Rothamsted Research
where knowledge grows

Epidemiology and forecasting of BYDV on winter cereals

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Rothamsted Insect Survey

"RETIRED"

Alnarp 5th June 2015

ROTHAMSTED RESEARCH

Talk content

Aphids

The suction-trap network

BYDV, its vectors, transmission

Insecticide resistance

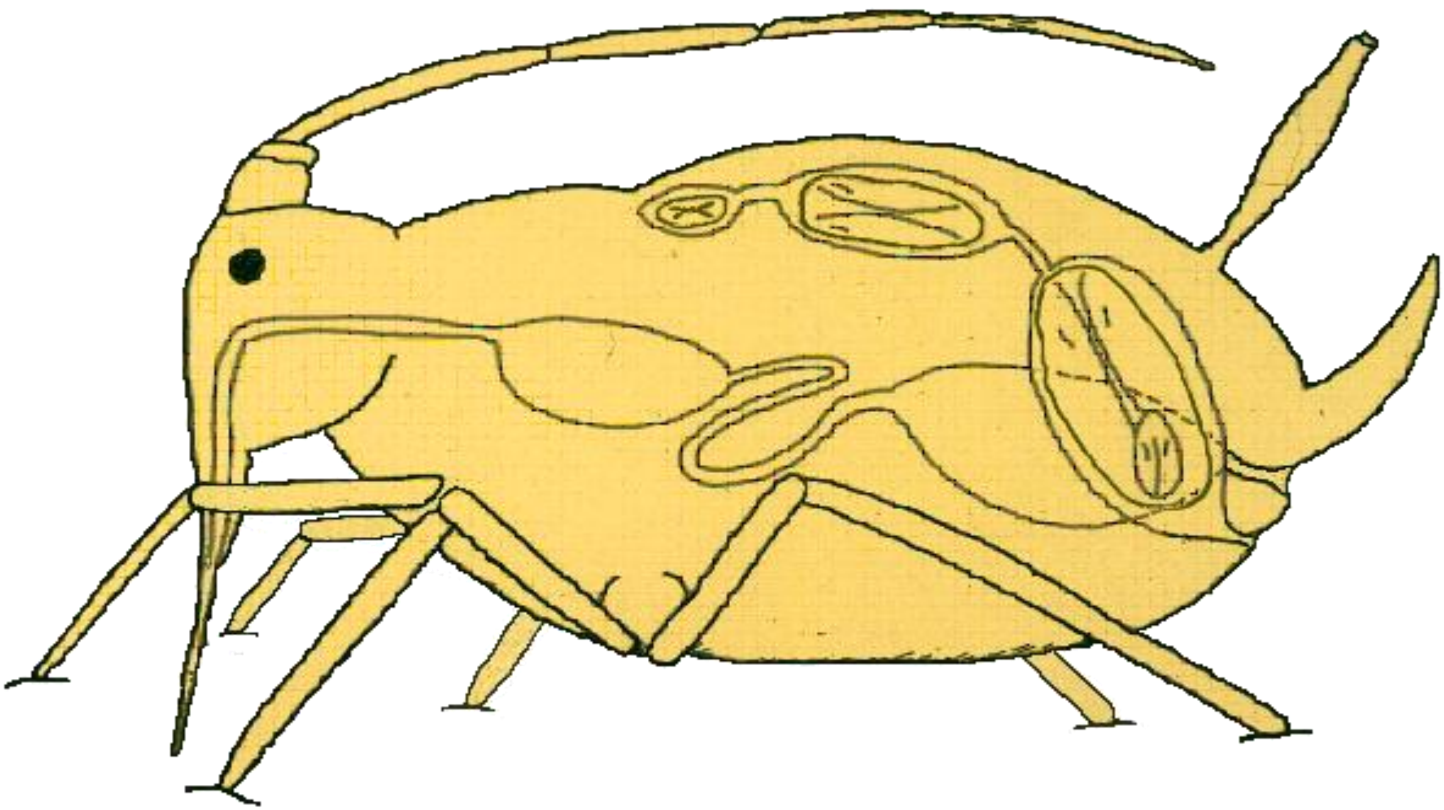
Climate change

Yield loss and control

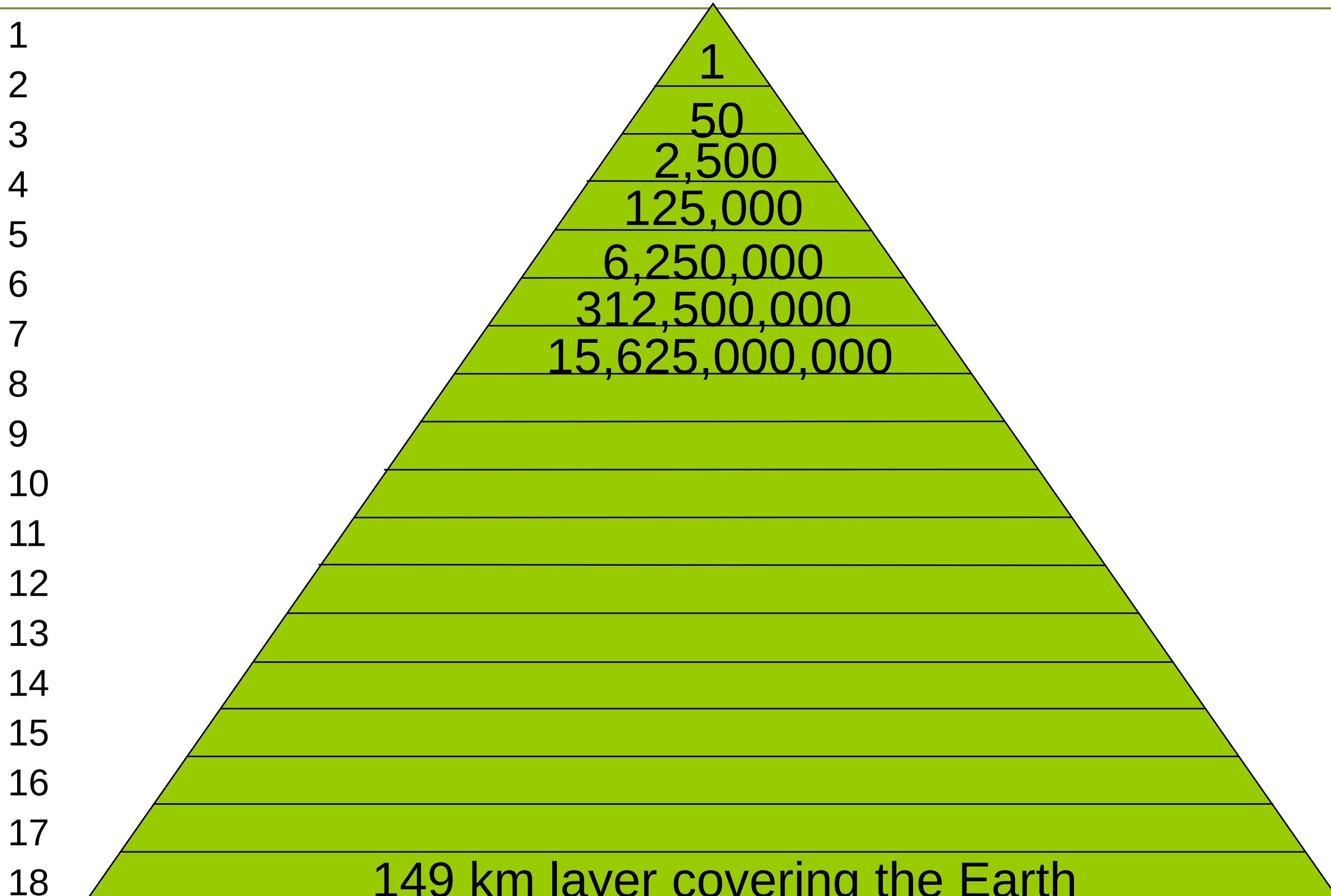
Aphids – and why they are pests

600 UK species

Telescoping of generations



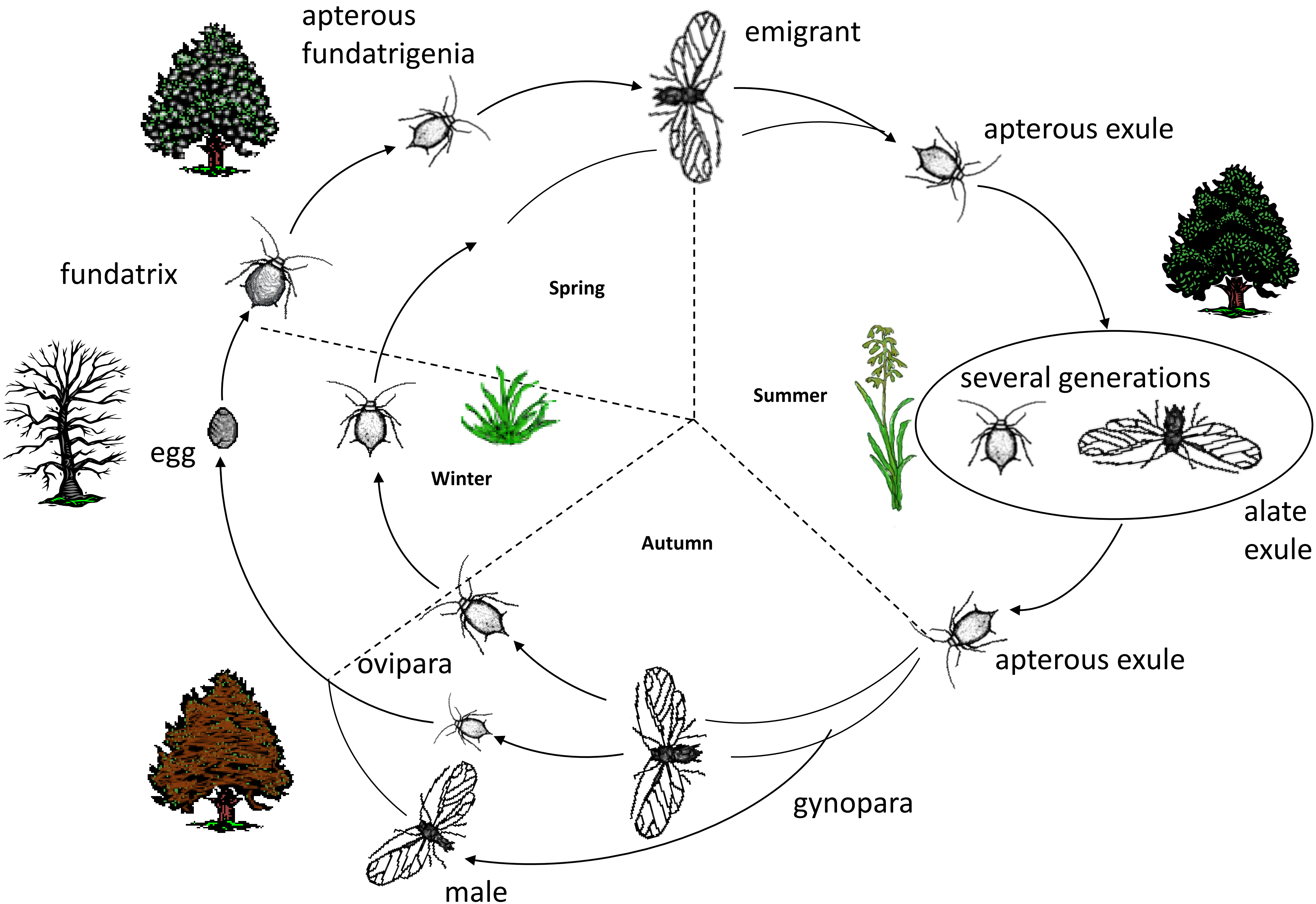
Fast breeders



Parthenogenesis in action

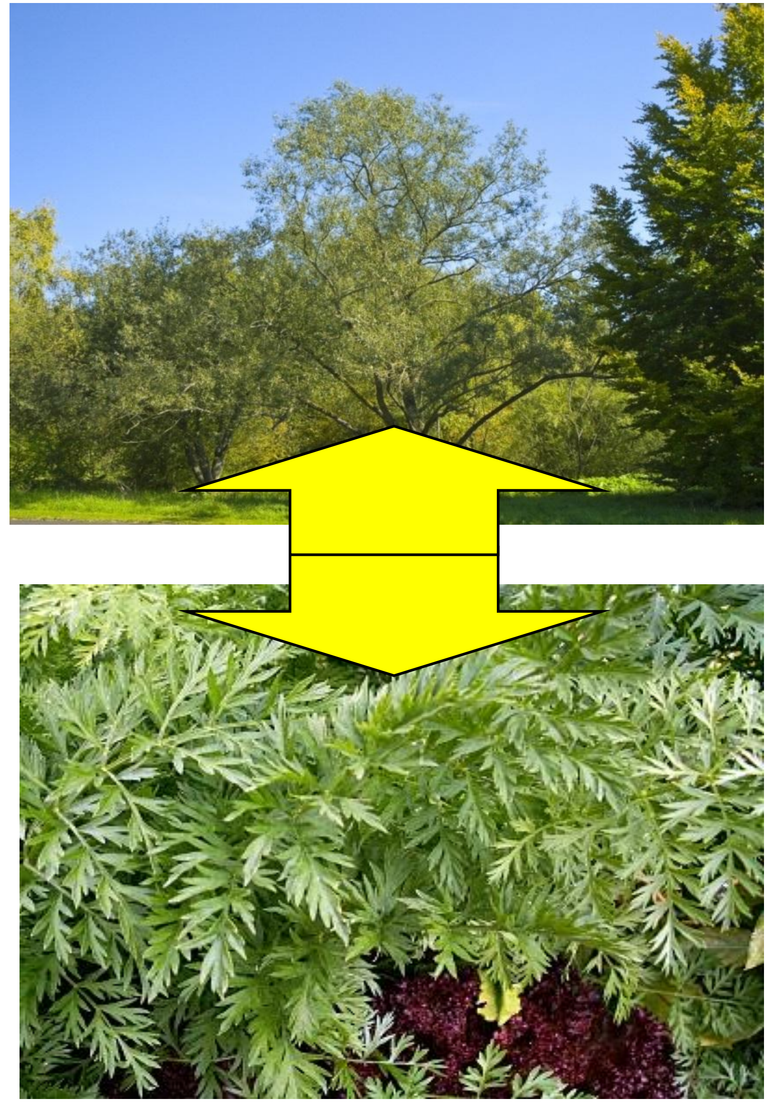
Sex once a year (for the lucky ones)

