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Study of Nematode in relation to Root rot disease (Macrophomina phaseolina) in Mulberry

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ABSTRACT

Root rot disease has become more alarming because of its epidemic nature and propensity to kill the plant completely. M. phaseolinais a soil borne pathogen was isolated from various root rot disease affected samples collected from the mulberry gardens ofTamil Nadu , South India. The affected plants show sudden withering of leaves followed by death of plants along with decaying and rotting of roots and stem cuttings. The disease is soil borne in nature and spreads fast primarily through contaminated soil, irrigation, diseased saplings farm implements etc. The population of nematodes in soil was assessed at the time of termination of the experiment by drawing a composite sample of 250g soil from each pot. The root system of the plants was carefully removed and dipped in a bucket of water for assessing adult nematode population in the root. the incidence of major nematodes namely, Meloidogyne incognita, Rotylenchus reniformis and Helicotylenchus ulcinctus populations varied from place to place, soil to soil and depends upon season to season.the maximum nematode population in mulberry garden viz., M. incognita in 58 (No./200cc soil), R. reniformis 34 (No./200cc soil) and H. ulcinctus 29 (No./200cc soil) in Erode district, where as low population of M. incognita (07 No./200cc soil) in Dharmapuri district, R. reniformis (13 No./200cc soil) in Tirunelveli District and (12 No./200cc soil) H. ulcinctus in Krishnagiri District, respectively.

1. Introduction

Mulberry (*Morus alba* L.) is a valuable tree of immense importance in silk industry due to its foliage, which constitute the chief food for silkworm (*Bombyx mori* L.). Being a perennial crop soil borne diseases and nematode infestation is widely prevalent and is a serious constraint for the production of quality leaf for feeding silkworm (Reddy *et al*., 2009; Shree and Nataraj, 1993). Root rot disease has become more alarming because of its epidemic nature and propensity to kill the plant completely. *M. phaseolina* is a soil borne pathogen was isolated from various root rot disease affected samples collected from the mulberry gardens of south India (Chowdary, 2006). *M. phaseolina* was reported as a major causative pathogen for root rot of mulberry in Coimbatore, Erode, Trichy and Thanjavur districts of Tamil Nadu (Sridhar, 2000; Marimuthu, 2005).The disease incidence ranges from 10 to 14% in hot spot areas (Philip *et al.,* 1995). The affected plants show sudden withering of leaves followed by death of plants along with decaying and rotting of roots and stem cuttings. The disease is soil borne in nature and spreads fast primarily through contaminated soil, irrigation, diseased saplings farm implements etc. due to its epidemic nature and potential to kill the plants completely. Feeding of the diseased leaves affects the health of the silkworm adversely and cocoon yield in terms of quality and quantity (Datta, 2010). The problem is observed both in nursery and established fields (Philip *et al*., 1995). The extent of damage in terms of leaf yield loss is 10-12 %. Application of organic manure improves the physical, chemical and biological properties of soil with direct on moisture retention, root growth, nutrient conservation, *etc.* Application of vermicomposting to mulberry serves as an alternative to chemical source of nitrogen as it enhances the foliar constituents which in turn improves the rearing and cocoon parameters of silkworm (Naik *et al*., 2011). The waste in sericulture contains organic matter like larval excreta, leaf litter, dead larvae, moth and cocoons (Kamili and Mosoodi, 2000).

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2. Materials and Methods

Surveys to assess the occurrence of root rot disease in mulberry

Root rots disease caused by *M. phaseolina* is the major disease in mulberry. The study was conducted in 50 mulberry gardenscovering 15 villages during the year 2012-13 by adopting random sampling method.The present survey was taken up in the districts *viz*., Coimbatore, Erode, Tirupur, Dharmapuri, Krishnagiri, Pudhukottai and Tuticorin to assess the incidence of root diseases (Fig.1).

$$\text{Percentage of disease incidence} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

Nematode population in soil

The population of nematodes in soil was assessed at the time of termination of the experiment by drawing a composite sample of 250g soil from each pot. The samples were processed for nematodes using Cobb's decanting and sieving method (Cobb, 1918) followed by modified Baermann's funnel technique (Schindler, 1961) and the population of nematode was recorded.

