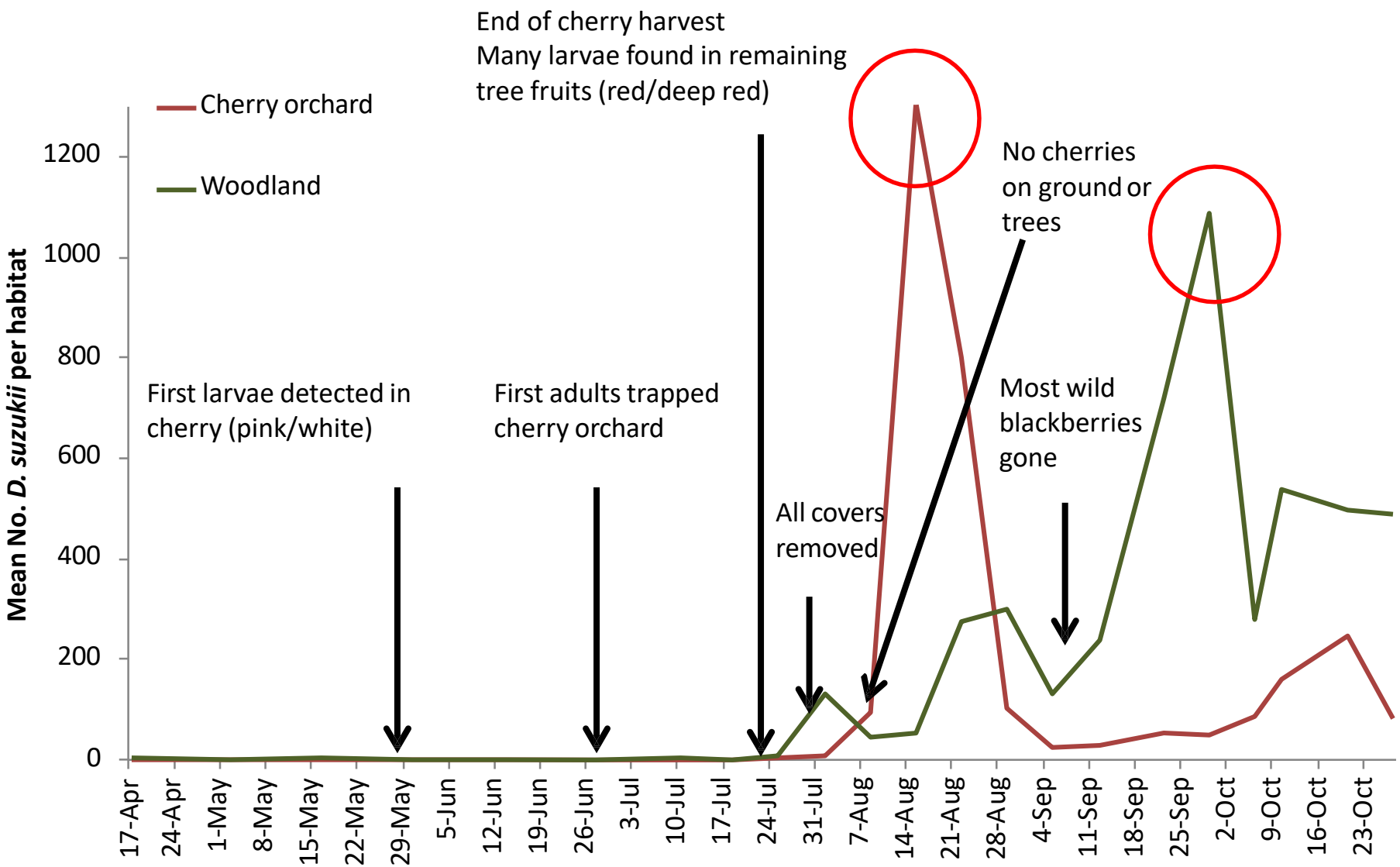
Areas of risk on your farms



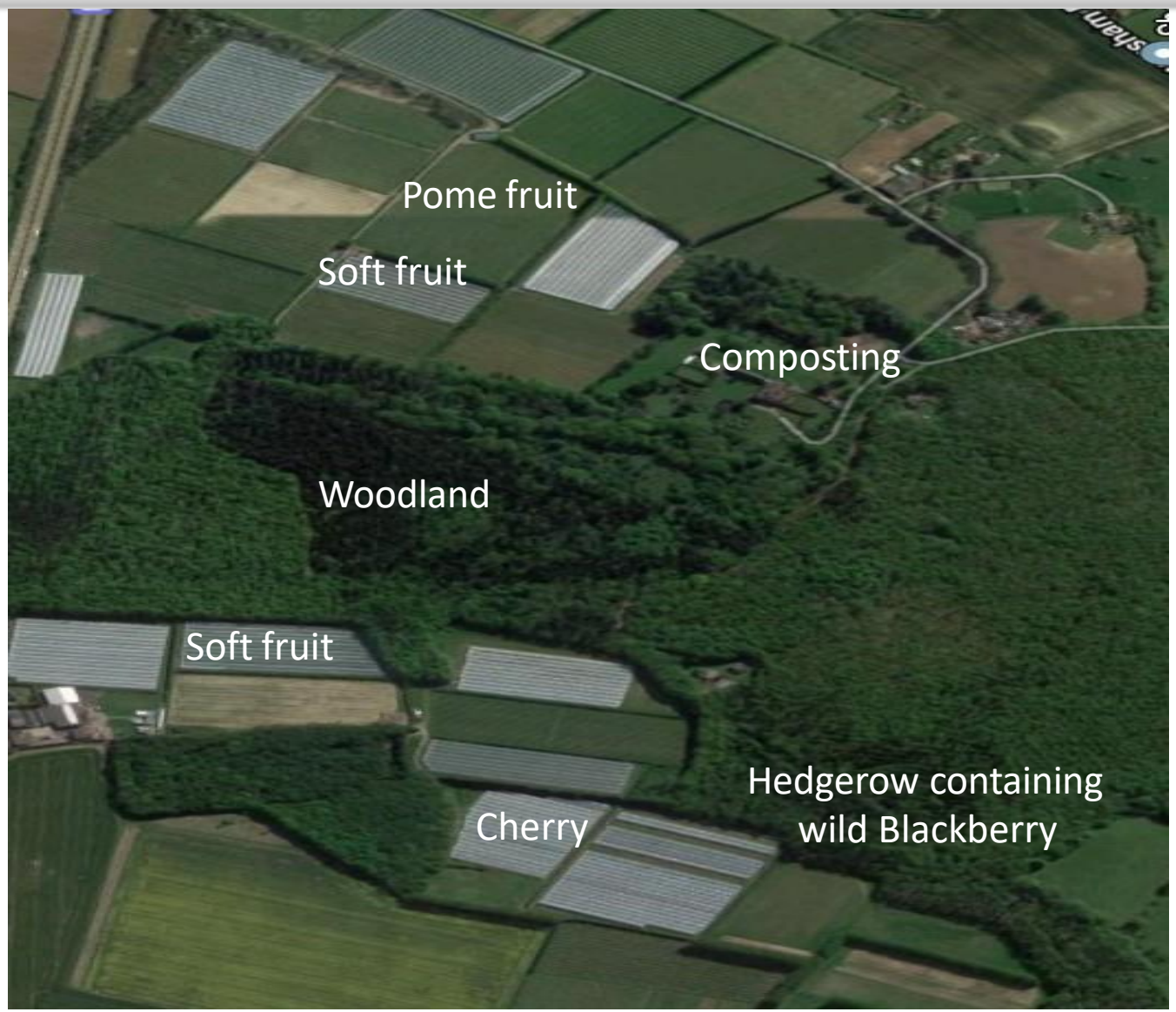
Where is it on the farm?

