Report Of Sooty Mold Infection In Subabul Trees At IFGTB Campus, Coimbatore

Abstract

The River tamarind or Subabul is an exotic tree species that is used to mark boundary in the agricultural fields. Large quantities of seed produced annually by Subabul trees get distributed over a large area of land. They germinate during the rainy season and establish easily. The seedlings make an excellent green manure when ploughed under after the kharif crop. This tree is generally used as fodder and a source for paper pulp. This tree was affected by psyllids in a high rate which cleared most of the plantation. Now it is reported that the Subabul trees in the institute of Forest genetics and tree breeding has been affected by sooty mold. This infection has resulted in the mortality of the plantation. The sooty mold's morphology is studied by using Scanning electron microscope. The electron microscopic images show the appendages, fruiting body and the spores.

Key words: Subabul, Sooty mold, Electron microscopys

Introduction

The River tamarind or Subabul (Hindi) is a Hawaiian tree that is widely found in the temperate region. Generally this tree meal is used as a fodder. The nutrient rich fodder is made into nutritious biscuits and fed to the cattle. This practice is said to increase milk yield and hence this tree is grown as a fodder crop. This agroforestry crop is also used as a source for paper pulp. This species is susceptible to pest attack. In the 1980s, a widespread loss in Southeast Asia was due to pest attack by psyllids. In India, this tree was initially promoted for afforestation due to its fast-growing nature. These trees are considered unsuitable for urban planting because of its tendency to get uprooted in rain and wind. Eight of every 10 trees uprooted by wind in Pune are subabuls (Hindi name for L. leucocephala. (Das and Dipannita, 2011). The leucaena psyllid, Heteroosylla cubana Crawford (Homoptera: Psyllidae), was not known as an important pest of leucaena, Leucaena leucocephala (Lam.). This remained unknown until the first outbreak in its native range occurred in Florida in 1983. The pest status of H. cubana was suddenly zacknowledged worldwide when it was discovered in Hawaii in 1984 and caused distressing defoliation to leucaena plantings beyond expectation. From Hawaii, H. cubana began invading exotic leucaena plantings in the Asia-Pacific region, including Australia during the latter half of the 1980s and early 1990s, causing widespread damage with resultant economic, ecological and social impacts in all affected countries. The seeds contain mimosine, an amino acid known to be toxic to non-ruminant vertebrates. The recent found sooty mould infestation is first recorded at Institute of Forest Genetics and Tree breeding. This infection found to be associated with a pest.

Sooty mold is a common name given to a group of Ascomycete fungi which includes many genera, commonly Cladosporium and Alternaria. It grows on plants and their fruit. The mold benefits from either a sugary exudate produced by the plant or fruit, or if the plant is infested by honeydew-secreting insects or sap suckers, the exudate is thus used. The infestation is said to

spread through a common pest vector. Sooty molds don't infect plants but grow on surfaces where honeydew deposits accumulate. Honeydew is a sweet, sticky liquid that plant sucking insects excrete as they ingest large quantities of sap from a plant. Because the insect can't completely utilize all the nutrients in this large volume of fluid, it assimilates what it needs and excretes the rest as "honeydew."

Sooty mold diseases on trees and shrubs usually cause blackened powdery plant parts through the proliferation of epiphytic fungal mycelium (Kim, 2016). The black fungal covering means that less sunlight reaches the leaf exterior, which reduces photosynthesis compared to green, healthy leaves (Insausti et al., 2015). It has been proposed that sooty regions might be warmer than neighboring healthy ones, as black areas absorb all wavelengths of incident electromagnetic radiation (energy) and reflect none of the incident radiation, which is known as black-body radiation in physics. However, there have been few studies on increased temperatures in sooty regions in sooty mold-plant interactions. The elevated temperature causes plants to transpire more water leading to necrosis.

