

Bean Carlavirus-

Cowpea mild mottle virus

Cowpea mild mottle virus (CPMMV) is a member of the Carlavirus group of plant viruses. When viewed by electron microscopy virus particles of CPMMV are slightly flexuous filamentous rods, approx. 600-700 nm in length. Considerable genetic diversity exists among the CPMMV group and virus strains now prevalent in the Americas and Australia are considerably different from the original virus reported from Ghana in 1973.

Unlike other Carlaviruses, which are aphid transmitted, CPMMV is transmitted by the silver leaf whitefly (*Bemisia tabaci*).

Distribution: CPMMV has a very wide geographical range, occurring in most countries where grain legumes are grown. These include countries of Asia, the Middle East, Africa, Central America and Caribbean, South America and Oceania.

CPMMV was first detected in Australia in 2016 on bean and soybean in south-east Queensland. This was the first record of the virus in Australia.

Hosts: The majority of host species for CPMMV are legumes (family Fabaceae) with French bean, soybean and cowpea being the species most frequently infected.

Other hosts include mung bean, asparagus bean, adzuki bean and lima bean. Several weed species in Fabaceae are also hosts.

In Queensland, the known natural hosts of CPMMV are French bean, soybean, mung bean, cowpea, Siratro (*Macroptilium atropurpureum*), *Glycine* and Phasey bean (*Macroptilium lathyroides*)

Symptoms: A wide range of symptoms can develop on infected plants, depending on the host species, variety and time of infection. Most infected plants develop leaf mottling and mosaic. Seed pods on beans may be deformed and the surface discoloured. This is most likely to occur on susceptible varieties infected in the first month of growth. The disease in beans is sometimes called angular mosaic because of the yellow, angular leaf spots seen against a normal green background.



Symptoms of CPMMV on bean



Infected plants with twisted pods in the field



CPMMV symptoms on cowpea

VG16086: Area wide management of vegetable diseases: viruses and bacteria

Economic impact: In Queensland the main economic impact on beans is poor pod development and the development of distorted, discoloured pods. Crops may not be harvested because of severe damage while considerable extra labour is required on the packing line to cull distorted pods from consignments.

The crops most severely affected overseas are soybean and bean. The virus was identified in soybean in Argentina and Brazil in 2001 with losses from stem and bud blight being as high as 85%. CPMMV is now the most widespread and economically important virus infecting soybean in Brazil.

Spread: The virus is transmitted by the silverleaf whitefly (*Bemisia tabaci*). Transmission is non-persistent with feeding times of only a few minutes needed to obtain virus from infected plant and transmit to another plant. About 10 minutes of feeding are required to efficiently obtain a virus charge and 5 minutes of feeding to inoculate another plant with virus. The virus is retained by whitefly for only one to two hours if it does not feed on another infected plant.



Pods from infected and healthy bean plants. Note distorted pods and reduced yields from infected plants on left.



Healthy and infected plots of a susceptible bean variety

At least some strains of CPMMV are seed borne to varying levels, depending on the host species and variety.

Seed transmission rates in cowpea were reported as 1% to 3% in India and up to 20% in Uganda.

Seed transmission rates in soybean in Egypt were 6.75% for variety Clark and 10.75% for Crawford.

In Queensland, seed transmission has not been found in grow out tests of bean, soybean and mung bean. In addition, seed transmission was not found when seeds from CPMMV- infected bean and soybean plants were grown and young plants tested for virus.

Management:

- In terms of virus vector management, whitefly control with insecticides is unlikely to be very effective because of the very short feeding times for transmission. However, management to reduce population levels is sensible and may prevent major population peaks which contribute to rapid virus spread and high disease levels.
- Destruction of annual crops after harvest and a period without major hosts and whitefly should reduce virus levels/ survival.
- Several commercially available green bean varieties are tolerant to the virus. When infected, even when young, plants develop few if any symptoms. Pods develop normally with very few deformed pods as occurs in susceptible varieties. These varieties are tolerant, not highly resistant, and varying levels of yield decrease may still occur compared with healthy plants of the same variety. The very low cull level of pods in the packing shed is a key advantage.
- Use of virus tolerant varieties combined with knowledge of likely whitefly populations throughout the production period provide the tools to minimise the economic impact of the virus.
- Another strategy is to plant a proportion of other crops, such as pumpkin, which is a preferred host for the whitefly and should result in limiting movement of whitefly into bean crops. Pumpkin is not a host of CPMMV and would have a positive impact in reducing virus spread into bean crops, particularly during high risk periods, for example autumn in the Fassifern area.



A tolerant bean variety with no leaf symptoms despite inoculation with CPMMV



Symptoms of CPMMV on a susceptible bean variety

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