CEREAL RUST BULLETIN

Final Report

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- Due to a mild winter and cool spring, wheat stripe rust spread throughout the Great Plains to an extent not seen in 40 years.
- Wheat leaf rust was less severe than in recent years except in the northern Great Plains where it has been more severe than average the last 3 years.
- Stem rust was found throughout the northern Great Plains on wheat, barley and oat, but developed too late to cause major damage.
- Oat crown rust was lighter than normal especially in the upper Midwest.

Wheat stem rust. During early May in west central Texas, wheat stem rust was reported in fields of Wintex and traces were reported in plots of McNair 701. In mid-May, stem rust severities ranged from trace to 40% in plots from northwestern Arkansas to northwestern Oklahoma. In wheat plots in north central Oklahoma, 20% severites were observed on 10% of the plants in plots of Chisholm, Lockett and Thunderbolt. Wheat stem rust developed later than normal and was light this year throughout the southern plains.

In late May, traces of stem rust were found in wheat fields in west central Missouri and east central Kansas. By the last week in June, stem rust was found in fields and plots in north central Kansas and southern Nebraska. Trace amounts of stem rust were observed in commercial fields, while 20% severities were observed on susceptible lines in plots. The rusted wheat in these fields and plots provided inoculum for susceptible wheat further north.

In early June, severe wheat stem rust was found in a southern Louisiana nursery in plots which were planted much later than the normal, in late January.

In early July, traces of stem rust were observed on the winter wheat cultivar Norstar in east central North Dakota plots. In mid-July, trace to 40% stem rust severities were observed on the cultivar 2137 in plots throughout South Dakota. Stem rust also was observed on winter wheat cultivars Rose and Scout 66. Stem rust developed late in the season so losses will be minimal.

In late June, traces of stem rust were found on the susceptible spring wheat Baart in southern and west central Minnesota rust detection plots. During mid-July, 10-40% wheat stem rust severities at 100% prevalence were observed on Baart (at the full berry stage) in southern Minnesota disease detection plots. In west central Minnesota and east central South Dakota plots trace-20% stem rust severities were found on Baart at the 1/4 berry stage. No stem rust was found in the commonly grown spring wheat cultivars at these locations.
Stem rust infections were found in moderate amounts on susceptible spring wheat trap plots throughout North Dakota and northwestern Minnesota during the last week of July. No stem rust infections were observed on released wheat cultivars in either farm fields, or breeding plots.

The increased severity of stem rust can be attributed to the increased amount of inoculum produced on susceptible winter wheat cultivars, e.g. 2137, in the Central Plains and to the temperatures and early moisture, which were ideal for stem rust infection in the Northern Plains this year. If current spring wheat cultivars were susceptible to stem rust, a serious epidemic with substantial yield losses would have occurred.

Wheat stem rust race virulence - To date, races Pgt-QCMD and QCMJ (Table 1) are the most common races identified from collections made in the U.S. The QCCJ race is virulent on barley cultivars with the *Rpg1* (T) gene for resistance. Again, as in 2000, race TPMK which was the most commonly identified race from 1993 to 1997 has not yet been identified from the stem rust collections made in 2001.

Table 1. Preliminary identification of wheat stem rust races identified through August 10, 2001

	Number of Isolates					
Pgt code	TX	LA	OK	AR	MO	KS
QCCJ	2			1		
QCCS	3					
QCMB	3					
QCMD	12	2	3			
QCMJ	2			1		6
QCMS	1					
QCRS		1				
QFCS					2	
Total Isolates	23	3	3	2	2	6
Total Collections	8	1	1	1	1	2

Wheat leaf rust. Southern Plains - By the third week in March, light amounts of wheat leaf rust were found on some wheat cultivars and lines in the Beeville nursery in southern Texas. Rust infections were noted on the lower leaves indicating the rust may have overwintered in the nursery. In early April in southern Texas wheat fields, traces of leaf rust were observed. By late April, severe rust was found on susceptible lines and cultivars in southern Texas. In mid-April, light leaf rust was found in central

Texas plots (Fig. 1). Throughout Texas, wheat was planted late and conditions were cooler than normal in late winter, which accounted for the slow development of leaf rust. By mid-May, 40% severities were reported on flag leaves of susceptible cultivars in winter wheat plots in north central Texas and southern Oklahoma nurseries. During the last week in May, in plots of Jagger wheat in north central Oklahoma, 20% severities were found while in fields of Jagger in south central Kansas, 5% severities were observed on 1% of the plants. In late May, 20% severities were observed on *Aegilops cylindrica* (goatgrass) growing along the roadside in north central Oklahoma. In 2001, leaf rust losses will be light in Texas and Oklahoma.