Some sooty mold species are specific to certain plants or insects while others might colonize many types of surfaces and use honeydew produced by several kinds of insects (Paine and Dreistadt, 2007). Once honeydew-producing pests are repressed, sooty molds will gradually perish. In some instances, if necessary, sooty molds can be washed off with a strong stream of water or soap and water. However, it can be difficult to remove sooty mold even with soap and water (Dreistadt and Perry, 2006). A number of insects can produce the honeydew sooty molds need for growth. Their common characteristic is that they all suck sap from plants. The insects include aphids, leafhoppers, mealybugs, psyllids (including eucalyptus lerp psyllid), soft scales, and whiteflies. So it is believed that controlling these pests can help in eradicating sooty mould in a large scale (Paine and Dreistadt, 2006).

Singh et al. (1983) also conducted studies on epidemiology of gummosis, brown spot and seedling impermanence of Subabul in plantations caused by Fusarium semitectum. Approximately 50% of seeds collected from diseased plantations were infected by the pathogen and 70% infected seeds either failed to germinate or seedlings were dead within 60 days after germination. Only 13% of diseased seeds grew into diseased plants. Primary infection on Subabul was found to take place from collateral hosts infected by F. semitectum and happened within Subabul plantations. Succeeding spread of gummosis and canker disease in Subabul plantations was found through the spores produced on infected seeds, pods and twigs fallen on the ground and through contact of young parts of Subabul plants with infected parts of the adjacent diseased plants. While, disease spread within plants was found to be persistent throughout the year, plant to plant spread was found during monsoon months only.

Sooty mould on Casuarina equisitifolia foliage due to Capnodium anonae was recorded by Anon in 1992. Sooty mould infestation was found in walnut leaves. In walnut leaves, Light microscopy showed that fungus from the leaf surface was composed of brown conidia and hyphae. Conidia, with longitudinal and transverse septa, were found in length ranging from 10 to 30 ?m, and commonly found in clusters, forming microsclerotia (Kim, 2016).

The sooty mould infestation in Subabul trees were recorded in a plantation at the Institute of Forest genetics and Tree breeding. This is the first case to show that Sooty mould infestation can occur in the Subabul trees. The occurrence of sooty moulds on tree surfaces denotes the result of triparty interactions in the natural environment: plants, sooty moulds and sap?feeding

insects. This work is done to show the morphology of the pest and fungal attack.

Materials and methods

Plant materials and light microscopy

The Subabul leaves with sooty mold were collected in the month of February. Both adaxial and abaxial leaf surfaces were examined for the fungal mold coatings. To check the leaf epidermis, black mold layers on the leaf surface were peeled off and observed using a stereomicroscope. Non-infested leaves were also collected as the control. All the leaf specimens were collected at the same time of the day. Fungal hyphae and spores from the infested leaves were observed using a light microscope after staining it with lactophenol cotton blue.

Field emission scanning electron microscopy

Leaf fragments (5 × 5 mm2) of infested and non- infested leaves were fixed with a modified Karnovsky's fixative consisting of 2% (v/v) glutaraldehyde and 2% (v/v) paraformaldehyde in 0.05 M sodium cacodylate buffer (pH 7.2) at 4°C overnight (Paudyal & Hyun, 2015). After washing in the same buffer three times for 10 min each, the specimens were post fixed with 1% (w/v) osmium tetroxide in the same buffer at 4°C for 2 hr, and completely washed with distilled water twice. They were then dehydrated in a graded ethanol series (30%, 50%, 70%, 80%, 95% and 100%), and three times in 100% ethanol for 10 min each. The specimens were further treated with liquid carbon dioxide in a critical point dryer. The dried specimens were mounted on a metal stub, and coated with gold using a sputter-coater. The specimens were examined using a Schottky- type field emission scanning electron microscope worked at an accelerating voltage of 2 kV. A coaxial annular in lens detector was used to collect secondary electrons from the specimens. Both adaxial and abaxial leaf surfaces were observed with the scanning electron microscope.

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