# CEREAL RUST BULLETIN

Final 2002 Report

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- Stem rust was found throughout the northern Great Plains on wheat, barley and oat, but developed too late to cause major damage.
- Wheat leaf rust developed earlier than normal and was more widespread and more severe than last year in the U.S.
- Wheat stripe rust was more severe in the lower Mississippi valley than last year and caused losses in states like Arkansas.
- Oat crown rust was less severe than normal.

**Wheat stem rust.** The first reports of wheat stem rust were in late April, when light amounts of wheat stem rust were found in plots in south Texas and southwest Louisiana.

In late May, traces of stem rust were found on wheat in a field and in a plot of the cultivar 2137 in central Kansas. Wheat stem rust was less severe than last year throughout the central plains area of the U.S.

During the last week in June, traces of stem rust were observed on susceptible winter wheat cultivars in central and east central South Dakota and southeastern North Dakota plots. In the western Dakotas above normal temperatures and dry conditions limited rust development.

By the third week in July, trace-20% stem rust severities were observed on the susceptible spring wheat cultivars Baart and Max in southern Minnesota, east central South Dakota and southeastern North Dakota plots. Also, during the third week in July, traces of stem rust were observed in hard red winter wheat fields in west central Wisconsin and northeastern South Dakota. By late July, 30% severities were reported in susceptible spring wheat plots and in a field in Foster County in central North Dakota.

Much of the early stem rust development in the northern plains was due to spores that were deposited with rains in June. The stem rust infections can be attributed to inoculum produced on winter wheat cultivars, e.g., 2137, farther south in the Great Plains and to the temperatures and moisture, which were ideal for stem rust infection in some areas of 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.

In late July, traces of wheat stem rust were found in fields and disease nurseries in western Washington.

**Table 1.** Preliminary identification of wheat stem rust races identified through August 6, 2002

| | Number of Isolates | | | | |
|---|---|---|---|---|---|
| Pgt code | TX | LA | KS | ND | SD |
| QCCJ | | | 3 | 4 | |
| QCCQ | | 3 | | | |
| QCMJ | | | 2 | | 1 |
| QCMS | 3 | | | | |
| QCRS | | | 1 | | |
| Total Isolates | 3 | 3 | 6 | 4 | 1 |
| Total Collections | 1 | 1 | 2 | 3 | 1 |

**Wheat stem rust race virulence –** To date, race Pgt-QCCJ (Table 1) is the most common race identified from collections made in the U.S. This race is virulent on barley cultivars with the *Rpg1* (T) gene for resistance, but is widely avirulent to most commonly grown wheat cultivars. As in the previous two years, race TPMK which was the most commonly identified race in the 1990s has not yet been identified from the stem rust collections made in 2002.

**Wheat leaf rust**. **Southern Plains** - In early January, traces of leaf rust were found in a nursery in central Texas and by the second week in February 80-100% severities were observed on lower leaves and 30% severities on the upper leaves in the same nursery. The cold temperatures in early March damaged leaves and thereby destroyed much of the rust infected leaf tissue. Drier and cooler than normal weather in March slowed rust development throughout the southern U.S.

By early-April, leaf rust was light in wheat fields and severe on susceptible cultivars in nursery plots from central Texas to Georgia. In early April, sufficient moisture in central and southern Texas allowed leaf rust to increase to 70% severity levels on flag leaves in plots at College Station and McGregor. At both locations in Texas 70% leaf rust severities were observed on flag leaves on wheat cultivars that have *Lr9* (Lockett) or *Lr41* (Thunderbolt). In drier areas of west Texas, only 5-10% leaf rust severities were observed on lower leaves.

In mid-April, wheat leaf rust was found in fields in trace to light amounts and was severe on susceptible cultivars in research plots from central Texas to South Carolina. In early May, in some wheat fields in central Texas, 60% rust severities were observed, but with the crop rapidly maturing, further infection was limited. By early May, leaf rust was light in northern Texas fields.

During the second week in March, light amounts of leaf rust were found in a few fields in central Oklahoma. In late March, only traces of leaf rust were found in wheat fields throughout Oklahoma. In early May, wheat leaf rust was light in fields and severe on susceptible cultivars in research plots from north central Oklahoma to central Alabama (Fig. 1). By mid-May, leaf rust was severe in plots and fields in central Oklahoma, however, the crop was near maturity so losses were reduced.

In 2002, leaf rust developed earlier than normal and was more widespread and more severe than last year in the southern United States. The southern rust locations provided much more leaf rust inoculum for the northern wheat growing area than last year and especially where the crop developed later than normal, i.e., eastern North Dakota and northern Minnesota.

**Central Plains** – By late April, no wheat leaf rust had been found in Kansas. In mid-May, leaf rust in Kansas was common on the flag leaves of susceptible cultivars in the south central area and light in the northern part of the state.

During the last week in May, leaf rust was severe in plots and fields of susceptible cultivars from central Kansas to west central Missouri. In fields of the cultivar Jagger at the late berry stage in south central Kansas, 60% severities were found, while in fields of Jagger in northeast Kansas, 5% severities were observed on flag leaves. In central Kansas varietal plots, rust severities ranged from trace to 60%. In southern Kansas, hot temperatures during the later part of May slowed rust development and since the crop was near maturity, losses due to leaf rust were reduced. In late May, in the plots at Lincoln, Nebraska, leaf rust was light.

