Identification and Control of Leaf Rust of Wheat in Georgia

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Wheat leaf rust, caused by the fungus *Puccinia triticina* (formerly known as *Puccinia recondita* f. sp. *tritici* [Figure 1]), is often a destructive foliar disease of wheat in the state of Georgia. Rust fungi in wheat are highly specialized pathogens with narrow host ranges.

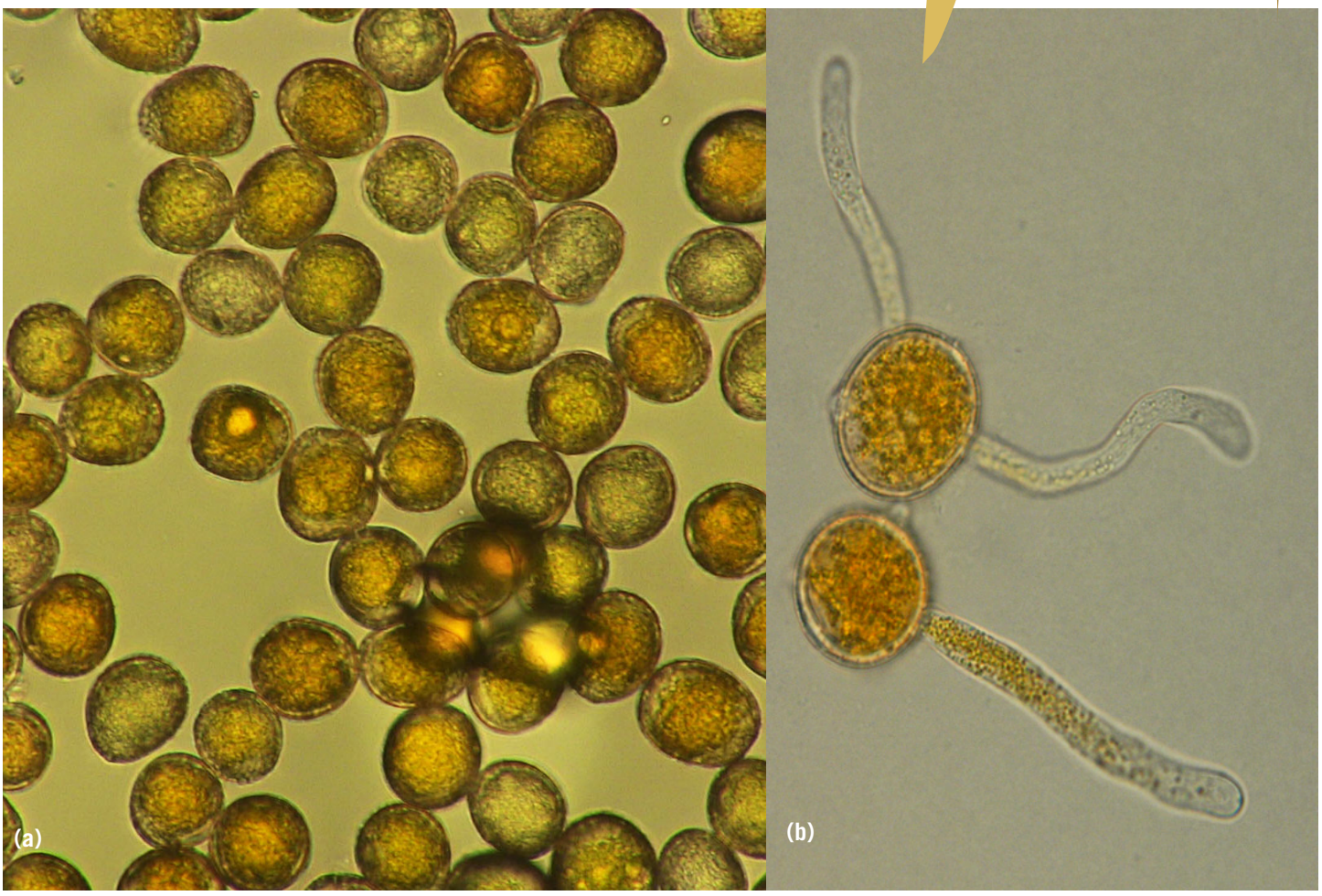

Figure 1. Micrographs of urediniospores (a) and germinating urediniospores (b) of *Puccinia triticina*, the causal agent of wheat leaf rust. (Photos: Alfredo Martinez, James Buck; taken using 40X and 100 X objectives.)

