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THE GERMINATION OF SEEDS AND GROWTH OF EGGPLANT AS INFLUENCED BY ROOT-KNOT NEMATODE TOGETHER WITH *ASPERGILLUS NIGER* AND *FUSARIUM OXYSPORUM* F. *LYCOPERSICI*

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Studies were made to determine the effect of *Aspergillus niger* on disease complex involving *Fusarium oxysporum* f. *lycopersici* and *Meloidogyne incognita*; both in nursery and transplantation stages. *A. niger* either alone or in combination with *F. oxysporum* f. *lycopersici* adversely affected the germination of seeds and growth of eggplant. Highest reduction in growth was observed when inoculated with *Aspergillus*, than with other microorganisms.

Keywords : *A. niger; F. oxysporum* f. *lycopersici; M, incognita;* Growth reduction.

Introduction

Brinjal is a transplantation crop where seedlings are raised in nurseries and then planted in fields. There is likelihood that seedlings are exposed to nematode as well as fungi in the nurseries and the field as well. Although considerable work has been carried out on the interaction of two microorganisms in field (Pitcher, 1965; Powell, 1971) but practically no information is available about this kind of interaction in the seedling stage. Moreover, most of the interaction studies between two microorganisms are made with pathogenic ones but nothing is known about the interaction if one rhizosphere saprophytic microorganism is incorporated in the complex involving nematode and a pathogen. Hence in the present investigation, an attempt has been made to determine the effect of *Aspergillus niger* on the interaction involving root knot nematode and *Fusarium oxysporum* f. *lycopersici* on egglant.

Material and Methods

The seeds of egglant cv-PPL were in the soil infested with *A. niger* (A), *F oxysporum* f. *lycopersici* (F) and root knot nematode (N) separately and in different combinations. Seeds were also sown in unifested soil to serve as control. For inoculation, *A. niger* and *F. oxysporum* f. *lycopersici* grown on Richard's solution for 15 days at 28°C (Riker and Riker, 1936) and were added at the rate of 5g/kg soil.

Table 1. Effect of *Aspergillus niger* with *Fusarium oxysporum* f. *lycopersici* and *Meloidogyne incognita* on germination of seeds of eggplant.

Treatment	No. of seedlings emerged out after days				
	10 days	15 days	20 days	25 days	30 days.
Control	55.00	70.00	77.50	77.50	77.50
Nematode	36.25	41.25	42.50	32.50	32.50
Aspergllus	37.75	46.25	41.25	40.00	37.50
Fusarium	41.25	52.50	50.00	42.50	42.50
Nematode + *Aspergillus*	17.25	20.00	25.00	20.00	20.00
Nematode + *Fusarium*	30.00	43.75	42.50	36.25	36.25
Aspergillus + *Fusarium*	31.25	53.75	52.50	47.50	35.00
Aspergillus + *Fusarium* + Nematode	31.25	27.50	22.75	21.25	21.25
L. S. D. 5%	3.25	2.75	2.15	1.95	1.75
,, 1./·	4.15	3.15	3.35	2.18	2.90

In order to determine the effect of culture filtrate the fungi were grown in the Richard's solution. After 15 days, the mycelial mats were removed and filtrate was used. To the soil where component was used,10 ml culture filtrate of that fungus was added.

Seedlings from the above treatments were planted in sterilised soil contained in 15 cm pots and were inoculated with 1000 larvae of root-knot nematode. Uninoculated seedlings from the above treatment were kept for control.

There were 5 replicates for each treatment. Observations for the emergence of seedling were made a ter 10, 15, 20, 25, 30 days of inoculation. Root-Koot index and nematode population were determined. Root-Koot index was rated as follows : 1— 0-50; 2— 51-100; 3— 101-150 and 4— 151-200. Root-knot nematode larvae were isolated from soil by using Cobb's sieving and decanting method and from root by mathod suggested by Stemerding (1964).

Results and Discussion

It is clear from Table 1, that all the microorganisms adversely affected the germination of seeds of egglant. Highest reduction in germination was

Table 2. Effect of culture filtrates of *Aspergillus niger* and *Fusarium oxysporum* f. *lycopersici* with *Meloidogyne incognita* on germination of seeds of eggplant.

Treatment	No. of seedlings emerged out after days.				
	10 days	15 days	20 days	25 days	30 days
Control	55.00	70.00	77.50	77.50	77.50
Nematode	36.25	41.25	42.50	32.50	32.50
Aspergillus	41.25	42.50	37.50	35.00	35.00
Fusarium	32.75	35.00	36.25	31.25	31.25
Nematode+*Aspergillus*	33.75	41.25	44.00	33.75	32.50
Nematode+*Fusarium*	43.75	43.75	42.50	36.25	36.25
Aspergillus+*Fusarium*	37.75	51.25	35.00	27.75	27.75
Aspergillus+*Fusarium*+Nematode	51.25	53.25	52.50	47.50	47.50
L. S. D.—1%	30.11	7.43	8.12	28.40	5.96
" —5%	21.55	5.31	5.81	20.39	4.26

observed when nematode was present together with *A. niger* at all the intervals. *Fusarium* was least effective in reducing the germination after 30 days.

When the three organisms were present separately, highest reduction in germination was observed with nematode followed by *A. niger* and *F. oxysporum* f. *lycopersici*. In treatment where all of three microorganism were present together the reduction was initially not very great but after 30 days of exposure the reduction was high enough comparable to that of nematode and *Aspergillus* together. It thus appears that *A. niger* when present alone or with nematode is also responsible for reduction in percentage germination of seeds (Jackson and Minton, 1968).

