FLORA

ARMILLARIA ROOT DISEASE

Richard Robinson

IN Western Australia, Armillaria root disease is caused by the pathogenic fungus *Armillaria luteobubalina*. It is an indigenous pathogen and is widespread in wandoo, tuart, jarrah and karri forests as well as in the coastal heath vegetation. The pathogen attacks and kills the roots of susceptible trees and shrubs and spreads from host to host by root contact. The list of susceptible hosts is extensive and is likely to include all native shrub and tree species as well as all introduced species. In undisturbed native forests and woodlands, however, Armillaria root disease is normally only associated with the death of trees weakened due to competition, age-related decline or environmental stress. Generally it is not the primary cause of death in healthy forest trees.

In recent years, reports of Armillaria root disease killing trees in backyard gardens and in remnant bushland on farms (*Fig. 1*) have increased. This increase is likely due to two reasons. Trees in remnant bushland are under increased physiological stress, due to exposure (which increases transpiration rates) and a rising water table, making them susceptible to disease. Trees and shrubs in backyards are succumbing to infection spreading from stumps or infected tree roots left following clearing of the bush when towns or new suburbs are established.

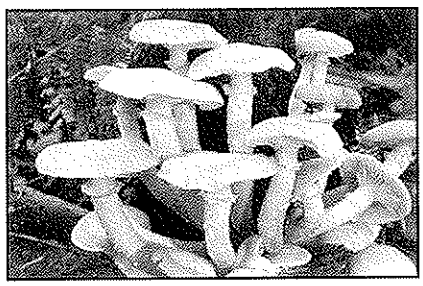

Figure 5. *Mushrooms produced by* Armillaria *at the base of an infected tree*

DISEASE SYMPTOMS

Trees are generally tolerant of Armillaria infection and do not usually show symptoms of the disease until it spreads all the way along the root to the root collar. When the pathogen spreads from the root into the bark at the base of the tree, an inverted V-shaped lesion, that is very similar in appearance to a fire-caused scar, may form at the base of the tree (*Fig. 2*). Even at this stage the tree crown may still appear healthy or normal. If or when the pathogen spreads to completely girdle the base of the tree, the tree then dies quite suddenly. Removing the bark from infected wood exposes a characteristic white fungal material (*Fig. 3*), often forming fan-shaped mats on the surface of the wood (*Fig. 4*). Armillaria also produces a light yellow to white stringy rot in infected wood. In the winter, rotted wood around the base of an infected tree is characteristically very wet and "mushy", and in the summer it is usually dry and "crunchy".