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Symptoms

Flaky, reddish-brown, 1/16-inch (1.5 mm) in diameter pustules develop on leaves and sheaths (Figure 2). Pustules break through the leaf epidermis, and spores are easily dislodged by rain, wind, or contact. Pustules may be found early in the growing season on lower leaves, but they often appear in large numbers on the upper leaves after flowering. A single spore can invade a leaf and produce a pustule with thousands of new spores within seven to 10 days. This allows the disease to spread rapidly and cause extensive damage within a short time.

Figure 2. Symptoms of wheat leaf rust. (Photos: Andrew Sawyer and Alfredo Martinez.)

Conditions Favoring the Disease

High relative humidity and/or free moisture and temperatures ranging from 59 degrees F to 77 degrees F (15 degrees C to 25 degrees C) are conducive for leaf rust to develop (Table 1). The optimum temperature for urediniospore germination is 68 degrees F (20 degrees C). If these conditions exist, infection can occur in six to eight hours. Leaf rust epidemic severity increases exponentially over time. Dry, windy days, which disperse spores followed by cool nights with dew, also favor leaf rust epidemics. Urediniospores serve as primary inoculum by virtue of long distance dispersal by wind.

Table 1. Environmental Conditions Required for Leaf Rust Growth Stages

Leaf rust stage	Temperature (°F/°C)			Light	Free Water
	Minimum	Optimum	Maximum		
Germination	35/2	68/20	86/30	Low	Essential
Germling	41/5	59-68/15-20	86/30	Low	Essential
Appressorium	-	59-68/15-20	-	None	Essential
Penetration	50/10	68/20	86/30	No effect	Essential
Growth	35/2	77/25	95/35	High	None
Sporulation	50/10	77/25	95/35	High	None

Modified from R.P. Singh, J. Huerta-Espino, A.P. Roelfs. 2002.

Control

Several methods can be used to prevent, manage and treat wheat leaf rust.

Genetic Control

Use of resistant varieties is the best way to control wheat losses to leaf rust. Resistant varieties have one or more specific leaf rust resistance genes (denominated *Lr* genes). There are more than 30 different *Lr* genes available to date; however, most varieties have only a few *Lr* genes. In order to cause disease (i.e. be virulent) on a certain variety, the leaf rust fungus must be able to defeat all the *Lr* genes in that variety. The prevalence of different rust races is always changing in response to the different wheat varieties being grown with different *Lr* genes. Because new races of the fungus can develop, it is important to know the susceptibility of a given wheat variety. Table 2 lists the relative rust resistance of the wheat varieties recommended for Georgia in 2014-15. See Figure 3 for an example of wheat germplasm screening in Georgia.

Figure 3. Screening of wheat germplasm at CAES Research and Education station in Plains, GA. (Photo: Alfredo Martinez.)

Table 2. Leaf Rust Resistant Wheat Variety Recommendations

Good	Fair	Poor
AGS 2026	Dyna-Gro 9171	Pioneer 26R20
AGS 2027	Pioneer 26R10	Roberts
AGS 2035	Pioneer 26R61	TV8525
AGS 2038	SS 8415	TV8848
AGS 2060	SS 8629	USG 3555
Dyna-Gro Baldwin	TV8535	
Fleming	TV8861	
Jamestown		
LA754		
Oglethorpe		
Pioneer 26R94		
SS 8641		
USG 3024		

Source: Georgia 2013-2014 Small Grains Performance Tests, UGA Extension Annual Publication No. 100-6, http://www.swvt.uga.edu/2014/sm14/AP100-6-contents.html.

Field Monitoring

Check fields periodically during the season, especially when warmer temperatures start to develop. Use a hand lens to look for symptoms on plant leaves and examining a number of plants throughout the field. Spores of rust are often seen on the upper portion of the leaf. Field confirmation of rust spores can be made by rubbing your fingers over the top of the leaf. Spores appear as a red-brown, clay matter on your fingers. Infection usually starts at the bottom of the plant and moves up. Usually field symptoms are so conspicuous and unique that visual inspection will suffice for a rapid identification (Figure 4). However, if symptoms are not sufficient to identify the disease, then a physical sample might be needed for identification. Information on how and where to submit a sample is located at *plantpath.caes.uga.edu/extension/clinic.html* or by calling your county Extension office (1-800-ASK-UGA1).

