

# Persistence and spread of exotic and indigenous nematodes in Irish coniferous forests

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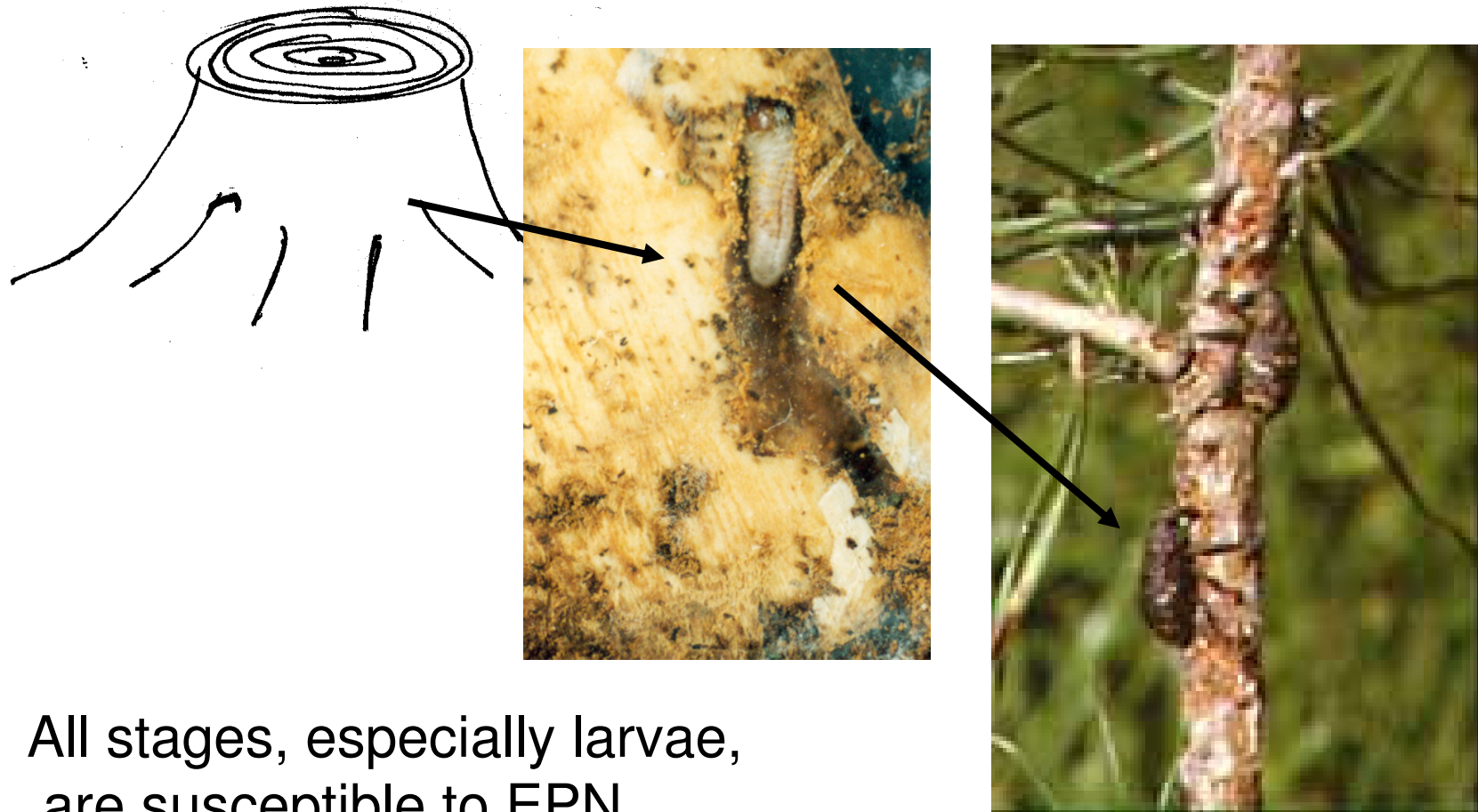
Ollscoil na hÉireann Má Nuad

The target:  
The large pine weevil *Hylobius abietis*  
attacks seedlings on reforestation sites\*



\*clear-felled, then replanted

# Pine weevils develop in conifer stumps, adults emerge and damage seedlings



All stages, especially larvae, are susceptible to EPN,

# Which EPNS to trial v pine weevil?

- Performance
  - expected from foraging strategy (cruiser)
  - demonstrated in bioassay/field (Scotland)

Other considerations:

- **Indigenous species** preferred unless exotic performs better
- **Commercially** available

# Species and strains tested

*Heterorhabditis downesi* K122

*Heterorhabditis megidis* UK211 comm product

*Steinernema feltiae* 4CFMO

*Steinernema feltiae* EN02 comm product

*Steinernema carpocapsae* All comm product

- Range of “foraging strategies”  
“cruiser”/”intermediate”/”ambusher”
- Indigenous and exotic

# Field trials against weevils in pine stumps

clearfell site



nematodes applied around stumps



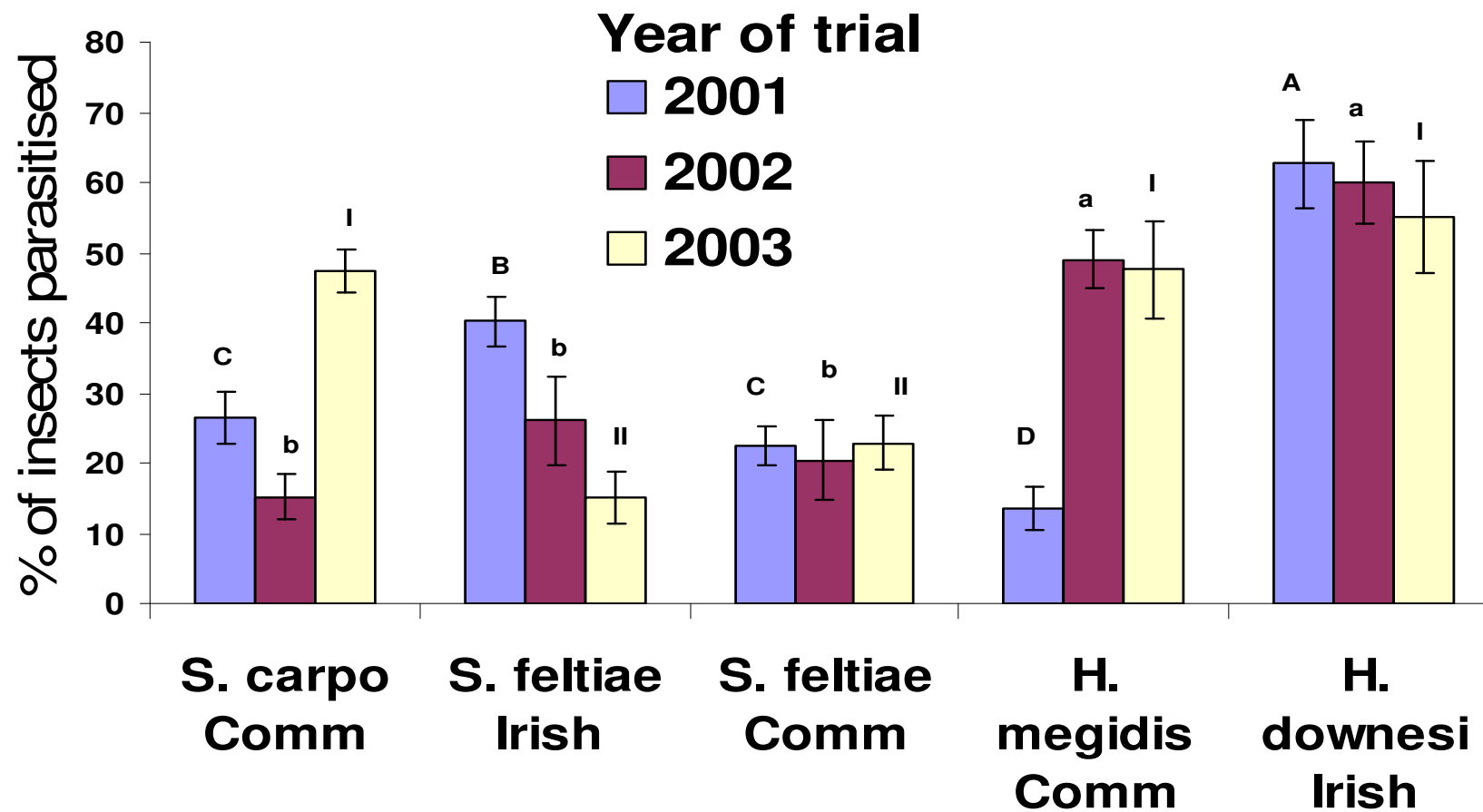
Assessment:  
parasitised weevils  
counted in some stumps,

emerging adults  
collected from other  
stumps



# Field trials of EPN against pine weevil:

*H. downesi* best (Dillon et al., *Biological Control*, in press)



# Control

- *H. downesi* is best species of those tested against pine weevils in stumps
- **but:** even the “ambush forager”  
*S. carpocapsae* parasitises weevils in pine stumps up to 40 cm from point of application (horizontally and vertically) and sometimes performed as well as *H. downesi*

# Persistence and spread

Will applied species/strains remain on site  
after pest is gone?

