CEREAL RUST BULLETIN

Report No. 1
April 14, 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
Tel. 612/625-6299 Fax: 612/649-5054

Issued By:
AGRICULTURAL RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE
(In cooperation with the Minnesota Agricultural Experiment Station)

The mild winter with ample moisture in much of the U.S. small grain cereal area has created optimism for a good crop in 1993. Wheat in southern Texas is in fair to good condition and about one week later than normal maturity. In the southeastern soft red winter wheat area the crop is in good shape and near normal maturity. A mid-March freeze caused scattered and light damage except on the earliest maturing cultivars. A cool spring will delay spring planting in the northern regions.

Wheat stem rust. During the last week in March, an area of severe stem rust was found in a 1200 acre area in Wharton county, Texas (65 miles southwest of Houston). In this area the cultivars Coker 9835, Coker 9323, and Mit had severities of 80, 30 and 10% respectively, however, the only location where Mit was found to be infected was near the other two cultivars. The current growth stage should be full berry. The heads of the Coker lines were killed by a mid-March freeze but some leaves and stems were still green and producing large numbers of spores at the end of March. Mit did not suffer from the freeze and should continue to be a source of inoculum until early May. Another stem rust infected wheat field (cultivar 2813) was found 45 miles south of San Antonio. In this field each tiller was infected, although the severity was low (1%). Stem rust was also present at low levels in a McNair 701 trap plot in Beeville, Texas. By the second week in April, traces of stem rust were found in Coker 9835 plots in Dallas, Texas. Conditions are similar to 1986 when stem rust spread from soft red winter wheat fields south of Houston to the southern Great Plains. This year there is a large stem rust inoculum source in southern Texas and susceptible cultivars (i.e. Chisholm and 2157) are grown on considerable acreage. However, the one variable which we cannot predict is the favorability of climatic conditions for disease development. If the temperatures are warm (≥50 F) during the dew or rainfall periods more stem rust could be expected further north in the Great Plains. However, if dew periods are cool (<40F) little disease will develop .

Wheat leaf rust. Leaf rust severities are generally light on southern soft red winter wheat and susceptible wheats in plots and fields from southern Louisiana to eastern Virginia (Fig. 1). The winter was mild and rainfall in these areas was above normal creating favorable conditions for rust infection, however, a mid-March freeze killed some of the rust-infected tissue. Since then rain and cool temperatures have slowed leaf rust spore production and movement. Severe rust (40% severity) was observed on Coker 9877 in a Baton Rouge, Louisiana nursery in early April. This cultivar has Lr

9 + 24 resistance which had held up for many years. On the susceptible cultivars Fla 302 and Coker 9766, 30-50% severities were observed in southern Alabama and northwestern Florida plots during the third week in March.

In early March, moderate (10-40%) leaf rust severities were reported on wheat growing in northeastern Mexico fields. Even though leaf rust is widespread across southern Texas, it is less severe than normal. In the southern plains of Texas wheat fields were planted late, therefore, less leaf rust overwintered than normal. In a Wharton county Texas soft red winter wheat field of Coker 9323, 60% severities were observed on 100% of the plants. In a spring wheat field in southern Texas, a 20% severity was observed, however, in most of the winter and spring wheat fields in southern Texas only light amounts of rust were found the last week of March. The main cultivar in this area is Mit which was resistant to leaf rust. Generally, leaf rust overwinters throughout southern Texas. Late planting (December) and lack of moisture are the factors other than resistance which restricts disease development. During late March leaf rust was observed in irrigated plots at Chandler, Arizona. Leaf rust does not occur in this area every year.

During the 1992-93 winter, leaf rust survived in much of eastern and southern Kansas, but in lighter amounts than during the 1991-92 winter. However, in Gove Co. in northwestern Kansas on TAM 107 a 1% severity and 100% incidence were recorded during late March. Leaf rust was heavy on volunteer wheat last fall in this area. Leaf rust is light throughout Kansas and the cool and wet weather have been ideal for Septoria development until conditions change and rust will not increase drastically.

