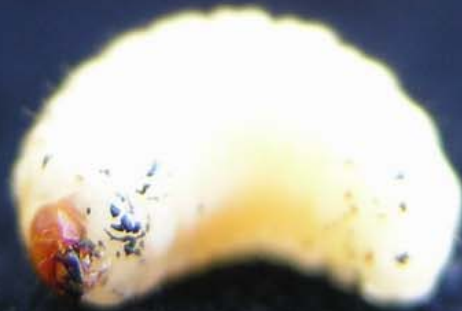


Biocontrol potential of entomopathogenic nematodes against chestnut pests

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- Pests, damage & biology
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- EPN screening
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Pests

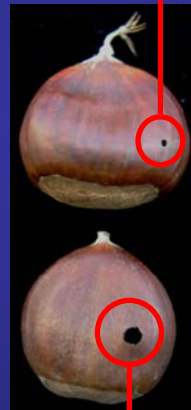
Chestnut weevil
(*Curculio elephas*)



Chestnut tortrix
(*Cydia splendana*)



small exit holes



big exit holes

other tortrix species:
(*C. fagiglandana*, *Pammene fasciana*)

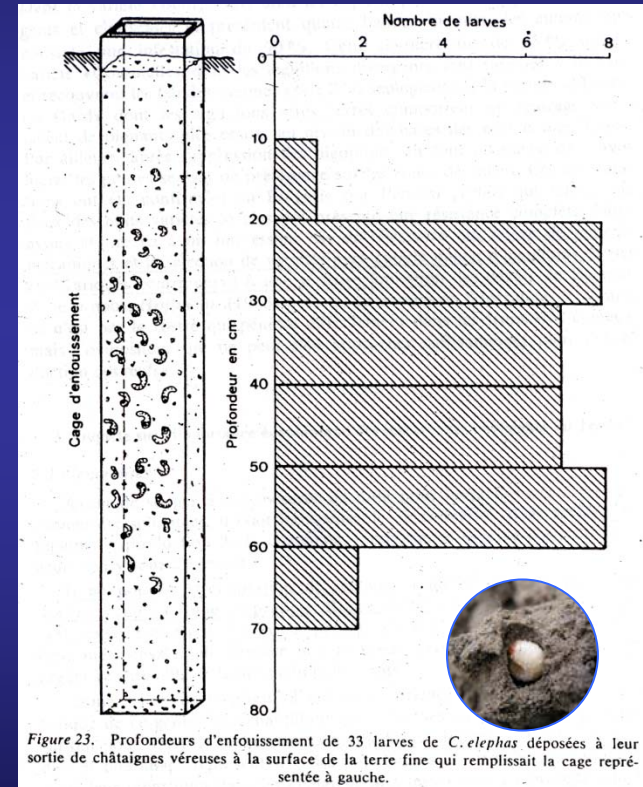


Chestnut weevil

BIOLOGY

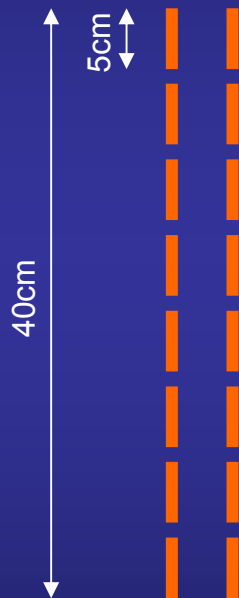
- univoltine
- adults (August-October)
- oviposition (from end of August; 25-50 eggs per female; one egg per fruit and female; up to 10 larvae per fruit)
- larval development (ca. 40 days; larval exit from fruits starts when fruits drop to the ground → October – December)
- diapause (in earth cells at depth of 10-70 cm)
- prolonged diapause (up to 3 hibernations)

Vertical distribution of diapausing larvae in the soil:



Bovey et al. 1975

Grub velocity



Experiment

4 PVC tubes (Ø: 7cm, length: 40cm (8x5cm))

→filled with sandy soil

40 larvae per tube (total 160 larvae tested)

Temperature: 15°C

Check vertical distribution after 14, 24, 38, and 5

Calculation of mean grub velocity:

4.7± 2.75 mm/h

➔ most larvae will reach their final depth within 3-6 days after entering the soil

Natural occurrence of EPNs in a chestnut forest in Ticino (Switzerland)



Galleria baiting method:

