Determination of Fungal and Bacterial Diseases on Bean Plants in Bean Production Areas in Konya Province, Turkey

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Abstract: Bean (*Phaseolus vulgaris* L.) is a major crop that provides an important source of protein for human nutrition. In this study presence of plant pathogenic fungal and bacterial agents was determined in five mostly bean growing districts of Konya province in 2006. The surveys were carried out at seedlings, blooming and pod-maturing phases of beans, and determined the average incidence of fungal diseases on three phases as 16.42%, 14.17% and 15.37% respectively. According to results, five fungal agents were identified as primary pathogens which were *Fusarium equiseti*, *F. oxysporum* f.sp. *phaseoli*, *Macrophomina phaseolina*, *Rhizoctonia solani* and *F. solani* f.sp. *phaseoli* on beans. In the three sampling phases and on majority at collected samples, *Fusarium* spp. were isolated at ratios 65.36%, 76.27% and 68.88% respectively. *R. solani* was determined to be the most virulent agent (77.78%) in all of the fungal pathogens by the pathogenicity tests. *Pseudomonas savastonoi* pv. *phaseolicola* was identified on collected bean samples and found incidence of disease as 11.59%.
Keywords: Fungal, bacterial, bean, disease, Konya.

Introduction

Legumes play an important role in human nutrition. Bean (*Phaseolus vulgaris* L.) is one of the most important legumes in the World due to its high commercial value, extensive production, consumer use, and nutrient value (carbohydrates, protein, minerals, and vitamins). It is traditionally a basic food crop in many developing countries, and it serves as a major plant protein source for rural and urban areas. Approximately 99.000 ha are planted annually to common bean in Turkey. Konya ranks first in Turkey in terms of the bean planting areas with a total area of 13.860 ha and a production level of 26.591 tons (Anonymous 2010).

Bean (*Phaseolus vulgaris* L.) plants are adversely affected by numerous biotic and abiotic stresses that result in important yield losses. More than 200 pathogens have been reported attacking beans; however, only about a dozen of them can cause considerable economic losses (Schoonhoven & Voysest 1991). Annual production losses in world bean production as a result of diseases average about 10%. On bean plants 61 different diseases were described 31 of these diseases are caused by fungi, five by bacteria, five by nematodes, 18 by viruses, and two by mycoplasmalike organisms. Fungal pathogens of bean are identified mostly by the size, shape, and color of their spores. Fungal pathogens cause a wide range of symptoms on beans. Most frequently they cause variously colored (brown, yellow, red, or black) spots or blotches on leaves, stems, pods, seeds, or roots. Bacteria that cause bean diseases are microscopic, colorless or yellow cells. They cause water-soaked spots (then brown) and blotches (often with yellow borders) on leaves, pods, or seeds (Hall 1994).

Konya province provides 21.5% of Turkey bean production (Çiftçi 2004). Therefore it's very important to determine diseases of bean plants and to plan control measures for diseases. It's reported that

yield losses which are caused by diseases, pests, and herbs in legumes cultivated areas in worldwide on developed countries and developing countries were 17.2% and 37.1%, respectively (Agrios 1988). Particularly in large bean production areas, irrigation by sprinkling plays an important role for spreading of bacterial and fungal diseases. Also, using seeds which were cultivated the previous year as seed plays an important role for spreading seed-borne diseases. In this study, it's aimed to determine and identify fungal and bacterial diseases and incidences of the diseases which may cause yield losses on bean production in Konya province.

In Turkey, early researches about bean diseases were carried out by Bremer (1948, 1954) and Göbelez (1956). Up to date, several survey studies about bean diseases in different provinces in Turkey has been carried out (Tekinel et al. 1969, Karahan 1971, Özalp 1971, Soran 1977, 1981, Turak & Arslan 1988, Temizel & Ertunç 1992, Demir & Gündoğdu 1994, Biçici et al. 1995, Hatat & Özkoç 1997, Turak 1997, Demirci & Çağlar 1998, Turhan et al. 2001, Kırbağ & Turan 2006)

Material and Methods

Material

The main material of the study is infected ones of bean plants which are grown in Konya province, in 2006. Survey area of the study is determined with regard to bean production statistics of 2005 which were provided from Konya Directorate of the Ministry of Agriculture. According to the data (Anonymous 2005), districts where bean are planted in more than 1000 ha, Center districts (Selçuklu, Meram and Karatay), Çumra, Altınekin, Ilgın and Ereğli were chosen as the survey area.

