

Data Sheets on Quarantine Pests

*Thecaphora solani***IDENTITY**

Name: *Thecaphora solani* (Thirumulachar & O'Brien) Mordue

Synonyms: *Angiosorus solani* Thirumulachar & O'Brien

Taxonomic position: Fungi: Basidiomycetes: Ustilaginales

Common names: Potato smut (English)

Charbon de la pomme de terre (French)

Kartoffelbrand (German)

Carbón, gangrena de la papa (Spanish)

Bayer computer code: THECSO

EPPO A1 list: No. 4

EU Annex designation: I/A1

HOSTS

The principal host is potatoes, but various other tuber-bearing *Solanum* spp. are also attacked, particularly var. *andigena* of *S. tuberosum*, and also the solanaceous weed *Datura stramonium*. In the EPPO region, potatoes are the only host of concern.

GEOGRAPHICAL DISTRIBUTION

T. solani is indigenous to the Andean region.

EPPO region: Absent.

North America: Mexico (unconfirmed).

Central America and Caribbean: Panama.

South America: Bolivia, Chile, Colombia, Ecuador, Peru, Venezuela.

EU: Absent.

Distribution map: See IMI (1993, No. 214).

BIOLOGY

T. solani survives in soil or in tuber debris (O'Brien & Thirumulachar, 1974), and the spores are thought to be long-lived, though it is not known how long they can persist. Incidence is increased in the absence of crop rotation and is favoured by high humidity and saline soils. Field observations (Abbott, 1932) indicate that seed tubers transmit the disease.

DETECTION AND IDENTIFICATION**Symptoms**

No symptoms are visible above ground. Infected tubers are misshapen, or have warty swellings on the surface, and are hard. The whole or part of the tuber may be infected. Numerous brown-black specks, interspersed with lighter brown specks, occur in the flesh. The specks (spore sori) are about 1 mm in diameter and are filled with rusty brown spore

balls. Infected tubers later become a dry brown powdery mass containing numerous spores. Galls resembling deformed tubers arise on the stems or stolons underground.

For more information, see Barrus & Muller (1943), O'Brien & Thirumulachar (1974), Hooker (1981), Mordue (1988).

Morphology

Spore balls, when mature, are 2-8 spored (the spores are rarely solitary), cinnamon to rust-brown, 15-50 x 12-40 µm in diameter (Zachmann & Baumann, 1975). Spores are pressed together but can be teased apart, globose to angular, smooth on the contiguous side and densely verrucose on the free side, 7.5-20 x 8-18 µm.

MEANS OF MOVEMENT AND DISPERSAL

The fungus has a very low natural dispersal potential. The most likely way in which potato smut could enter uninfested areas would be with potato tubers. It has been intercepted by the USDA in 52 consignments of tubers of *Solanum tuberosum* and *S. stoloniferum*, almost all from Mexico, since 1946 (USDA Lists of Intercepted Plant Pests). Soil from infected areas could also introduce the fungus.

PEST SIGNIFICANCE

Economic impact

The disease is reported to be serious (Bazan de Segura, 1960; Gregory, 1979). Losses of up to 80% have been known in the very susceptible cultivar Peruanita (Abbott, 1932).

Control

In field trials in Peru (Torres & Henfling, 1984), methyl bromide and dazomet, used as soil disinfestants against *T. solani*, reduced the weight of hypertrophied tubers considerably (but did not eliminate the fungus). Susceptibility to infection varies, some cultivars being resistant. Screening for resistance is actively carried out at CIP (International Potato Center) in Peru (Torres & Martin, 1986). General control measures recommended in Hooker (1981) are: use of resistant cultivars, planting of smut-free seed potatoes, long rotation, elimination of the weed *Datura stramonium* (also reported as a host), removal of smutted galls.

Phytosanitary risk

EPPO lists *T. solani* as an A1 quarantine pest (OEPP/EPPO, 1979) and it is also of quarantine significance for CPPC. *T. solani* certainly presents a significant risk to both seed and ware potato production in the EPPO region. However, there is little published information on the biology and life history of the causal organism and it is not clear in which parts of the EPPO region it presents most risk. Being soil-borne, it would be virtually impossible to eradicate once established. The evidence of climatic influence on the disease is confusing, as it has been reported from the Andean region (not below 3000 m) in Venezuela (latitude 9° N) (O'Brien & Thirumulachar, 1974) and from the mountains and near sea level in Peru (latitude 18° S) (Abbott, 1932). This may indicate that, in Europe, the fungus would have potential to thrive from the Mediterranean to the north. Varietal resistance would seem to offer the possibility of control.

PHYTOSANITARY MEASURES

T. solani belongs to the group of South American pests of potatoes which justifies strict post-entry quarantine procedures in the EPPO region, together with equivalent checks before export. Only material for scientific purposes should normally be imported from

infested countries. EPPPO's specific quarantine requirements (OEPP/EPPO, 1990) outline suitable quarantine measures.

It may be noted that, although malformed tubers are conspicuous, consignments from areas in which the disease occurs could carry infection at undetectable levels or as spores on the surface of healthy tubers. Inspections cannot be fully reliable and there is no alternative to a quarantine period to ensure freedom from the disease.

BIBLIOGRAPHY

- Abbott, E.V. (1932) [Diseases of cultivated plants in Peru]. *Estación Experimental Agricultural Molina (Peru) Circular* No. 18, 20 pp.
- Barrus, M.F.; Muller, A.S. (1943) An Andean disease of potato tubers. *Phytopathology* **33**, 1086-1089.
- Bazan de Segura, C. (1960) The gangrena disease of potato in Peru. *Plant Disease Reporter* **44**, 257.
- Gregory, R.H. (1979) Movement of diseases between neighbouring states: some South American examples. In: *Plant health* (ed. by Ebbels, D.L.; King, J.E.), pp. 269-274. Blackwell Scientific Publications, Oxford, UK.
- Hooker, W.J. (editor) (1981) *Compendium of potato diseases*. American Phytopathological Society, St. Paul, Minnesota, USA.
- IMI (1993) *Distribution Maps of Plant Diseases* No. 214 (edition 3). CAB International, Wallingford, UK.
- Mordue, J.E.M. (1988) *Thecaphora solani*. *CMI Descriptions of Pathogenic Fungi and Bacteria* No. 966. CAB International, Wallingford, UK.
- O'Brien, J.; Thirumulachar, M.J. (1974) The identity of the potato smut. *Sydowia* **26**, 199-203.
- OEPP/EPPO (1979) Data sheets on quarantine organisms No. 4, *Angiosorus solani*. *Bulletin OEPP/EPPO Bulletin* **9** (2).
- OEPP/EPPO (1990) Specific quarantine requirements. *EPPO Technical Documents* No. 1008.
- Torres, H.; Henfling, J. (1984) [Chemical control for potato smut]. *Fitopatologia* **19**, 1-7.
- Torres, H.; Martin, C. (1986) Field screening for resistance to potato smut in Peru. *American Potato Journal* **63**, 559-562.
- Zachmann, R.; Baumann, D. (1975) *Thecaphora solani* on potatoes in Peru: present distribution and varietal resistance. *Plant Disease Reporter* **59**, 928-931.