5-1956

Bean, Subterranean clover and lupi diseases caused by the Bean yellow mosaic virus in Western Australia- Dahlia virus diseases

H. L. Harvey

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For the past two seasons a survey of the diseases caused by the bean yellow mosaic virus in Western Australia has been carried out with a view to assessing their economic importance. This article is intended to give information on the symptoms and occurrence of these diseases on the more important hosts in Western Australia. Consideration has been given to control aspects, but in the present state of our knowledge, no reliable recommendations can be made.

Bean yellow mosaic has occurred naturally in Western Australia on French and runner beans for some years. Newly recorded hosts are subterranean clover, burr medic (Medicago denticulata), West Australian blue lupin (Lupinus varius), New Zealand blue lupin (L. angustifolius), yellow lupin (L. luteus), ornamental lupin (L. mutabilis) and broad bean. Others that have been infected artificially by inoculation are garden pea (Greenfeast), white lupin (L. albus), crimson clover (Trifolium incarnatum), Bokhara "clover" (Melilotus alba) and barrel medic (Medicago tribuloides). Barrel medic does not appear to have been recorded elsewhere as a host of the virus.

Hosts, in addition to these, have been recorded elsewhere and include red clover (T. pratense), yellow sweet clover (Melilotus officianalis), cowpea, lima bean, pigeon pea, soybean and gladiolus.
**SYMPTOMS**

**French Bean.**

When the disease first appears, the small veins in the leaf become conspicuous due to “clearing” or gradual loss of green colour. At the same time, the leaf surface tends to become rugose or roughened in contrast to the flat surface of the healthy leaves. Finally, a mosaic pattern of dark and light green to yellow develops on the leaves (Fig. 1) which are generally smaller in size than normal leaves and slightly irregular in shape. The diseased plants, especially if infected at an early stage of growth, may become stunted and yellow, and yield small and late-maturing crops.

**Subterranean Clover.**

Vein-clearing first appears and this gradually develops into a dark and light green mottle (Fig. 2). Leaflets are smaller in size and develop a puckered surface while leaf stalks are shorter than usual giving a dwarfed or rosetted appearance to the whole plant. A case of extreme dwarfing (Fig. 3) is seen in a plant of the Dwalganup variety several weeks after inoculation with the bean yellow mosaic virus.

**West Australian Blue Lupin.**

The first sign of the disease in West Australian lupins is the malformation of newly emerged leaves (Fig. 4). The leaf stalks bend down slightly and the leaflets instead of retaining their normal shape, become noticeably twisted. Growth subsequently, may cease or result in only very small leaves which assume the shape of a clawed hand. In the advanced stage of the disease, affected plants in the field can be noticed readily among healthy lupins by the bunched and often stunted habit of growth of one or more branches (Fig. 5) on which flowers and seeds may fail to develop. Very young plants may be killed by the virus.

**New Zealand Blue Lupin.**

The disease first makes its appearance as a slight drooping of the growing tip which soon bends over to one side (Fig. 6). The young leaves wilt and the growing tip finally dies. On some of the older leaves, the leaflets may wilt and hang vertically. They turn yellow and fall, leaving bare leaf stalks. The main stem assumes a dark colour due to death and blackening of internal stem tissues. As with West Australian lupins, plants infected in the early stages of growth may be killed rapidly (Fig. 7). If however, infection occurs in a plant nearing full development, the tip of the main stem wilts, bends over
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and dies but the rest of the plant may remain normal. All stages between early and late infection may be seen in the field.

**Burr Medic.**

Symptoms are similar to those found on subterranean clover. The veins become markedly "cleared" but mottling is less pronounced.

**Yellow Lupin.**

Vein clearing is an early symptom on the young leaves. Plants which survive to near maturity may be badly rosetted with short narrow leaflets which fail to unfold normally. The flowers may be abortive (Fig. 8).

**TRANSMISSION AND SEASONAL CARRY-OVER OF THE VIRUS**

The only known method by which yellow mosaic may be transmitted in nature is by aphides which carry the virus-infected sap from diseased to healthy plants in the process of feeding. There is no evidence to suggest that the virus is carried by the seed or that it survives in the soil.

In the bean-growing areas, the last of the late-sown beans in some years are still standing in the market gardens when the first of the early beans are planted in adjacent gardens. In addition, West Australian lupins and burr medic (which grow as winter weeds in these areas), are often found infected with the virus. Under these circumstances, virus reservoirs are always present for aphids, which are active to a greater or lesser extent throughout the year.

