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RESEARCH ARTICLE

ROOT-ROT DISEASE OF *MADHUCA INDICA* (MAHUA): A NEW RECORD

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ABSTRACT

Mahua (*Madhuca indica*) is a multipurpose tree used in food, medicine, timber, etc. For plantation purposes seedling of this important species were raised in nursery. A root rot disease caused by *Fusarium solani* in nursery was observed during rainy season (July – September) for the first time from central India. Soil drenching with 0.2% ridomil at fortnightly intervals fully controlled the disease.

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INTRODUCTION

Mahua (*Madhuca indica* J.F. Gmel.) is a deciduous tree of dry region and native of India. It is a multipurpose tree, mostly grown on wastelands in north and central part of the country where generally tropical and sub tropical climates prevails including Andhra Pradesh, Bihar, Chhattisgarh, eastern Uttar Pradesh, Gujarat, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Odisha and West Bengal (Patel and Naik, 2010). Different part of mahua tree (leaf, flowers, wood, seeds) are used in daily life for different purposes (Banerji and Mitra, 1996), Liquor distilled from the flowers are used to make vinegar and after fermentation considered to be a tonic and nutritive drink. Flower juice is used in the treatment of enlargement of axillary gland, neurotic disorder and taken with cow's milk as an aphrodisiac, in cough and bronchitis. The seeds yield fat known as mahua butter used in cooking, adulteration of ghee, manufacturing chocolates and even soaps, besides treatment of rheumatism and constipation, its cake is insecticidal and also used for fishing. Seed paste is applied to cure muscle fatigue and relieve pain in the muscle and joints to improve the texture and vigor of skin. Mahua seed oil is also

used as biodiesel and cooking oil (Jayasree et al., 1998), hair oil, illumination, lighting and body oil which keep body glossy and warm. The presence of toxic and bitter saponins in mahua cake/meal precludes its utilization in poultry/animal feeds (Mishra and Padhan, 2013). Mahua cake can be used as cheap organic manure. Bark decoction is used in curing bleeding gums and ulcers. Leaves, flowers and fruits are lopped for goats and sheep. Mahua tree wood is also used as timber mainly for making door and window frames as substitute of sal wood. This tree has spreading superficial root system which control erosion. The tree provides shade or shelter (wide spreading crown), reclamation of soil. Mahua tree also improve soil, act as boundary or barrier in intercropping (Mishra and Padhan, 2013).

Seedling grown in forest nurseries are the primary sources of planting stock, it is necessary to investigate the seedling disease and apply control measures either before sowing the seeds or at the seedling stage (Verma and Verma, 2015a). The seedling in nursery beds as well as in polythene containers suffer from many disease (Sehgal, 1983) causing mortality and affecting the health and vigorous of plants, there by seriously affecting plantation programmes (Harsh et al., 1992). The health of root system is perhaps the most important factor in the total health

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of a plant (Tattar, 1989). Poor drainage or overwatered conditions in nursery favor root rot diseases. These conditions can cause some of the roots to die back due to a lack of oxygen. As the root die, they can start to decay or rot away. The rot can then spread to healthier roots and kill them, even if the soil conditions are corrected. Other causes of root rot are fungi present in the soil. The fungi may remain dormant in soil for indefinite time and they may be suddenly flourished when the plant is overwatered once or twice. The root rot fungi attacked the roots and caused them to die and rot away (Omukhua, and Godwin-Egein, 2011). The leaves start to get dull and turn yellow and the whole plant seems to be on a slippery slope towards death. Newly infected seedlings typically have tip dieback, wilt symptoms and stunting as the disease progresses. Diseased root systems show lack of fine root development and extensive cortical decay so that the epidermis is easily stripped away from the core tissues. Root rot pathogens may spread from plant to plant causing widespread death of the seedlings in the nursery (Harsh and Gupta, 1993; Torgeson *et al.*, 1954).

Most of the soil borne pathogens is responsible for causing many diseases and amongst them the most common is root rot disease in nursery (Jamaluddin *et al.*, 1997). Root rot disease was observed in *Acacia auriculiformis*, *Albizia lebbek*, *Boswellia serrata*, *Ceiba pentandro*, *Eucalyptus globules*, *E. tereticornis*, *Eucalypyus* hybrid, *Peltophorum pterocarpum*, *Pinus roxburghii*, *Polyalthia pinnata*, *Tectona grandis*, *Santalum album*, etc. (Harsh and Gupta, 1993).