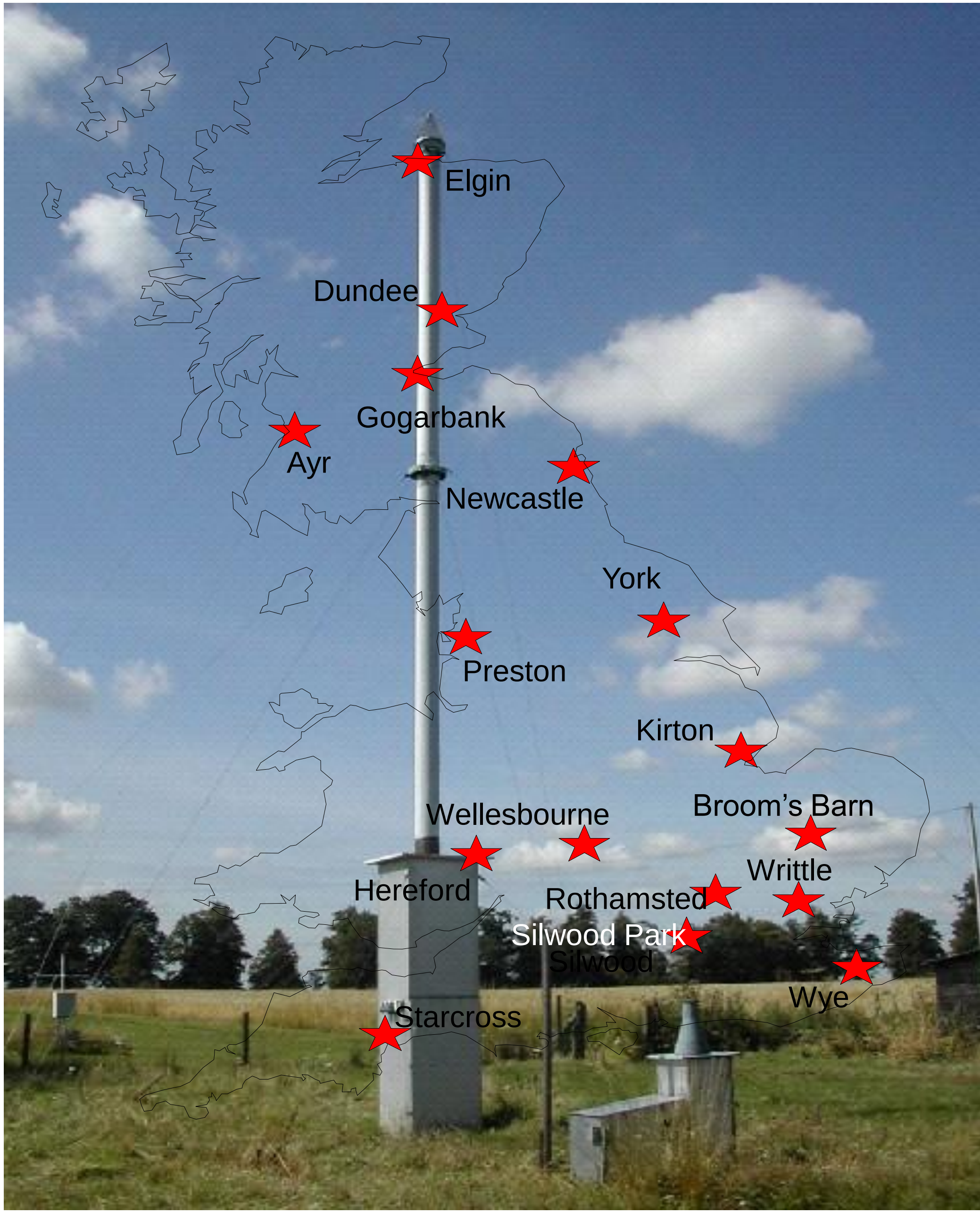
Winter eggs


apterous
fundatrigenia
emigrant
apterous exule
fundatrix
Spring
Summer
several generations
egg
Winter
alate
exule
Autumn
apterous exule
ovipara
gynopara
male

Host alternation

Spindle to Bean
Willow to Carrot
Bird cherry to Cereals
Peach to Potato
Blackcurrant to Sowthistle
Blackcurrant to Lettuce
Plum to Reeds
Plum to Hops
Rose to Cereals
Dogwood to Grass roots
Apple to Plantain
etc.