50 soil samples (200 ml each)
>80% contained EPNs

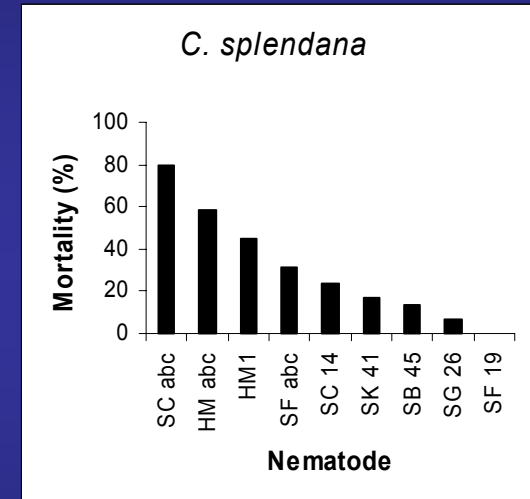
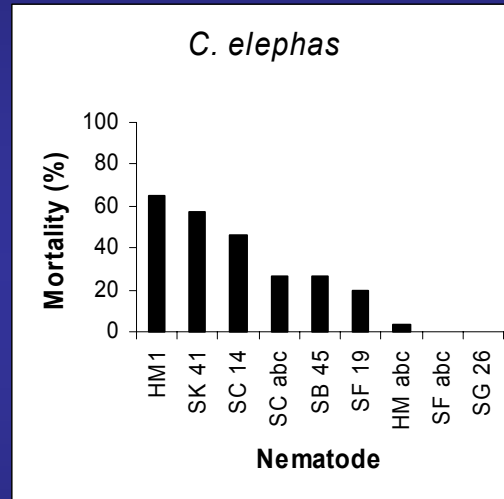
nematodes found:

Steinernema feltiae (>99%)
Heterorhabditis sp. (unidentified)

EPN screening

Bioassay

Multiwell-plates, 21°C,
75% RH, permanent
darkness, 7 days
Dosage: **100 IJ/host**
n=5 (30 individuals)



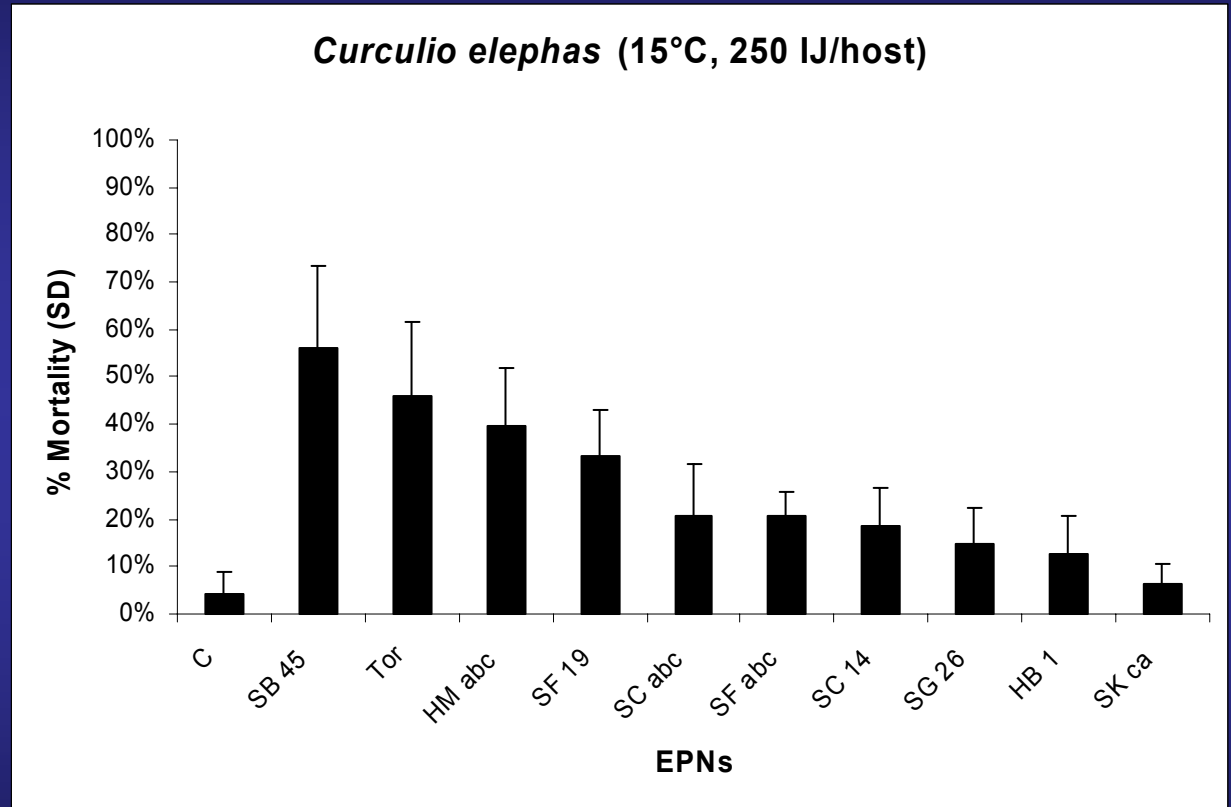
HB= *H. bacteriophora* SF= *S. feltiae*
HM= *H. megidis* SG= *S. „glaseri“ type*
SB= *S. bicornutum* SK= *S. kraussei*
SC= *S. carpocapsae*

