Pest Leaflet

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ARMILLARIA ROOT ROT

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Introduction

Armillariella mellea (Vahl ex Fr.) Kummer [Armillariella mellea (Vahl ex Fr.) Karst.] is one of the commonest and most destructive of facultative parasites. Root disease caused by this fungus is responsible for considerable economic loss in plantations and forest crops in tropical and temperate regions (Sokolov 1964). The many hosts of the fungus include potato and strawberry plants, tea and currant bushes and coniferous and broadleaf forest trees (Raabe 1962, Sokolov 1964).

This leaflet describes the disease as it occurs in British Columbia, including the hosts, range and life history of the fungus and symptoms, damage and control of the disease.

Hosts and Distribution

In British Columbia, A. mellea has been reported on about 50 host species including all commercially important conifers and hardwoods. Records of the Forest Insect and Disease Survey indicate that the fungus is distributed province wide up to about the 56th parallel (Baranyay and Bauman 1972).

Life History

Armillaria mellea is one of a group of root disease fungi (others are Phellinus weirii and Fomes annosus) that invade living tissues during the parasitic phase of their life cycle and use the host, which is usually a stump or other woody tissue, as a food base during the saprophytic phase. The duration of the saprophytic phase is limited by the size of the food base and competing fungi.

Armillaria mellea spreads from a food base to a potential host by rhizomorphs or at points of contact between the food base and host roots. Rhizomorphs are red-brown to black strands, 1-2 mm in diameter, that are produced on the food base and may grow freely through soil (Fig. 1). When a rhizomorph contacts the root of a potential host, a branch of this rhizomorph may penetrate the healthy bark of the host. Following penetration, mycelial fans develop beneath the bark scales and in the cambial zone. When spread occurs across root contacts, mycelium grows from the food base onto the healthy root, penetrates the bark and grows in the cambial zone. Resin is usually produced by coniferous hosts at the point of attack (Fig. 3).

In coastal British Columbia, rhizomorphs appear to be the principal mode of spread, whereas in the southern interior spread is almost exclusively by root contact.

Once established in the host, A. mellea may behave in a number of ways: (a) the host is killed by girdling of the principal roots or the stem, (b) mature or resistant hosts may have root or root collar infections that are checked by host resistance (Fig. 4) or (c) decay of the lower bole may follow entry of the fungus through a root infection (Fig. 8).

In September and October, after rain, the mushroom-type fruiting bodies of A. mellea are produced in clusters near the base of an infected tree or stump or on the soil above an infected root (Fig. 2). The fruiting bodies have a honey-coloured cap with dark scales, whitish gills and a yellow-brown stem with a ring below the cap. Although conifer stumps have been infected by spores experimentally, the very low level of success suggests that it occurs rarely under natural conditions (Rishbeth, 1971).

Disease Symptoms

The crown symptoms caused by the disease on conifers are typical of all root diseases: leader growth declines, foliage becomes thin and yellow and a crop of small cones is often produced.

Several other signs and symptoms are of greater value in diagnosing A. mellea. In the early stages of an attack, resin exudation is common at the site of a root infection; beneath the bark, a necrotic lesion is found (Fig. 3a, 3b). The most useful signs are white mycelial fans under the bark of roots and the root collar (Fig. 5) and basal resinosis; these signs are found when the fungus has reached the root collar. When trees have been dead for a year or more, it is usually necessary to look below ground for subcortical mycelial fans.

Rhizomorphs are often found, particularly on the coast, on the roots and in the soil around attacked trees; flattened rhizomorphs may be found beneath the bark (Fig. 7).

The mushroom fruiting-bodies of A. mellea are found on the food base and infected trees in Autumn (Fig. 2).

Armillaria mellea may cause a butt rot. In the incipient stage, decayed wood has a water-soaked appearance; later, the wood is yellowish or white with a spongy texture and often contains black zone lines (Fig. 8). Decay seldom extends more than a few feet above-ground.

Damage

The amount and type of damage caused by A. mellea differs considerably between coastal and interior British Columbia. On the coast, mortality caused by A. mellea usually occurs in plantations and natural stands up to 20 to 25 years old. Incidence of attacked trees rarely exceeds 2-3% and is usually below 1%. Infection centers contain 1-3 dead or infected trees. Buckland (1953) observed that the incidence of killing is greater in plantations than naturally regenerated stands. After 25 years of age most trees are resistant to killing although basal lesions and butt rot may still develop. Pole-size trees under environmental stress and those near a source of inoculum may be successfully attacked.

In contrast to the coast, the damage caused by A. mellea in the Douglas-fir, hemlock and subalpine zones in much of the Kamloops and parts of the Nelson Forest Districts is significant. Trees of all ages (up to 250 years old) are killed and infection centers may occupy up to 3/4 acre; the incidence of dead and infected trees ranges up to 25%.

