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Plant diseases: Armillaria root rot of fruit trees

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Armillaria root rot is a fungal disease capable of causing serious damage to both young and established orchards. Although outbreaks are usually localised, eradication of the fungus and replacement of affected trees can involve the grower in considerable expense. For new plantings, thorough clearing of the land is recommended for preventing losses from this disease.

Armillaria root rot is caused by Armillaria mellea, a mushroom-type fungus which occurs naturally in the soil in association with the roots of native trees, especially marri or red gum (Eucalyptus calophylla), banksias and wattles (Acacia spp.). The fungus does not appear to be very damaging on these trees but may cause a serious root rotting of fruit trees if the area is cleared and planted to orchard.

Armillaria root rot disease occurs throughout the fruit growing districts of Western Australia, and has been recorded on a wide range of host plants. It is particularly severe on oranges and lemons but is also damaging to apples, peaches, plums, apricots, nectarines, mulberries, grapes and passion vines. In addition there are local records of this disease on rhubarb, potato, rose, Queensland umbrella tree (Brassaia actinophylla) and Victorian tea-tree (Leptospermum laevigatum).

SYMPHTOMS

In established orchards Armillaria attack can be suspected if trees show symptoms of leaf yellowing, sparse foliage or poor growth (Fig. 1.) A thorough examination of the crown and main roots of such trees should be made to confirm presence of the disease. The fungus will be obvious as a layer of white felt-like mycelium lying under the bark of infected roots and butt at ground level (Fig. 2).

Black fungal threads, resembling shoe-laces and known as rhizomorphs, are frequently found growing along or imbedded in the surface of such roots (Fig. 3). These rhizomorphs can be observed more readily by carefully washing the roots to remove adhering soil. A characteristic mushroom-like smell can usually be detected from the rotted roots, which are often of a jelly-like consistency.

Clusters of brown mushrooms or fruiting bodies of the fungus are occasionally seen at the base of affected trees in the autumn or early winter (Fig. 4). Extensive killing of roots results in decline and ultimate death of affected trees.
SURVIVAL AND SPREAD

Although the Armillaria fungus occurs naturally on the living roots of native trees it can also exist for many years on dead root pieces left in the ground after clearing. Such root pieces serve as infection centres for the fungus which spreads to the roots of fruit trees following on orchard establishment.

This spread may be accomplished through direct contact of fruit tree roots with an infected root piece or indirectly by means of rhizomorphs. These rhizomorphs, which develop from the infected root pieces, grow through the soil and invade the proximate roots of fruit trees.

Once fungal invasion has occurred the rhizomorphs advance along the root to the butt and may also pass on to infect the nearby roots of adjacent fruit trees. Thus the fungus, which may initially be confined to a single tree, spreads through the soil and in the course of time may affect many of the neighbouring trees.
CONTROL MEASURES

1. Prevention

As the disease is very difficult to control once established in the orchard, prevention should be the aim rather than cure.

Every endeavour should be made to clear the land thoroughly in order to remove the maximum amount of infected root material. Deep ripping of an orchard site is essential, in addition to normal cultivation, so as to bring as many roots as possible to the surface. All such debris should be removed and burnt.

If possible a period of two or three years should elapse before planting the cleared site, as this will allow many of the small root pieces to decay in the soil.

The orchard should be adequately drained to further reduce the activity of the Armillaria fungus, which is favoured by moist soils.

2. Treatment

Once the Armillaria fungus has extended along the main roots and encircled the butt little can be done to save the tree. However, if the disease is detected at a much earlier stage of development prompt surgical treatment of affected roots may lead to complete recovery of the tree.

The soil should be removed from around the tree to expose the main roots for a distance of one or two feet from the butt. Any infected roots located by this procedure should be cut off well above the decayed portion and dug out of the soil. The freshly cut root stumps can then be protected by painting with Bordeaux paste.*

*To make a small quantity of Bordeaux paste dissolve one ounce of bluestone (copper sulphate) in ½ pint of water and slake one ounce of quicklime (equals 1½ ounces fresh hydrated lime) in ½ pint of water. The two materials are then combined and produce a mixture of paint-like consistency.
A thorough search should be made for the original piece of native timber, which has initiated the trouble, by tracing back along the infected root during digging operations. This material should be removed and burnt, together with all diseased roots.

To check further spread of the disease in the orchard the main roots of trees in the two adjacent rows surrounding the infection site should also be exposed in a similar manner. All such excavations should be left open for several years as exposure of the roots to light and air restricts the spread of the fungus and so prevents butt infection.

The use of mechanical methods of soil removal from around the trees rather than laborious hand digging may accomplish equally satisfactory results. Either a high pressure jet of water from a spray plant or a jet of air from a compressor would be worthy of trial for this purpose.

3. Eradication

Where Armillaria root rot is so advanced that surgical treatment is not possible affected trees should be removed and the fungus eradicated by suitable soil fumigation. As much as possible of the root system should be dug out and destroyed by burning.

All excavations should be filled in, the ground levelled and then fumigated with carbon bisulphide. This operation is best carried out in summer or early autumn when the soil is relatively dry. If possible an area extending halfway to all adjacent trees from the diseased tree site should be treated with the fumigant. Care should be taken, however, not to treat the soil closer than six feet to the butts of nearby healthy trees as the material is highly toxic to living roots.

Just before using the fumigant the soil should be wetted to a depth of two or three inches to prevent escape of the gas. The carbon bisulphide is then applied at the rate of 1¼ fluid ounces (equals 2 oz. by weight) in holes eight to 12 inches deep and 18 inches apart in staggered rows. A few additional charges should be placed in holes 18 inches to two feet deep close to the former site of the tree. Immediately after applying each charge of chemical the hole should be filled in with soil.

Care should be taken when handling the liquid, as it is both poisonous and inflammable and a suitable gas mask should be worn.

Approximately 1½ gallons of carbon bisulphide would be required to treat a single tree space of 20 x 20 feet.

At least two months should elapse before new trees are planted in the fumigated areas. This will allow all traces of the gas to disappear from the soil.