

Puccinia coronata var. *coronata*: Crown rust of glossy buckthorn (*Frangula alnus*) and reed canarygrass (*Phalaris arundinacea*)

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Background: Crown rust (*Puccinia coronata* Corda *sensu lato*) is a complex of various species and subspecies, each of which alternates between parasitizing a grass host and a host in the families in *Rhamnaceae* and/or *Elaeagnaceae*. Crown rust of oats, is a devastating pathogen of oats and regularly reduces yield by 5 – 10 %. Recently, a close relative has been observed in the U.S. that affects two invasive species, glossy buckthorn (*Frangula alnus*) and reed canarygrass (*Phalaris arundinacea*). Where the two species coexist, rust may cause severe defoliation and drastically reduce seedset of glossy buckthorn, and cause premature leaf senescence and reduced growth in canarygrass.



Fig. 1 Crown rust infection on *F. alnus*: **A.** Pycnia on *F. alnus*; **B.** Aecial infection shown on flower, stem, and underside of leaf; **C.** *F. alnus* with severe aecial infection.

Rust biology, life cycle, and ecology: Crown rust is a macrocyclic, heteroecious rust, meaning it has 5 spore stages and alternates between two unrelated hosts. In spring, the overwintering spore stage, the teliospore, germinates to produce basidiospores, which infect glossy buckthorn. On buckthorn, orange fungal pycnia (1A) are formed on the upper surface of leaves. They exude a sugary liquid containing spermatia, which may be spread by water, wind, or insects to other pycnia of compatible mating types. Pycnia, once fertilized develop into bright orange aecia (1B, 1C), which may occur on both leaf surfaces, flowers, and young stem tissue, on which shepherd's crooks and cankers may occur. Aecia are short lived, disappearing about 3-4 weeks after infection. Infected flowers are aborted and do not produce fruit. Aeciospores infect reed canarygrass (2C) to produce numerous small orange uredinial pustules (2A). In Minnesota this occurs in mid-late June, but occurs earlier in warmer climates. Uredinia produce asexual urediniospores which may reinfect the grass and can be spread long distances by wind. The asexual cycle repeats throughout the summer. In fall as leaves senesce, abundant dark brown to black telia form on the underside of leaves (2B) and survive through winter.

The rust is also known to infect *Frangula caroliniana*, a native buckthorn species from the Eastern United States, and *Calamagrostis canadensis*, a native wetland grass. Common buckthorn is not affected, but does host other crown rusts.

