Mycopath (2003) **1**(2)**:** 111-113

Chemical control of wilt in Shisham (*Dalbergia sissoo* Roxb.)

Rukhsana Bajwa*, Arshad Javaid, J.H. Mirza* and Naureen Akhtar***

**Department of Mycology & Plant Pathology and **Department of Botany, University of the Punjab, Quaid-e-Azam Campus, Lahore 54590, Pakistan*

Abstract

Fusarium solani (Mart.) Appel & Wr. was isolated from the roots of shisham (*Dalbergia sissoo* Roxb.) plants of 6–30 years age, showing symptoms of wilt disease at different stages. *In vitro* toxicity assays with three fungicides revealed that Benomyl is the most effective in controlling mycelial growth of *F. solani* followed by Ridomil Gold while Aliette had insignificant effect. Field study showed that application of 50 liters of 200 ppm Benomyl can effectively recover 6-8 years old wilting shisham plants.

Introduction

Shisham is an important tree species of great economic importance in the sub-continent. This precious tree has been inflicted with dieback and wilt diseases in the recent years and the incidence is also reported in Tarai tract of Nepal, believed to be its home (Bajwa *et al.,* 2003). The characteristic symptoms of shisham wilt are yellowing and death of leaves in acropetal succession up the tree, as a result the whole tree appears yellow. In advance stages the affected trees show signs of wilting, the leaf shed rendering the branches bare, and ultimately plants die within a few months. Older trees are usually found to be more prone to mortality. The outer sapwood shows characteristic pink to reddish stain. Though it is restricted to outer sapwood, it sometimes penetrates in the inner sapwood, the heartwood is not discoloured. The stain progresses along the outer sapwood of the root to the stem and in later stages of wilting it extends up the stem to about 3-5 m from the ground (Baksha and Basak, 2000). Wilting is more serious and damaging than die back because it results in a rapid mortality of the infected trees.

The objective of this study was to isolate and identify the causal agent of wilt disease and to evaluate some fungicides for prospective control of the causal organism.

Materials and Methods

Isolation of the pathogen

Root samples of 10 shisham plants of different ages (6-30 years) and at different stages of wilting, were collected from Quaid-e-Azam Campus. University of the Punjab Lahore, Pakistan during September-November 2003. The root specimens were cut into small pieces and surface disinfected by immersing in 1% sodium hypochlorite solution for one minute and then rinsed thrice in sterilized water. The surface sterilized root pieces were placed on to the malt extract agar (MEA), potato dextrose agar (PDA), Czapek's dox agar and corn meal agar media in petriplates and incubated at 25°C. After 8 days the fungal isolates appearing on the root pieces were identified and transferred to PDA slants for purification.

In vitro chemical control of *F. solani*

The *in vitro* toxicity of three fungicides viz. Ridomil Gold, Benomyl and Aliette were tested against *F. solani* by the poisoned food technique (Nene and Thapliyal, 1979). Each fungicide was mixed separately in autoclaved melted PDA medium to obtain required concentration i.e., 10, 20, 30, 40 and 50 ppm. Twenty ml of poisoned melted PDA medium was poured into each sterilized plate and allowed to solidify. PDA medium without fungicides served as control. After solidification of medium, 3 mm agar plugs of the fungus on PDA were transferred in the center of the plates. Each treatment was replicated thrice. All the plates were incubated at 25±2°C. Growth inhibition rate was recorded after 8 days of incubation. Percent inhibition in fungal growth was calculated according to Vincent (1957). Data were analyzed by applying t-test.

In vivo chemical control of shisham wilt

The fungicide (Benomyl) found most effective in inhibiting the mycelial growth of *F. solani* in poisoned food technique was further evaluated in field for the control of shisham wilt by soil drenching with fungicidal solution of 200 ppm concentration. Three shisham plants of 6-8 years old, showing clear symptoms of wilt disease were selected in Punjab University, Lahore. Fifty litres of 200 ppm suspension of Benomyl were drenched in the soil around each selected tree. The

disease incidence was recorded 45 days after treatment.

