

Fungal diseases in forest nurseries in Shimoga district, Karnataka, India

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Five forest nurseries in Shimoga district maintained by the State Forest Department of Karnataka raise and supply seedlings of 30 economically important tree species for various purposes. Of these, 14 grow naturally in the Western Ghats region of Karnataka, seven are hardwood species and six are fruit yielding species. During routine survey of nurseries, at least 17 species were found infected by 15 fungal pathogens leading to leaf spot diseases during the rainy and winter seasons. Some of the important pathogens include species of fungi belonging to the genera *Cercospora*, *Colletotrichum*, *Diplodia*, *Fusarium*, *Gloeosporium*, *Myrothecium*, *Pestalotia*, *Pseudocercospora*, *Phoma* and *Septoria*. Over crowding often resulted in seedling blight. The incidence of fungal diseases in seedlings grown in all five nurseries during the two seasons are described, detailed in a table and constraints in seedling production are discussed.

Keywords: nursery diseases, forest nurseries, fungal diseases, Shimoga

Introduction

India is one of the eighteen-mega diversity centers and consists of two 'Hotspots' – the Eastern Himalayas and the Western Ghats. The Western Ghats boasts of biologically diverse forests and consists of a variety of forest types and spreads over the states of Karnataka, Maharashtra and Kerala. Shimoga district in Karnataka is situated in the middle of Western Ghats and is an unique place for socio-cultural activities. The headquarters of the Shimoga Forest Department are situated in Shimoga town and is an important place for collection of seeds of forest trees and raising of seedlings of more than 30 tree species that grow in the Western Ghats. The seedlings raised here are supplied to the governmental and non-governmental organizations for the purpose of regeneration of forests and social forestry and raising vegetation in the barren and uncultivable lands.

A preliminary survey of nurseries in Shimoga division revealed the poor health of tree nurseries and as the result of poor management practices seedlings were often susceptible to diseases, which reduced their vigour. Often, diseases developed in epiphytic proportions. There is not much information available on the tree nursery diseases in Karnataka. The present study is an attempt to survey and document diseases prevailing in forest nurseries in Shimoga district, Karnataka.

Materials and methods

Location and identification of forest nurseries

Five forest nurseries located in Shimoga district were selected and visited two times in the winter, summer and rainy seasons during the year 2001–2002. The tree species were identified and data on their economic importance were collected.

Collection and incubation of infected plant materials

Information on the number of infected seedlings in each species, the extent of damage caused, and disease symptomatology were collected. Diseased leaves, stems and roots were collected and brought to the laboratory where they surface disinfected (1.5% NaOCl solution, 5 minutes) and incubated on moistened sterilized blotter discs or on PDA medium contained in Petri dishes and incubated for 5 days at 23 ± 2 °C and light-darkness cycle of 12/12 h. The incubated diseased materials were observed and the fungal species associated with disease symptoms were identified. The fungal species were identified based on their habit and colony characters and reproductive properties and confirmed by comparing with information given in standard manuals.

Pathogenicity testing

Single spore isolations of fungal species that were associated with disease symptoms were made separately on PDA medium contained in Petri dishes. Further, fungal cultures obtained on PDA slants which were tested again and their identification was confirmed. Spore suspensions were prepared from seven-day-old cultures on PDA and the spore density was adjusted to 10^5 , 10^6 or 10^7 spores per ml. Fifty μ l of the above spore suspensions was placed on the upper surface of the leaves at a place that was previously pricked with a sterile needle. The artificially inoculated leaves were placed on moistened sterilized blotter discs and incubated for 3–5 days as described earlier.

