

A Forgotten Foe

Stem rust and the barberry brew lethal combination

By Tim Murray, Xianming Chen and Diana Roberts*



There are three different types of rust on wheat: stripe, leaf and stem. Usually stripe rust makes the headlines in the PNW and Intermountain West. Now, the reemergence of a disease brought under control back in the 50's may become center stage. Stem rust typically doesn't cause widespread damage in the Northwest because it's usually too dry and temperatures too cool for optimal disease development.

Although the PNW may not be ground zero for stem rust infection, it has been shown to be an incubator for infections that can not only transmit the disease to fields as far away as Minnesota, but can actually produce new races of the stem rust fungus. In other words, the Northwest could create a homegrown Ug99.

How is that possible? Ask the common barberry. An ornamental plant that was introduced across the United States

by the settlers, the barberry is an essential ingredient in the complicated life of the stem rust fungus, *Puccinia graminis* f. sp. *tritici*, which for simplicity's sake, is referred to as Pgt.

Stem Rust Life Cycle

In addition to wheat or barley, Pgt requires the common barberry (not to be confused with the cultivated Japanese barberry, which is resistant) to complete its life cycle. Although the rusty red spores on wheat and barley are the most obvious and damaging stage of the disease, the cycle of Pgt begins on the innocuous evergreen garden shrub.

During the 1660's, France had a law banning co-culture of wheat and barberry.

As the wheat plant is maturing and/or dying from stem rust, Pgt enters into a black-colored spore stage that enables

it to survive the winter – much like a seed. The black spores lie dormant in the wheat straw during winter and germinate in spring to produce another type of spore that is carried by wind to nearby barberry bushes.

There, the spores penetrate leaves and fruit, reproduce, and are carried by wind relatively short distances to wheat or barley plants where they infect and begin producing the red-colored spores. The spores can spread thousands of miles to infect wheat and barley plants and start another cycle.

The closer barberry is to a wheat field, the earlier stem rust begins in the growing season. An earlier start for the rust results in more cycles of disease and greater damage. By removing the barberry from this love triangle, the impact of stem rust is reduced--which was the rationale for a 63 year national effort to eradicate barberry bushes.

Beginning in 1918 and continuing until 1981, more than 400 million barberry bushes were eradicated from northern wheat-producing states. The eradication program was a resounding success and as a result, three or fewer stem rust races have been found east of the Rocky Mountains in the last 10 years.

Despite the extensive eradication effort barberry was not completely elimi-



Stem Rust (*Puccinia graminis*) on barberry, *Berberis vulgaris*)



Barberry bushes range in size from small to very large. This covey of bushes at Potlatch, ID, probably missed eradication the first time. There were at least eight bushes this size growing together.

nated, and it has made a comeback in some areas - which is why stem rust continues to occur sporadically.

Races on the Rise

A race is a strain of the stem rust fungus that is able to infect different wheat or barley varieties. Races are similar to strains of flu viruses – each year different combinations of flu virus genes combine in different ways to create new strains able to overcome immunity in people exposed. In plants, the ability of a race to infect a specific variety depends on which resistance genes the variety contains and which “virulence” genes the race contains.

Some PNW races have virulence genes in common with Ug99, which are not present in the Western Hemisphere. It is these shared virulence genes and presence of the barberry that raises concern for the potential to produce a “homegrown” Ug99 that could spread from the PNW to other wheat-producing areas of the North America.

When the stem rust fungus reproduces on barberry, it's like shuffling a deck of cards and the virulence genes form many new combinations. It's the many different



Bill Flory, Idaho wheat grower, Culdesac, highlights the area currently at risk, as more barberry bushes are being identified.

“hands” dealt to these races that makes breeding resistant wheat and barley varieties difficult.

Time to Re-evaluate

Based on new information and the concern over the diversity of races found recently in the PNW, a decision

has been made to revisit the barberry situation and more closely monitor stem rust races to better understand the risks. In the past three years, historical records and reports of stem rust outbreaks have been used to look for barberries. So far, more than 20 locations have been identified where barberries are present in Whitman, Stevens, and Latah counties. And that is barely scratching the surface.

With funding from USDA-APHIS, the PNW Barberry working group has been formed consisting of state and federal scientists, and extension personnel from Idaho, Montana, Oregon and Washington to investigate reports of stem rust and barberries, and to educate those working in the wheat and barley industry about this forgotten foe.

More information is available at <http://PNWstemrust.wsu.edu>.

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Idaho and Stem Rust

Currently there have been no verified outbreaks of stem rust in southern Idaho. The immediate risk to our barley and wheat crops is for those growers in the Potlatch and northern Idaho areas where barberry plants have been found.

For southern Idaho, common barberry plants may have difficulty establishing due to the very dry climate,” says Juliet Marshall, University of Idaho, Extension Crop Management Specialist. “However, they may have become established in the river bottoms and stream bank areas. The greater risk in southern Idaho is from new races that can be blown in from our west and north.”

That scenario would be similar to the way stripe rust epidemics develop – with little to no overwintering of the fungus, but with late season development of damaging epidemics requiring control with widespread application of fungicides.

If you hunt along local streams and rivers, identification of any barberry plants is needed for success in controlling this damaging disease.

“It is critical to eliminate the threat of rapidly developing races of stem rust,” says Marshall. “This can only be done through the cooperation and elimination of the barberry by landowners and producers. This disease can cause up to 100% yield loss in susceptible varieties, posing a substantially greater threat than stripe rust.”

Pictures of the disease and the common barberry are available. For more information contact Juliet.Marshall@uidaho.edu.



Stem Rust — *Puccinia graminis* f. sp. *Tritici* on wheat.



Juliet Marshall, University of Idaho, Extension Crop Management Specialist, discusses the barberry and stem rust connection with Mark Darrington, Declo, during the UI / IWC research review.