Indian J. mycol. Res., 25(1), 1-8 (1987)
Printed in India

STUDIES ON DISEASES OF INDIAN MEDICINAL PLANTS-III

BY

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An account of major diseases of Khair *(Acacia catechu* Willd), namely root rot by *Ganoderma lucidum* (Leyss). Karst, root rot by *Polyporus gilvus*, rust by *Ravenalia tandonii* Syd., powdery mildew by *Erysiphe acaciae* Blumer, and *Phyllactinea acaciae* Syd., powdery leaf spot by *Micro acaciae* Syd. and Pyrethrum *(Chrysanthemum Cinerariaefolicum* (Trev) Vis., root rot or ailt by *Phytophthora cambivora* (Petri) Buism ; *Rhizoctonia solani* Kahn ; *Fusarium solani* and *Verticillium alboartum* are given. In Khair, root rot and in pyrethrum root rot or wilt are the most serious ones.

INTRODUCTION

This report is the third in the series. The diseases of medicinal plants are very important but so far no serious attempt has been made to study the problem. However an attempt has been made to present the present status of the problem on the basis of available literature.

CATECHU, KHAIR

Botanical Name : *Acacia catechu* Wild.

Family : Leguminosae

The tree is widely distributed in India from the Indus eastwards to Assam and throughout the Peninsula, particularly in the drier tropical regions

A. catechu is a moderate sized tree. Catechu is obtained by boiling the heartwood with water. Catechu is used in Indian medicine. It is regarded as astringent, cooling and digestive, useful in relaxed conditions of the throat, mouth and gums, also in cough and diarrhoea.

Root Rot

Ganoderma lucidum (Leyss.) Karst.

Root rot caused by *G. lucidum* is a serious menace in the tropical areas. Bakshi *et al.* (1976) studied the problem in detail. As high as 12 per cent mortality of seedlings has been recorded in certain plantations (Bakshi *et al* , 1968)

Symptoms

G. lucidum infects roots through damaged or undamaged surfaces. The pathogen infects and kills the bark and causes whites pongy rot in the sapwood. The plants are susceptible to attaek at all ages. Affected plants show pale foliage which eventually dries up. Young plants are killed soon after infection. Mature plants are also killed when most of the roots are damaged due to infection. The fungus produces thin white mycelial mat between the wood and bark. It possesses ecotrophic growth in the form of thin mycelial strands on solid surfaces, like stones and soil lumps which are in direct contact with affected roots.

The Causal Organism

Fruit bodies of *G. lucidum* commonly develop on affected plants, usually at the base or apparently on the ground but in the latter bodies are invariably attached to decayed roots,

Fruit bodies are perennial, stipitate, usually lateral, rarely central, sometimes sessile, corky, becoming woody later, usually 19-12 cm X 10-12 cm X 3-4 cm but may grow upto 230 cm or more. Upper surface shinning, laccate crust, Ox-blood in colour, smooth crust of vertical, solid, thick-walled, palisade hyphae, about 40μm long, impregnated with dark-organe varnishing surface which they secrete. Cortex brown, 2.5-10 mm thick. Hyphae in the cortex pale yellow, thick-walled, sparsely branched. Thin walled hyaline branched hyphae with clamp connections, 1.7-30 μm broad present only in hymenium. Hymenial surface whitish or creamish, turning brown later ; pores small, round 90-250 μm in diameter. Pore tubes about 6-7 mm long. Basidiospores are brown, thick walled, minutely verrucose, truncate at one, 8.3-10. μm$\times$5.8-6.7μm, average 8.8 μm$\times$6.4μm (Bagchee and Bakshi,1950).

Control Measures

The disease is only serious in plantations but not in natural forests. Mortality in Khair due to *G. lucidum* may be minimised or kept under control by using one or more of the following measures.

Mechanised plantations : *G. lucidum* is endemic in the natural forests but become epidemic in a plantations established without clearing residual roots and stumps of earlier natural broad leaved forest. The disease can be minimised by adopting mechanised plantations where stumps and roots are mostly removed.

Extraction of stumps : If the mechanised plantation is not possible, removal of stumps and roots present in the lines helps to minimise the disease incidence.

Isolation trenches : Once the disease establishes in the line, its spread can be checked by isolating the row of diseased and dead plants from the adjacent healthy plants by digging trenches about 0.3 m wide X 0.7 deep x 1.5 m long across the line.

Planting resistant species : In a reforested stand where the risk of *G. lucidum* root rot is serious, plantation of resistant species like Oilanthes and semul in first rotation may be made, At the end of the rotations, susceptible species may be planted. Mixed stands : Susceptible species liks Khair can be planted in a close intimate mixture with resistant species like Semul and Oilenthes which will help to break the continuity of a pure line of Khair and thereby, prevent rapid spread of the disease in the plantation.

Root Rot

Polyporus gilvus (Schw.) Fries

Pathogen is a wound parasite causing damage to roots and tree bases. The fungus is a weak parasite and does not cause serious damage to trees. The fungus is of common occurence ia all Khair forests.