Methods

Surveys

Survey area was selected from intensively bean cultivated areas and in such a way to represent Konya province. Surveys were carried out in bean growing areas in Center districts (Karatay, Selçuklu and Meram), Çumra, Altınekin, Ilgın and Ereğli. Sampling was done at least in 1% of bean production area in each of the districts. Minimum sampling areas of the districts were determined as 150 da., 450 da., 210 da., 140 da., and 100 da., respectively. Bean planting areas, sampled field numbers and areas in the districts were shown in Table 1.

District	Planting Areas (ha.)	Sampled	
		Field Number	Planting Areas (da.)
Center	1480	14	186
Çumra	4500	15	517.5
Altınekin	2100	14	386
Ilgın	1400	14	157
Ereğli	985	10	285
Toplam	10465	67	1531.5

Table.1. According to the districts and size of field examined field numbers.

In this study, the surveys were carried out at 3 phases as at seedlings, blooming and pod-maturing phases of beans. The first one was carried out at appearing of bean seedlings on the soil surface to two real leaves phase (first week of June), the second one was at appearing of first flowers (second week of July) and the last one was at maturing of pods and seeds phase (third week of August).

In field surveys controlled plant numbers in examined field were determined according to size of examined field, as in Table 2.

Area of field (da.)	Number of controlled plant
1-5	25
6-10	50
11-50	100
51-100	150

Table 2. According to size of examined field, number of controlled plant

During survey studies, disease incidence ratio and infected plant ratio values which belong to each field, each district and Konya province were calculated according to Bora and Karaca (1970).

a) Isolation and Identification of Fungal Pathogens from Infected Bean Plants

Preliminary diagnosis was based on symptoms in shoots, hypocotyls, and roots that are usually associated with specific root rot and wilt pathogens. In all isolations, hypocotyl or root tissues showing symptoms were first washed in running tap water and cut into 1-cm portions. They were then surface sterilized in 1.5% NaOCl for 1min, double rinsed in sterile distilled water, blot dried between sterile paper towels, and plated aseptically on potato dextrose agar added with streptomycin sulphate. Plates were then incubated in a growth chamber at 22 to 26°C with a 12-h photoperiod supplied by long, fluorescent, day light tubes. Plates were examined 2 to 14 days later for fungi associated with the various symptoms observed (Warcup 1958). Pure cultures were obtained by subculturing. Fungi were identified according to colony characteristics and reproductive structures by using binocular microscope according to Von Arx (1970); Booth 1971; Barnett and Hunter (1987); Domsch et al. (1980). Fungal structures of identified fungi were screened by means of a trinocular microscope and photographed by digital camera.

b) Pathogenicity Tests

In the pathogenicity tests "Akman 98" bean cultivar used. It's known as sensitive to fungi which were tested. The most frequently isolated fungal species were chosen. Pathogenicity tests of 5 *Fusarium oxysporum* f.sp. *phaseoli (Fop)*, 5 *F. solani* f.sp. *phaseoli (Fsp)*, 3 *Rhizoctonia solani* and 3 *Macrophomina phaseoli* isolates which were identified by species, were carried out on pots in climate chamber conditions. In this study, corn flour sand culture which is mostly used and thought better for soil borne fungi was used. (Killebrew et al. 1988).

Assessments were done after 30 days from planting. Therefore, CIAT 1-9 scale (Pastor-Corrales & Abawi 1987) was used for plants inoculated by *Fop* and *Fsp*, and 0-4 scale (Meinhardt et al. 2002, Eken & Demirci 2003) for plants inoculated by *R. solani* and *M. phaseoli.*

Isolation and Identification of Bacterial Pathogens from Infected Bean Plants

Bacteria were isolated and identified according to Schaad et al. (2001) from the parts of bean plants which showed bacterial disease symptoms. For identification, biochemical tests including Gram's stain, motility, utilisation of mannitol, sorbitol and inositol together with LOPAT tests and growth on King's B were carried out.

