Prepared by CABI and EPPO for the EU under Contract 90/399003

Data Sheets on Quarantine Pests

Endocronartium harknessii

IDENTITY

Name: *Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka
Synonyms: *Cronartium harknessii* E. Meinecke
Peridermium harknessii J.P. Moore
Taxonomic position: Fungi: Basidiomycetes: Uredinales
Common names: Western gall rust, pine-pine gall rust (English)
Notes on taxonomy and nomenclature: In the past, a broad concept of *C. coleosporioides* (EPPO/CABI, 1996) was followed, by which it was considered to include a set of distinctive aecial stages: *Peridermium stalactiforme* (northern distribution), *P. filamentosum* (southern distribution) and *P. harknessii* (ubiquitous and autoecious) (Mordue & Gibson, 1978). However, Hiratsuka (1969) concluded that the aeciospores of *P. harknessii* function as teliospores and erected the new genus *Endocronartium* to accommodate such endocyclic life cycles. *E. harknessii* is thus now considered as a distinct species.
Bayer computer code: ENDCHA
EPPO A1 list: No. 11
EU Annex designation: I/A1 - as *Endocronartium* spp. (non-European)

HOSTS

The aecial hosts of *E. harknessii* in North America are two- and three-needled *Pinus* spp., of which the most important 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 recorded aecial hosts include the locally less important far western species knobcone pine (*P. attenuata*), bishop pine (*P. muricata*) and Monterey pine (*P. radiata*). The European species Aleppo pine (*P. halepensis*), mountain pine (*P. mugo*) and Austrian pine (*P. nigra*) have been found to be infected in North America. In view of the fact that *P. contorta* is widely planted in northern and western Europe, *P. radiata* in western Europe and *P. ponderosa* to a certain extent in central Europe, and the previously mentioned European species are also susceptible, *E. harknessii* would certainly find hosts on which to establish in the EPPO region. Since it is, by nature, an autoecious short-cycle rust, there are no telial hosts (the aeciospores of *E. harknessii* function as teliospores, leading to reinfection of the original *Pinus* host). For more information, see Spaulding (1956, 1961), Boyce (1961), USDA (1963), Davidson & Prentice (1967), Peterson (1967), Hepting (1971), Ziller (1974).

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), Mexico, USA (western and northern states Alaska, Arizona, California, Colorado, Idaho, Massachusetts, Maryland, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New York, North Dakota, Oregon, Pennsylvania, Virginia, Washington).
Central America and Caribbean: Unconfirmed reports in Central America.
South America: Unconfirmed reports.
EU: Absent.
Distribution map: See CMI (1993, No. 449).

BIOLOGY

The life history of *E. harknessii* is remarkably simple: aecidioid teliospores (spores having the morphological characteristics of aeciospores but germinating and functioning like teliospores) develop in the spring on branch galls (rarely on stem cankers) of *Pinus* 2-4 years after infection; these spores are carried in air currents and reinfect *Pinus* directly. Once established, galls continue to produce spores each spring; invasion by secondary fungi usually results in death of the branch. The rust may continue to survive in cankers for up to 200 years, but produces few, if any, spores. Van der Kamp (1994) found that most infections of *P. contorta* by *E. harknessi* 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 Peterson (1960), Ziller (1967, 1974), Krebill (1970), Byler & Platt (1972), Peterson (1973).

DETECTION AND IDENTIFICATION

Symptoms

In spring, droplets of clear, viscous liquid are produced. These are followed by pale-yellow aecia, 1-8 mm in diameter, containing powdery yellow-orange spores. Each new infection is followed by the formation of a well delimited, spherical to oblong gall, up to 8 cm, sometimes accompanied by a small witches' broom. Small galls on twigs 1-2 years old are frequently pyriform. The bark sloughs off in large scales, finally exposing the smooth wood, with a collar of old bark standing out around the upper and lower ends of the gall. Galls form on branches and small stems of *Pinus* of all ages. For more information, see also Boyce (1961), USDA (1963), Hepting (1971), Ziller (1974), Sinclair *et al.* (1987).

Morphology

Teliospores subglobose to obovoid and ellipsoid, with colourless, coarsely verrucose walls which have a lateral smooth spot; 23-35 x 14-24 µm. They produce germ tubes (basidia) with one to four septa. See also Peterson (1960), Ziller (1967, 1974), Sinclair, *et al.* (1987). The fungus has been cultured (Allen *et al.*, 1988).

Detection and inspection methods

Isoenzyme and protein analysis of aeciospores can differentiate between *E. harknessii* and various *Cronartium* spp. (e.g. *C. quercuum*) in, for example, *P. banksiana* (Powers *et al.*, 1989; Tuskan & Walla, 1989).

MEANS OF MOVEMENT AND DISPERSAL

E. harknessii can be carried considerable distances as wind-borne aeciospores and can survive long periods in the airborne state (Chang & Blenis, 1989). More importantly, it can

also be carried to new areas on plants for planting of the coniferous aecial hosts, as has occurred in parts of the USA. Long incubation periods mean that latent infections easily go undetected unless post-entry quarantine is applied. There is no risk in the movement of *Pinus* seeds or pollen.

PEST SIGNIFICANCE

Economic impact

E. harknessii is damaging in its effect on form, lumber content and growth rates of *Pinus*, and kills individual trees, although it is not known to wipe out whole stands. Galls on the main stem of young trees can lead to the death of the tree, but galls on branches of older trees cause little loss (Gross, 1983). Severe outbreaks on seedlings of *P. ponderosa* and *P. contorta* have been recorded in north-west Canada as well as serious damage on young natural stands of *P. banksiana* and *P. sylvestris* plantations in Quebec. Damage in commercial stands occurs chiefly to *P. contorta* in the Rocky Mountains (Ziller, 1967, 1974). *P. sylvestris* has recently been reported to be much less susceptible than *P. contorta* (Van der Kamp, 1989). When compared with "blister rusts" (e.g. *C. comandrae*) on *P. banksiana* and *P. contorta* in northern Canada, *E. harknessii* was found not to be so aggressive on dominant trees, but to attack intermediate or suppressed trees which would disappear in any case (Hiratsuka *et al.*, 1988).

Control

The autoecious nature of the rust makes control difficult. Removal of infected trees may be economical. Nurseries should be well away from infection foci. Several non-rust fungi have been reported in association with and acting as natural biological control agents of *E. harknessii*. *Scytalidium uredinicola* has attracted particular interest, and produces a spore germination inhibitor of *E. harknessii* (Cunningham & Pickard, 1985). Resistance to *E. harknessii* also exists (Yanchuk *et al.*, 1988; Burnes *et al*., 1989).

Phytosanitary risk

E. harknessii is an EPPO A1 quarantine pest (OEPP/EPPO, 1979), and is also a quarantine pest for IAPSC. It is considered a major quarantine pest for Australia (Commonwealth Department of Health, 1982). The potential danger of *E. harknessii* to commercially important *Pinus* in the EPPO region, especially the native species *P. sylvestris*, but also other native species and introduced North American species, can clearly be seen, in view of its considerable importance in North America, the difficulties of control and the fact that the fungus can spread from tree to tree, without an alternate host.

PHYTOSANITARY MEASURES

Since symptoms may not be apparent for several years after infection, the only practical safeguard is to prohibit entry of the *Pinus* species which are hosts (see Hosts) from countries where *E. harknessii* occurs (OEPP/EPPO, 1990). Bark and wood of host *Pinus* should have been appropriately treated (heat-treated, fermented, kiln-dried; EPPO quarantine procedures are in preparation).

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