Symptoms

Fungus causes root rot in Khair infecting through an injury due to mechanical causes or damage by animals. Similar types of symptoms are produced as in case of *Ganoderma* infection.

The Causal Organism

Fruit body annual, hard, brittle, usually reflexed, single or imbricate, usually 5.0-6.0 cm X 4.0-5.0 cm X 0.5-1.5 cm. Upper surface with shades of yellow, brown or red and either coarsely hairy, faintly zoned and rugulose in *P. gilvus* forma *gilvoides* or smooth with concentric zonations often with pustules in *P. gilvus* forma *lichnoides*. Cortex I - 5 mm thick, yellowish brown, pores round, regular, 80-175 μm in diameter or stratified. Basidia hyaline, clavate, 12-14 μm x 4 μm. Basidiospores hyaline, oval with a globule, 3.3-5.0μm X 2,5-3 4 μm, average 4.3-3.2 μm. Setae mostly projecting into the pore tube, abundant, thick-walled, dark brown 10-20 μm x 6-10 μm (Bagchee and Bakshi, 1950).

Control Measures

Same as described in case of *Ganoderma* root rot.

Heart Rot : Butt rot

Fomes badius Berk.

The fungus is destructive to Khair in its natural habitat, causing damage to heart wood (Bakshi, 1957). The disease is common in all Khair forests, both natural

and planted throughout its range of distribution. The fungus is mostly restricted to Khair and occasionally attacks babul (*Acasia nilotica* f. sp. *indica*) and lal-Khair (*A. chundra* (Roxb.) Willd.). It is a wound parasite which gains its entry through injuries caused by animals or owing to lopping off of branches for fuel, which may often also result in the formation of cankers, through which the fungus may gain its entry.

Symptoms

Fungus causes heart rot in plants infecting through any injury. The tree becomes susceptible to attack when the heart wood begins to develop. The diseased tree is not killed out right, but continues to grow indefinitely without losing any vigour or showing any other external symptoms. The fruit bodies of the fungus appear within three years of infection and their presence is the only means of spotting out the diseased tree. The infected heart wood. which is red brown, changes to a deeper shade and later becomes yellow, spongy and light and shows a mottled appearance owing to the formation of long indistinct streaks and zonate lines. the spread of dec y being confined to 30 cm to 2 meters longitudinally and 10 cm laterally (Bakshi, 1957).

The Causal Organism

Fungus grows well in culture at 24°C and under dark condition. Mat woolly becoming felty later with advancing zone distinct, Colour of colony is buff in general with shades of masicot yellow and light buff. On malt agar growth is vigorous.

Aerial mycelium ; (a) hyphae hyaline, thin walled, branched with simple septa, 1.3-2.5 μm broad, (b) fibre hyphae brown, thick-walled, 2.1-2 9 μm broad, (c) setae hyphae present in some isolates, apparently lacking in others, thick-walled, brown, submerged mycelium, thin walled, as in aerial mycelium.

Fruit body perennial, hard, woody, sessile, reflexed, usually 7 cm x 4 cm x 3 cm or little larger. Upper surface dull brown, rough, becoming rimose and black in old specimens, cracking. Cortex dull brown, brown or yellowish brown, corky when young, becoming hard with age, about 1 cm thick, with black lines in some sporophores, hypha thick walled, yellow er yellow brown, septate, rarely branched, 2.8-5.5 μm broad. Hymenial surface plane or convex, bay brown, dull, rough, with fine branching ridges sometimes present, pores round or nearly so, 130-175 μm in diameter. Pore tubes stratified, 3-8 mm long in each layer, ferruginous. Basidia, hyaline, thin walled, barrel shaped, 6.6-10.0 μmx4.1-6.6μm. Basidiospores round to oval, thick-walled, yellow brown, 5.8-7.5 μmx4.1-5.8 μm, average 6.8-5.1 μm (Bagchee and Bakshi, 1950).

Control Measures

The disease can be controlled by :

a) removal of diseased trees even they are green

b) by removal of fruit bodies immediately after their appearance

c) prevention of injury particularly by preventing cutting off of branches ; and

d) mixed cropping e. g. growing some immune plants alongwith

Rust

Ravenelia tandonii Syd.

The disease is common in Khair in Northern India. The disease has been reported from India by Sydow *et al* , (1937).

Rust pustules appear on the leaf pinnules. The infected pinnules are shed prematurely. Minute uredinia and telial pustules are developed below the cuticle on the upper surface of pinnules.

Uredosori are epiphyllous, either solitary or occurring in groups of two. They are minute, brown and are exposed through rupture of the cuticle. Paraphyses are numerous, cylindrical and measures 35-40 μm X 8-10 μm, subhyaline particularly towards the apex, membraneous. Uredospores are subglobose to ovate to oblong, finely verrucose to echinulate, membrane subhyaline to pale brown, 1.0-1.5 μm thick. They measure 20-20 μm x 15-19 μm. Teleutosori vary in magnitude. They are chestnut brown to dark brown, subcuticular, form a heaf of one layered fertile spores (6-8), hemispherical to convex in shape measuring 16-20 μm each. The group of fertile spores is supported by subhyaline cyst cells, which are numerous, round to eliptical, pedicels are hyaline, short and deciduous (Bakshi and Singh, 1967).