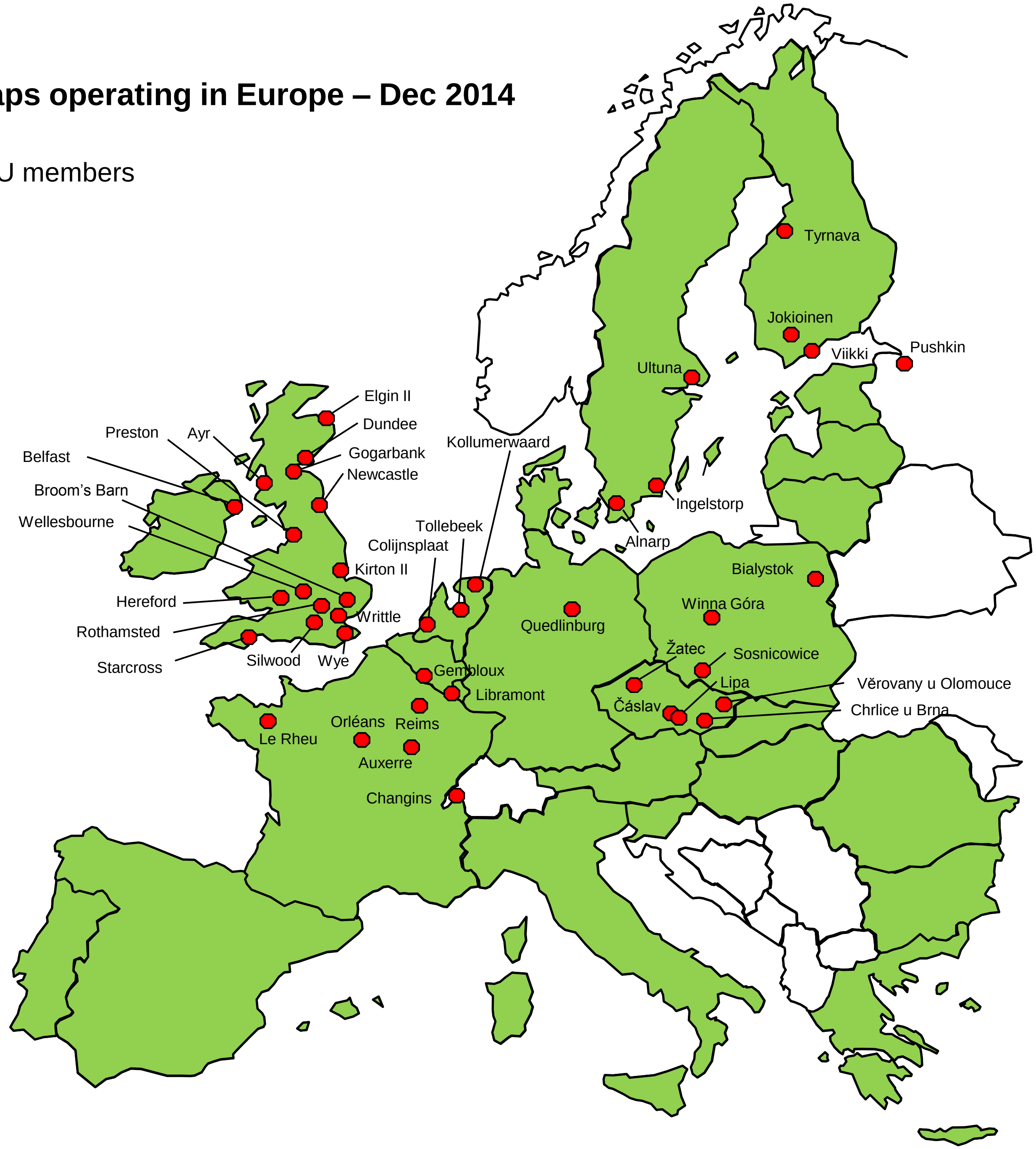
HGCA AHDB

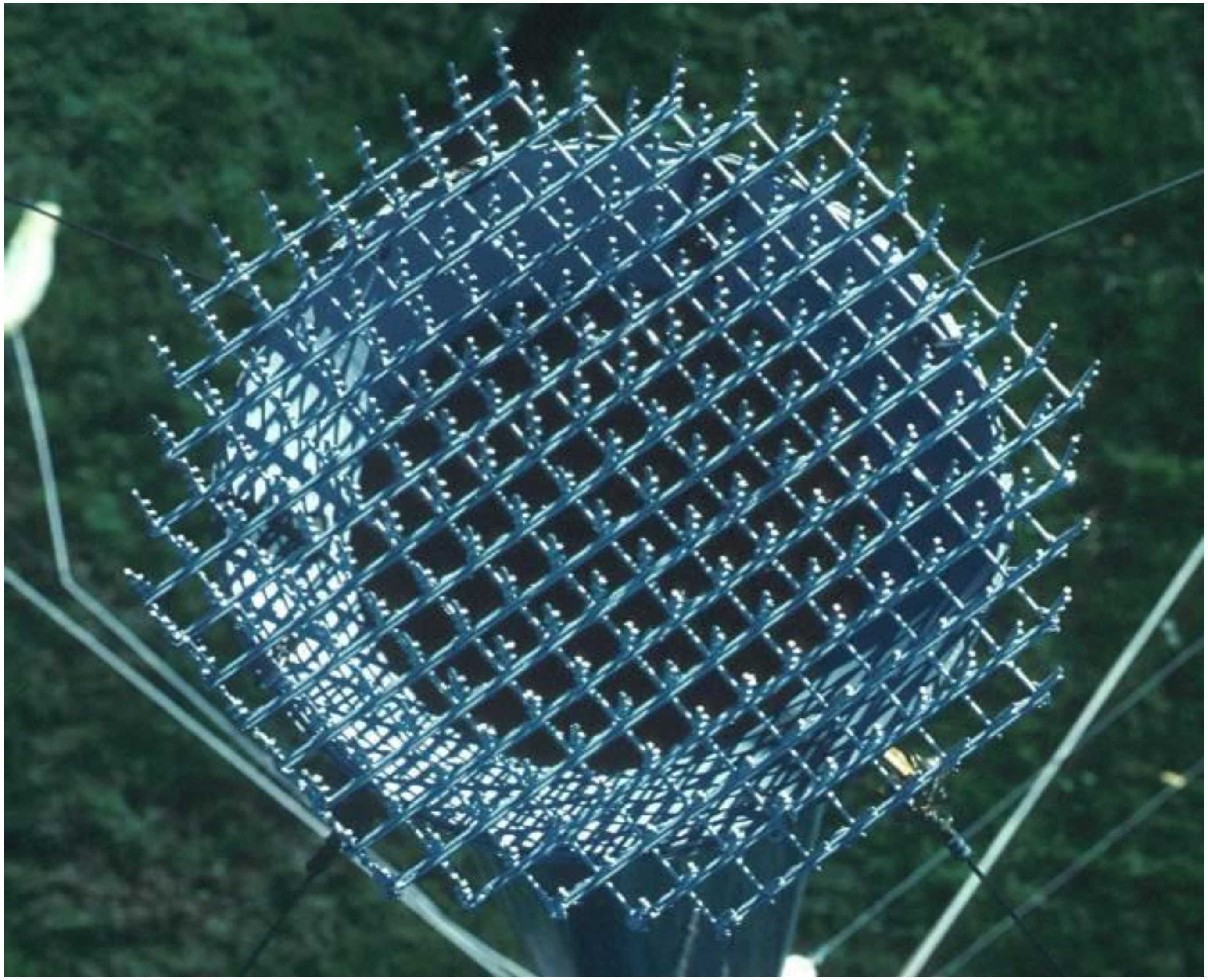
1964 – 2014+
Daily data

12.2 m suction traps operating in Europe – Dec 2014

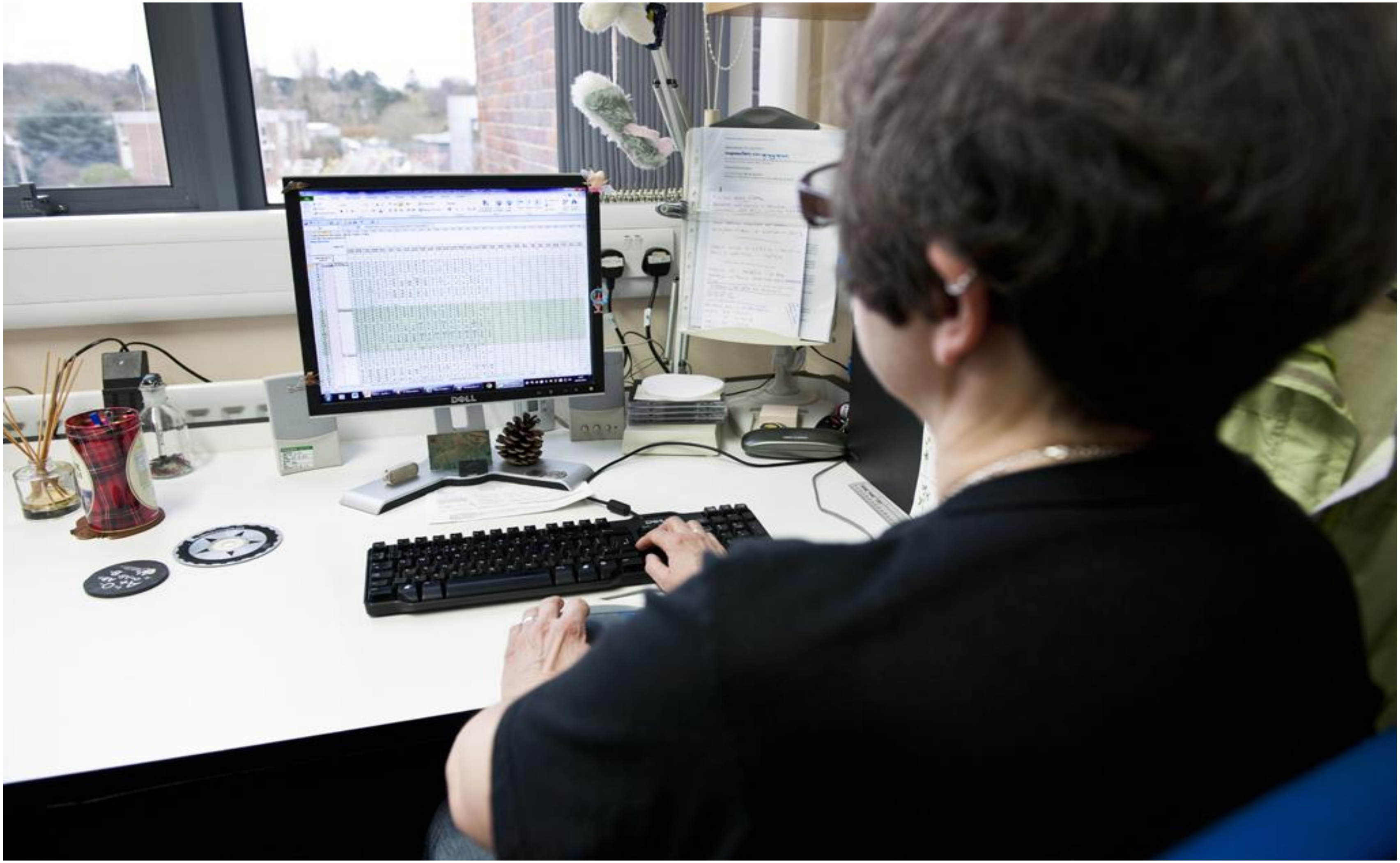
Shaded countries are EU members

