

Specificity of soil-borne pathogens on grain legumes

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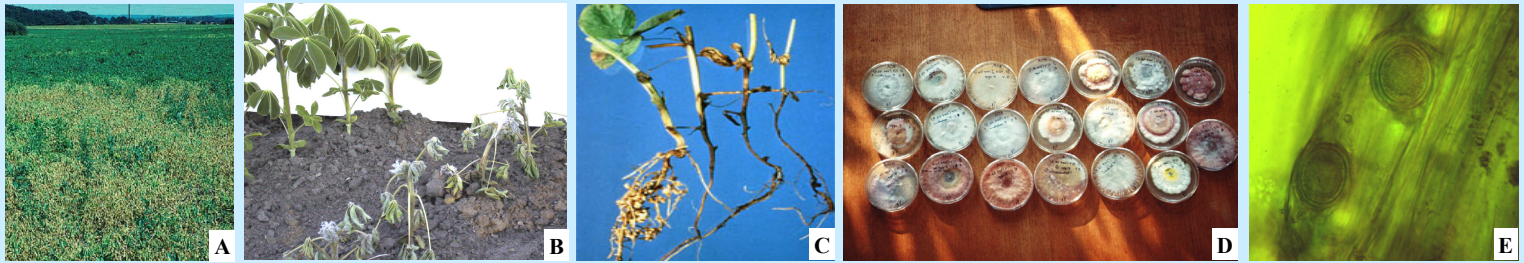


Fig. 1. *Aphanomyces* root rot in pea (A), *F. oxysporum* wilting in lupin (B), Pea root rot (C), Fungal isolates from legume roots (D), *A. euteiches* oospores in pea root (E).

SUMMARY AND CONCLUSIONS

Specificity of soil-borne legume pathogens on pea, lupin and faba bean is currently investigated in fields where grain legumes are intensively cultivated.

- Legume host-pathogen interactions demonstrate specificity of pathogen populations particularly in pea and lupin.
- A. euteiches* root rot was specified to pea in Denmark as root rot symptoms and oospores of the pathogen never were observed in roots of faba bean and lupin
- F. oxysporum* followed by *F. solani* were most frequently isolated from plant roots in plots highly infested by lupin pathogens
- F. avenaceum* was most frequently isolated from plant roots in plots highly infested by pea pathogens
- Pathogenicity tests showed *F. solani* followed by *F. avenaceum* to be the most pathogenic *Fusarium* species on pea while *F. avenaceum* was the most destructive pathogen on faba bean. In contrast *F. avenaceum* was non-pathogenic on lupin.

INTRODUCTION

A short crop rotation either with pea (*Pisum sativum*), faba bean (*Vicia faba*) or lupin (*Lupinus* spp.) often leads to a build up of soil-borne pathogens with a long persistence in the field. In Scandinavia and parts of France, many fields are no longer suitable for growing pea due to a high level of soil-borne pathogens. In such fields, faba beans and lupins can be introduced as alternative legume crop.

OBJECTIVE

To study the specificity of soil-borne legume pathogens on pea, lupine and faba bean with emphasis on *Aphanomyces euteiches* and *Fusarium* spp.

MATERIALS & METHODS

In 2002 and 2003, pea, lupin and faba bean varieties were sown on two highly infested (HI) localities due to intensive growth of, either pea (HI pea plot) or lupin (HI lupin plots). Ten plants from each of four replicates were sampled. Disease symptoms were scored on roots and stem bases and a disease index (DI) was calculated: (0 = 0 % discoloration, 1 = 1 - 10 %, 2 = 11 - 30 %, 3 = 31 - 60 %, 4 = 61 - 90 %, 5 = 90 - 100 % or dead). Fungi were isolated from root and stem sections. The most dominating *Fusarium* species from each crop species and location were estimated. Furthermore *A. euteiches* oospore colonization was examined under microscope.

Trials were also conducted in 11 fields differing widely in history of previous cropping with grain legumes (Knudsen et al., 1997). Pea and faba bean were sown in 6 replicates in two years. Fungi were isolated from root lesions of 6 plants from each plot. The pathogenicity of 47 *Fusarium* spp. isolates was tested in growth chamber assays on pea and faba bean, respectively. Root of plants grown in vermiculite were inoculated with sporesuspension. DI and top dry weight measured after 4 weeks incubation.