Wheat stripe rust. Stripe rust was reported in mid-February on two susceptible cultivars in Arkansas. By late February, the progress of the disease was reduced and the number of spores on infected leaves significantly decreased. In late March, stripe rust was not found in Arkansas. In early March, heavy stripe rust was found on many cultivars and lines in a central Louisiana nursery, however, by late March stripe rust development had slowed and very little stripe rust increase is expected in the future.

During late March, light amounts (trace-5% severities) of stripe rust were found in two fields in southern Texas at the berry stage. At the Uvalde nursery in southern Texas, 40% severities were observed on March 31 on the soft red winter wheat cultivar McNair 701. Stripe rust is retarded by high temperatures. NOTE: Stripe rust urediniospores are vulnerable to heat and do not survive long at warm temperatures, therefore, if shipment of collections for race identification is delayed their viability will be poor. Please send wheat stripe rust collections (10 or more rusted green leaves) as soon as possible after collecting to: Dr. Roland Line, USDA-ARS, 361 Johnson Hall, Washington State University, Pullman, WA 99164-6430.

Oat stem rust. Oat stem rust was reported in early March in a northeastern Mexico field. The only stem rust observation in Texas was traces in the nursery at Beeville during the last week in March. This is less rust than usual at this time of year. In severe rust years oat stem rust can be widespread along the Gulf Coast from Texas to Florida. Late planting and perhaps less inoculum in the fall were the main factors in the low level of disease. Little winter oats are grown north of this area thus this disease will likely not be important in 1993.

Oat crown rust. The first report of oat crown rust this year was in northeastern Mexico fields (10-30% severities) in early March. During the last week in March, severe crown rust was observed in southern Texas nurseries and fields at heading through the milk growth stage. Many fields in this area will suffer yield losses or greatly reduced grazing value because crown rust killed the foliage. During the second week in April traces of crown rust were observed in plots at Temple, Texas in the central part of the state. In late March, crown rust was severe on oats in the Baton Rouge, Louisiana nursery. During mid-March severe crown rust was found on the cultivar Simpson in southern Alabama plots. The severe and widespread crown rust is comparable to the rust development of last year in the southern area of the U.S. South Texas could directly provide inoculum for the northern oats emerged by early May. Otherwise crown rust would need to increase in central and northern Texas to infect the northern crop. Another important northern inoculum source is aeciospores from buckthorn.

Barley stem rust. As of April 12, no barley stem rust has been reported on barley in the United States this year. Limited amounts of barley are grown commercially in the southern states. Stem rust on barley often is not found in this area.

Barley leaf rust. By the last week in March, no leaf rust, caused by Puccinia hordei, was observed on barley in southern Texas. Leaf rust was found in Mesa, Arizona winter increase plots the last week in March. Leaf rust is generally a minor barley disease in the Northern Plains. Leaf rust overwintered in light amounts in eastern Virginia. Since the advent of Rph-7 virulence in the winter barley along the Atlantic Coast leaf rust in this area has resulted in severe losses.

