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Data Sheets on Quarantine Pests

Beet curly top hybrigeminivirus

IDENTITY

Name: Beet curly top hybrigeminivirus
Synonyms: Sugarbeet virus 1
Sugarbeet curly-leaf virus
Western yellow blight virus
Tomato yellows virus
Taxonomic position: Viruses: Geminiviridae: Hybrigeminivirus
Common names: BCTV (acronym)
Curly top (sugarbeet and potato), yellows (tomato), green dwarf (potato) (English)
EPPO computer code: BTCTXX
EPPO A2 list: No. 89 (deleted in 1984)
EU Annex designation: II/A1 - for non-European isolates

HOSTS

BCTV has an extremely wide host range, but the most important hosts economically are potatoes, sugarbeet and tomatoes. Besides its main hosts, a number of other species in various families are reported as hosts of the virus, including Chenopodiaceae, Solanaceae, Brassicaceae, Violaceae, Geraniaceae, Cucurbitaceae, Caryophyllaceae, Fabaceae, Asteraceae, Linaceae and Apiaceae.

A number of weed hosts have also been reported: *Atriplex* spp., *Capsella bursa-pastoris*, *Chenopodium* spp., *Datura ferox*, *Polygonum* spp., *Rumex* spp. and *Stellaria media*. For more information, see Severin (1929).

GEOGRAPHICAL DISTRIBUTION

BCTV is thought to have originated in the eastern Mediterranean area and to have spread from there to America (Bennett & Tanrisever, 1957).
EPPO region: At least Cyprus, Egypt, Italy (Sicily), Spain, Turkey.
Asia: Cyprus, India (Punjab), Iran, Turkey.
Africa: Egypt.
North America: Canada (British Columbia), Mexico, USA (California, Iowa, Idaho, Illinois, Maryland, Michigan, Minnesota, Nebraska, North Carolina, Ohio, South Dakota, Texas, Virginia, Washington, Wisconsin).
Central America and Caribbean: Costa Rica, Puerto Rico.
South America: Argentina, Bolivia, Brazil (unconfirmed), Uruguay.
EU: Present.
Distribution map: See CMI (1977, No. 24).

BIOLOGY

The virus is not easily transmitted by mechanical means.

It seems to be confined to the phloem tissue, where it causes degeneration, other tissues being apparently toxic to it. Virus particles exhibit considerable resistance to a number of common disinfectants and can remain active for 10 months in dried phloem exudate, 4 months in dried sugarbeet tissue and 6 months in dried sugarbeet leafhoppers.

The main vectors are phloem-feeding leafhoppers, such as Circulifer tenellus in North America and *C. opacipennis* in the Mediterranean area. There seem to be two types of transmission of the virus by the insect: a purely mechanical transmission by contaminated mouthparts, and circulative transmission in which there is a delay of 21-24 h in the development of infective power of the insect. It is not thought that the virus multiplies in the insect vector. The leafhoppers can acquire the virus in a matter of minutes during sucking on infested material and retain it for a month or even more (Duffus, 1986). For more information, see Bennett (1935; 1971), Kheyri & Alimoradi (1969), Smith (1972).

Many strains differing in virulence, symptomatology and host range have been reported, especially in North America (Thomas & Mink, 1979).

DETECTION AND IDENTIFICATION

Symptoms

On the whole, symptoms produced by BCTV are generally similar throughout its host range. In sugarbeet, the most reliable, early diagnostic feature is an inward rolling of the leaf margins and a clearing of the minute veins on the youngest, innermost leaves. Initially, these symptoms are confined to a portion of the youngest leaf but, in a few days, the entire leaf is affected. Subsequently, development of wart-like protuberances on the veins of the lower leaf surfaces is characteristic. Leaves are dark, dull-green in colour, thick, crisp and brittle. Occasionally, clear, viscid droplets exude from the petioles, midribs or veins on the lower leaf surfaces of infected plants. This liquid subsequently becomes black and sticky and then dries forming a brown crust. A hairy or woolly condition of the roots develops in badly diseased sugarbeets as the number of rootlets increases.

In cross section, affected sugarbeet shows black concentric rings which alternate with light areas, while in longitudinal section the dark discoloration is seen extending lengthwise.

