

Establishment and persistence of entomopathogenic nematodes in conventional and organic agriculture



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Material and Methods

- ⌘ Application at 0.5 million DJs *H.b./m²*, 1200 litre water/ha, application area of 500 x 5 m in conventional and 80 x 3 m in organic fields
- ⌘ DJ quality checked before and after application
- ⌘ Application density checked with 10 petri dishes distributed over 5-10 m in the field
- ⌘ Soil and air temperature recorded
- ⌘ Collecting soil samples: Soil borer of 2 cm diameter x 10 cm depth. 50 soil samples/field. Each sample contains nearly 40 g from the area of 3 cm².
- ⌘ EPN were trapped with 2 *G. mellonella* larvae at 25 °C for 3 days. This procedure was repeated twice.
- ⌘ No endemic population of *H. bacteriophora* in all samples

Potato and Lupine



Results in organic agriculture



- *Application time: 08.07.03, 15:00 hours*
- *The first soil samples: 20.07.03*
- *The weather: No rain, but cloudy*
- *Soil temperature: 17-18 °C in first 15 cm depth*
- *Air temperature: 25 °C*
- *Height of crops at application: Lupine=90-100 cm, Pea=80-90 cm and Potato=30-40 cm*
- **Endemic EPNs not detected in these fields (n=50)**

Results in organic agriculture

DJ/petri dishes after application in field

Peas:	23.6±6.7 IJs/cm²
Lupine:	3.02±1.8 IJs/cm²
Potato:	42.6±5.3 IJs/cm²
Control:	54.8±11.2 IJs/cm²
(control without plants)	

Results in organic agriculture



Quality Control of DJs:

Survival during application:

Before application: 95.6 % alive

After application: 94.3 % alive

% Efficiency of nematodes against *Galleria* larvae:

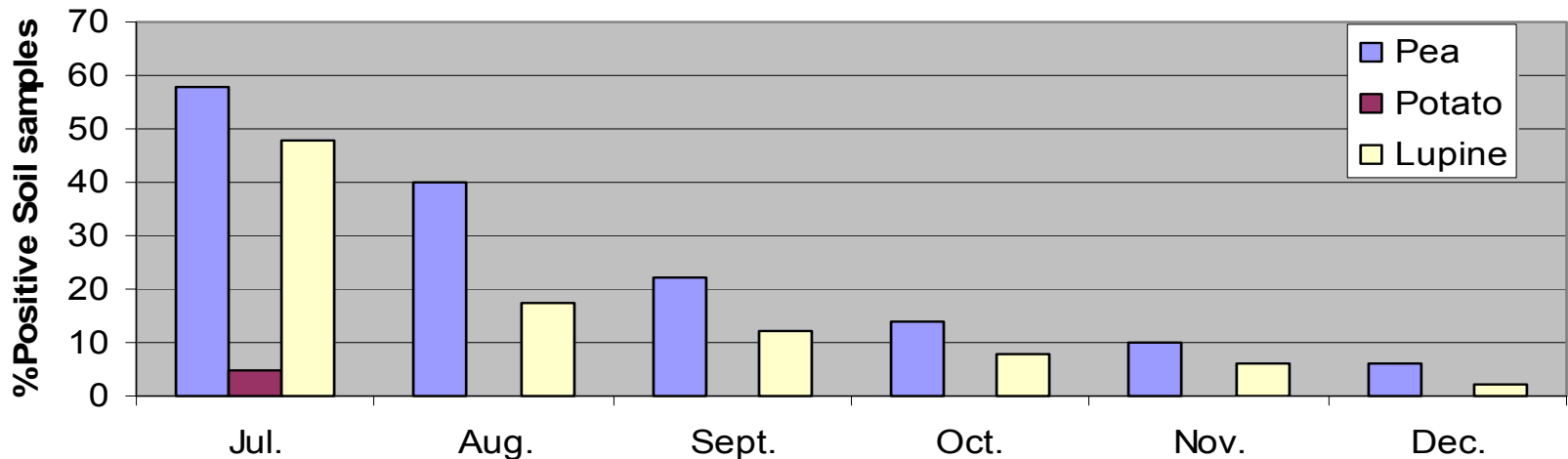
Galleria larvae in sand were infected with 100 IJs (n=10)

Before application: 88.3 %

After application: 85,0 %

Persistence in organic farming

Persistence of *H. bacteriophora* in different cultivations in organic farm (in 2003)