Control

In coastal British Columbia mortality caused by A. mellea is usually insignificant when considered over the life of the stand (Johnson et al 1972). Exceptions are arboreta, seed orchards and other high-value plantings; before these are established, all stumps and roots containing A. mellea should be removed from the site and burned. Soil fumigation with carbon disulfide or methyl bromide is an alternative to stump removal (Bliss 1951, Munnecke et al 1970).

In the interior, where losses are significant, the

best way to rehabilitate badly infested sites is to remove as much of the A. mellea inoculum from the soil as possible before regenerating, However, this is expensive and not feasible on all sites. An alternative to inoculum removal is to establish a resistant species; although susceptible to attack, lodgepole pine appears more resistant than any other species.

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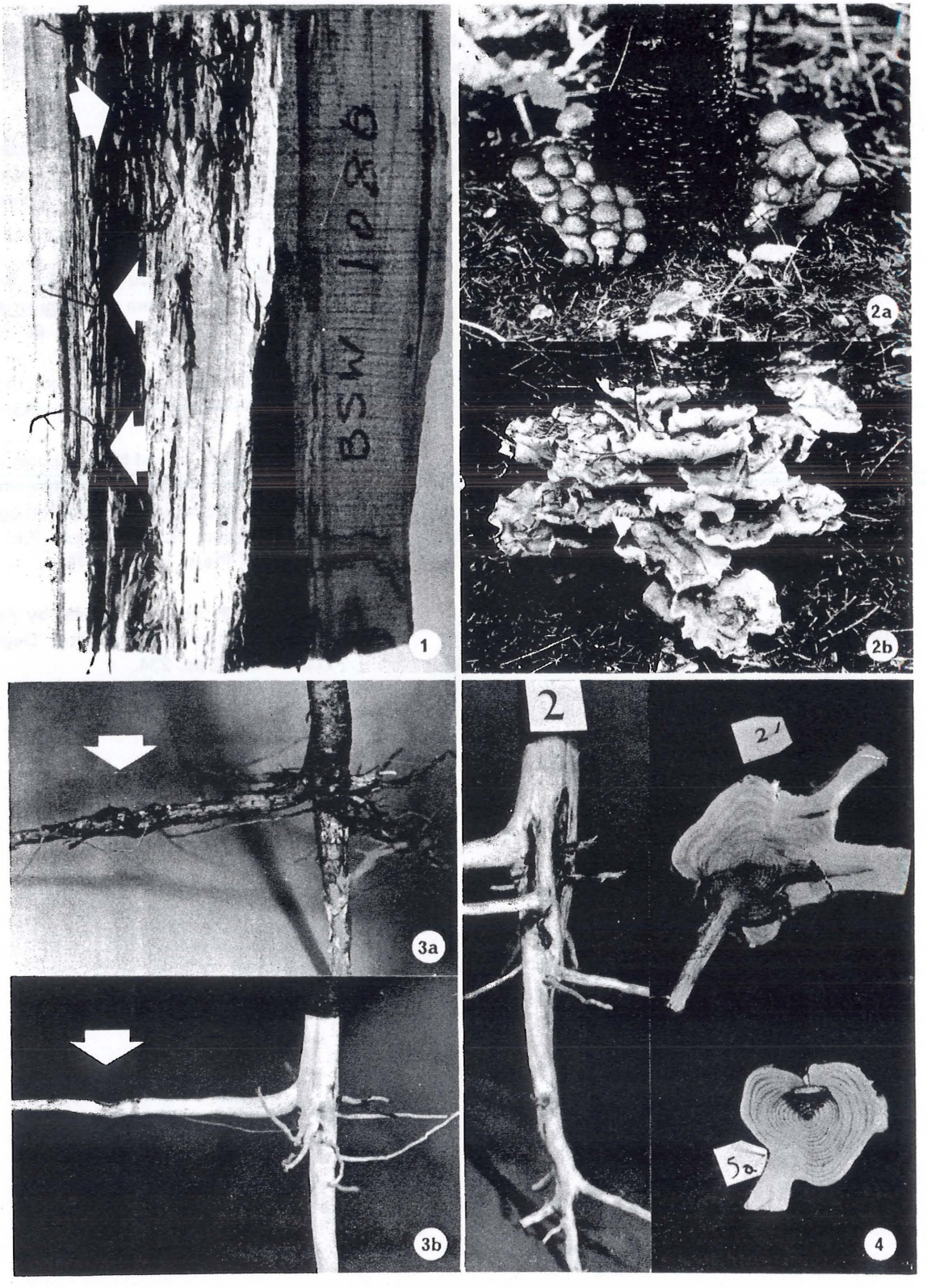

Fig. 1. The dark colored string-like underground rhizomorphs are produced on dead wood.

