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CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
UNIVERSITY OF MINNESOTA
1551 Lindig St, ST. PAUL , MN 55108-6052

(612) 625-6299 FAX (612) 649-5054
Internet: markh@puccini.crl.umn.edu

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- Leaf rust was found on winter wheat in Minnesota 10 days earlier than normal.
- Leaf rust was more severe than usual on spring wheats in the northern plains.
- Wheat stripe rust was found throughout the Great Plains from Texas to Minnesota.
- Oat stem rust was widespread throughout the southern and northern oat-growing area.
- Barley stripe rust caused substantial losses in the Pacific Northwest.

Most of the small grains in the northern Great Plains are in good condition and 1-2 weeks ahead of normal plant maturity.

Wheat stem rust. In 1998, wheat stem rust severities were generally light in varietal plots throughout the southern U.S., and no rust was found in commercial fields. In a few cultivars like CK 9835 in northwestern Florida plots, stem rust was severe but no stem rust was found on the majority of cultivars. These southern locations normally provide wheat stem rust inoculum for susceptible wheats further north.

During the third week in May, traces of wheat stem rust were found in a nursery in south central Kansas. Stem rust and stripe rust pustules were found on the same leaf, which correlated to a deposition of spores 7 to 10 days earlier from a rain storm that originated in the southern Mississippi Valley area. The exact source of the deposited spores is unknown.

In late June, traces of wheat stem rust were found in a plot of the cultivar 2137 in a central South Dakota winter wheat nursery. Stem rust foci in the plot had severities as high as 30%. The first rust spores probably arrived in early June, indicating that southern Kansas was the likely inoculum source.
By early July, traces of wheat stem rust were found in check plots of highly susceptible spring wheat cultivars such as Baart in eastern South Dakota. By mid-July, traces of wheat stem rust were found in plots of the spring wheat cultivar Max in southeasern North Dakota. In early July, trace to 20% severities were observed in winter wheat plots in east central Minnesota and

southeastern North Dakota. By late July, trace to 20% severities were reported in susceptible spring (Marquis) and durum (Mindum) wheat plots in east central North Dakota at the soft dough stage.

Two factors delayed stem rust development in the northern plains: first, little stem rust overwintered in the southern U.S., and second, stem rust resistance in the spring wheats remains highly effective in the northern Great Plains.

By mid-July, scattered plants in eastern Washington winter wheat plots had severities of 90%. In late July, stem rust was severe in winter wheats and a few of the susceptible spring wheat cultivars in eastern Washington, and will cause lower grain weights in some fields.

To date, races Pgt-QFCS, -RCRS and-TPMK (Table 1) have been identified from collections made in the southern U.S. Last year, only race Pgt-TPMK was identified from collections made in the southern U.S. This increased frequency of race RCRS could represent a significant race shift in the wheat stem rust population.

TABLE 1. Wheat stem rust races identified through July 31, 1998

Pgt		Number of Isolates by State					
Code	Virulence formula	AR	FL	KS	LA	MS	TX
QFCS	5,21,8a,9g,17,9a,9b,10	6					
RCRS	5,9g,36,9b,10,9a,9d,10		3	1	6	3	12
RKQQ[1]	5,21,7b,6,8a,9g,36,9b,9a,9d						
TPMK	5,21,9e,7b,11,8a,9g,9d,10,Tmp				3	3	
Number of Isolates		6	3	1	9	6	12
Number of Collections		2	1	1	3	2	4

[1] From barberry collection made in Massachusetts.

Wheat leaf rust. Southern Plains - Leaf rust was lighter than last year in much of the southern Great Plains. During the last week in March, wheat leaf rust severities ranged from traces to 60% on the lower leaves of cultivars in nursery plots throughout southern Texas. For example, plots of TAM 300 had traces of leaf rust, but TAM 107 had 60% severities. In southern Texas commercial fields, rust severities ranged from traces to 20% on the lower leaves. In these fields, rust increased on the lower leaves when moisture was abundant, but rust increase farther up the plant was limited, either because of dry weather or because earlier heavy rains washed the rust spores onto the ground. In early February in central Oklahoma, leaf rust was severe on the lower leaves of some of the commonly grown cultivars. However, by early March, leaf rust was less severe since most of those rusted leaves died without the rust spreading to the younger leaves because of the dry weather in late February.

During the second week in April, leaf rust was much more widely distributed than normal within wheat fields in southern Texas and the Gulf Coast states, but the average severity of leaf rust was low (Fig. 1). In this area, *Stagonospora* (Septoria) was severe on the lower leaves, destroying much of the leaf area where rust normally increases. Cool, moist conditions in central Texas during the first two weeks in April created good conditions for rust and powdery mildew increase. In mid-April, leaf rust severities of 80% were observed in central Texas plots of TAM-107 at Temple, while in the same plots three weeks earlier, only traces were found.