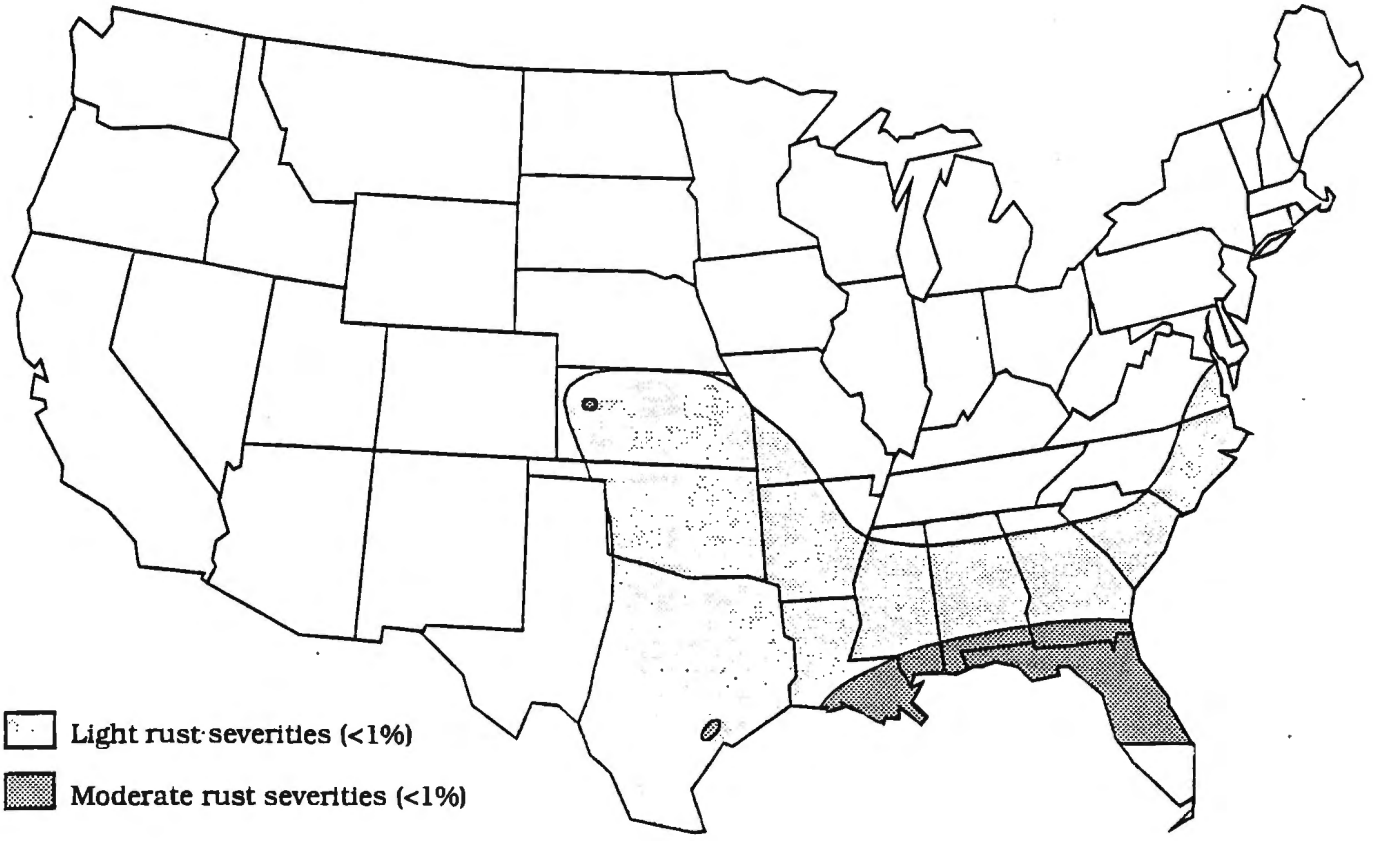
Barley stripe rust. During the third week in March moderate amounts of stripe rust were observed at many locations in a Chandler, Arizona barley nursery. By the last week of March, stripe rust was found in barley plots at Uvalde (40% severity), Dallas and Amarillo (trace severity), Texas. Little barley is grown commercially in this area. Last fall significant stripe rust was found in south central Colorado on barley at maturity. Unfortunately, these cultures did not survive for race typing.

Barley stripe rust collections should be sent to the Cereal Rust Lab, St. Paul, MN or to Dave Marshall, Texas A&M Univ. Res. & Ext. Center, 17360 Coit Rd, Dallas, TX 75252.

Rye rusts. Light amounts of rye leaf rust were noted in southern Georgia plots in mid-March. No stem rust has been reported in the United States as of this date. Due to the winter hardiness of rye tissue these diseases can survive much further north, so rust still may appear.

Other rusts. Light amounts of leaf rust were observed on Lolium perenne and Bromus plants during the last week in March in Texas. Hordeum pusillum growing in roadside ditches throughout southern Texas had 1% severities. This leaf rust which is caused by Uromyces hordeinus does not attack commercial barley cultivars.