In late May, 40% leaf rust severities were observed on *Aegilops cylindrica* (goatgrass) growing in the road sides in north central Oklahoma and south central Kansas. Last year in the same areas, stripe rust severities of 40% were observed on goatgrass where none was found in 2001.

This year in Kansas, leaf rust was severe in the southern part of the state in late May, but then hot temperatures slowed rust development and with the crop near maturity, less rust was produced for areas further north. By the second week in June in southeastern Nebraska fields, leaf rust incidence ranged from 30-100% and the leaves had 2 to 200 pustules per leaf. Drought-like conditions in most of Nebraska slowed leaf rust development.

**Northern** – In mid-June, light leaf rust was observed on the flag leaves of hard red winter wheats in an east central South Dakota nursery.

During the third week in June, 10% leaf rust severities were observed at anthesis in susceptible winter wheat in east central Minnesota plots. Infections were noted on flag and flag-2 leaves which probably means there were two spore showers. One spore shower occurred 7 days prior to the observation and the second occurred 16 to 21 days previously. Another interesting observation was the infections on cultivars with *Lr9* resistance, which was unusual for these plots. Traces of leaf rust were found in two fields in northwestern Minnesota the third week of June. Weather conditions were ideal for rust infection throughout Minnesota in June.

By the last week in June, 60% rust severities were reported on susceptible winter wheat cultivars in east central and south central Minnesota plots. During the final week in June, leaf rust on winter wheat was light in central and eastern areas of South Dakota. On a few susceptible cultivars like Jagger and Alliance, 30% severities were observed, but on the majority of cultivars only trace levels of infections were observed on the flag leaves. Leaf rust was more severe in Minnesota than in South Dakota since moisture conditions were more favorable for the rust infection. As in previous years, winter wheat flag leaves dried up quickly because of hot windy conditions throughout South Dakota and southern Minnesota. During the last week of June, 40% rust severities were observed on the lower leaves (Flag-2) of susceptible spring wheat cultivars in southern Minnesota plots. In most of the spring wheat cultivars growing in plots and fields only traces of rust were observed.

During the fourth week of June, trace to 20% rust severities were found in winter wheat (heading stage) in plots in east central North Dakota. In the same area, traces of leaf rust were common in fields of spring wheats (berry stage). In the Fargo, North Dakota nursery, 30% rust severities were reported in a plot of the susceptible cultivar Thatcher.

In mid-July, 30% leaf rust severities were reported on a few durum lines at the Carrington research center in central North Dakota. During the third week in July, trace-40% leaf severities were observed in spring wheat varietal plots in southeastern North Dakota and west central and southern Minnesota. In upper Midwest fields, trace to 10% severities were common. By the fourth week in July, leaf rust was present in high levels throughout northwestern Minnesota.

In early August, leaf rust was present at high severity levels in the Red River Valley of Minnesota and North Dakota. In many wheat fields the leaves had dried prematurely due to the heavy leaf rust infections combined with high temperatures. Many wheat fields had been sprayed with fungicide to reduce leaf rust. In farm fields in the Red River Valley severity levels of up to 40% were observed on the commonly grown wheat cultivars. High levels of leaf rust were also observed in fields in central and southeastern North Dakota. In the northern tier of counties in North Dakota leaf rust was at reduced levels due to very dry conditions. The wheat in this area was in poor condition due to drought stress.

This year, leaf rust was more severe in the upper Midwest than last year. More rust inoculum arrived from the southern plains and was deposited with the frequent rains in June The hot temperatures favored infection. Most of the spring wheat cultivars currently grown are moderately susceptible to leaf rust. Significant economic losses due to leaf rust occurred in northwestern Minnesota and eastern North Dakota

**Southeast** – In mid-December, leaf rust development was uniform on the lower leaves of wheat in a northeastern Arkansas field. In mid-January, light leaf rust infection levels were observed on entries in a nursery in southwestern Arkansas. By mid-February, leaf rust was found in light amounts throughout Arkansas in plots and fields. During the third week in February, leaf rust that overwintered was observed on wheat in a field in northwestern Arkansas and in plots of wheat in southwestern Arkansas. By mid-March, because of the cold weather there were no signs of leaf rust in northwestern Arkansas wheat plots. During the last week in April, 10% leaf rust severites were observed in northeastern Arkansas wheat plots and traces in fields. Leaf rust was more scattered and severe then last year in Arkansas, however, it still only caused minor losses.

In late January, leaf rust was reported in northeastern Louisiana plots. By mid-February, 20% severities were observed on susceptible cultivars in southern Louisiana. In mid March, cold weather slowed leaf rust development in the southern Louisiana plots.

During the second week in February, light amounts of leaf rust were found on the cultivar Coker 9835 in a south central Georgia nursery. By late February, rust levels were severe in the vicinity of the initial focus indicating this was likely an overwintering site for leaf rust.

In mid-April from northeastern Louisiana through Alabama and Georgia to North Carolina, trace to light amounts of leaf rust were observed in research plots. Leaf rust was widely present in trace amounts throughout the winter wheat area of the southern plains and the southeastern states.

In early May from central Louisiana to central Alabama, 60% leaf rust severities were observed on susceptible cultivars and trace levels of infection on resistant cultivars in nursery plots. In some specific locations, e.g., east central Alabama, where conditions were drier, leaf rust severities on susceptible cultivars were 10-20%. In 2002, leaf rust was scattered and more severe than last year throughout the southeastern winter wheat area of the U.S., however, losses were light.