In mid-April, leaf rust was light throughout Oklahoma. During mid-May, leaf rust was increasing in plots in southern and central Oklahoma, but was light in fields in these areas. During the third week of May, wheat leaf rust severities of 60% were observed on the flag leaves of susceptible cultivars growing in commercial fields in central Oklahoma. In north central Oklahoma varietal plots, cultivars such as Karl 92, TAM 107 and Chisholm had 60% severity readings, while rust severities on cultivars like Custer, Jagger and 2137 were less than 3%. In late May, traces of leaf rust were observed on *Triticum cylindricum* (goatgrass) in southwestern Oklahoma.

There was much less wheat leaf rust in Oklahoma than in 1997 because of the reduced amounts of rust that overwintered, the dry conditions in late February, and cooler than normal temperatures in April and early May.

Central Plains - In late March, leaf rust severities were light throughout most southern Kansas fields and plots. Very little leaf rust overwintered this year in Kansas. During late April, leaf rust was found in the mid-canopy leaves of wheat growing in south central Kansas. In mid-May, in south central Kansas, 5% leaf rust severities were reported on the flag leaves of susceptible cultivars, while 20% severities were found on flag leaves in southeastern Kansas fields (Fig. 1). In mid-May, in central Kansas the flag leaves were clean, but the flag-1 and flag-2 had leaf rust severities of trace to 10%. By late May, in central Kansas varietal plots and fields, severities of 10% were common on susceptible cultivars and on the more resistant cultivars, rust severities were less than 1%.

Leaf rust development was slow during May throughout northern Kansas. By the second week in June, the last of the green leaves dried up in northern Kansas. The hot dry winds at the end of May caused premature ripening of wheat in central Kansas. Leaf rust developed late, but still managed to kill the flag leaves of susceptible cultivars during the soft dough stage throughout eastern and central Kansas. Some of the commonly grown varieties like Jagger had significant amounts of rust (50% severity at early dough).

During the fourth week in June, leaf rust severities ranged from 10 to 60% on flag leaves of susceptible winter wheat cultivars in south central Nebraska and southeastern South Dakota fields. Flag leaves dried up quickly because of the leaf rust. Also, in late June leaf rust severities ranged from trace to 80% on cultivars in south and west central Nebraska varietal plots. The rust infections in Nebraska and South Dakota probably originated from inoculum sources in Oklahoma and northern Texas.

Northern Plains - During the third week in May, 2% severities were reported on the flag-1 leaf in a winter wheat nursery in east central South Dakota. Traces of leaf rust were found in winter wheat plots in east central North Dakota and in spring wheat fields in southeastern North Dakota in late May.

On May 29, severities of 5% were observed on the flag-1 leaves in the Roughrider winter wheat plot at the Rosemount Experiment Station in east central Minnesota. Traces of rust were observed on other winter wheat cultivars. This rust development originated from rust spores that were deposited with rain 12-16 days earlier. This is the earliest that leaf rust has been observed in these plots, except in the years when rust overwintered in the plots. The likely source of these infections was from spores that originated in southern Kansas.

During the second week in June, leaf rust severities of trace to 5% were reported on flag leaves of winter wheat in a nursery in southeastern South Dakota. On the lower leaves, leaf rust severities ranged as high as 40%. In spring wheat plots, traces of leaf rust were observed on early planted lines at Brookings, South Dakota. During the second week in June, trace to 20% severities were found in winter wheat varietal plots in east central Minnesota. Leaf rust severities of trace to 1% were observed on winter wheat in south central Wisconsin in early June.

By the fourth week in June, leaf rust severities ranged from 10 to 60% on flag leaves of susceptible winter wheat cultivars in southeastern and central South Dakota fields. In both North Dakota and South Dakota, yield losses due to leaf rust occurred in winter wheat.

During the fourth week in June, leaf rust severities of 10 to 40% were reported on the lower leaves of susceptible spring wheat cultivars in plots in southwestern and west central Minnesota. In fields, severities ranged from 0 to 10% on the lower leaves of spring wheats in western Minnesota and northeastern South Dakota. In plots of susceptible spring wheats in west central Minnesota, east central South Dakota, and east central north Dakota, 20-100% leaf rust severities were reported on flag leaves by mid-July.

Although many of the spring wheat cultivars in the northern plains are resistant to leaf rust, some cases of higher than usual leaf rust severities were reported. In mid-July, in east central North Dakota, trace to 30% leaf rust severities were observed on flag leaves of commercial spring wheat cultivars (2375, Grandin, AC Ac barrie) at the anthesis stage. In late July, in north central North Dakota spring wheat fields, trace to 40% severities were observed at soft dough stage. Losses are expected, especially in late planted fields.

Southeast - In late March, along the U. S. Gulf Coast, leaf rust was light in wheat plots and fields, due to heavy rains in February and early March, which limited rust spread by washing the spores off the leaves.

In early April, wheat leaf rust severities were light in plots of southern soft red winter wheat cultivars in central Louisiana and southern Arkansas. During mid-April, leaf rust was light in plots of susceptible southern soft red winter wheat cultivars throughout the southeastern U.S.

In early April, moisture and overcast conditions created ideal conditions for rust development, but the cool nights slowed the rust increase. In mid-April, light amounts of leaf rust were reported in wheat fields in east central and northeastern Arkansas.