	Pea		Potato		Lupine	
	<u>Soil Temp./High of Plants</u>		<u>Soil Temp./High of Plants</u>		<u>Soil Temp./High of Plants</u>	
Juli:	17-18 °C	80-90cm	19-20 °C	30-40 cm	16-17 °C	90-100cm
Aug:	19-20 °C	80-90 cm	20-21 °C	30-40 cm	18-19 °C	90-100 cm
Sept.:	17-18 °C	Soil	17-18 °C	Soil	17-18 °C	Soil
Oct.:	12-14 °C	Soil	12-14 °C	Soil	12-14 °C	Soil
Nov.:	7-8 °C	Soil	7-8 °C	Soil	7-8 °C	Soil
Dec	2-3 °C	Soil	2-3 °C	Soil	2-3 °C	Soil

Results conventional agriculture



- **Application time: 19.06.03 at 16:30 clock**
- **Weather: Rain at 20:00 of the same evening**
- **The first soil sample: 20.06.03**
- **Soil temp. : 15-16 °C in 15 cm depth**
- **Air temp. : 20 °C**
- **Height of crops at application: Oilseed rape=100-110 cm, Wheat=80-90 cm and Clover=5-7 cm**
- **Endemic EPNs not detected prior to application (n=50)**

Results in conventional farming

DJ/petri dishes after application in field

Canola: 2.28 Wheat: 26.2 Clover: 41.8 DJs/cm²

Quality control of the nematodes:

Before application: 89,4 % alive

After application: 83.6 % alive

% Efficiency in *Galleria* test:

***Galleria* larvae was infected with 100 IJs (n=10).**

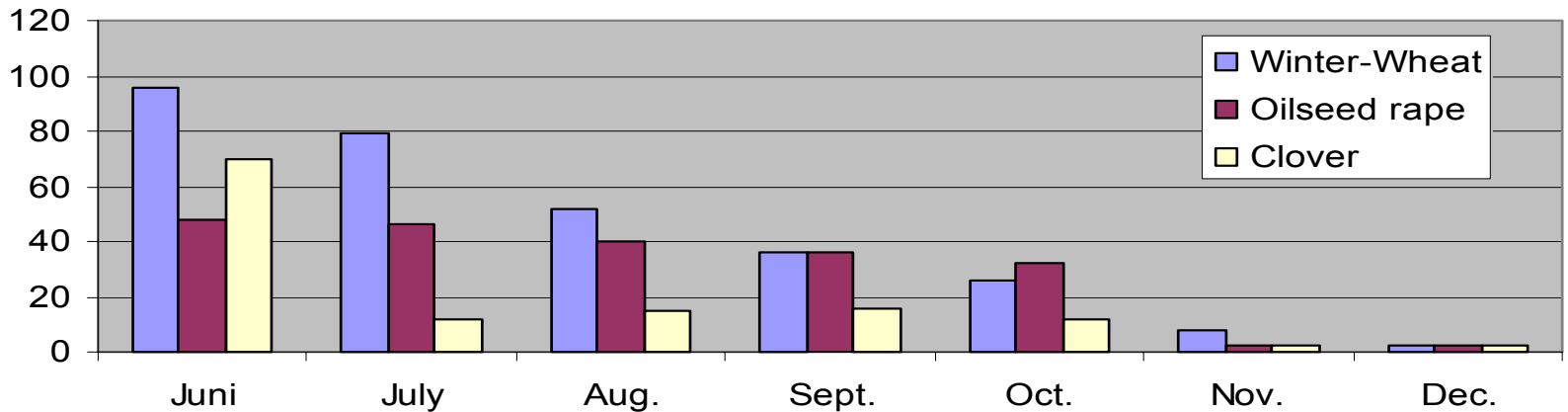
Before application, 89.1 %, After application, 86,9 %

Canola, Pasture and Wheat



Results-Conventional Farming

Persistence of *H. bacteriophora* on different cultivations in conventional farm (in 2003)



Wheat
Soil Temp./High of Plant

Juni:	15-16 °C	70-80 cm
Juli:	17-18 °C	70-80cm
Aug.:	19-20 °C	70-80 cm
Sept.:	17-18 °C	Soil
Oct.:	12-14 °C	Soil
Nov.:	7-8 °C	Soil
Dec.:	2-3 °C	Soil

