Symptomatology, Interacton and Management of Rhizome Rot of Ginger by Xenobiotics

ANIL DOSHI AND SNEH MATHUR

도쉬, A.·S. 마투르 : 생강 뿌리썩음증상의 병징학, 기생체간 상호작용 및 약제방제

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ABSTRACT Three diffeerent types of symptoms were observed according to the pathogen associated with the rhizomes. The maximum rotting was observed in case when *Pythium aphanidermatum* was inoculated first followed by *Fusarium solani*. There was no interaction in case of root knot nematode *Meloidogyne incognita* and *Pythium aphanidermatum*. Average per cent germination of the rhizomes were increased significantly in each treatment and maximum in case of Alliette(.25%). The per cent pre & post drenching rotting was minimum in case of Alliette, Burgandy mixture, Dithane-M 45 and Difolatan. These fungicides also increase the yield of rhizome significantly.

INTRODUCTION

Several diseases attack ginger crop. Among them rhizome rot is the most important devastating disease in the ginger growing areas of our country and cause considerable losses in field as well as in storage. The pathoegen responsible for rotting of rhizome are *Pythium aphanidermatum, P. myriotylm, P. monospermium, P. gracile, P. butlari, Fusarium solani* and *Fusarium Oxysporum*, etc. (Bhagwat, 1961, Shahare and Asthana, 1962, Bertus, 1942, Haware *et al*, 1973, Sharma *et al* 1980),

The aim of the experimentation was to see the interaction of pathogen with nematode, to control the disease with different fungicide and to see their effect on the yield of rhizome. In our conditons at Udaipur and surrounding areas, the disease was found to be induced by *Pythium aphanidermatum* and *Fusarium solani*. During frequent collection of diseased material from farmer's fields and isolations, it was observed that from diseased rhizome both the fungi were recovered at the ratio of 6 : 4 for *Pythium aphanidermatum* and *Fusarium solani* respectively. Pathogenicity of both the fungi were tested and it gave positive results. Typical symptoms on inoculated plants appeared within ten days.

Department of Plant Pathology, Rajasthan Collge of Agriculture, Sukhadia University, Udaipur-313001(India)

SYMPTOMS

There are 3 different types of symptoms observed according to the pathogen associated with the rhizomes.

1. Rot caused by *Phthium aphanidermatum* alone:

Leaves turn yellow, ultimately wither and die out. Whole shoot is finally affected and the foot of plant becomes watery and soft. The rhizome is discoloured and gradually decomposes forming a watery mass of putrefying tissues enclosed by the tough rind. The root also rot and rhizomes formation ceases. This rot was severe when season was wet by continuous rains and free water is available.

2. Rot Caused by *Fusarium solani* alone:

Yellowing of leaves and wilting of plants in seedling stage and the adult stage. Collar region become dry and hard but seedling never toppel down. This rot was more severe during dry season.

3. Rot caused by pathogen complex:

Yellowing gradually spreads down the

leaf to the leaf sheath, often more rapidly along the margins. Behind it the leaf progressively withers and dies, and ultimately hangs dropping from the sheath. Then the whole shoot dries up. Meanwhile the base of the shoot between the rhizome and the surface of the soil turns to pale, translucent brown colour, and by the time that the leaves are well yellowed, it is very watery and soft, so that the whole shoot can easily be torn off from this point. The soft rot also extends beyond the collar into the rhizomes, which is discoloured and gradually decomposes, forming a watery mass of putrefying tissue enclosed by the tough rind. On the roots galls of the root knot nematodes were present.

MATERIALS AND METHODS

(1) Preparation of inoculum and fungicidal treatments:

Both *Pythium* and *Fusarium* spp were multiplied in petri plates, for *Pythium* spp. Oat meal agar medium were taken and for *Fusarium* PDA was taken. Seven days old culture were taken and equal number of petri-plates were used for preparation of the suspension and this Inoculum was used for inoculations. The rhizomes were kept in humidity chamber for 24 hrs. and dipped in fungicidal solution for half an hour, dried under shade and then sown in the field.

(2) Interaction of rhizome rot pathogen and nematode:

The experiment was carried out to see the interaction of rhizome rot fungi with nematode(*Meloidogyne incognita*). The experimentation was carried out in the pots having sterilized soil and rhizomes were inoculated with pathogen singly or in combination. In each pot 3 petri-plates-full of *Pythium* and *Fusarium* spp. were added after 15th day of sowing. One thousand larvae of *Meloidogyne incognita* were added in each pot. After 45 and 75 days of sowing observations were recorded for pre and post emergence death of seedlings.

(3) Effect of different fungicides on the germination and rotting of rhizomes in the field:

The experiment was carried out in the sick field in kharif season of 1983, 1984 and 1985. The plot size was 1.5m to 2.0m and plant to plant distance was 30cm and row to row distance 20cm. The healthy rhizomes were inoculated with both the pathogen before sowing. For better germination multching with mustard straw was done, it also checked the water evaporation from the soil. The drenching of the fungicidal solutions (1 lit/sq. feet) were done after 30 days of the sowing and repeated after 60days in the respective treatment. Observation for the germination of the rhizomes and death of the seedling were recorded before and after drenching.

RESULTS

Interaction of rhizome rot pathogen and nematode: The observation from the table 1 revealed that maximum rotting was observed in case when *Pythium* spp was inoculated first followed by *Fusarium* spp. Significant rotting was also observed in case where root knot nematodes was inoculated first followed by *Fusarium* spp. There was no interaction in case of root knot nematode+*Pythium* spp.

