EFFECT OF SOIL TYPE ON THE POPULATION OF *QUINISULCIUS SOLANI* ON POTATO

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ABSTRACT

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The development of *Quinisulcius solani* Maqbool, 1982 was favorably influenced by high sand content of soil while clay soil alone showed an adverse effect on it. The growth of the potato (*Solanum tuberosum* L.) cv Desiree was best observed in sandy clay. Presence of a host plant was essential for maintenance of *Q. solani* populations, as was evident by its decreased number in soils without the host plant. Significant differences in plant growth measurements were also observed between inoculated and uninoculated plants.

Additional key words: nematode ecology, soil analysis, soil texture, pathogenicity.

RESUMEN

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El desarrollo de *Quinisulcius solani* Maqbool, 1982 fue influenciado favorablemente por los suelos con alto contenido de arena, y adversamente por los suelos con alto contenido de arcilla. Se obtuvo un mejor crecimiento de la papa (*Solanum tuberosum* L.) cv Desiree en los suelos arcillo-arenosos. La presencia del hospedero es escencial para el mantenimiento de la población de *Q. solani*, lo cuál se demostró por la disminución del numero de nematodos en los suelos sin papa. También fueron observadas diferencias significativas en las medidas del crecimiento de la papa entre plantas inoculadas y no inoculadas con *Q. solani*.

Palabras claves adicionales: ecología de los nematodos, análisis del suelo, textura del suelo, patogenicidad.

Quinisulcius solani Maqbool, 1982 was first described from soil around potato (*Solanum tuberosum* L.) roots from Murree Hills, Pakistan (4). During pathogenicity and host range tests conducted in sandy soil, the potato cv Desiree was reported to be the best host of *Q. solani* (5). However, it also reproduced well on tomato, eggplant, citrus, and sugarcane. Since the soil preference of this nematode was unknown, the present investigation was made to study the influence of different soil types on the population development of *Q. solani* on the potato cv Desiree under

greenhouse conditions. Under natural conditions, *Q. solani* is usually observed in clay loam.

MATERIALS AND METHODS

The effect of soil type on the population of *Q. solani* was studied in 3 mixtures of soil. The soil mixtures used were: sandy clay (70% sand, 30% clay), silt loam (10% sand, 80% silt, 10% clay), and clay soil (90% clay, 10% sand).

Each of these soils were mixed, cleared of stones and debris, and autoclaved to kill any plant-parasitic nematodes. The pH of all the three combinations of soil was adjusted to 7.5. For each soil type, eight 30-cm-diam. pots were filled with 3 kg of autoclaved soil each. A single potato tuber (cv Desiree) was planted in each pot, and after 15 days, 4 pots of each soil type were each inoculated with 1000 larvae of *Q. solani*, obtained from a pure culture maintained on the potato cv Desiree in pots. Four pots of each soil type were left uninoculated to serve as controls. Urea fertilizer at the rate of 4g/pot was applied at the begining of the experiment, and soil was watered regularly to maintain normal soil moisture. The experiment was designed as a randomized complete block, and data were subjected to factorial analysis of variance. At zero time and at monthly intervals, nematodes were extracted (1) from a set of 4 pots of each combination. The experiment was started in the month of November, 1983 when the atmospheric temperature ranged from 25-30 C and terminated on April 15, 1984 when it was between 30-35 C.

Simultaneously in a second experiment, each soil type was inoculated with 1000 larvae of *Q. solani* per pot to examine the effect of soil type on the nematodes in the absence of a host. There were 4 replicates of each treatment.