EPN screening

Bioassay

Multiwell-plates, sandy soil,
15°C, 75% RH, permanent
darkness, 7 days

Dosage: **250 IJ/host**
n=4 (48 individuals per
treatment)



HB= *H. bacteriophora* SF= *S. feltiae*
HM= *H. megidis* SG= *S. glaseri* type
SB= *S. bicornutum* SK= *S. kraussei*
SC= *S. carpocapsae* Tor= *S. feltiae* from Ticino CH

Semifield experiments with *S. carpocapsae*



2003/04

PVC tubes (\emptyset :10cm, 40cm length)
filled with soil from orchard

EPN: *S. carpocapsae* commercial strain
(Carponem) from Andermatt Biocontrol AG
Dosage: 16'000 IJ/Tube [\sim 2Mio IJ/m²] in
200 ml of water

Treatments: **A** (application in autumn), **S**
(spring application), **A+S** (autumn + spring;
2 x 2 Mio IJ/m²) and Control (water only)

Replicates: 6

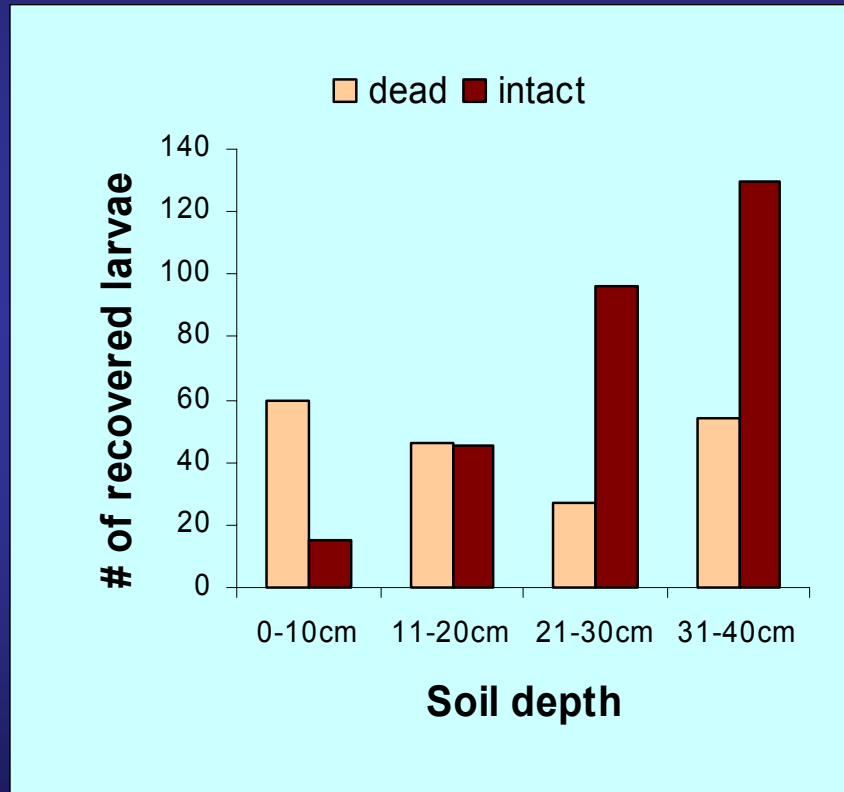
Nmb of larvae per tube: 53

Inoculation period: 20 days

Evaluation: 10 days after final inoculation

Results 2003

