

Puccinia jaceae Otth.

INVASIVE SPECIES ATTACKED: Diffuse knapweed (*Centaurea diffusa*)
Spotted knapweed (*C. biebersteinii*)

TYPE OF AGENT: Leaf & stem rust (fungus)

COLLECTABILITY: Not permitted

ORIGIN: Western Europe

DESCRIPTION AND LIFE CYCLE

General development:

Twelve to 16 days after inoculation, rust-coloured pustules range from 0.4 - 1.3 mm in diameter, with a yellow halo. The fungus attacks stems and leaves which gradually turn brown. Recurring generations are produced every two weeks at 15 - 20°C.

Detailed development:

Puccinia jaceae has five stages of development on two host plant varieties in Canada. Overwintering spores (teliospores) develop into wind borne spores (basidiospores) in the spring. Germination often occurs on alternate hosts within the plant community which results in sexual reproducing pustules. The pustules produce a sweet nectar that attracts insects. The pollination process is usually done by flies or other insects as they move through the plant community. After pollination, the spores then develop into sexual reproductive spores (aeciospores). The aeciospores germinate and in turn create self-producing spores (urediospores) which require a moisture period of 18 - 20 hours for germination. The advantage of urediospores is their ability to rapidly duplicate. In this stage they are capable of dispersing long distances. As the day length shortens, or with the onset of drought, they begin to develop the overwintering spores (teliospores).

Overwintering stage:

In the dryer climates, *P. jaceae* may overwinter as mycelium on knapweed rosettes or as sexual reproductive spores on alternate plants. In some climates it overwinters as thick-walled spores (teliospores) on plant debris.



Fig. 1. *P. jaceae* rust pustules on knapweed (credit Powell et al. 1994)

EFFECTIVENESS ON HOST PLANT

P. jaceae can be observed from summer through fall on leaves and stems. Rust pustule coverage on leaves and stems can be up to 20%. Moist conditions increase reproduction, affecting more plants and larger areas. Inoculated four week old diffuse knapweed plants have 55% less root and 33% less leaf biomass than plants not affected. It is only effective when attacking seedling form. Heavy infection on five week old plants reduces the leaf life span by 66 - 76%. Pustule size is not an indicator of *P. jaceae* efficacy.

HABITAT AND DISTRIBUTION

Native:

P. jaceae is native to western Europe found between latitudes 44°N to 62°N, and to the Caspian Sea within latitudes 35°N to 55°N.

North America:

The first known sighting of *P. jaceae* (=var *diffusae*) in North America was on diffuse knapweed found in 1988 in B.C. Canada. It is also now dispersed in the northwestern U.S.A. in Wash., Oreg., Idaho, Mont. and S. Dak.

P. jaceae is capable of inhabiting all diffuse and spotted knapweed habitats. Increased moist habitat, more common with spotted knapweed, can encourage rust reproduction. Dry climates inhibit reproduction.

British Columbia:

P. jaceae is recorded established in the Ponderosa pine biogeoclimatic zone. It is believed to be more widespread than is recorded. The dry interior regions of southern BC may restrict continual reproduction.

BRITISH COLUMBIA RECORD

Origin:

P. jaceae originates in western Europe and the first recorded North American site occurred in B.C.

History:

P. jaceae was initially found on diffuse knapweed in 1988 in Oliver, BC. The following year it was found on diffuse knapweed in Lillooet and was noted then to be widespread in the Lillooet Forest District (now part of the Cascades Forest District). Since these earliest sightings, *P. jaceae* has also become common on spotted knapweed. The rust has not adapted to spotted knapweed, but instead was shown that 26% of spotted knapweed plants are susceptible and 38% are immune to the strain found near Oliver. It is suspected the preferred moist habitat preferences of spotted knapweed may increase spore development and infection. The rust has freely dispersed itself with no assisted redistribution efforts.

Field results:

When *P. jaceae* was first located near Oliver, the plants had 15 - 20% of stem and leaf area covered with rust pustules. From the original 10 km² site, it dispersed to 1,400 km² in seven years. Spotted knapweed susceptibility to *P. jaceae* is variable. Although *P. jaceae* is reported to be quite widespread throughout the diffuse and spotted knapweed habitat there have not been many records added to the provincial application (IAPP) at this time.

Collection for redistribution:

Not permitted for redistribution.

NOTES

- *P. centaureae* var. *centaureae* is found on black knapweed (*C. nigra*) in N.S. and B.C.

REFERENCES

1. Harris, P. 2005. Classical biological control of weeds established biocontrol agent *Puccinia jaceae* Oth. var *diffusae*. Leaf and stem rust disease. Agriculture and Agri-Food Canada. Updated August 3, 2005. http://res2.agr.ca/lethbridge/weedbio/agents/apucjac_e.htm. (Accessed February 15, 2007).
2. Mortensen, K. P. Harris, and R. M. D. Makowski. 1989. First occurrence of *Puccinia jaceae* var. *diffusae* in North America on diffuse knapweed (*Centaurea diffusa*). Can. Journ. Plant Path. 11: 322-324.
3. Powell, G. W., A. Sturko, B. Wikeem and P. Harris. 1994. Field guide to the biological control of weeds in British Columbia. B.C. Min. For. Res. Prog.