RESULTS

The nematode population differed markedly with the soil type as well as with the development of the host plant. After one month, the nematode population in sandy clay had doubled compared to the initial population, in silt loam it increased by 1½ times, and in clay an increase to 1¼ times the initial number was observed (Fig. 1). After 4 months the population of nematodes increased to approximately 6 times the initial level in sandy clay, 3 times in silt loam, and 1½ times in clay soil. Factorial analysis of variance of the data (Table 1) clearly indicates that all the factors studied (soil type, time period, and their interaction) had a highly significant effect on the nematode population. Uninoculated control pots of each soil type did not show any nematode occurrence except for some saprophytic nematodes. These uninoculated control

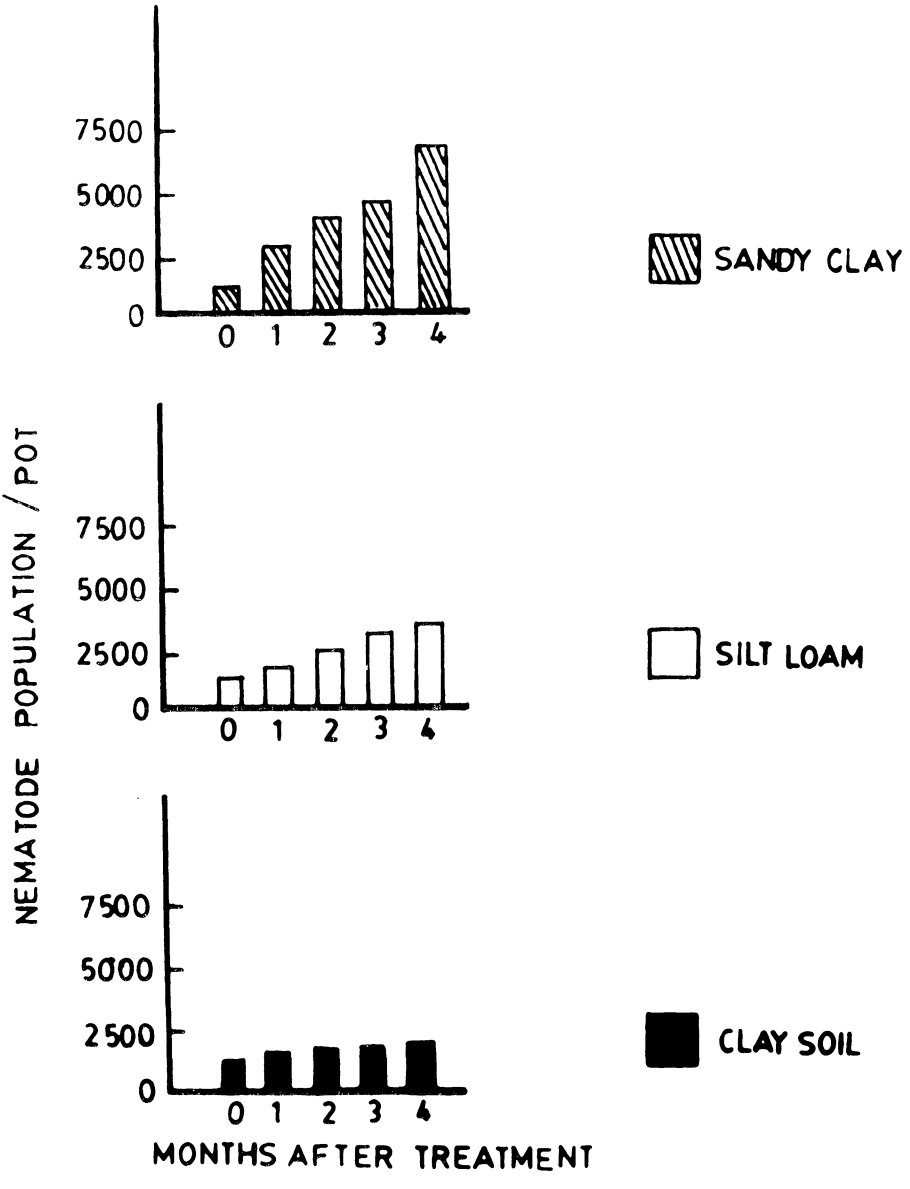

Fig. 1. Population of *Quinisulcius solani* in three different soil types around potato.