Fig. 1. Leaf rust severities in wheat fields on April 14, 1993.



CEREAL RUST BULLETIN

Report No. 2

May 5, 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
Tel. 612/625-6299 Fax 612/649-5054

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(In cooperation with the Minnesota Agricultural Experiment Station)

The winter-sown small grain crop is generally in good condition. Wheat in northern Texas is 7-10 days behind normal. In Kansas, wheat development is behind normal due to cool, damp weather during most of the spring. Throughout the spring grain growing area, the cool temperatures and scattered precipitation have delayed field work and planting progress is well behind average.

Wheat stem rust. During late April, traces of stem rust were found scattered throughout fields of the awnless cultivar Wintex at the quarter berry stage in central Texas. In trap plots of McNair 701 at the half berry stage in central Texas, 5% severities were observed on 10% of the plants on April 26 and in north central Texas traces of stem rust were found on April 30. Moisture has been adequate in these areas but the weather has been cool especially at night. As temperatures warm up, more stem rust may develop and provide more inoculum for the areas farther north.

Stem rust was starting to increase in northern Louisiana the last week in April, while in south central Louisiana 50% severities were observed on 100% of the plants in a nursery plot at early milk. In southwestern Alabama plots, 20% severities were observed on 40% of the plants during late April. The number of stem rust infected sites in the southern U.S. is greater than normal for this time of the year and the crop is later than normal.

The southern Texas stem rust collections made in early April of 1993 were not the QCC race which attacks barley.

Wheat leaf rust. During late April, it was common to observe 20% leaf rust severities on susceptible wheat cultivars in central and north central Texas fields at the late flowering to quarter berry stage. In nurseries, leaf rust ratings ranged from a trace to 60% severity. There was less rust observed this year than last year on the same date which probably was due to the cooler than normal temperatures and less leaf rust overwintering in 1993. In north central Texas, a 60% severity was observed in clumps of Triticum cylindricum (Aegilops cylindrical) growing along the roadside. In a field of wheat that was growing less than 3 feet from the T. cylindricum no leaf rust was found. The rust identified from this wild species generally is avirulent on *Lr* 3 and 10 as well as all of the newer resistances.

During the last week in April, normal amounts of leaf rust were observed in Kansas even though temperatures were cooler than normal. However, severities and incidences are much higher in western Kansas where more volunteer wheat existed last fall. Little movement of the disease up the plant has been noted in the past two weeks. Last year, leaf rust was much more severe and losses were heavy.

In late April, leaf rust was moderate to heavy and increasing throughout Louisiana. In Arkansas, severe leaf rust levels were observed in isolated fields where susceptible cultivars were grown. In most fields leaf rust was present in the low to mid canopy and was very seldom found on the flag leaf. In the rest of the southern soft red winter wheat area from central Mississippi to central Georgia, rust is severe on susceptible cultivars in plots but rust is moderate to light in fields and slowly increasing.

In early April, 30% leaf rust severities were found in wheat fields in the San Joaquin Valley in California.

From collections made from the susceptible cultivar Redhart at Baton Rouge, Louisiana in mid-February the following leaf rust races were identified: TBG-10, MBG-10, TDG-10, MDB-10, KBG-10 and PNB-10. The PNB-10 race represented by a single isolate is virulent on 9 & 24 and is the race that rusted Coker 9877.

Wheat stripe rust. In late April in Louisiana, stripe rust development has been reduced because of warmer weather, but the rust had an impact on yield because of the severity in many fields. In some cases the entire leaf surface area was diseased and in a few cases many pustules were found on the head. In southeastern Arkansas in late April, stripe rust was increasing in severity and incidence. The rust was first noticed in mid March and by early April rust development was thought to have ceased; however,the newer leaves are now rusted.