Central Plains - In early May, traces of wheat leaf rust were found in southern Kansas (Fig. 1). During the last week in May, leaf rust was light in plots and only traces were found in fields from west central Kansas to west central Missouri. In south central Kansas wheat plots, 20% severities were found on Jagger at the late berry stage compared to 80% severities reported last year on Jagger in the same nursery at the same plant growth stage. The cooler than normal temperatures and excessive moisture during the latter part of May actually slowed leaf rust development in Kansas. During late June, leaf rust was found in fields and plots in north central Kansas and southern Nebraska. The loss to leaf rust in Kansas this year was 0.4% which was significantly below the 2.9% in 2000 and the 10-year average loss of 4.8%. Twenty percent leaf rust severities were observed on lower leaves in wheat fields (at soft dough stage) in east central and southern Nebraska. Conditions were not conducive for rust development in the southern and central plains in 2001.

Northern Plains - In mid-June, light leaf rust was observed on the flag leaves of hard red winter wheats in an east central South Dakota nursery. By late June, 20% severities were common on lower leaves of winter wheats and traces on susceptible spring cultivars in southern Minnesota and east central South Dakota plots. In late June, trace to 40% severites were observed on winter wheats growing in east central North Dakota plots. By late June, leaf rust in the northern plains had developed slower and to a lesser extent than normal. This is due to the small amount of leaf rust inoculum arriving from the southern grain growing areas, cool wet spring weather, and the hot dry conditions in late June that were not favorable for rust development. Also, many of the flag leaves of the winter wheats that previously were free of rust were infected with wheat stripe rust which normally is not found in this area. During mid-July, 10% severities were found on leaves of winter wheat growing in northeastern South Dakota and southeastern North Dakota fields at the late berry maturity stage.

In late June, traces of leaf rust were found in a spring wheat field in south central North Dakota and in plots in east central North Dakota. In mid-July, 40% wheat leaf rust severities were noted on susceptible spring wheat in southern Minnesota and east central South Dakota plots. Trace to 10% severities were noted on a few of the commonly grown spring wheat cultivars. The hot dry weather slowed rust development but rain stimulated further rust increase. By the last week in July, leaf rust infections were found on spring wheat throughout North Dakota and Minnesota. Leaf rust was found on wheat in nearly every field that was surveyed in North Dakota and Minnesota, and also in breeding plots throughout both states. Heavy leaf rust infections were observed in plots and fields in central North Dakota near Carrington and Minot. Many wheat fields in this area had leaf rust severities of over 50% at the late milk to soft dough stage, and flag leaves were starting senescence due to leaf rust. Most wheat cultivars in the demonstration plots at Carrington and Minot had leaf rust severities of over 20%. A significant yield loss due to leaf rust would normally be expected with this level of rust severity, however the extreme temperatures of over 90 F in the last week of July and first week of August would have increased leaf senescence, reducing the effects due to leaf rust. The high rust severities on cultivars

in the nursery plots indicates that many spring wheat cultivars do not have good levels of resistance to leaf rust. Leaf rust infections were generally lighter in the Red River Valley area of North Dakota and Minnesota. A table of leaf rust severities on spring wheat cultivars in Minnesota and North Dakota in 2001 can be found on the Cereal Disease Laboratory website (http://www.cdl.umn.edu/germplasm/survey/MN_ND2001.html).

In early July, leaf rust was present on susceptible winter wheat cultivars across much of southern Wisconsin. By mid-July, light levels of leaf rust were observed in winter wheat plots and fields in northeastern Wisconsin.

Southeast and East - In mid-April, light leaf rust was found in plots in southern Georgia, southern Alabama and southern Louisiana. This was the lightest and latest in the year leaf rust that has been observed in this southern region in many years. In late April, leaf rust was light in plots in southern and central Georgia and Alabama and central Louisiana. In plots at Tallassee in central Alabama a 40% severity was reported on 20% of the plants of the cultivar Jackson and only 1-2% severities were observed on a few of the other entries. In early May, traces of wheat leaf rust were found in eastern Arkansas and southern South Carolina fields. By the second week of May, light leaf rust was found in fields in eastern Arkansas. In late May, 20-40% severities were observed on plots of Thatcher wheat at Plymouth, North Carolina. Leaf rust incidence and severity on winter wheats in North Carolina was very light in 2001 compared to previous years. Some rust was observed on Coker 9663 and Foster in plots. Late planting of the crop in the fall, colder than normal winter in January and February and dry conditions in April all contributed to the light rust development in the southern U.S.