**East** – In mid-December, leaf rust was easily observed on the variety Saluda at Kinston, North Carolina. Heavy leaf rust infections were reported for eastern North Carolina in late April to early June. In mid-May, moderately severe leaf rust was reported in eastern Virginia plots. By late-May, light leaf rust was reported in Blacksburg (western Virginia) plots. In early June, 50-75% leaf rust severities were found on susceptible cultivars in a nursery in western Virginia and east central Maryland. Traces of leaf rust were found in central New York fields in mid-June. During mid-June, light leaf rust was observed in southwestern Ontario. In 2002, leaf rust was observed throughout the eastern soft red winter wheat area, however, losses to leaf rust were light.

**Mideast** - During the second week in June, trace-40% leaf rust severities were reported in plots and trace levels in fields of soft red winter wheat cultivars from northeastern Missouri to northwestern Ohio (Fig. 1) at the early to late berry maturity stage. One exception was a 60% severity reading in a field of a susceptible cultivar in northwestern Ohio. The cooler than normal temperatures during the last part of May and first part of June slowed leaf rust development.

**California** - In early May, 75% leaf rust severities were reported on wheat in fields in the Sacramento Valley of California. Rust development was less than normal in California this year because of the dry conditions in March and April. By mid-May, leaf rust had spread throughout the Central Valley of California. In the southern San Joaquin Valley 40% severities were observed on lines and cultivars in nurseries. Leaf rust was also found on a few durum wheat cultivars and lines and moderate severity was reported on one triticale cultivar. During the third week in May, leaf rust was severe on wheat flag leaves in most commercial fields throughout the Sacramento Valley. The crop was in the latter stages of grain fill (late dough) when high levels of leaf rust developed, so yield losses to leaf rust were minimal.

**Washington** - In mid-July, wheat leaf rust was increasing on spring wheats in eastern Washington fields and susceptible wheats in nurseries had 10-20% severities. In late July, traces of leaf rust were found in commercial fields. Yield losses due to leaf rust were minimal in the Pacific Northwest this year.

**Wheat Leaf Rust Virulence** - The preliminary 2002 leaf rust race identifications from collections made in the U.S. are presented in Table 2. From the central and southern plains 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. 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. There also has been an increase in the number of T—races (TNRS, TNRJ, TNGS and TNGJ) with virulence to *Lr9, 10* and *24* in Texas. Many of the T—races with virulence to *Lr9* and *24* were identified from rust collections made from the cultivars Lockett (*Lr9* resistance) and

Thunderbolt (*Lr41* resistance). Race MBBJ was the most common race found in California as it has been for the past ten years.

**Table 2.** Preliminary identification of wheat leaf rust races identified through August 6, 2002

| Pt code[1] | Virulence formula[2] |
|---|---|
| FMMQ | 2c,3a,3ka,9,10,26,30,B |
| MBBJ | 1,3a,10,14a |
| MBCJ | 1,3a,10,14a,30 |
| MBDJ | 1,3a,10,14a,17 |
| MBDS | 1,3a,10,14a,17,B |
| MBGJ | 1,3a,10,11,14a |
| MBHJ | 1,3a,10,11,14a,30 |
| MBJR | 1,3a,10,11,17,18,B |
| MBRG | 1,3a,3ka,10,11,30 |
| MBRJ | 1,3a,3ka,10,11,14a,30 |
| MBRS | 1,3a,3ka,10,11,14a,30,B |
| MCBJ | 1,3a,10,14a,26 |
| MCDS | 1,3a,10,14a,17,26,B |
| MCGS | 1,3a,10,11,14a,26,B |
| MCRJ | 1,3a,3ka,10,11,14a,26,30 |
| MCRS | 1,3a,3ka,10,11,14a,26,30,B |
| MGBS | 1,3a,3ka,10,14a,16,B |
| MGDS | 1,3a,10,14a,16,17,B |
| PBRT | 1,2c,3a,3ka,10,11,14a,18,30,B |
| PCRK | 1,2c,3a,3ka,10,11,14a,18,26,30 |
| TCBJ | 1,2a,2c,3a,10,14a,26 |
| TCRJ | 1,2a,2c,3a,3ka,10,11,14a,26,30 |
| TCRS | 1,2a,2c,3a,3ka,10,11,14a,26,30,B |
| THBJ | 1,2a,2c,3a,10,14a,16,26 |
| THBS | 1,2a,2c,3a,10,14a,16,26,B |
| TKBS | 1,2a,2c,3a,10,14a,16,24,26,B |
| TLGD | 1,2a,2c,3a,9,11,14a |
| TLGJ | 1,2a,2c,3a,9,10,11,14a |
| TLGS | 1,2a,2c,3a,9,10,11,14a,B |
| TLHJ | 1,2a,2c,3a,9,10,11,14a,30 |
| TNGJ | 1,2a,2c,3a,9,10,11,14a,24 |
| TNGS | 1,2a,2c,3a,9,10,11,14a,24,B |
| TNRJ | 1,2a,2c,3a,3ka,9,10,11,14a,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 6, 2002