Table 1. Disease index (DI) on root of five pea, faba bean and lupin varieties. Plants were grown on localities highly infested (HI) with lupin and pea pathogens, respectively. DI range from 0-100, where 0 = no root discoloration and 100 = dead. Means in columns followed by different letters are significantly different (P=0.05)

Pea cultivars	Disease index on roots				Faba bean cultivars	Disease index on roots				Lupin cultivars	Disease index on roots			
	HI lupin plot		HI pea plot			HI lupin plot		HI pea plot			HI lupin plot		HI pea plot	
	2002	2003	2002	2003		2002	2003	2002	2003		2002	2003	2002	2003
Santana	4	0	94	100	Scirocco	58 a	25 a	8	55 a	Prima	80 a	97 a	4	4
Jackpot	4	1	87	99	Marcel	42 ab	11 b	6	46 a	LAE1	46 b	84 ab	1	6
Algarve	3	1	97	100	A603	40 ab	20 ab	4	50 a	LAE22	38 bc	73 b	2	6
Baccara	2	2	93	100	Columbo	27 b	13 b	6	31 b	Rose	44 bc	74 b	-	1
Pinochio	1	0	95	100	7123	-	14 b -	-	41 ab	Borwetta	28 c	78 b	3	11

RESULTS

In HI pea plots all pea varieties suffered from severe root rot lesions (Table 1) caused mainly by *A. euteiches* as roots were heavily colonised by oospores of the pathogen (Table 3). In contrast lupin varieties had no symptoms while root necrosis only were observed on faba bean in 2003 (Table 1). Non of these species were infected by *A. euteiches* (Table 3). In HI lupin plots all lupin varieties had high DI. Peas were unaffected by the lupin pathogen population while DI was intermediate on faba beans both years (Table 1). *F. avenaceum* was frequently isolated from pea and faba bean from HI pea plots while *F. oxysporum* and *F. solani* were frequently isolated from lupin and faba bean roots in HI lupin plots (Table 2). Pathogenicity tests of *Fusarium* spp. on pea and faba bean showed *F. solani* followed by *F. avenaceum* were most pathogenic on pea while *F. avenaceum* was the most pathogenic species on faba bean (Fig. 2). Newly performed tests on lupin showed several Danish *F. avenaceum* to be non-pathogenic on lupin (data not shown).

Table 2. *Fusarium* spp. frequently isolated from root of plant grown in soils highly infested (HI) with pea or lupin pathogens

Plant species	Most frequently isolated	
	HI lupin soil	HI pea soil
Pea	¹⁾	<i>F. avenaceum</i>
Faba bean	<i>F. oxysporum</i> <i>F. solani</i>	<i>F. avenaceum</i>
Lupin	<i>F. oxysporum</i> <i>F. solani</i>	¹⁾

¹⁾ No severe root discoloration, only few isolates

Table 3. Presence or absence of *A. euteiches* oospores in roots of pea, faba bean and lupin

Plant species	Oospore colonization ¹⁾	
	2002	2003
Pea	+	+
Faba bean	-	-
Lupin	-	-

¹⁾ Oospores morphology similar to *A. euteiches*

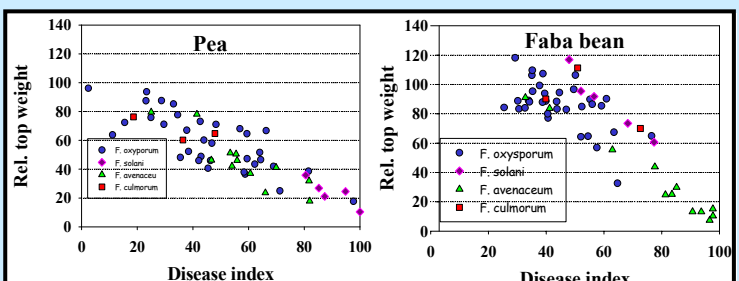


Figure 2. Fresh weight of pea and faba bean inoculated with spores of four *Fusarium* species relative to the weight of inoculated controls as a function of the disease severity index.

References

Knudsen, J.C., Hattesen, M & Bødker, L. (1997). Can faba beans be produced on soil infested by pea root rot pathogens SP-rapport nr. 8, 129-140.