Nematode population in root

The root system of the plants was carefully removed and dipped in a bucket of water for assessing adult nematode population in the root. A weighed quantity of the fibrous roots taken were cut into small bits, mixed well and a composite sample of one gram was taken and examined under microscope for the presence of egg masses, number of galls and number of females after staining with acid fuchsine lactophenol followed by destaining in clear lactophenol and examined.

Identification of Nematode

The nematode identification of species is based on posterior cuticular or perineal pattern characters and natural openings like anal and vulval openings present in the posterior region. The method outlined by Taylor and Netscher's (1974) was followed for the preparation of perineal pattern.

Selected galls with mature females selected from mulberry roots and soil were placed in Syracuse dish with tab water. The root tissue was teased apart with forceps to remove adult females. A cut at the anterior portion up to neck was made to remove the body contents. The cuticle was placed in a drop of 45% lactic acid on a plastic petri dish. The lactic acid facilitates the removal of body tissues that adhere to the cuticle after trimming. A half cut (equatorially) was given to the cuticle and the perineal pattern was trimmed to square. Five to ten such perineal patterns were transferred to a drop of glycerine on a clean glass microscope slide. The perineal patterns were aligned so that are in a straight line and the anus is oriented down. A round or square coverslip was placed gently on the glycerine drop and the excess was absorbed by a piece of filter paper. Then the coverslip was sealed and labelled.

3. Results and discussion

A survey was made in seven mulberry growing districts of Tamil Nadu *viz.,* Coimbatore, Erode, Dharmapuri, Tirupur, pudukkottai, Tirunelveli, and Krishnagiri to find out the occurrence of root rot disease in mulberry. The results showed that per cent disease incidence of root rot disease was found to be maximum in all the places but exhibited variations which was ranged from 19.60 per cent to 43.58 per cent. However, the maximum incidence was found in (Ayyampalayam) Erode district (43.58%) followed by Annur of Coimbatore district. (31.57%), Uthangarai of Krishnagiridistrict (27.70%),Udumalpet of Tirupurdistrict (27.21%).Pappirettipatti of Dharmapuridistrict (23.58%) and Navaneethakrishnanpuram of Tirunelveli district (22.56%). The minimum disease incidence (19.60%) was recorded in Alangudi village of Pudukottai district (Table 1 and Figure 1.). This study was supported by several workers.Philip *et al.,*(1992) reported that a survey on the incidence of root rot disease showed its wide spread occurrence in almost all mulberry growing area of Kerala besides its prevalence in Karnataka and Andhra Pradesh. MerinBabu (2002) reported that incidence of stolon rot of mint was prevalent in all the areas surveyed and the incidence ranged from 16.48 to 36.81 per cent. Gangwar and Thangavelu (1991) conducted a survey covering 973 mulberry fields and 22 taluks of Tamil Nadu and reported an average incidence of 5.7 per cent. The highest incidence of 33.30 per cent was recorded in Kundadam taluk of Erode district followed by 14.30 per cent in Mettupalayamtaluk of Coimbatore district.

Table1. Occurrence of mulberry root rot disease in different mulberry growing areas of Tamil Nadu

Sl. No	Name of the Districts	Name of the village	Percent disease incidence*
1	Coimbatore	Annur	31.57 [b]
2	Erode	Ayyampalayam	43.58 [a]
3	Thirupur	Udumalpet	27.21[c]
4	Dharmapuri	Pappirettipatti	23.58[d]
5	Pudukottai	Alangudi	19.60[f]
6	Tirunelveli	Nava-neethakrishnan-puram	22.56[e]
7	Krishnagiri	Uthangarai	27.66[c]
CD (.05) = 0.7820			