42 sites in 11 countries






(1)
(2)
Myzus ligustri
Myzus persicae
Myzus certus

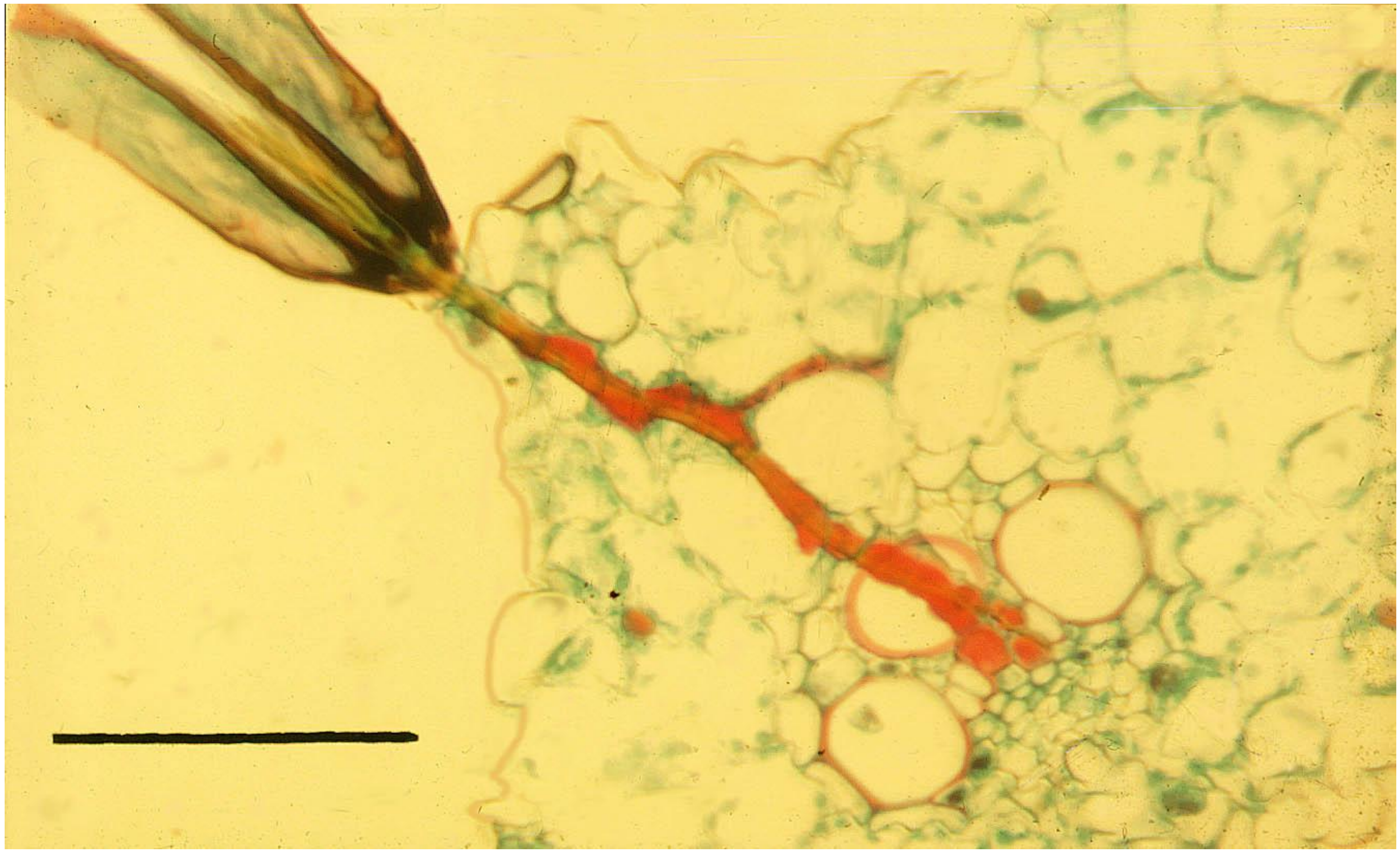

DELL


English grain aphid, *Sitobion avenae*

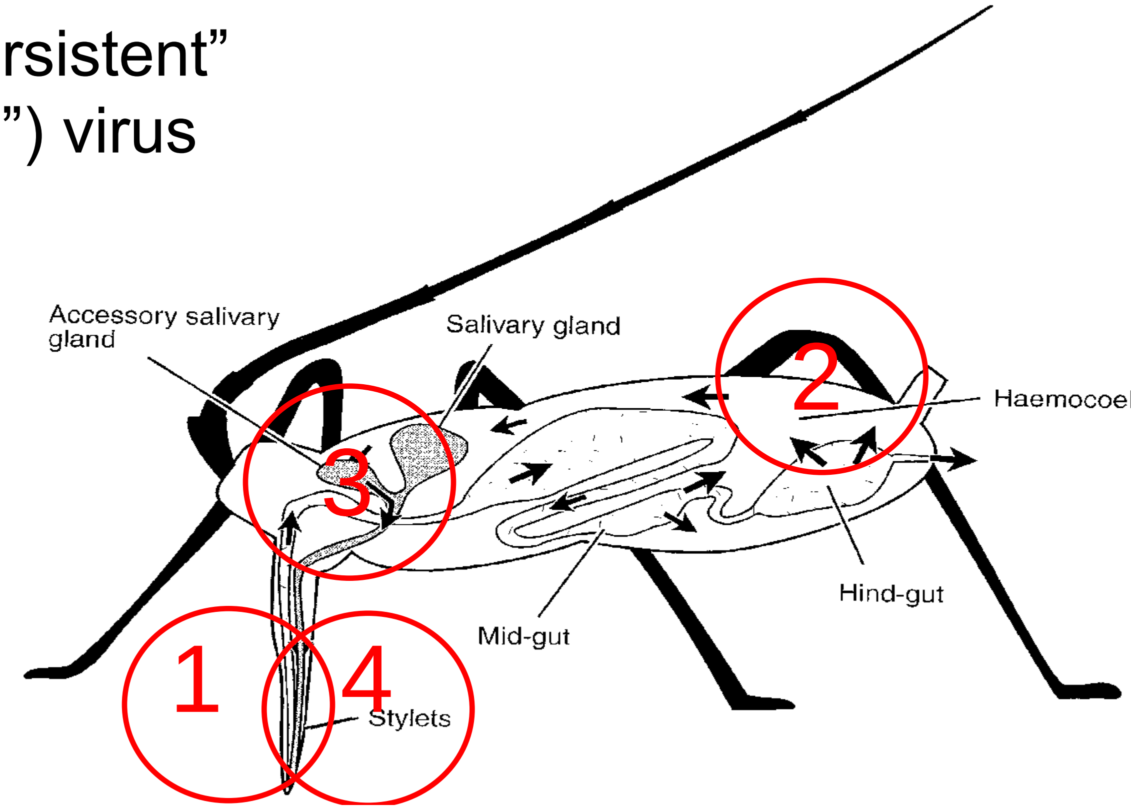
Bird cherry–oat aphid, *Rhopalosiphum padi*

