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Data Sheets on Quarantine Pests

Colletotrichum acutatum

IDENTITY

Name: *Colletotrichum acutatum* Simmonds
Synonyms: *Colletotrichum xanthii* Halsted
Taxonomic position: Fungi: Ascomycetes: Polystigmatales (probable anamorph)
Common names: Anthracnose, black spot (of strawberry), terminal crook disease (of pine), leaf curl (of anemone and celery), crown rot (especially of anemone and celery) (English)
Taches noires du fraisier (French)
Manchas negras del fresón (Spanish)
Notes on taxonomy and nomenclature: The classification of the genus *Colletotrichum* is currently very unsatisfactory, and several species occur on the principal economic host (strawberry) which are regularly confused. As well as *C. acutatum*, these include the *Glomerella cingulata* anamorphs *C. fragariae* and *C. gloeosporioides*, all of which can be distinguished by isozyme analysis (Bonde *et al*., 1991). Studies are continuing. *Colletotrichum xanthii* appears to be an earlier name for *C. acutatum*, but more research is necessary before it is adopted in plant pathology circles.
Bayer computer code: COLLAC
EU Annex designation: II/A2

HOSTS

The species has a very wide host range, but is economically most important on strawberries (*Fragaria ananassa*).

Other cultivated hosts include *Anemone coronaria*, apples (*Malus pumila*), aubergines (*Solanum melongena*), avocados (*Persea americana*), *Camellia* spp., *Capsicum annuum*, *Ceanothus* spp., celery (*Apium graveolens*), coffee (*Coffea arabica*), guavas (*Psidium guajava*), olives (*Olea europea*), pawpaws (*Carica papaya*), *Pinus* (especially *P. radiata* and *P. elliottii*), tamarillos (*Cyphomandra betacea*), tomatoes (*Lycopersicon esculentum*), *Tsuga heterophylla* and *Zinnia* spp.

Colletotrichum acutatum can apparently affect almost any flowering plant, especially in warm temperate or tropical regions, although its host range needs further clarification. It has rarely been noted on other than agricultural or forestry land.

GEOGRAPHICAL DISTRIBUTION

Some country records may refer instead to the *Glomerella cingulata* - *Colletotrichum fragariae* aggregate.
EPPO region: Belgium, France, Israel (unconfirmed), Italy, Netherlands, Portugal (unconfirmed), Spain, Switzerland (unconfirmed), United Kingdom (England, Jersey).
Asia: China (Hainan, Hubei), Hong Kong, India (Punjab), Indonesia, Israel (unconfirmed), Japan (Honshu), Korea Republic, Malaysia, Sri Lanka, Thailand.

Africa: Ethiopia, Kenya, Nigeria, South Africa, Tanzania, Zimbabwe.
North America: Canada (British Columbia), USA (California, Connecticut, Florida, Mississippi, Missouri, North Carolina, Ohio, Oklahoma).
Central America and Caribbean: Costa Rica, Dominican Republic.
South America: Brazil, Colombia, Ecuador.
Oceania: Australia (New South Wales, Queensland, Victoria), New Zealand.
EU: Present.

BIOLOGY

The conidia germinate to form appressoria on plant surfaces, from which penetration hyphae develop into plant cells. Infection may occur through almost any plant surface, but for the particularly susceptible herbaceous species such as strawberry and anemone, the crown with its relatively humid microclimate is often favoured. In suitable conditions, the fungus can grow rapidly inside the plant and cause severe symptoms very quickly, but in other circumstances the fungus may be quiescent inside host tissues for a period, in some cases only becoming apparent after harvest. Once the fungus has developed sufficiently inside the plant, dark fruit-bodies are produced, causing typical anthracnose symptoms. Conidia are formed liberally, and are normally dispersed by watersplash (Yang *et al*., 1992). They may lie dormant in the soil for some time, often overwintering in this fashion. Survival is longest under relatively cool, dry conditions (Eastburn & Gubler, 1992). The fungus can also remain dangerous for long periods in dead plant material on the surface or buried in the soil.

Although the disease in strawberry crops tends to be more virulent in warm climates, where damage can be devastating, it frequently has its origins in cooler conditions where propagating material is grown (Opgenorth *et al*., 1989; Wilson *et al*., 1990; Sutton, 1992). The disease may possibly occur in all countries where strawberries are cultivated. However, it is reported to be absent from the premises of most major strawberry propagators in the UK, and it may be possible to exclude the fungus from these sites despite its presence elsewhere in the areas concerned. There is little information on the biology of *C. acutatum* other than for strawberry crops.

In some crops, notably mango (Liu *et al*., 1986) and tamarillo (Yearsley *et al*., 1988), *C. acutatum* causes postharvest diseases of fruits.

DETECTION AND IDENTIFICATION

Symptoms

The spread of the disease is often so rapid that by the time symptoms are noticed, the crop is in serious danger. For strawberry, fruit and occasionally petiole rots may be noticed, with sunken, water-soaked spots enlarging to cover the whole fruit within 2-3 days, with dark-brown fruit bodies producing pink spore masses. For other crops such as anemone and celery, crown rots and leaf curl may be the principal symptoms. In pine seedlings, the developing leaves around the apical bud are affected, with small, brown lesions appearing and rapidly extending. Severe stunting is eventually caused as the uninfected tissue beneath the apex continues to develop.