Oilseed rape
Soil Temp./High of Plant

19-20 °C	100-110 cm
20-21 °C	100-110 cm
17-18 °C	Soil
12-14 °C	Soil
7-8 °C	Soil
2-3 °C	Soil

Pasture
Soil Temp./High of Plant

16-17 °C	5-7cm
18-19 °C	5-7 cm
17-18 °C	5-7 cm
12-14 °C	5-7 cm
7-8 °C	5-7 cm
2-3 °C	5-7 cm

***H.b.* and *S. f.* in clover in October 2001**



Weather: No rain, but cloudy

Soil temp.: 6-7 °C

Appl. time: 23.10.2001, at 05:30

Height of the plants: 6-7 cm

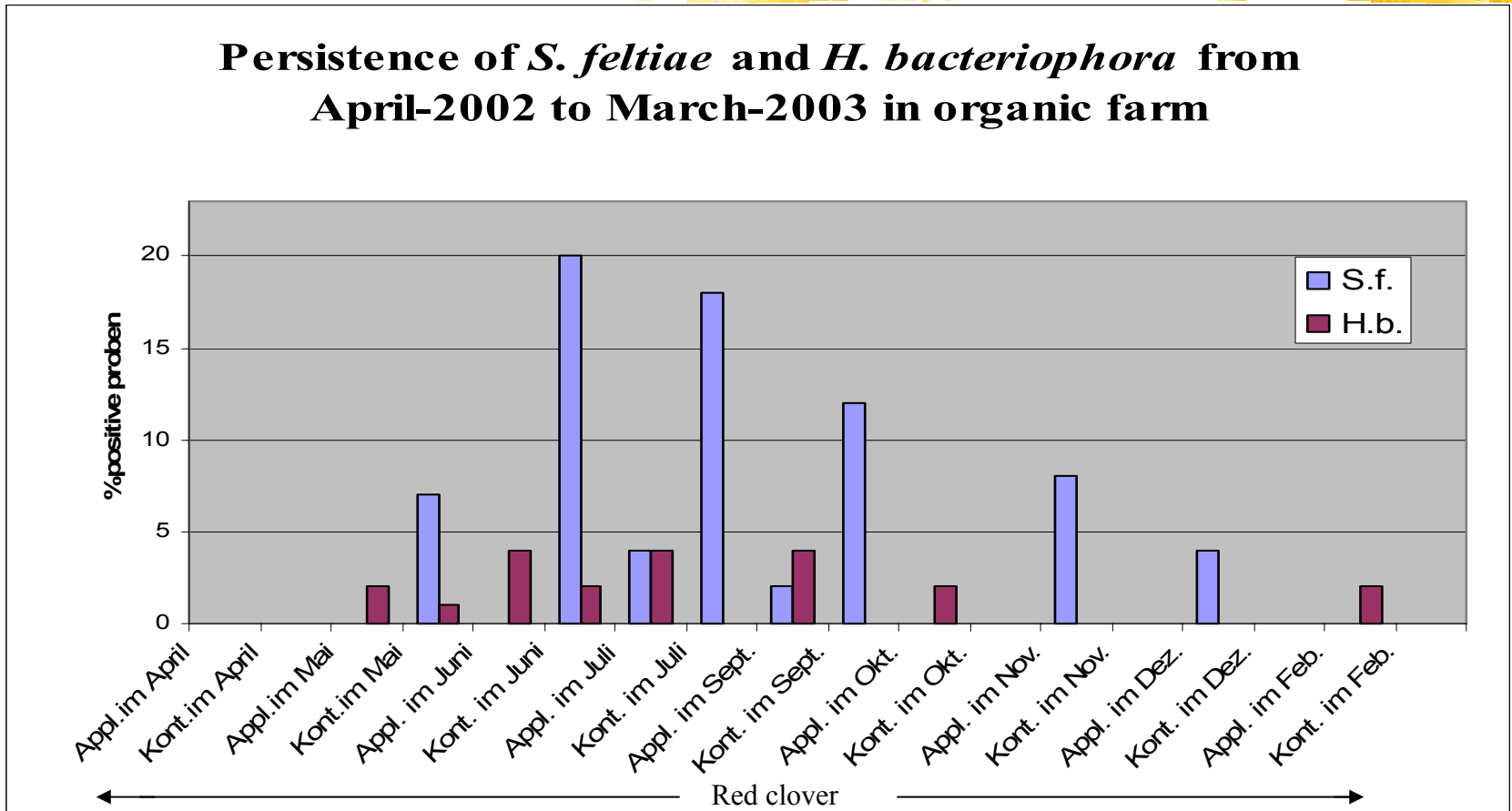
Natural occurrence of EPNs:

H.b.* plot: 10% of soil samples with *S. feltiae* in application and control areas, after application 57% positive samples with *H. bacteriophora

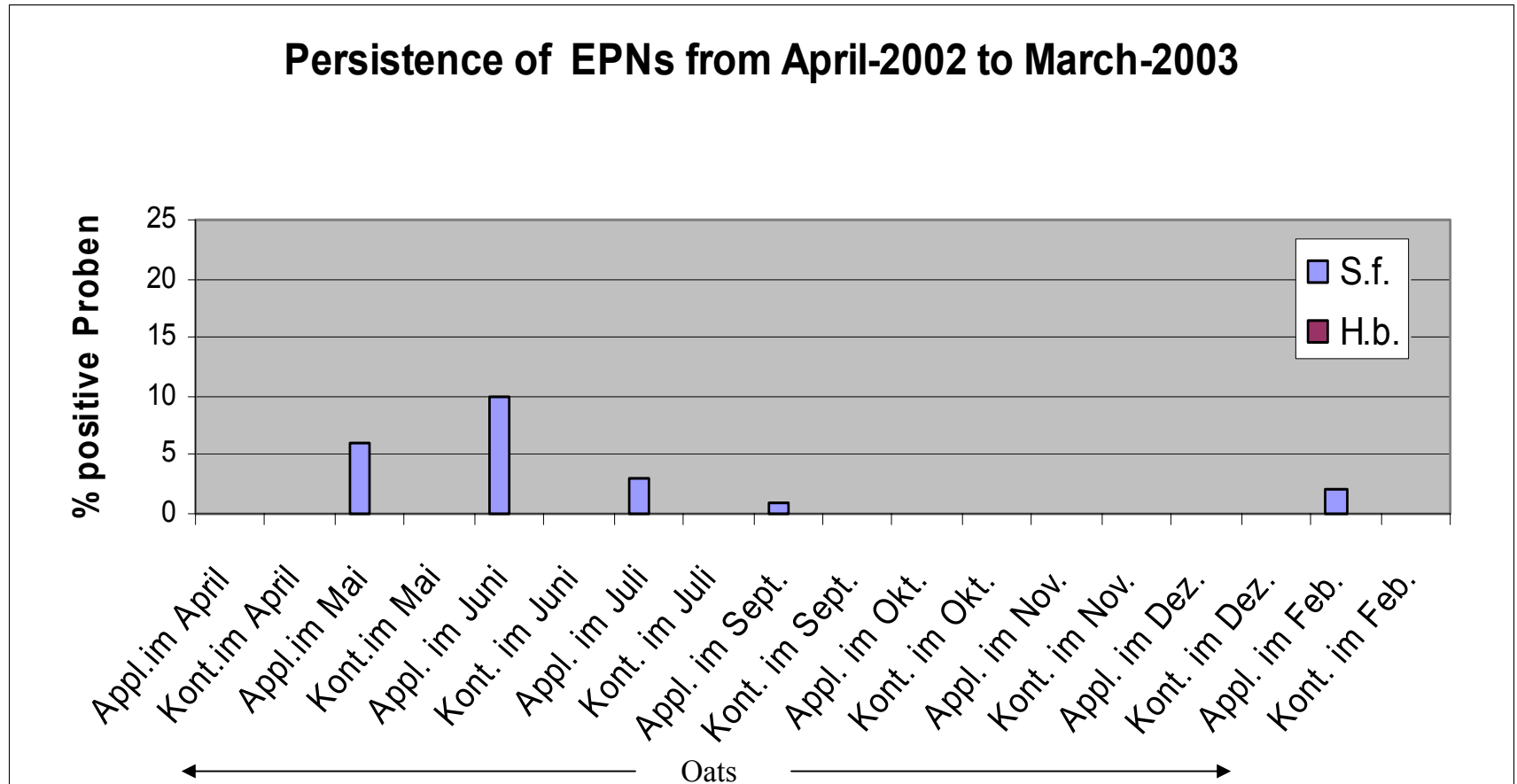
***S.f.* plot: 2% of samples positive for *S. feltiae* in control, 25% positive after application**