Predictions based on prior knowledge of  
EPN biology:-

# *Heterorhabditis downesi*

Common in Ireland but  
exclusively in coastal,  
sandy soils, beetle  
larvae amongst  
natural hosts



Expected to disappear  
when weevil hosts are  
depleted-

Predicted not to  
establish



## *H. megidis* (exotic)

- Similar ecology and biology to *H. downesi*- also expected to disappear once hosts are depleted-
- Predicted not to establish

## *S. carpocapsae* (exotic)

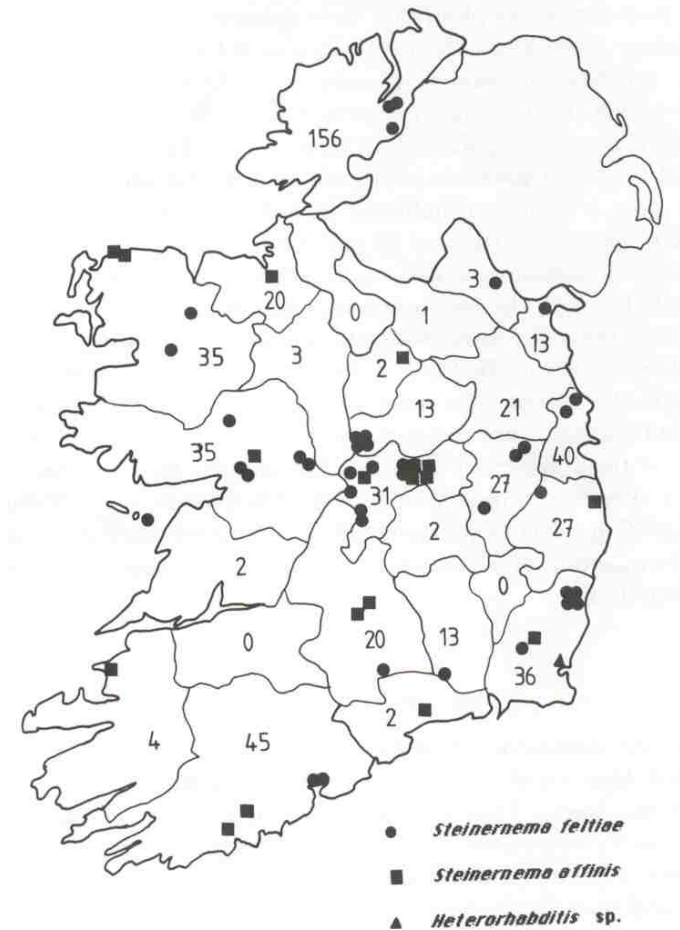
- Never found in Ireland
- Britain: Following an epizootic in Wales (Georgis & Hague, 1984), disappeared from Britain;
- Suitable hosts/conditions for establishment not present in these islands?
- Predicted not to establish