Results

Survey Results

Incidence of Fungal Root Rot on Bean Plants

Extent of the study, result of the surveys which were carried out at seedling phase of bean in 2006 incidence of fungal root rot in Center, Çumra, Altınekin, Ilgın and Ereğli districts were determined as

19.88%, 10.40%, 17.81%, 19.75% and 21.35%, respectively. The average of Konya province was determined as 16.42% (Fig. 1).

In the same year, result of the second surveys which were carried out at blooming phase of bean incidence of fungal root rot in the same districts were determined as 16.57%, 10.84%, 14.68%, 11.43% and 19.45%, respectively. The average of Konya province was determined as 14.17% (Fig. 2).

Result of the last surveys which were carried out at pod maturing phase of bean incidence of fungal root rot in the same districts were determined as 15.96%, 15.28%, 11.95%, 17.63% and 18.53%, respectively. The average of Konya province was determined as 15.37% (Fig. 3).

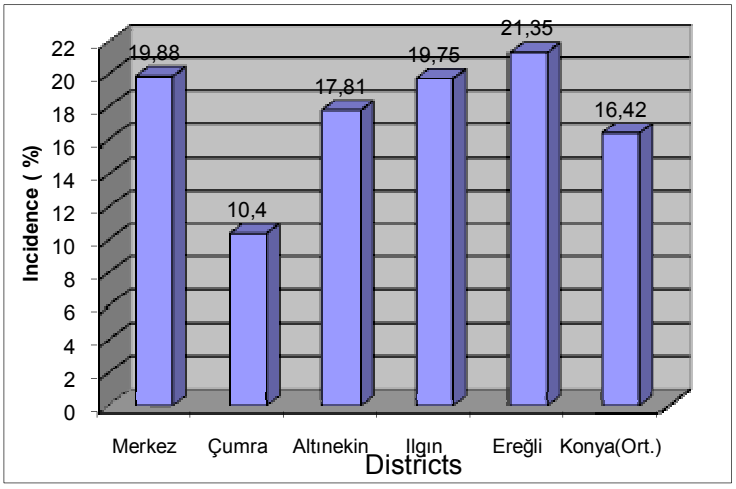

Figure 1. Incidence of fungal root rot on bean plants at seedling phase

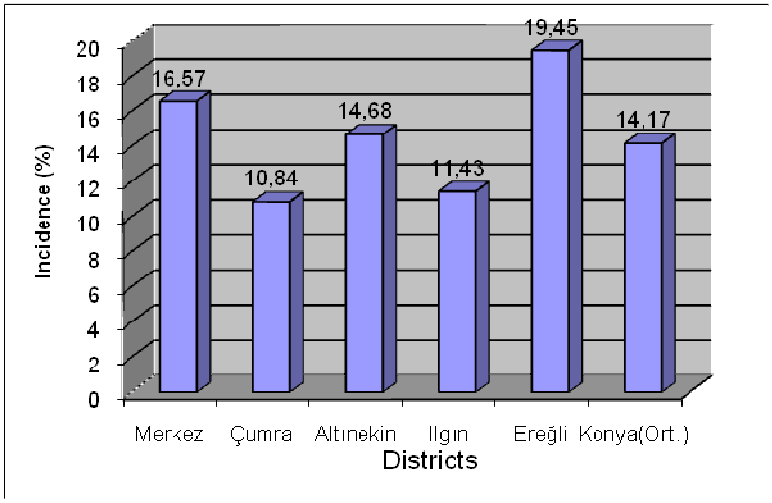

Figure 2. Incidence of fungal root rot on bean plants at blooming phase

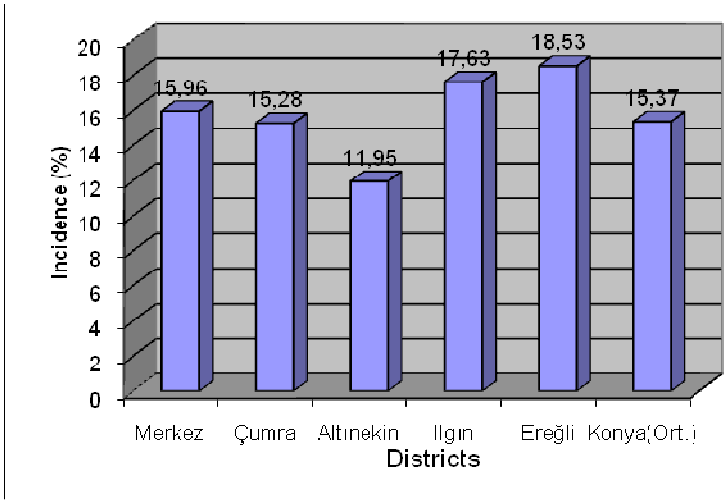

Figure 3. Incidence of fungal root rot on bean plants at pod maturing phase

Incidence of Bacterial Diseases on Bean Plants

In the survey studies which were carried out at seedling, blooming and pod maturing phases of bean in Konya Center, Çumra, Altınekin, Ilgın and Ereğli districts, in 2006 bean production seasonal symptoms of bacterial diseases were only observed at pod maturing phase. Therefore, only this survey results were given and evaluated. As a result of the analysis of these findings, plants which infected with bacteria were observed mostly in Altınekin district by 27.74%. Çumra, Ilgın, Center and Ereğli districts followed Altınekin by 9.56%, 7%, 3.22% and 1.36%, respectively. The average of Konya province was determined as 11.59% (Fig. 4).

