



Department of
Primary Industries and
Regional Development

Journal of the Department of Agriculture, Western Australia, Series 3

Volume 1
Number 2 March-April, 1952

Article 9

3-1952

Muresk Agricultural College

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Recommended Citation

(1952) "Muresk Agricultural College," *Journal of the Department of Agriculture, Western Australia, Series 3*: Vol. 1: No. 2, Article 9.
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PLANT Diseases

By W. P. CASS SMITH, B.Sc. Agric.
(Government Plant Pathologist)

BROWN ROT OF CITRUS

BBROWN rot is a serious disease of citrus, which fortunately has proved to be readily controllable. It attacks both leaves and fruits causing partial or complete defoliation, and a rather characteristic fruit rot. The disease may also affect the bark of citrus trees in the basal trunk region resulting in "collar rot," or as it is sometimes called, brown rot gummosis. This phase of the disease will be referred to later.

The parasitic fungi causing brown rot* are favoured by abundant moisture and thus liability to the disease is greatest in the wetter areas, particularly where the soil is heavy or poorly drained. Brown rot occurs commonly in various localities in the Darling Ranges and coastal plains and especially in low-lying areas subject to flooding, or kept moist by seepage or poor drainage.

Orange, mandarin, and lemon trees are very susceptible and the disease has also been noted infrequently on grape-fruit.

LEAF SYMPTOMS

Affected leaves develop dark water-soaked areas, which generally extend either from the tips downwards or from the edges inwards. Very occasionally a leaf may be attacked centrally without involving the margin.

Diseased leaves curl somewhat and fall readily while still green and healthy-

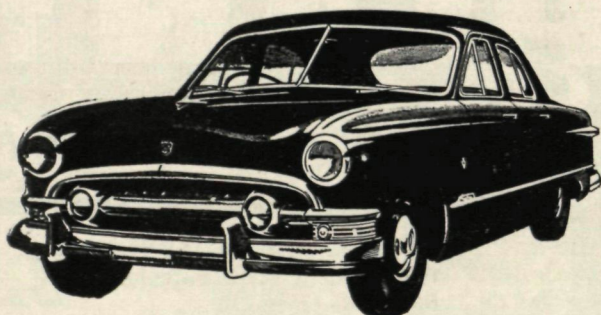
looking over the greater part of their surfaces. This defoliation is generally the most obvious sign of the disease in its early stages, or in mild attacks.

Typically, brown rot infects the lower leaves first, and spreads upwards to higher branches, and usually infections are most numerous on the sides of the trees sheltered from sun or wind, which remain moist longest after rain.

FRUIT SYMPTOMS

Affected oranges and mandarins develop a dull, dark brown area usually on one side, which may spread until the whole fruit is involved. The rotted areas remain firm to the touch unless invaded by secondary organisms, and have a penetrating and characteristic odour unlike that usually associated with mouldy citrus fruit. In the absence of secondary infection brown rot affected fruit eventually shrinks to a

* *Phytophthora hibernalis* and *Phytophthora citrophthora*.



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dry hard mummy. Usually in the orchard however, secondary infection with common moulds such as *Penicillium* spp. eventually occurs resulting in a soft breakdown of the whole fruit.

The first infected fruits are usually the lowest ones, near to or in contact with the soil, but as the disease progresses infected fruit may be found at higher levels. In general however, the disease is progressively less abundant towards the top of the tree. Brown rot may also spread by contact between diseased and healthy fruits. Affected parts of lemon fruits develop a washed-out, pale yellow or almost white colour, which contrasts sharply with the brighter yellow of the sound skin.

As with oranges the affected areas eventually turn brown, and in the rare absence of secondary infection, diseased fruits shrink and dry.

TWIG BLIGHT

When leaf infections are numerous and severe defoliation results, the smaller twigs and branches often die. In consequence the yield of fruit on affected trees may be greatly reduced in the following season.

CONTROL

1. Prune the trees so that the lowest branches are at least a foot above soil level when weighted with fruit, and thin out any excess branches. Also keep down tall weed or cover crop growth underneath the spread of the branches.

2. Before the autumn rains commence, say from the middle to the end of April, *thoroughly* spray the lower two-thirds of the trees with Bordeaux Mixture 4:4:50 plus a spreader such

as prepared white spraying oil 1:80; or calcium caseinate $\frac{1}{2}$ lb. in 50 gallons. The latter spreader would be preferable in areas where liability to water spot and rot is high. To ensure thorough coverage the foliage should be sprayed from below upwards, as well as from above downwards. Also to reduce the amount of the fungus in the surface soil, and guard against "brown rot gummosis" or collar rot, the soil under the spread of the branches, and the butts of the trees should be well drenched with spray. Where mottle leaf due to zinc deficiency is prevalent zinc-copper-Bordeaux mixture may be used for the control of both troubles simultaneously. In this case, half the powdered bluestone, should be replaced with an equal weight of zinc sulphate when preparing the Bordeaux mixture.