During the last week in April in the southeastern U.S. , severities of 60% were observed in plots of susceptible soft red winter cultivars, while in fields, trace to 1% severities were more common on the flag-1 leaves (Fig. 1). Wheat leaf rust was lighter than normal in both plots and fields due to the cooler than normal early spring and the heavy rainfall in early April, which tended to keep the spores inside the wheat canopy. It was also observed that during mid- to late April in the southeastern U.S., relative humidities were low and therefore there was little dew formation, which is needed for rust infection to occur.

In mid-May, in most of the southeastern U.S., rust was severe on susceptible cultivars in plots, but light in commercial fields. Moisture was a limiting factor in rust development in early May, and by mid-May the crop was mature so losses to leaf rust were limited.

By the third week in May, leaf rust severities of 30% were reported in rapidly maturing wheat fields of susceptible cultivars in northeastern Arkansas and the bootheel of Missouri. Losses were light except in a few fields of susceptible cultivars.

Midwest - By June 1, traces of wheat leaf rust were found as far north as Lafayette in Indiana. During the second week in June, leaf rust severities of trace to 5% were reported in wheat fields from northeastern Missouri to northwestern Ohio and southern Michigan (Fig. 1). On June 10, on flag leaves, leaf rust severity ratings of trace to 5% were recorded on most of the wheat varieties in northeastern Indiana plots, while 60% severities were recorded on a few susceptible lines. Throughout this area, leaf rust was more severe than 1997 because in May the weather was wetter and warmer than normal. Losses were light except in a few fields of susceptible cultivars.

East - In mid-April, traces of leaf rust were found on the lower leaves of wheat in North Carolina plots. During late April, leaf rust severities of 5-10% were observed on the flag leaves of soft red winter wheats in east central North Carolina and central South Carolina. In early May, severities of 20% were reported on wheat in Clarendon County plots in northeastern South Carolina. Leaf rust was light in plots in eastern Virginia in late April.

In early May, low levels of leaf rust that overwintered were reported in the snowbelt region east of Lake Ontario. In early June, traces of leaf rust were observed in the winter wheat varietal plots at Ithaca, New York. In late June, leaf rust was common in winter wheat fields in New York, some with flag leaf severities greater than 30%. Wheat leaf rust losses were light in the New York winter wheat fields.

California - During the third week in April, leaf rust was light in wheat plots and fields in the San Joaquin and Sacramento Valleys of California. By late April, leaf rust severities ranged from 10-40% in plots throughout the Central Valley of California, but because of the advanced crop development, losses were not significant. By mid-May, leaf rust was severe in fields of

susceptible cultivars in the San Joaquin and Sacramento Valleys where losses to leaf rust occurred.

Northwest - In early May, leaf rust was light in winter wheat fields in northeastern Oregon (Fig. 1). In mid-June, leaf rust was present and increasing in the Willamette Valley of western Oregon. In early July, leaf rust was severe in the spring wheats in northeastern Oregon but losses were light except for a few fields of susceptible cultivars.

By the second week in June, wheat leaf rust was increasing throughout the state of Washington. Rust severities were high in winter wheat plots at Walla Walla and starting to increase in plots at Pullman in eastern Washington and Mt. Vernon in western Washington. By the fourth week in June, wheat leaf rust was increasing throughout the state of Washington. Rust was severe in winter wheat plots at Pullman in eastern Washington and Mt. Vernon in western Washington. By mid-July, 90% severities were observed on susceptible spring wheats growing in eastern Washington plots. Most of the spring wheat cultivars have adequate leaf rust resistance to combat the rust.

Canada -During the last week in June, leaf rust was found in winter wheat plots 85 km southwest of Winnipeg, Canada. Infections ranged from 5-20% on lower leaves, while traces were found on the flag leaves. This is the normal stage of rust development for the last week of June.

The wheat leaf rust races identified so far in the 1998 survey are presented in Table 2. Most of the identified races were from collections made in Texas in early spring, and again, as in 1997, there is a large diversified population of races. The MCDL race is the most commonly identified race and the predominant race collected from Jagger, which is grown on a large part of the hard red winter wheat acreage.

TABLE 2. Wheat leaf rust races identified through July 31, 1998

		Number of Isolates by State				
Code[1]	Virulence Formula[2]	AL	GA	LA	OK	TX
MBBQ	1,3,10,18		2			
MBDL	1,3,17,10					9
MBGQ	1,3,10,11,18			2		
MBRB	1,3,3ka,11,30					2
MBRL	1,3,3ka,10,11,30		6	3	2	10
MCDL	1,3,10,17,26					30
MCRL	1,3,3ka,10,11,26,30				1	
MCRQ	1,3,3ka,10,11,18,26,30				6	
MDBL	1,3,10,24					4
MDRL	1,3,3ka,10,11,24,30				3	2 26
MFBL	1,3,10,24,26					4
MJBL	1,3,10,16,24					4
MNRL	1,3,3ka,9,10,11,24,30			1		
TBRB	1,2a,2c,3,3ka,11,30					2
TCBL	1,2a,2c,3,10,26					2
TCML	1,2a,2c,3,3ka,10,26,30				1	
TDBL	1,2a,2c,3,10,24					1
TDDL	1,2a,2c,3,10,17,24					5
TDRL	1,2a,2c,3,3ka,10,11,24,30					8
TDTL	1,2a,2c,3,3ka,10,11,17,24,30					2
TFBL	1,2a,2c,3,10,24,26					2 5
TFBQ	1,2a,2c,3,10,18,24,26					1
TFGL	1,2a,2c,3,10,11,24,26					4
TFGQ	1,2a,2c,3,10,11,18,24,26					2
TFRQ	1,2a,2c,3,3ka,10,11,18,24,26,30					1
TLGG	1,2a,2c,3,9,11,18			2		
Number of Isolates			8	8	13	4 122
Number of Collections			5	5	8	2 63

[1]Race code, see Phytopathology 79:525-529.