Virus transmission



Virus transmission

BYDV is a "persistent" (or "circulative") virus

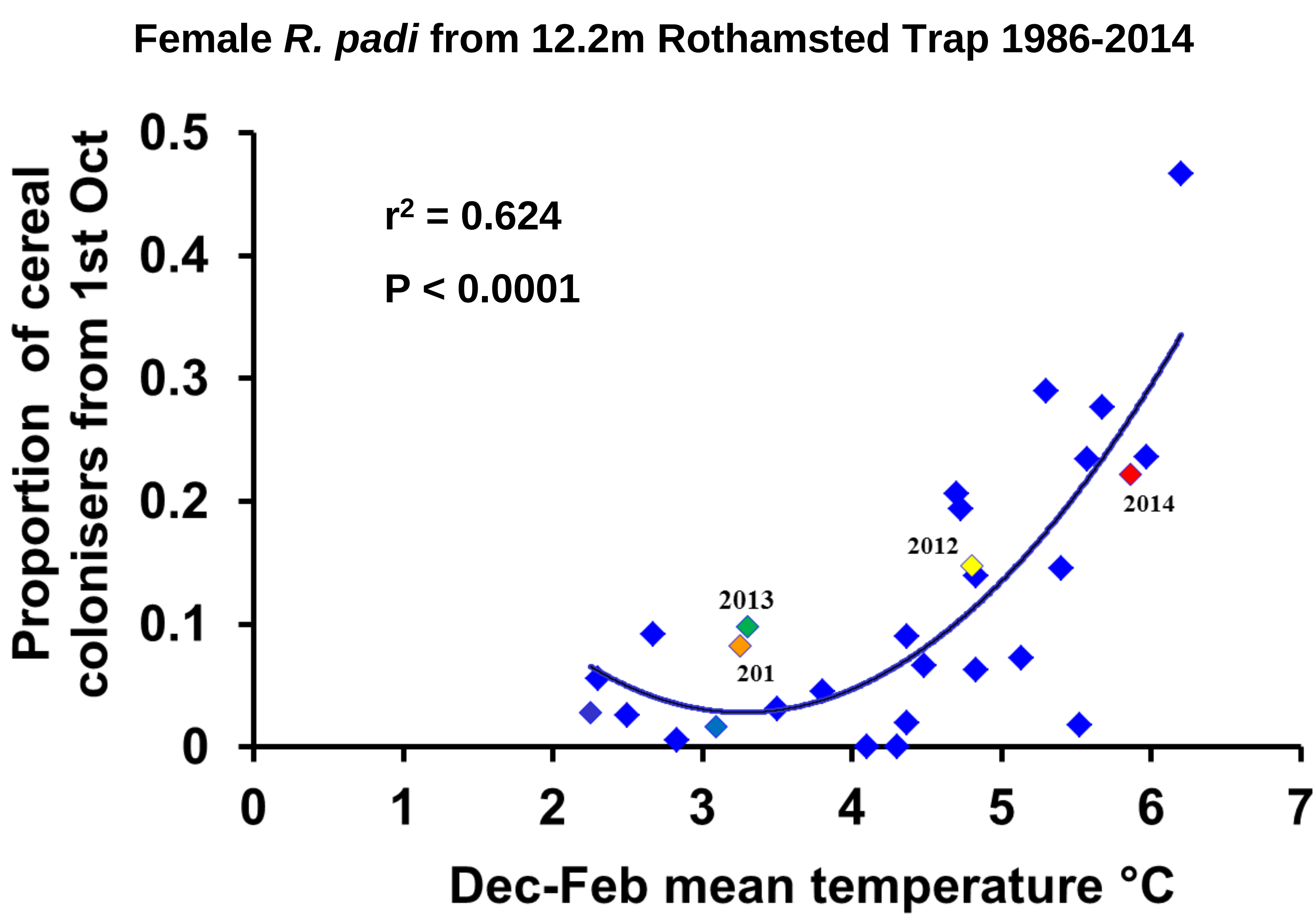



Forms of bird cherry–oat aphid

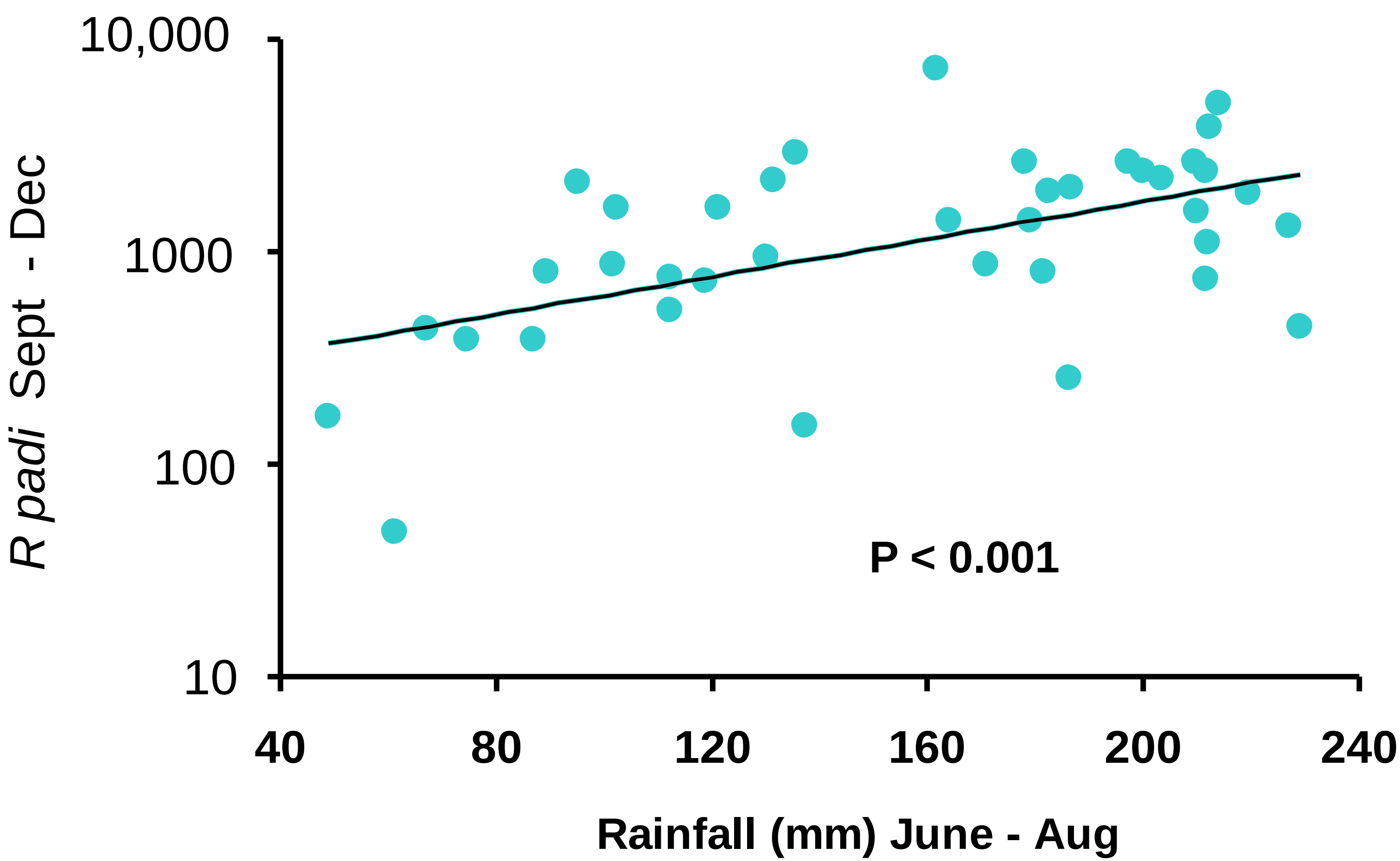
ASEXUAL

PRE-SEXUAL

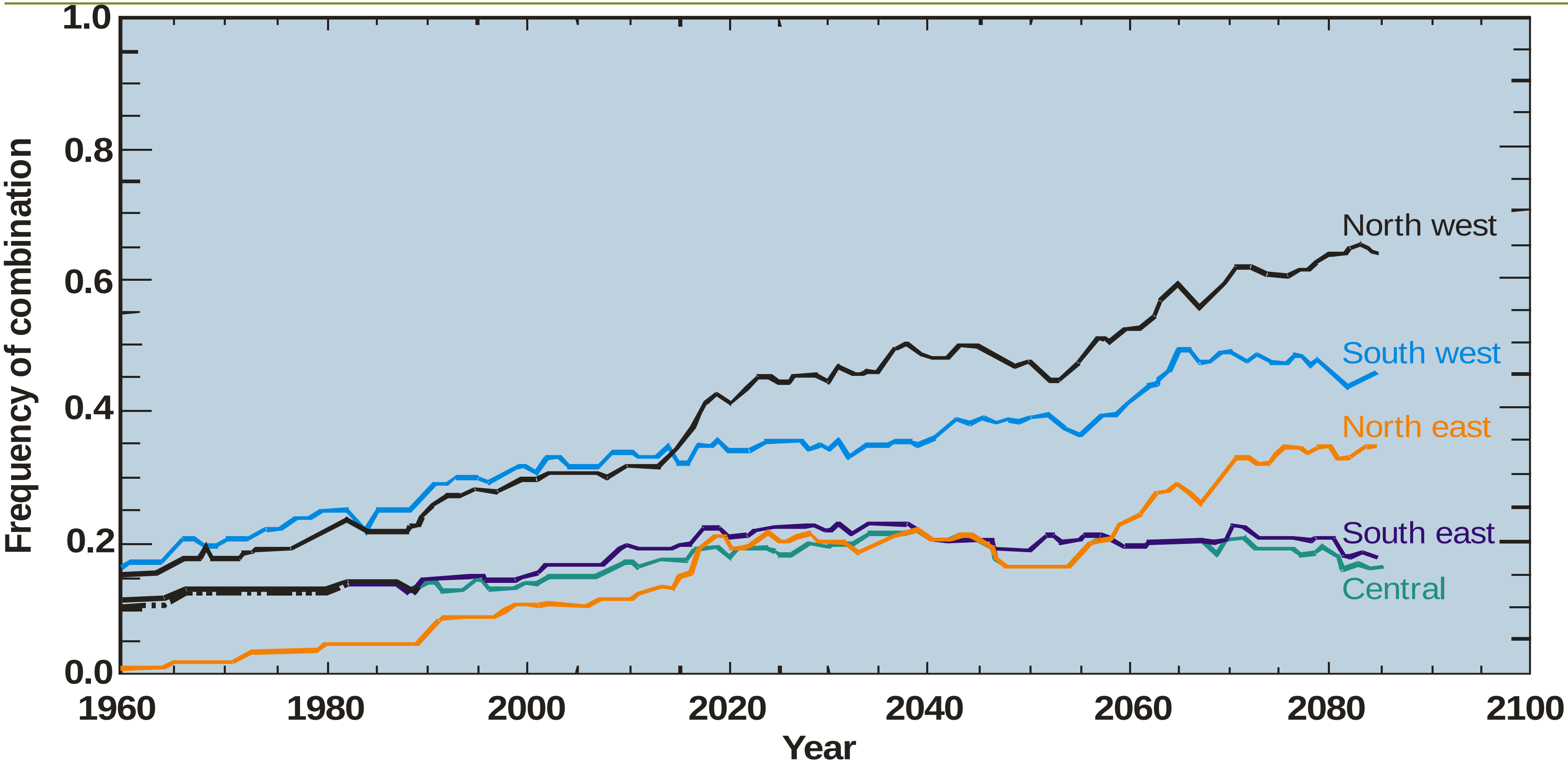
Proportion of cereal-colonising forms



Number of *R. padi* in autumn at Rothamsted *vs* summer rainfall 1968-2006




WARM WINTER + WET SUMMER + WARM WINTER



2011/12 SEASON

Nothing notable in early autumn in terms of aphid numbers

Very warm dry conditions of October to January led to much extended aphid flight, reproduction and movement than usual

HGCA aphid news 25th November 2011

Activity on the ground should continue apace with development and reproduction possible above 4ºC and walking between plants above 1ºC. The BYDV threat remains high with reports of even the