STATUS OF SLOW DECLINE DISEASE OF BLACK PEPPER AND APPROACHES OF DISEASE MANAGEMENT

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Phytophthora foot rot and slow decline disease continue to be the major production constraints in black pepper. The status of these two diseases has been reviewed recently (Sarma ***et al.***, 1991; Ramana, 1991). Slow decline which was known earlier as slow wilt is considered as fungal nematodal complex coupled with mal-nutrition and moisture stress (Nambiar and Sarma, 1977). However the detailed investigations carried out in recent years have clearly brought out the major role played by the burrowing nematode, ***Radopholus similis*** and the root knot nematode ***Meloidogyne incognita*** (Venkitesan, 1976; Ramana ***et al.***, 1987) and feeder root damage caused by ***Phytophthora capsici*** (Anandaraj ***et al.***, 1991).

ETIOLOGY

Although malnutrition and moisture stress have been reported as associated factors in the slow decline, detailed pathogenicity tests with ***R. similis*** and ***M. incognita*** alone and in combination were carried out under simulated field condition with adequate moisture and nutrition, there by eliminating these two factors. Thus symptoms reproducing were mainly attributed to nematode damage (Mohandas and Ramana, 1991). Although ***R. similis*** is undoubtedly a potential pathogen fungal, association with slow decline affected root system, especially, ***Fusarium*** sp. has not been clearly explained so far. However ***P. capsici*** association with roots of slow decline affected vines was very low compared to other associated fungi. But ***P. capsici*** alone was found pathogenic to pepper, indicating its pathogenic potential.

Besides the recently concluded field experiment on the slow decline disease management in an areca-pepper mixed cropping system, clearly indicated the role of ***P. capsici*** in root rot apart from root damage caused by plant parasitic nematodes (Ramana ***et al.***, 1991). Feeder rot damage by ***P. capsici*** also could induce foliar yellowing and declining symptom. However interaction studies of nematodes and ***Fusarium solani*** are yet to be carried out precisely to determine the role of ***F. solani*** in disease syndrome, if any. However the indirect evidence showed that it didn't have any major role.

APPROACHES ON DISEASE MANAGEMENT

Nursery Stock: Raising disease free rooted cuttings under hygenic nursery management is of paramount importance. Using either fumigated or solarised nursery mixture would help in reducing pathogen load considerably.

Choice of Crop Combination: Although nematode damage to black pepper is noticed both in pure and mixed crop systems, their population build up in mixed cropping system differ considerably based on the susceptibility of the crops involved. Where areca-pepper and coconut-pepper are involved, the measures that check the nematode population build up should be given priority since both the hosts would lead to preponderence of nematode population. The importance of choice of supporting standards to reduce the nematode damage has been stressed (Ramana, 1991).

CHEMICAL CONTROL

Although soil application of phorate and carbofuran reduced nematode damage (Ramana, 1991), its large scale field application might not be a feasible proposition in view of the environmental pollution that it would lead to. Hence biocontrol would be an ideal proposition.

Effect of Organic Plant Recidues: The importance of organic amendments in nematode control is well known (Muller and Gooch, 1982). Mulching of black pepper with

Eupatorium odoratum @ 45 t/ha has been reported to check nematode infections (Litzenberger and Lip, 1961). Recent studies at NRCS clearly indicated that application of neem cake @ 2 kg/vine reduced the root knot nematode population considerably but was not found effective on ***R. similis*** (Ramana *et al.*, 1991). There is a need to identify locally available low cost organics that are effective against the nematodes since chemical control would be uneconomical and the population problem it poses. Organics invariably alter the microbial load in the soil both through the volatiles and this effects on supply of basic nutrients that it would ensure as a consequence of decomposition. It is essential to identify the biocontrol agents in such system and exploit them for nematode suppresion at the base of the vine.

