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BRIEF COMMUNICATION

Seed Rot and Root Rot Complex of Beans (*Phaseolus vulgaris* L.)

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Abstract. *Fusarium solani* (76%), *Phyllosticta phaseolina* (12%) and *Aspergillus flavus* (10%) were isolated from bean (*Phaseolus vulgaris*) seeds showing lesions. Out of these the first two caused 30 per cent and 20 per cent seed rotting respectively after artificial seed inoculations. When inoculum was added into the soil before sowing the seed, 35 per cent and 10 per cent pre-emergence rot ocurred and there was 35 per cent and 15 per cent post-emergence blight when soil with healthy seedlings was inoculated with *F. solani* and *P. phaseolina* respectively. *F. solani* caused similar lesions on bean seeds when inoculated after an injury. *F. oxysporum* was isolated from the roots of dried bean plants showing necrosis.

Fungi associated with seed during storage and in the soil play a great role in causing seedling blights and root rots. Various spp. of *Fusarium*, present in soil or on seed surface are known to cause root rotting in *Phaseolus vulgaris* (ARMSTRONG and ARMSTRONG 1964). *Fusarium solani* f. sp. *phaseoli* (MEINERS 1950) is known to cause dry root rot in beans. *F. oxysporum* f. sp. *batatas* causes lesions on bean seeds (NASH and SNYDER 1967). In the present investigations *Fusarium* spp and other fungi were isolated from seeds and dried roots of *P. vulgaris*. Their relation to cause lesions on seed and seedling blight was also worked out.

Bean (*Phaseolus vulgaris* L.) seeds were taken from stored material at the farm and those showing lesions on the outer surface of cotyledons were kept for isolation. Potato dextrose agar medium was used to isolate and to maintain the fungus cultures. For pathogenicity tests, seed were inoculated with fungi by soaking them in culture suspension. They were also inoculated by injuring them with a needle. For soil tests, inoculum was added into the soil before and after seed sowing.

Isolation of Fungi from Bean Seeds and Pathogenicity Tests

Sterilized bean seeds showing lesions were placed on PDA plates for the isolation of fungi associated with them. *Fusarium solani* (76%), *Phyllosticta phaseolina* (12%) and *Aspergillus flavus* (10%) were the fungi isolated from the diseased seeds.

To prove pathogenicity, a lot of healthy seed was surface sterilized in 0.1 percent mercuric chloride and then washed in sterilized water three times. These were then soaked in the spore suspension of the isolated fungi for 4 h and then sown in the sterilized soil. Germination data were recorded after 7 days. Healthy surface sterilized seeds were also soaked in sterile water to serve a control. Seeds which were soaked in the suspension of *Fusarium solani* showed 70 per cent germination. Some of the germinated seedlings showed stunted root growth and a white mat

of the fungus on unopened cotyledons. Seeds inoculated with *Phyllosticta phaeolina* showed 80 per cent germination. Ungerminated seeds rotted completely with the fungal growth on them. Seeds soaked in *Aspergillus suspension* showed 100 percent germination. In the control 100 per cent of the seeds germinated. Reisolation from rotted seeds gave the same fung.

Pathogenicity Tests by Adding Fungi into Soil

a) *F. solani* and *P. phaseolina* were grown on PDA slants. Sterilized soil was inoculated with these fungi individually, 24 h before sowing the seeds. Germination data were recorded after 7 days. There was only 65 per cent germination in soil inoculated with *F. solani*. Fungus was grown on cotyledons and the seedlings were weak. 90 per cent of the seeds germinated in soil inoculated with *P. phaseolina*. In the control germination was 100 per cent.

b) In another experiment, bean seeds were sown in sterilized soil. After 7 days a 100 per cent germination was recorded. The soil was then inoculated with fungi namely *F. solani* and *P. phaseolina* to study their effect on the vigour of the seedling. The observations on such inoculated seedlings were recorded up to 35 days. 35 per cent of the seedlings died in the case of *F. solani* and 15 per cent in the case of *P. phaseolina* treatments. The rest of the seedlings in the soil inoculated with *F. solani* showed slightly stunted growth. In the control lots all the seedlings showed normal vigour. Reisolation from roots showed *F. solani* and *P. phaseolina* respectively.