[2]Single gene resistances evaluated: *Lr*1,2a,2c,3,3ka,9,10,11,16,17, 18,24,26,30.

Wheat stripe rust.- In early April, wheat stripe rust foci rated at 40% severity were observed in a plot of the soft red winter wheat CK 9835 at the Uvalde, Texas experiment station. In other soft red winter wheat plots, rust severities ranged from traces to 5%. Most of the rust was found on the flag-1 leaves, indicating the rust did not overwinter in these plots.

In late March, light stripe rust was reported in southern Arkansas plots**.** In mid-April, a hot spot of wheat stripe rust was found in an east central Arkansas field. **I**n mid-April, traces of wheat stripe rust were found in southern Louisiana plots. During late April in Arkansas,

temperatures were cooler than normal (highs in the 60s and lows in the 40s), which allowed for continued development of stripe rust throughout the state in plots and fields. During the last part of April, stripe rust was severe in west central Mississippi plots and light in northwestern and central Louisiana and north central Texas varietal plots as well as northeastern Louisiana fields. In early May, wheat stripe rust was severe in plots in northwestern Arkansas and light in commercial fields in the Delta region of eastern Arkansas. Wheat stripe rust was much more scattered and heavier than normal this year in the south central U.S. Warm temperatures retarded further development of stripe rust in the south central U.S.

In early May, wheat stripe rust was reported in plots in central Oklahoma. In late April and early May, weather conditions were ideal for stripe rust development in many parts of Oklahoma. A three-meter square wheat stripe rust center was found in a commercial field in Anderson County, Kansas on May 18. The rust ceased developing with the onset of warm weather.

By the third week in May, 10% severities were observed on 5% of the plants at the early berry stage in a field of wheat in south central Kansas. This rust developed from spores that were deposited in the early part of May from storms that originated in the Mississippi Valley area. The hot temperatures during the last two weeks of May disrupted the development of stripe rust in this area.

During the second week in June, stripe rust severities of 60% were found in a winter wheat plot in east central Minnesota. Hot weather in mid-June slowed the stripe rust development. During the fourth week in June, wheat stripe rust was light on the winter wheat cultivar 2137 in a central South Dakota nursery.

This year, stripe rust was reported from the Texas-Louisiana area northward throughout the central U.S. into the Minnesota-South Dakota area. This is the most extensive stripe rust development in the Great Plains in the last 20 years. Generally, when temperatures warm up in an area, stripe rust development ceases.

By late March, wheat stripe rust was increasing in nurseries in the San Joaquin Valley in California, in the Walla Walla area in southeastern Washington, and in the Skagit Valley of northwestern Washington. During mid-April, wheat stripe rust was increasing in the central and Walla Walla areas of Washington. The cool and moist conditions were ideal for the development of wheat stripe rust.

During the second week in April, wheat stripe rust was present in light to severe amounts in varietal plots in the San Joaquin and Sacramento Valleys of California. By late April, wheat stripe rust was severe in regional test plots from Butte County (northern Sacramento Valley) south to Kings County (San Joaquin Valley) in the Sacramento Valley of California. Rust "hot spots" were found in fields of the fall-sown hard red spring wheat cultivar Express, the predominantcultivar grown in the Sacramento Valley. In late July, extensive wheat stripe rust was reported in the Tulelake region of California. This year, losses to wheat stripe rust occurred throughout California on many of the susceptible cultivars.

In late April, wheat stripe rust was present in fields as far north as Pullman in eastern Washington and 40% severities were found on susceptible cultivars in plots at Walla Walla. In southeastern Washington, in fields of hard red winter wheat, severities of 40% were found and farmers sprayed for rust control. Also by late April, stripe rust was found on wheat in northeastern Oregon plots, but was not as heavy as in the Walla Walla plots. By early May, 50% stripe rust severities were reported in wheat plots in northwestern Washington.

In early May, stripe rust was increasing in the Mount Vernon plots in western Washington, while in central Washington, rust development was slowed because of dry weather. In mid-May, in the Skagit Valley of western Washington, stripe rust was severe on winter wheat, but barley yellow dwarf virus infection impeded further development. Stripe rust was present and increased on spring wheat in the area. In late May, east of the Cascade Mountains in Washington and Oregon and in the Palouse region of northern Idaho, stripe rust was increasing. Severities of 50% were found on susceptible cultivars in Pullman, Washington, with much higher severities at Walla Walla, Washington, Hermiston, Oregon, and south of Pendelton, Oregon. Frequent rains in the Pacific Northwest the last two weeks of May set the stage for further rust increase. An emergency label for Folicur was obtained for use on wheat and barley in Washington, and Tilt was labeled for use on wheat up to the heading stage. Damage to the soft white winter and spring wheats was limited due to their adult plant resistance to stripe rust.

