Chapter 15

Miscellaneous Bean Viruses

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Introduction

Previous chapters have reviewed many bean viruses transmitted by insect vectors such as aphids, beetles and whiteflies. Other bean viruses also are known to be transmitted by these vectors, or by other insects, such as thrips and leafhoppers. Some bean viruses are not known to be transmitted by any insect vector. This chapter will review briefly some miscellaneous virus diseases of *Phaseolus vulgaris*.

Alfalfa Mosaic Virus

Alfalfa mosaic virus (AMV) is an aphid-transmitted virus that was initially detected on beans in the United States (31). AMV consists of various strains including yellow dot, alfalfa yellow mosaic (31), vein necrosis (30) and spot mosaic (29). None of these strains of AMV has been reported to be economically important (31).

AMV was known previously as Lucerne mosaic virus, Alfalfa virus 1, Alfalfa virus 2, Medicago virus 2, and *Marmor medicaginis* Holmes (7, 31). Alfalfa mosaic virus has not been studied on beans in Latin America, but AMV and its strains have the Spanish names of mosaico de la alfalfa, punto amarillo, mosaico amarillo de la alfalfa, necrosis venal, mosaico de la mancha and calico.

AMV and its strains may produce a light systemic mottling, an intense chlorotic mottling of leaves, necrosis of leaves or stems, and dieback of the growing point. However, the most common symptom consists only of local necrotic lesions which may have a diameter of 0.5-3.0 mm (31).

AMV is easily transmitted mechanically and by aphids (17). It is not reported to be transmitted in bean seed, but is transmitted in seed of alfalfa (6%) and pepper (1-5%). AMV particles are bacilliform in shape, have three different lengths and contain RNA (7).

Since AMV is not an economically important virus disease of beans, little research has been conducted with control measures. However, some differences have been observed in the frequency of local lesions produced on specific bean cultivars (16). Susceptibility is also correlated with plant age, ability of the virus to induce local lesions or systemic infection, and temperatures during the pre-and post-inoculation period (3, 6, 14, 19, 28).

Curly Top

Curly top of beans is transmitted by the beet leafhopper, *Circulifer tenellus* (Baker). This virus can cause economic losses to beans and other cultivated crops, such as beets *(Beta vulgaris* L.), in the United States and Canada (4,31). Curly top has been called *Ruga verrucosous* Cars.& Bennett, and reportedly contains 10 strains which differ for their virulence (31). The common name of curly top in Latin America is ápice rizado de la remolacha.

Infected young bean plants commonly exhibit trifoliate leaf symptoms of puckering, downward curling, yellowing and death. Primary leaves of infected plants may be thicker and more brittle than those of uninfected plants. The initial symptoms of curly top may resemble those induced by bean common mosaic virus (31). Leaf curling and yellowing also may resemble damage induced by green leafhopper *(Empoasca* spp.) feeding.

Virus particles of curly top are geminate, have a sedimentation coefficient of 82 S and a 20% nucleic acid content (20, 22).

Control measures consist of resistant cultivars. This resistance is temperature-sensitive in some bean cultivars since it can be destroyed at high temperatures, regardless of plant age at the time of inoculation (25). Silbernagel (24) reports that the breeding lines, ARS-6BP-5 and ARS-5BP-7, are highly resistant to the curly top virus.

Bean Summer Death

Bean summer death is reported to occur in New South Wales, Australia (1, 2, 8). The disease agent is transmitted by the brown leafhopper, *Orosius argentatus,* which also is known to transmit various mycoplasma-like pathogens of beans and other legumes (refer to Chapter 11). Bean summer death was originally suspected to have a mycoplasma-like etiology, but Bowyer and Atherton (8) claim that the causal agent is not a mycoplasma but is similar in some respects to curly top.

The host range of bean summer death includes *Phaseolus vulgaris, Datura stramonium, Beta vulgaris* var. *vulgaris, B. vulgaris* var. *cicla* and

Callistephus chinensis (8). The Spanish name for bean summer death is muerte de verano del fríjol.

The symptomatology of this disease consists of yellowing and subsequent death of beans, commonly following a period of high temperature (1,2). The insect vector has a minimum latent period of 24-48 hours and remains infective for at least 21 days after acquisition of the causal agent during the nymphal or adult stage.

Little research has been conducted into control measures. However, Ballantyne *et al.* (2) report that various materials resistant to curly top in the United States also were resistant to bean summer death in Australia. Additional research is required to identify resistant cultivars and to fully characterize the agent responsible for bean summer death.

Tomato Spotted Wilt Virus

Tomato spotted wilt virus (TSWV) is reported to occur in Brazil and Canada on various plant species. It is not reported to cause serious economic damage to beans. However, it can affect other legumes, tomatoes, tobacco, pineapple and ornamental plants. The virus is transmitted mechanically in tomato seed and by various types of thrips, such as *Thrips tabaci, Frankliniella schultzei, F. fusca, F. paucispinosa* and *F. occidentalis* (9,10,11, 23).

Tomato spotted wilt virus also is known as Kromnek virus, *Lycopersicum* virus 3, Pineapple yellow spot virus, tomato bronze leaf virus and vira-cabeca virus. It is commonly referred to as marchitamiento manchado del tomate in Latin America.

Kitajima *et al.* (18) reported that particles of the virus were partially isometric, apparently surrounded by a membrane, contain RNA, and measure 80-120 nm in diameter. TSWV was the first plant virus reported to contain lipids (27). Its identification and characterization are reported by Best (5) and Ie (15).

Red Node

Red node has been reported to occur in the United States (31) but rarely in Latin America (11, 26). This viral disease is reported to be related to tobacco streak virus (31). The common Latin American names of red node and tobacco streak virus are nudo rojo and mosaico rayado del tabaco, respectively.

Symptoms include a reddish discoloration at the nodes of stems and pulvini of leaves, as well as reddish concentric rings on pods. Pods may be shriveled and not produce seed. Plants also may be stunted or killed (31).

The virus is transmitted mechanically and in bean seed (12, 31). There are no reports of insect vectors. The virus particles are isometric, measure 28 nm in diameter, contain three to four nucleoproteins, and have a sedimentation coefficient between 90-123 S (21).

The virus may be controlled by production of clean seed and use of resistant cultivars such as Kentucky Wonder No. 780 and Kentucky Wonder Brown No. 814 (31).

Other Bean Viruses

Many other viruses are reported to infect beans, but primarily only under controlled conditions in the laboratory or glasshouse (13, 31). A few examples of these viruses are clover blotch, clover (red) necrotic mosaic, cowpea aphid-borne mosaic, adzuki bean mosaic, pea dwarf mosaic, clover yellow bean, and Desmodium yellow mottle. Little if any information is reported concerning the natural occurrence of these minor bean viruses.

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