Assessments of:

- Trap catches
- Monitoring of crop phenology
- Larval extraction/ adult emergence from cultivated and wild crops


End of cherry harvest
Many larvae found in remaining tree fruits (red/deep red)
Cherry orchard
Woodland
No cherries on ground or trees
Most wild blackberries gone
First larvae detected in cherry (pink/white)
First adults trapped cherry orchard
All covers removed
Mean No. D. suzukii per habitat
0
200
400
600
800
1000
1200
17-Apr
24-Apr
1-May
8-May
15-May
22-May
29-May
5-Jun
12-Jun
19-Jun
26-Jun
3-Jul
10-Jul
17-Jul
24-Jul
31-Jul
7-Aug
14-Aug
21-Aug
28-Aug
4-Sep
11-Sep
18-Sep
25-Sep
2-Oct
9-Oct
16-Oct
23-Oct

On farm detection



Key points:

- Trap catches do not reflect population density
- Larval extraction good indicator of actual threat to crops
- Note what is happening in the local vicinity
- Hygiene very important

Hygiene and waste disposal

Why hygiene is so important

Unmarketable ripe fruit left on cane

Eggs laid in fruit

Fruit drops to ground

Next generation emerge

Larvae develop

Under ripe fruit on canes

SWD and other drosophila feed

Fruit now decomposing

Waste management

Disposal


FACTSHEET 19/16
Cross Sector

AHDB HORTICULTURE

(Project SF 145)
Ralph Noble and Andreja Dobrovin-Pennington,
NIAB EMR

Disposing of fruit waste affected by spotted wing drosophila

Fruit affected by spotted wing drosophila (SWD) is unmarketable and must be disposed of as waste during and after the harvest operation. Inadequate disposal perpetuates populations of SWD in soft and stone fruit crops. This factsheet outlines the best practices to follow when disposing of this waste, to reduce populations of SWD to a minimum.

Figure 1. Waste fruit should be disposed of in plastic bins with a capacity of 500–670 litres


Figure 5. Filling, emptying and handling plastic barrels can be more difficult than plastic pallet bins


Figure 6b. Sealing the top of the bin with shrink wrap


Figure 6c. Positioning the lid on the top of the pallet

- Soft fruit larvae/eggs destroyed in sealed containers ~ 3 days - CO_2
- Ambient air temperatures of 12-20 °C

Very wide hosts range

Wild and ornamental hosts

Blackberry (brambles), elderberry, mistletoe, wild cherry, nightshade, Chokeberry (*Aronia*), Snowberry (*Symphoricarpos*), Red Bryony (*Bryonia*)

JUST A FEW

J Pest Sci
DOI 10.1007/s10340-016-0755-6

ORIGINAL PAPER

Non-crop plants used as hosts by *Drosophila suzukii* in Europe

Marc Kenis[1] · Lorenzo Tonina[2] · René Eschen[1] · Bart van der Sluis[3] · Manuel Sancassani[2] · Nicola Mori[2] · Tim Haye[1] · Herman Helsen[3]