During the second week in June, wheat stripe rust was widespread in the Pacific Northwest. In susceptible winter wheat cultivars in plots near Pullman, Washington, 100% severities were observed at heading to anthesis. Severities of 90% were reported in eastern Washington fields of Westbred 470 near Walla Walla. Farmers growing Westbred 470 sprayed for stripe rust, while cultivars with high-temperature, adult-plant resistance continued to provide durable resistance. By late June, stripe rust was increasing on spring wheats in the Pacific Northwest, but rust losses were minimal, since most of the cultivars have high temperature, adult plant resistance.

During mid-July, wheat stripe rust was increasing in spring wheat fields in the Palouse region of Washington, but the adult plant resistance of commercial cultivars minimized losses. The most severe stripe rust in the Palouse region was on the cultivar Vanna. This increased rust severity may be due to a new race in the area.

Oat stem rust. On March 31, severe oat stem rust was observed in a 250-acre field of Harrison oats, 10 miles north of Uvalde,Texas. In part of this field, stem rust had destroyed the oat plants and within two weeks the crop was totally lost to stem rust. The rust was noticed 6 weeks earlier and it was sprayed with a fungicide, but it didn't stop the rust development. The farmer said that when the winds are strong from the south, you can see the dust (spores) heading north. This oat field provided inoculum for areas farther north, but the lack of oat acreage in the central Great Plains tends to interrupt potential epidemics. In oat fields within a 20-mile radius of this field, no rust was observed.

In late March, traces of oat stem rust were observed in plots at Beeville and Beaumont, Texas and Fairhope, Alabama. During the last week in April, oat stem rust was severe and overwintering centers of rust were found in oat varietal plots in northwestern Florida, southwestern Alabama and central and northwestern Louisiana. Traces of oat stem rust were found in varietal plots in north central Texas, northeastern Louisiana, west central Mississippi, southeastern and east central Alabama. This is the most widespread distribution of oat stem rust in the last 5 years in the southern U.S. This increase in oat stem rust may be partially due to increases in the acreage of stem rust susceptible cultivars like Harrison and Chapman. These cultivars are widely adapted and moderately resistant to crown rust but super susceptible to stem rust. Stem rust from these southern areas provided rust inoculum for susceptible oats growing further north.

In late May, stem rust severities ranging from 5 to 30% were reported on some elite oat lines at the Plains Experiment Station in southwestern Georgia. The stem rust appeared very late and did not affect the yield.

In early July, oat stem rust was reported next in the U.S., in plots in eastern South Dakota and in a southwestern Minnesota field at trace to 5% severities. In late July, traces of oat stem rust were found in plots and fields in northwestern Minnesota and east central North Dakota. Losses to oat stem rust will be minimal in the northern oat-growing area.

The only race identified from collections made in the southern U.S. was the common race NA-27 (*Pg*-1,-2,-3,-4, and -8 virulence).

Oat crown rust. During the last week in March, crown rust was severe in southern Texas plots and fields. Sixty-percent severities were common on the most susceptible cultivars in nursery plots. In southern Texas fields, rust severities ranged from 1 to 20%, but on average, rust development was less than last year.

In late March, crown rust was light in varietal plots in southern Louisiana. Throughout the region from Georgia to Louisiana, rust development was much less than normal for late March, probably because heavy rains limited the spread of rust spores. In mid-April, crown rust was light in southeastern U.S. fields, where normally by this date it is severe. During mid-April, crown rust severities were less than 30% in susceptible oat plots in Baton Rouge, Louisiana and Fairhope, Alabama.

In late April, crown rust was light and less widespread than normal from southeastern U.S. to central Texas. In southeastern U.S. and central Texas varietal plots, crown rust ranged from trace to 20%, while in oat fields severities were light (trace to 2%). This crown rust development is the least in the southern U.S. in the last 5 years. These southern areas provided little inoculum for areas further north this year.

Abundant well-developed pycnia were observed in the St. Paul, Minnesota buckthorn nursery on April 23. Many of the infected leaves were just 1.0 to 1.5 cm long, which means that they were infected just as the buds were opening. This suggested that the release of basidiospores

peaked early this year, relative to the development of the buckthorn leaves. In late April, well-developed aecia were found in the St. Paul buckthorn nursery, but dry weather limited development of new infection. Well-developed pycnia were found on buckthorn at the Fargo, North Dakota buckthorn nursery during the last week in April.

The first uredinial infections on oat in the St. Paul, MN buckthorn nursery were found on May 14. This was 2-3 weeks earlier than normal. In east central South Dakota, pycnia on buckthorn were observed on May 7, and mature aecia were observed on May 13. These infections were very early this year (nearly 2-3 weeks earlier than the last few years). Throughout the northern oat-growing area, aeciospores were a significant source of local inoculum this year.