During the second week in June, trace-10% leaf rust severities were reported in plots and traces in fields of soft red winter wheat cultivars from northeastern Missouri to northwestern Ohio (Fig. 1). The cooler than normal temperatures during the last part of May and first part of June actually slowed leaf rust development. This was an abnormally poor year for leaf rust development throughout most of the U.S. and losses to leaf rust will be minimal.

By the last week in May, 10-70% leaf rust severities were observed on susceptible cultivars in a nursery in east central Virginia.

By the last week in June, 5 to 20% severities were reported on winter wheat fields in northwestern New York at the late milk growth stage.

California - During the second week of May, light leaf rust was found in fields in the San Joaquin and Sacramento Valleys of California. During the fourth week of May, 60% wheat leaf rust severities were common in plots of susceptible varieties and in commercial fields throughout the Central Valley of California.

Washington - During the second week in June, 10% leaf rust severities were found on susceptible winter wheat cultivars at the milk growth stage in southeastern Washington. By early July, only light amounts of leaf rust were found on wheat throughout Washington.

Canada - In late June, high levels of leaf rust were observed on susceptible winter wheat varieties in southwestern Ontario, Canada. In early July in winter wheat fields (anthesis stage) in southern Manitoba, 1% severities and 10% prevalences of leaf rust were observed. Light losses are expected on winter wheats because of the low rust levels and the advanced growth stage.

Leaf rust on durum. Leaf rust resistance in some commercial durum cultivars in northwestern Mexico broke down this year. In some fields farmers applied fungicides.

Wheat leaf rust virulence - The preliminary 2001 leaf rust race identifications from collections made in the U.S. are presented in Tables 2 and 3. From the central and southern plains rust collections the most common races were M-races (virulent to *Lr1,3,10,17,+*)(Table 3). Many of the MBDS and MCDS races were identified from rust collections made from Jagger which is grown on significant acreage in the southern and central plains states. Race MBRK was the race most commonly identified from collections from North Carolina and also was the most widely found race from that area last year. Race MBGJ was the predominant race found in California and has been for the past ten years. There also has been an increase in the number of T-- races (virulent to *Lr1, 2a, 2c, 3, +*), particularly, an increase in T-- races with virulence to *Lr9* and *10* in the southern soft red winter wheat area. The first time the *Lr9* and *10* combination was found in significant amounts in the race survey was in 2000.

Table 2. Preliminary identification of wheat leaf rust races identified through August 4, 2001

Pt code[1]	Virulence formula[2]
FCRT	2c,3a,3ka,10,11,14a,18,26,30,B
MBBJ	1,3a,10,14a
MBDS	1,3a,10,14a,17,B
MBGJ	1,3a,10,11,14a
MBJJ	1,3a,10,11,14a,17
MBRJ	1,3a,3ka,10,11,14a,30
MBRK	1,3a,3ka,10,11,14a,18,30
MBRS	1,3a,3ka,10,11,14a,30,B
MBTS	1,3a,3ka,10,11,14a,17,30,B
MCDS	1,3a,10,11,14a,17,26,B
MCRJ	1,3a,3ka,10,11,14a,26,30
MCRK	1,3a,3ka,10,11,14a,18,26,30
MCRS	1,3a,3ka,10,11,14a,26,30,B
MCTS	1,3a,3ka,10,11,14a,17,26,30
MDRJ	1,3a,3ka,10,11,14a,24,30
MFDJ	1,3a,10,14a,17,24,26
NBCR	1,2c,10,18,30,B
TBBJ	1,2a,2c,3a,10,14a
TBRJ	1,2a,2c,3a,3ka,10,11,14a,30
TBRS	1,2a,2c,3a,3ka,10,11,14a,30,B
TFBJ	1,2a,2c,3a,10,14a,24,26
TLGF	1,2a,2c,3a,9,11,14a,18
TLGJ	1,2a,2c,3a,9,10,11,14a
TLGP	1,2a,2c,3a,9,11,14a,18,B
TLGS	1,2a,2c,3a,9,10,11,14a,B
TLHS	1,2a,2c,3a,9,10,11,14a,30,B
TLRJ	1,2a,2c,3a,3ka,9,10,11,14a,30
TMGJ	1,2a,2c,3a,9,10,11,14a,26
TNMJ	1,2a,2c,3,3ka,9,10,14a,24,30

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

[2] Single gene resistances evaluated: *Lr1,2a,2c,3,3ka,9,10,11,14a,16,17,18,24,26,30,B.*