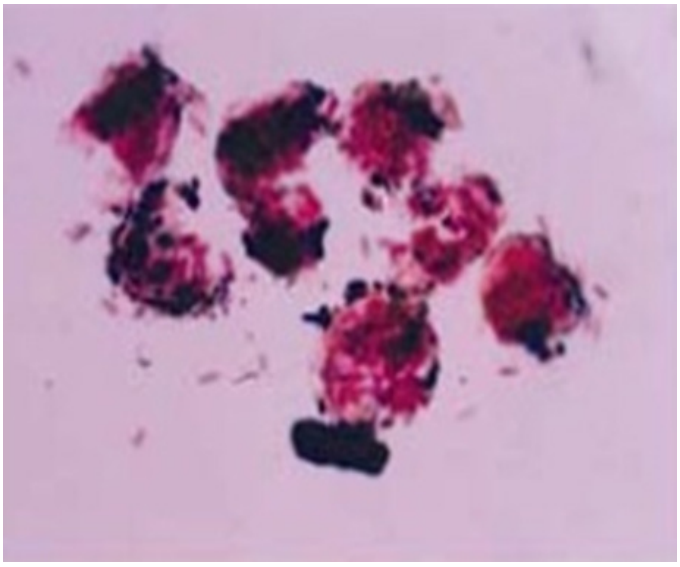
*Values are the mean of the three replications
Means followed by a same letter are not significantly different at the 5 % level by DMRT.

During the survey period (August 2012 to May 2013) the incidence of major nematodes namely, *Meloidogyne incognita, Rotylenchus reniformis* and *Helicotylenchu sulcinctus* populations varied from place to place,

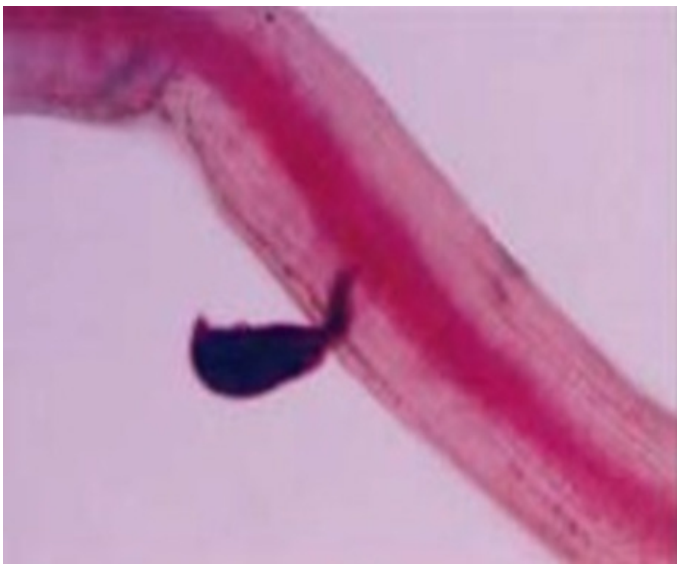
Table 2. Occurrence of nematodes on mulberry in different districts of Tamil Nadu

Nematode species	Coim-batore	Erode	Thirupur	Dharma-puri	Pudukottai	Krishnagiri	Tirunelveli
	No./ 200cc soil	No./ 200 cc soil	No./ 200cc soil	No./ 200 cc soil	No./ 200cc soil	No./ 200 cc soil	No./ 200cc soil
	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Meloidogyne incognita	43	58	31	07	24	39	26
Rotylenchusreni-formis	21	34	16	19	14	20	13
Helicotylenchu-sulcinctus	25	29	27	14	12	13	16

*Values are the mean of the three replications



Egg masses



Fully matured female

Plate 1. Microscopic view of Reniform nematode (R. reniformis) mulberry

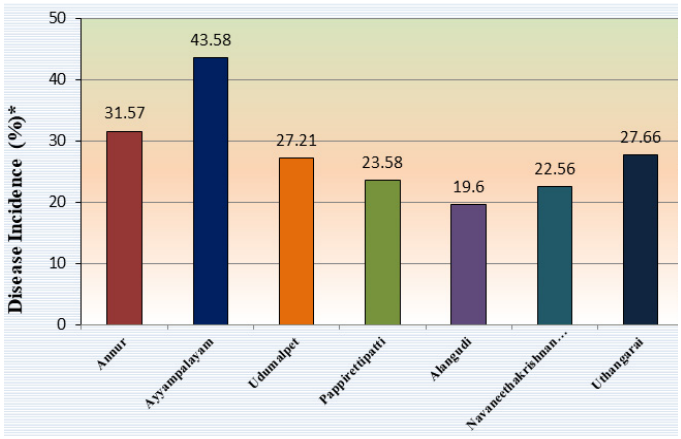


Figure 1. Occurrence of mulberry root rot disease in different mulberry growing areas of Tamil Nadu