| | Number of Isolates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pt code | AL | AR | CA | GA | LA | MS | OK | TX | USA |
| FMMQ | | 2 | | | | | | | 2 |
| MBBJ | | | 10 | | | | | | 10 |
| MBCJ | | | 2 | | | | | | 2 |
| MBDJ | | | | | | | | 2 | 2 |
| MBDS | | 1 | 4 | | | | 3 | 39 | 47 |
| MBGJ | 2 | | 2 | | | | | | 4 |
| MBHJ | | | 2 | | | | | | 2 |
| MBJR | | | | | 2 | | | | 2 |
| MBRG | 2 | | | | | | | | 2 |
| MBRJ | 3 | | 1 | 6 | | | | | 10 |
| MBRS | 3 | | | | | 7 | | 1 | 11 |
| MCBJ | | | 4 | | 1 | | | | 5 |
| MCDS | | 3 | | | | | | 5 | 8 |
| MCGS | | | | | 2 | | | | 2 |
| MCRJ | | | | 5 | | | | | 5 |
| MCRS | 6 | | | 2 | | 1 | | 1 | 10 |
| MGBS | | | | | | | | 2 | 2 |
| MGDS | | | | | | | | 8 | 8 |
| PBRT | 2 | | | | | | | | 2 |
| PCRK | | | | 2 | | | | | 2 |
| TCBJ | | | | | | | | 2 | 2 |
| TCRJ | | | | | 2 | | | | 2 |
| TCRS | 2 | | | | 2 | | | | 4 |
| THBJ | | | | | | | | 5 | 5 |
| THBS | | | | | | | | 8 | 8 |
| TKBS | | | | | | | | 3 | 3 |
| TLGD | | | | 2 | | | | | 2 |
| TLGJ | 1 | 1 | | 13 | 9 | | | 3 | 27 |
| TLGS | | 2 | | | 6 | | | | 8 |
| TLHJ | | | | | | | | 2 | 2 |
| TNGJ | | | | | 3 | | | 6 | 9 |
| TNGS | | | | 1 | | | | 4 | 5 |
| TNRJ | | | | | | | | 6 | 6 |
| TNRS | | | | | | | | 20 | 20 |
| Total isol | 21 | 9 | 25 | 31 | 27 | 8 | 3 | 117 | 241 |
| Total coll | 14 | 6 | 14 | 17 | 14 | 5 | 2 | 67 | 139 |

**Wheat stripe rust. Great Plains -** In mid-January, hot spots (70-80% severities) of stripe rust infection were found in central Texas wheat plots. This is a classic example of overwintering stripe rust and the result of primary infection not long after seedling emergence in the fall. Stripe rust development was much earlier in these plots than last year. In early February, stripe rust was at light levels in plots in southern Texas. By early March, stripe rust was slowed by cold temperatures in southern Texas plots, but was uniform across the nursery at 50-70% severity on lower leaves. During the third week in March rain improved conditions for rust development in much of central and southern Texas. Stripe rust requires cool temperatures (generally less than 70 F) and moist conditions for infection and development.

In early April, light stripe rust was found in wheat fields in southern and central Texas and rust readings ranged from trace levels to approximately 40% severity in southern Texas nurseries. Last year in early April, stripe rust caused complete losses in many of the cultivars in southern Texas nurseries. But in 2002 in the same plots, stripe rust was severe on the lower leaves, but had not developed onto the upper leaves because of dry and cool weather in March. Stripe rust severities on soft red winter wheat cultivars generally were higher than those on the hard red winter cultivars in the southern and central Texas nurseries. Jagger and Cutter are two cultivars that had the best stripe rust resistance in the Uvalde nursery in southern Texas.

By mid-April, wheat stripe rust development in central Texas had slowed in some areas, but was still active despite the warm weather in some plots in south central Texas. From initial collections made in central Texas, race PST-79, which was very prevalent in Texas and Great Plains last year was identified. By late April, the warmer temperatures slowed stripe rust development in central Texas and eastern Oklahoma.

During the first week in May, wheat stripe rust was still active on some cultivars in northern Texas plots (Fig. 2). Also in early May, severe wheat stripe rust was reported in some north central Oklahoma plots, while in fields in the same area rust was light or not found. In early May, stripe rust was observed in south central Kansas and since wheat was in the full berry developmental stage yield impact was minimal. In mid-May, a 2-meter foci of stripe rust was found in a plot of the highly susceptible cultivar Lakin in northeastern Kansas. In late May, traces of stripe rust were found in central and southern Kansas plots and fields. In late May, traces of stripe rust were found in wheat plots in east central Nebraska.

There was much less stripe rust found in Oklahoma and Kansas in 2002 than in 2001. In both 2001 and 2002, cool spring and nighttime temperatures in the 40s and 50s, plus humid weather were conducive for stripe rust development throughout the Great Plains, but the rust inoculum load from Texas was less, which accounted for the reduced stripe rust development in 2002.

In 2001, there were extensive stripe rust infections throughout the northern plains hard red winter wheat area, but this year there were no reports of stripe rust found.

**Louisiana, Arkansas and Missouri**. In mid-March, stripe rust was severe in observation plots in a southern Louisiana nursery. By mid-April, stripe rust infections of 40% severity were found in fields in northeastern Louisiana. Then temperatures of 80 degrees F and higher, slowed the development of stripe rust. Across all of Louisiana, stripe rust was at moderate levels, and a number of fields were sprayed with fungicides to reduce yield losses. Significant amounts of stripe rust have occurred in three of the last five years in Louisiana. Wheat lines Coker 9663 and AGS 2000 were resistant to stripe rust in Louisiana.