Table 3. Preliminary wheat leaf rust race identifications through August 4, 2001

	Number of Isolates													
Pt code	AL	AR	CA	FL	GA	KS	KY	LA	MO	NC	OK	TX	VA	USA
FCRT	1													1
MBBJ								1				2		3
MBDS			6			14		4			15	27		67
MBGJ			16				2							18
MBJJ			4											4
MBRJ	7				2									9
MBRK	4			2	2					18				26
MBRS	1													1
MBTS			2											2
MCDS			11			3		3			10	9		36
MCRJ	1												2	3
MCRK							1							1
MCRS												2		2
MCTS												2		2
MDRJ												2		2
MFDJ						2								2
NBCR	1													1
TBBJ									1					1
TBRJ								2	3					5
TBRS		2	2							1				3
TFBJ												2		2
TLGF	2							1						3
TLGJ	4			2	4			1						11
TLGP	2			2	4									8
TLGS								6		1		1		8
TLHS										6				6
TLRJ								2						2
TMGJ										2				2
TNMJ								5						5
Total isolates	23	2	41	6	12	19	3	25	4	28	25	47	2	238
Total Coll	12	1	21	3	7	12	2	15	2	17	14	25	1	132

Wheat stripe rust. Southern Plains - In mid-March, wheat stripe rust was severe in the Beeville, Texas nursery and in a few southern Texas fields. Commercial wheat in this area was at the heading stage.

This is the most stripe rust observed in this nursery in the past 20 years. Prevalences were rated at 1520% with 20% severities within the foci. Primary infections were noted on the upper leaves and were 3-4 weeks old. This indicates the initial stripe rust spore shower may have come from infected areas further south, i.e., Mexico, in early to mid February. During the third week in March in a soft red winter wheat field near College Station in central Texas light stripe rust was observed on the middle and lower leaves of wheat plants. By the third week in March, farmers were spraying wheat fields for stripe rust in the San Angelo area in west central Texas. Throughout Texas this year the winter crops were planted later than normal and moisture conditions were above normal. The cool temperatures in late winter were especially favorable for stripe rust development throughout southern Texas. In early April, wheat stripe rust was found in wheat fields in southern Texas and in south-central Texas. Disease severities ranged from trace amounts to 80%. At high severities, stripe rust significantly reduces yields and test weight. In early April, stripe rust caused complete losses in many of the entries in nurseries in south Texas. Jagger and TAM 201 were the two cultivars that showed the best stripe rust resistance in the Uvalde, southern Texas nursery. Last year no stripe rust was observed in southern Texas but was found farther north and east in Texas. In 2001, south Texas provided inoculum for susceptible wheat in the northern wheat growing area.

By mid-April, stripe rust was reported in central and north Texas. Rust was severe in a few central Texas fields which were planted early and in McCulloch county plots rust was light on the lower and middle leaves. Cool spring temperatures and unusually cool nights allowed for more stripe rust development in early April. In Texas by mid-April, wheat stripe rust had slowed with the onset of hot dry weather. In central Texas rust was severe in a few fields. In late April in north central Texas, stripe rust was severe on highly susceptible lines but undetectable in fields. In northeast Texas, stripe rust was not detected in either fields or nurseries. In early May in west central Texas, stripe rust was moderate on susceptible cultivars, but because of the drought conditions and hot weather further rust development was limited. During the second week in May, severe stripe rust was found in fields of 2137, 2174 and Custer in southwestern Oklahoma (Fig. 2). In late May, 20% severities were observed on *Aegilops cylindrica* (goatgrass) growing along the roadside in north central Oklahoma.

Central Plains - During the first week in May, wheat stripe rust was found on susceptible cultivars in a south central Kansas nursery and in fields of susceptible cultivars in southern Kansas. The plants were in the late boot maturity stage. By the second week in May, stripe rust had nearly defoliated susceptible varieties at the late milk stage across southern Kansas. In late May, severe stripe rust was reported in northern Kansas. Despite expectations that the epidemic would be halted by warm weather in mid-May, unusually cool conditions prevailed and allowed it to stay active through the first week of June. Three main factors apparently came together to generate the stripe rust problem in Kansas. First, unusually cool, wet weather in Texas in March and April were favorable for rust development. Second, very strong southerly winds transported a heavy spore shower to Kansas in mid-April. Third, unusually cool wet weather in Kansas in May allowed the epidemic to prosper. Economic losses were significant in many fields of susceptible varieties across a large portion of the state. The loss to stripe rust this year in Kansas was 7.3%, which is the most stripe rust loss on record for Kansas.

During the last week in June, stripe rust was the most common rust found on wheat throughout southern and eastern Nebraska. Stripe rust on susceptible winter wheat cultivars ranged from 20 to 80% on the flag leaves at late anthesis to soft dough.

