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Data Sheets on Quarantine Pests

Cronartium comandrae

IDENTITY

Name: *Cronartium comandrae* Peck
Anamorph: *Peridermium pyriforme* Peck
Taxonomic position: Fungi: Basidiomycetes: Uredinales
Common names: Comandra blister rust (English)
Notes on taxonomy and nomenclature: It may be noted that *C. comandrae* belongs, with *C. coleosporioides* and *C. comptoniae*, to the group of the "blister rusts", heteroecious rusts with *P. banksiana* and *P. contorta* as main aecial hosts and wild indigenous herbaceous plants as telial hosts.
Bayer computer code: CRONCO
EPPO A1 list: No. 249
EU Annex designation: I/A1 - as *Cronartium* spp. (non-European)

HOSTS

The aecial hosts of *C. comandrae* in North America are twoand three-needled *Pinus* spp., of which the most important in practice are jack pine (*P. banksiana*), across Canada, and lodgepole pine (*P. contorta*) and western yellow pine (*P. ponderosa*) in western Canada and USA. The European Scots pine (*P. sylvestris*), widely planted in North America, is susceptible. Other *Pinus* spp. are attacked to a limited extent in different parts of North America: knobcone pine (*P. attenuata*) and possibly Jeffrey pine (*P. jeffreyi*) in western USA, Table Mountain pine (*P. pungens*), red pine (*P. resinosa*) and pitch pine (*P. rigida*) in eastern USA, loblolly pine (*P. taeda*) and shortleaf pine (*P. echinata*) in southeastern USA. The European species maritime pine (*P. pinaster*), mountain pine (*P. mugo*) and Austrian pine (*P. nigra*) have been found to be susceptible in North America. In view of the fact that *P. contorta* is widely planted in northern and western Europe and *P. ponderosa* to a certain extent in central Europe, and that the previously mentioned European species are also susceptible, *C. comandrae* would certainly find aecial hosts on which to establish in the EPPO region.

The telial hosts, however, are members of the santalaceaous genus: *Comandra: C. umbellata* var. *pallida* (on dry sites), *C. livida* (on wet sites), *C. richardsiana*. The only European species of this genus is *C. elegans*, an uncommon plant occurring only in the Balkan peninsula. For more information, see Spaulding (1956, 1961), Boyce (1961), USDA (1963), Davidson & Prentice (1967), Peterson (1967), Hepting (1971), Ziller (1974), Sinclair *et al.* (1987).

GEOGRAPHICAL DISTRIBUTION

EPPO region: Absent.
North America: Canada (practically throughout - Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Northwest Territory, Ontario, Quebec, Saskatchewan,

Yukon Territory), USA (practically throughout - Alabama, Arkansas, Arizona, California, Colorado, Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Kentucky, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, Wisconsin, Wyoming).
EU: Absent.
Distribution map: See CMI (1982, No. 444).

BIOLOGY

The biology of all the heteroecious North American *Cronartium* spp. is broadly the same, and the following general account can be applied to *C. comandrae*. Pycnia and aecia are produced on the *Pinus* hosts in the spring and early summer, one to several years after infection. Aeciospores can be carried over long distances in the wind and infect the alternate (telial) host; they cannot reinfect *Pinus*. About 2 weeks after infection, uredinia appear on the alternate hosts. Successive production of uredinia and reinfection throughout the summer result in high levels of infection on the alternate host. Telia are produced in late summer, and *Pinus* hosts become infected via the first-year needles by the wind-borne basidiospores which arise from germination of teliospores; the telial host cannot be reinfected by basidiospores. Basidiospore infection, which occurs in summer and autumn, is usually limited to an area within 1.5 km of the alternate host, owing to the spores being delicate and short-lived. Infection of *Pinus* by basidiospores completes the life cycle, the duration of which varies between rusts. The fungal mycelium of these rusts may overwinter in bark and galls of *Pinus*. Van der Kamp (1994) found that most infections of *P. contorta* by *C. comandrae* occurred within 2 m of the ground and disappeared as the branches concerned were progressively shed, without new infections appearing. For more information, see also Boyce (1961), USDA (1963), Davidson & Prentice (1967), Peterson & Jewell (1968), Peterson (1973), Ziller (1974), Jacobi *et al.* (1993). The widely distributed and much studied *C. ribicola* has similar biology.

