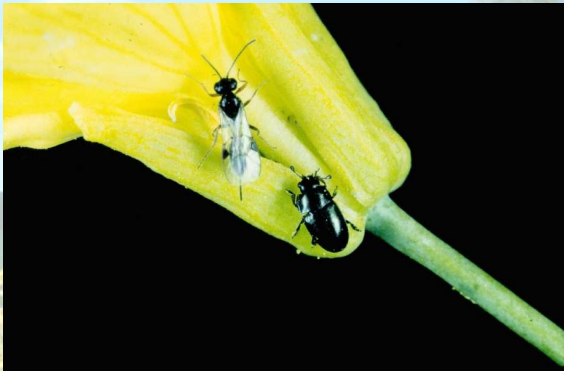
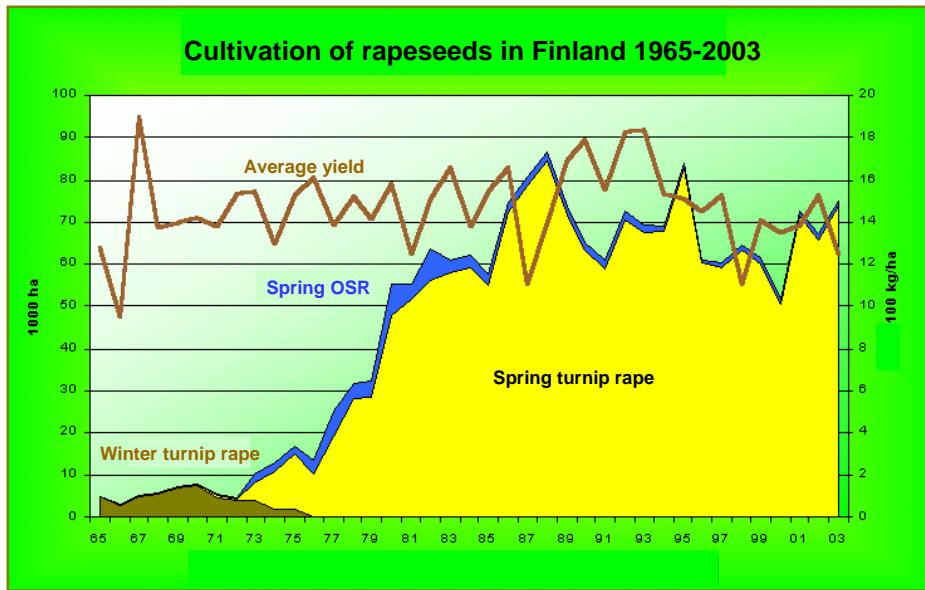


Exploitation of parasitoids of the pollen beetle

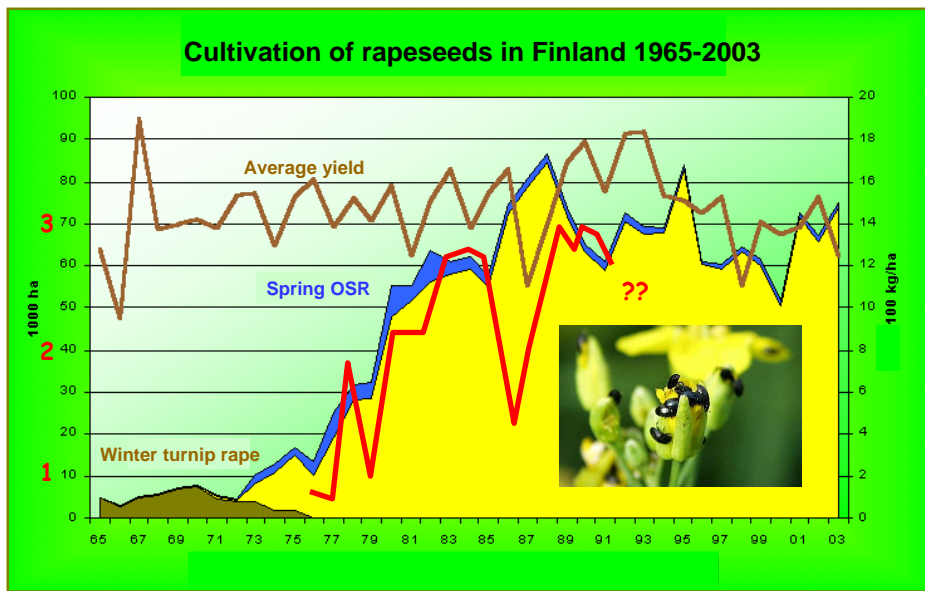
Heikki M. T. Hokkanen
Department of Agricultural Sciences
University of Helsinki, Finland