Antagonistic Plants: Reduction of ***M. incognita*** was reported in pepper roots in plants grown along with African marigold (Anon., 1988). However the choice of the crop and its economic viability are the determining factors particularly in heavy rainfall areas of Kerala and Karnataka. Studies are warranted on this line especially on certain medicinal herbs which can fit in to the pepper cropping system and also suppress the nematodes as well as ***P. capsici.***

BIOCONTROL

The importance of biocontrol and its potentiality in suppressing plant parasitic nematodes is receiving enough attention (Jatala, 1986; Jairajpuri *et al.*, 1990).

Role of VAM (Vesicular Arbuscular Mycorrhiza): Various degrees of association of VAM with root system of black pepper has been reported (Manjunath and Bagyaraj, 1982). However the realisation of their in disease suppression in black pepper is recent. Out of the four VAM species tested under pot culture in comparison with phorate, ***Acaulospora laevies*** and ***Glomus faciculatum*** gave good suppression of root knot damage in black pepper almost on par with phorate (Table 1) (Anandaraj ***et al.***, 1991). Detailed studies are in progress to isolate and identify efficient VAM types that have suppressive ability on both ***R. similis*** and ***M. incognita.*** Once such efficient isolates are identified, incorporation of such inoculum into the nursery mixture would help in checking these pathogens at an early stage and also would ensure better

Table 1. Effect of VAM fungi and pesticides on *M. incognita*

Treatment	Shoot length (cm)	No. of nodes	Root volume (cc)	Dry weight shoot (g)	Root-knot index
G. mosseae + *M. incognita*	147.3	24.5	6.1	9.0	1.25
A. laevis + *M. incognita*	150.5	25.8	5.3	9.2	0.75
G. fasciculatum + *M. incognita*	111.8	18.8	4.9	5.8	2.00
G. margarita + *M. incognita*	114.8	20.3	4.7	7.3	1.25
M. incognita + Phorate	89.5	14.8	3.9	4.4	1.00
M. incognita + Quinalphos	56.5	11.3	2.8	3.8	2.50
M. incognita	40.5	9.0	2.5	3.5	3.50
Uninoculated	71.2	13.8	3.6	3.6	0.00
LSD at P = 0.01	26.6	5.14	0.86	2.34	

Source : Anandaraj *et al.*, 1990.

growth. However, delivery systems of VAM for large scale field application are being developed.

Role of other Microorganisms as Biocontrols: ***Pasteuria penetrans*** a bacterium, has been reported to be an efficient biocontrol agent (Sayre and Starr, 1985) and studies are in progress to isolate local types for screening. Nematode antagonistic bacteria and fungi should receive attention in future studies. Although ***Paecilomyces lilacinus*** was found to be very effective in suppressing root knot infections and leading to enhanced production of foot biomass in pepper at NRCS, the recent report that it is a facultative human pathogen (Kerry, 1987) would make its application a health hazard. However other fungal associations and their potentiality as biocontrol agents need be explored. The predatory nematodes that could check this ***M. incognita*** and ***R. similis*** should receive attention (Jairajpuri and Bilgrami, 1990).

Disease resistance: High degree of resistance to the nematodes in black pepper is yet to be identified. The multiple resistant types to plant parasitic nematode and ***P. capsici*** are of great relevance to Indian condition specifically under mixed cropping system where both ***P. capsici*** and nematodes are mainly responsible for considerable crop loss (Sarma ***et al.***, 1991). An integrated approach with cheap and efficient plant protection technology is of great relevance to check plant parasitic nematodes and ***P. capsici.***

REFERENCES

ANONYMOUS. 1988. National Research Centre for Spices. Annual Report for 1986, Calicut, Kerala, India. p.8.

ANANDARAJ, M. RAMANA, K.V. and SARMA, Y.R. 1991. Interaction between Vesicular Arbuscular Mycorrhizal fungi and ***Meloidogyne incognita*** in black pepper. ***In*** Mycorrhizal symbiosis and plant growth pp. 110-112. Proc. Second National Conference on Mycorrhize held at Bangalore Nov. 21-22, 1991. (Eds) D.J. Bagyaraj and A. Manjunath, University of Agric. Science, Bangalore.

JAIRAJPURI, M.S., ALAM, M.M., and AHAMAD, I. 1990. Nematode bio- control - aspects and prospects CBS publishers and Distributers Pvt. Ltd., Delhi-110 032, India.