Traces of crown rust were found on oat growing in the St. Paul, MN buckthorn nursery on June 2. Moderate crown rust infection (pycnia and aecia) was observed on buckthorn at the Casselton Station, Cass County, North Dakota on May 29. The majority of the aecia were releasing aeciospores. In early June, moderate aecial infections were found on buckthorn bushes in south central and southeastern Wisconsin. During the second week in June, traces of crown rust were found in southern Wisconsin fields. By June 15, crown rust was severe on the lower leaves of oat growing near the buckthorn bushes in the nursery on the University of Minnesota, St. Paul campus, but little rust had spread to the upper leaves. Cool weather in early June limited crown rust development.

By the fourth week in June, oat crown rust severities of 5% were reported in fields in northeastern Nebraska and northwestern Iowa and traces of rust were observed in fields in central South Dakota and southwestern Nebraska. Rust severities on flag leaves in oat plots ranged from traces in west central Minnesota to 15% in southeastern South Dakota. Crown rust severities of 30-40% were found on flag-1 leaves on susceptible oat cultivars in the buckthorn nursery in St. Paul. By late June, crown rust was severe on susceptible oat cultivars in the central Ohio nursery at Wooster.

During early July, crown rust severities ranged from trace to 5% in oat fields and trace to 20% on flag leaves in plots in eastern South Dakota, west central Minnesota and southern Wisconsin. By mid-July, 40-60% severities were observed in plots in east central South Dakota.

Although crown rust development started early this year in the Midwest, the final severity was much less than last year. Buckthorns throughout eastern Minnesota were heavily infected, but the aecia were probably of forms of crown rust that infect wild grasses but not oat. Cool weather in June limited the increase of oat crown rust. When the weather turned hot in July, crown rust began to develop, but the oat plants matured rapidly before crown rust became severe. This year, losses to crown rust in northern oat-growing areas were limited to oat cultivars that were planted late.

Heavy crown rust infections were found on smooth brome grass at several sites in 1998, near St. Paul, Minnesota, which is unusual.

By the second week in June, crown rust had shown up on susceptible spreader strips adjacent to buckthorn hedges, but did not spread to later planted plots in southern Ontario, Canada because of extreme dry conditions. The buckthorn was not heavily infected, but adequate to initiate a good epiphytotic in the spreader strips.

In early April, light amounts of crown rust were found on wild oats in Sonoma County, California. In early May, crown rust severities of 100% were reported in Yolo county oat plots in California. By mid-May, severities of 100% were found in plots of susceptible cultivars in regional plots in the Central Valley of California.

Barley stem rust. The first report of barley stem rust this year was of traces in spring barley plots in early July in southwestern Minnesota and east central South Dakota. During mid-July, traces of stem rust were found in southeastern North Dakota and west central Minnesota spring barley plots. Traces of barley stem rust were reported in plots and there was a report of a 70% severity reading in a field in late July in east central North Dakota.

In late July, 40% stem rust severities were reported at soft dough stage in barley varietal plots in southeastern Washington.

The number of barley stem rust infections found in the U.S. is significantly down from the number found in the mid-1990s. The decrease in barley stem rust infections is probably due to the decrease in the percentage of QCCJ, which infects barley, in the race population (due to the reduced acreage of QCCJ susceptible winter wheats in Kansas).

Barley leaf rust. During the last week in March, 10% leaf rust severities were observed on lower leaves in a few barley plots in southern Texas. Lighter amounts were found in the other barley

plots in the same nursery. In late April, traces of barley leaf rust were found on cultivars growing in nurseries in central Texas.

In early April, light amounts of barley leaf rust were reported in plots in the San Joaquin Valley of California. Barley leaf rust was light in plots throughout the Central Valley of California in mid-May. Leaf rust of barley was light to moderate on susceptible lines at the Yuma, Arizona nursery by late April.

In late April, barley leaf rust was light in plots in northeastern Oregon and eastern Virginia.

During the third week in May, barley leaf rust was severe on the lower leaves of susceptible varieties in the Uniform Winter Barley Nursery in central Ohio. Hot dry weather prevented movement of rust to the upper leaves.

In early June, barley leaf rust was increasing on spring barley at the late jointing stage near Mt. Vernon in western Washington.

In late June, severities of 5% were reported in barley plots in east central Nebraska, and traces in plots in south central Minnesota.

In mid-July, trace to 10% leaf rust severities were observed in barley plots in west central Minnesota, east central South Dakota and southeastern North Dakota. In late June, 50% leaf rust severities were observed on barley in central Wisconsin fields. In late July, rust severities of 20% were reported in barley plots in northwestern Minnesota and 5% severities in central North Dakota at the dough stage.

During the second week in June, barley leaf rust severities of 80% were reported at the soft dough stage on some susceptible lines in a southern Ontario, Canada nursery. Rust was just starting to increase on spring barley.

Losses to barley leaf rust were light in the U.S. this year.

Barley stripe rust. In late March, barley stripe rust foci were found in winter barley plots at Uvalde, Texas. Severities of 40% were common in the foci in the Sussex cultivar and in other cultivars the severities ranged from traces to 2%.