Alternative hosts

Winter

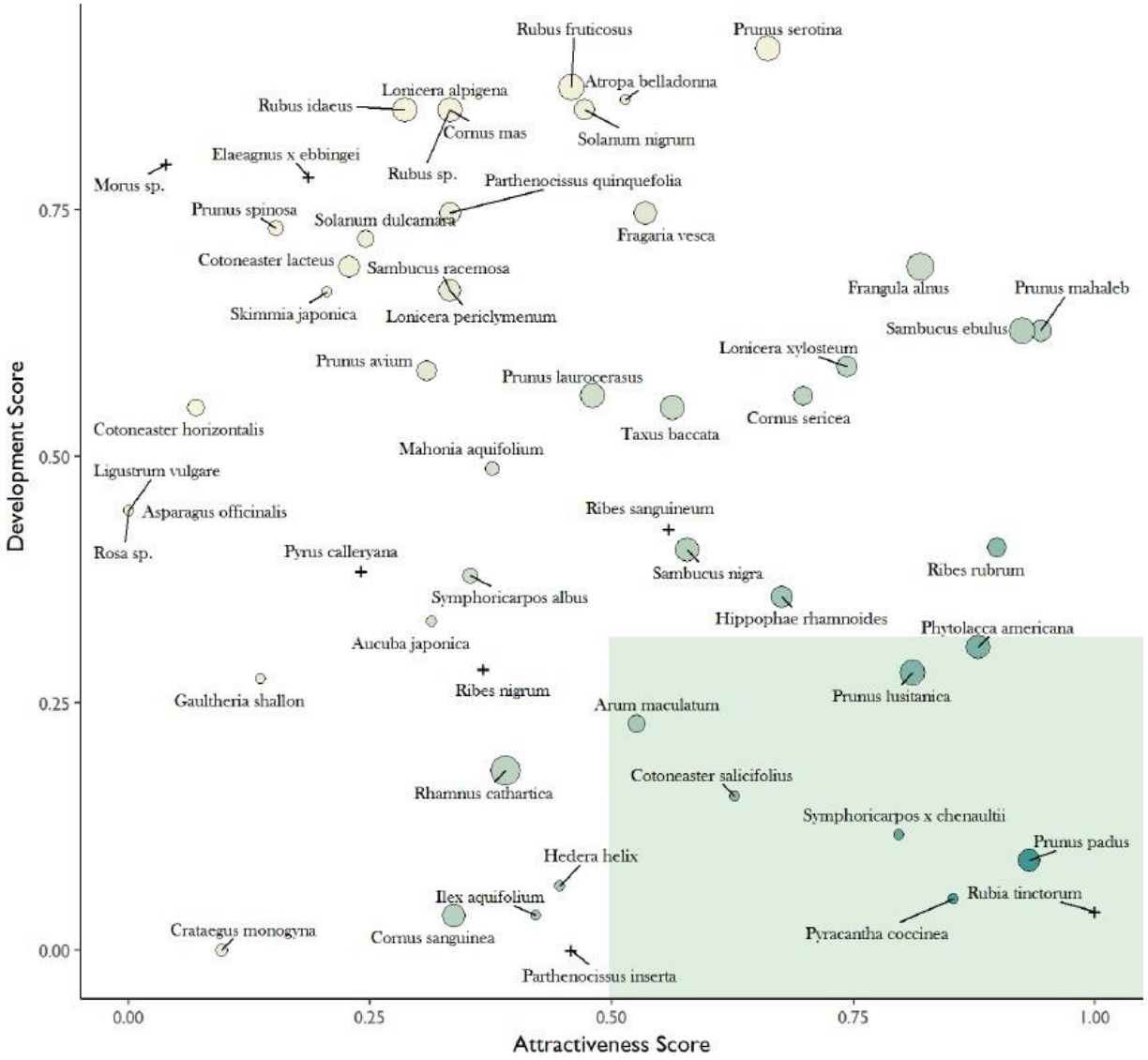
Spring

Habitats for natural enemies of fruit pests

Autumn

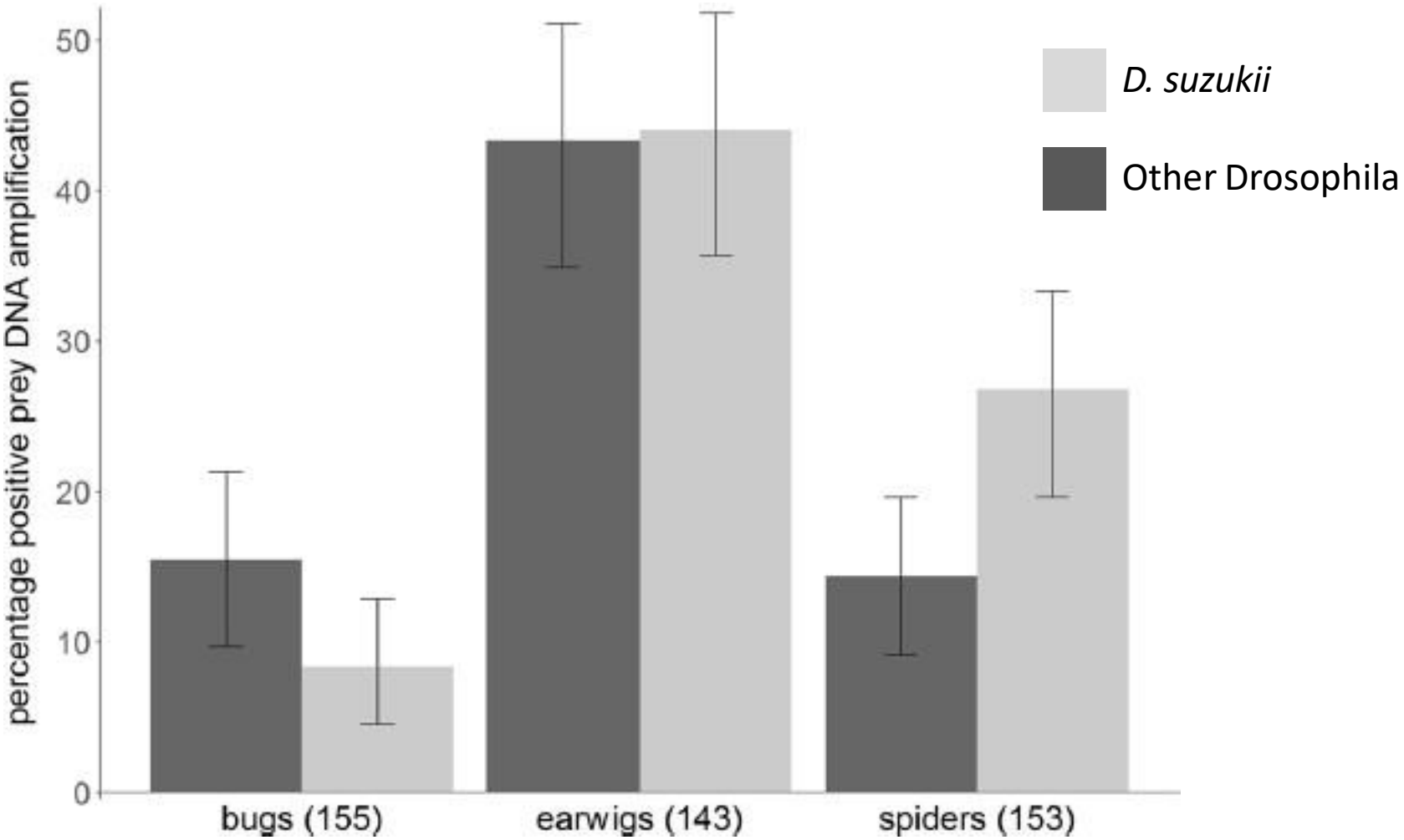
Summer

Dead End Hosts



Sam Ardin, 2017 A review of fruiting plant species as potential dead-end hosts of *Drosophila suzukii.*

Possible predators



Wolf et al. 2018. A simple and cost-effective molecular method to track predation on *Drosophila suzukii* in the field. J Pest Sci (2018) 91: 927. https://doi.org/10.1007/s10340-017-0948-7

Surveying parasitoid wasps in England

Found in wild areas not in crops- very sensitive to protection products

Family, Species	Habitats	Individuals	Traps
Pteromalidae			
Pachicrepoydeus vindemmiae	Woodland, Brambles, Elderberry edge, Farmyard, Hedgerow, Raspberry and Strawberry edges, Wild cherry orchard and Vineyard	1100	31
Spalangia erythromera	Woodland, Hedgerow, Raspberry and strawberry edges, Wild cherry orchard	219	14
Figitidae			
Leptopilina heterotoma	Woodland	15	2
Braconidae			
Asobara tabida	Woodland	9	2