In tomatoes in the field, there is an inward rolling of leaflets along the midrib; the petiole and midrib frequently curve downwards, giving the leaf a drooping but not wilting appearance. Leaves become thickened and crisp and may later assume a yellow colour with purple veins.

The pith dries out leaving stems hollow. As foliage symptoms appear, the plant ceases growth and takes on an erect, rigid habit. Fruits, if formed, ripen prematurely and seeds are abortive. Starting at the tips of smaller roots, there is a decay of the roots, which may occur before aerial symptoms become apparent. The plant finally dies, the stems and leaves turning brown.

In tomatoes in the glasshouse, initially, the most diagnostic symptom is the appearance of transparent veins. Purple venation is usually absent. Inward curling of leaflets occurs, especially in older plants. White excrescences sometimes appear on the veins and a yellowing develops between them. There is a marked stunting of plants infected at an early stage. Eventually, the whole plant turns yellow and dies.

In potatoes, the plants are stunted with yellowish, inward-rolled leaflets and sometimes a bending of the petioles. In advanced stages of infection, dwarfed shoots frequently develop in the axis of leaves near the tip of the plant. Ultimately, infected plants turn yellow and die.

Morphology
Small geminate particles 18-22 nm in diameter, single or paired (geminivirus) (Thomas & Mink, 1979).

Detection and inspection methods
On sugarbeet, microscopic observation of diseased material in the early stages of infection reveals a hypertrophy and necrosis of the pericycle or phloem parenchyma adjacent to the sieve tubes. Cells further removed from the sieve tubes are induced to divide and a large proportion of these hyperplastic cells undergo differentiation similar to that of sieve tubes, e.g. they develop slime bodies and plastids which later disintegrate, cytoplasm is reduced and walls thicken. This tissue, in which sieve tubes predominate, readily characterizes the disease in its early stages (Esau, 1935).

Nicotiana tabacum cv. White Burley and *Datura stramonium* can be used as differential hosts. *N. tabacum* cv. White Burley develops a vein-clearing followed by a shortening of internodes and thus stunting of the plant. The youngest leaves are dwarfed and outwardly cupped. On *D. stramonium* the youngest leaves are dwarfed, while vein-clearing occurs in older leaves. See also Thomas & Mink (1979).

MEANS OF MOVEMENT AND DISPERSAL

BCTV is moved locally by its insect vectors. Internationally, it may be carried in infected host material, or possibly in the vector. There are no reports of the virus being seed-borne or tuber-borne and, therefore, such plant parts are not considered as possible infection sources.

PEST SIGNIFICANCE

Economic impact
The disease was first recognized causing important damage in 1888, in Nebraska (USA), and has since caused frequent and often very destructive outbreaks throughout the area to the west of the Rocky Mountains and locally to the east of them. During the last 20 years in the USA, BCTV isolates have increased in severity to the point that isolates considered severe in the 1950s are now considered mild; infection of a resistant cultivar with severe BCTV isolates, even 10 weeks after seeding, can cause losses of over 13% when only 72% of the plants are showing symptoms. Furthermore, current virulent isolates have a serious impact on the sugar content of both susceptible and resistant sugarbeet cultivars (Duffus & Skoyen, 1977). In the EPPO region, in contrast, BCTV is not considered a significant pest.

Control
Successful control of the virus is possible through a combination of measures. Chemical control against the vector should be applied inside the production area as well as outside in order to eliminate the breeding areas of the leafhoppers (Duffus, 1986). Resistant cultivars should also be used, as described by Martin & Thomas (1986), Lewellen (1989).

Phytosanitary risk
BCTV used to be an EPPO A2 quarantine pest (OEPP/EPPO, 1982), on the basis of the reported problems in North America. However, in view of the probable origin of the virus in the eastern Mediterranean area, its presence in several Mediterranean countries, its failure to spread in the EPPO region, the limited natural distribution of its vectors and its very minor importance in Europe, it was deleted from the EPPO list in 1984. There is a certain danger that severe strains of the virus could spread in Europe in areas where sugarbeet and potatoes are grown. The virus is of quarantine signficance for IAPSC and CPPC.

PHYTOSANITARY MEASURES

Plants with roots are the only plants in question for phytosanitary requirements, seeds and tubers not apparently being involved. Although seedlings of sugarbeet and tomato may be traded, they are less likely to be infected than mature plants.

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