During the last week in April, foci of stripe rust were found in soft red winter wheat plots in central and north central Texas. Generally, 10 % of the leaf area was covered and 10% of the plants were infected in a plot. In plots at Temple, Texas the heaviest stripe and stem rust occurred in the exact same foci.

During the last week in April, significant of amounts of stripe rust were observed in wheat cultivars in the northwestern Washington area. Severities of 20% were observed on the most susceptible lines in the Mount Vernon nursery.

Oat stem rust. In late April, oat stem rust was increasing rapidly at Beeville, Texas. During the last week in April oat stem rust was found within 75 miles of the Gulf Coast in nurseries at Quincy, Florida (80% severity) and Fairhope, Alabama (25% severity). No oat stem rust was found in north central Texas during the last week in April.

Oat crown rust. In oat fields throughout Louisiana, crown rust was severe the last week in April. In oat plots in central and north central Texas, 20% severities were observed the last week in April while in fields only traces of rust were found. This widespread crown rust is comparable to the rust development of last year in the southern U.S.

Barley stem rust. As of May 4, no stem rust has been reported on barley in the United States this year. Limited amounts of barley are grown commercially in the southern states. Stem rust on barley often is not found in this area.

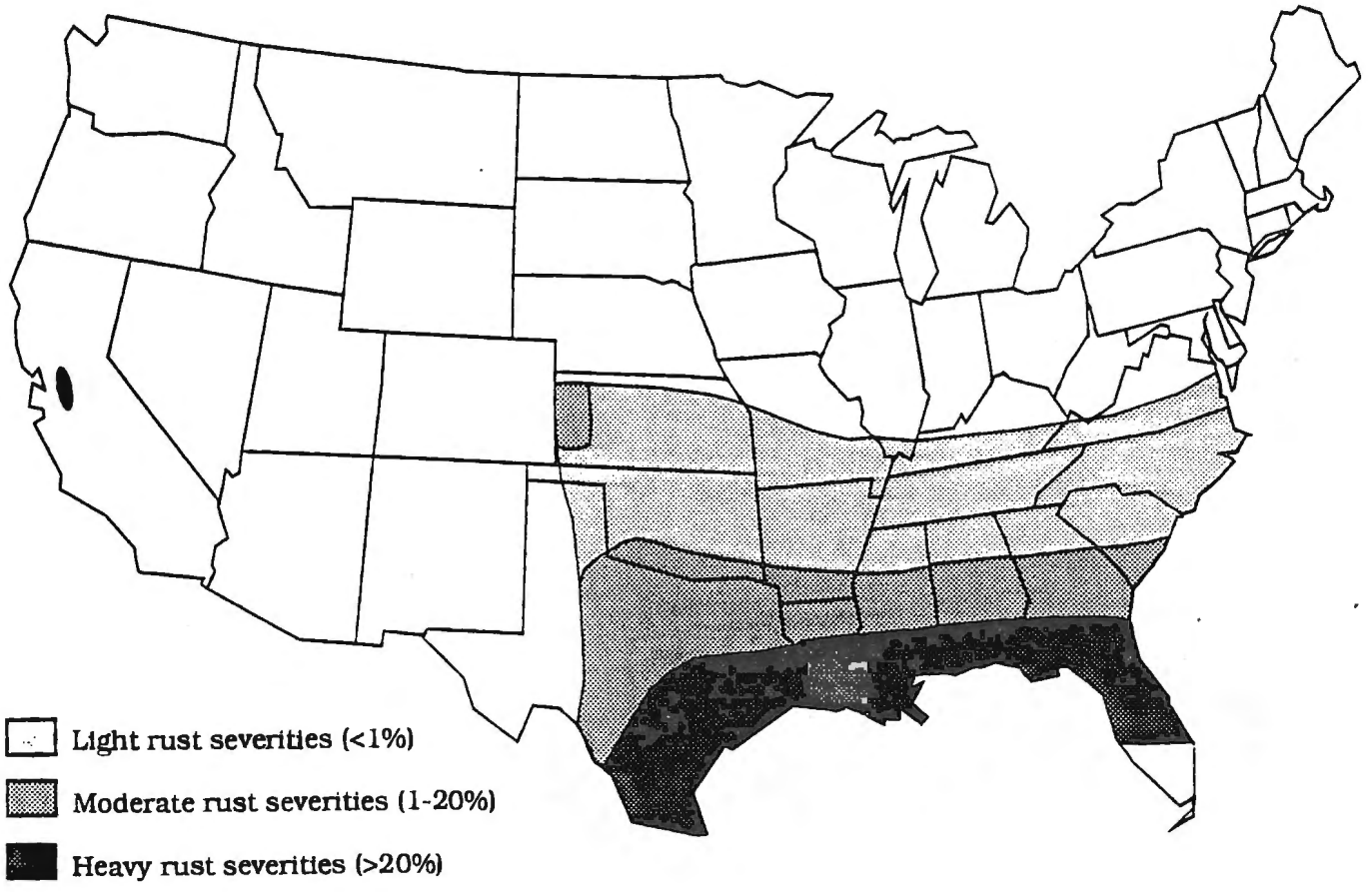
Barley leaf rust. Light amounts (1% severity) of barley leaf rust were found in plots and fields in north central Texas during the last week in April. Leaf rust is seldom a problem in central and northern Texas.