In early June, stripe rust was severe in irrigated wheat, but light in dryland wheat in northeastern Colorado. In late June, stripe rust was severe on the flag leaves of irrigated white wheat (e.g., Platte) in the Front Range of the Rocky Mountains in Colorado .

Northern Plains - On June 8 and 9, light infections of wheat stripe rust were found in soft red winter wheat plots at Rosemount, and St. Paul, Minnesota, respectively. In contrast to last year, stripe rust and leaf rust were not found together on the same leaves, which probably indicates they did not develop from the same spore shower. By mid-June, wheat stripe rust development was extensive in east central and northern South Dakota and severities ranged from traces to 80% on flag leaves of winter wheats. Much of the stripe rust development originated from spores produced farther south in Texas, Oklahoma, Kansas or adjacent states. During late June, stripe rust was found in winter wheat plots in east central North Dakota. Hot temperatures that followed the initial rust sighting in Minnesota and the Dakotas set back the rust development, but cool and moist weather in mid-June resulted in further development. In mid July, stripe rust was still evident on some winter wheat cultivars, (especially the cv. Foster which has *Yr9* resistance) despite hot, dry weather in northeastern North Dakota.

In late June, traces of stripe rust were observed on lower leaves of susceptible spring wheat in the disease observation nurseries in east central South Dakota and in a field in south central North Dakota. Stripe rust in spring wheats was limited because most spring wheats have *Yr18/Lr34* resistance and there are no reports of stripe rust isolates that have virulence to the resistance conditioned by *Yr18*. Also, with the onset of the hot dry temperatures in late June and early July, stripe rust development essentially ceased in spring wheats.

The past two years have seen the most widely dispersed stripe rust development observed throughout the northern winter wheat area in at least 40 years.

Louisiana and Arkansas - During the second week in March, wheat stripe rust was found in fields in the Evangeline parish of southern Louisiana. By this date last year stripe rust already was found in northeastern Louisiana. By early April, wheat stripe rust was severe in a few fields at the 1/4 berry maturity stage in southern Louisiana. The fields in this area had centers (foci) with 40-50% severities, while throughout the rest of the field there was light infection. The rust infection centers probably developed from rust spores that arrived in early March. Stripe rust losses were significant in a few southern Louisiana fields. The hot dry weather in April slowed stripe rust development in Louisiana. By late April, only light amounts of stripe rust were found in central Louisiana wheat plots at the one-half berry stage and none had been reported in fields. In late April, the only report of stripe rust in Arkansas was in an infection center 2 feet in diameter in the east central part of the state. Last year stripe rust was severe by this date throughout the state of Arkansas. By mid-May, reports of stripe rust in Arkansas were limited to only a few areas in the east central and west central parts of the state. Losses to stripe rust were light in Louisiana and Arkansas this year.

Mideast - By mid-June, wheat stripe rust was found in northeastern Indiana plots and severities ranged from traces to 80% on flag leaves. Light stripe rust was observed in fields in northern Indiana and northeastern Ohio. Losses to stripe rust were light.

California - In early April, wheat stripe rust was found in Central Valley, California plots. In the Davis, California nursery susceptible entries had 5-40% severities. In mid-April, the moist cool conditions were ideal for increase of rust in the Davis nursery and had reached 70-100% severities in plots of

susceptible entries. By early May, wheat stripe rust was found on susceptible cultivars growing in fields in the Sacramento Valley of California. The cool moist conditions were ideal for rust development.

Washington - In late April, as usual, stripe rust was severe in the cereal disease nurseries at Mt. Vernon in the Skagit Valley in northwestern Washington. Severities of 40 to 60% were reported on susceptible wheat entries while in commercial fields traces of rust were observed. In late April, in a few eastern Washington fields, traces of stripe rust were found. In mid-May, wheat stripe rust was increasing in western Washington and traces were found on winter wheat in eastern Washington. The rains and cool temperatures provided ideal conditions for stripe rust increase in most of the Pacific Northwest. By late May, wheat stripe rust was increasing on susceptible winter wheat cultivars in the Pacific Northwest. In mid-June, 100% severities of wheat stripe rust were reported on susceptible winter wheat cultivars in plots in western Washington. In eastern Washington 40% severities were observed in some fields of susceptible varieties. In early July, wheat stripe rust was present in eastern Washington but severity levels were generally low because most cultivars are resistant except for a few fields of susceptible cultivars such as 'WestBred 470'. Stripe rust did not cause much damage on winter wheats in the Pacific Northwest this year. Since most spring wheats have good resistance to stripe rust, losses were minimal.