Results and discussion

There were three species of *Acacia*, i.e. *A. auriculiformis* A. Cunn., *A. concinna* (Willd.) DC., *A. mangium* Willd., four species of *Ficus*, i.e. *F. bengalensis* Linn., *F. glomerata* Roxb., *F. religiosa* L. and *F. mysorensis* Heyne ex Roth., two species of *Madhuca*, *M. indica* Gmel. and *M. latifolia* Macbride and three species of *Terminalia*, *T. bellerica* Roxb., *T. tomentosa* Roth. and *T. arjuna* (Roxb.) W. & A. while all other genera were represented by single species. They are *Anacardium occidentale* L., *Artocarpus hirsutus* Lam., *Azadirchta indica* A. Juss, *Bambusa arundinacea* (Retz.) Willd., *Bauhinia variegata* L., *Bombax malabarica* DC., *Casurina equisetifolia* Forst., *Dalbergia latifolia* Roxb., *Eucalyptus globulus* Labill., *Grewelia robusta* F., *Lagerstroemia lanceolata* Wall., *Mangifera indica* L., *Michelia champaka* L., *Phyllanthus emblica* L., *Pongamia pinnata* (L.) Pierre, *Pterocarpus marsupium* Roxb., *Santalum album* L., *Sapindus trifoliatus* L., *Saraka asoka* (Roxb.) De Wilde, *Swietenia mahagony* (L.) Jacq., *Syzigium cumini* L., *Tamarindus indica* L., *Tectona grandis* L. and *Thespesia populinea* (L.) Soland. ex Correa.

All the tree species are not grown in all five nurseries since culture of different species depends on their demand and importance. Disease symptom restricted mainly to the aerial parts and leaf spot/blight was the common symptom observed. Root rot was some times caused by *Fusarium* sp. particularly common on *T. indica*. Fifteen genera of fungi were recorded in seedlings of 17 tree species. The number of nurseries affected by each disease and occurrence of disease in different seasons is given in Table 1. *Pseudocercospora* leaf spot disease that occurred on *Eucalyptus* was prevalent at all the nurseries. The other species, *Alternaria* leaf spot on *T. tomentosa*, *Fusarium* leaf spot on *A. occidentale*, *Pestalotia* leaf spot on *S. cumini*, *Phyllachora* leaf spot on *P. pinnata* and rust caused by *Ravenelia* on *P. emblica* occurred in three nurseries. Other species of fungi either occurred in two nurseries or in one nursery.

Disease occurrence was severe in the rainy season followed by winter and summer seasons. About 10 tree species were found to have disease incidence of 50–100% during the rainy season (May–August) and almost an equal number of them expressed disease that ranged between 20 and 100% during winter (September–December). Only *Rhizoctonia* caused 100% infection during winter, 85% infection during the rainy season and during summer the incidence was less (20%). The organisms that caused severe diseases during the rainy season were *Cercospora* leaf spot on

Table 1. Occurrence of pathogenic fungi, symptoms caused and disease incidence in respective host seedlings grown in different forest nurseries of Shimoga district.