H. bacteriophora did not displace endemic population of *S. feltiae*

Persistence of *S. feltiae* and *H. bacteriophora* from April-2002 to March-2003 in organic farm



Establishment of *S. feltiae* in org. farming in October 2001,

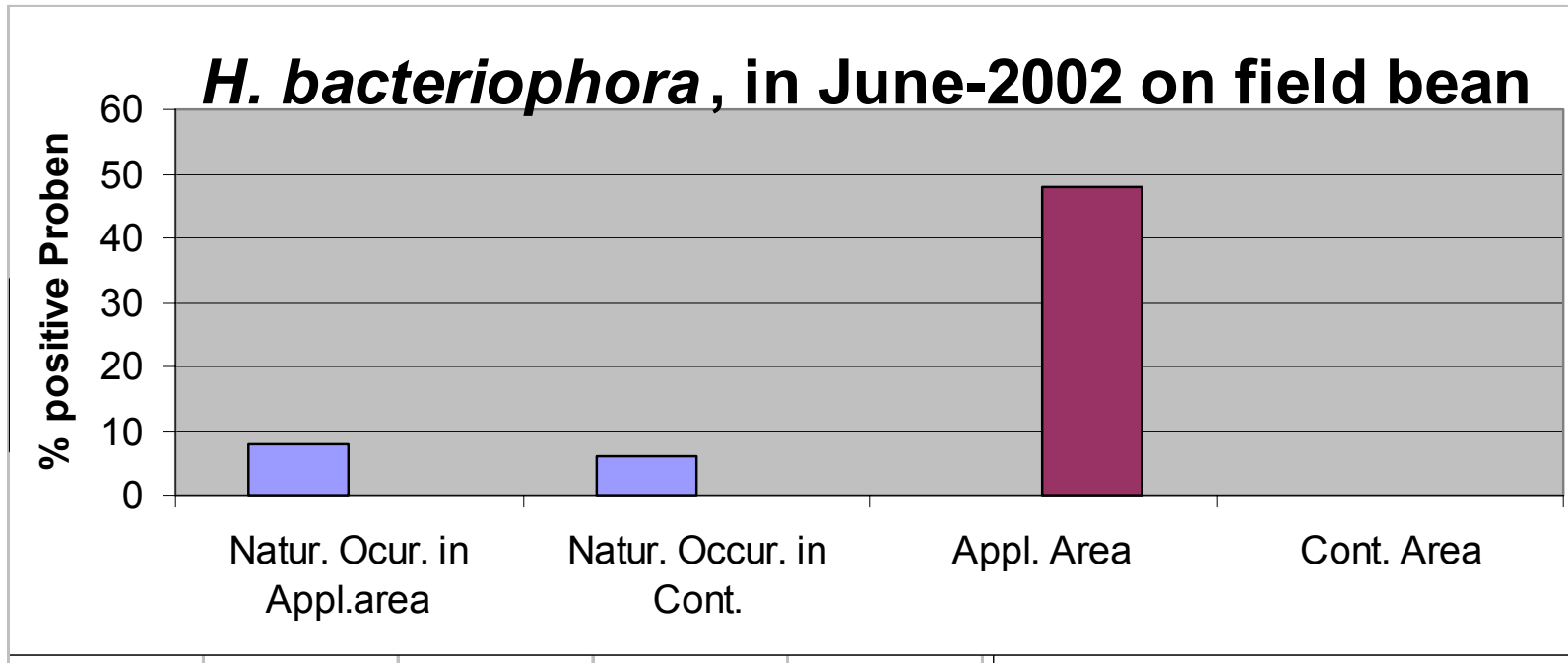


In March-2003, intensive tilling for Potato cultivation, nematodes were not isolated from March to December-2003

Establishment of *S. feltiae* in conventional agriculture - Canola

- **Application time: 14.11.03 at 15:00**
- **Weather: No rain**
- **Temp. : Soil 5 °C, Air 7°C**
- **Height of crops at application: Canola = 11 cm**
- **No endemic EPNs (n=25)**
- **90% positive after application**
- **12.12.03: 76% positive**
- **04.02.04: 100% positive**
- **Field infested with 3rd instars of cabbage root fly**