# *S. feltiae*

Widely distributed in  
Ireland

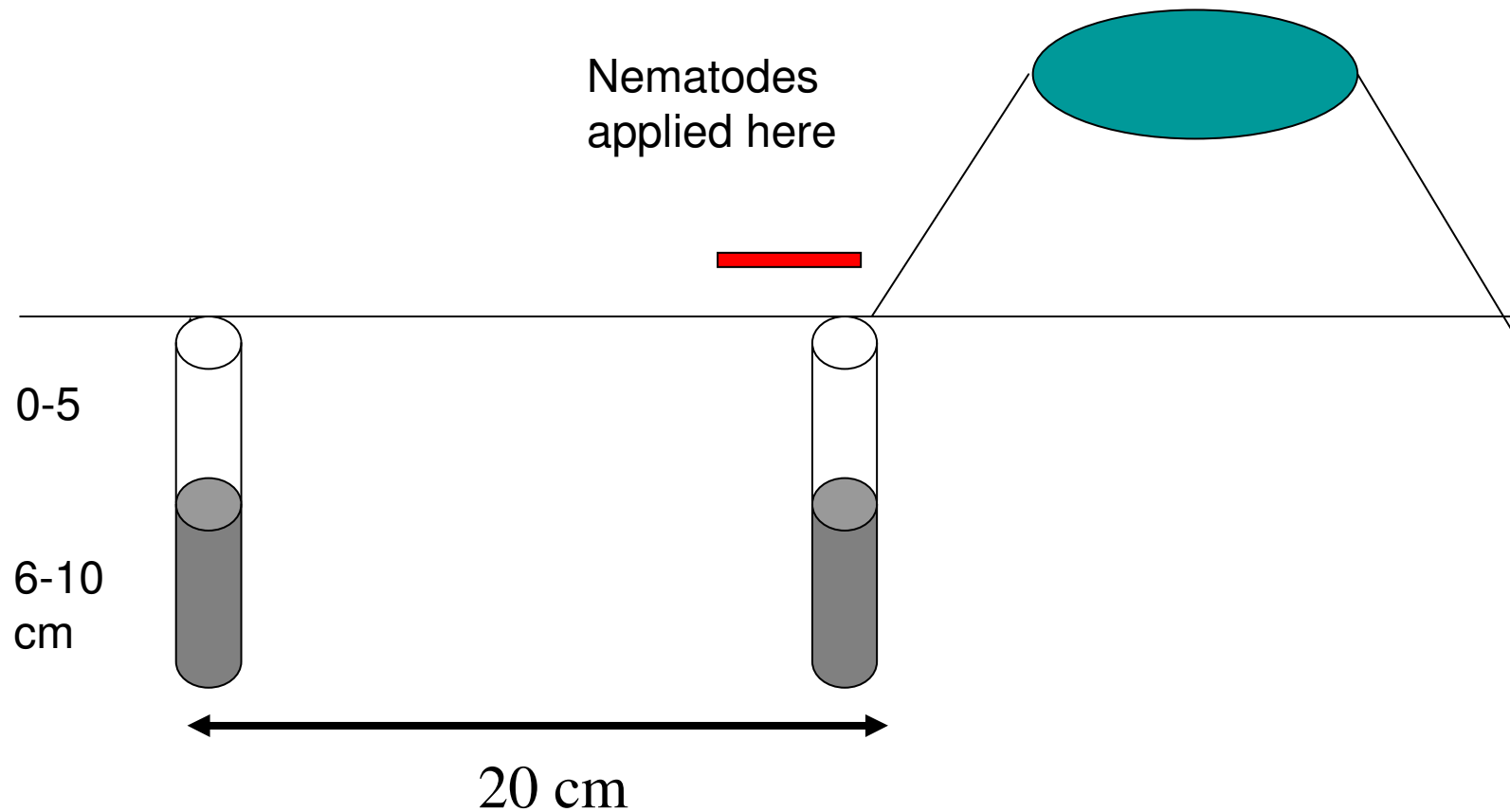
Recovered from  
coniferous forests, both  
mature and replanted  
(8-9% of sites) (Dillon, 2003)