By the third week in February, hot spots of rust infection (foci) were observed on wheat in a field in northwestern Arkansas and were found in plots of wheat in southwestern Arkansas. In mid-March, cold temperatures killed the stripe rust in northwestern Arkansas plots. In late March, stripe rust was found in wheat fields and variety demonstration plots in east central Arkansas. In mid-April, warm weather slowed the development of stripe rust in Arkansas. By the first week in May, stripe rust development had slowed in southern Arkansas, but in the northern part of the state, rust infections were still viable.

In 2002, stripe rust developed in the lower Mississippi Valley area due to adequate moisture and cooler temperatures that allowed the rust to infect and spread over a larger geographic area. Stripe rust caused significant yield losses in Arkansas in 2002, being the most important disease of wheat this year. Infection levels of up to 95% severity at flowering stage were seen in fields and research plots. The fungicide Tilt was widely used to reduce stripe rust infections and yield losses. This year in Arkansas stripe rust was not as severe as in 2000 since the cultivar CK 9663 (which comprises half of the acreage) was more resistant in 2002.

During the third week in May, 40% stripe rust severities were observed on flag leaves of soft red cultivars at the late berry stage in west central Missouri. This year more stripe rust overwintering sites occurred further east in the U.S. than last year when overwintering sites were more concentrated in the Texas and Oklahoma area. Where stripe rust spores are deposited in late fall and create potential overwintering sites is very critical to where stripe rust will develop the next year.

**Southeast** - In mid-April, light amounts of stripe rust were found in southern Alabama wheat plots. In early May, stripe rust was found in plots in north central Alabama. Severities ranged from traces to 40%.

**Virginia and Maryland** - In mid-May, traces of stripe rust were found scattered throughout the state of Virginia. In late May, wheat stripe rust was more severe than normal in the plots at the Blacksburg, Virginia experiment station. In mid-June, stripe rust was found in east central Maryland wheat plots.

**Mideast -** During the third week in May, stripe rust foci were found in 3 plots at the Southwest Purdue Ag Center in Knox County, Indiana. The wheat was in the early milk stage. The rust was most severe on the flag leaves, so it probably was from a spore shower in early May.

In mid-June, trace to 10% stripe rust severities were observed in plots and traces in fields of soft red winter wheat cultivars in northeastern Missouri to northwestern Ohio (Fig. 2). In mid-June, traces of stripe rust were found in winter wheat plots in south central Wisconsin. Stripe rust development in the northern soft red winter wheat growing area was less than last year.

**California** - By late April, moderate to severe wheat stripe rust had been reported on susceptible cultivars in the Sacramento/San Joaquin Valley Delta and the Sacramento Valley. In mid-May, stripe rust of wheat had spread throughout the Central Valley of California. Despite the warmer, drier climate of the southern San Joaquin Valley, stripe rust was easily detected (80% severity/20% incidence), in commercial fields in the southern end of the valley. In the San Joaquin Valley, some durum wheat cultivars also had stripe rust infections, but at lower levels than hard red wheat. This year stripe rust development in California was less than normal because of the drought-like conditions in late winter.

**Pacific Northwest** - The 2002 wheat stripe rust epidemic was the most severe in the last five years in the Pacific Northwest. Stripe rust severity of 100% occurred on susceptible entries in wheat nurseries in western Oregon, western Washington, eastern Washington, and northern Idaho. Although some susceptible winter wheat cultivars with small acreage had severe rust, the stripe rust epidemic mainly affected spring wheat crops in eastern Washington and northern Idaho. The recently released 'Zak' cultivar, which was grown on over 93,000 acres in Washington and ranked the second most common spring wheat cultivar for this in 2002, and some other spring wheat cultivars were susceptible. Most of susceptible spring wheat fields were sprayed with fungicides. Stripe rust caused multimillion-dollar yield losses as well as fungicide cost and application.

Race PST-78 (virulent on Lemhi, Heines VII, Lee, Fielder, Express, *Yr8*, *Yr9*, Clement, and Compair) and similar races, which were predominant in California, south central states, and the Great Plains in 2000, 2001, and/or 2002, became prevalent in the Pacific Northwest in 2002. The relatively warm winter and cool spring weather plus periods of rain were favorable to survival and development of the rust. The relatively large acreage of susceptible cultivars like Zak made the severe and large-scale epidemics possible. Fortunately, the predominantly grown spring wheat cultivars Alpowa (about 280,000 acres in Washington) and most of winter wheat cultivars (over 70% of total wheat acreage in Washington) still showed good high-temperature, adult-plant resistance.

**Oat stem rust.** In early April in the southern Texas nursery at Uvalde, an overwintering site of oat stem rust was found on the cultivar Harrison. Stem rust infections at 5% severity were found on the sheath of the oldest tiller in this plot. In mid-April, stem rust was light in plots in Uvalde and College Station, Texas. In late April, traces of oat stem rust were found in central Texas plots. In early May, significant amounts of oat stem rust were observed in southern Texas plots at Uvalde. Thirty-eight of 40 entries had `S' type reaction types. TAM 397 and Horizon were severely rusted and in tests done in previous years stem rust was not observed on these two varieties. In seed production fields of TAM 397 near Castorville, Texas, large stem rust pustules were found on oat plants throughout the field. Many of the plants still were green because of regrowth after the freeze damage in March. These late developing tillers were the best places for the stem rust to develop. Almost every year in Texas, oat stem rust has developed late in the season on later maturing oats. By mid-May, oat stem was severe in oat plots and fields in central Texas.