Effect of different fungicides on the germination and rotting of rhizomes in the field: The experiment was carried out to see the effect of seed treatment and soil drenching of the fungicides on the rotting of rhizomes and yield of rhizomes. The

Table 1. Interaction of rhizome rot pathogen and nematode

S. N.	Treatments	Mean percent rottings of rhizomes
1.	P	72.50
2.	F	37.50
3.	N	No disease
4.	P+N	No disease
5.	F+N	50.00
6.	*P_1+F	83.50
7.	*F_1+P	30.00
8.	*N_1+P	No disease
9.	*N_1+F	67.00
10.	Control	67.00

N=Nematode-*Meloidogyne incognita*
P=*Pythium aphanidermatum*
F=*Fusarium solani*
* =Pathogen is inoculated first followed by another pathogen

persual of the data from table 2, revealed that the average per cent germination of the rhizomes were increased significantly in each treatment over control except Ridomix ZM and Captan. The maximum germination was obtained in case of Alliette (25%) treated rhizomes.

The per cent pre-drenching rotting was minimum in case of Alliette and Burgendy Mixture and maximum in case of Bavistin, Topsin M, Captan as compared to other treatments.

The per cent post-drenching was minimum in Dithane-M-45, Difolotan and Alliette and maximum in Captan and Bavistin.

The maximum per cent increase in yield was in case of Difolation followed by Burgendy mixture and Dithane-M-45. However, all the Xenobiotics increased the yield over control.

DISCUSSION

When *Pythium* spp. was inoculated first followed by *Fusarium* spp. there was more disease, when *Fusarium* spp. was inoculated first followed by *Pythium* spp. there was less disease. This indicates that role of *Fusarium* is secondary in disease development. *Pythium* spp. alone caused more disease but when *Fusarium* spp. was inoculated alone there was not much rotting. When root knot nematode was inoculated alone and when root knot was inoculated first followed by *Pythium* there was no disease. This may be due to mycophagus habit of nematode or due to some secretion or physiological changes developed in roots of ginger due to nematode infection. There was more rotting when root knot inoculation were followed by *Fusarium* inoculations.

Table 2. Effect ef different fungicides on the germination, rotting and yield of rhizomes

Treatments	Average per cent germination	Per cent rotting		Mean yield	% increase in yield
		Pre-drenching	Post drenching		
1. Dithane M-45 0.2%	73.44	15.15	3.5	467.83	51.73
2. Ridomix 6ml/liter	67.62	15.63	4.33	428.88	28.10
3. Difolotan 0.2%	74.19	12.96	3.79	483.86	36.27
4. Bavistin 0.1%	73.58	19.19	4.96	356.66	13.55
5. Captan 0.2%	69.72	17.80	6.11	418.86	26.38
6. Topsin-M 0.25%	71.58	18.33	4.21	418.33	26.29
7. Burgendy Mixture 0.2%	74.74	11.11	4.75	481.00	56.00
8. Alliette 0.25%	77.03	9.16	4.07	404.66	31.24
9. Control Inoculated	62.01	21.75	17.14	308.33	—
Critical difference at 5%	NS	NS	1.84	105.80	
Critical differenceat 1%	NS	NS	2.54	NS	

NS : Not significant

This shows that there is positive interactions between *Meloidogyne* spp. and *Fusarium* spp. Here *Fusarium* spp. again played role of secondary invader.

When seed treatment was done with fungicides, the average per cent germination of the rhizomes increased significantly in each treatment over control. This shows that fungicides check the growth of the fungus present in the seed and soil. This result is in confirmation with the results of Mathur *et al.* (1984), Bhagwat(1961), Shahare and Asthana(1962), Haware and Joshi (1973 and 1974).

Soil drenching was done after 30 days and 60 days of sowing with Alliette, Burgendy mixture, Dithane-M-45, Difolotan help in controlling the pre and post drenching rottings. These results were in confirmation with the Mathur *et al.* (1984), Sharma *et al.* (1980).

Observation for rotting of rhizomes taken after drenching reveal that almost all fungicides could reduce rotting over control. Dithane-M-45 followed by Difolotan and Alliette were found more efficient in controlling disease in standing crop than other fungicides. These results are in agreement with Mathur *et al.* (1984) and Sharma *et al.* (1980).

According to Mathur *et al.* (1984) and Sharma *et al.* (1980), seed treatment with fungicide alone cannot check disease after germination. So seed treatment plus two drenching after 30 and 60 days of germination was done to compare some new fungicides like Alliette and Ridomix with non-systemic fungicides tested before. Observations reveal that seed treatment plus two drenching with fungicides gave better control and increased yield significantly.

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적 요

뿌리썩음증상은 병징에 따라 3가지로 대별되었다. 뿌리썩음증상은 *Pythium aphanidermatum*을 선접종 후 *Fusarium solani*를 후접종 하였을 때 가장 심하였다. 뿌리흑선충과 *Phthium aphanidermatum*과의 상호작용은 없었다. 근경발아는 각 처리에서 현저히 증가하였고 Alliette 0.25% 처리에서 가장 높았다. 토양관주에 의한 치료 및 예방효과는 Alliette, Burgandy mixture, 다이센 M-45, 디포라탄이 우수하였으며, 수량도 증가하였다.

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