

# Two novel targets in berries?

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# Plant protection in soft fruits

- Ca 2000 ha strawberries & raspberries in Norway
- Decreasing number of pesticides available in minor cultures like berries, those remaining tend to be less effective.
- No/few pesticides registered for protected cultivation (tunnels/greenhouses). Difficult to combine chemical and biological control.
- Reports of pesticides not working

# Introducing the 2 targets



Raspberry beetle

*Byturus tomentosus*



Strawberry blossom weevil

*Anthonomus rubi*

# Introducing the targets, ctd

<b>Feature</b>	<b>Blossom weevil</b>	<b>Raspberry beetle</b>
<b>Host plants</b>	Strawberry, <i>Rubus</i> , etc)	<i>Rubus</i> (Raspberry, blackberry, etc)
<b>Juvenile habitat</b>	Inside closed bud on the ground	Larva in berry, postfeeding stages in the soil below plants
<b>Juvenile period</b>	4-5 weeks (summer)	6 months (winter, univol.) –18 months (if semivoltine)
<b>Adult habitat</b>	Host plants + litter	Soil, host plants, pollen feeding on other plants

# Life cycle, raspberry beetle



T > 15°C:  
Flight  
treshold,  
pollen  
feeding  
*Malus*,  
*Prunus*



Adults climb  
the canes 2-4  
m before  
flowering

Feeding  
on buds  
and  
leaves



June: Mating and  
oviposition  
during flowering



The  
larva  
feeds for  
4-7  
weeks

Larva develops to pupa  
and imago next year.  
Second winter as adult. If  
univoltine: Just one winter  
in the soil, as adult.

August: Larva **0-20 cm**  
into the  
soil beneath  
plants. First  
winter as larva

# Possibilities for nematodes

## Raspberry beetle

### Soil application

When?

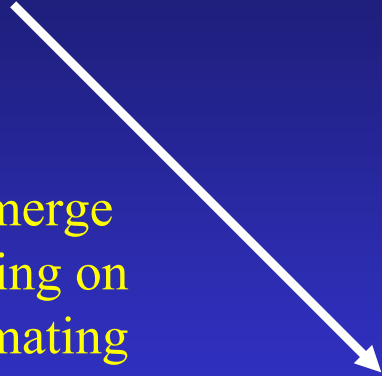
Just before larvae leaving plants?

Just as new adults emerge?

Anytime the temperature is favourable?

*Heterorhabditis* spp?

# Life cycle, blossom weevil



$T > 12^{\circ}\text{C}$  adults emerge after winter. Feeding on buds and leaves, mating

Adults overwinter in litter inside the field or near it



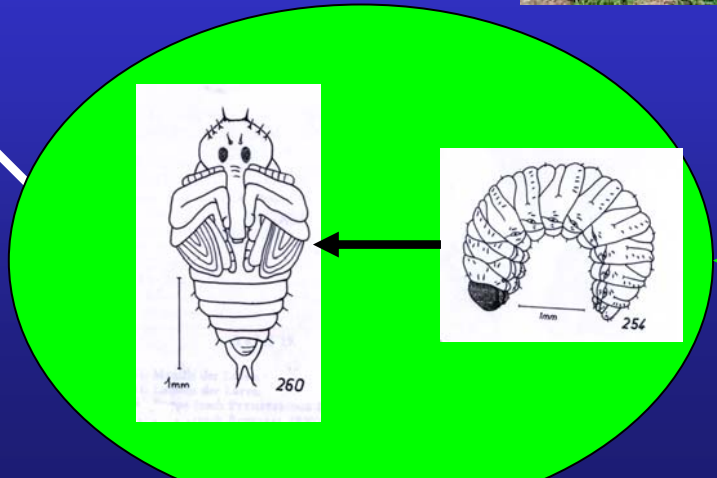
$>18^{\circ}\text{C}$ ?  
Oviposition (cutting buds),  
May & June



New adults emerge at the time of harvest; in reproductive diapause?