Canada - By late June, stripe rust was found in several locations across southwestern Ontario in plots of several varieties of winter wheat. Infections were generally localized, but spreading rapidly. Grain filling was in the early stages, so yields will likely be affected in some plots. In southern Manitoba, in early July, in winter wheat fields (anthesis stage), 1% severities and 10% prevalences of stripe rust were observed. Light losses are expected because of the low rust levels and the advanced growth stage. In late July, wheat stripe rust was widespread in southwestern Ontario, Canada, but severity was low and it was very spotty in many commercial fields and in plots no cultivar was more susceptible or resistant than the rest.

Preliminary results of stripe rust race identification show that the group of new races virulent on *Yr8*, *Yr9* and Express, that were identified last year are prevalent again this year in California and Texas.

Oat stem rust. During the third week in March, oat stem rust severities ranged from traces to 10% on the leaves of cultivars Chapman, Harrison and two experimental lines in the nursery at Beeville in southern Texas. In late March, a stem rust collection was made from wild oat (*Avena fatua*) in south Texas. In early April, in a south Texas field, oat stem rust was found and in mid-April, light stem rust was found in a central Texas field. In early May, light oat stem rust was found in central Texas plots. The cooler than normal temperatures in early spring slowed oat stem rust development throughout Texas.

In late April, in a field of the cultivar Chapman near Fairhope in southern Alabama, scattered centers of oat stem rust with 60% severities were found. The overwintering centers were 2 meters in diameter. Rust development was slow in these centers because of the cool temperatures in March, while the April weather was warmer, moisture was the limiting factor. In late April, oat stem rust was severe in nursery plots in Baton Rouge, Louisiana and the crop was near maturity. In early May, light oat stem rust was found in north central Louisiana plots. The dry weather in April in the southern U.S. slowed oat stem rust development.
In mid- July, in southern Minnesota and east central South Dakota oat plots and fields, trace to 20% stem rust severities were observed. Stem rust developed late in oat and therefore losses were minimal.

On May 25, limited oat stem rust was found on wild oats (*Avena fatua*) in Sonoma Co. California. In general, oat stem rust development is equal to last year throughout the southern U.S.

To date, oat stem rust races NA-27, -29 and-67 have been identified from collections made in Texas in early spring. Race 29 was identified from rust collections made in southern Alabama in late April.

Table 4. Preliminary identification of oat stem rust races identified through August 10, 2001

	Number of Isolates			
NA code	TX	AL	CA	LA
NA-5			4	
NA-10			4	
NA-27	18			
NA-29	35	6		6
NA-67	9			
Total Isolates	62	6	8	6
Total Collections	22	2	3	2

Oat crown rust. In late March in Beeville, Texas oat plots, crown rust was moderate to severe on susceptible cultivars. In the oat plots in the Uvalde, Texas nursery, crown rust was light and in a field in the immediate area a few pustules of crown rust were found. In early April, oat crown rust was severe in some fields in southern Texas and light in a few central Texas fields. In mid-April, crown rust was severe on common oat and wild oat (*Avena fatua*) growing alongside the road sides in central Texas. In early May, crown rust was light in fields and moderate on susceptible cultivars in plots in central Texas. In late May, 10% crown rust severities were observed in an oat field in north central Oklahoma.

By the second week in April, crown rust was light in southern Louisiana varietal plots. The average cultivar was in the late boot stage, which was about 10 days later than normal. By early May, crown rust was severe in Baton Rouge, Louisiana plots. In late April, 20% severities at the early milk maturity stage were observed in southern Alabama oat nursery plots. This year crown rust development in the southern U.S. was lighter than normal and these locations provided minimal rust inoculum for susceptible oat growing farther north.

In late June, 40% crown rust severities were observed in two oat fields in north central Kansas and south central Nebraska . During the first week in July, light crown rust was observed in oat fields in southern Wisconsin.

During the second week in May, aecial infections were observed on bushes at the St. Paul, Minnesota buckthorn nursery. The aecial development in the buckthorn nursery was 2 weeks behind last year, but near normal for this date. In late May, the plentiful moisture and warm temperatures were ideal for aecial infection. By early July, oat growing in the spreader row near the buckthorn nursery in St. Paul, Minnesota, had severe crown rust infection (60% severities) on the upper leaves. Traces of crown rust

were found on oat in the other St. Paul nurseries. In early July, trace to 40% crown rust severities were found in a east central North Dakota nursery. By mid-July, oat crown rust (trace to 60% severities) was observed in some east central South Dakota and west central Minnesota fields. Crown rust was found on cultivated oat in plots and wild oat throughout North Dakota and Minnesota in the last week of July. Severity levels were generally light to moderate on wild oat. Some oat cultivars in breeding plots in North Dakota had moderate to high levels of crown rust infections. This year crown rust was lighter than normal throughout the northern oat growing area. Since crown rust was slow to develop in the northern oat growing area, losses were less than normal.

