Host plant resistance to pest insects

Rosemary Collier

THE UNIVERSITY OF WARWICK

Nasonovia ribisnigri – currant lettuce aphid

- Major pest aphid of lettuce in northern Europe
- Increasing problem in other parts of the world

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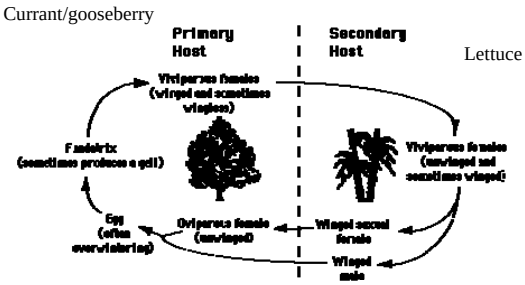
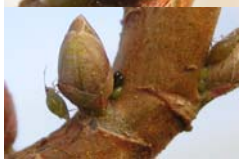
Aphid life cycles

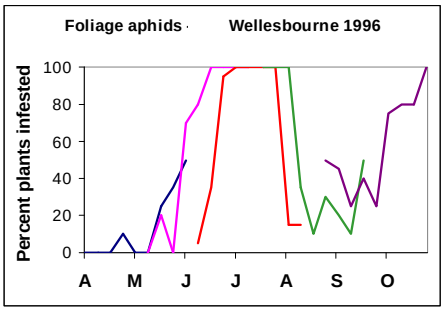
Life cycle of the currant-lettuce aphid



Life cycle: currant lettuce aphid on currant and lettuce



Life cycle: aphids on lettuce



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Insecticide resistance – early studies

- Cypermethrin - wide range, up to at least 10-fold resistance.
- Heptenophos - more uniform, within range for standard strains (up to 4-fold resistance).
- Pirimicarb - all field strains 'resistant', magnitude varied, some more than 11-fold resistant (4 to19-fold in SW Europe).
- Imidacloprid - no evidence of resistance.

Defra project - percent mortality with diagnostic doses

Date	Origin	Imidacloprid (10ppm)	Pirimicarb (100ppm)	Pymetrozine (50ppm)	Lambda-cyhalothrin (2.5ppm)	Treatment
Sept'03	Lincs	100	100	30	100	Gaucho (seed), Dovetail, Plenum, Nicotine
July'04	Sussex	100	96	88	100	Gaucho (seed), Dovetail, Plenum, Nicotine, Hallmark
Aug'04	Sussex	100	100	85	92	Thiacloprid, Nicotine, Cypermethrin
Sept'04	Cambs	100	100	78	96	None (organic)
Sept'04	Lancs	85	100	94	88	None (organic)
Nov'04	Lincs	93	100	53	77	Unknown
Sept'05	Cambs	100	97	90	83	Unknown
Sept'05	Lincs	100	100	100	100	Gaucho (seed), Dovetail, Aphox, Nicotine
Sept'05	Lincs	100	97	97	94	Gaucho (seed), Plenum, Dovetail
Oct'05	Worcs	100	100	90	100	Gaucho (seed), Plenum, Aphox
Oct'05	Worcs	100	93	80	93	Gaucho (seed) Plenum, Aphox, Stalwart

Cultivars resistant to lettuce aphid

- Range of cultivars available with full resistance to *N. ribisnigri*
- 2007 – evidence that host plant resistance had been broken in continental Europe
- 2008 – evidence that resistance broken in UK
- 2009 – we have collected some resistance-breaking aphids for a PhD project – Gemma Hough – funded by HDC – and to screen in this Defra project

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Facilities/techniques

- Aphid cultures – several clones (insecticide susceptible, insecticide resistant) plus host-plant resistance breaking biotype
- Techniques to produce overwintering eggs

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Facilities for tests:

- Glasshouses
- Open plots
- Small cages
- Controlled environment rooms

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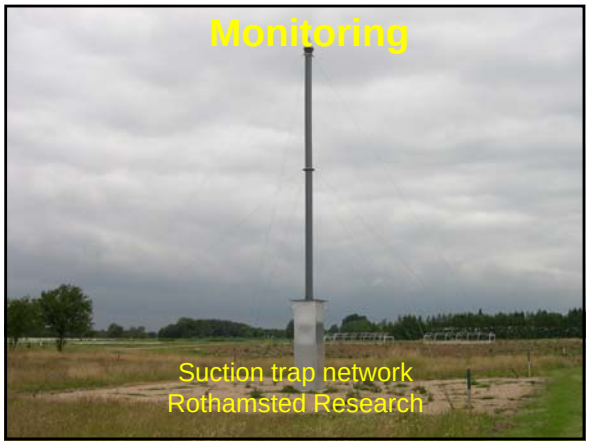
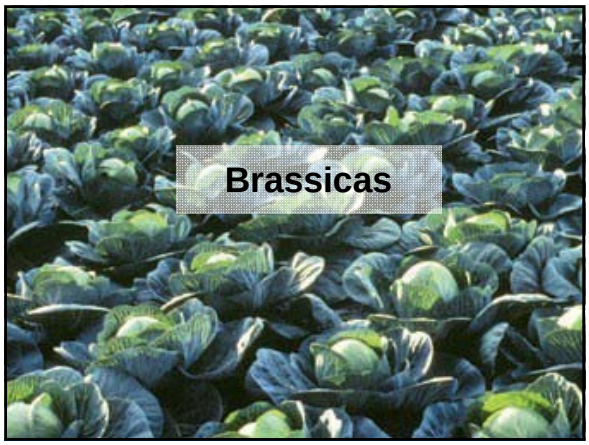
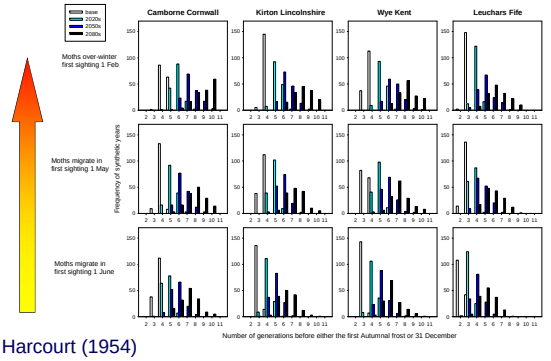




Diamond-back moth - *Plutella xylostella*

- World-wide pest of brassica crops
- Can complete its life-cycle rapidly in warm weather – more generations, more damage
- Insecticide resistant strains selected very rapidly – harder to control
- Migrates into UK and causes damage
- Cannot survive UK winters at present
- But this may change…….

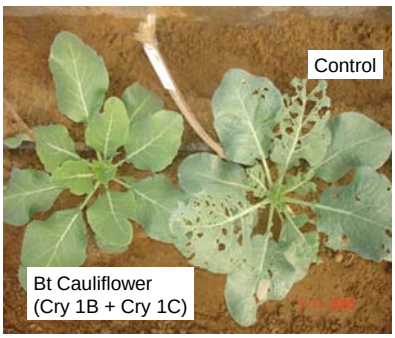
Climate change projections – diamond-back moth – number of generations per year



Harcourt (1954)

Cauliflower in India devastated by diamond-back moth despite 50 applications of insecticides

Cauliflower inoculated with 25 DBM



Wild brassicas

Resources and facilities

- Insect rearing unit
- Glasshouses
- Field plots, field cages
- Facilities to investigate mechanisms of resistance – behaviour and 'chemical' analyses

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Other *Brassica* pests in culture

- Cabbage root fly (*Delia radicum*)
- Cabbage aphid (*Brevicoryne brassicae*)
- Peach-potato aphid (*Myzus persicae*)
- Large white butterfly
- Accessible in field – whitefly, flea beetle, pollen beetle, other Lepidoptera

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Other crops - carrot

- Resistance to carrot fly (*Psila rosae*)
- Field population
- Can screen varieties/breeding lines
- Investigate mechanisms of resistance

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Other crops - alliums

- Resistance to thrips (+ other pests)
- Wild population/greenhouse culture
- Can screen varieties/breeding lines
- Investigate mechanisms of resistance

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