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Diseases of clovers in Western Australia

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LEGUMES of the Trifolium species are grown widely in the State, and occupy an important place in our Agriculture. There are a number of parasitic diseases of clovers, yet none have gained major economic importance.

The diseases of clover are described below, and the more important ones illustrated. Where possible the control measures are given.

**LEAF AND STEM DISEASES**

**Rusts**

Rust is a readily recognisable disease. It has been observed on drooping flowered clover (*Trifolium cernuum* Broth.), subterranean clover (*T. subterraneum* L.), and white clover (*T. repens* L.). The rusts found on these clovers are subspecies of the fungus *Uromyces trifolii* (Hedw. f.) Lev.

The diseases are characterised by the presence of slightly raised reddish brown pustules on the leaflets and petioles (Fig. 1). The pustules are often prominent on the under-surface of the leaf. Severely affected plant parts die prematurely, but there is a tendency for the tissues immediately surrounding the pustules to remain green the longest.

Subterranean clover rust (*U. trifolii subterranei* Latter) has been noted in many areas, but it is most prevalent in the higher rainfall regions of the lower southwest.

Rusts appear to be of minor importance except possibly in the wetter areas. Control could be achieved through the use of resistant varieties.

**Powdery Mildew**

This relatively uncommon fungus disease is caused by *Erysiphe polygoni* DC., and has only been recorded on subterranean clover.

The organism produces a whitish, powdery growth on the leaflets (Fig. 2), which yellow and die prematurely when infection is severe.
Pepper spot or burn

Pepper spot is probably the most common disease of clover. It is caused by the fungus *Leptosphaerulina trifolii* (Rostr.) Petr., and has been found on bladder (*T. spurmosum* L.), strawberry (*T. fragiferum* L.) subterranean, and white clover, and on *T. cheranganiense* J. B. Gillett.

The disease symptoms vary on different clovers. On white clover black pinpoint spots on the leaflets and petioles are characteristic (Fig. 3.) On the other hosts the spots are larger and have brown centres surrounded by dark brown or greenish brown areas (Figs. 4 and 5). The Yarloop strain of subterranean clover is particularly susceptible to a severe form of the disease which results in curled leaflets being attached to dead petiole apexes. Blackwood subterranean clover is very susceptible to infection. Minute black dots may occur on the dead leaf tissues; these are fruiting bodies of the fungus.

The organism persists in infected plant debris. Disease development occurs during cool, moist weather.

The only control measure that can be recommended at present is the use of the less susceptible clovers.

Wart

Wart disease was discovered in 1955, and is caused by the organism *Physoderma trifolii* (Pat.) Karling. The disease is usually only evident on plants growing in wet situations. It has been recorded on subterranean clover and woolly clover (*T. tomentosum* L.).

Affected plants show swellings on the stems, petioles, leaves, and flowers up to about 3 m.m. in diameter (Fig. 6). Dissection of the swellings reveals a light brown discoloration of the tissues caused by spore masses of the organism. Severely affected plants are stunted and distorted.
The disease has been found in many parts of the State, but due to its low general incidence it is not of economic importance.

**Other leaf and stem diseases caused by fungi**

A number of other fungi have been recorded on the leaves of strawberry and subterranean clover. These include *Colletotrichum trifolii* Bain and Essary, *Pleospora herbarum* (Pers. ex Fr.) Rabenh., and *Pseudopeziza trifolii* (Biv.-Bern. ex Fr.) Fuckel. Infection is evident as light to dark brown spots similar to those caused by pepper spot.

Leaf spotting and stem decay caused by the fungus *Ascochyta pisi* Lib. has been recorded on subterranean clover. Leaf and stem decay of yellow suckling clover (*T. dubium* Sibth.) has been associated with a *Sclerotinia* species. Heavily infected plants are overrun by a white fungal growth and small, black bodies form on the tissues.

These diseases appear to be of minor importance.