Table 1. Population of *Quinisulcius solani* in three soil types around potato roots. Analysis of variance results.

Source	Df	MS	F	P
Soil type	2	25,810,000	3820	<.001
Time period	4	18,830,000	2786	<.001
Soil type x time period	8	3,328,000	492	<.001
Error	45	6757		

potato plants were healthy but the inoculated plants showed decreases of 10-11 cm in shoot length, 5 cm in root length, 20-30g in top fresh weight, and 8-10g in root weight (Table 2). The growth of the potato plant was best in sandy clay, and poor in clay soil. Analysis of variance (Table 3) indicated that soil type and inoculation showed significant independent effects but no significant interactions in the case of shoot growth and root growth, whereas fresh weight of shoot and root showed both highly significant main effects and interactions.

The nematode population in the absence of a host plant showed a decline in all soil types, and after one month it was reduced to 700, 655, and 600 in sandy clay, silt loam, and clay soil respectively. After 4 months the nematode population was further reduced to 300, 100, and 50 respectively in sandy clay, silt loam, and clay soil.

DISCUSSION

A gradual decline in population was observed in soil without a host plant. However, the characteristics of sandy soil seemed to be most

Table 2. Effect of soil types on the growth of nematode inoculated and uninoculated potato plants.

Plant variable measured	Soil Type					
	Sandy clay		Clay		Silt loam	
	In[z]	Un[z]	In	Un	In	Un
Shoot growth (cm)	72	83	62	72	64	75
Root growth (cm)	30	35	25	30	27	32
Fresh weight of shoot (g)	300	330	280	300	285	310
Weight of root (g)	50	62	42	50	45	55

[z]In = Inoculated; Un = uninoculated.

Table 3. Effect of soil types on the growth of shoot and roots of potato plants. Analysis of variance results.

Source	Df	MS	F	P
Soil type				
Soil type	2	242	253	<.001
Inoculation	1	688	720	<.001
Soil type x Inoculation	2	0.698	0.731	ns
Error	18	0.955		
Root growth				
Soil type	2	51.0	28.1	<.001
Inoculation	1	145	79.7	<.001
Soil type x Inoculation	2	0.042	0.023	ns
Error	18	1.82		
Weight of shoot				
Soil type	2	1288	330	<.001
Inoculation	1	3825	980	<.001
Soil type x Inoculation	2	50.0	12.8	<.001
Error	18	3.90		
Weight of root				
Soil type	2	203	152	<.001
Inoculation	1	600	450	<.001
Soil type x Inoculation	2	8.00	6.00	<.010
Error	18	1.33		

favorable for the survival of *Q. solani*. Although populations increased only gradually when plants were grown in clay soil, when sand was mixed with clay in a 70-30 ratio, the nematode multiplied, reaching a number 6 times greater then the initial population. The best growth of the potato plant was seen in sandy clay, resulting in a greater number of feeding sites being available for supporting reproduction of the nematode. Preference for sandy clay for the multiplication of *Q. solani* is similar to observations of Kleyberg and Oostenbrink (3) in respect to *Pratylenchus penetrans* (Cobb, 1917) Filipjev & Schuurmans-Stekhoven, 1941 and *Tylenchorhynchus dubius* (Bütschli, 1873) Filipjev, 1936. Best reproduction of *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949, *M. hapla* Chitwood, 1949, and *Trichodorus pachydermus* Seinhorst, 1954 have been reported in sandy loam soil (6,7). Good multiplication of *Hemicycliophora arenaria* Raski, 1958 and *Xiphinema americanum* Cobb, 1913 have also been observed in sandy soil (2,8). In the present study, less multiplication of *Q. solani* in clay soil is similar to the observation of Ward (9) with *Xiphinema* spp. Out of the 3 soil types

tested, sandy clay appeared to be the most favorable for the growth of the potato plant and for the multiplication and survival of *Q. solani.*

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