During the third week of April, stem rust had increased in oat plots at Baton Rouge, LA, where moisture and temperature conditions were ideal for stem rust development. By the first week of May, overwintering foci of oat stem rust were found in central Louisiana, northeastern Louisiana and west central Mississippi varietal plots. Severities in the middle of the foci ranged from 20-60%, while a meter from the center severities were trace-1%.

This year oat stem rust development in the southern U.S. was heavier than normal and these locations provided rust inoculum for susceptible oat growing farther north.

In late June, trace amounts of oat stem rust were found in fields in northwestern Iowa and south central South Dakota.

During the third week in July, traces to 20% severities of oat stem rust were found in fields and plots at the late berry growth stage throughout southern Minnesota. By late July, traces to 40% severities were reported in spring oat plots and in Foster County in central North Dakota.

Oat stem rust was more scattered than last year throughout the northern oat-growing area. Inoculum arrived from locations further south with frequent rains. The hot temperatures were good for rust development. Most current oat cultivars are not resistant to stem rust. Losses to oat stem rust occurred in many fields in the northern oat growing area.

In early May, severe oat stem rust was found in plots in the central coast region of California.

To date, oat stem rust races NA-27 and 29 have been identified from collections made in the U.S. In 2001, NA –29 race (*Pg-1,-2,-3,-4,-8,-15* virulence) was the most commonly identified race from oat collections.

**Table 4.** Preliminary identification of oat stem rust races identified through August 6, 2002

| | Number of Isolates | | |
|---|---|---|---|
| NA code | TX | LA | FL |
| NA-27 | 8 | | 4 |
| NA-29 | 9 | 2 | 1 |
| Total Isolates | 17 | 2 | 5 |
| Total Collections | 6 | 1 | 2 |

**Oat crown rust.** In early February, crown rust was found in southern Texas fields. By early April, oat crown rust was severe in plots in a central Texas nursery at Giddings, where there was adequate moisture for rust development. Traces of crown rust were found in grazed oat fields in southern Texas. In mid-April, crown rust was light in nurseries at College Station and McGregor, Texas, but severe in roadside oat (common and *Avena fatua*) throughout central Texas. Crown rust hot spots were found in plots at Uvalde, Texas. In mid-April, crown rust was severe in plots at Giddings where some lines approached 100S. In early May, trace amounts of crown rust were found in varietal plots in north central Texas.

In mid-March, crown rust was set back by the cold weather and was hard to find in southern Louisiana plots. During the first week in May, 60% severities were observed in varietal plots in central Louisiana, east central Mississippi and traces in west central Alabama. In fields in central Louisiana 20% severities were observed.

In mid- June, traces of crown rust were found in a field in southeastern Iowa. By the last week in June, trace to 5% severities were observed on lower leaves of oat in south central Minnesota. In fields in northwestern Iowa and southeastern South Dakota trace to 20% severities were found at the early berry stage. By late June, oat crown rust had developed very slowly in the upper Midwest. During the third week in July, trace to 60% oat crown rust severities were found in fields and plots at the late berry maturity growth stage throughout southern Minnesota. Conditions were good for crown rust development throughout much of the oat growing area in Minnesota and Wisconsin. However, since the initial rust inoculum from the south was less than normal and the rust developed on the alternate host buckthorn slower than normal in the northern areas, crown rust infections were less than normal throughout the northern oat growing area. In general economic losses to oat crown rust were reduced in the northern oat-growing area.

In mid-May, light crown rust was found in a San Joaquin Valley, California field.

**Buckthorn.** During late April, buds on buckthorn, the alternate host for oat crown rust, were just beginning to break in the buckthorn nursery at St. Paul, Minnesota. This was much later than normal, due to the prolonged cool temperatures in April and May.

By the third week in May, aecia were found on the 10% of the leaves that had emerged from buckthorn, at the St. Paul, Minnesota nursery. Despite the slow leafing out of the buckthorn due to the prolonged cool temperatures in April and May the appearance of aecia was near the average date observed.

In late May, crown rust aecial infections were moderate to severe at the St. Paul buckthorn nursery. Uredinial infections were observed on oat in spreader rows in the nursery on June 3. Adequate moisture and warm temperatures were ideal for infection. The buckthorns at the University of Minnesota Experiment Station at Lamberton had more crown rust infections than observed in recent years. Relatively light aecial infections were found on buckthorn bushes at Red Wing, Minnesota and Grantsburg, Wisconsin in late May and early June, respectively.

In mid- June, moderate to severe crown rust infection was observed on lower leaves of oat in spreader rows close to the St. Paul, Minnesota buckthorn nursery.

Crown rust aecia were found on buckthorns growing in a hedge at Ithaca, New York in early May.

**Barley stem rust.** The first report of barley stem rust was during the third week in July, when trace-10% severities were reported in plots of susceptible two and six-rowed cultivars in plots in southern and west central Minnesota and traces in fields in northeastern South Dakota. In mid-July, traces of stem rust were found on the six-rowed barley Robust, which has the T-gene, in a field in northwestern Minnesota. By late July, traces-5% stem rust severities were reported in barley fields and plots from central North Dakota to northwestern Minnesota. Light losses occurred in some of the fields, especially the late planted ones.

In mid-July, traces-5% stem rust severities were reported on wild barley (*Hordeum jubatum*) plants growing alongside the roadway in west central Minnesota and east central South Dakota. This year the rust did not develop on wild barley as extensively and early as in previous years because of the cooler than normal spring in the northern Great Plains. However, if current spring wheat cultivars were more susceptible to stem rust, the stem rust infected wild barley would be a good source of inoculum and substantial yield losses would likely occur.