The context:



The problem:



— = severity index of pollen beetle attack

Natural enemies of the pollen beetle in Finland

Predators



Parasitoids



Pathogenic fungi



Pathogenic nematodes



Nosema

Natural enemies of the pollen beetle in Finland

Conservation BC?



Classical introductions?

Inundative applications?

Natural enemies of the pollen beetle in Finland

Conservation BC?



IPM?

Push and pull?



Classical introductions?

Inundative applications?

Parasitoids



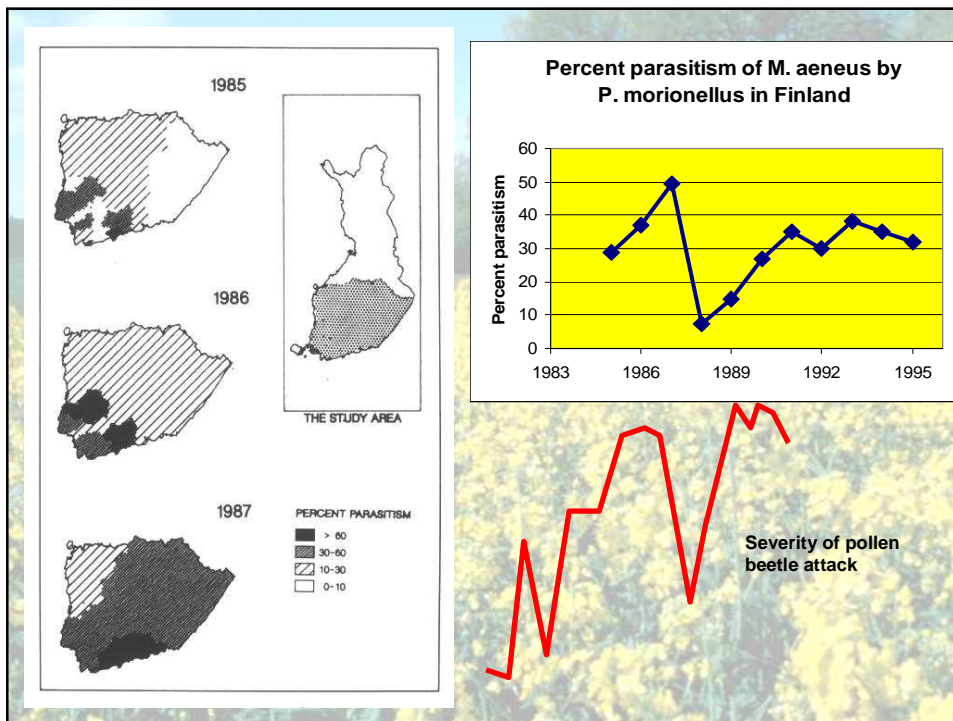
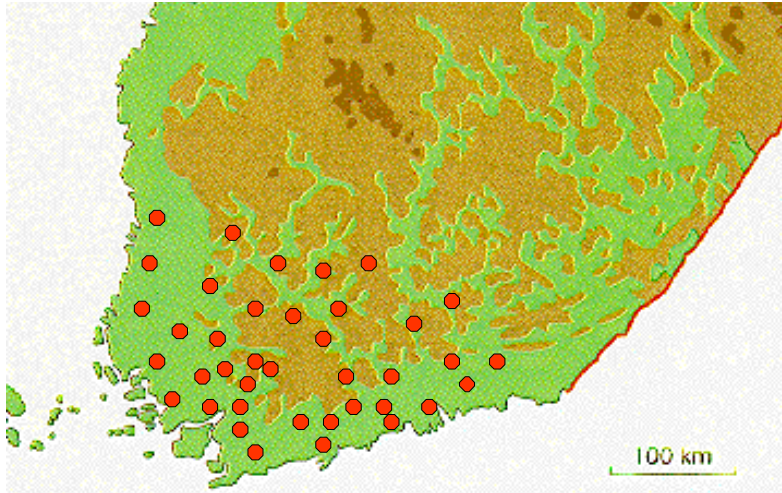
Two species:

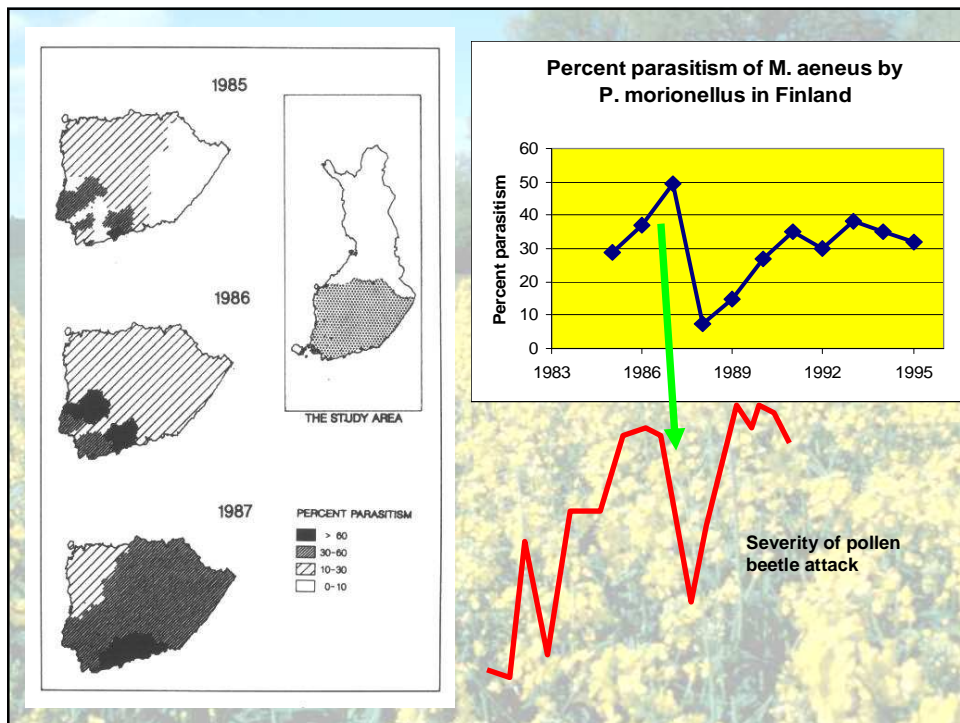
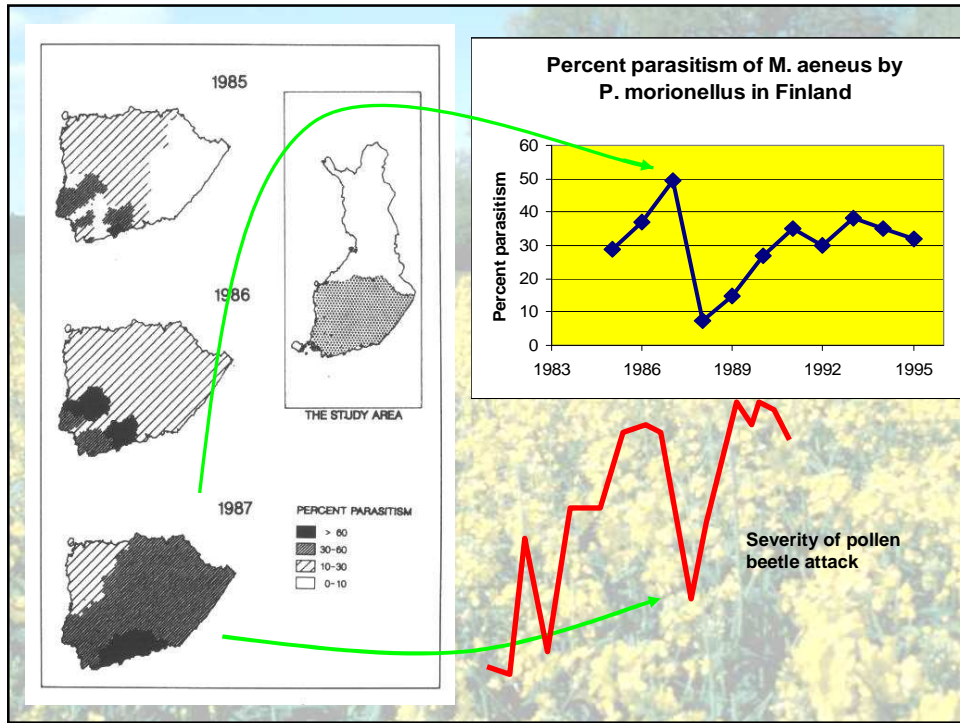
Phradis morionellus (Ichneumonidae)
Diospilus capito (Braconidae)

