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RESEARCH ARTICLE

FIRST REPORT OF POWDERY MILDEW FUNGI ON SANDLWOOD IN MADHYA PRADESH

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ABSTRACT

During the survey of plant disease 2013 and 2014, powdery mildew disease was found on sandalwood. *Pseudoidium santalacearum* (U.braun and Hosag.) U.Braun and R.T.A. Cook. was identified as the causal agent of a powdery mildew disease occurring on sandalwood *Santalum album* L. in Mandsaur and Indore districts of Madhya Pradesh India on the basis of symptoms, morphological characters and host range. This disease was observed in leaf of sandalwood tree located in the boundary area of Panchayat bhawan Mandsaur and Agriculture College campus, Indore. Floury small, circular white patches were seen on both sides of leaf surface in initial stage and these spots increased in size and spread all over the surface of leaves. The mycelium of *Pseudoidium santalacearum* are epiphytic, amphiphyllous, thick coating, hyaline, conidia formed singly (not in chain). This disease was noticed for the first time in Madhya Pradesh, India. The pathogenecity was confirmed by dusting of conidia on healthy leaves.

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INTRODUCTION

Sandalwood (*Santalum album* L.) is the most important valuable flowering tree/shrubs belonging to family Santalaceae. Commercially valuable sandalwood is found naturally in all over the world. In India it is mostly found in southern part of the country namely Karnataka and Tamil Nadu. It is second most expensive wood in the world. Sandalwood finds mention in ancient Indian literature like in the Ramayana, written sometimes in 2000 B.C. In 1792, sandalwood was declared a "Royal tree" by Tipu Sultan who ruled the kingdom of Mysore (Fox, 2000). A wide variety of articles are made from sandalwood such as picture frames, pen holders, combs, card cases and other handicraft material. From sandalwood, essential oil is obtained from heartwood by steam distillation of matured 40 to 80 years old sandalwood tree. It is very expensive and sold by weight. There are many health benefits of sandalwood essential oil as it is used as antiseptic, anti-inflammatory, antiphlogistic, antispasmodic, astringent, carminative, diuretic, disinfectant, memory booster sedative and tonic substance.

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(Srinivasan *et al*., 1992 and Coppen 1995) reported that sandalwood and sandalwood oil are used in incense and medicine, as well as the wood is used in carving. Jain *et al* (2003) reported that heartwood of S*antalum album* was priced at 2 lakh of Indian rupees per tones and oil was priced at 22000 of Indian rupees per kg, However prizes are highly dependent on the quality. Sandalwood was infected by several fungal, viral, Phytoplasmas and bacterial diseases. There are various soil borne pathogen that attack in nurseries (Nayer et al., 1980). Damping off vascular wilt disease was recorded in sandalwood seedling caused by *Fusarium oxysporum* in Karnataka and Tamil Nadu Nagaveni *et al.* (2014). Canker problem has been reported on sandalwood in Western Australia (Treena et al., 2006) and in India canker disease was reported for the first time in Karnataka by Nagaveni *et al.* (2014). Surveys were conducted to study the occurrence of powdery mildew disease on sandalwood in Madhya Pradesh during 2012-13 and 2013-14. The disease was observed in November to March in Mandsaur and Indore district of Madhya Pradesh, India. Regular efforts are always made to identify the occurrence of new diseases on new crops to discover their management practices. Powdery mildew disease is a serious problem in many crops/trees (Desai et al 1970 and Sharma and Khare 1992).