latest crops to emerge being treated this year in some areas. The continuing relatively mild conditions suggests checking untreated crops is still worthwhile.

HGCA aphid news 2nd December 2011

The warm dry conditions through October and November led to a significantly extended autumn flight period and enabled aphids to continue multiplying and moving within crops. These aphids have the potential to spread BYDV and because of the exceptional weather this autumn, crops at risk could include those grown from insecticide treated seed.

Aphid news Newsflash 20th January 2012

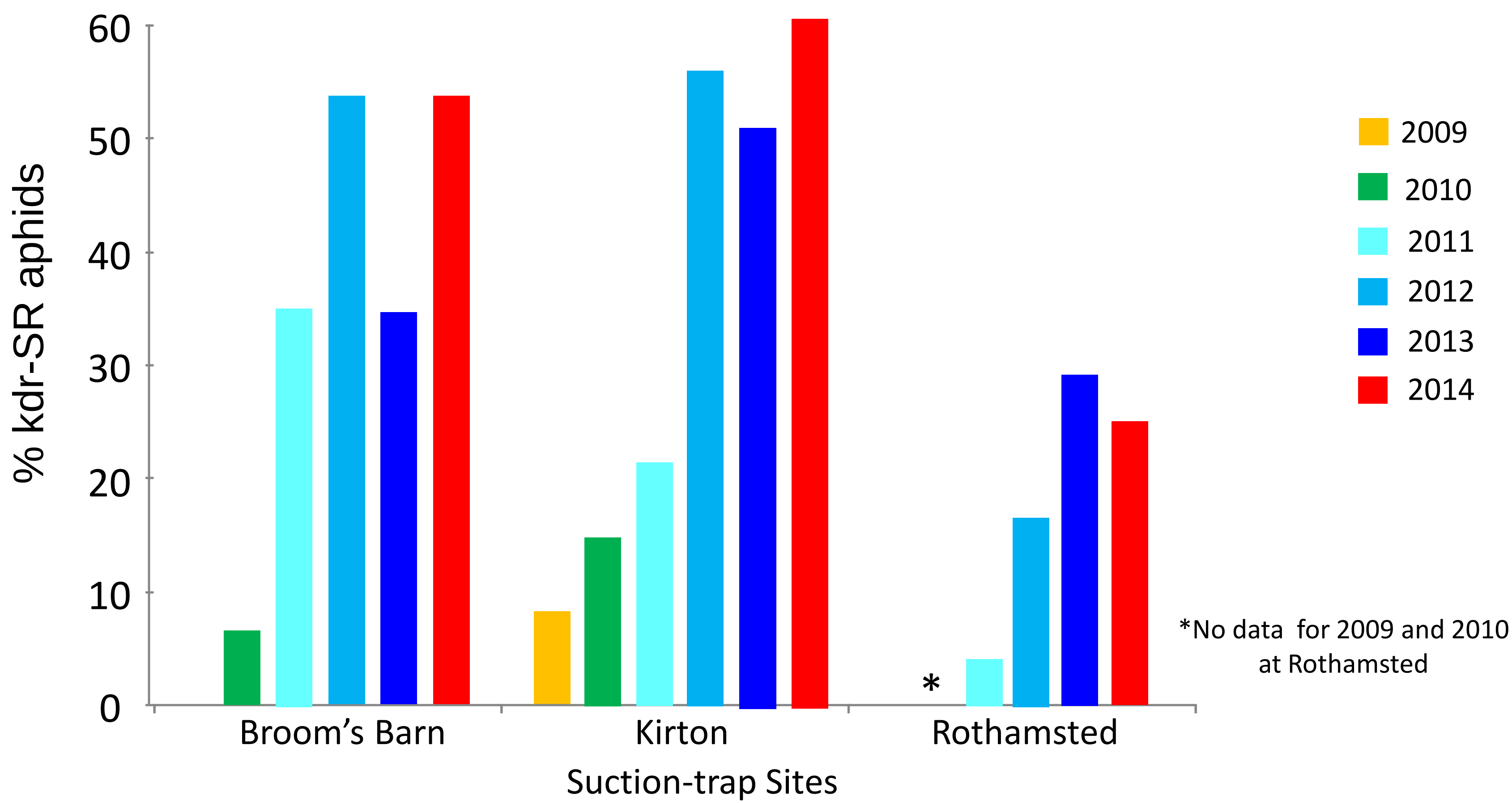
Aphids will be multiplying and moving in autumn-sown crops, especially in more southerly areas and, where they were not fully controlled before flights ended in autumn, the risk of virus spread (e.g. BYDV and TuYV) is likely to be high.