Results and Discussion

The wilt disease was most common during the months of September -.November In India and Bangladesh the disease manifests during humid months from July to September (Sharma *et al.,* 2000; Baksha and Basak, 2000). The affected plants show characteristic symptoms of disease i.e., yellowing and death of leaves in acropetal succession up the tree and eventually the entire tree appeared chloriotic (Sharma *et al.,* 2000). The roots of the diseased plants were not different from healthy ones in newly diseased plants.

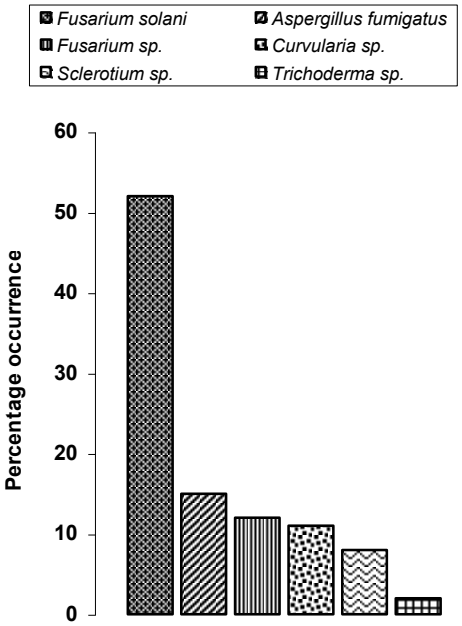

Fig. 1: Percentage occurrence of different fungi isolated from wilting shisham trees.

Fusarium solani was isolated from roots of all the infected trees. The other fungal species, which were isolated in low percentage were *Aspergillus fumigatus, Fusarium* sp., *Curvularia* sp. *Sclerotium* sp. and *Trichoderma* sp. (Fig. 1). *Fusarium solani* seems to be the possible cause of wilting as it was found in roots of all the infected trees in very high percentage. Shakir *et al.* (1999) also isolated *F. solani* from diseased roots and assumed this organism to be the cause of shisham decline. Similar observations have also been reported from Bengladesh, Nepal and India during the last few years. Baksha and Basak (2000) have reported a wide spread mortality of shisham trees of varying ages in Bangladesh and assumed that *F. solani* and shothole borer may be the cause of disease. Earlier, Bakshi (1957) also isolated *F. solani* from diseased shisham plants. The fungal hyphae and jelly like substances plug the vessels resulting in wilt symptoms (Bakshi and Singh, 1959). According to Davis *et al*. (1953) wilt is generally the result of *Fusarium* attack at the roots or even lower portions of stem where its growth interferes with the conduction of water and excreted toxins of the nature of conjugated phenols. According to some workers, *Fusarium oxysporum* is the cause of shisham wilt (Gill *et al*., 2001). Some people confuse the wilt with dieback. Dieback is entirely different disease characterized with thinning of leaves and crown, drying up of the ends of branches, table topped condition and stag-headness in extreme conditions (Khan, 2000). Dieback is caused by *Phytophthora cinnamomi* (Gill *et al.,* 2001).

Among the three fungicides evaluated against *F. solani* in *in vitro*, Benomyl was found to be highly effective causing a significant reduction in mycelial growth of the test fungus even in very low concentration of 10 ppm. Ridomil was effective in higher concentration while Aliette failed to alter the growth of this fungus significantly even at 50 ppm concentration level (Fig. 2). Some other fungicides such as Vitavax, Dithane M-45, Bavistin and Benlate are also known to have significant suppressive effect on growth of *F. solani* (Ahmad *et al.,* 1996). Benomyl, the most effective fungicide in *in vitro* trial was also proved very effective in *in vivo* experiment. All the three shisham plants, which were likely to be dead by wilting during next few weeks, managed to recover themselves from disease after treatment with Benomyl. The treatment with this fungicide may prove highly beneficial to save the shisham trees from the menace of wilting. However, there is need to study the effectiveness of this fungicide against the wilt attack in older trees. A benomyl derived fungus toxicant MBC (Methyl-2-benzi midazol carbamate) is also known to be effective against wilting. It is a stable fungicide suitable for injection into the trees (Mcwain and Gregory, 1973).