In mid-April, stripe rust of barley first appeared on susceptible lines in nursery plots at Yuma, Arizona, and by the end of the month moderate severities were present, and the rust was spreading rapidly. The March and April weather was cooler and much wetter than normal, resulting in much higher relative humidities, which made conditions better for rust infection to occur.

By late March, barley stripe rust was light to severe on susceptible entries in nurseries of fall-sown spring barley in the Sacramento and San Joaquin Valleys in California. During the second week in April, stripe rust was present in moderate to severe amounts in barley varietal plots in

the San Joaquin and Sacramento Valleys of California. By late April, barley stripe rust was severe in plots throughout the Central Valley of California, with several breeding lines and cultivars at 100% severity. Initial infections occurred later this season than the previous two seasons. Many putative resistant lines did show effective resistance. The initial infections were later this year (after heading) than the previous 2 years, when severe statewide losses occurred. As a result, losses to stripe rust in California were lower than the last two years. In late July, barley stripe rust was reported in the Tulelake area of California.

In early March, barley stripe rust was found near Corvallis, Oregon and by late March, stripe rust was prevalent in the Skagit Valley of northwestern Washington. In late April, severities of 50% were reported in plots in northeastern Oregon, northwestern and southeastern Washington. In early May, stripe rust on barley was increasing in the Mount Vernon area of northwestern Washington.

In early June, stripe rust on barley was found throughout southeastern Oregon and the state of Idaho. In a southwestern Idaho field, a 90% disease severity at the milk stage was reported and in a northern Idaho field a 20% severity was reported, primarily on the lower leaves. By mid-June, barley stripe rust was increasing on spring barley near Pullman in eastern Washington and Mt. Vernon in western Washington.

By late June, stripe rust on barley was increasing in fields and varietal plots in eastern Washington and northern Idaho. Weather conditions were ideal for rust development under the canopy. Most of the 6-row cultivars were severely infected, while many of the 2-row cultivars were moderately susceptible. Some farmers in this area sprayed with a systemic fungicide, such as Tilt or Folicur, to control stripe rust.

By early July, stripe rust on barley in the Pacific Northwest was severe on susceptible spring-sown barleys from the intermountain area of northeastern California, through northeastern Oregon to eastern Washington and northern Idaho. In this area, 50% rust severities were recorded on Steptoe, but on other cultivars with slow-rusting characteristics like Baroness, 5% severities were recorded.

Throughout most of the Pacific Northwest area, losses to barley stripe rust will be much more severe than last year, when 0.6% losses (4% in Oregon, 0.5% in Washington and 01.% in Idaho) were recorded in this area.

Crown rust on barley. By late June, crown rust on barley had developed very slowly at the Brookings, South Dakota nursery and 5-10% severities were observed on lower leaves of susceptible cultivars at the heading stage. Traces of crown rust were found on barley in the buckthorn nursery at St. Paul. During the second week in July, trace to 1% crown rust severities were observed on barley growing in southeastern North Dakota plots. Traces of crown rust were found on barley in the buckthorn nursery in St. Paul, MN. Light losses to barley crown rust occurred in barley fields growing in close proximity to *Rhamnus* bushes. In 1998, throughout the upper Midwest, crown rust on barley was less severe than in previous years.

Rye stem rust. There were two reports of rye stem rust this year, and they were in July. Trace amounts were found in a winter rye field in southeastern North Dakota and trace to 5% severities were observed in a west central Minnesota varietal plot.

Rye leaf rust. During the last week in March, traces of leaf rust were found on leaves of winter rye in central Texas. During the third week in May, severities of 20% were observed on the flag leaves of rye growing in fields in north central Oklahoma and south central Kansas.

In late May, leaf rust severities of trace to 10% were reported in winter rye plots in east central Minnesota and southeastern North Dakota. By the fourth week in June, 20-50% severities were common on flag leaves of winter rye in plots and fields in southeastern South Dakota and east central Minnesota. In late June, 20 to 40% severities were reported on flag-1 leaves in winter rye plots in southeastern North Dakota. During the third week in June, only traces of leaf rust were found in spring rye plots in southern and west central Minnesota. In early July, trace to 2% severities were reported on spring rye in plots and fields in west central Minnesota and northwestern South Dakota.

In a field of rye in southern Alabama in late April, 10% leaf rust severities were observed on the flag leaves.

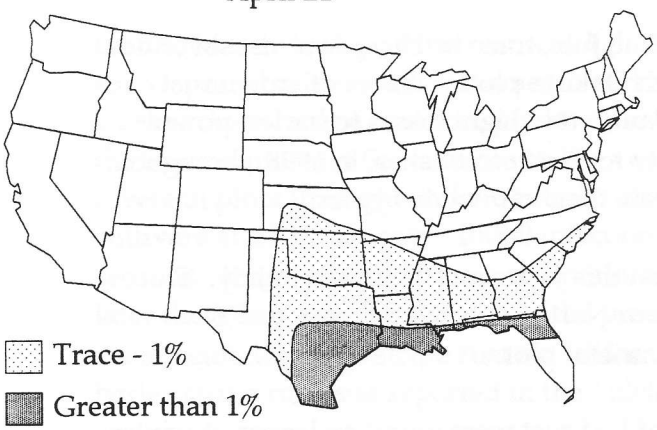
Stem rust on barberry. In mid-April, the aecial stage of wheat stem rust was found on common barberry (*Berberis vulgaris*) bushes (alternate host for stem rust) in Iowa County, in southeastern Wisconsin. In early June, aecial infection was light on barberry in south central Wisconsin and southeastern Minnesota. From these collections, rye stem rust (*Puccinia graminis* f. sp. *secalis*) was identified.