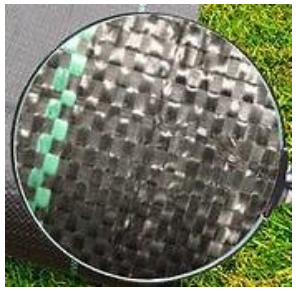
Crop Management

Less chance of fruit being missed. SWD prefers lower fruits in humid areas

Humidity

Spray penetration

Irrigation



Matting

Crop end

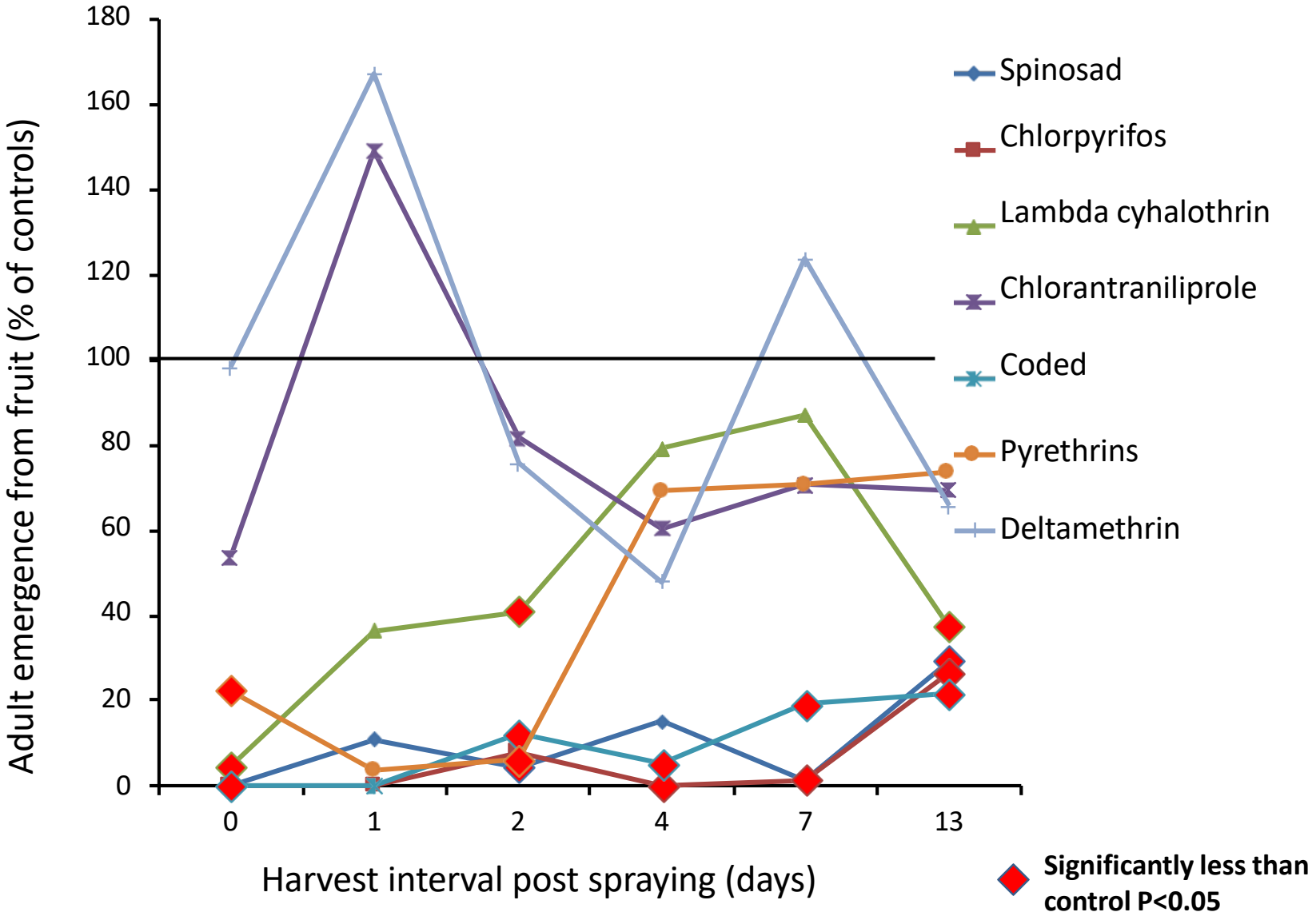
Strawberry spray trial

Active ingredient	Product name	Ai/l	Product rate/ ha (spray volume/ha)
Chlorantraniliprole	Coragen	200 g/l SC	175 ml
Chlorpyrifos	Equity	480 g/l EC	1.5 l
Deltamethrin	Bandu	0.2 ml/l	200 ml
Lambda cyhalothrin	Hallmark	100 g/l CS	75 ml
Pyrethroids	Spruzit	4.59 g/l EC	20 l
Spinosad	Tracer	480 g/l SC	200 ml
Coded	Coded	100 g/l OD	750 ml
Control		Untreated	-

Dried residues on fruit

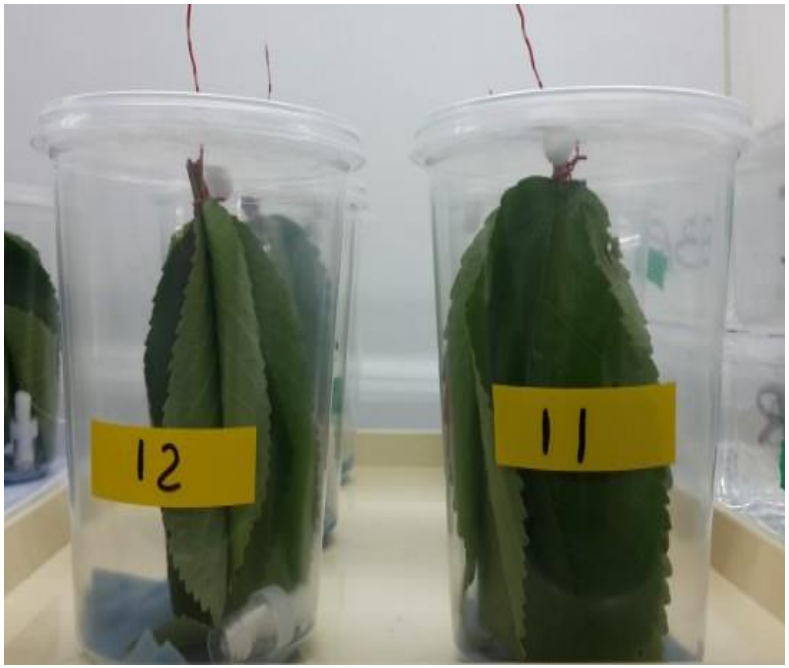
Strawberry **under protection**

Strawberry spray trial



Spray interval trial on cherry

Objective: Investigate prolonging spray intervals for maximum effect but minimal applications