In *Madhuca indica* many diseases were recorded for example leaf spot by *Pestalotia* (Shivanna, 2005), spotted anthracnose disease by *Sphaceloma madhucae* (Wani and Thirumalachar, 1971). The present article reports a new record of root rot disease of *Madhuca indica* caused by *Fusarium solani* (Mart.) Sacc. in nursery of central India.

MATERIALS AND METHODS

Study area

Tropical Forest Research Institute, Jabalpur is situated between 23°5'37" to 23°6'10"N latitude and 79°59'49" to 79°59'42"E longitude. The area falls under basaltic landscape and the soil texture is more than 55% clay content. An average elevation of Jabalpur in 411 meter (1348 ft) from sea level. Jabalpur district is situated in the Mahakosal region of Madhya Pradesh. The soil of Jabalpur is black cotton soil. The temperature of Jabalpur varies from 9°C to 43°C. The average annual rainfall over the area is 1358mm (Totey and Gupta, 1993).

Collection of sample

The samples were collected from nursery of Genetics and Plant Propagation Division, TFRI, Jabalpur. Mahua seeds were collected from Balod and Jagdalpur forest divisions, Chhattisgarh and seedlings were raised in polyethylene bags (Fig. 1-2).

These seedlings were kept in groups under agro-shade house and irrigated with sprinkler misting system.

Identification of pathogen

Diagnosis and identification of causal organism was done in laboratory. The pathogen was cultured in Petri dish using sterilized potato dextrose agar (PDA) medium by inoculating surface sterilized diseased bits of tender roots on to it. After 5 days of incubation at 28±2°C, whitish wooly growth of fungal colony appeared in Petri dish. The culture is deposited in Tropical Forest Research Institute, Jabalpur culture collection under Acc. No. TFC-61. The pathogen was identified after cultural and microscopic study and by consulting literature (Booth, 1971; Booth, 1977; Nagmani *et al.*, 2006; Verma *et al.*, 2008).

Disease incidence

Numbers of infected seedlings from each row of nursery were counted. Percentage disease incidence was determined as follows:

$$\text{Disease Incidence \%} = \frac{\text{Number of seedlings infected}}{\text{Total number of seedlings}} \times 100$$

Pathogenicity test

The pathogenicity was proved as per Koch's postulates by inoculating the healthy seedlings with fungal spore suspension. The spore suspension of pathogen was prepared (4×10^3 cfu/ml) from 15d-old culture and each replicate of 9 healthy seedling having 6-8 cm height was poured on the soil with 25 ml of fungal spore suspension. The same pathogen was re-isolated in pure form and identified as *Fusarium solani*.