Barley stripe rust. During the last week in April barley stripe rust was severe in barley plots of susceptible cultivars in north central Texas at Prosper and central Texas at McGregor. Other barleys in these plots had severities ranging from traces to 20%. Stripe rust was reported in Salano County, California this week. If it increases it is likely to move into the Pacific Northwest.

Rye rusts. In rye plots in north central Texas, traces of leaf rust were found in late April. A rye stem rust collection was made in plots in southwestern Georgia.

Other rusts. Stem rust on fescue (40% severity on 50% of the plants) was found in west central Louisiana in late April.

Fig. 1. Leaf rust severities in wheat fields on May 4, 1993.



CEREAL RUST BULLETIN

Report No. 3
May 19, 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
Tel. 612/625-6299 Fax: 612/649-5054

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The majority of the winter-sown cereal crop is in good condition throughout the United States. Most of the crop is 7-14 days behind normal maturity for this date but with more warm dry weather the crop should mature at near normal time. Nitrogen deficiency is common from north central to south central Kansas due to excessive rain and standing water in fields. In the spring grain growing area, crop development remained behind average due to delayed planting. Now with less rain and warmer temperatures, planting is progressing rapidly.

Wheat stem rust. A stem rust overwintering site was found in CK 9766 in the southern Georgia nursery at Plains. Throughout this nursery, stem rust was increasing during the first part of May on susceptible cultivars. Stem rust is scattered throughout the state of Louisiana in light amounts. In plots at Alexandria, 10% severities were observed the second week in May. Conditions for rust infection have been optimal in these areas, and more stem rust development is expected.

Trace-1% stem rust severities were common in wheat fields from south central to southwestern Oklahoma the third week in May. A pustule of stem rust was found in a plot of McNair 701 in Sumner Co. (south central), Kansas the third week in May. Airborne diseases like rust have not moved much in these areas because the rain has kept infected leaves wet. But once things start to dry off, the rust spores should have a better chance of moving and providing exogenous inoculum for areas farther north.

The stem rust race TPMK was identified from collections in fields of CK 9835 and Mit southwest of Houston, Texas and in a plot of McN 701 at Beeville, Texas in late March. Race QFCS was identified in a field of the hard red winter wheat 2813 in Atascosa Co., Texas. These two races usually are two of the commonly identified races in the survey. As stated in report No. 2, these are <u>not</u> the races which attack barley.

Wheat leaf rust. Severe leaf rust was found on susceptible cultivars in nurseries and fields from central South Carolina to north central Texas (Fig. 1). These southern areas are providing exogenous inoculum for areas farther north.