Morphology

Colonies in culture are usually white, pale-grey or pale-orange, sometimes producing strong pinkish-purple pigments. Conidiomata are usually poorly developed, with few or no setae, especially in culture. Conidiogenous cells are roughly cylindrical, sometimes borne in weak clusters, and produce conidia successively from single loci. Conidia are 8-16 x 2.5-

4 µm in size, fusiform, thin-walled, aseptate and hyaline. Appressoria are few in number, 6.5-11 x 4.5-7.5 µm in size, clavate to circular and light to dark-brown.

Full descriptions are given by Mordue (1979), Sutton (1980), Baxter *et al.* (1983) and Gunnell & Gubler (1992).

Detection and inspection methods

No rapid methods exist, although early results from a detection system using monoclonal antibodies are promising (Barker, personal communication). Current tests involve either inoculation of apples with strawberry petioles or paraquat treatment of petioles to stimulate sporulation of the pathogen (Cook, 1993). These tests are time-consuming and labour-intensive.

MEANS OF MOVEMENT AND DISPERSAL

Most natural transmission is probably by conidia, although appressoria, hyphal fragments and appressorium-like thick-walled cells may also play a part (Nair *et al.*, 1983). Local dispersal seems to be at least mostly by water-splash (Yang *et al.*, 1990), with propagules sometimes overwintering in soil to affect strawberry crops planted in subsequent years (Eastburn & Gubler, 1990). Long-distance transmission due to human influence is probably widespread, and has contributed to the rapid spread of the fungus in recent years. The disease is frequently intercepted on strawberry material imported into the UK.

PEST SIGNIFICANCE

Economic impact

The disease is significant worldwide on strawberry (on which it is considered the second most important pathogen after *Botrytis cinerea*), and also on a few other crops such as anemones. The disease on pine may not now be so severe as in recent years, judging from the decline in research papers. Little detailed information on economic losses is available. In France, the disease has caused up to 80% losses of unsprayed strawberry crops, especially of ever-bearing cultivars (Denoyes & Baudry, 1991). Crops sprayed for *B. cinerea* control have suffered much less. In Britain, where the disease is statutorily notifiable, presence forces the burning of crops and fumigation of the soil.

Recent studies in Australia showed that *C. acutatum* caused losses of 25-50% in celery crops in Queensland (Wright & Heaton, 1991).

Control

The only serious research on control has been in connection with strawberry crops. Some success was reported in New Zealand by spraying with dichlofluanid and a captan-benomyl mixture (Cheah & Soteros, 1984), with various chemicals in Australia (Washington *et al.*, 1992), and in South Africa with captan and captafol (van Zyl, 1985). Recently in the USA, studies showed that no acceptable fungicide is effective (Milholland, 1989). Fungicide-resistant strains of related species have been reported in the USA and Japan (Chikuo & Kobayashi, 1991; McInnes *et al.*, 1992). There have been considerable efforts in the USA to develop resistant strawberry cultivars, but limited success has been achieved due to the presence of varied races within the species (Delp & Milholland, 1981; Smith, 1985; Smith & Black, 1990; McInnes *et al.*, 1992). Gupton & Smith (1991) have suggested some potentially useful directions for further research.

In Britain, the disease is rare owing to strict quarantine controls and a policy of destroying affected crops and fumigating soil. McInnes *et al.* (1992) found that nursery material derived from tissue culture which was free from the related species *C. fragariae* and planted in isolated fields remained healthy, suggesting that careful selection of disease-free stock and soil sterilization in affected beds might be at least as effective as attempting chemical control.

In celery crops, Wright & Heaton (1991) found both a variation in cultivar susceptibility and amenability to chemical control of the disease. For anemone, disease incidence decreased with storage of corms (Doornik & Booden, 1990), and treatment by soaking with hot water proved effective (Doornik, 1990). Yearsley *et al*. (1988) found that dipping of tamarillos in imazalil and prochloraz reduced the incidence of postharvest disease caused by *C. acutatum*. However, dipping strawberry plants in hot water or fungicides did not eliminate the disease (R.T.A. Cook, personal communication).

For pine, regular applications of prochloraz have been found to be effective, as has dichlofluanid (Vanner, 1990).

Phytosanitary risk

C. acutatum has not been considered to be a quarantine pest by EPPO or any other regional plant protection organization. A certain ambiguity remains on its geographical distribution and impact on the strawberry crop, due to confusion with other *Colletotrichum* spp. In several countries of mainland Europe, the names *C. fragariae* or *C. gloeosporioides* have been used for all fungi causing anthracnose on strawberry. *C. acutatum* was only described on strawberry in the 1960s (Simmonds, 1966) and it is not clear whether its subsequent appearance as a strawberry pathogen in the literature is due to geographical spread of a pathogen which previously had a restricted distribution, to the rise in importance of a pathogen which was previously insignificant, or simply to the clarification of a taxonomic situation which was previously confused. Since *C. acutatum* attacks several other crops without being a serious cause of concern, and indeed many other plant species, it does not appear logical to attempt to control it by international phytosanitary measures. In addition, identification in imported consignments presents difficulties because of the confusion with related species. Pathogen-free certification of strawberry planting material seems the best approach.

PHYTOSANITARY MEASURES

The inclusion of *C. acutatum* (and other *Colletotrichum* spp.) among the species covered by a strawberry certification scheme would ensure that healthy planting material is traded nationally and internationally. A suitable scheme has been recommended by EPPO (OEPP/EPPO, 1994).

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