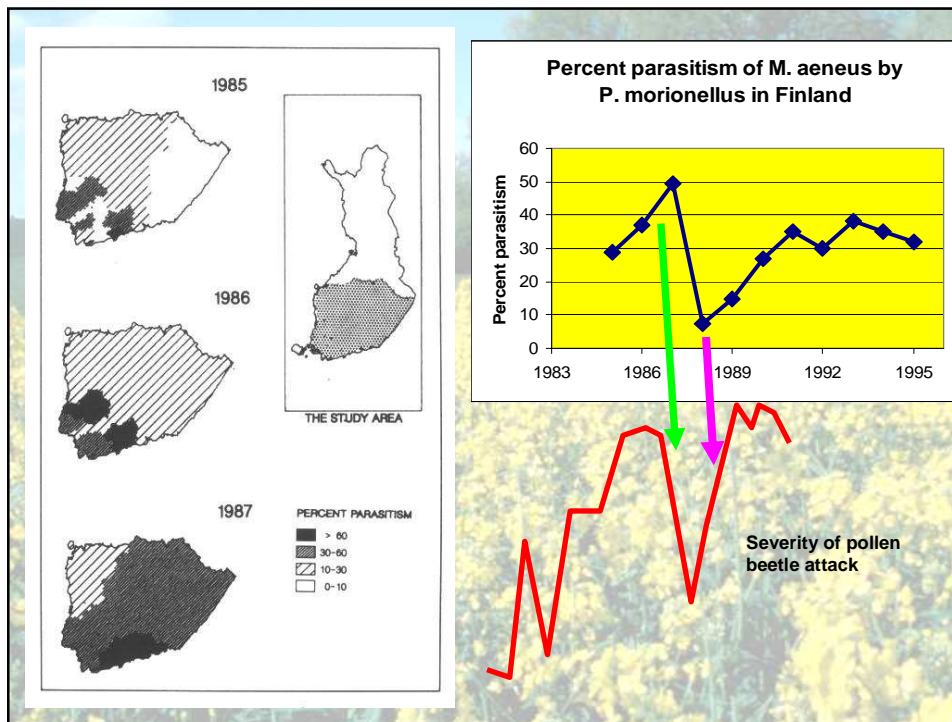


Annual %-parasitism data collected from 1985-1995 (11 years) from 35-70 locations in Finland, combined initially to about 18 'regions' for analysis

