

Data Sheets on Quarantine Pests

Potato purple-top wilt phytoplasma**IDENTITY****Name:** Potato purple-top wilt phytoplasma**Synonyms:** Aster yellows phytoplasma (*sensu lato*)**Taxonomic position:** Bacteria: Tenericutes: Mollicutes: Phytoplasmas**Common names:** Apical leafroll, blue stem, bunch top, haywire, late breaking, purple dwarf, yellow top (English)**EPP0 computer code:** POPTWX**EPP0 A1 list:** No. 128**EU Annex designation:** I/A1**Notes on taxonomy and nomenclature:** Following the concepts of the *Compendium of potato diseases* (Wright *et al.*, 1983) and of Khurana *et al.* (1988) and Nagaich & Singh (1989), one can provisionally distinguish six phytoplasmas on potato (but it remains very difficult to decide how to group or separate them).

- **Potato witches' broom phytoplasma**

With witches' broom symptoms, transmissible by tuber and by *Scleroracus* spp. This occurs in Europe, Asia and North America and also causes lucerne witches' broom. Because of its geographical distribution and minimal importance, it is not regarded as a quarantine pest.

- **Potato marginal flavescence phytoplasma and potato purple toproll phytoplasma**

These two phytoplasmas are regarded as similar by Khurana *et al.* (1988) and occurring in India. Purple toproll has been reported in France (Cousin & Moreau, 1977). These have not been assessed for quarantine significance.

- **Potato phyllody phytoplasma**

Occurs like the previous two in India, but distinct from them and similarly not assessed for quarantine significance.

- **Potato stolbur phytoplasma**

Occurs in the EPP0 region and is already classified as an A2 quarantine organism (EPP0/CABI, 1996).

- **Potato purple-top wilt phytoplasma**

Occurs in North America and, in so far as it causes potato haywire disease, is considered as an A1 quarantine pest by EPP0 (OEPP/EPP0, 1984).

All but the first of these are regarded as belonging to "the aster yellows" group, with yellow or purple leaf discoloration as main symptoms. They are not usually transmissible by tuber. The leafhopper vectors include *Macrostelus* and *Hyalesthes* spp.

In Europe, there are numerous phytoplasmas of the aster yellows type, attacking various hosts, but only potato stolbur phytoplasma is found in potato. It is usually considered as a distinct phytoplasma. Tomato big bud phytoplasma occurring in Australia, several Asian countries and USA causes a disease very similar to stolbur. The three Indian phytoplasmas are also recognized as of the Old World aster yellows type and are distinguished from potato stolbur phytoplasma.

Potato purple-top wilt phytoplasma is considered as a form of North American aster yellows. This data sheet singles it out as the best documented and the one which corresponds most closely with the original concept of a non-European virus-like pathogen.

It may be noted that Harding & Teakle (1985) in Australia have transmitted eggplant little-leaf phytoplasma, a pathogen from India, to tomato where it causes big bud, and from tomato to potato, where it causes purple-top wilt. Purple-top wilt is a disease of potato seen in Queensland - but presumably caused by a different pathogen from North American aster yellows. This example is cited to illustrate the very confusing situation which prevails.

Finally, one may mention potato leaflet stunt disease (of quarantine significance to NAPPO), on which the only published information appears to be Klein *et al.* (1976), who report it only from Israel, and suggest that it is due to a phloem-limited bacterium (possibly like citrus greening bacterium).

HOSTS

Potato purple-top wilt phytoplasma is closely related to the aster yellows phytoplasma complex which has a very wide host range. About 350 species from at least 54 plant families are susceptible. Potatoes are not favoured hosts (Wright *et al.*, 1983). It is difficult to state categorically what is the host range of the phytoplasmas of this group found in potato.

GEOGRAPHICAL DISTRIBUTION

Aster yellows diseases occur world-wide. The New World and Old World forms are generally considered separate. The diseases attributed to aster yellows phytoplasma, or more specifically potato purple-top wilt phytoplasma, in potato in North America are not known in the EPPO region. Purple-top wilt is known from North America generally and haywire from Canada (Connors, 1967; Hodgson *et al.*, 1974).

EPPO region: Russia (Far East).

Asia: Japan (Shiumi & Sugiura, 1984), Russia (Far East) (Reifman, 1983) (but both these cases could be different phytoplasmas).

North America: Canada (Alberta, New Brunswick, Ontario, Quebec, Saskatchewan), Mexico, USA (Illinois, Minnesota, Ohio, Washington, Wisconsin).