**Barley leaf rust**. In early April, 60% severities were observed in a plot of the P-721 line at Uvalde, Texas in southern Texas. By late April, 80% severities were reported in barley plots in central Texas.

In late April, 5-40% leaf rust severities were observed on barley lines in nurseries in eastern Virginia.

During mid-May, 60% severities were observed on barleys in nurseries in the San Joaquin and Sacramento Valleys of California.

In early July, 40% leaf rust severities were reported on lower leaves in susceptible spring barley plots in east central and southern Minnesota. Losses to barley leaf rust were minimal.

**Stripe rust on barley.** By mid-May, barley stripe rust was severe in the Sacramento and San Joaquin Valleys of California. Plots of many susceptible cultivars and lines in nurseries had 100% severity and 100% incidence.

In 2002, stripe rust of barley occurred in Oregon, Idaho, and Washington. On susceptible barley entries, over 90% severity levels occurred in nurseries at Mt. Vernon in northwestern Washington and over 70% severity levels occurred in nurseries near Pullman in southeastern Washington. Trace to 10% stripe rust severities were observed in commercial barley fields in eastern Washington and northern Idaho.

**Rye leaf rust**. In early April, 60% rye leaf rust severities were observed in plots of winter rye in a central Texas nursery at Giddings. In this area moisture conditions were more suitable for rust development than in other parts of the state.

In early April, 20% leaf rust severities were observed on rye growing in plots in Plains, Georgia. During the first week in May, 10% severities were observed on winter rye in fields in west central Georgia.

In late May, moderate 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.

By late June, 60% severities of leaf rust were found on upper leaves of winter rye and trace-1% severities in spring rye in east central Minnesota plots.

**Rye stem rust**. There were no reports of rye stem rust this year.

**Stem rust on barberry**. In mid-May, aecial infections were found on susceptible barberry (alternate host for stem rust) in south central Wisconsin.

In late May, stem rust aecial infections were found on susceptible barberry bushes in southeastern Minnesota. In mid-June, aecial infections were common on barberry bushes in southeastern Minnesota.

**Other stem rust grass hosts**. By mid-July, 20-60% stem rust severities were observed on quackgrass (*Elytrigia repens*), redtop (*Agrostis alba*), and timothy (*Phleum pratense*) in southeastern Minnesota.

This is the last issue of the Cereal Rust Bulletin for the 2001-2002 growing season. I would like to thank all of those who helped with the bulletin this year, especially Mark Hughes who coordinates its distribution through the CDL website (http://www.cdl.umn.edu) and email (markh@cdl.umn.edu). All rust situation reports were greatly appreciated. All messages were placed on our web page and used in the preparation of the Cereal Rust Bulletins.

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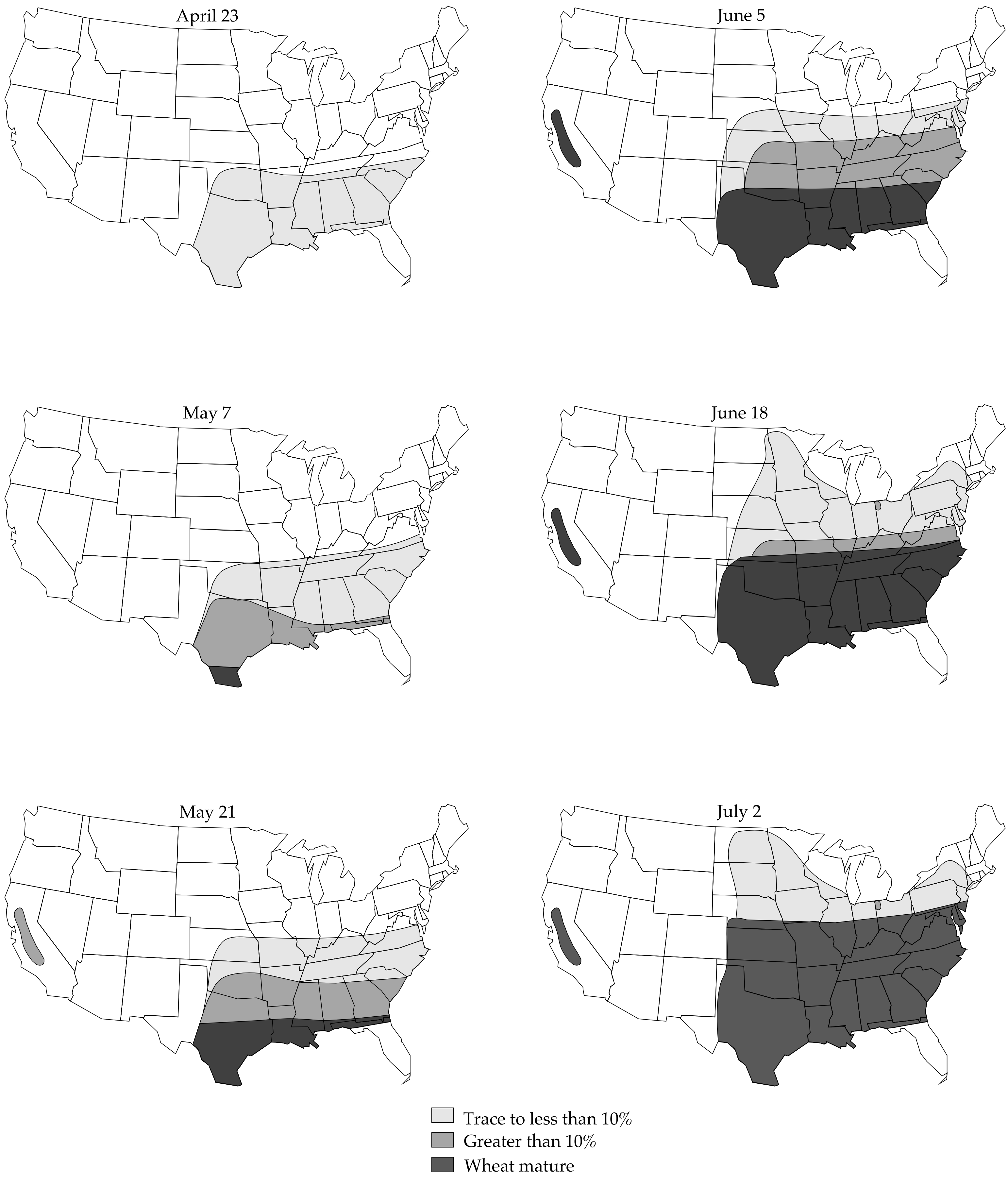
Fig. 1. Leaf rust severities in wheat fields in 2002.