soil to soil and depends upon season to season. The *M. incognita* nematode populations *viz*., were maximum (58No./200cc soil) in Erode district, followed by Coimbatore district (43No./200cc soil), Krishnagiri district (39No./200cc soil), Tirupur district (31No./200cc soil), Pudukottai district (24 No./200cc soil) and Tirunelvelidistrict (26 No./200cc soil). The very low level of (07 No./200cc soil) was recorded in Dharmapuri district.

Maximum population of *R. reniformis* were recorded in Erode district *viz*., in (34 No./200cc soil), followed by Coimbatore district (21 No./200cc soil), Krishnagiri district (20 No./200cc soil), Dharmapuri district (19 No./200cc soil), Tirupur district (16 No./200cc soil) and Pudukottai district (14 No./200cc soil), whereas very low level were observed in (13 No./200cc soil) in Tirunelveli district.

Helicotylenchus ulcinctus population was maximum in Erode district (29 No./200cc soil), followed by Tirupur district (27No./200cc soil), Coimbatore district (25 No./200cc soil), Tirunelveli district (16 No./200cc soil) and Dharmapuri district 14 (No./200cc soil), whereas low level of *H. ulcintus* were observed in Pudukottai district (12No./200cc soil).

In the present study indicated that the maximum nematode population in mulberry garden *viz.,M. incognita* in 58

(No./200cc soil), *R. reniformis* 34 (No./200cc soil) and *H. ulcinctus* 29 (No./200cc soil) in Erode district, where as low *M. incognita* (07 No./200cc soil) in Dharmapuri district, *R. reniformis* (13 No./200cc soil) in Tirunelveli District and (12 No./200cc soil) *H. ulcinctus* in Krishnagiri District, respectively (Table 2, Plate 1).

The present finding was also reported by of Govindaiah *et al*. (1993) who reported race-2 of *M. incognita* affects mulberry. Sharma and Sarkar (1998) reported that root knot nematode incidence was very high in red sandy soil (66.30%) with very severe intensity having 31 to more than 100 galls and egg masses/root system followed by red loamy soil (42.55%) under irrigated gardens whereas rainfed condition is absence of nematode populations.

M. incognita and *H.indicus* considerably reduced shoot length, shoot weight, number and weight of leaves and number of leaf-buds of mulberry plants. *M. incognita* induced root galls (Saha *et al*., 1983).

Migration of nematodes in the soil is also influenced by pore space and moisture as the infective juveniles are generally mobile in sandy soil and their mobility decreases in the soil Reddy (1983), Sasser*et al*. (1983), Govindaiah (1990) and Dhangar *et al*. (1995) who observed the poor or negligible establishment of root rot knot nematode in clayey soil and rainfed conditions in vegetables and mulberry crops.

4. Conclusion

Maximum nematode population of *M. incognita* as (58 No./200cc soil) and the highest root rot incidence (43.58%) were recorded in Erode district. These results revealed that, the disease is favored by maximum nematode population. Management practices against nematode may reduce the severity of root rot disease by some extent.

References

[1] Chowdary, N. B. 2006. Studies on root rot disease of mulberry (*Morus* spp.) and its management with special reference to the antagonistic microbes. Ph.D. Thesis submitted to the University of Mysore, Mysore, India.

[2] Cobb, N.A. 1918. Estimating the nematode population of the soil. *Agric. Tech. Circ. Bur. Pl. Ind. U.S. Dep. Agric.*, No.1: 48.

[3] Datta, S. C. 2010. The Role of Cina in the Field of Enriched Sericulture.HpathyEzine,.Febuary, 2010.