In the autumn, the fungus may

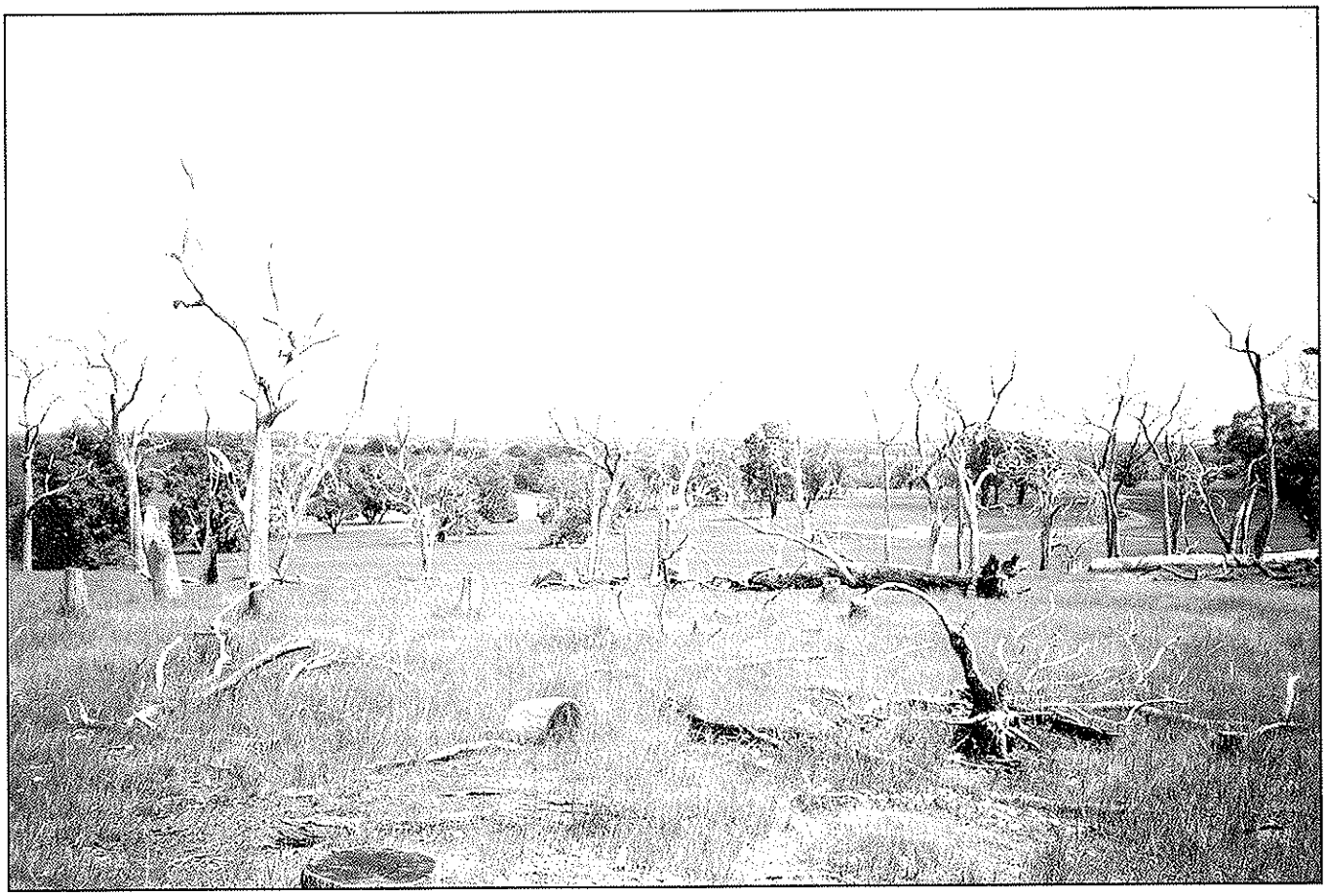

Figure 1. *Armillaria root disease centre in wandoo woodland*

continued on page 9

continued from page 8

Figure 2. Armillaria *scar at the base of a tree*

Figure 3. *White fungal mats under the bark of an infected tree*

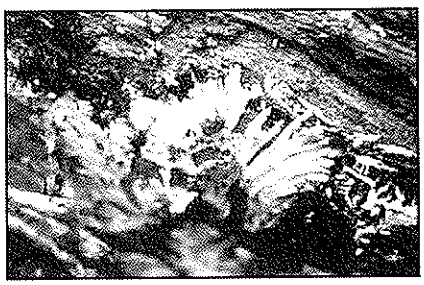

Figure 4. *Fan-shaped fungal mats on the surface of infected wood under the bark*

FLORA

form a cluster of yellow mushrooms on the base of the tree or on the ground close to the tree (*Fig. 5*). The mushrooms on the ground originate from an infected root. There are several species of fungi that look similar, but the dry cap surface of *Armillaria luteobubalina* is covered in the centre with tiny black scales that give it a characteristic sandpaper-like texture.

INFECTION AND SPREAD

In wet forests, Armillaria may survive for decades in the stump of a large tree. It spreads when the roots of a healthy tree encounter the infected roots of a stump or neighbouring tree. Healthy vigorous trees usually confine the infection to a discrete lesion on the surface of the root. However, if the tree becomes stressed or weakened the infection can rapidly spread from the lesion. If the health of the tree improves it may check the spread of the pathogen once again, but if it does not the pathogen can quickly spread through the whole root system and eventually girdle and kill the tree. When healthy trees within an infested stand are felled, Armillaria can rapidly spread into the resulting stumps. These stumps provide an increased infection source and are responsible for initiating new disease centres.

MANAGEMENT

Because *Armillaria luteobubalina* is a native pathogen it is not feasible to expect complete eradication. Management should thus be directed towards limiting buildup of inoculum and reducing disease impact. The most efficient method of achieving this is through removal of all infected material from the soil.

In backyard gardens where infection is limited, maintaining vigorous growth and minimising stress may provide adequate management options. In the dry Western Australian environment, mulching may help prevent moisture stress. If or when plants are killed, be sure to remove all infected material from the soil before planting replacement shrubs or trees.

In remnant bushland on farms, the trees are generally over-mature and have little regeneration under them. Check the roots and base of standing trees that have been dead for many years and old stumps for symptoms of infection. If there is no sign of Armillaria-caused rot in the wood there may be no reason to remove them. Although Armillaria can survive for decades on large stumps in wet forests the survival time in hotter, drier environments is likely much shorter. However, the stumps of recently killed trees should be uprooted and removed. It is expensive to remove large stumps, unless landowners own their own heavy machinery, but it is the best option. Stump removal should be followed up with raking the area to remove infected roots. Isolated stands should be fenced off to allow natural or planted regeneration to grow and an understorey to develop. This will help alleviate environmental and grazing induced stress. If the infested area is adequately prepared and managed then there should be sufficient survival of regeneration to replace the trees lost to disease.

Sometimes other factors may be more significant than Armillaria. Before embarking on a management option, be sure to make a thorough evaluation of the situation and rule out the possibility of site and stand characteristics that may be contributing to your trees being susceptible to Armillaria root disease. Planting and protecting regeneration, to improve site quality and the health and vigour of your remnant stand, will go a long way to increasing the resistance of the trees not only to disease but also to insect pest attack.

Richard Robinson is a Research Scientist in Forest Pathology and Fungal Ecology, at the Department of Conservation and Land Management, Manjimup. He can be contacted on 9771 7993 or e-mail: richardr@calm.wa.gov.au