Detailed data from 13 locations from 1990-1995 (6 years) for % parasitism and density of host larvae



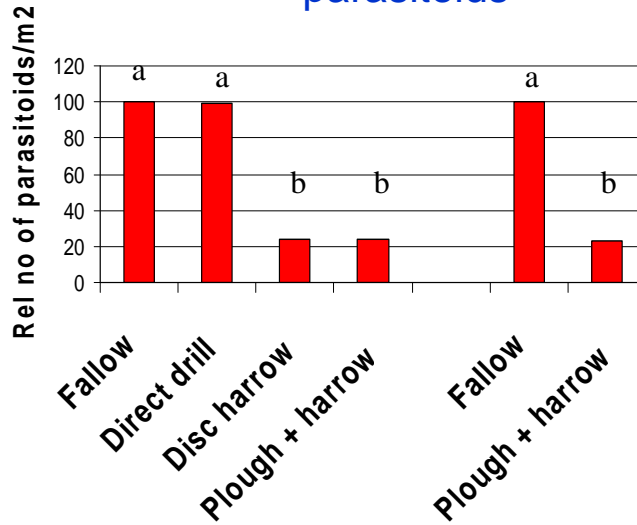




Main factors contributing to efficacy of *Phradis*:

- **soil management** AFTER OSR harvest: mechanical killing of 75% of the population
- **insecticide sprays**:
 - in rapeseed [OK before mid-June in Finland]
 - in crop which follows rapeseed in rotation
- **physical arrangement** of crop rotation: the closer the next year's rapeseed crop is, the better [less 'migrating losses']

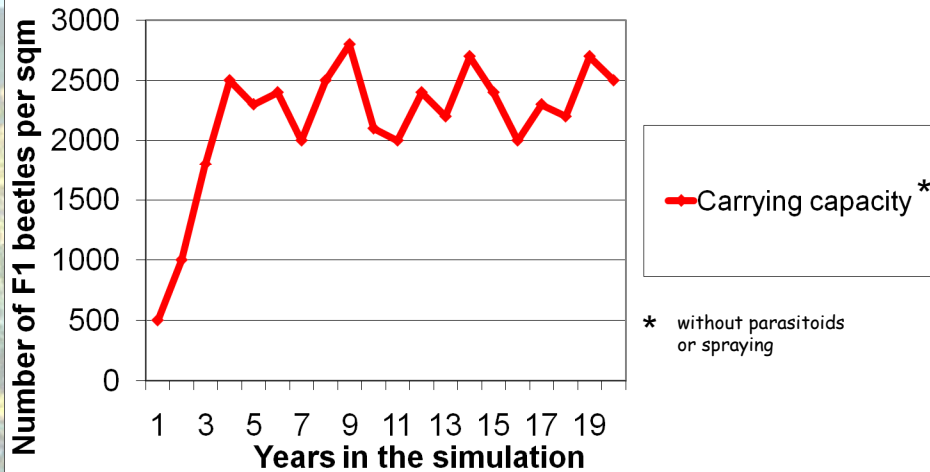
Effect of soil tillage on emergence of parasitoids