Might establish

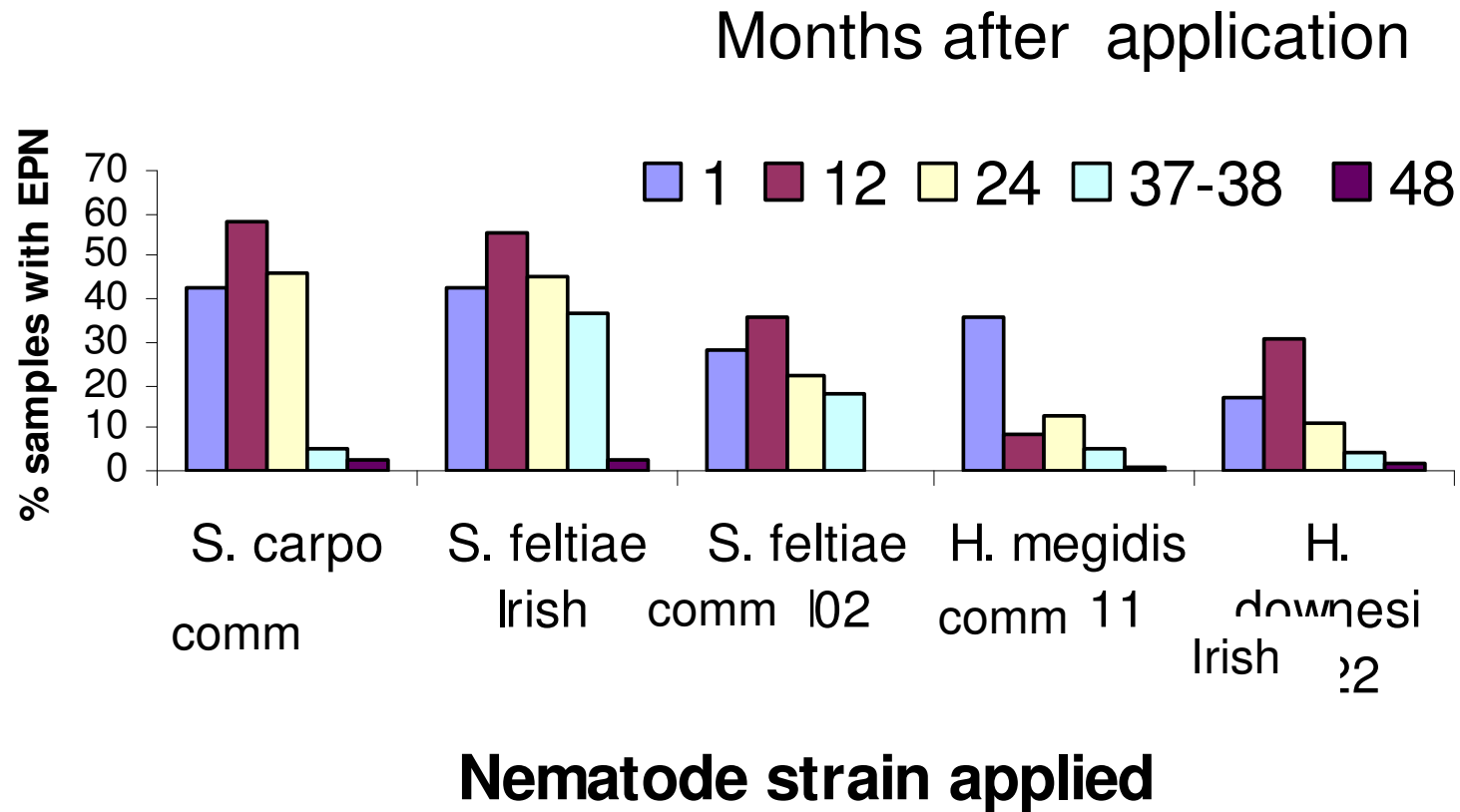


(Griffin et al. 1991)

# Persistence of applied nematodes monitored by baiting soil cores from around stumps

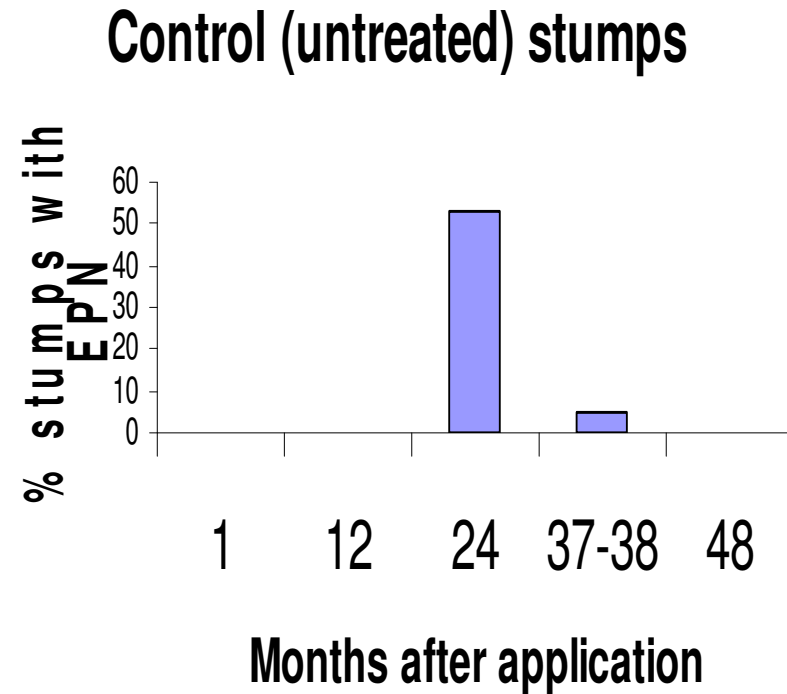


# Percentage of soil samples with EPN increased after 1 year (recycling?) and then declined



# Spread

- EPN at control (untreated) stumps within plots by 24 months
- No EPN outside plots  
Samples (not at stumps) at 1, 5 and 10 m from experimental plots:



# Persistence

- After 48 months only *S. feltiae* found-
- *S. feltiae* recovered from stumps treated with
  - *S. feltiae* Irish (4)
  - *S. feltiae* Comm (0)
  - *S. carpocapsae* (4)
  - *H. downesi* (2)
  - *H. megidis* (1)
  - Control (0)

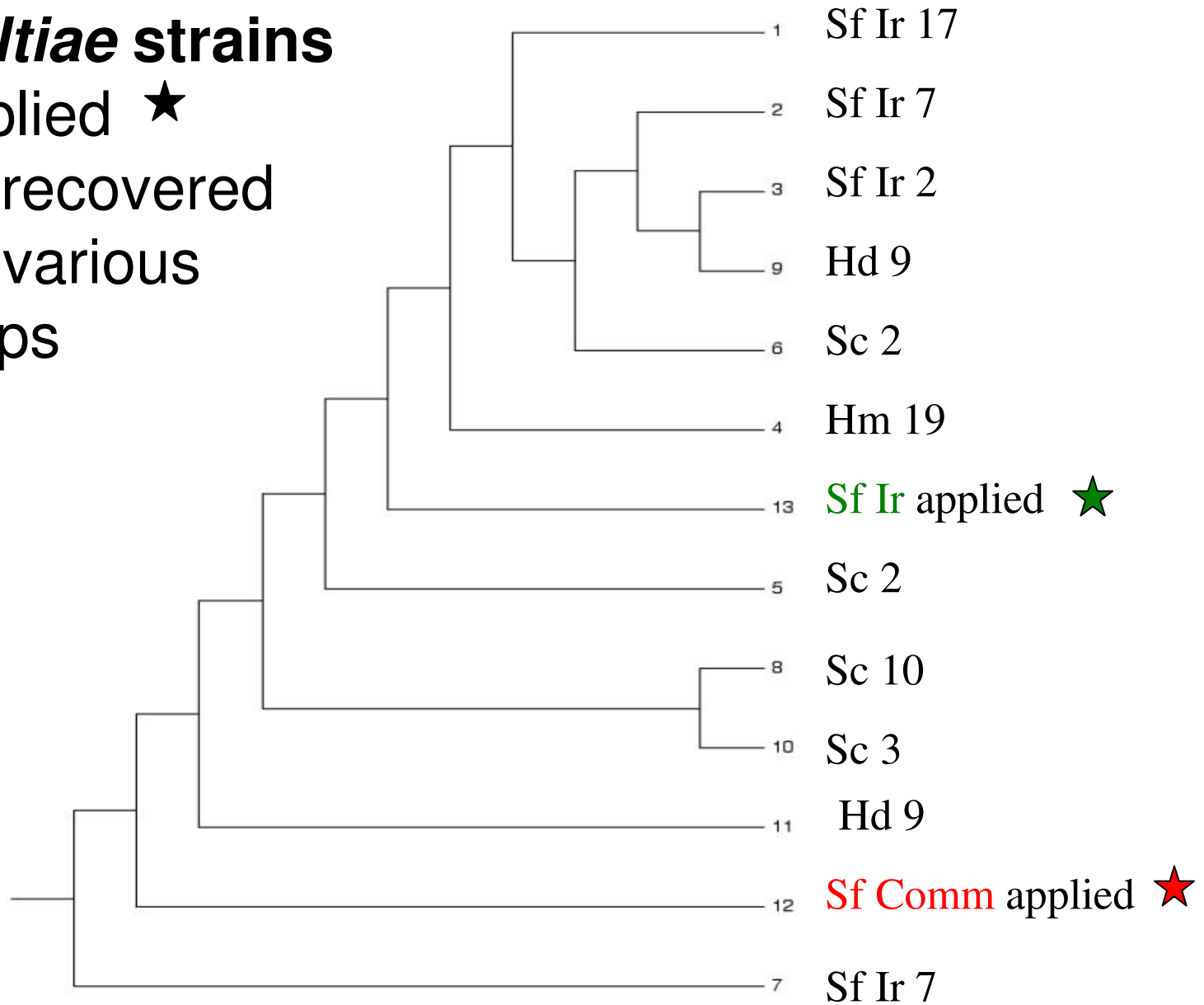
Which *S. feltiae* (4CFMO or All strain) was recovered after 48 months?