When culture filtrates of fungi were used instead of inoculation, reduction was observed in all the treatments but highest reduction was observed in mixture of culture filtrate of *A.niger* togteher with *F.oxysporum* (Table 2). By and large, after 30 days there has been more reduction in germination in the treatments where culture filtrates were used. This shows that toxic metabolites in the culture filtrate are equally responsible for the reduction in the seed germination. The toxic metabo-

Table 3. Effect of *Aspergillus niger* with *Fusarium Qxysporum* f. *lycopersici* and *Meloidogyne incognita* on the growth of eggplant.

Pre treatment at seedling stage	Post treatment after seedling emergence and transplant	Length (cm)	Dry Weight (gm)	No. ofgalls /root system	Root knot Index	No. of larvae	No. of larvae/ 250g soil.
Uninoculated	UIN	48.25	4.84	—	—	—	—
	In with RKN	32.60	3.73	144	3	3680	2350
Nematode	UIN	33.90	3.73	37	1	1480	1250
	In with RKN	32.60	2.37	134	3	3630	2500
Aspergillus	UIN	40.90	3.65	—	—	—	—
	In with RKN	43.75	3.15	50	2	1009	1300
Fusarium	UIN	38.25	3.37	—	—	—	—
	In with RKN	34.75	2.53	101	3	2000	1750
Nematode + *Aspergillus*	UIN	33.87	2.71	57	2	1200	880
	In with RKN	34.26	2.64	170	4	3900	3000
Nematode +	UIN	37.30	3.20	30	1	950	550
Fusarium	In with RKN	32.75	2.70	86	2	2610	2000
Aspergillus + *Fusarium*	UIN	36.67	3.58	—	—	—	—
	In with RKN	37.00	3.17	28	1	1200	950
Aspergillus + *Fusarium* +	UIN	40.27	3.00	58	2	1750	1250
Nematode	In with RKN	37.80	2.85	132	3	3450	2250
L. S. D. at 5%	—	5.30	0.2574	12.42	16.032		

RKN = Root-knot nematode; UIN = Uninoculated; IN = Inoculated.

Table 4. Effect of culture filtrates of *Aspergillus niger* and *Fusarium oxysporum* f. *lycopersici* with *Meloidogyne incognita* on growth of eggplant.

Pre treatment at seedling stage	Post treatment after seedling emergence and transplant	Length (cm)	Dry Weight (gm)	No. of galls /root system	Root knot Index	No. of larvae / root system	No. of larvae/ 250g soil.
Uninoculated	UIN	48.25	4.84	—	—	—	—
	In with RKN	32.60	3.73	142	3	3680	2350
Nematode	UIN	33.90	3.73	37	1	1480	1250
	In with RKN	32.60	2.37	134	3	3630	2500
Aspergillus	UIN	41.25	4.35	—	—	—	—
	In with RKN	38.00	4.16	48	2	1298	750
Fusarium	UIN	39.00	3.14	—	—	—	—
	In with RKN	33.90	2.95	60	2	988	875
Nematode + *Aspergillus*	UIN	31.95	1.01	95	2	1280	700
	In with RKN	33.90	0.71	150	3	1776	950
Nematode +	UIN	32.75	0.44	69	2	1012	575
Fusarium	In with RKN	25.65	0.57	89	2	1099	625
Aspergillus + *Fusarium*	UIN	40.75	2.36	—	—	—	—
	In with RKN	35.03	1.44	58	2	875	375
Aspergillus + *Fusarium* +	UIN	30.90	2.38	80	2	900	710
Nematode	In with RKN	27.30	0.68	171	4	2150	1275
L. S. D. at 5%	—	1.371	0.3734	23.3	2.38		

RKN=Root-knot nematode; UIN=Uninoculated; In=Inoculated.

lites of *Aspergillus* and *Fusarium* also appear to be compatible as the reduction was more in the mixture of the two than either of these alone. Here also, thers has been a reduction with increase in the duration of exposure to culture filtrate.

Results tabulated in Table3 show that when seedlings from different treatments in preceeding experiment were reinoculated with root-knot nematode alone, there has been a reduction in length, and dry weight of the plants in all the treatments. Highest reduction in growth in terms of dry weight was observed when seedlings from nematode infested soil were reinoculated with nematode alone. By and large seedlings obtaind from different treatment show general weakness even when they were left uninoculated.

Nematode multplication was also affected by the pretreatment. There was poor multiplication of nematode taken from soil infested with *Aspergillus* either alone or with *Fusarium*. The multiplication rate of nematode has been highest when inoculated both at seedling stage and transplanted stage.

Similar results were obtained when culture filtrates were used in place of fungus mycelia (Table 4). When the results on growth in terms of dry weight and nematode multiplication were observed and plants inoculated with fungi were compared with those with culture filtrate show that by and large there was more reduction in latter. This could in part probably due to more higher concentration of toxic metabolites present at the site of seed germination and roots. The toxic metabolites present in culture filtrate had thus deleterious effect both on plants and nematode multiplication.

Aspergillus niger is already known for the production of mycotoxins (Kurata, 1978) which could be affecting the seedlings emergence and plant growth adversely in present studies. *A. niger* with nematode appears to be affecting more adversely than either of two alone. It is probably the mycotoxin component which is contributing more towards the reduction in seedling emergence; thus *A. niger* when present alone causes much more damage. Certain species of *Fusarium* also known for production of toxins (Kurata, 1978).

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