DETECTION AND IDENTIFICATION

Symptoms

On *Pinus*, slight, spindle-shaped swellings form, followed by break-up of the infected bark. As the fungus spreads in the bark, it quickly girdles the stem. Death of branches infected by *C. comandrae* correlates with the activity of secondary organisms, not the girdling. Girdled branches and stems may live for many years. Large cankers, from which copious resin flows especially on *P. contorta* and *P. ponderosa*, are common on large branches or trunks. Subsequent rodent attack hastens mortality. Dead and dying tops and branches are conspicuous. Large, reddish-orange pycnia (4-8 mm in diameter) appear on swollen bark 2-3 years after initial infection. In the alternate host, *Comandra*, pale-yellow spots develop on leaves and stems following infection. For more information, see also Mielke (1957), Boyce (1961), USDA (1963), Hepting (1971), Ziller (1974), Sinclair *et al.* (1987).

Morphology

Aecia scattered, distinct, caulicolous; aecial filaments lacking or few, stalactiform. Aeciospores distinctively pyriform, acuminate above, red-orange; wall colourless, finely verrucose, thickened at both ends and without a true smooth spot; warts less than 1 µm high; 19-24 x 32-66 µm. Uredinia and telia hypophyllous, amphigenous or caulicolous. Urediniospores globose, wall nearly colourless, 1.5-2 µm thick, sparsely and minutely echinulate; 20-33 x 22-28 µm. Telial columns cylindric; 1 mm. Teliospores oblong or

cylindric, wall smooth and uniformly 2-3 µm thick; 12-15 x 32-44 µm. See also Mordue & Gibson (1978).

MEANS OF MOVEMENT AND DISPERSAL

Cronartium spp. can be carried considerable distances as wind-borne aeciospores and can survive considerable periods in the airborne state (Chang & Blenis, 1989). More importantly, these rusts can also be carried into new areas on plants for planting of the coniferous aecial hosts, as has occurred in parts of the USA (*C. comandrae* was introduced into Tennessee on nursery trees of *P. ponderosa*). The long incubation periods of *Cronartium* spp. mean that latent infections easily go undetected unless post-entry quarantine is applied. The alternate hosts of *C. comandrae* are wild plants which are extremely unlikely to be traded internationally. Similarly, there is no risk in movement of *Pinus* seeds or pollen.

PEST SIGNIFICANCE

Economic impact

The *Cronartium* rusts cause very important diseases in North America, resulting in malformation, reduced vigour and death of trees and seedlings. However, their abundance does depend primarily on the abundance and localization of the alternate host (Gross *et al.*, 1983). *C. comandrae* became epidemic between 1910 and 1945, then subsided for 10 years, but is now increasing in importance again, particularly on *P. taeda* in southeastern USA; seedlings may be killed within a few years after infection. Serious injury, in the form of basal infections on young *P. contorta*, has caused considerable reduced growth and mortality in Canada (Alberta, northern British Columbia and the Yukon) where *Comandra livida*, the alternate host, is locally abundant. Hiratsuka *et al.* (1988) found, in northern Canada, that *C. comandrae* lesions spread more aggressively to girdle young trees than those of the other "blister rusts". Geils & Jacobi (1993) have recently made a quantitative evaluation of losses of *P. contorta* due to *C. comandrae* in Montana and Wyoming. There is a suggestion that *C. comandrae* infection may predispose *P. contorta* to attack by the bark beetle *Dendoctonus ponderosae* in Utah (Nebeker *et al.*, 1995). For more information on the pest significance of *C. comandrae*, see also Boyce (1961), Peterson & Jewell (1968), Ziller (1974), Sinclair *et al.* (1987).

Control

Control can be effected by removing infected material and eradicating the alternate host, although this is rarely economically viable. Geils & Jacobi (1990) found that *C. comandrae* cankers develop slowly and predictably, so that removal of infected plants is a workable strategy. Nurseries should be located away from possible infection sources. The use of chemical sprays is feasible in nurseries. Research into resistant cultivars has led to successful control of some *Cronartium* spp.

Phytosanitary risk

C. comandrae is one of the non-European *Cronartium* spp. of the EPPO A1 list (OEPP/EPPO, 1979). The danger presented by these fungi to the EPPO region is classically exemplified by reference to the quarantine pest *C. ribicola* (Phillips, 1988), which has made it almost impossible to grow *P. strobus* commercially in most areas in Europe and North America to which the fungus was introduced from Asia. However, it should be stressed that the potential risk from introduced *Cronartium* spp. is much affected by the status of the alternate hosts concerned. While the *Ribes* hosts of *C. ribicola* are widespread cultivated plants, the telial hosts of *C. comandrae* are wild plants which do not occur in

Europe, and there is only a single related European wild plant (*Comandra elegans*), uncommon and occurring only in the Balkans, which might also be infected. On this basis, the risk of establishment of *C. comandrae* in the EPPO region is practically nil.

PHYTOSANITARY MEASURES

No specific phytosanitary measures seem appropriate, though it may be noted that measures taken against, for example, *C. coleosporioides* and *E. harknessii* (EPPO/CABI, 1996) will in any case exclude *C. comandrae*.

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