In mid-May, 50% rust severities were observed in plots in Davis, California and a collection of crown rust was made from *Avena fatua* in Sonoma County, California.

Barley stem rust. In mid-May, the first barley stem rust of the year was reported in a south Texas nursery at Uvalde. Moderate severities were reported on a few entries in the nursery.

In late June, trace to 5% severities were reported in nurseries in east central Nebraska and east central South Dakota.

In mid- July, in southern Minnesota disease detection plots, 5% stem rust severities were noted on the barleys Robust (six-rowed) and Hypana (two-rowed). Also in mid-July, trace to 30% stem rust severities were observed on six-rowed barleys in northeast and east central South Dakota.

In mid-July, trace to 20% stem rust severities were noted on *Hordeum jubatum* (wild barley), plants growing along the roadside in eastern South and North Dakota. *Hordeum jubatum* is also a host for stem rust of wheat. In some cases it was noted that a single stem was heavily infected with stem rust but because of the dry hot weather the rust did not develop any further from the single foci.

Barley leaf rust. During the third week in March, light amounts of leaf rust were observed in barley plots at Beeville and Uvalde experiment stations in southern Texas. By early April, barley leaf rust was severe in plots at Uvalde in southern Texas. During the last week in June, light leaf rust was found on barley in east central Nebraska plots.

During the first week in June, leaf rust was increasing on susceptible barley in southwestern Ontario, but severities were low because of the cool conditions in late May and early June. By late July, barley leaf rust was severe on the upper leaves of susceptible cultivars in southwest Ontario, Canada. Due to both powdery mildew and leaf rust yields were lowered in the main barley growing regions of Ontario.

Stripe rust on barley. During the third week in March, light amounts of barley stripe rust were found on two experimental lines at the Uvalde, Texas nursery. Stripe rust was reported on barley in east central Nebraska plots in early June.

By mid-March, stripe rust was starting to increase in barley plots in the Davis, California nursery, but spread from the foci was slow. In early April, there was a low incidence and moderate severity of barley stripe rust in plots in several areas of the Central Valley and south-central coastal foothills of California. Barley was in the boot to early heading growth stage. In early April, in the large barley screening nursery in Davis, some very susceptible lines were expressing 50-80 severities which was

from natural infection but many lines were still free of rust. In mid-April, rust was increasing throughout the nursery.

In mid-April, 20% severities were reported on susceptible barley entries in the Mt. Vernon nursery in the Skagit Valley in northwestern Washington. In mid-May, stripe rust was increasing on barley in western Washington and western Oregon. By late May, barley stripe rust was increasing on susceptible barley cultivars in the Pacific Northwest. Rust development was slower than normal because of the dry conditions in mid-May, but during the third week in May weather conditions were better for stripe rust increase in most of the Pacific Northwest. In mid-June, stripe rust was severe on susceptible barley varieties in western Washington and starting to increase on varieties in eastern Washington fields. In early July, stripe rust was found in eastern Washington barley fields at low severity levels. Stripe rust severities of 75-90% were observed in some susceptible spring barleys in eastern and western Washington nurseries. Stripe rust development on barleys was limited with the hot dry weather in July. Stripe rust did not cause much damage to barley in the Pacific Northwest this year.

Rye leaf rust. In late April, traces of rye leaf rust were observed in a field in southern Georgia. In late May, light leaf rust was observed on rye in a field in south central Kansas. In mid-June, traces of leaf rust were reported in a rye field in northeastern Indiana. In early July, trace to 10% severities were reported on winter rye in east central North Dakota plots.

Rye stem rust. In mid-July, traces of rye stem rust were observed in winter rye plots in east central Minnesota. In early August, 25% stem rust severities were found in a plot of the susceptible spring rye cultivar Prolific in central North Dakota.

Stem rust on barberry. In late May, stem rust aecial infections were found on susceptible barberry bushes in southeastern Minnesota. In mid-June, a few aecial infections were observed on common barberry bushes in south central Wisconsin.