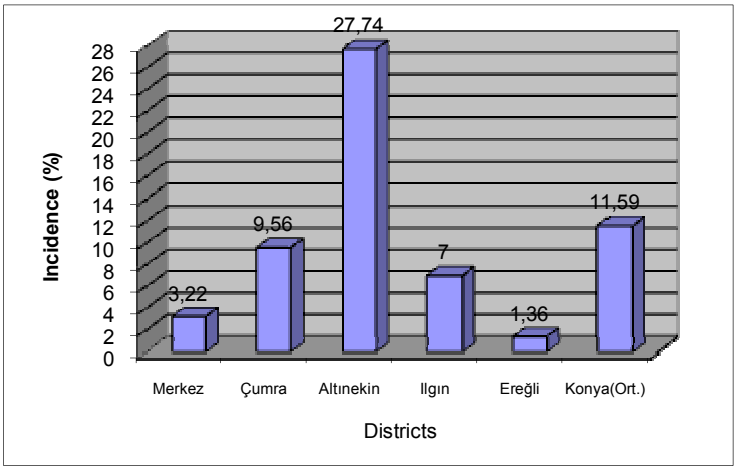

Figure 4. Incidence of bacterial diseases on bean plants at pod maturing phase

Results of Laboratory Studies

Isolation and Identification of Fungal Pathogens from Infected Bean Plants

In the survey studies, from Center districts, Çumra, Altınekin, Ilgın and Ereğli, bean plants were collected number of 440, 710, 430, 345 and 315, respectively. And fungal pathogens were isolated from these plants. In the survey studies at seedling phase, totally 615 diseased bean plants, 160 from Center districts, 200 from Çumra, 75 from Altınekin, 95 from Ilgın and 85 from Ereğli were collected and used for fungal isolation. Isolated fungi and incidence rates of each fungus as regards to districts are shown in Table 3. As given by the table fungi species were determined from 9 different genus. In this phase, 402 of 615, in other words 65.36% of bean seedlings which were examined for isolation were determined as infected by Fusarium species. In addition, in seedling isolation studies; incidence rates of *R. solani*, *M. phaseoli*, *Alternaria* spp and *Pythium* spp were determined as 19.18%, 8.61%, 8.61% and 1.78, respectively.

At blooming phase of bean, totally 590 bean plants,160 from Center districts, 155 from Çumra, 75 from Altınekin, 95 from Ilgın and 105 from Ereğli were collected and used for fungal isolation. Isolated fungi and incidence rates of each fungus as regards to districts are shown in Table 4. As given by the table fungi species were determined from 8 different genus. In this phase, 450 of 590, in other words 76.27% of bean plants which were examined for isolation were determined as infected by *Fusarium* species. *Fusarium* spp. were followed by *R. solani* (22.37%), *M. phaseoli* (10.67%) and *Pythium* spp (5.59%).