There is no ready explanation however of the summer carry-over of the virus in the more remote grazing areas where no known hosts survive the summer months.

The infection of subterranean clover and lupins in the winter is therefore suspected of originating from certain species in the surrounding native flora which survives the summer months. The only suspect to date is a red flowered perennial leguminous creeper (*Kennedya prostrata*) which grows throughout the South-West corner of the State where subterranean clover, lupins and beans are grown. Leaf mottling, distortion and dwarfing of many of these plants has suggested virus infection but attempts to isolate a virus have so far been unsuccessful. Further work on this and other possible native hosts is proposed.
Fig. 4.—Left: West Australian blue lupin showing early symptoms of B.Y.M. infection. Right: Healthy plant of the same age.

Fig. 5.—West Australian blue lupin naturally infected with B.Y.M. showing advanced symptoms on the upper parts of the plant.

Fig. 6.—New Zealand blue lupin showing wilting of top growth, an early symptom of B.Y.M. infection.

INCIDENCE OF THE DISEASE

The amount of spread is governed by the activity of infective aphides. In plague years, the incidence of yellow mosaic can be expected to be high and conversely when aphid activity is low, the spread of the disease is only slight. It is to be ex-
pected then that considerable fluctuation in the seriousness of the disease will occur from year to year.

This phenomenon has been observed for a number of years with French and runner beans but for the remaining hosts which were recorded for the first time in 1954, observations have been made for two years only.

**French Bean.**

In most seasons, yellow mosaic ranks as important as any other bean disease in Western Australia. It is quite often found in association with common mosaic a similar but distinct virus disease and when both occur on the same bean plant, an overlapping of symptoms may result. Yellow mosaic appears to be worse in the early spring sown French beans than in the main summer crops of runner beans.

**Subterranean Clover.**

From observations in 1954 and 1955, the midseason variety, Mt. Barker, was the only one affected to any noticeable extent on grazing properties and then only on restricted areas. It was estimated that, on the average, infected plants grew to only 75 per cent. of the size of normal plants. No information has yet been obtained on the effects of the disease on seed setting or on seed viability.

Little or no mosaic was observed in the lower rainfall wheatbelt areas which are predominantly sown to Dwallganup subterranean clover. Glasshouse tests however have shown all varieties commonly grown in Western Aus-
Australia to be susceptible. The varieties tested were Dwalganup, Mt. Barker, Yarloop, Bacchus Marsh and Tallarook.

**West Australian Blue Lupin.**

In 1954, West Australian lupins examined in the area between Northampton and Perth were virtually free of the disease but within a 20 mile radius of Perth a fairly uniformly low percentage of infected plants were found. The disease was therefore not serious. The naturally shed seeds of this legume are valuable as sheep feed in summer and autumn and for re-seeding for the following season.

In 1955, the disease incidence was relatively high within a radius of 40 miles of Perth, and seed formation was significantly impaired in many cases. In one grazing area of lupins, 80 per cent. of the plants became infected early and were killed or stunted and many of the remainder were infected later. The loss in seed produced for grazing was more than 90 per cent. In a West Australian lupin crop grown at Gingin, for commercial seed production, a 50 per cent. loss of seed was estimated to have resulted from virus infection.

**New Zealand Blue Lupin.**

New Zealand lupin green-manure crops in many orchards and vineyards contained only a low percentage of infected plants. Moreover the infection occurred in most cases very late in the season just about flowering time when crops are usually ploughed in. The loss was therefore insignificant. It is possible however that in an early Spring, infection may occur at a young growth stage and reduce the bulk of a green-manure crop considerably. To date this has not been observed. It has been noted however, that where West Australian lupins and New Zealand lupins are growing together or in close proximity, the incidence of the disease is much higher and occurs earlier in the season in the former than in the latter species. The reason for this is not known but it may indicate greater palatability of West Australian lupins for the aphid vectors.

**Burr Medic.**

Although widely grown in this State, the disease has only been observed on a few individual plants in the vicinity of Perth.

**Yellow Lupin.**

This lupin is only grown to a limited extent and the incidence of the disease is very low.

**THE PROBLEM OF CONTROL.**

In view of the economic importance of these diseases in certain areas, the problem of control is receiving attention but it is not yet possible to recommend suitable measures. Three lines of approach which have possibilities and on which further investigation is required, are the prevention of virus transmission by aphides, the discovery of resistant varieties and the elimination of native and weed hosts in the vicinity of bean, subterranean clover and lupin areas.