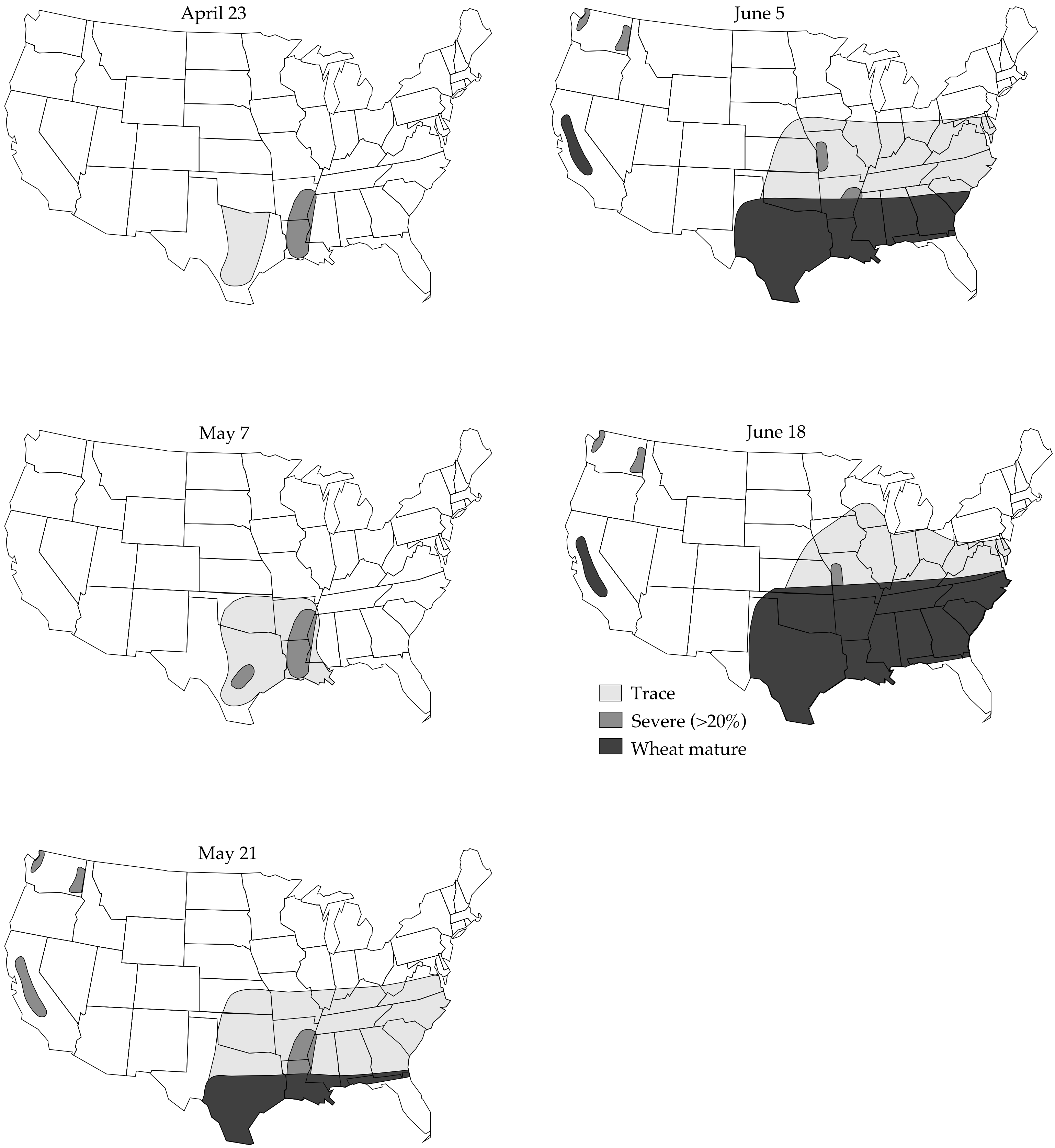



Fig. 2. Stripe rust severities in wheat fields in 2002.