Vertical distribution of larvae in tubes



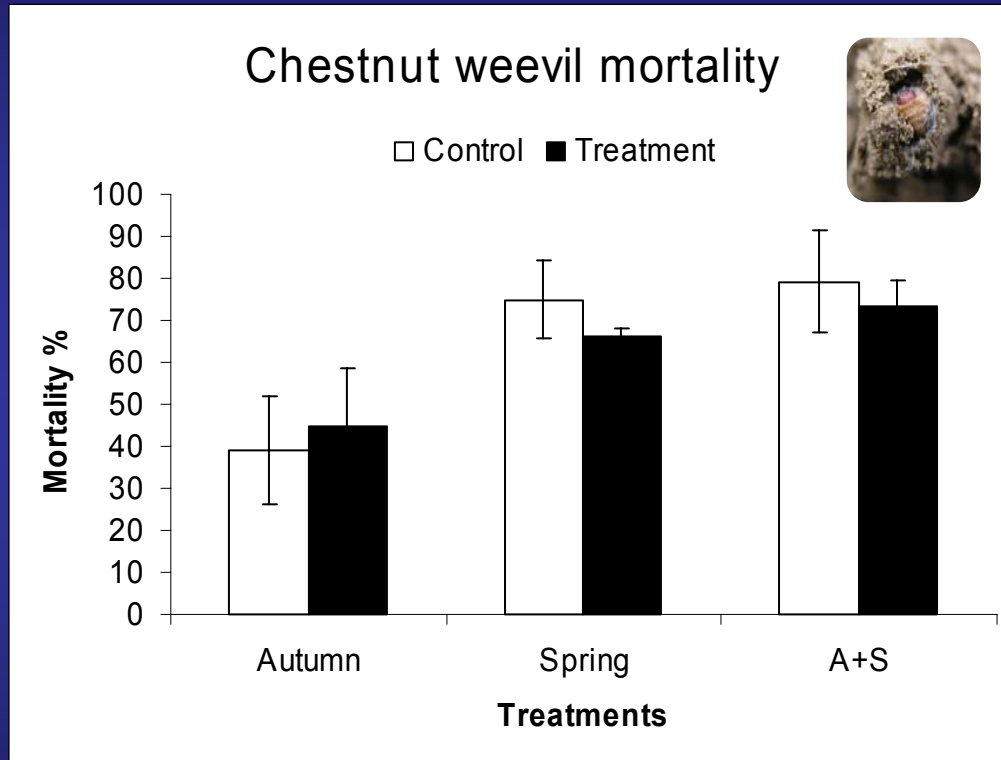
Treatment:

A (autumn application)

Number of recovered larvae:

n=473 (74.4%)

Results 2003



Total number of weevils used in the experiment: 1272

Percentage of weevils recovered in tubes:

Autumn: **74.4%**
Spring: **40.1%**
A+S: **31.9%**

No significant differences in mortality between treatments and control!

Semifield experiment 2004

Modifications from 2003 series:

EPNs used (Treatments):

S. feltiae (Andermatt Biocontrol)

S. krausse (Syngenta Bioline) → cold active strain

H. megidis (Andermatt Biocontrol)

Control: Water only

Nematode concentrations: 2 (or 4) Mio IJ/m²

Nmb of larvae per tube: 52

Replicates: 6

Inoculation period: 20 days

Evaluation: 3 weeks after final inoculation

Application time: autumn only (5.10.2004)

Application types: TOP or TOP + BOTTOM

Application types

TOP (1x)



TOP (2x)