3. To guard against further infection in spring, spray the lower two-thirds of the trees with Bordeaux 4:4:50 plus spreader in late winter or spring, say in the first or second week of August. This spray is particularly important for lemon trees, which usually are more subject to the disease in spring than during the winter months.

4. Where spraying at the times stated has been neglected and the disease has broken out, spraying should be done at the earliest opportunity, i.e. during the first period of fine bright weather.

5. Fallen diseased fruits and leaves if left under the trees favour the development of the fungus in the soil, and increase the chances of further infection. They should therefore be gathered up and destroyed.

SPECIMENS HELP DIAGNOSIS

WRITTEN descriptions of plant diseases are often insufficient for accurate diagnosis. Send specimens, preferably several, showing the disease at various stages. They will usually carry well if wrapped in moist newspapers and enclosed in well-ventilated containers.

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COLLAR ROT OR BROWN ROT GUMMOSIS OF CITRUS TREES

COLLAR rot or brown rot gummosis is a disease which kills the bark of citrus trees in the basal-trunk or collar region. It is caused by a parasitic fungus* which is also partly responsible for the brown rot disease of citrus leaves and fruits.

The parasite usually infects the bark near the soil line and spreads both upward and around the trunk. It seldom progresses downward beyond the union on to the roots except in the case of seedling trees. As a result of its activities the invaded bark is killed and often quantities of gum are exuded. Later the dead bark dries and shrinks causing bark cracks to appear which run parallel with the trunk. (Fig. 1.).

Gum exudation, and the occurrence of longitudinal bark cracks are usually the symptoms by which collar rot infection is first noticed. As the disease progresses however, and more extensive areas of bark are killed, the foliage yellows and the tree becomes unthrifty in appearance. In the absence of treatment ring-barking and death of trees usually occurs although occasionally trees may recover naturally.

Wet conditions favour the occurrence of collar rot and thus it is most prevalent on heavy or poorly drained soils, in the wetter areas. Of the citrus varieties, lemons are by far the most susceptible, followed by grapefruit, navel and valencia oranges, and mandarins. The rough lemon or citronelle rootstock on which the majority of our citrus trees are "worked" is less susceptible than lemon or sweet orange varieties and it is for this reason that collar rot usually makes slower progress below than above the bud union. Seville or sour orange rootstock is even more resistant than citronelle, and according to New South Wales experience, trifoliata stock is immune.

CONTROL MEASURES FOR COLLAR ROT OR BROWN ROT GUMMOSIS

Preventive

Probably under local conditions the main factors contributing to collar rot attack are:—

(a) Excessively wet soil; (b) deep planting; (c) accumulation of infectious material in the soil surface.

Wet soil conditions encourage the causal fungus and hence adequate drainage should be provided. Skirting the trees so that there is at least a foot of clearance between the lowest branches and the ground, facilitates air movement and sunlight penetration and thus promotes more rapid drying of the surface soil and tree trunks. As the bark of lemon and sweet orange varieties is more susceptible than the citronelle stock on which they are commonly "worked", deep planting or the piling up of soil around the trunk should be avoided. Trees should be planted so that after settling in the soil the bud union is well above ground and the main crown roots are as near the surface as possible.

As the fungus causing collar rot is also partly responsible for brown rot, particularly of lemons, liability to collar rot attack is increased when brown rot affected leaves and fruits are left lying on the ground. They should therefore be gathered up and destroyed, and when routine sprays are applied for brown rot control the butts of the trees and the soil under the branches should be well drenched.

* *Phytophthora citrophthora*.