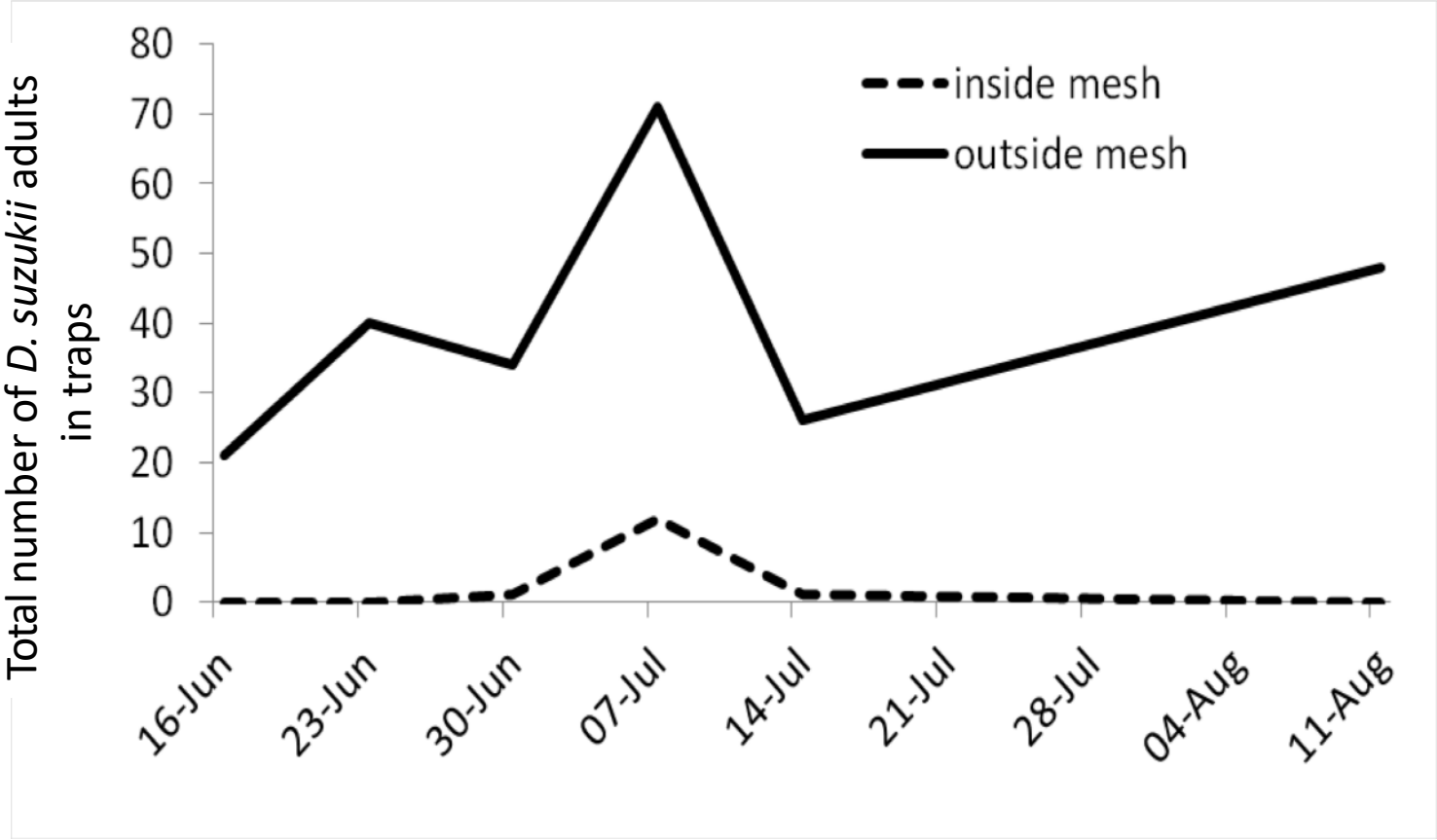


- Either weekly (cyantraniliprole, spinosad, lambda-cyhalothrin, pyrethrum and acetamiprid) or fortnightly (cyantraniliprole and spinosad)
- Leaves collected every week
- Groups of *D. suzukii* added to areas
- Mortality assessed 48 hours after exposure

NSD in mortality between weekly and fortnightly sprays

Spray interval trial

Objective: Investigate prolonging spray intervals for maximum effect but minimal applications- with insect proof mesh



Emergence from fruit samples

Commercial trial: Kordia and Regina sampled 9 Jun to 8 Aug (~3,500 fruits)

1 *D. suzukii* from Regina on 7 Jul (weekly)

1 *D. suzukii* from Kordia on 14 Jul (fortnightly)

Cold storage

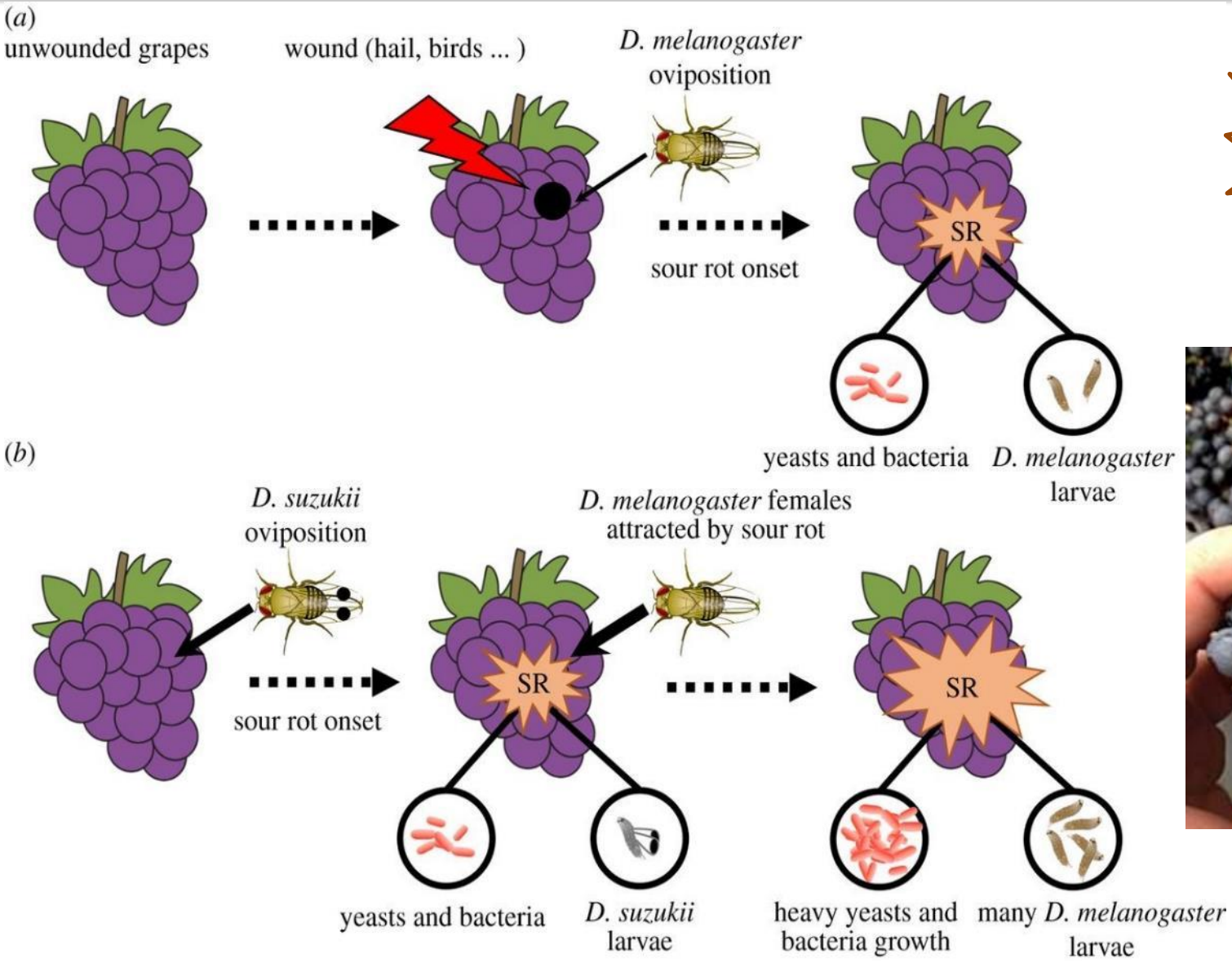
- Keep fruit cold to prevent further damage – cold chain management.
- All good practice for disease managing – should be something that is already done.