Nilsson 1985

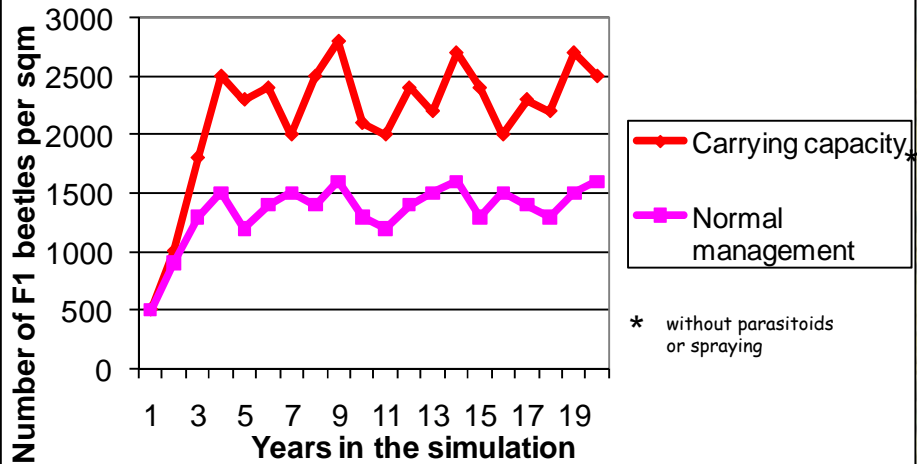
Hokkanen et al. 1988

Simulation model results: *M. aeneus* F1 generation numbers produced with different management strategies

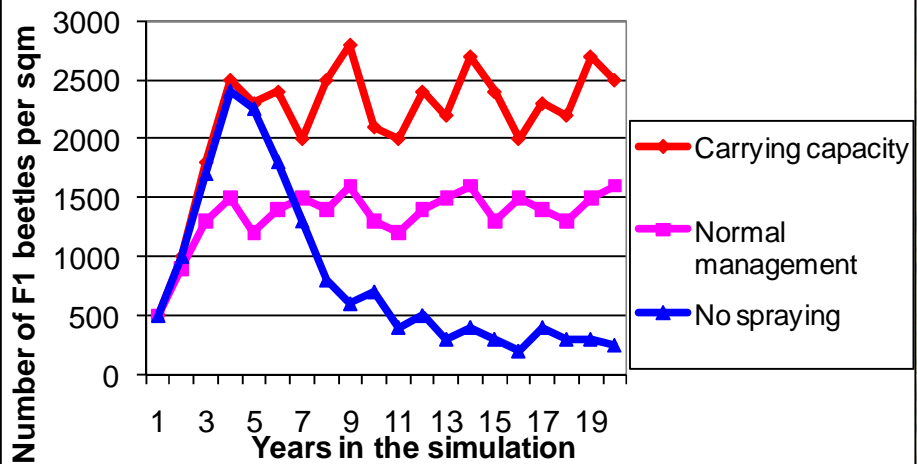


* without parasitoids or spraying

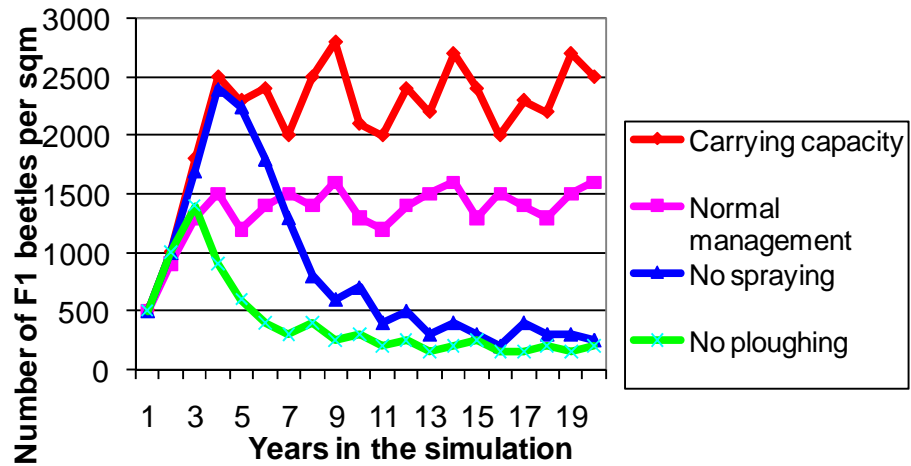
Simulation model results: *M. aeneus* F1 generation numbers produced with different management strategies



Simulation model results: *M. aeneus* F1 generation numbers produced with different management strategies



Simulation model results: *M. aeneus* F1 generation numbers produced with different management strategies



After OSR harvest: **DO NOT PLOUGH** or **TILL** the soil before middle of next summer !!

