Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(2): 1777-1779
Received: 12-01-2019
Accepted: 15-02-2019

Ravi Kumar MR
College of Agriculture, Hanumanamatti, Ranebennur, Karnataka, India

Harish DK
College of Agriculture, Hanumanamatti, Ranebennur, Karnataka, India

Kumara BH
College of Agriculture, Hanumanamatti, Ranebennur, Karnataka, India

Correspondence
Ravi Kumar MR
College of Agriculture, Hanumanamatti, Ranebennur, Karnataka, India

Low cost technology for management of panama wilt disease of Banana by stem injection method

Ravi Kumar MR, Harish DK and Kumara BH

Abstract
Fusarium wilt, caused by *Fusarium oxysporum* f.sp. *cubense* (Foc), is the most important disease of bananas in India. There is no effective control measure for this disease other than the use of resistant cultivars. The objective of this study was to evaluate newly available fungicides under *in-vitro* and *in-vivo* conditions for their efficacy against the responsible pathogen *Fusarium oxysporum* f. sp, *cubense* (Foc). Results are proved that stem injection with carbendazium (0.3%) + copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml twice at 20 days intervals has maximum recovery after 10-15 days after first injection. However, injection with carbendazium (0.3%) + COC (0.3%) and carbendazium (0.3%) + Boric acid (0.3%) delayed recovery upto 35-45 days. Therefore, for the management of panama wilt of Banana can be managed by combined application of carbendazium (0.3%) + copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml.

Keywords: Banana, fusarium wilt, panama wilt, carbendazium, copper oxychloride and boric acid

Introduction
Banana (*Musa spp*.) is an important cash and food crop in the tropics and subtropics. Banana is widely grown in India with great socio-economic and cultural heritage of country. In India, Banana contributes 37% of the total fruit production. Fusarium wilt of banana was first reported from Australia, although the pathogen probably originated in Southeast Asia (Stover, 1962). Southeast Asia it rapidly spread throughout the world by means of infected rhizomes (Stover, 1962) [14]. Fusarium wilt diseases are known to be destructive to many economically important an agricultural crops planted around the world (Armstrong and Armstrong, 1981) [3]. The disease has decimated crops and has threatened an estimated 80 percent of the world's banana crop. Fusarium is a soil-borne fungus active under a wide range of environmental conditions and survives in the soil as chlamydospores (Booth, 1971; Kreutzer, 1972) [5, 10]. Chlamydospores are usually globose and are formed singly or in pairs in hyphae or conidia (Nelson *et al*., 1983) [13]. These spores can remain dormant for several years after the host dies. The fungus remains dormant in agricultural soils until stimulated by a susceptible host species (Nelson, 1981) [3]. The infection always occurs through infected lateral roots. After entering the lateral roots the fungus proceeds to rhizomes where it develops extensively in vascular tissue before passing up the vascular symptom into pseudo stem and other older leaf petioles. *F.o.cubense* infects bananas by penetrating the root tips of the small lateral or feeder roots of the plant (Stover, 1962; Beckman, 1990) [14, 4, 7]. As the disease progresses upward through the plant, it clogs the vessels and blocks the flow of water and nutrients. The first visible banana fusarium wilt symptoms are stunted growth, leaf distortion and yellowing, and wilt along the edges of mature, lower leaves. The leaves gradually collapse and droop from the plant, eventually drying up completely. The pathogen is primarily spread by the movement of infected plants, plant debris and infected soil (Green, 1981) [7]. The panama wilt disease in banana can be managed by using resistant cultivars and by preventing its introduction into new fields. The elimination of the pathogen from soil by conventional control measures very difficult (Armstrong and Armstrong, 1975) [2]. Some measure of success against Fusarium wilt diseases has been merely achieved with fungicides belonging to the benzimidazole group, which include fungicides such as benomyl, carbendazim, thiabendazole and thiophanate when they come in contact with the plant surface by drenching or spraying (Erwin, 1973; Agrios, 1997) [6, 1]. Various fungicides have been evaluated for their effectiveness against *F.o.cubense*. However, no long-term control measures could be established with the application of fungicides for controlling panama wilt at field level.
The objective of this study was to evaluate newly available fungicides under invitro and invivo conditions for their efficacy against the responsible pathogen *Fusarium oxysporum* f. sp, *cubense* (Foc).