This is the last issue of the Cereal Rust Bulletin for the 2000-2001 growing season. I would like to thank all of those who helped with the bulletin this year, especially Mark E. Hughes who coordinates its distribution through the CDL website (http://www.cdl.umn.edu), email (markh@cdl.umn.edu) and the post. We would especially like to thank all our cooperators who have sent us rust reports for their area. This information was distributed to our mail list, posted and maintained on our website, and used in the preparation of the Cereal Rust Bulletins.

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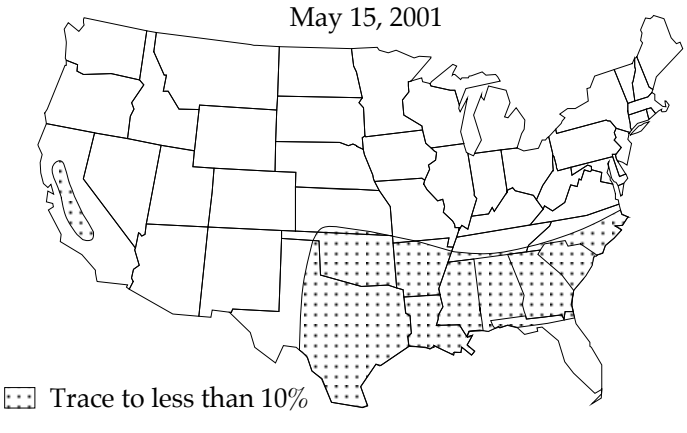
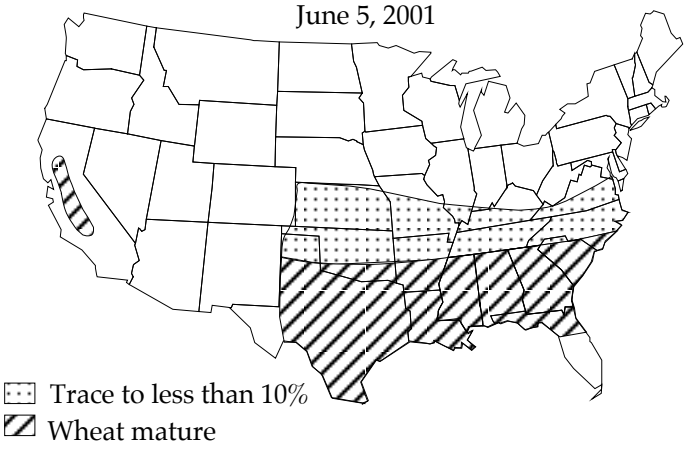
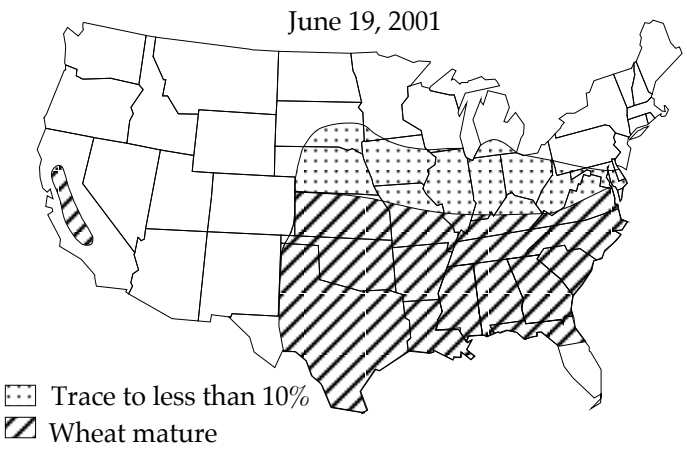
Fig. 1. Leaf rust severities in wheat fields







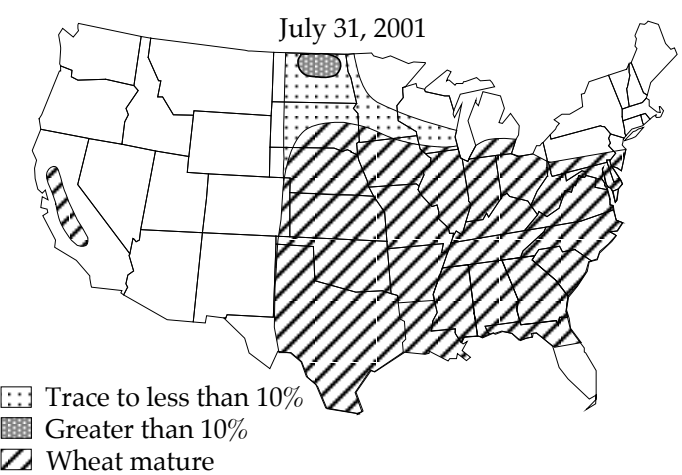


Fig. 2. Stripe rust severities in wheat fields