Egg, larval and pupal stage inside bud, 4-5 weeks



# Possibilities for nematodes

## Strawberry blossom weevil

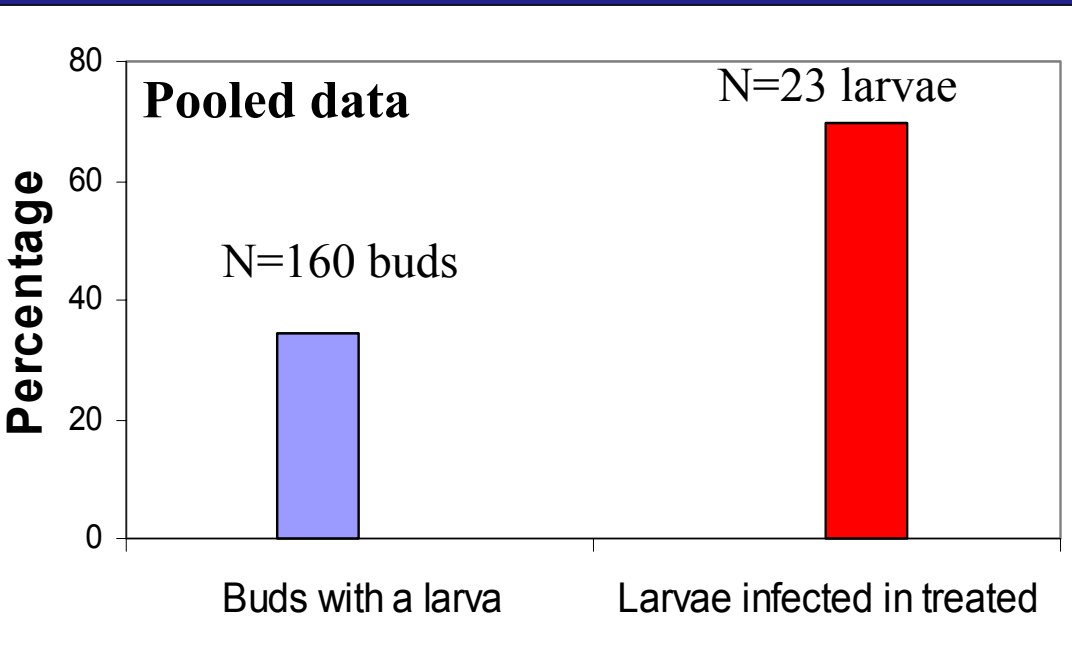
Summer application on plants, targeting the stages inside cut buds?

- Possible nematode species *Steinernema carpocapsae* and *Heterorhabditis* spp.

Less promising: Targeting adults

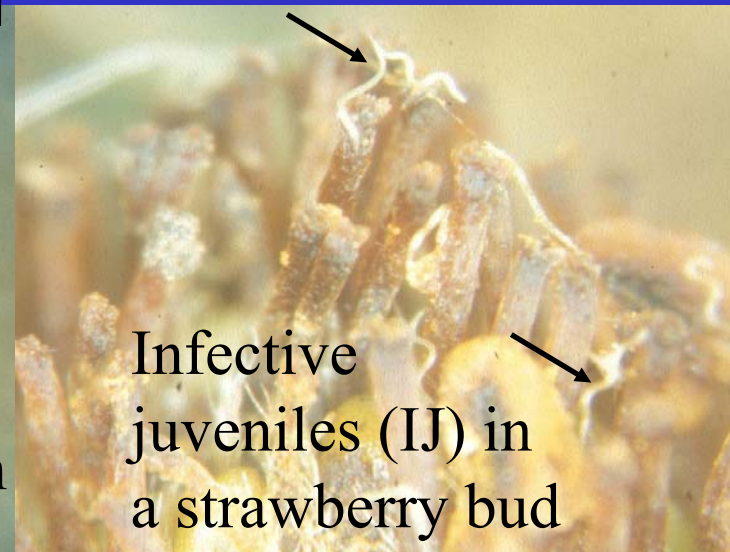
- Adults emerging from the buds? (coincides with harvest)
- Adults in the spring? Need to investigate susceptibility

# Petri dish bioassay, *H.megidis* on *A.rubi*



1000 IJ per dish with 10 buds, 10 July 2002. Room temp. Infection registered 2 DAT.

Severed buds sampled from organic field 5 July



# Conclusions & Questions

- A 100% reliance on pesticides for control of all pests in berries is no longer possible => **ALTERNATIVE METHODS ABSOLUTELY NECESSARY!**
- We suggest that the potential of epn's in the control of *B. tomentosus* and *A. rubi* should be explored
- *A. rubi* (blossom weevil): test 2 epn species (*S. carpocapsae* and *H. megidis*) against the different life stages (incl adults) in lab and simulated field tests?
- *B. tomentosus* (raspberry beetle): test field collected larvae and pupae to find most susceptible stage to epn infection (*H. megidis*)?