Materials & Methods

The experiments were conducted in Sirsi talukas (Banavasi), Byadagi taluk, Ranebennur taluk (Kadaramandaligi, Gangajala Thanda) and Hirekerur taluk (Thipayakoppa) of Karnataka state, India.

Since the discovery of Fusarium wilt of banana, various control methods have been attempted to curb the damage caused by the disease. Yet, no long-term control measures are available other than the planting of resistant cultivars (Moore *et al*., 1999) [12]. Soil fumigation (Herbert and Marx, 1990) [8], fungicides (Lakshmanan *et al*., 1987) [11], crop rotation (Hwang, 1985; Su *et al*., 1986) [9], flood-fallowing (Wardlaw, 1961; Stover, 1962) [16, 14] and organic amendments (Stover, 1962) are some of the control strategies that have been investigated in the past. The disease can be effectively managed by stem injection is one of the most and recent effective method to controlling Fusarium wilt of banana with carbendazium (0.3%) + Copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml per plant twice at an intervals of 20 days.

Table 1: Effect of stem injection with different fungicides on panama wilt disease of Banana

Sl. No.	Treatment	No. of plant injected	No. of plants recovered after days of treatments
1	Carbendazium (0.3%) + CoC (0.3%) + Boric acid (0.3%)	200	All injected plants partially recovered within 10-15 days after 1st injection and complete recovery after 2nd injection
2	Carbendazium (0.3%) + CoC (0.3%)	200	All plants partially recovered within 35-40 days after 2nd injection
3	Carbendazium (0.3%) + Boric acid (0.3%)	200	All plant partially recovered 40 -50 days after 2nd injection
4	Carbendazium (0. 3%)	200	All plants partially recovered 60-70 days after 2nd injection
5	Control	200	All infected plants leaves were yellowing, splitting of pseudo stems and drying of plants

Results & Discussion

Recently, part of Northern Karnataka and Uttarakannada faced severe problem of panama wilt disease of Banana. The environment may have an important influence on Fusarium wilt development. In a subtropical country like India, disease symptoms are the best observed and most severe after or during the winter (Viljoen, 2002) [15]. The pathogen *Fusarium oxysporum fsp. cubanes* infected the plants upto age group of 12 months. Our studies are also showed that the defence mechanisms in banana plants is affected by temperature. The spread of the fungus was inhibited at 34º due to gel and tylose formation by the plant. Byadagi, Ranebennur and Hirekerur talukas of Haveri district experienced madarate temperature and higher soil moisture that are condusive for spreads the panama wilt in Banana. At temperatures of 21 º and 27 º the host responses were delayed and this led to pathogen invasion. Wardlaw (1961) [16] also stated that the onset of a rainy season, or after less active plant growth periods, the disease incidence is higher.

The lowest (28.5 t/ha) yield and B:C ratio (1.9) were recorded with without stem injection (control) and highest (51.9 t/ha) yield and B:C ratio (3.6) was with Carbendazium (0.3%) + Cupper Oxy Chloride (0.3%) + Boric acid (0.3%) (Table 2). However, increased in yield and B:C ratio were obtained when combined application of Carbendazium (0.3%) with Copper oxy Chloride (0.3%) (49.8 t/ha and 3.4) and also with Boric acid (0.3%) (50.5 t/ha and 3.4), respectively. The results of our studies showed that stem injection with carbendazium (0.3%) + copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml twice at 20 days intervals recovered maximum recovery of 100 per cent after 10-15 days second injection. However, injection with carbendazium (0.3%) + COC (0.3%) and carbendazium (0.3%) + Boric acid (0.3%) delayed recovery upto 35-45 days. Fuerther, untreated plants failed to recovery from yellowing of leaves and wilting of plants after expression of the symptom. Therefore, for the management of panama wilt of Banana, combined application of carbendazium (0.3%) + Copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml may be recommended.