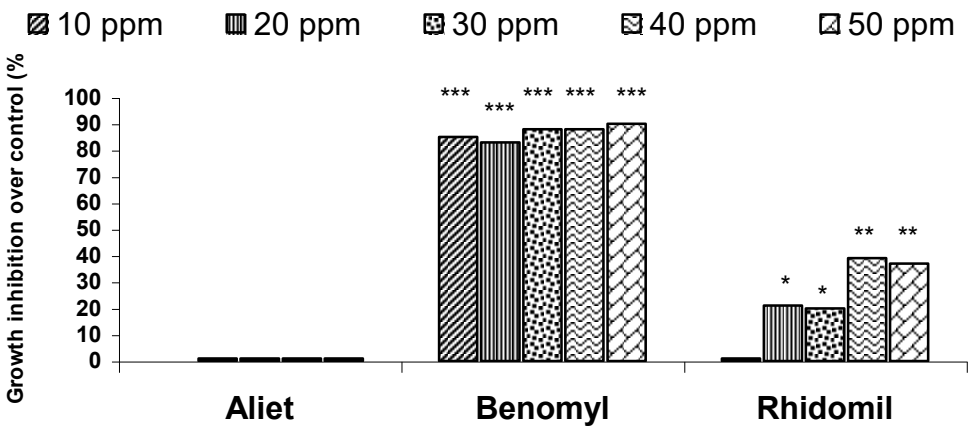

Fig. 2: Percentage reduction in *in vitro Fusarium solani* growth due to three fungicides as compared to control.
*, **, ***, show significant difference from control at 5, 1 and 0.1 % level of significance as determined by t-test.

References

Ahmad M, Khan MA, Ahmad F, Khan SM, 1996. Effectiveness of some fungicides on the colony growth of *Fusarium oxysporum* and *F. solani* associated with potato wilt. *Pak. J. Phytopathol.,* **8:** 159-161.

Bajwa R, Javaid A, Shah MBM, 2003. Extent of shisham decline in Lahore, Sialkot, Gujranwala and Sergodha districts, *Mycopath,* **1:** 1-6.

Baksha MW, Basak AC, 2000. Mortality of sissoo in Bengladesh. In: *Proceedings of the Sub-Regional Seminar on Dieback of Sissoo in Katmandu, Nepal,* 25-28, April, 2000, pp.1-4.

Bakshi BK, 1957. Wilt disease of shisham II Behavior of *Fusarium solani,* the wilt organism in the soil. *Indian Forester* **81:** 276-281.

Bakshi, BK, Singh AC, 1959. Root disease of shisham (*Dalbergia sissoo*). VIII. Inoculation study on wilt. *Indian Forester*, **85**: 415-421.

Davis D, Qaggoner PE, Diamond AE, 1953. Conjugated phenals in the *Fusarium* wilt syndrome. *Nature, Lond.* **172:** 95.

Gill MA; Ahmad I, Khan AU, Khan AU, Khan M, 2001. *Phytophthora cinnamomi*. A cause of shisham decline in Punjab, Pakistan. In: *Proceedings of 3rd National Conference of Plant Pathology*, October, 1-3, 2001, NARC, Islamabad, pp. 33-37.

Khan MH, 2000. Shisham die-back in Pakistan and remedial measures. In: *Proceedings of the Sub-Regional Seminar on Dieback of Sissoo in Katmandu, Nepal,* 25-28, April, 2001. pp. 45-50.

Mcwain P, Gregory GFA, 1973. Benomyl derived fungitoxicant for tree wilt disease control. USDA *For. Serv. Res. Note, N.E. Forest Expt. Sta*. No. 162. RPP. 53, **2**: 689 Abst.

Nene HL, Thakliyar PN, 1979. Fungicides in plant disease control. Oxford and IBH Publishing company, New Delhi, pp.507.

Shakir AS, Khan SM and Ahmad R, 1999. First report on shisham decline in Pakistan. *Pak. J. Phytopathol,* **11:** 106.

Sharma MK, Singal RM, Pokhriyal TC, 2000. *Dalbergia sissoo* in India. In: *Proceedings of the Sub-Regional Seminar on Dieback of Sissoo in Katmandu, Nepal,* 25-28 April, 2000. pp. 5-17.

Vincent JM, 1957. Distribution of fungal hyphae in the presence of certain inhibitors. *Nature*, **159:** 850.