Districts	**Konya Center**		**Çumra**		**Altınekin**		**Ilgın**		**Ereğli**	
Fungi	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**
Fusarium spp.	113	70,62	115	57,5	41	54,66	75	78,94	58	68,23
R. solani	20	12,5	39	19,5	18	24	23	24,21	18	21,17
M. phaseoli	4	2,5	20	10	12	16	---	---	17	20
Alternaria spp.	14	8,75	16	8	10	13,33	9	9,47	4	4,70
Pythium spp.	11	6,87	---	---	---	---	---	---	---	---
Curvularia spp.	1	0,62	2	1	---	---	4	4,21	---	---
Ulocladium spp.	3	1,87	1	0,5	---	---	1	1,05	---	---
Penicillium spp.	---	---	7	3,5	3	4	1	1,05	1	1,17
Chaetomium spp.	---	---	2	1	4	5,33	---	---	---	---
Toplam	160	---	200	---	75	---	95	---	85	---

Table 3. Infection rates of bean seedling samples with fungi

Districts	**Konya Center**		**Çumra**		**Altınekin**		**Ilgın**		**Ereğli**	
Fungi	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**
Fusarium spp.	107	66,87	117	75,48	62	82,66	79	83,15	85	80,95
R. solani	22	13,75	73	63,47	4	5,33	18	18,94	15	14,28

M. phaseoli	12	7,5	22	14,19	5	6,66	7	7,36	17	16,19
Alternaria spp.	7	4,37	1	0,64	4	5,33	12	12,63	5	4,76
Pythium spp.	9	5,62	---	---	---	---	---	----	24	22,85
Penicillium spp.	---	---	4	2,58	1	1,33	---	---	---	---
Chaetomium spp.	---	---	3	1,93	5	6,66	---	---	1	0,95
Gliocladium spp.	---	---	3	1,93	---	---	---	---	---	---
Toplam	160	---	155	---	75	---	95	---	105	---

Table 4. Infection rates of bean plant samples with fungi at blooming phase

At pod maturing phase of bean, totally 1035 bean plants,120 from Center districts, 355 from Çumra, 280 from Altınekin, 155 from Ilgın and 125 from Ereğli were collected and used for fungal isolation. Isolated fungi and incidence rates of each fungus as regards to districts are shown in Table 5. As given by the table fungi species were determined from 10 different genus. In this phase, 713 of 1035, in other words 68.88% of bean plants which were examined for isolation were determined as infected by *Fusarium* species. *Fusarium* spp. were followed by *R. solani* (24.05%), *Alternaria* spp. (15.26%), *Pythium* spp (11.59%), and *M. phaseoli* (10.33%).

Districts	**Konya Center**		**Çumra**		**Altınekin**		**Ilgın**		**Ereğli**	
Fungi	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**	**Number of infected seedlings**	**Infection rate %**
Fusarium spp.	60	50	255	71,83	213	76,07	88	56,77	97	77,6
R. solani	15	12,5	59	16,61	42	15	36	23,22	42	33,6
M. phaseoli	8	6,66	17	4,78	34	12,14	34	21,93	14	11,2
Alternaria spp.	27	22,5	53	14,92	44	15,71	12	7,74	22	17,6
Pythium spp.	14	11,66	40	11,26	34	12,14	5	3,22	1	0,8
Ulocladium spp.	---	---	3	0,84	4	1,42	17	10,96	---	---
Penicillium spp.	---	---	5	1,40	3	1,07	4	2,58	---	---
Chaetomium spp.	---	---	3	0,84	2	0,71	1	0,64	---	---
Gliocladium spp.	---	---	15	4,22	15	5,35	---	---	---	---
S.sclerotiorum	1	0,83	---	---	---	---	---	---	---	---
Toplam	120	---	355	---	280	---	155	---	125	---

Table 5. Infection rates of bean plant samples with fungi at pod maturing phase

Distribution of Isolated Fungi

During the survey studies, as a result of the isolation of the media grown from collected bean plants, 221 isolates from 15 different fungi species were obtained (Tab. 6). 57.02% of the isolates in other words half of the isolates were identified as *Fusarium*. In this study, 5 different *Fusarium* species were identified. As a result of species identification studies, isolation frequency of *F. equiseti* at seedling, blooming and pod maturing phases was determined as 24.70%, 23.40% and 22.58%, respectively. *F. equiseti* was followed by *F. oxysporum* with 17.65%. Isolation frequency rates of this fungus were determined as 19.75%, 14.90% and 17.20%, respectively. *Macrophomina phoseoli* was third mostly isolated fungus by 15.38%. Isolation frequency rates of this fungus were determined as 11.11%, 25.53% and 13.98%, respectively. Isolation frequency rates of *R. solani,* which is one of the most important pathogens of bean plants at seedling, blooming pod maturing phases and average were determined as 16.05%, 12.77%, 15.05% and 14.93%, respectively (Tab. 7).