RESULTS AND DISCUSSION

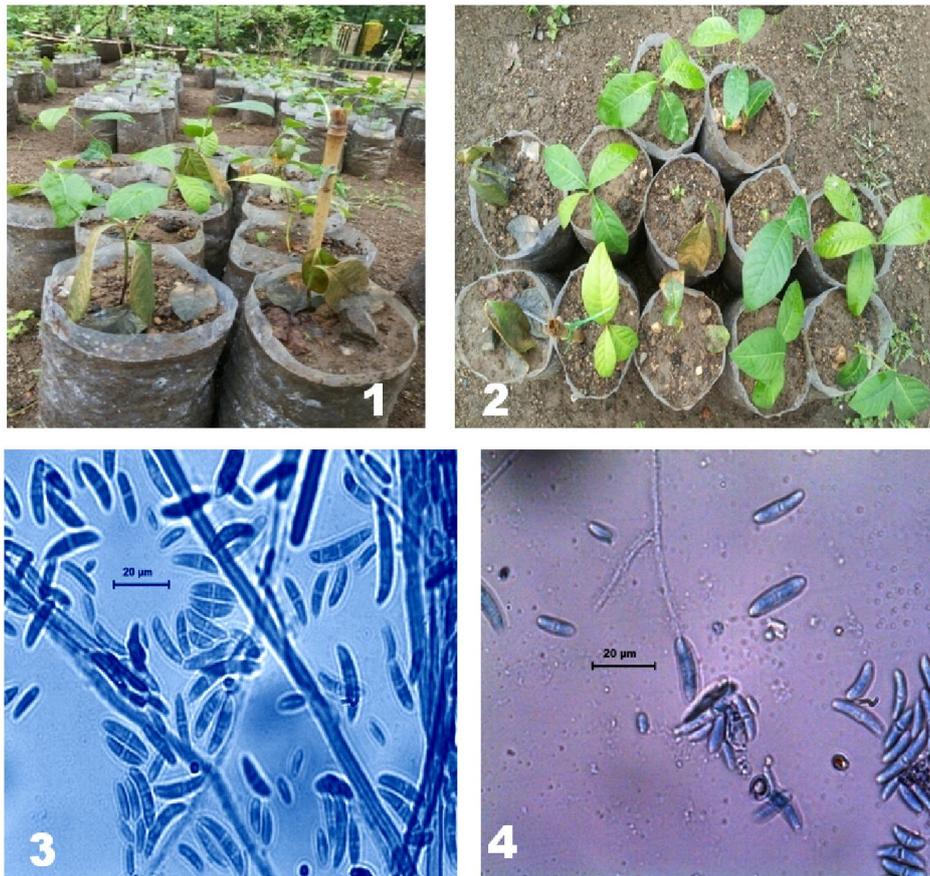
Pathogen

The causal organism of mahua root rot was identified as *Fusarium solani* as follows:

Colony diameter on PDA medium was 3.8 cm after 7 days of incubation. Mycelium striate, sparse, floccose, grey white agar develops brownish pinkish discoloration. Micro-conidia develop abundantly after 2-3 days, aseptate hyaline 8-15 x 3-5 µm phialide 40-70 x 2.5-3 µm. macroconidia develop after 4-7 days from short multibranching conidiophores, which may form sporodochia, fusoid, 1-3 septate, 25-38 x 4-8 µm (Fig. 3-4). Chlamyospore develop after 7-14 days, globase oval, smooth rough walled terminal or intercalary.

Percentage occurrence of disease

The occurrence of the disease was calculated after counting the numbers of root rot affected seedlings. Seedling raised in nursery at Jabalpur and arranged in 4 groups of each localities (Jagdalpur and Balod). In seedlings of Balod disease ranges from 12.5 to 25% with an average of 17.7% while seedlings raised from seeds collected from Jagdalpur the disease ranges 13.3 to 30% with an average of 21.83% (Table 1). Seedlings raised from seeds collected from Balod have comparatively less disease as compared to Jagdalpur.



Figures 1-4. Root-rot disease of mahua seedlings in nursery. 1-2 affected seedlings showing symptoms caused by *Fusarium solani*, 3-4 mycelium, micro and macro conidia of the pathogen produced on potato dextrose agar medium

Table 1. Occurrence of root rot disease in nursery at Jabalpur (seedlings raise from seed collected from Balod and Jagdalpur, Chhattisgarh)

| Group No. | Balod | | | Jagdalpur | | |
|-----------|------------------------------|-----------------------------|-------------|------------------------------|-----------------------------|-------------|
| | Number of seedlings examined | Root rot affected seedlings | Disease (%) | Number of seedlings examined | Root rot affected seedlings | Disease (%) |
| 1 | 15 | 3 | 20 | 20 | 6 | 30 |
| 2 | 16 | 2 | 12.5 | 11 | 3 | 27.28 |
| 3 | 15 | 2 | 13.33 | 15 | 2 | 13.33 |
| 4 | 20 | 5 | 25 | 24 | 4 | 16.7 |
| Avg. | 16.5 | 3 | 17.7 | 17.5 | 3.75 | 21.83 |

Management of disease

To control the disease fungicide, 0.2% Ridomil Gold, Make, Syngenta (containing metalaxyl – M, 4%, mancozeb, 64%, sodium lignosulfonate, 2% and dibutylnaphthalene sulfonic acid sodium salt, 2%) was applied at fortnightly interval as soil drench. The watering schedule was also monitored to avoid extra moisture in and around root zone of seedlings. The above treatments successfully control the disease. New wilt diseases of *Litsea glutinosa* and *Pterocarpus marsupium* caused by *Fusarium solani* in nursery at Jabalpur, Madhya Pradesh were also reported very recently (Verma and Verma, 2015ab).

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