Fungal species	Disease symptoms	Host seedling	No. nurseries affected	Disease incidence, %		
				Rainy	Winter	Summer
<i>Acrosporium</i> (<i>Oidium</i>)	Powdery mildew	<i>Tamarindus indica</i>	2	33	23	9
		<i>Azadirachta indica</i>	2	32	19	3
		<i>Tectona grandis</i>	1	20	9	0
<i>Alternaria</i>	Leaf spot	<i>Acacia concinna</i>	1	27	22	9
	Leaf spot	<i>Terminalia tomentosa</i>	3	19	18	5
<i>Cercospora</i>	Leaf spot	<i>A. indica</i>	1	51	14	4
	Leaf spot	<i>Bombax malabarica</i>	2	57	45	15
	Leaf spot	<i>T. grandis</i>	2	38	26	5
<i>Cladosporium</i>	Leaf spot	<i>Michelia champaka</i>	1	60	45	13
<i>Colletotrichum</i>	Leaf spot	<i>Bauhinia variegata</i>	2	40	30	8
	Leaf spot	<i>Eucalyptus globulus</i>	1	65	46	11
	Leaf spot	<i>Artocarpus hirsutus</i>	3	19	6	1
	Leaf spot	<i>Dalbergia latifolia</i>	1	48	18	5
<i>Diplodia</i>	Leaf spot	<i>Ficus glomerata</i>	1	43	24	12
	Leaf spot	<i>F. mysorensis</i>	2	51	26	6
<i>Fusarium</i>	Leaf spot	<i>Anacardium occidentale</i>	3	37	20	5
<i>Myrothecium</i>	Leaf blight	<i>Mangifera indica</i>	1	45	28	8
<i>Pestalotia</i>	Leaf spot	<i>M. indica</i>	1	29	7	1
	Leaf spot	<i>Syzigium cumini</i>	3	29	12	5
	Leaf spot	<i>Madhuca indica</i>	1	41	25	7
<i>Phyllachora</i>	Tar spot	<i>D. latifolia</i>	1	39	28	16
	Tar spot	<i>F. religiosa</i>	1	57	37	12
	Leaf spot	<i>Pongamia pinnata</i>	3	57	48	20
<i>Pseudo-cercospora</i>	Leaf spot	<i>Eucalyptus</i> sp.	5	61	39	15
<i>Phoma</i>	Black leaf spot	<i>Madhuca latifolia</i>	2	29	15	7
<i>Ravenelia</i>	Rust	<i>Phyllanthus emblica</i>	3	75	35	12
<i>Rhizoctonia</i>	Leaf blight	<i>B. variegata</i>	2	47	28	9
	Leaf blight	<i>Cassia fistula</i>	1	85	100	20
<i>Septoria</i>	Leaf spot	<i>F. bengalensis</i>	2	38	23	12
	Leaf spot	<i>F. religiosa</i>	1	48	29	15

A. indica (51%), *B. malabarica* (57%), *Cladosporium* leaf spot on *M. champaka* (60%), *Colletotrichum* leaf spot on *E. globulus* (65%), *Diplodia* leaf spot of *F. mysorensis* (61%), *Phyllachora* tar spot on *F. religiosa* (7%), *P. pinnata* (57%), *Pseudocercospora* leaf spot on *Eucalyptus* species (61%), rust on *P. emblica* (71%) and *Rhizoctonia* leaf blight on *C. fistula* (85%) (Table1).

Disease symptoms on inoculated leaves were similar to those occurring on seedlings in the nurseries. The inoculum load required varied depending on the fungal species, but most organisms caused disease at an inoculum load of 10^6 and 10^7 spores per ml.

At least 11 fungal diseases that affect nine tree species are reported to occur on mature trees in India and only a few of them are reported to cause seedling diseases in nurseries. Some of the diseases that occur on nursery seedlings have been reported earlier to cause disease in the same species. For example, leaf spot of *F. bengalensis* and *F. religiosa* caused by *Septoria* (Joshi and Vashista 1959), leaf spot of *P. pinnata* caused by *Phyllachora pongamiae* and powdery mildew of *P. emblica* caused by *Ravenelia phyllanthus* (Rangaswamy et al. 1970), leaf spot of *Eucalyptus* species caused by the *Colletotrichum* state of *Glomerella cingulata* and *Pseudocercospora eucalyptorum* (Giri et al. 1996), leaf spot of *D. latifolia* caused by *Phyllachora dalbergiae* and the *Colletotrichum* state of *Glomerella cingulata* (Sharma et al. 1984).

Most nurseries in Shimoga raise more seedlings than are required. Oftentimes seedling numbers are large and the over crowding results in the creation of congenial conditions for transmission and establishment of fungal pathogens. Inquiry at nurseries revealed that plant production practices were followed by seed dressing with malathion and brassicol and spraying seedlings with blitox and agromine. Since brassicol is a narrow spectrum fungicide and blitox is a weak broad-spectrum fungicide, these appear to be inefficient plant production practices being followed in these nurseries. The study demonstrated that adequate plant production practices needs to be followed in order to avoid nursery seedling diseases.

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