The disease has not been observed to be of any economic importance.

Powdery mildew

Erysiphe acaciae Blumer

Phyllactinia acaciae Syd.

This disease has been recorded on foliage of Khair from Poona (Blumer, 1926). The disease is very common and unimportant (Browne, 1968). From Madhya Pradesh *Phyllactinia acaciae* Syd. is recorded on Khair by Tandon and Chandra (1963-64).

Powdery Leaf spot

Micro acaciae Syd

The disease has been recorded from Majhgawan in Uttar Pradesh by Sydow *et al.* (1937). The disease shows snowy white tufts on lower surface of leaves of Khair. Stromata are subepidermal. Basidiospores burst out from stromata. No further detail is available.

PYRETHRUM

Botanical name : *Chrysanthemum cinerariaefolium* (Trev.) Vis.

Family : Compositae

C. cineraiae folium is a native of Dalmatia, Herzegovina nnd Montenegro and is cultivated jn commercial scale in Algeria, Dalmatia, Australia, Brazil, Bulgaria, California, China, Japan, France, Italy, Kenya, Persia, Russia, Spain and Switzerland. Cultivation has also been undertaken in England and in India.

Plant is a glaucous perennial herb of 45-60 cm high. Flower heads are used in finely ground form as an insectiside for household purposes. The active ingredients are a group of compounds, commonly known as pytethroids or pyrethreius, which are mixed estero of pyrathrolone and cinerolone with chrysanthemic and pyrethric acids. These substances are collectively known as pyrethrius.

Root rot and Wilt

Phytophthora cambivora (Petri) Buism ; *Rhizoctonia solani* Kuhn ; *Fusarium solani* ; *Verticillium alboatrum*

Pyrethrum plants grown in cleared areas in the upper elevations of the Nilgiri and Palni hills in the year 1939-46 showed particularly during dry months, progressive drying of the leaves and shoots, which eventually resulted in the death of plants. The disease was more severe on the plants growing on the steeper slopes where the roots were exposed owing to erosion of soil from the base of plants (Ramakrishnan and Soumini, 1948). The causal organisms responsible for the diseases were found to be *Phytophthora cambivora* and *Rhizoctonia solani.* The extent of loss was not estimated.

Phytophthora cambivora grows readily on oat agar, potato-dextrose agar, cornmeal agar and french bean agar producing luzurious white aerial mycelium, occasionally with indistinct to distinct zones. Reproductive bodies are absent on solid media, but irregularly swollen vescicular bodies are sometimes developed by the submerged hyphae. Sporangial formation is evident within 24 hrs of placing

cultures in watch-glasses containing tap water or soil leachate. The sporangia are produced terminally on slender hyphae which are much finer than normal hyphae. Sympodial growth of the sporangiophores is also very common. The sporangium is obpyriform with a broad apex, non-papillate, measuring 20.0-71.0μmX11.0-21.5μm. The sporangia germinate by producing zoospores, which are produced in varying numbers depending on the size of the sporangium by means of germ tubes, has also been observed. Proliferation through a germinated or empty sporangium is absent. Sexual reproduction has not been noticed in culture.

There is some confusion regarding the identity of the pathogen (*P. cambivora*) in this case. The non-papillate nature of the sporangium formed in liquid media and the absence of reproductive bodies on solid media suggest affinity to both *P. camlivora* and *P. cinnamoni*. White mycelium and scanty production of vesicle on solid media place it close to *P. cambivora*, whereas capability of rotting wounded potato tubers exhibited by this isolate is also characteristic of *P. cinnamoni*.

Rhizoctonia solani known to cause root rot of large number of plants, also incites root rot of this host.

A species of *Fusarium* (*F solani*) has been reported to cause root rot in South Africa (Ingamells, 1974).

Shivanandappa and Govindu (1965) reported *Verticillium alboatrum* as a potent pathogen of root rot or wilt disease.

All the pathogens are soil borne. The conditions favouring the incidence of the disease are not fully known Ramakrishnan and Soumini (1948) suggested that the incidence of the disease can be checked by preventing soil erosion and helping the development of roots. No other chemical control measures has been recommended but the experience of controlling root rot diseases of other crops can be utilized for this disease also.

Leaf spot

Stemphylium nabarii Sarwar

Sarwar and Srinath (1966) described a leaf spot caused by *Stemphylium nabarii* Sarwar that caused large dark brown, spots with irregular shape and size. Severely infected plants eventually die.

Srinath and Sarwar (1965) reported a leaf spot or in severely infected crop which looks like blight. It is caused by *Alternaria tenuissima*. No detailed work on these diseases have been conducted.

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(Accepted for publication September 26, 1986)