

# Chapter 18

## ADDITIONAL VIRUSES

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### Introduction

At least 70 different viruses infect *Phaseolus vulgaris* L. under experimental or natural conditions. This observation clearly shows the potential susceptibility of this species to those legume viruses and their strains which can adapt to beans under a mixed-cropping system. This chapter describes some of the viruses that have occasionally infected beans under natural conditions.

### Beet Curly Top Virus

Curly top of beans is caused by a geminivirus (BCTV) transmitted by the beet leafhopper, *Circulifer tenellus* (Baker). This virus can cause economic losses to beans and other cultivated crops, mainly to beets (*Beta vulgaris* L.) (Bennett, 1971; Zaumeyer and Thomas, 1957). Curly top, reportedly, has 10 strains which differ in their virulence (Zaumeyer and Thomas, 1957). The Spanish name of beet curly top in Latin America is “ápice rizado de la remolacha.”

Infected young bean plants commonly exhibit leaf puckering, downward curling, cupping, and yellowing (Figure 141). Primary leaves of infected plants may be thicker and more brittle than those of uninfected plants. Younger leaves are usually more curled and cupped than older leaves (Nuland et al., 1983). The leaf curling and yellowing symptoms may resemble feeding damage induced by the green leafhopper (*Empoasca* sp.).

The main control measure is the use of resistant or tolerant cultivars. The resistance of some bean cultivars is temperature-sensitive and can be destroyed at high temperatures, regardless of

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plant age at the time of inoculation (Silbernagel and Jafri, 1974). However, there are some breeding lines which are highly resistant to the virus (Silbernagel, 1979). New infections depend on the movement of leafhoppers which may overwinter on some weed species such as mustards (Nuland et al., 1983).

## **Tobacco Yellow Dwarf Virus**

Bean summer death apparently occurs only in Australia (Ballantyne, 1968; Ballantyne et al., 1969; Bowyer and Atherton, 1971) and is transmitted by the brown leafhopper, *Orosius argentatus* (Evans). Bean summer death was originally suspected to have a mycoplasma-like etiology, but was discovered (Bowyer and Atherton, 1971) to be caused by a geminivirus similar to the beet (bean) curly top virus. The name of the causal geminivirus has now been changed to tobacco yellow dwarf virus (Thomas and Bowyer, 1984).

The host range of bean summer death includes *Phaseolus vulgaris*, *Datura stramonium* L., the beets *Beta vulgaris* var. *vulgaris* and *B. vulgaris* var. *cicla*, and *Callistephus chinensis* (L.) Nees (Bowyer and Atherton, 1971). The Spanish translation for bean summer death is “muerte de verano del frijol.”

The symptoms of this disease are stunting, leaf curling, vascular necrosis, epinasty, interveinal chlorosis, wilting, and death of the plant. Symptom development is more rapid after a period of high temperature (Ballantyne, 1968; Ballantyne et al., 1969). The insect vector has a minimum latent period of 24-48 hours. It remains infectious for at least 21 days after acquiring the virus during the nymphal or adult stage (Thomas and Bowyer, 1984).

Ballantyne et al. (1969) report that various materials resistant to curly top in the United States were resistant to bean summer death in Australia.

## **Tomato Spotted Wilt Virus**

Tomato spotted wilt virus (TSWV) occurs in Brazil and Canada on various plant species. Although it does not cause economic damage to beans, it induces severe malformation and stunting in infected

bean plants. The appearance of chlorotic or necrotic spots on affected leaves is also a diagnostic feature (Costa and Foster, 1941; Costa et al., 1971).

The virus is transmitted by various thrips such as *Thrips tabaci* Lindeman, *Frankliniella schultzei* (Trybom), *F. fusca* (Hinds), and *F. occidentalis* (Pergande) (Costa, 1957; Costa and Foster, 1941; Costa et al., 1971; Paliwal, 1974).

Tomato spotted wilt virus is also known as Kromnek virus, *Lycopersicum* virus 3, pineapple yellow spot virus, and tomato bronze leaf virus. In Latin America, it is known as “marchitamiento manchado del tomate” (Spanish) and “vira-cabeça” (Portuguese).

The virus particles are round, 80-120 nm in diameter, surrounded by a lipid membrane, and contain RNA. Its identification and characterization are reported by Best (1968) and Ie (1970). There are no specific control measures because it is limited in distribution and importance.

## **Tobacco Streak Virus, Red Node Strain**

Red node occurs in the United States (Zaumeyer and Thomas, 1957) and Latin America (Costa et al., 1971; Silberschmidt and Nobrega, 1943). This disease is caused by a strain of tobacco streak virus (Zaumeyer and Thomas, 1957). The common Latin American names of red node are “nudo rojo” (Spanish) and “novermelho” (Portuguese), and of tobacco streak virus “mosaico rayado del tabaco” (Spanish).

Symptoms include a reddish discoloration at the nodes of stems and pulvini of leaves (Figure 142), as well as reddish concentric rings on pods. In severe cases, infected plants will bend over or break at a discolored node. Veins and veinlets of leaves may exhibit a red to reddish brown streaking (Nuland et al., 1983). Pods may shrivel and not produce seed. Plants also may be stunted or killed (Zaumeyer and Thomas, 1957).

The virus is transmitted mechanically, apparently in bean seed (Fulton, 1971; Zaumeyer and Thomas, 1957), and by thrips (Nuland et al., 1983). However, R.O. Hampton has never detected seed

transmission in thousands of field-infected seedlings of susceptible cultivars, but has recovered the virus from nearby weeds and other crop hosts (personal communication). The virus particles are isometric and about 28 nm in diameter (Mink et al., 1966).

## Miscellaneous Bean Viruses

In Brazil, Costa et al. (1983) studied the transmission, by the common whitefly, *Bemisia tabaci*, of carlavirus-like particles. The particles are 650 nm in length and 13 nm in diameter and are characteristically transmitted to the bean cv. Jalo by aphids.

This virus infected more than 80 of the bean varieties tested, inducing very mild or no symptoms in most of them. In the bean cv. Jalo the virus induces a mild mottle, vein chlorosis, and a yellow angular mosaic in older leaves. The virus does not appreciably stunt the plant. However, a slight reduction in the number of pods per plant and seeds per pod is apparent in infected bean plants. The virus is not seed-borne. There are no specific measures of control.

Other virus diseases of beans include peanut stunt (Allen, 1983; Quiot et al., 1979), cowpea severe mosaic, tobacco ringspot, and tobacco necrosis (Allen, 1983).

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