In early May, the pycnial stage of stem rust was found on common barberry leaves in Massachusetts, and by early June, aecial infections were present. From this collection, the Pgt-RKQQ race and rye stem rust were identified.

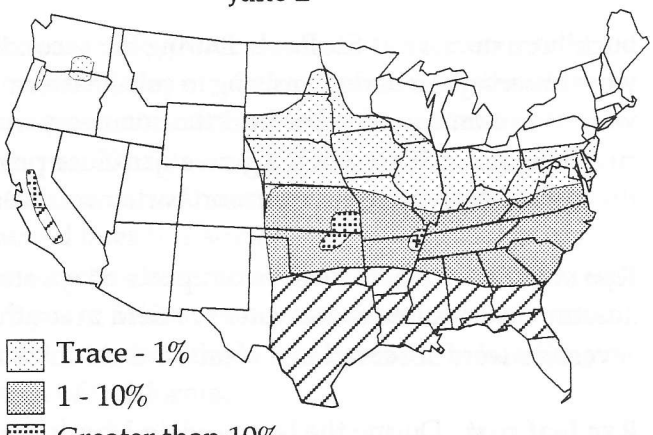
This is the last issue of the Cereal Rust Bulletins for the 1997-98 growing season. I would like to thank all of those who helped with the bulletin this year, especially Mark Hughes (markh@puccini.crl.umn.edu) who coordinates its distribution through the CDL web page (http://www.crl.umn.edu), email (markh@puccini.crl.umn.edu) and the post. Any reports of rust that you find in your area will be appreciated and this information will be added to the CRB and possibly our web page. - David Long (davidl@puccini.crl.umn.edu)

Fig. 1. Leaf rust severities in wheat fields in 1998

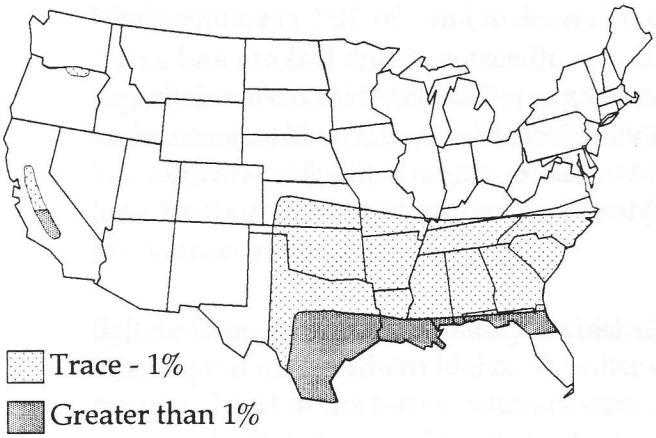
April 21



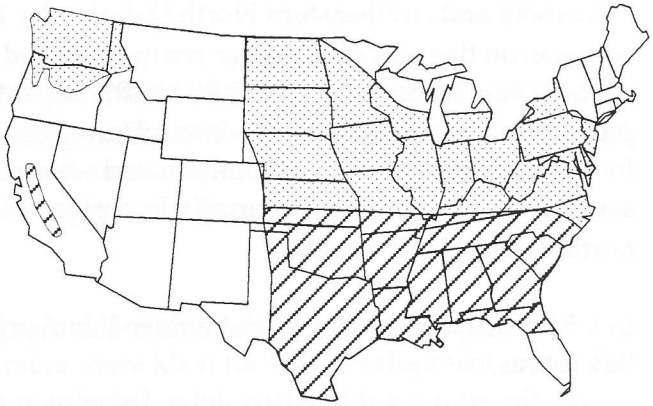
June 2



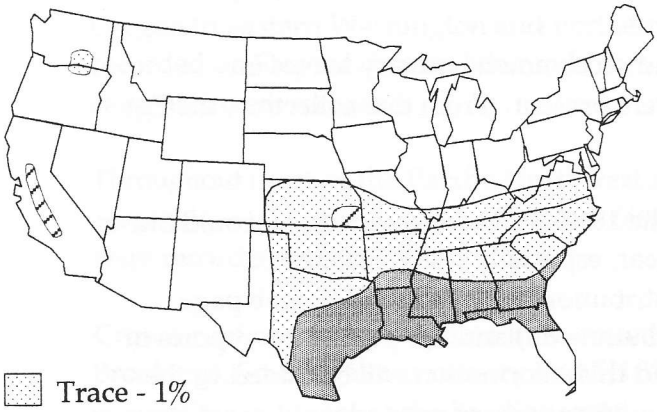
May 5



June 16



May 15



June 30