- Used AFLP (amplified fragment length polymorphism) on applied and recovered strains
- AFLP is commonly used for fingerprinting strains of organisms including nematodes
- AFLP uses total genomic DNA, screens several loci simultaneously for polymorphisms

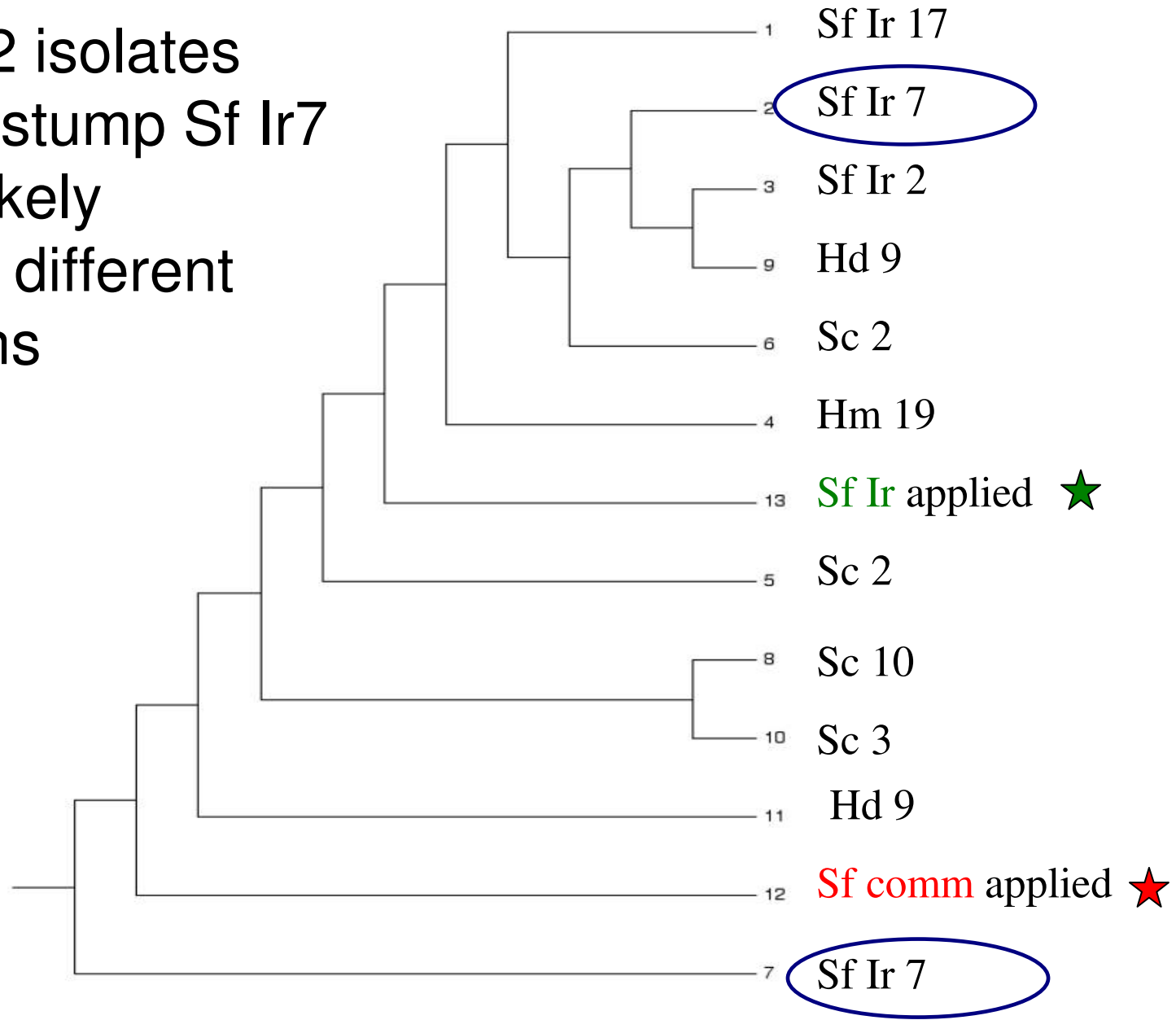
# ***S. feltiae* strains**

2 applied ★

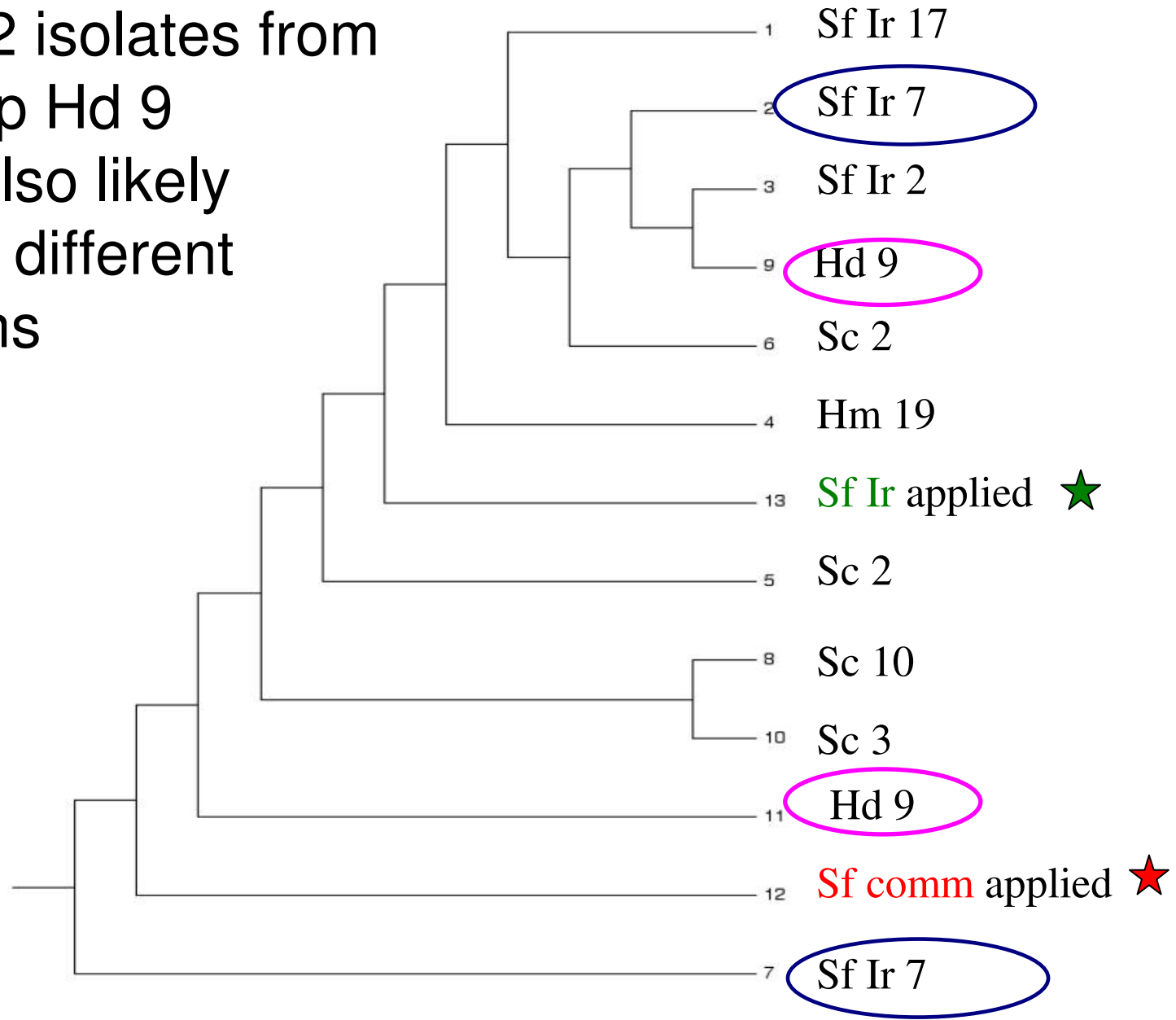
+ 11 recovered  
from various  
stumps



The 2 isolates  
from stump Sf Ir7  
are likely  
to be different  
strains



The 2 isolates from stump Hd 9 are also likely to be different strains



# Conclusions

- As predicted, *H.downesi*, *H. megidis* and *S.carpocapsae* were not detected on site after 4 years when all weevils were gone. Only *S. feltiae* established- possibly both the Irish and the commercial strains- probably using alternate hosts
- There was some lateral spread of EPN to untreated control stumps, but not outside treated areas
- Background knowledge of biology and biogeography of EPN can give useful predictions about performance and establishment

# Acknowledgements

Coillte for experimental sites