Fig.-1 Healthy leaves of *Santalum album*

Fig.-2. infected leaves of *Santalum album*

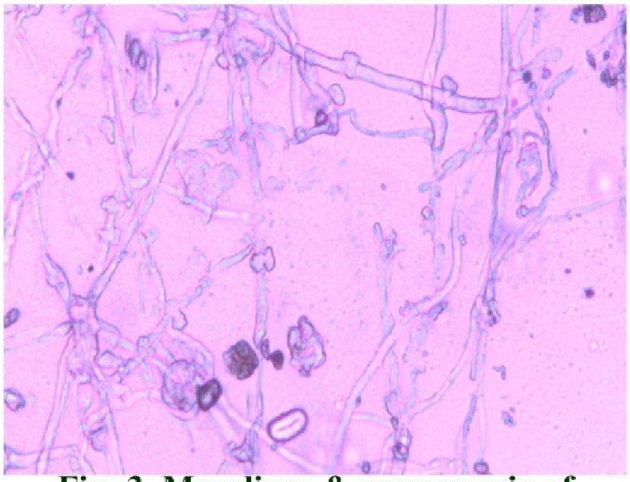

Fig.-3. Mycelium & appressoria of *Pseudoidium santalacearum*

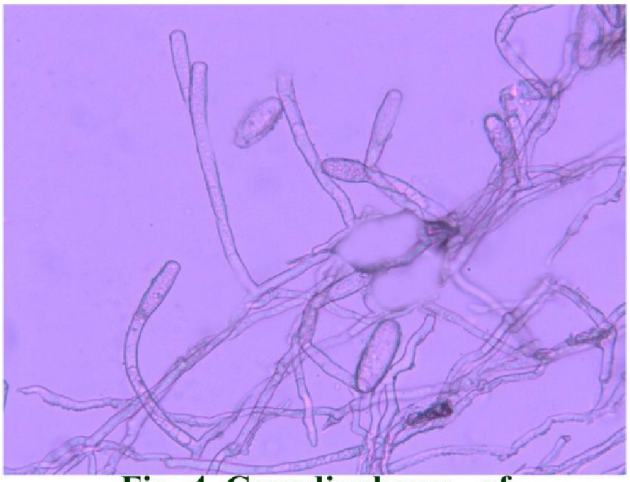

Fig.-4. Conodiophores of *Pseudoidium santalacearum*

Fig.-5. Conidia of *Pseudoidium santalacearum*

Fig.-6. Germinating conidia of *Pseudoidium santalacearum*

The characteristic symptoms of powdery mildew fungi were appeared in initial stage as small floury patches on lower and upper side of leaves and later spread all over the surface of leaves. The powdery mildew fungi are identified as *Pseudoidium santalacearum* (U.braun and Hosag.) U. Braun and R.T.A. Cook on the basis of study of anamorphic characters and host range. The telomorph (chasmothecia) was not seen in this powdery mildew fungus. The observation and photomicrograph were taken on newly infected live leaves revealing presence of hyaline, septate mycelium, conidia produce in singly chain and terminal to sub terminal germination prove the identification of *Pseudoidium santalacearum* (U.braun and Hosag.) U.Braun and R.T.A .Cook on Sandalwood (*Santalum album* L). The powdery mildew fungi are reported for the first time in Madhya Pradesh. The anamorph of this Powdery mildew disease on *Santalum album* caused by *Pseudoidium santalacearum* Synonyms of *Odium santalacearum had* previously been reported from Tamil Nadu state by (U.braun and Hosag.) U. Braun and R.T.A. Cook (1989 and 1912) Severity of the powdery mildew disease depends on many factors like growth stage of plant and weather condition during the disease development. Powdery mildew is severe in warm, dry climates. Fungus spore do not germinate in presence of water on the surface of leaf. The disease is more severe in shaded areas and succulent part of plants.

MATERIALS AND METHODS

Collection of material

During the disease survey of sandalwood plant in Mandsaur and Indore district in Mandhya Pradesh, India. The shady area of tree is more prevalent than sunny area .Infected sandalwood leaves were removed from infected sandalwood tree and observation was made. Sample were collected in polythin bag and brought to the plant pathology laboratory KNK.Collge of Horticulture RVSKVV, Mandsaur, M.P. for further investigation.

Identification of Causal organism: Fungus associated with disease part was removed by good quality transparent cello tape. Fungal mycelium, conidia and conidiophores adhered in cello tape then one drop of sterilized distill water was put on slide and transparent cello tape was placed with fungus on slide. Morphological characters of fungus were seen through trinocular research microscope and hyphae, conidia, and conidiophores were measured by lieca application suit software then 50 observation of each character were done and averaged. Other morphological characters like colour of conidia, mycelium, and conidiophores type of germination, fibrosin body present or absent, vacuoles are also observed. The teleomorphic stage was not observed in disease sample.

RESULT AND DISCUSSION

Survey was carried out in M.P. during 2013 and 2014. Critical observation of sandalwoods trees shows the infection caused by powdery mildew fungi. This disease appeared as white floury, small patches on the both sides of the leaf in initial stage and later increases in size and spread all over the surface of leaf (Fig. 2). The leaves are drop off in heavy infection with powdery mildew. Observation taken on the research trinocular microscope revealed that mycelium are amphiphyllous, thick coating of powdery masses on leaves, persistent, hyphae were septate thin walled, smooth, hyaline, branched, appressoria, solatotry, lobed shaped (Fig. 3) up to an average 5.49 µm. Foot cell of conidiophores are straight to slightly curve cylindrical up to 24.7-56.2 x 6.4-11.12 µm av. 49.53x12.68 µm (Fig. 4). Conidiophores emerging from upper surface of hyphal mother cell, pseudoidium type, straight to flexuous, A and B unit consist of 2-3 cells up to 81.39-149.9 x14.2-5.2 µm av. 100.23 x 6.99 µm (Fig. 4). Conidia are hyaline (without colour) elliptical to cylindrical up to 24.0-49.82 x 12.42-18.2 µm av. 38.16 x 15.72 µm (Fig. 5). fibrosin body are Absent and conidia formed in singly. Germ tube terminal to subterminal (Fig. 6). Based on the symptoms, microscopic study and host range diagnostic characters of powdery mildew fungi on *Santalum album,* pathogen is easily identifiable as an asexual anomorph of *Pseudoidium santalacearum* (U.braun and Hosag) U.Braun and R.T.A.Cook of the synonyms of genus *Oidium santalacearum* U.braun and Hosag.

A critical scrutiny of Indian powdery mildew literature (Bilgrami *et al.,* 1991; Sharma and Khare 1992; Jamaluddin *et al.,* 2004; Paul and Thakur 2006; Pande 2008; Hosagoudar and Agarwal 2009; Annonyous 2013) revealed that there is a single report of powdery mildew on *Santalum album* L. in India . *Oidium santalacearum* Braun and Hosagoudar reported 1989 on *Santalum album* L. from Tamil Nadu, India. Now the present accepted name of *Oidium santalacearum* is *Pseudoidium santalacearum* (U.Braun and Hosag.) U.Braun and R.T.A. Cook. This is the first report of powdery mildew fungus on *Santalum album* in Madhya Pradesh, India.

Habitat :- On leaves of *Santalum album* L (Santalaceae) January 16, 2015 Mandsaur district (M.P.) leg. R.P. Patel Fig. 2. The specimen has been deposited in the college of Horticulture, Mandsaur in Plant Pathology laboratory RVSKVV, Gwalior (M.P.)

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