Effects of Postharvest Cold Storage on the Development and Survival of Immature *Drosophila suzukii* (Diptera: Drosophilidae) in Artificial Diet and Fruit

Marwa F. K. Aly, Dylan A. Kraus, Hannah J. Burrack

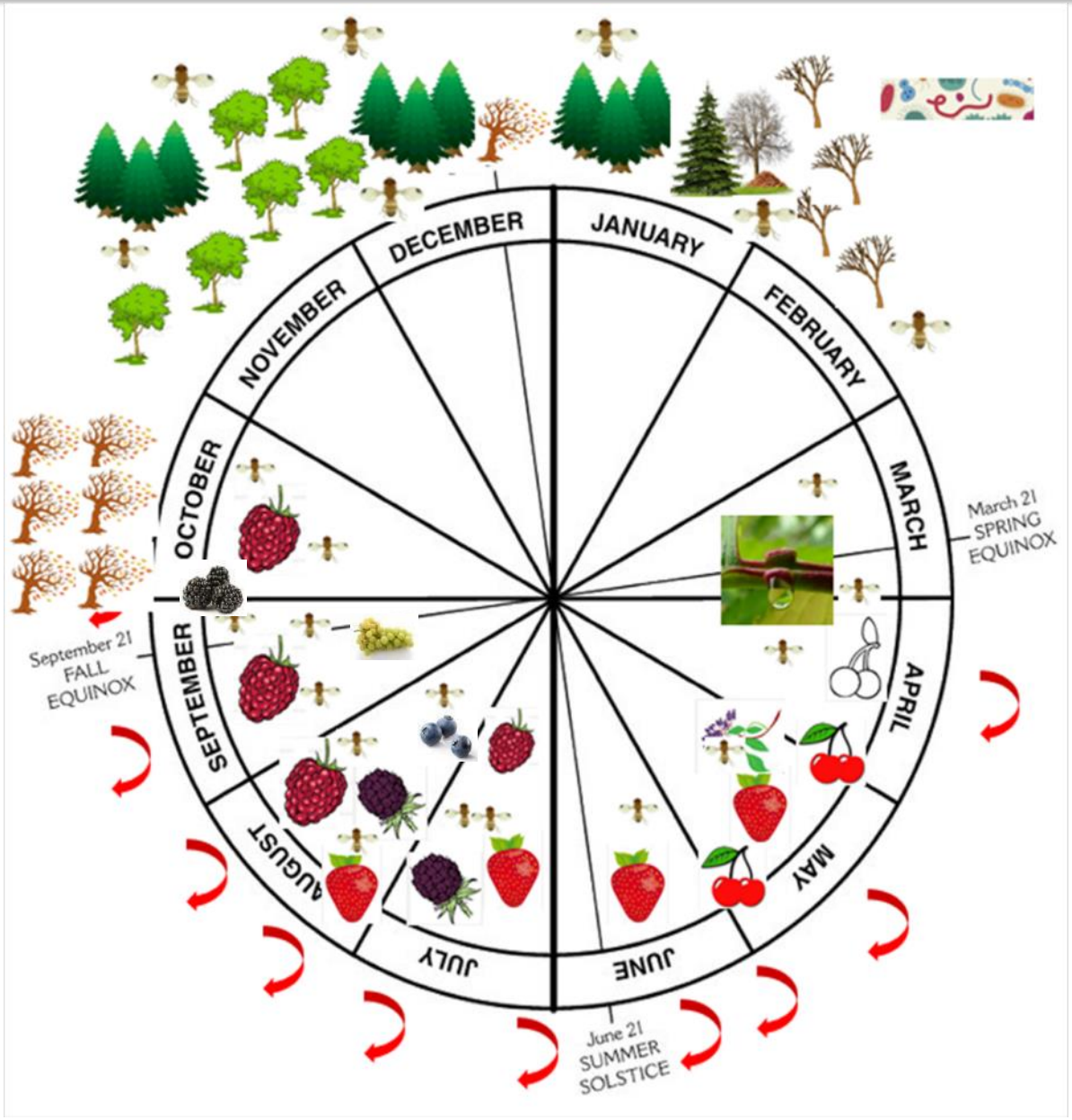
Journal of Economic Entomology, Volume 110, Issue 1, 1 February 2017, Pages 87–93,
https://doi.org/10.1093/jee/tow289
Published: 09 February 2017

Secondary impacts



Rombaut A, Guilhot R, Xuéreb A, Benoit L, Chapuis MP, Gibert P, Fellous S. 2017 Invasive Drosophila suzukii facilitates Drosophila melanogaster infestation and sour rot outbreaks in the vineyards. R. Soc. open sci. 4: 170117. http://dx.doi.org/10.1098/rsos.170117

Assessing the risks on each farm



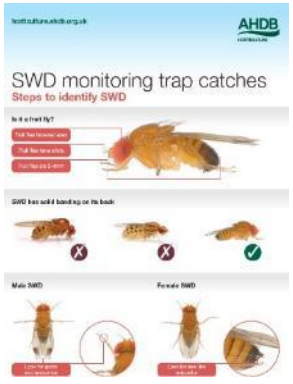
Key points:

- **Trap catches do not reflect population density**
- **Larval extraction good indicator of actual threat to crops**
- **Note what is happening in the local vicinity**
- **Hygiene very important**

Main message for growers

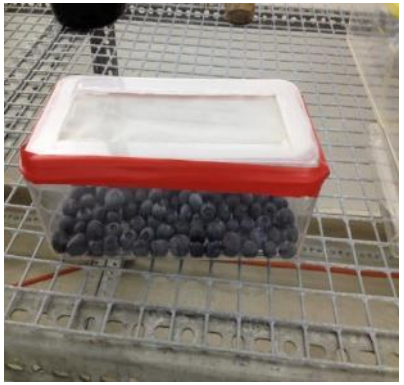
PREPARE

- Provide/attend training sessions for pickers/farm workers
- Identify the risk areas on farm
- Keep up to date with IPM control options
- Talk to your neighbours