Fungi	**Number of isolates**																			
	Center				**Çumra**				**Altınekin**				**Ilgın**				**Ereğli**			
	S	**B**	**P**	**T**	**S**	**B**	**P**	**T**	**S**	**B**	**P**	**T**	**S**	**B**	**P**	**T**	**S**	**B**	**P**	**T**
F. equiseti	3	0	1	**4**	10	4	4	**18**	0	4	8	**12**	3	0	3	**6**	4	3	5	**12**
F.oxysporum	5	0	0	**5**	7	2	5	**14**	2	1	8	**11**	1	0	2	**3**	1	4	1	**6**
F. solani	1	0	0	**1**	3	4	4	**11**	0	0	1	**1**	0	0	0	**0**	1	1	0	**2**
F. culmorum	0	0	0	**0**	4	0	2	**6**	0	0	0	**0**	1	0	0	**1**	3	0	1	**4**
F.semitectum	1	0	0	**1**	0	2	0	**2**	0	0	2	**2**	2	0	2	**4**	0	0	0	**0**
R. solani	2	0	1	**3**	5	6	4	**15**	2	0	1	**3**	2	0	4	**6**	2	0	4	**6**
M. phaseoli	1	0	1	**2**	3	4	3	**10**	4	2	4	**10**	0	1	1	**2**	1	5	4	**10**
Alternaria spp.	0	0	0	**0**	0	0	3	**3**	1	1	2	**4**	1	0	0	**1**	0	1	2	**3**
Curvularia spp	0	0	0	**0**	0	0	2	**2**	0	0	0	**0**	1	0	0	**1**	0	0	0	**0**
Ulocladium spp.	0	0	0	**0**	1	0	2	**3**	0	0	0	**0**	1	0	0	**1**	0	0	0	**0**
Chaetomium spp.	0	0	0	**0**	1	0	2	**3**	0	1	0	**1**	0	0	0	**0**	0	0	0	**0**
Gliocladium spp.	0	0	0	**0**	0	1	1	**2**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
P.oligandrum	0	0	0	**0**	1	0	0	**1**	0	0	1	**1**	0	0	0	**0**	0	0	0	**0**
Pythium spp.	0	0	0	**0**	0	0	1	**1**	0	0	0	**0**	0	0	0	0	0	0	0	**0**
S.sclerotiorum	0		1	**1**	0	0	0	0	0	0	0	0	00	0	0	0	0	0	0	0
TOTAL	13	0	4	17	35	23	33	91	9	9	27	45	12	1	12	25	12	14	17	43

S: Seedling survey, B: Blooming survey, P: Pod maturing survey, T: Total of the surveys.

Table 6. Distribution of isolated fungi depending on survey phases and districts

Isolates	Isolation rates (%)			
	Seedling	Blooming	Pod maturing	Average
F. equiseti	24,70	23,4	22,58	23,53
F. oxysporum	19,75	14,9	17,2	17,65
F. solani	6,17	10,64	5,38	6,79
F. culmorum	9,88	0	3,23	4,98
F. semitectum	3,7	4,26	4,3	4,07
R. solani	16,05	12,77	15,05	14,93
M. phaseoli	11,11	25,53	13,98	15,38
Alternaria spp.	2,47	4,26	7,53	4,98
Pythium spp.	0	0	1,08	1,08
S. sclerotiorum	0	0	1,08	1,08

Table 7. Isolation rates of the fungi depending on survey phases.

Results of Pathogenicity Tests

Results of pathogenicity tests were given by Table 8. According to the results of pathogenicity tests, Ç.12/2 of *Fop* was determined as the most pathogen isolate with 67.41% rate of disease severity. The isolate caused stunting, chlorosis and total growth reduction on bean plants in comparison with control plants. In other isolates of *Fop*, rate of disease severity were determined as varying from 31.85% to 54.96%. The average rate of disease severity of all isolates was calculated as 54.96%.