You can: direct drill, fallow, grow a catch crop ...

Also: **DO NOT** kill your parasitoids by spraying your OSR crop, NOR in the crop which follows

Direct drilling experiment after rapeseed in Finland, late 1980s

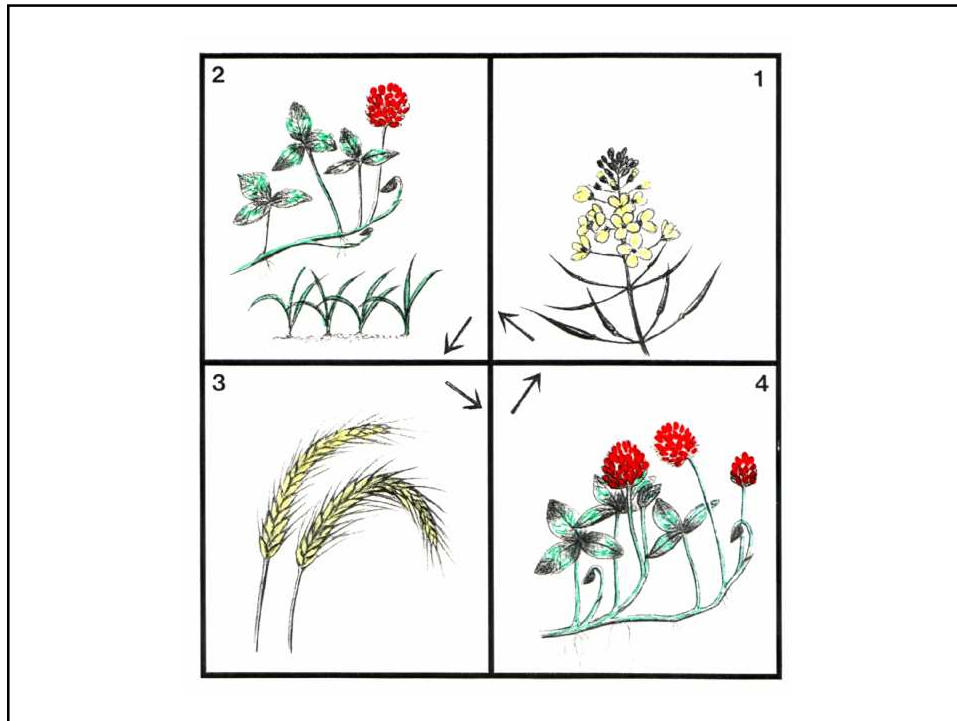


To maximise bio-control by pollen beetle natural enemies, we should:

- not plough the field after OSR harvest (parasitoid management)
- not spray insecticides on OSR, nor on the following crop (parasitoid management; *Nosema* enhancement)
- undersow or intercrop with clover (predator enhancement; alternative hosts for nematode replication)
- re-introduce insect pathogenic fungi and nematodes to our OSR cropping systems (inundative, inoculative applications)
- knock-down pollen beetle peaks using trap crops and honey-bee mediated, targeted application of EPF
- re-introduce *Nosema meligehti* (inoculative or classical introductions)



White clover undersown in spring turnip rape helps to support insect pathogens via providing alternative hosts also after rapeseed harvest; it also helps to control weeds and to fix nitrogen, and can be grown in the following year as a cover crop (or honey crop), serving also for conservation of parasitoids of OSR pests (no tillage).



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CONCLUSION

Permanent, effective biological control of the pollen beetle can be achieved in Northern Europe by a skillful utilization of local functional biodiversity:

- possibly by the parasitoids alone,
- but at least with some further help from (i.e., proper management of) the other naturally occurring antagonists.

Numerous collaborators have helped with these studies over the past decades at the University of Helsinki and at the Agricultural Research Centre of Finland

**THANK YOU FOR
YOUR ATTENTION**