Oceania: Australia (New South Wales, Queensland, South Australia, Victoria; Harding & Teakle, 1985, but this could be a different phytoplasma).

EU: Absent.

BIOLOGY

Phytoplasmas of the aster yellows complex are not sap-transmitted but grafting is used for experimental transmission. The principal vector is the leafhopper *Macrostelus fascifrons*, in which the phytoplasmas are propagative. The vectors remain infective for life. They can feed on a variety of plants, and the apparent host range of the phytoplasma depends more on the host preferences of the vector than on any particular specificity between plant and phytoplasma.

Potato purple-top wilt phytoplasma from Japan is reported to be transmitted by *Scleroracus flavopictus* and not by *Macrostelus* spp., unlike aster yellows phytoplasma from USA (Shiumi & Sugiura, 1984).

DETECTION AND IDENTIFICATION

Symptoms

Apical leaves are pinched or curled, roll inward and develop yellowish-purple pigments. Infected plants lose their apical dominance and proliferation of axillary buds occurs. Plants may wilt and die prematurely. These plants commonly form hair sprouts. According to Connors (1967) the primary symptom is purple-top wilt, and the haywire stage is due to secondary infection.

Morphology

Potato phytoplasmas vary in their size and shape. They are pleomorphic with a diameter up to 1000 nm. They occur mainly in the sieve tubes and can be seen there by electron microscopy or fluorescent detection methods (Seemüller, 1976; Hiruki & Rocha, 1986; Chen *et al.*, 1989).

Detection and inspection methods

phytoplasma-infected potato plants can be identified according to their characteristic symptoms. Specific monoclonal antibodies against aster yellows phytoplasma have been produced and the agent identified by ELISA (Lin & Chen, 1985), but this technique is not claimed to be strain-specific within the aster yellows group and does not yet seem to have passed into routine practice. However, immunofluorescence techniques have been used to detect aster yellows phytoplasma in sieve tubes (Rocha *et al.*, 1986).

MEANS OF MOVEMENT AND DISPERSAL

Under natural conditions, potato purple-top wilt phytoplasma can be dispersed by its leafhopper vectors. Internationally, it could be carried in potato plants or in vector insects associated with them, but such movement hardly occurs in practice. It should be stressed that aster yellows type phytoplasmas are not normally tuber-transmitted in potato.

PEST SIGNIFICANCE

Economic impact

phytoplasma diseases have very serious effects on individual infected plants, and their yields may be negligible. However, the incidence of infection in a potato crop is normally slight because the potato is not attractive to the vector leafhopper (Rich, 1983; Beemster & de Bokx, 1987; Burton, 1989). Purple-top is reported to be a cause of "dark chip" in USA (Banttari *et al.*, 1990). Severe losses have, however, been reported in Mexico (Cadena-Hinojosa & Galindo-Alonso, 1985).

Control

The diseases are not important enough to merit any particular control measures, except in Mexico.

Phytosanitary risk

The EPPO A1 quarantine entry "Non-European potato viruses" included potato purple-top wilt phytoplasma to the extent that the published data sheet (OEPP/EPPO, 1984) referred to potato haywire disease as one of the relatively minor non-European disorders of potato deserving quarantine significance. It now seems clear that this disease is caused by potato purple-top wilt phytoplasma. The same data sheet, however, declares that the aster yellows group is not thought to have strains of quarantine significance.

In conclusion, it is doubtful whether it is worth specifically including potato purple-top wilt phytoplasma as a significant element in the list of non-European potato viruses and

virus-like organisms. Its distinctness from aster yellows phytoplasmas on other hosts, and the distinctness of North American aster yellows phytoplasmas from Old World ones, remains debatable (though new serological or cDNA techniques may clarify these points). Its economic importance is very minor. It is not normally tuber-transmissible, and lacks a pathway of introduction in practice. Finally, it differs from the non-European viruses in being extremely unlikely to become established and propagated in seed potato production systems: infected plants become severely diseased and are thus self-eliminating, and tuber transmission does not normally occur. At the very most, it could be considered as presenting a risk of the same order as potato stolbur phytoplasma (EPPO/CABI, 1996), with which some pathologists would group it in any case.

PHYTOSANITARY MEASURES

In practice, potato purple-top wilt phytoplasma is liable to be introduced from the origins already covered by EPPO's recommended requirements concerning non-European potato viruses (EPPO/CABI, 1992). It can accordingly easily be covered by those requirements. For it alone, however, it would probably be sufficient to require that plants for planting of potato originate from an approved certification scheme.

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