MONITOR

- Regularly inspect fruit for damage/larvae
- Begin monitoring in spring with traps for adults woodland, hedgerows and adjacent vulnerable crops (early flowering/fruiting)
- Crop phenology and SWD incidents



CULTURAL CONTROL

- Good horticultural practices to **prevent** or **reduce** the probability of SWD including
  - -Managing irrigation to avoid fruit splitting and reduce humidity
  - -Manage canopy
  - -Harvest fruit frequently- every 2-3 days for soft fruit
  - -Remove waste/unmarketable fruit and dispose correctly
  - -Immediate cold storage of fruit

Over all aim

No single control method
A toolbox of lots of little hammers
which contribute to reducing
overall populations

INTEGRATED PEST AND DISEASE MANAGEMENT

D. suzukii research group

Dr Michelle Fountain

Jerry Cross

Adrian Harris

Glen Powell

Bethan Shaw

Adam Walker

Charles Whitfield

Francesco Rogai

Celine Silva

Adam Peters

Ralph Noble (MICROBIOTECH LTD)

Support and Thanks

realIPM

AHDB HORTICULTURE

fera

Innovate UK
Technology Strategy Board

Bioline AgroSciences

Berry Gardens

United Kingdom Vineyards Association

emt east malling trust

Worshipful Company of Fruiterers

Worshipful Company of Vintners

The James Hutton Institute

UNIVERSITY of GREENWICH
NRI | Natural Resources Institute

The Scottish Government

Russell IPM
INTEGRATED PEST MANAGEMENT

Department for Environment Food & Rural Affairs

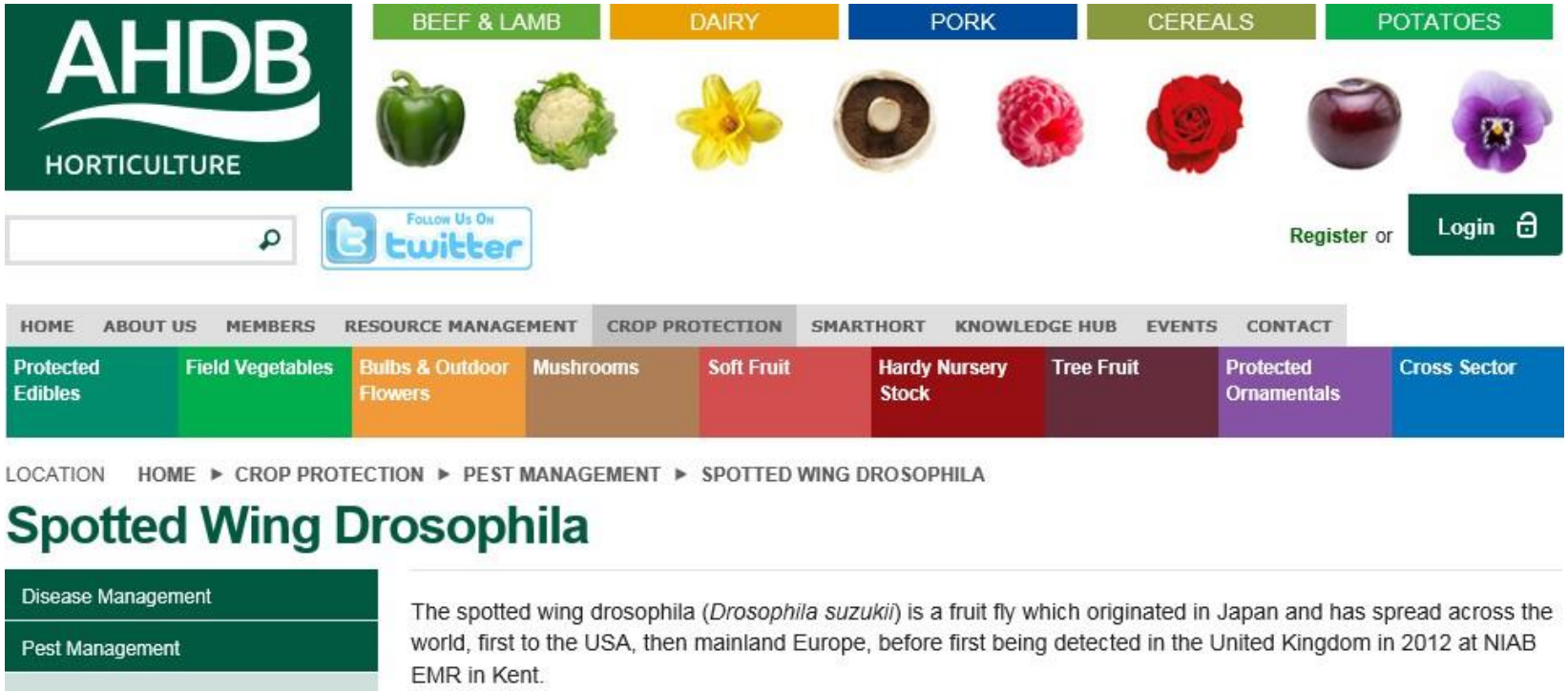
British Summer Fruits

Thank you for your attention

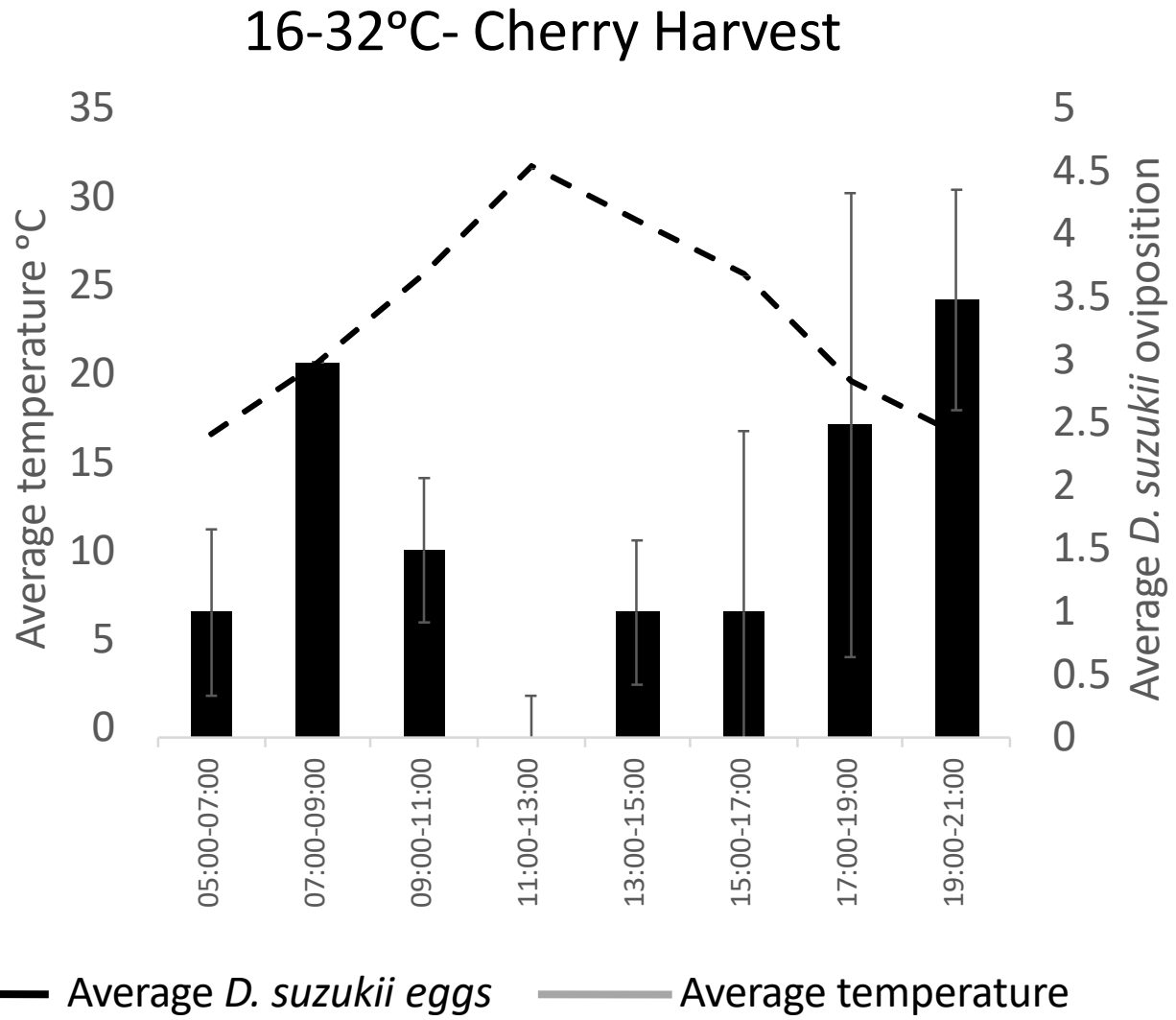
Useful contacts/websites

- bethan.shaw@emr.ac.uk
- michelle.fountain@emr.ac.uk

- https://horticulture.ahdb.org.uk/swd

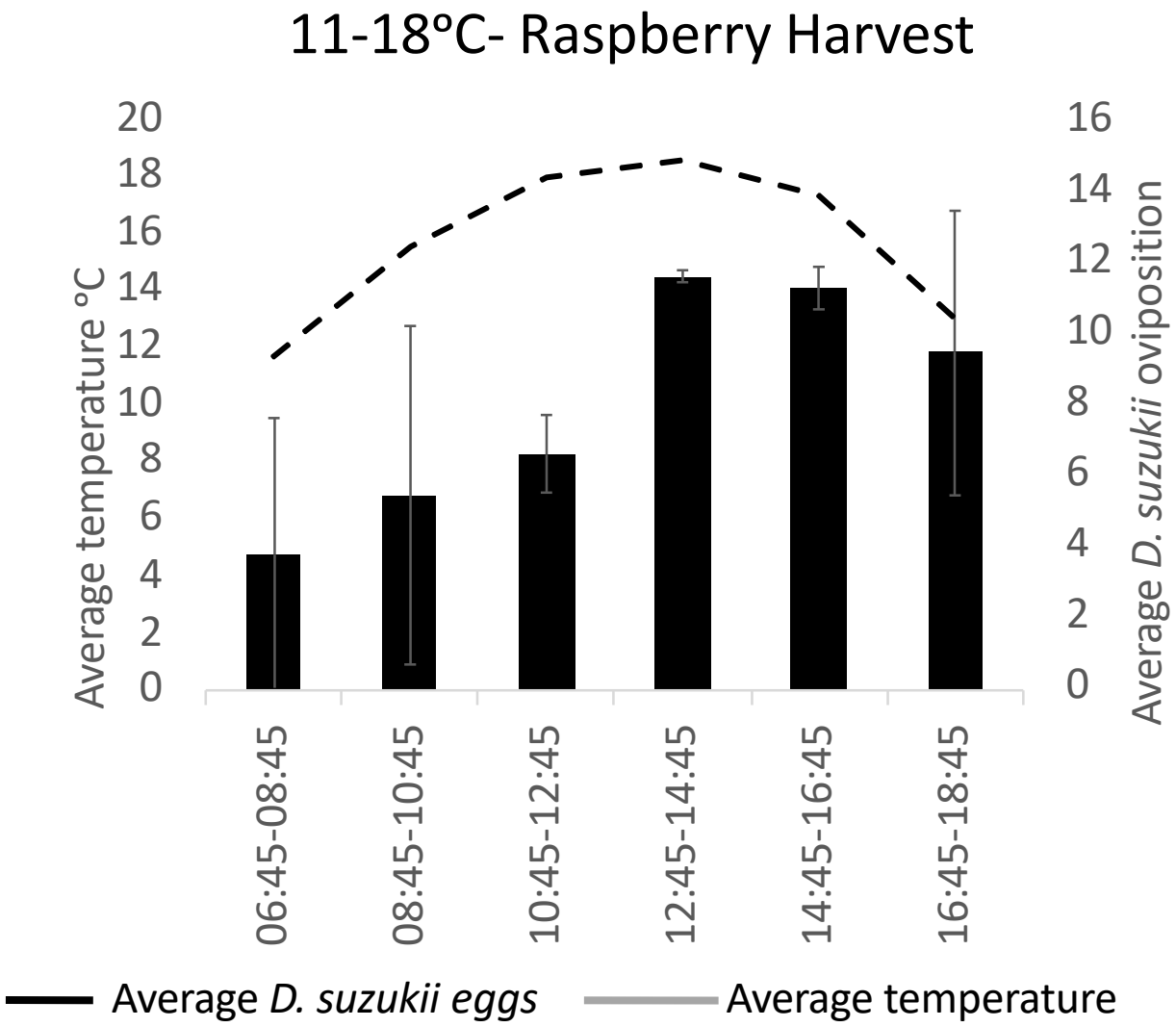


Egg laying rhythms



- Very little oviposition overnight
- At 30°C egg laying falls = escape response (ectotherms)

Egg laying rhythms



- No oviposition at night
- Egg laying rise and fall with temperature