

Puccinia carduorum (Jacky)

INVASIVE SPECIES ATTACKED: Nodding thistle (*Carduus nutans* L.)

TYPE OF AGENT: Leaf & stem rust (fungus)

COLLECTABILITY: Not permitted

ORIGIN: Unknown, presumed to be Turkey

DESCRIPTION AND LIFE CYCLE

General Development:

Puccinia carduorum has several stages of spore development and ideal conditions are necessary for the successful advancement of the stages. *P. carduorum* is capable of completing its entire lifecycle only on nodding thistle. It is capable of multiple generations per year and can complete a lifecycle in two weeks. As with other *Puccinia spp.*, it also has multiple stages it must develop through to complete its lifecycle³.

Detailed Development:

The overwintered teliospores that measure 54.1 long x 36.4 wide (microns) germinate to produce spores that require cross pollination (basidiospores)^{2,3}. The basidiospores then go on to infect the nodding thistle plants³. The next spore development stage involve self-producing spores (urediniospores) and are lightweight and powdery and easily redistribute by wind to new host plants³. The urediniospore in most cases will have three germ pores. Urediniospores are light brown or cinnamon coloured and have a thick wall that becomes thicker where it has attached itself to the plant and at each of the germ pores (hilum). They are spherical shaped and measure approximately 25 microns in diameter (22.2 x 24.1 microns). Urediniospores germinate at ideal temperatures between 11 and 19°C, however, germination can occur in temperatures as low as 3.5°C or as high as 29.0°C². During ideal conditions, *P. carduorum* reproduces urediniospores within two weeks. As the nodding thistle plants complete their biennial cycle and die, the fungus prepares for cooling weather and completes its lifecycle by producing teliospores that will overwinter³.

Overwintering stage:

P. carduorum overwinters in the teliospore stage. The teliospores are hardy and resistant to cold and freezing weather conditions³.

EFFECTIVENESS ON HOST PLANT

Aerial plant parts are attacked by *P. carduorum*, including the leaves, stems and bracts. The infection and destruction caused by *P. carduorum* occurs during both the urediniospore and teliospore lifecycle stages. When plants are infected with a high level of attack, seed set and seed quality are reduced. There is speculation that, like other *Puccinia spp.*, when dew and temperature conditions are unfavorable, the effectiveness of *P. carduorum* may also decrease. Once *P. carduorum* infects a few plants at a site, it generally will readily spread when weather temperatures are adequately favorable. There is speculation that dense stands increase the success of *P. carduorum* establishment. There is some indication that *P. carduorum* and *Rhinocyllus conicus* work better together on nodding thistle than alone. Other biocontrol agents such as *R. conicus*, *Trichosirocalus horridus*, and *Cassida rubiginosa* do not appear to be negatively affected by the *P. carduorum*³.



Fig. 1. *P. carduorum* on senescing nodding thistle



Fig. 2. *P. carduorum* on green nodding thistle



Fig. 3. *P. carduorum* on nodding thistle

HABITAT AND DISTRIBUTION

Native:

P. carduorum is found throughout the native range of nodding thistle in Eurasia and North Africa³. Bruckart (undated) specifically reports nodding thistle is present in Germany, Austria, Hungary, Switzerland, Italy, Britain, Russia, Siberia, Portugal and Finland, therefore, it is suspected *P. carduorum* will also be present in these areas.

North America:

P. carduorum obtained from Turkey was permitted for field evaluation research in Virginia in 1987, but spread quickly. By 1995, *P. carduorum* was established in Delaware, Georgia, Indiana, Kentucky, Maryland, Ohio, South California, Tennessee and Virginia and has since spread into Montana and Wyoming^{3, 4}. No strains of *P. carduorum* have been approved for release in U.S.A.⁴. A seemingly joint U.S.A. and Canadian proposal exists to introduce the rust into Saskatchewan for research purposes in 1987, but, it is unknown whether this occurred².

British Columbia:

At this time the only sites recorded in the Invasive Alien Plant Program occur in the Bunchgrass and Interior Douglas-fir biogeoclimatic zones¹.



Fig. 4. *P. carduorum* dispersal location near Walloper Lake in the Kamloops area (Interior Douglas-fir zone)

BRITISH COLUMBIA RECORD

Origin:

P. carduorum is adventive to B.C. The origin of the population discovered in B.C. is unknown, however, it is possible that the spores spread from the U.S.A. into Canada.

History:

It is unknown where and when *P. carduorum* was first found in B.C., but, is found to be passively redistributing itself at nodding thistle sites.

Field results:

There is very little information regarding *P. carduorum* in B.C. Limited records of nodding thistle plants exhibiting *Puccinia* infection and its distribution in B.C. have been kept by Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) staff for only a few years. These records include plants being propagated inside mesh cages for the biocontrol agent *T. horridus* in Kamloops and some incidental observations. No samples of the *Puccinia* found on nodding thistle have been collected for analysis to determine what strain it may be.

NOTES

- *P. carduorum* is known to initially infect artichoke, some *Cirsium spp.* and other *Carduus spp.*, however, it is unable to fully complete a lifecycle on any of these plants².
- Some plants, including those in the following genus, *Cirsium*, *Cynara*, *Saussurea*, and *Silybum* appear to develop resistance to *P. carduorum* within six weeks after planting².

REFERENCES

1. British Columbia Ministry of Forests Lands and Natural Resource Operations. Invasive Alien Plant Program (IAPP) Application. <http://apps24.for.gov.bc.ca/iapp/> (Accessed January 2015)
2. Bruckart, W.L. and D.J. Politis. Undated. *Puccinia carduorum* for biological control of musk thistle. A proposal for release of the fungus. U.S. Dept. of Agriculture.
3. Coombs, E.M., G.L. Piper, and N.E. Rees. 1996. *Puccinia carduorum*. Sect. II, Thistles, Nodding thistle. In: Biological control of weeds in the west. N.E. Rees, P.C. Quimby Jr., G.L.Piper, E.M. Coombs, C.E. Turner, N.R. Spencer, and L.V. Knutson, (editors). Western Soc. Weed Sci.
4. Winston, R., C. Bell Randall, R. De Clerck-Floate, A. McClay, J. Andreas and M. Schwarzlander. 2014. Biological control of weeds in the northwest. Forest Health Technology Enterprise Team.