Production of Lesion on Seeds

F. solani was inoculated on both the cotyledons with the help of a needle by causing an injury. These inoculated seeds were kept in a moist chamber to see the effect of the fungus. There was 100 per cent germination of the seeds but all of them showed a brown lesions on both sides. There was white fungus growth on the inner surface of the seed coat as well as on the outer surface of cotyledons. The spots on the cotyledons were bigger as compared with the outer seeds coat and were identical with the original lesions present on the seeds as shown in Fig. 1.

Isolation of Fungi from Seeds and Roots of Dried Bean Plants

During the kharif season of 1971 a healthy bean crop growing at the farm of the College of Agriculture, Palampur, dried in the field within a week just before maturity. The pods showed black spots and the roots necrosis.

TABLE 1

PERCENTAGE OF DIFFERENT CATEGORIES OF SEED and their average weight

	Categories of seed			
	1	*2*	*3*	*4*
Percentage	21	37	17	25
Average wt. of 50 seeds [g]	15.7	14.5	8.8	2.0

A seed lot from the crop yielded 4 different types of seeds varying in shape, size and colour as is shown in Fig. 2.

The data regarding the percentage of different categories of seed and their average weight are given in Table 1.

The average weight of 50 normal seeds (21%) was 15.7 g. The seeds in No. 2 category were slightly smaller in size showing brown spots varying in size and the inner cotyledons showed light brown spots. The weight of 50 seeds was 14.5 g. Seeds in No 3 were sightly wrinkled and showed brown spots on both surfaces. 25 per cent of the seeds were deeply wrinkled with crevices. The colour was dark brown to reddish and 50 seeds weighed 2.0 g. There seems to be a correlation between the intensity of the seed infection and their weight. These seeds after plating on a medium yielded colonies of *Fusarium solani*, *Aspergillus niger*, *Aspergillus flavus* and *Rhizopus* sp.

The roots of these dried plants showing necrosis, yielded *Fusarium oxysporum* only in 100 samples.

Fusarium solani (76%), *Phyllosticta phaseolina* (12%) and *Aspergillus flavus* (10%) were isolated from beans (*Phaseolus vulgaris*) seeds which showed lesions on the cotyledons. NASH (1965) has reported that hypocotyl lesions on bean seeds were caused by *Fusarium solani* f. sp. *phaseoli* (70—90%). *Rhizoctonia* sp. and *Sclerotinia sclerotiorum* were isolated from bean seeds (WALKER 1960). *F. solani* in the present studies caused 30 per cent of seed rotting and *P. phaseolina* 20 per cent when the seeds were soaked in a culture solution for 4 h. *A. flavus* did not cause any rotting. When the fungus culture was added into the soil before sowing the seed, pre-emergence death to the extent of 35 per cent and 10 per cent occurred in *F. solani* and *P. phaseolina* treatments respectively. Post-emergence seedling blight up to 35 per cent and 15 per cent occurred when *F. solani* and *P. phaseolina* cultures were added into the soil with healthy seedlings. *Fusarium oxysporum* was mainly isolated from the field of beans and dried completely within 7 days because of root rot. *Fusarium oxysporum* f. sp. *phaseoli* from runner bean (ARMSTRONG and ARMSTRONG 1964), *F. oxysporum* f. sp. *tracheiphylum* from diseased beans fields (KENDRICK and SNYDER 1942) and *F. solani* f. sp. *phaseoli* from bean plants (CHATTERJEE 1958, MEINERS 1950) have been proved to be the pathogens causing dry root rot. *F. solani* under the present investigations caused lesions on both the outer surfaces of bean seeds when inoculated by means of injury. Such spots were also visible on the surface of both the cotyledons and fungus was grown there as a white mat. This proves that *F. solani* is the main invader causing lesions on bean seeds and *F. solani* and *F. oxysporum* in causing root rots in the field in Himachal Pradesh (India). *F. solani* f. sp. *phaseoli* has been identified as a primary invader of bean seeds by NASH and SNYDER (1967).

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Figures at the end of the issue.

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