Fig. 2. Fruiting bodies of Armillaria mellea grow in clusters. a. young; b. fully-developed mushrooms.

Fig. 3. a. Resin crust produced on roots at the site of infection; b. under the bark a black canker-like scar is visible.

Fig. 4. Vigorous trees localize and overgrow infection.

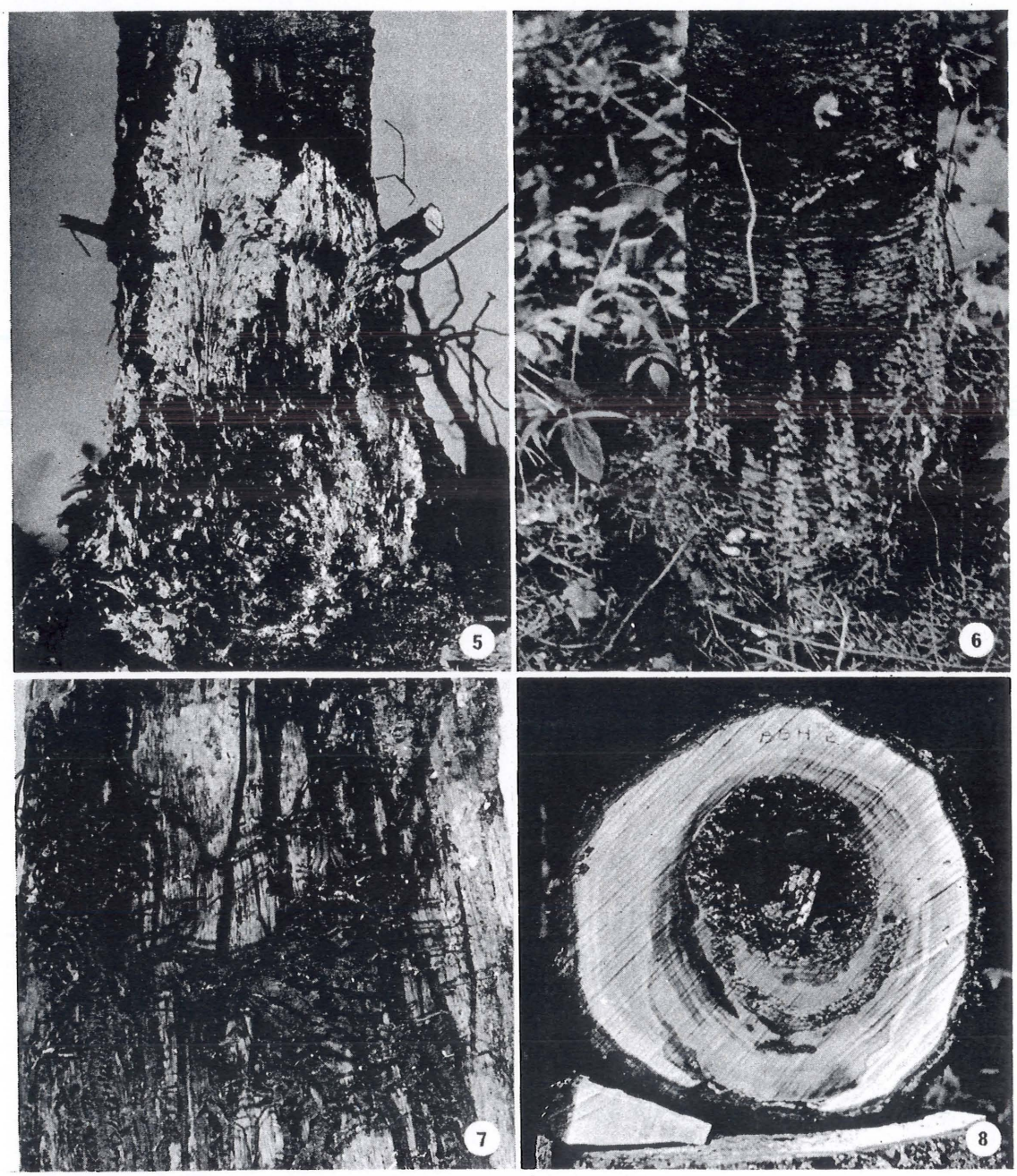

Fig. 5. Mycelial fans of Armillaria mellea with dark streaks.

Fig. 6. Basal resinosis is a common symptom of Armillaria attack.

Fig. 7. Flattened rhizomorphs under the bark of infected tree.

Fig. 8. Advanced butt rot caused by Armillaria.