[4] Dhangar, D. S., Gupta, D. C. and Jain, R. K. 1995. Effect of marigold (*Tagetes errecta*) intercropped with brinjal in different soil types on disease intensity of root knot nematode (*Meloidogyne javanica*). *Indian J. Nematol.,*25: 181-186

[5] Govindaiah, Dandin, S. B., Sharma, D. D. and Datta, R. K. 1993.Efficacy of different doses of carbofuran on *Meloidogyneincognita* infecting mulberry.*Ind. J. Sericulture*, 32: 99-101.

[6] Govindaiah. 1990. Studies on root-knot nematode, *Meloidogyne incognita* infesting mulberry. *Ph.D. Thesis*, University of Mysore, India.

[7] Kamili, A. S. and Mosoodi, A. M. 2000. Principle of Temperate Sericulture. *Kalyani Publishers*, New Delhi: 105-116.

[8] Marimuthu, T. 2005. Mulberry root rot caused by *Macrophomina phaseolina*. In: Brainstorming session on mulberry root rot. Coimbatore, India: Centre for Plant Protection studies, Tamil Nadu Agricultural University: 1 – 5.

[9] Naik. R., Sannappa. B., Bhaskar, R. N. and Dvaiah, M. C. (2011). Investigation of the sources of organics for mulberry and impact on quantitative traits of the silkworm, *Bombyx mori L. Internation journal of Science and nature.*Vol. 2(1)2011: 114-117.

[10] Philip, R., Sharma, D. D., Govindaiah, S., Bajpai, A. K. and Dutta, R. K. 1995. Root rot disease of mulberry and its management. *Indian Farming*.5: 23–24.

[11] Reddy, C. R., Nirmala, R. S. and Ramanamma, C. H. 2009. Efficacy of phytoextracts and oils of certain medicinal plants against *Cercospora moricola* Cook.,incitant of mulberry (*Morus alba* L.) leaf spot. *J. Biopestic,*2: 77-83.

[12] Reddy, P. P. 1983. *Plant nematology*.Agriclolepuplishing Academic, New delhi, India: 93-99.

[13] Saha.,Subhada, S., Sinhababu, S. P. and Sukul, N. C. 1983. The effect of nematode infestation on mulberry plants and their effect on feeding silkworms, *Bombyx mori* L. *Nematologica*, 29: 463-467.

[14] Sasser, J. N., Eisenbeck, T. O. and Carter, C. C. 1983. The International *Meloidogyne* project; its goals and accomplishment. *Annu. Rev. phytopathology*. 21: 270-278.

[15] [15]. Schindler, A. F. 1961. A simple substitute for a Baermann funnel. *Plant Disease Reporter*, 45 747-748.

[16] Sharma, D. D. and Sarkar, A. 1998. Incidence and intensity of species/ races of root knot nematode associated with mulberry under different farming systems and soil types in Mysore region, Karnataka State, India. *Indian J. Seric*., 37: 137-141.

[17] Shree, M. P. and Nataraj, S. 1993. Post-infectional biochemical and physiological changes in mulberry.*Curr. Sci*., 65: 337-341.

[18] Sridhar, R., Subramanian, A., Chandramohan, N. 2000. Management of root rot with antagonistic microorganisms. *Sericologia*.40 (3): 383 -386.

[19] Taylor, D. P. and Netscher, C. 1974. An improved technique for preparing perennial pattern of *Meloidogyne spp. Nematol.*, 20: 268.

[20] MerinBabu. 2002. Etiology and management of stolon rot of mint (*Mentha viridis* linn.) *M.Sc. (Ag.) Thesis,* Tamil Nadu Agricultural University, Coimbatore, India.

[21] Philip, T., Latha, J. and Govindaiah, S. 1992. Studies on root rot disease of mulberry and their control by chemical and biological methods. *Annual report CSR &TI.,* Mysore.

[22] Gangwar, S. K., Thangavelu, K. 1991. Occurrence of mulberry diseases in Tamil Nadu.*Indian Phytopath.,*44 : 545-549.