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INFLUENCE OF SOIL TEXTURE ON THE INCIDENCE AND DEVELOPMENT OF THREE SOIL BORNE DISEASES

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Abstract

Influence of five different textural classes of soil namely, coarse sand, sandy loam, silty loam, clay loam and loam were tested for pathogenic activities of *Fusarium oxysporum*, *Sclerotium rolfsii* and *Meloidogyne incognita*. Sandy loam and coarse sand were best for developing diseases caused by both *Fusarium oxysporum* and *Sclerotium rolfsii*. Fine textured soils were not suitable for these pathogens. Severity of root-knot and population of *Meloidogyne incognita* were the highest in coarse sand followed by sandy loam soil and the activities of *M. incognita* were low in silty loam, loam and clay loam soil.

Key words: Soil texture, Root-knot, Wilt, Seedling blight, Soil borne pathogens.

Introduction

Wilt (*Fusarium oxysporum)* of chickpea, Seedling blight (*Sclerotium rolfsii*) of barley and root-knot *(Meloidogyne incognita)* of eggplant are the most damaging and wide-spread diseases in several countries including Bangladesh (Talukdar, 1974; Taylor and Sasser, 1978; Ahmed *et al.*, 1981; Ahmed and Hossain, 1985; Rahman and Ahmed, 1985). Soil texture have been reported to play an important role in the incidence and development of soil borne diseases (Davide, 1980; Sasser and Carter, 1985; Mishra and Bais, 1986). The soils of cultivated lands differ in their textural classes in different regions and the distribution and population densities of these pathogens varied considerably in different localities (Chattopadhyay and Mustafee, 1977; Davide, 1980); but little work has been done in this aspect in Bangladesh. Therefore, an attempt was made to study the effect of soil texture on the severity on wilt of chickpea, seedling blight of barley and root-knot of eggplant.

Materials and Methods

Independent pot experiments with *F. oxysporum, S. rolfsii,* and *M. incognita* were

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conducted at the pot house of Plant Pathology Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur-1701, Bangladesh. Five different types of soils namely, coarse sand (P^H 6.1, organic matter 0.65%), sandy loam (P^H 5.2, organic matter 1.1%), clay loam (P^H 5.1 organic matter 1.6%), silty loam (P^H 7.2, organic matter 2.0%) and loam (P^H 5.5, organic matter 1.5%) were collected, sterilized and poured into three sets of 5 kg capacity earthen pots, arranged in completely randomized design (CRD), with 4 replications. Inocula of *F. oxysporum* (grown on corn meal sand) at the rate of 50 cc/kg soil (Nene *et al.*, 1982) and *S. rolfsii* (grown on rice husk) at the rate of 2 g/kg soil (Anon., 1990) were mixed separately in the top (6 cm) of the pot soils. Ten surface sterilized seeds of chickpea (Var. Nabin) and barley (Var. Centinella) were sown after 7 days of inoculation. For nematode experiment one seedling (6 weeks old) of eggplant (Var. Uttara) was planted in each pot. After 7 days of transplanting five mature egg masses of *M. incognita* were placed at the base of the seedling of each pot. For chickpea wilt and seedling blight of barley, data on mortality percentage of seedling were recorded up to one month of growing plant. Gall index (0-10 Scale, Zeck, 1971) and nematode population per 100 cc soil were also recorded. The experiments for Chickpea wilt and seedling blight of barley were repeated twice and for nematode three times.

Results and Discussion

Lowest mortality of chickpea plants was observed in clay loam and silty loam soil in both years and these differed significantly from the other treatments. However, the remaining soils exhibited statistically similar result (Table 1). These results are corroborated with Chauhan (1962) and others (Anon., 1990).

Table 1. Effect of different soil textures on wilt of chickpea caused by *F. oxysporum*.

Soil texture	Percentage of mortality	
	First year	Second year
Sandy loam	60.0 (54.56) A	60.0 (50.83) A
Coarse sand	52.5 (46.50) A	52.5 (46.50) A
Clay loam	50.0 (45.00) B	42.5 (40.61) B
Silty loam	45.0 (42.11) B	42.5 (40.61) B
Loam	55.0 (47.88) A	52.5 (46.44) A

Figures within the parenthesis are angular transformed values and those in the same column having a common letter do not differ significantly (p= 0.01)

Highest mortality of barley was recorded in sandy loam and coarse sand in both years; and significantly lower mortality was observed in clay loam, silty loam and loam soils compared to sandy loam and coarse sand. Their mortality in loam and sandy loam was statistically similar in both years. These results are supported by the findings of Chattopadhyay and Mustafee (1977) and Mishra and Bais (1986).

Table 2. Effect of different soil textures on seedling blight of barley caused by *Sclerotium rolfsii*.

Soil texture	Percentage of mortality	
	First year	Second year
Sandy loam	52.5 (46.44) A	62.5 (52.71) A
Coarse sand	45.0 (42.12) A	62.5 (49.61) A
Clay loam	25.0 (29.14) C	45.0 (42.11) B
Silty loam	32.5 (34.03) B	42.5 (42.61) B
Loam	32.5 (34.03) B	40.0 (38.69) B

Figures within the parenthesis are angular transformed values and those in the same column having a common letter do not differ significantly (p= 0.01)

The gall index and population density of *M. incognita* differed in various texture of soil. In the first and third years trial statistically similar gall index was recorded in clay loam, silty

loam, and loam soil, and in the second year trial root galls formed in clay loam soil were significantly higher than silty loam and loam soil (Table 3). It indicates that clay loam, silty loam and loam soils are poor to support development of root galls. These results are in accordance with those of Sasser (1954) and Van Gundy (1985).

Table 3. Effect of different soil textures on the development of root gall caused by *Meloidogyne incognita.*

Soil texture	Gall index (0- 10 Scale)		
	First year	Second year	Third year
Coarse sand	5.25 A	4.25 A	5.00 A
Sandy loam	4.50 A	2.75 BC	4.50 A
Clay loam	2.75 B	3.25 AB	2.25 B
Silty loam	3.00 B	1.75 CD	1.75 B
Loam	2.75 B	1.25 D	2.50 B

Values in the same column having a common letter do not differ significantly (p=0.01)

The population of *M. incognita* in coarse sand and sandy loam soils were statistically similar but significantly higher as compared to other types of soils. The nematode population was the lowest in silty loam followed by loam and clay loam except in 2nd year trial, where silty loam, loam and clay loam soils had statistically similar effect (Table 4). These results are in agreement with the findings of Upadhyay *et al. (1972),* Davide (1980) and Prot and Van Gundy (1981); but differed from those of Whitehead (1969) who reported that in East Africa, there was no correlation of *M. javanica* and *M. incognita* with soil texture.

Table 4. Effect of different soil textures on the population of root-knot nematode (*Meloidogyne incognita*) .

Soil texture	Nematode population/ 100 cc soil		
	First year	Second year	Third year
Coarse sand	226.25 A	167.50 A	245.50 A
Sandy loam	202.50 A	103.75 A	200.75 B
Clay loam	102.50 B	71.25 B	100.00 C
Silty loam	57.50 C	61.25 B	45.00 D
Loam	83.75 B	60.00 B	73.75 CD

Values in the same column having a common letter do not differ significantly (p= 0.01)

It appears from the present study that the activities of *Fusarium oxysporum, Sclerotium rolfsii* and *Meloidogyne incognita* are higher in coarse sand and sandy loam soils.

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