In *Fsp* isolates Ç.O.10/2 was determined as the most pathogen one with 63.70% rate of disease severity. The isolate caused stunting, growth reduction, early blooming, lesions on hypocotyls and taproot on bean plants in comparison with control plants. In other isolates of *Fsp*, rates of disease severity were determined as varying from 45.93% to 62.96%. The average rate of disease severity of all *Fsp* isolates was calculated as 56.89%.

The average rate of disease severity of *Rhizoctonia solani* isolates was calculated as the highest with 77.78% in all tested fungal isolates. E.O.3/1 isolate was determined as the most pathogen isolate with 100% rate of disease severity. On all pots which the isolate was inoculated, it prevented the emergence of all bean seeds.

In *M. phaseolina* isolates Ç.O.15/3 was determined as the most pathogen one with 51.66% rate of disease severity. The isolate caused stunting, growth reduction, chlorosis, blight on stems on bean plants in comparison with control plants. In other isolates of *M. phaseoli*, rates of disease severity were determined as varying from 32.14% to 38.33%. The average rate of disease severity of all isolates was calculated as 40.91%.

Fungi	Isolate Name	Disease Severity (%)*	
		Isolate	Average**
F. oxysporum f.sp. *phaseoli* *(Fop)*	K.11/1	31.85	54.96 B
	A.4/2	57.78	
	E.Çi.2/4	59.26	
	Ç.2/1	58.52	
	Ç.12/2	67.41	
F. solani f.sp. *phaseoli* *(Fsp)*	A.O.10/1	60.00	56.89 B
	Ç.O.16/2	62.96	
	Ç.Ç.9/2	45.93	
	Ç.O. 10/2	63.70	
	Ç.Ç.6/3	51.85	
R. solani	E.O.3/1	100.00	77.78 A
	Ç.Ç.8/2	86.66	
	I.O.7/2	50.00	
M. phaseoli	A.6/2	38.33	40.91 B
	E.Ç.6/3	32.14	

	Ç.O.15/3	51.66	
Kontrol	Kontrol-1	0.00	0.00 C
	Kontrol-2	0.00	
	Kontrol-3	0.00	

*Disease severity was calculated by McKinney's infection index formula.

**LSD = 19.04;P<0.01. Means followed by the same letters within each fungus aren't significantly different according to $LSD_{0.01}$

Table 8. Pathogenicities of the isolates on Akman 98 bean variety

Suggestions

Determination of factors which negatively effect crop yield and quality in plant production provides a basis of pest control. The first step of pest control is identification of problem correctly. If it couldn't obtain, control strategies wouldn't achieve. This condition is most important for bean production areas in Konya province.

According to results of the study, for reducing or eradication of phytopathological problems in bean production areas in Konya province and in order to produce more yielded and more quality bean production, the following suggestions must be regarded.

1. First of all, certified and pathogen-free seed must be used because, most of the important bean pathogens can survive on or in seed.
2. Before seed sowing, field soil must be cultivated properly. Therefore, in autumn plant debris of the previous year is buried in soil by cultivating 10-15 cm deep. In spring, when soil humid is proper, it should be prepared for sowing by cultivating 1 or 2 times, then, harrow or disc harrow can be used.
3. Especially, it's very important to minimize soil compaction in control of mostly observed root rot diseases in surveyed bean fields. This can be achieved by crop rotation, by loosening sublayers or wheel tracks with chisels at planting time, by not cultivating wet soil, and by reducing the pressure exerted by wheels on the soil surface.
4. As well in other plant crops production, in bean production cultural practices are very important. If all conditions which are necessary for growing healthy plant can be obtained, possibility of phytopathological problems occurrence will minimum. For this purpose, cultural practices such as sowing, fertilizing and irrigation should be done properly.
5. Planting depth is effective on seedling emergence and occurrence of root rot diseases. As well as depending on seed size, generally planting at a depth of 3-4 cm is suitable.
6. Crop rotation should be done, particularly for soil borne diseases. For this purpose, long term crop rotation (at least 3 years) out of beans such as corn, wheat, barley, alfalfa etc. may reduce soil inoculum.
7. Thiram (a.i.80%) should be used for controlling root rot diseases as seed treatment.
8. Bean is planted from beginning of May in Konya province. Early planting isn't recommended, as it stimulates root rot diseases.
9. As much as possible, tolerant varieties should be used.

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