In south central and central Oklahoma, leaf rust severities range from 20-60% where the rust overwintered but in other fields in the same area only traces were found the third week in May. In north central Oklahoma leaf rust was light with a few fields rated at 5% severities. In central

Oklahoma light leaf rust was observed on Triticum cylindricum (Aegilops cylindrica) growing along the roadside. Leaf rust is light in central and eastern Kansas fields. In some fields of Tam 107 in western Kansas leaf rust has moved up the plant and 20% severities are common in scattered fields.

In the San Joaquin Valley in California, 70% severities were reported on susceptible cultivars in nurseries and 40% in fields of Yecora Rojo the second week in May.

From 51 isolates collected from the susceptible cultivar Redhart at Baton Rouge, Louisiana in February, 12 different isolates were identified: TBG, MBG, MFB, TDB, TDG, MDB, PBS, KBG, TCG, TCB, KDB and PNB. All of these isolates were virulent on Lr10 and avirulent on Lr18. Except for PBS and PNB (virulent to the Lr9 and 24 combination) all of these races were found in the 1992 US race survey.

Wheat stripe rust. Severe stripe rust was found in a few entries in the San Joaquin Valley wheat plots in California the last week in April. Light wheat stripe rust was found on Triticum cylindricum (Ageilops cylindricum) growing along the roadside in southwestern Oklahoma.

Oat stem rust. Oat stem rust was severe on susceptible cultivars throughout a southern Louisiana nursery at Baton Rouge the first week in May. Severe oat rust was found on a few lines in the southern Georgia nursery at Plains the second week in May. On a oat line at the Davis, California nursery, a 20% severity stem rust was observed the first week in May.

No oat stem rust was found the third week in May in south central Kansas and central Oklahoma plots where limited oats is grown each year.

Race NA-27 was identified from the first oat stem rust collections made in March in a northeastern Mexico field and in a nursery at Beeville, Texas.

Oat crown rust. During the first week in May, crown rust was severe in susceptible plots of oats in the San Joaquin Valley. The aecial stage of this disease was found on buckthorn in Dane Co. and Iowa Co., Wisconsin on May 10, 1993. Crown rust pycnia were found on buckthorn at St. Paul, Minnesota on May 13. Crown rust that overwintered on wild oats (Avena fatua) was found in south central Oklahoma the third week in May. There have been no new reports of crown rust on oatsin the southern states since the last bulletin.

Crown rust virulence patterns have been determined for 62 isolates collected from a Brooks/Simpson oat mixture in border rows of a 4-acre breeding nursery at Baton Rouge, Louisiana on February 8. There were 44 different virulence patterns among the isolates. The most common pattern occurred in 7 isolates. Virulence frequencies were similar to samples from Texas and Louisiana in 1992. No virulence was found to Pc 50, Pc 62, or Pc 68. Only one highly virulent isolate was virulent on Pc 52 and Pc 53. Five of six isolates virulent on Pc 38 were also virulent on Pc 39.

Barley stem rust. As of May 17, no stem rust has been reported on barley in the United States this year. Limited amounts of barley are grown commercially in the southern states and stem rust often is not found in this area.