JAIRAJPURI, M.S., and BILGRAMI, A.L. 1990. Predatory nematodes. pp. 95-125. ***In*** Nematode Biocontrol (aspects and prospects) (Eds.) Jairajpuri, M.S., Alam, M.M., and AHAMAD, I. CBS Publishers and Distributors Pvt. Ltd., Delhi-110 032, India.

JATALA, P. 1986. Biological control of plant parasitic nematodes. ***Ann. Rev. Phytopathol, 24***: 453-89.

SAYRE, R.M. and STARR, M.P. 1985. ***Pasteuria penetrans*** (Ex-Thorne 1940).non. rev. comb. n. sp. n. a mycelal and endospore forming bacterium parasitic in plant parasitic nematodes. ***Proc. Helminthol Soc. Wash, 52***: 149-165.

KERRY, B.R. 1987. Biological control. pp. 233-263. ***In*** Principles and practice of nematode control in crops (Eds. R.H. Brown and B.R. Kerry). Academic Press, Australia.

LITZENBERGE, S.C. and LIP, H.T. 1961. Utilising ***Eupatorium odoratum*** L. to improve the crop yields in cambodia. ***Agron. J. 55***: 221-324.

MANJUNATH, A., and Bagyaraj, D.J. 1982. Vesicular Arbuscular Mycorrhizae in three plantation crops and cultivars of yield bean. ***Curr. Sci. 51***: 707-708.

MOHANDAS, C. and RAMANA, K.V. 1988. Population behaviour of ***Radopholus similis*** in roots of black pepper (***Piper nigrum*** L.) in Kerala, India, Indian J. Nematol 18:18-21.

MOHANDAS, C. and RAMANA, K.V. 1991. Pathogenicity of ***Meloidogyne incognita*** and ***Radopholus similis*** on black pepper (***Piper nigrum*** L.). ***J. Plant. Crops. 19***: 41-53.

MULLER, R. and GOOCH, P.S. 1982. Organic amendments on nematode control. An examination of literature. ***Nematropica, 12***: 319-326.

NAMBIAR, K.K.N. and SARMA, Y.R. 1979. Wilt diseases of black pepper. ***J. Plant Crops 5***: 92-103.

RAMANA, K.V., MOHANDAS, C. and BALAKRISHNAN, R. 1987. Role of plant parasitic nematodes in the slow wilt disease complex of black pepper (***Piper nigrum*** L.) in Kerala. ***Indian J. Nematol. 17***: 225-230.

RAMANA, K.V., SARMA, Y.R. and MOHANDAS, C. 1990. Slow decline of black pepper (***Piper***

nigrum L.) and the role of plant parasitic nematodes and ***Phytophthora capsici*** in the disease complex. ***In*** Ninth Symposium on Plantation Crops Research and Development IX 5-7 December 1990, Bangalore, Abstract P. 17-18.

RAMANA, K.V. 1991. Slow decline disease of black pepper (***Piper nigrum*** L.) in India. pp. 136-157. Paper in Disease of Black Pepper - Proceedings of the International Pepper Community Workshop on Black Pepper Diseases 27-29 th October, 1988. Goa, India. (Eds. Y.R. Sarma and T. Premkumar).National Research Centre for Spices, Calicut, Kerala, India.

SARMA, Y.R., RAMACHANDRAN, N., and ANANDARAJ, M. 1991. Black pepper diseases in India. pp. 55-101. ***In*** Diseases of Black Pepper - Proceeding of the International Pepper Community Workshop on Black Pepper Diseases 27-29th October, 1988, Goa, India (Eds. Y.R. Sarma and T. Premkumar). National Research Centre for Spices, Calicut, Kerala, India.

VENKITESAN, T.S. 1976. Studies on the burrowing nematode ***Radopholus similis*** (Cobf 1893) Thorne 1949 on Pepper (***Piper nigrum*** L.) and its role in slow wilt disease. Ph.D. Thesis. University of Agricultural Science, bangalore. pp. 122.