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**DAHLIA VIRUS DISEASES**

By H. L. HARVEY, B.Sc. (Agric.), Senior Plant Pathologist

Of the various disorders occurring in dahlias, a group of diseases caused by viruses can be responsible for considerable damage to this otherwise attractive garden plant. Two such diseases of importance in Western Australia are dahlia mosaic and spotted wilt. Rarely, if ever, do they destroy the plants. They may, however, cause dwarfing, leaf abnormalities and a reduction in the number and size of blooms.

In common with many other plant virus diseases, mosaic and spotted wilt are spread by the sap-sucking insects, aphids and thrips respectively.

A virus is an infectious principle that, once introduced into a plant, generally finds its way to all parts of that plant except the flower seeds. Initial freedom from virus is therefore ensured by propagating with seed but not with tubers or cuttings from infected parent plants.

**Mosaic.**

Causes a yellowish banding of the leaf veins (Fig. 1) which may be obvious in some cases or only just discernible in
others. There is a tendency for a shortening of the stems, with the development of side branches, and in bad cases, plants become dwarfed and bushy in appearance. Dahlia mosaic is not known to infect plants other than dahlias in Western Australia.

**Spotted Wilt.**

Causes leaf symptoms ranging from small faint yellowish spots (Fig. 2) to single or concentric rings and patterns of

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**Fig. 1.**—Dahlia mosaic. Leaf showing yellow vein-banding.

**Fig. 2.**—Spotted wilt. Yellow spots on dahlia leaves.

**Fig. 3.**—Spotted wilt. Lines in the form of rings and other patterns on dahlia leaves.

**Fig. 4.**—Spotted wilt. Numerous concentric rings have turned brown and given a rust-brown appearance to the leaf surface.
wavy lines (Figs 3 and 4). The rings and lines are at first yellow or pale green but may later turn brown due to the death of plant cells along the lines.

Spotted wilt hosts are numerous, including ornamentals, vegetables and certain weeds, but it is probably best known as a tomato disease of considerable economic importance.

**CONTROL**

Control measures for both diseases are based on:

1. Propagation by seed or by tubers and cuttings taken only from healthy parents.

2. Control of the insect carriers by regular applications of insecticides containing DDT and parathion. Applications should begin when plants are small.

3. Removal and destruction of plants which develop virus symptoms. Regular examinations should be made through the growing period.

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**CITRUS CROP ESTIMATE**

The following estimate of the citrus crops for the 1956-57 season has been released by the Superintendent of Horticulture, Mr. H. R. Powell. It has been prepared from information obtained from the main citrus growing districts. Fruit Growing Industry Trust Fund figures have been used as a basis of the estimate, with suitable adjustments to bring the figures to a twelve-month period.

Following on a most unusual year, commencing with heavy rains in February and a record wet winter and later spring, the blossoming of all citrus varieties was much lighter than usual and very variable in nature.

Navel oranges flowered fairly well, particularly in the coastal districts, but in northern areas it was patchy. Valencias, on the other hand, blossomed poorly in practically all areas and in northern areas was both very sparse and extremely late. This erratic blossoming and subsequent setting has made the forecasting of the coming orange crop very difficult.

Lemon blossoming was only fair, while mandarins and grapefruit was not profuse.

The setting followed very much the pattern of the blossoming. Navel oranges set fairly good crops, but Valencias were very light and in some orchards the crop is at an all-time low. Lemons set somewhat better than the previous year, but the crop will still be very much below normal. Lisbons are carrying better crops as a rule than Eurekas.

The summer growing conditions have not produced any abnormal shedding, and due to the lightness of the crops, fruit size is generally satisfactory.

At the present time, it appears that oranges in the coming season will show a very substantial decrease on the previous year, and this will be particularly marked in the case of Valencias. Lemons, which reached a very low level last year, should show a slight improvement, but the extent of this improvement will be largely influenced by the setting of the summer crops. Both grapefruit and mandarins are expected to be lighter than in 1955-56.

The following forecast of production is based on the assumption that normal weather conditions will be experienced between now and harvest.

<table>
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<tr>
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<th>1955-56 (bus.)</th>
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<tr>
<td>Oranges</td>
<td>405,000</td>
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<td>Lemons</td>
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<td>Grapefruit</td>
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<tr>
<td>Mandarins</td>
<td>9,400</td>
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* These figures are taken from data supplied from the Fruit Growing Industry Trust Fund, with suitable adjustments for outstanding deliveries.
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