Figure 4. Rust spores on shoes after walking through a heavily infected field. (Photo: John Youmans.)

It is recommended to implement practices that include the eradication of volunteer plants and crop debris, which can harbor inoculum over the winter. This cultural practice does not guarantee freedom from rust because urediniospores are carried long distances by wind. Avoid early sowing and excess nitrogen applications.

Chemical Control

There are several fungicides labeled for leaf rust on wheat. Generally there is no economic benefit from applying fungicides to control leaf rust when resistant varieties are grown. However, exceptions can occur. There are only a few varieties that are highly resistant to leaf rust, and there is some potential for use of fungicides. Possible disease race shifts may make it necessary to use fungicides. IF leaf rust is found in the field, a fungicide application is recommended. Protection of the flag leaf is critical for yield preservation. Due to constant changes in fungicide labeling, check the entire product label and/or contact your local county Extension agent for the most up-to-date information. Fungicides for managing leaf rust are found in Table 3. Additional information is found in the Georgia Pest Management Handbook (UGA Extension Special Bulletin 28 — *www.ent.uga.edu/pest-management/*). Always follow product labels for recommendations, precautions, and restrictions. See Figure 5 for an example of fungicide efficacy evaluations for wheat leaf rust control in Georgia.

Figure 5. Evaluation of chemical options for control of leaf rust at the CAES Research and Education Center in Plains, GA. (Photo: Alfredo Martinez.)

Table 3. Fungicides for Leaf Rust of Wheat[2]

Fungicide(s)				Leaf Rust[1]	Harvest Restriction
Class	Active Ingredient	Product	Rate/A (fl. oz)		
Strobilurin	Picoxystrobin 22.5%	Aproach SC	6.0–12	VG	Feekes 10.5 and 45 days
	Fluoxastrobin 40.3%	Evito 480 SC	2.0–4.0	VG	Feekes 10.5 and 40 days
	Pyraclostrobin 23.6%	Headline SC	6.0–9.0	E	Feekes 10.5
Triazole	Metconazole 8.6%	Caramba 0.75 SL	10.0–17.0	E	30 days
	Propiconazole 41.8%	Tilt 3.6 EC3	4.0	VG	Feekes 10.5
	Prothioconazole 41%	Proline 480 SC	5.0–5.7	VG	30 days
	Tebuconazole 38.7%	Folicur 3.6 F3	4.0	E	30 days
	Prothioconazole19% Tebuconazole 19%	Prosaro 421 SC	6.5–8.2	E	30 days
Mixed modes of action	Metconazole 7.4% Pyraclostrobin 12%	TwinLine 1.75 EC	7.0 – 9.0	E	Feekes 10.5
	Fluxapyroxad 14.3% Pyraclostrobin 28.6%	Priaxor	4.0 - 8.0	VG	Feekes 10.5
	Propiconazole 11.7% Azoxystrobin 7.0%	Quilt 200 SC3	10.5–14.0	E	Feekes 10.5
	Propiconazole 11.7% Azoxystrobin 13.5%	Quilt Xcel 2.2 SE	10.5–14.0	E	Feekes 10.5
	Prothioconazole 10.8% Trifloxystrobin 32.3%	Stratego YLD	4.0	VG	Feekes 10.5 35 days
	Tebuconazole 22.6% Trifloxystrobin 22.6%	Absolute 500 SC	5.0	E	35 days
	Cyproconazole 7.17% Picoxystrobin 17.94%	Aproach Prima SC	3.4–6.8	VG	45 days

[1]Efficacy categories: VG = Very Good; E = Excellent.

[2]Modified from 2014 fungicide table produced by "The North Central Regional Committee on Management of Small Grain Diseases (NCERA-184)" and from the CAES Wheat Production Guide (*www.caes.uga.edu/commodities/fieldcrops/gagrains/documents/2014-2015WheatProductionGuide.pdf*). This information is provided only as a guide. By law, it is the responsibility of the pesticide applicator to read and follow all current label directions. No endorsement is intended for any products listed, nor is criticism meant for products not listed. The University of Georgia and members or participants in the NCERA-184 committee assume no liability resulting from the use of these products.

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