Establishment of *H. bacteriophora* in organic farming - *Vicia faba*



Weather: Rain during application

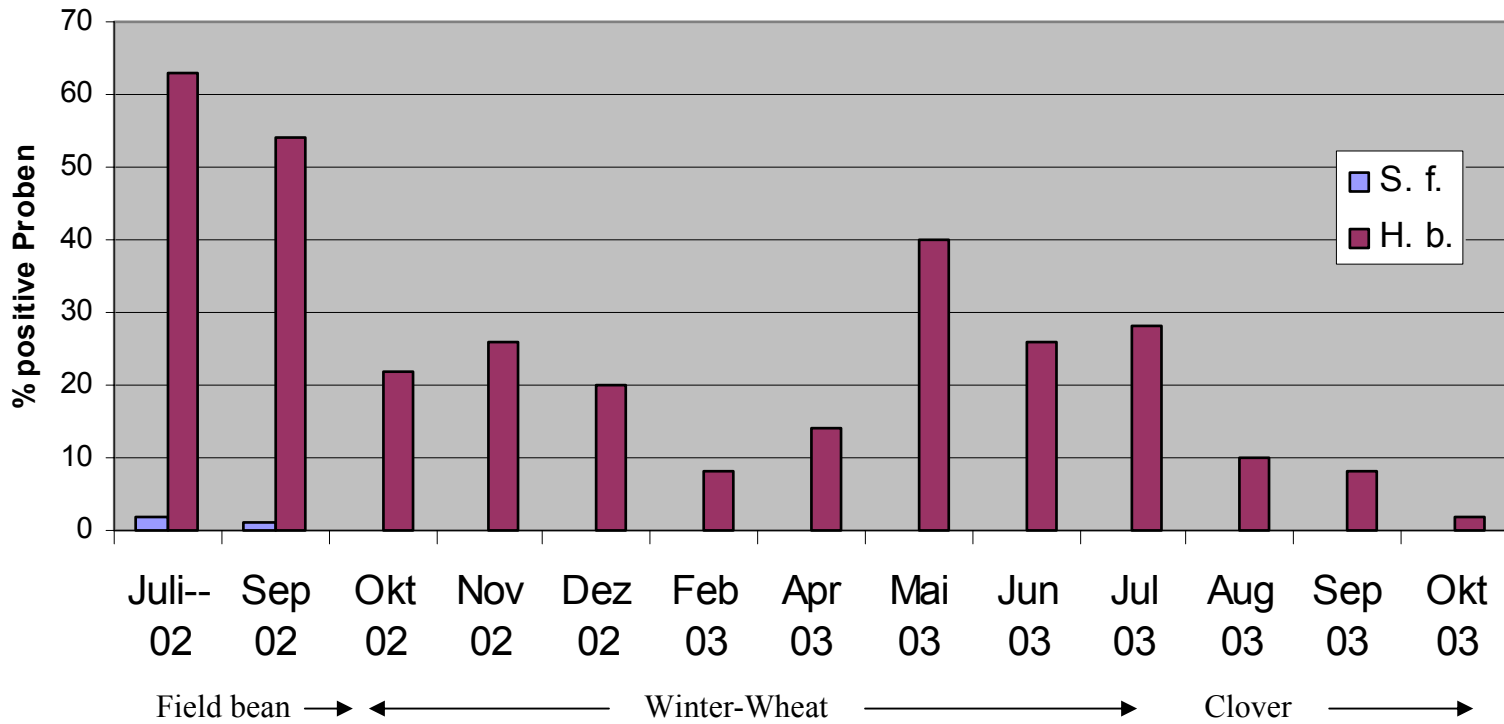
Soil temp.: 15-16 °C

Application: 11.06.2002 at 14:00

Height of plants: 60-70 cm *Vicia faba*

A very good example for successful establishment of *H. bacteriophora* (Host - *Sitona lineatus*)

Persistence of EPNs from June-2002 to October-2003



Tilling after field bean in October 2002, not after Winter Wheat

Summary



- **Tilling reduces population rate of EPNs**
- **Establishment of EPNs depends on presence of potential host insects**
- **Application on plant cover is more successful than application directly onto soil or plants with low coverage (e.g. potato)**
- **Establishment of *H. bacteriophora* had no negative effect on endemic population of *S. feltiae***

Acknowledgements



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Thank you very much for your attention