Insecticide resistance in grain aphid

Some pyrethroid control failure noticed since Summer 2011

Photo: Alan Dewar, Dewar Crop Protection

English grain aphid % resistant



2014 data funded by Potato Council

Rhopalosiphum maidis (Corn leaf aphid) and BYDV-RMV

R. maidis transmits RMV efficiently and other BYDV strains inefficiently

RMV is transmitted by other aphids very inefficiently

RMV not currently a problem in UK

R. maidis is entirely asexual

Prefers maize to wheat and barley

But, with warmer conditions …………

Rhopalosiphum maidis (Corn leaf aphid) and BYDV-RMV

More maize

More successful aphid overwintering

R. padi may become more efficient at transmitting RMV

(Lucio-Zaveleta *et al*. (2001) Variation in transmission efficiency among BYDV–RMV isolates and clones of the normally inefficient aphid vector, *R. padi*. *Phytopathology* **91**, 792-796)

RMV likely to become an issue

Yield loss

Varies considerably with crop species, virus strain and sowing date

Example of sowing date effect (1990 winter barley)

SOWING DATE	% INFECTION	YIELD (t/ha) untreated	YIELD (t/ha) treated	YIELD (t/ha) increase
5th Sept	32.5	4.42	5.95	1.53
18th Sept	12.5	6.51	7.77	1.26
29th Sept	8.7	7.29	7.75	0.46
9th Oct	6.1	7.40	7.69	0.29
18th Oct	2.8	7.02	7.42	0.40

Cultural control

Clean stubble before preparing seedbed

Leave at least 5 weeks between ploughing and sowing new crop

Consider a desiccant herbicide if cultivation to sowing < 5 weeks

Delay sowing by a week to reduce BYDV spread by up to half

Choose a moderately resistant spring barley variety

Chemical control

Use of neonic-treated seed can provide about 6 weeks' protection

In mild seasons the threat of infestation may continue into winter

Pyrethroid sprays will kill most wingless aphids

Chemical control is usually ineffective in spring-sown crops

No satisfactory thresholds for treatment exist

Day-degree (dd) calculation (“t-sum”)

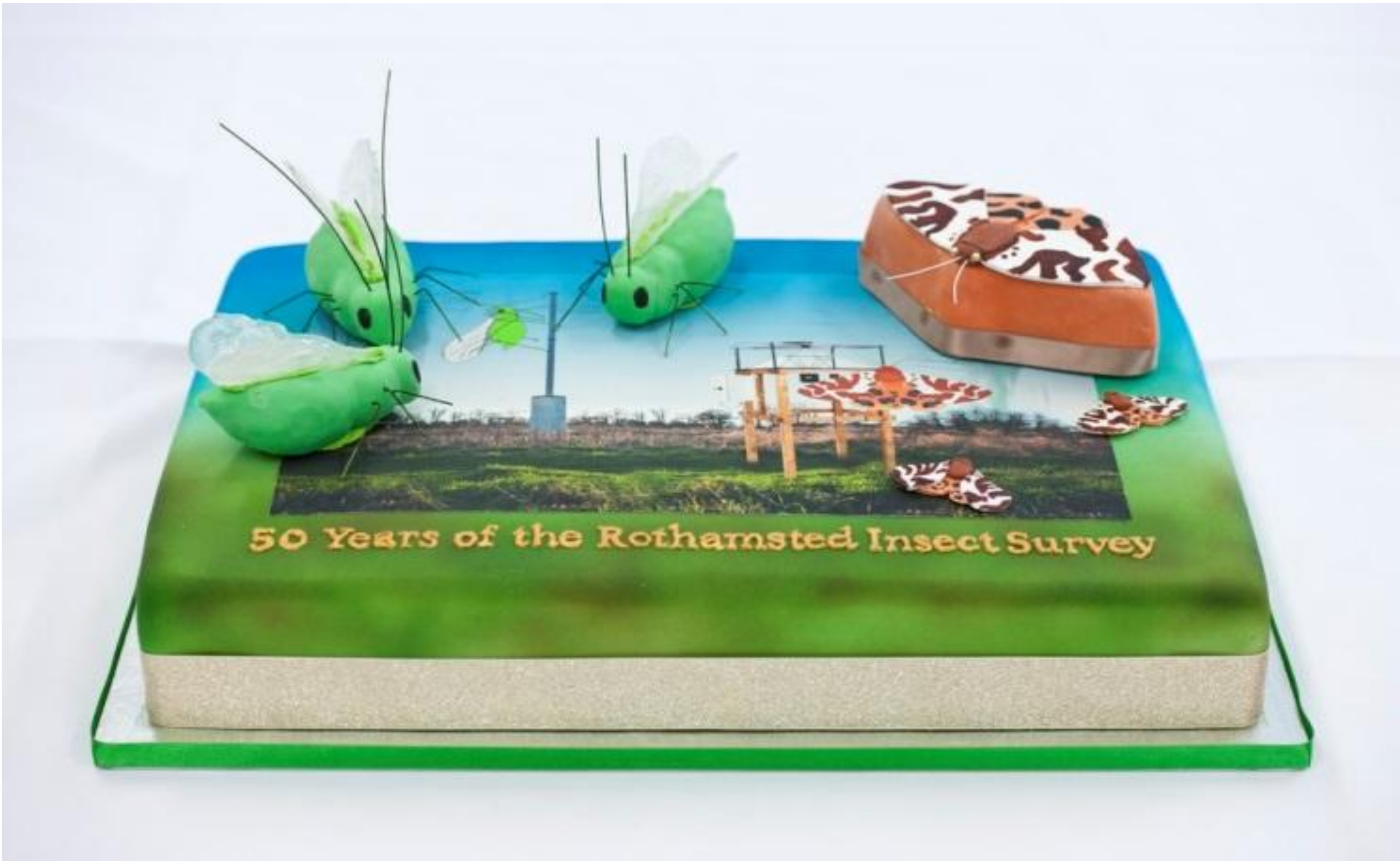
Serious spread begins when the second generation after colonisation is produced.

A generation takes around 170 dd above 3 deg. C
e.g. 17 days if the mean temperature each day is 13 deg. C.

A generation later (i.e. 340 dd after colonisation) serious spread is inevitable if there has not been high mortality.

Start accumulating the dd sum:
6 weeks after sowing for neonicotinoid-treated crops;
date of emergence for other crops;
one week after pyrethroid spray treatment.

50 years and counting (aphids)

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SASA
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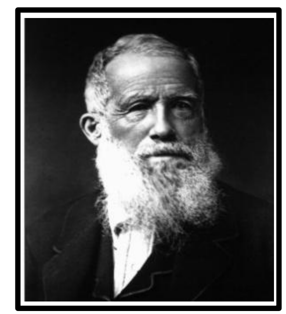
BBRO
Research Organisation

AHDB
Agriculture & Horticulture
DEVELOPMENT BOARD



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ROTHAMSTED RESEARCH

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