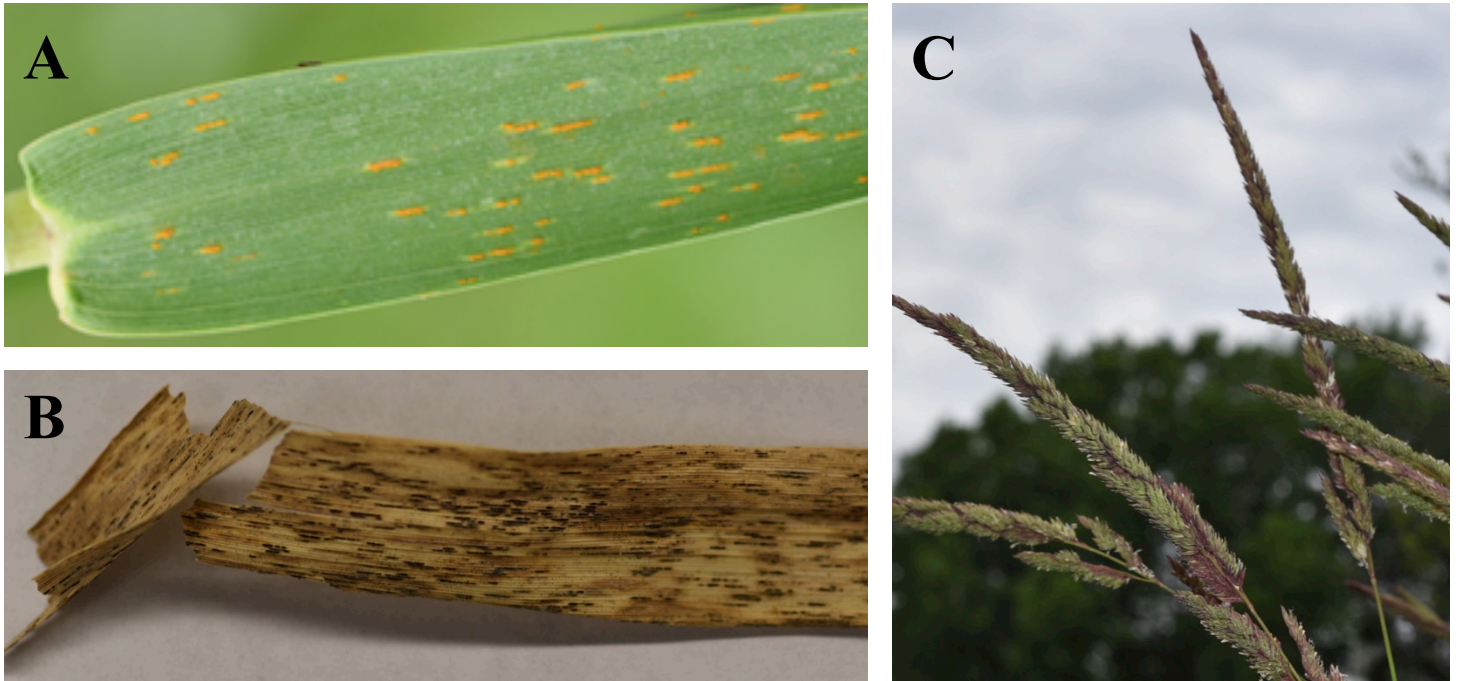


Fig. 2. Crown rust infection on reed canarygrass: A. Uredinial infection; B. Telia; C. reed canary grass flower

Host biology: Glossy buckthorn is a large shrub native to Europe, Northern Africa and western Asia. It was introduced as an ornamental plant for use in shelterbelts and hedgerows. Today it is prohibited for sale in Minnesota, but may be purchased elsewhere, especially in popular “fern-leaf” and columnar varieties. Glossy buckthorn can be differentiated from common buckthorn by its smooth leaf margins, glossy leaf, roughly opposite leaf venation, and bisexual flowers. Glossy buckthorn tends to occur in more wet soils, but may also invade forest understories, like common buckthorn. Reed canarygrass is native to North America and Eurasia, but Eurasian genotypes are present in North America. It colonizes wetlands and meadows, forming vast stands that outcompete other species. It thrives in disturbed environments, especially where there are fluctuating water levels or nitrogen pollution, such as lands near agriculture or in urban areas. It spreads vigorously by rhizome. Some variegated cultivars are found in gardens, but its use is discouraged due to the plant’s tendency to escape cultivation. It is uncommonly used as a forage or for cellulosic ethanol production.

Management: For now, the disease is not cause for significant concern, as it apparently seems to affect two highly invasive plants. The rust is capable of defoliating glossy buckthorn and reducing fruit set, which may be undesirable for garden specimens. Gardeners might consider removing nearby reed canarygrass or other grass hosts that may be a source of inoculum for infection. Ornamental varieties of reed canarygrass tend not to have severe infection. Reed canarygrass is sometimes farmed. Large monoculture stands of reed canarygrass are frequently observed with severe rust infection and cultivated reed canarygrass may suffer similar infection. Please contact us if you farm reed canarygrass or have observed infection in an agriculture setting.

Research: As of 2020, research is being conducted at the University of Minnesota Department of Plant Pathology with funding provided by the [Minnesota Invasive Terrestrial Pests and Plants Center](#) (MITTPC). We are investigating its distribution, its relation with other forms of rust fungi, its ecology, effects on hosts, and potential as a biological control agent of its invasive hosts. If you have questions about ID or would be interested in providing samples, please contact Nicholas Greatens at the University of Minnesota (great013@umn.edu). Please report observed disease in your area by using EDDMapS or iNaturalist.