**Virus diseases**

Three aphid-transmitted virus diseases have been identified on clovers in Western Australia. The most spectacular of these is caused by stunt virus and is commonly referred to as stunt disease of subterranean clover. The incidence of the disease appears to be greater in years when there is high rainfall during late summer. It occurs mainly in the southern coastal regions, but has been found in other coastal areas.

Affected plants may be severely stunted, depending on the stage of development at which infection takes place. Foliage produced after infection is small, distorted, and pale. The leaflets are slow to open and have pale green to yellow margins which become puckered as the leaflets open. Older leaves often turn red or develop red margins (Figs. 7 and 8).

Bean yellow mosaic and pea mosaic viruses produce similar symptoms on infected plants. Vein clearing and the development of a dark and light green mottle are characteristic (Fig. 9). The leaflets and leaf stalks may be stunted and the leaflets puckered. Generally, the occurrence of the diseases is restricted. Bean yellow mosaic virus has been recorded on subterranean and crimson clover (*T. incarnatum* L.), and pea mosaic virus has been found on subterranean and red clover (*T. pratense* L.).

The only practical method of control of virus diseases is through the use of resistant or tolerant varieties. The Tallarook...
strain of subterranean clover is resistant to stunt virus. The diseases are not seed transmitted, except possibly bean yellow mosaic.

**Stem nematode**

This rare disease is caused by the eelworm *Ditylenchus dipsaci* (Kuehn) Filipjev, and has been recorded on white clover in the Boyanup area.

The parasite mainly attacks the aboveground parts and causes the tissues to become swollen and spongy. Affected plants are stunted and distorted and the leaves tend to cluster. Infected tissues have a decayed appearance. The disease is favoured by moist conditions. Disease spread can be minimised by avoiding the transfer of soil and plant refuse to adjacent paddocks.

**ROOT DISEASES**

**Root knot**

Root knot is caused by the nematodes (eelworms) *Meloidogyne hapla* Chitwood, *M. javanica* (Treub) Chitwood, and *M. incognita* (Kofoid and White) Chitwood. The disease has been recorded on strawberry, subterranean, and white clover, and is limited to relatively small areas in the south-west corner of the State.

The disease is characterised by swellings and distortions of various sizes and shapes on the roots (Fig. 10). The presence of root nodules is not to be confused with the disease symptoms; nodules are outgrowths of the root rather than swellings. The disease leads to dwarfing, and consequently to decreased yields.

As yet no satisfactory control in pastures can be recommended.

**Other nematode diseases**

The nematodes *Pratylenchus* sp. and *Radopholus* sp. have been associated with injury to subterranean clover roots. Their significance as a disease factor is not known.

**Root rot**

Plants affected with root rot are stunted, show yellowing or purpling of the foliage, and may finally die. The roots show varying degrees of rotting.

Root rot has been noted, in particular, in subterranean clover stands three and more years old on some of the medium to heavy soil types. Fungi associated with various root rots are *Fusarium* species, *Mycosphaerella phaseoli* (Maubl.) Ashby, *Ascochyta Aspergillus*, and *Phoma* species.

Crop rotation may aid in controlling root rot.

**NON-PARASITIC DISEASES**

Non parasitic diseases are caused by unfavourable environmental factors, nutritional deficiency or excess, or by the failure of plants to nodulate.

Clover stands may be difficult to establish in the absence of satisfactory nutrition. Plant nutrition in Western Australia is reviewed by Burvill (1965) in the *Journal of Agriculture of Western Australia* volume 6 (Fourth Series), pages 353-371 (Department of Agriculture bulletin 3342).

It is well known that poor nodulation of plants or nodulation with ineffective strains of rhizobia is a cause of unthrifty clover stands. Nodulation is usually essential for adequate plant growth. Nodulation failure, particularly in the second and subsequent years after planting, is widespread. The plants fail to develop, become pale, then turn red and die.

The inoculation of seed with an effective strain of rhizobia is usually sufficient to prevent nodulation failure in the establishment year, but no recommendations can be made for the prevention of failure in subsequent years. This problem is receiving attention, and it is hoped that strains of rhizobia will be found that will survive satisfactorily in the problem soils.
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