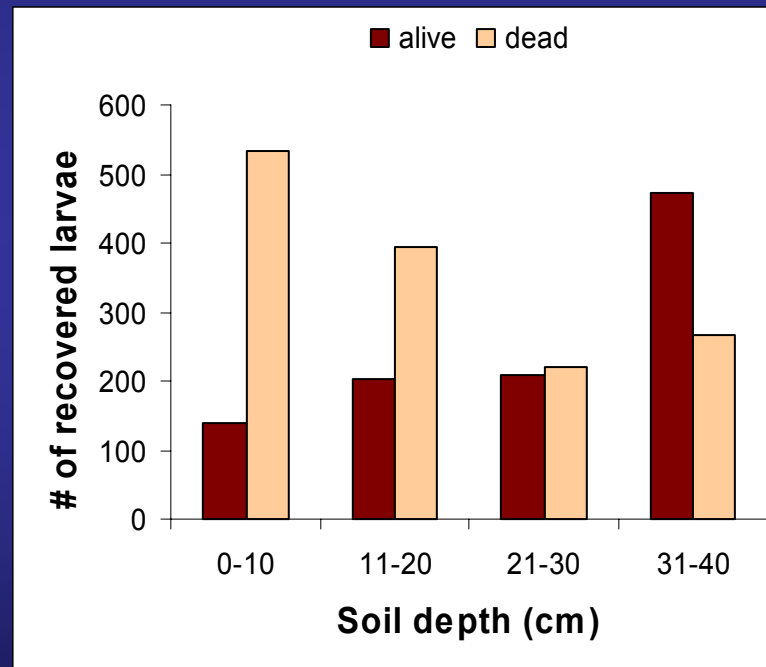


TOP (1x) + BOTTOM (1x)



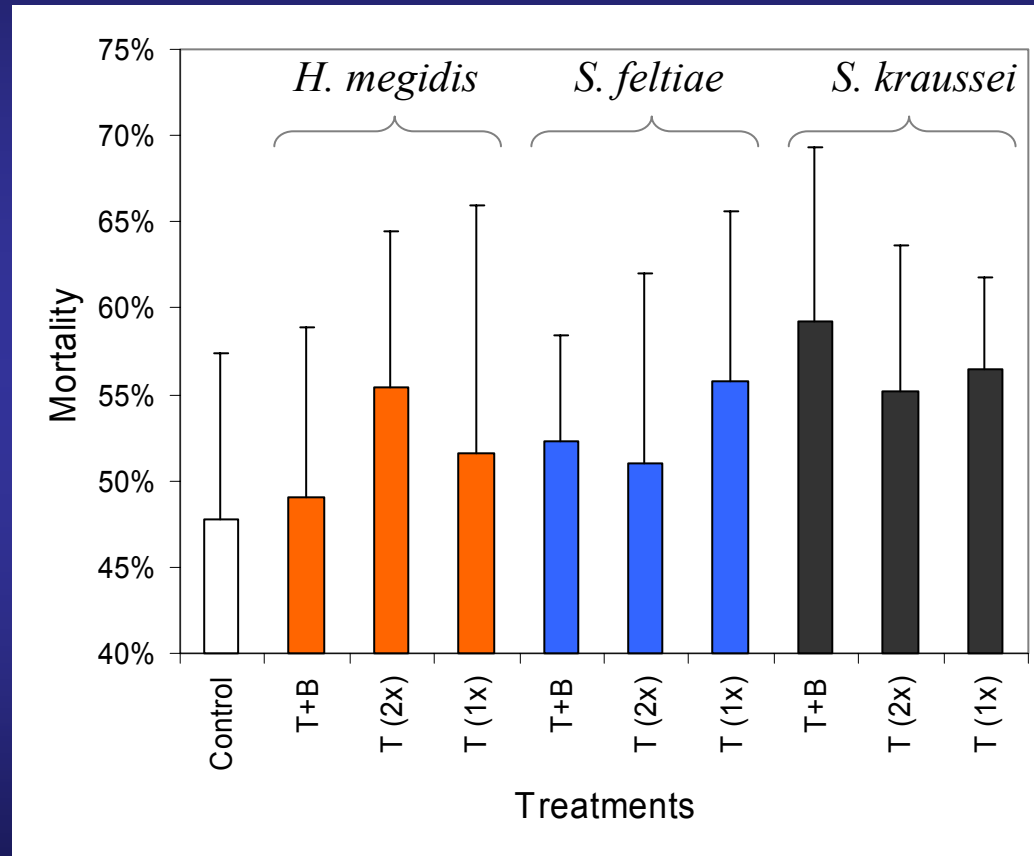
Results 2004

Vertical distribution of larvae in tubes



Number of recovered larvae:
2240 (78.2%)

Results 2004



n.s.
Anova: $p > 0.05$

Conclusions

Successful control of chestnut weevils with EPNs appears to be strongly limited...

...since weevil larvae enter the soil when soil temperatures and nematode activity are rapidly decreasing (October-December)

...because weevil larvae reach soil depths (25-50cm) for diapause that are unfavorable for EPNs

Perspectives

Select strains that:

... are active at relatively low temperatures (?)

... follow host down to increased soil depths

Test other release systems

Entomopathogenic fungi

New approaches

Thank you