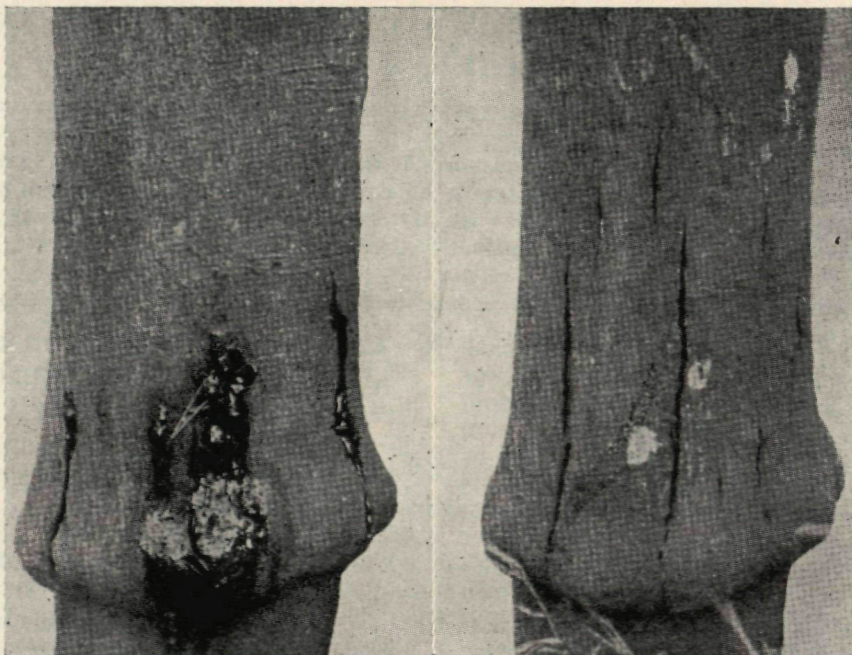


Fig. 1.
Collar rot or brown rot gummosis on lemon tree. At left, early stage of disease showing gum exudation. At right, same tree at a later stage. Note that the gum first formed has been dissolved by winter rains, and the dead bark has dried and shrunk causing bark cracks. (After Fawcett.)

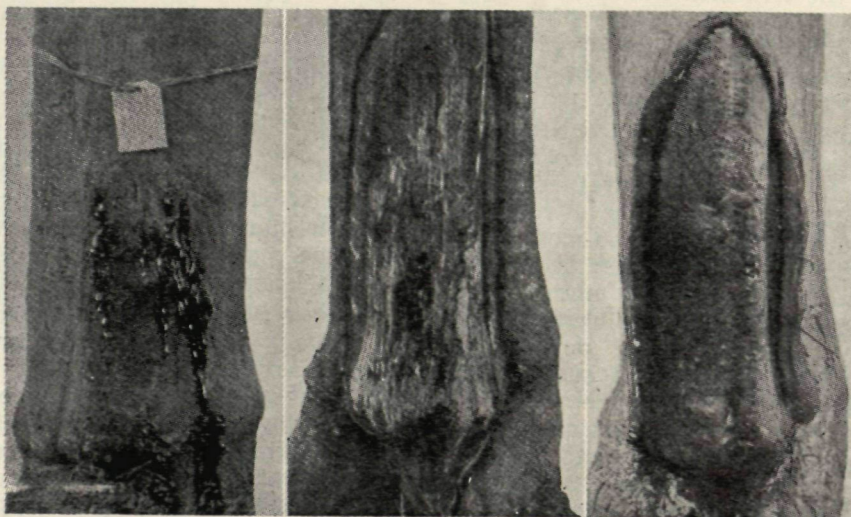


Fig. 2.
Showing curative treatment of collar rot or brown rot gummosis: At centre, the diseased bark and a small surrounding strip of live bark has been cut away ready for painting with Bordeaux paste. At right, same tree two years later, showing healing of wound at edges, and covering of asphalt paint on the exposed wood. (After Fawcett.)

Curative

When collar rot is first noticed, the soil should be removed from around the butt of the tree and the bark scraped lightly to ascertain the extent of infection. The diseased bark may be differentiated from the healthy bark by its darkened, brownish colour. With a heavy knife cut out the dead bark and also an inch or two of live bark surrounding this area. The disease does not penetrate deeply so it is only necessary to cut away the bark and not the woody tissue below. To assist rapid calousing bring the cuts to a point, both above and below, as indicated in Figure 2.

If the infection has spread below the union on to some of the roots, they should be treated in the same way, or if very badly diseased, removed completely.

Finally to assist healing and prevent secondary infection with wood-rotting fungi, or other organisms, the wounded

surfaces should be coated with Bordeaux paste. The coating should be renewed as required by weathering, until the cut edges begin to heal, when it may be replaced with a good seal of asphalt paint or other permanent wound dressing. Bordeaux paste may be prepared according to the following formula: Powdered copper sulphate 1 lb., quicklime 2 lbs. (or good quality hydrated lime 3 lb.), water $1\frac{1}{2}$ gallons.

Dissolve the copper sulphate in 1 gallon of water, and slake the quicklime in the remaining $\frac{1}{2}$ gallon. Then pour together and stir thoroughly before using. When not in use the mixture should be kept in a closed container.

When trees are so badly affected by the disease, that they would be ring-barked by the surgical removal of the dead bark, they may sometimes be saved by bridge-grafting or inarching. In this case the local Horticultural Instructor should be consulted regarding treatment.

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