Table 2: Effect of stem injection on yield and economics of Banana by different fungicides for panama wilt of banana

Sl. No.	Treatment	Bunch weight (Kg/plant)	Yield (t/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs.)	Net Return (Rs.)	B:C ratio
1	Carbendazium (0.3%) + CoC (0.3%) + Boric acid (0.3%)	17.40	51.90	145000	519000	374000	3.6
2	Carbendazium (0.3%) + CoC (0.3%)	16.85	49.80	146000	498000	352000	3.4
3	Carbendazium (0.3%) + Boric acid (0.3%)	16.90	50.50	146500	505000	358500	3.4
4	Carbendazium (0. 3%)	14.22	42.50	147000	425000	278000	2.9
5	Control	11.00	28.50	147500	285000	137500	1.9

Conclusion: The management of Fusarium wilt of banana has become a relevant and important research topic with the outbreaks of the disease in the subtropics and tropics. The stem injection with carbendazium (0.3%) + copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml twice at 20 days intervals resulted in maximum recovery after 10-15 days of second injection. Management of panama wilt of Banana, combined application of carbendazium (0.3%) + Copper oxychloride (0.3%) + Boric acid (0.3%) 30 ml may be recommended.

Reference

1. Agrios GN. Plant Pathology. Academic Press, USA, 1997, 173-221.
2. Armstrong OM, Armstrong JK. Reflections on the wilt Fusaria. Annual Review of Phytopathology. 1975; 13:95-103.
3. Armstrong OM, Armstrong JK. Formae speciales and races of *Fusarium oxysporum* causing wilt disease. In: Nelson, P.E., Toussoun, T.A., and Cook, R.J. (Eds), Fusarium: Disease, Biology and Taxonomy.

Pennsylvania State University Press, University Park, USA, 1981, 391-399.
4. Beckman CH. Host responses to the pathogen. In: Ploetz, R.C. (Ed.), Fusarium wilt of banana APS Press, St Paul, Minnesota, USA, 1990, 93-105.
5. Booth C. The Genus *Fusarium.* Commonwealth Mycological Institute, Kew, Surrey, England, 1971, 237.
6. Erwin DC. Systemic fungicides: Disease control, translocation, and mode of action. Annual Review of Phytopathology. 1973; 11:389-422.
7. Green RJ. An Overview. In: Mace, M.E., Bell, A.A., and Beckman, C.H. (Eds), Fungal wilt diseases of plants. Academic Press, New York, USA, 1981, 1-24.
8. Herbert JA, Marx D. Short-term control of Panama disease in South Africa. Phytophylactica. 1990; 22:339-340.
9. Hwang SC. Ecology and control of fusarial wilt of banana. Plant Protection Bulletin. (Taiwan) 1985; 27:233-245.
10. Kreutzer WA. *Fusarium spp.* as colonists and potential pathogens in root zones of grassland plants. Phytopathology. 1972; 62:1066-1070.
11. Lakshmanan P, Selvaraj P, Mohan S. Efficiency of different methods for the control of Panama disease. Tropical Pest Management. 1987; 33:373-376.
12. Moore NY, Pegg KG, Bentley S, Smith LJ. Fusarium wilt of banana: Global problems and perspectives. In: Molina, A.B., Masdek, N.H.N. and Liew, K.W. (Eds), Banana Fusarium wilt management: Towards sustainable cultivation. Proceedings of the International Workshop on banana Fusarium wilt disease, Genting Highlands Resort, Malaysia, 1999, 11-30.
13. Nelson PE, Toussoun TA, Marasas WFO. *Fusarium species*: An illustrated manual for identification. Pennsylvania State University Press, University Park, USA, 1983, 193.
14. Stover RH. Fusarial wilt (Panama disease) of bananas and other Musa species. Commonwealth Mycological Institute, Kew, Surrey, UK, 1962, 117.
15. Viljoen A. The status of Fusarium wilt (panama disease) of banana in South Africa. South African Journal of Science. 2002; 98:341-344.
16. Wardlaw CW. Banana diseases, including plantains and abaca. Longmans, Green and Co. Ltd, London, 1961, 648.