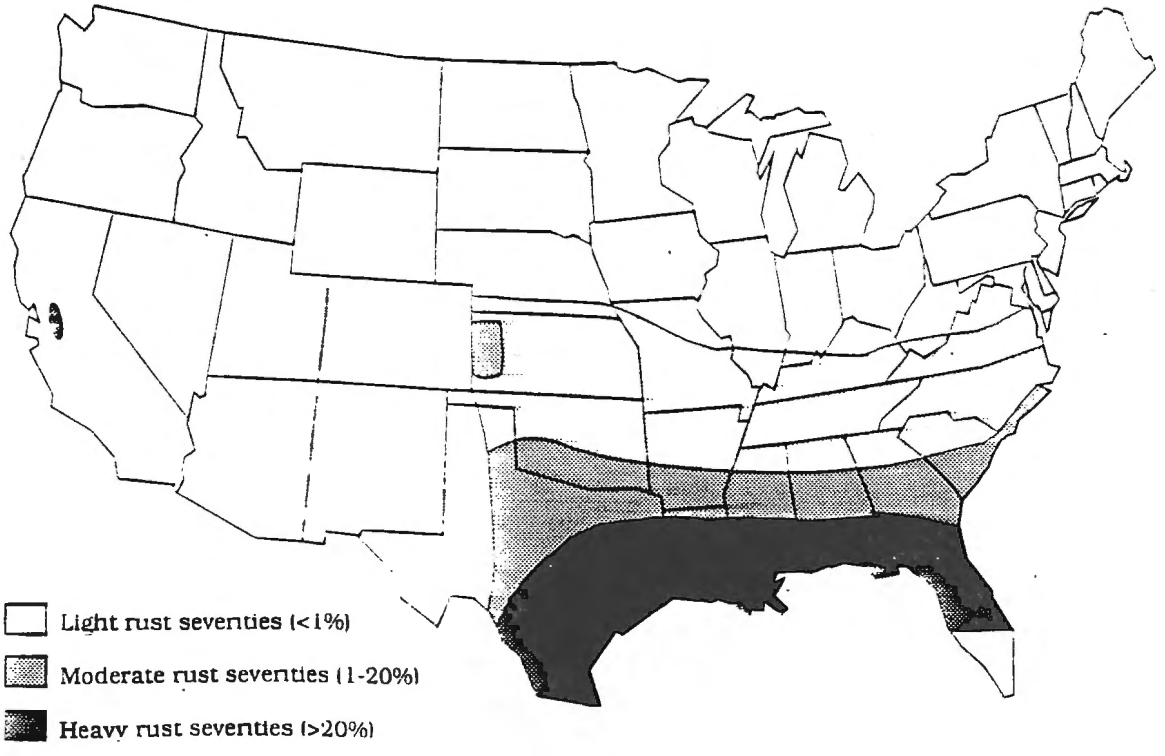
Barley leaf rust. Barley leaf rust was widespread in fields and severe on susceptible cultivars in nurseries in Virginia and adjoining states during the second week in May. In the San Joaquin Valley, California plots, leaf rust was severe the second week in May. Barley leaf rust overwintered in both Virginia and California. When the temperatures started increasing in the spring, secondary rust infection cycles commenced.

Barley stripe rust. During the first week in May, severe stripe rust was observed in susceptible irrigated barley plots at Maricopa, Arizona. However, hot temperatures are slowing the disease process. Last year in the same plots little barley stripe rust was noted, but this year rust development was severe.

Rye rusts. By the first week in May, rye leaf rust was increasing in southern Georgia fields and nurseries. Leaf rust was light to moderate in central Oklahoma fields the third week in May. The only report of rye stem rust this year was in southwestern Georgia plots.

Barberry rust. On May 10, the aecial stage of stem rust was observed on Berberis vulgaris bushes in Dane and Iowa Counties in southern Wisconsin.

Fig. 1. Leaf rust severities in wheat fields on May 18, 1993.



CEREAL RUST BULLETIN

Report No. 4
June 1, 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
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The small grain harvest is underway from Florida to central Texas. Throughout much of the U.S. the crop is still behind normal maturity. In the northern grain growing area most spring sown small grains have been planted.

Wheat stem rust. During the third week in May, traces of wheat stem rust were found in southwestern Oklahoma fields. A few stem rust pustules were found scattered in south central and western Kansas plots in late May.

Wheat stem rust was severe in plots and light in fields by the third week in May in Louisiana, this is normal for this area at crop maturity. By late May, in northeastern Arkansas 80% stem rust severities were observed in a plot of CK 9835 and in the Bootheel of Missouri traces were observed in plots of wheat. Traces of stem rust were found in plots of Cardinal and the old cultivars Trumball, Knox, Riley 67 at Columbia, Missouri at the end of May.

Wheat leaf rust. Leaf rust increased rapidly during the third week in May in many western Kansas fields and was becoming the major disease. Approximately 10% of the U.S. winter wheat crop is grown in this area (Fig. 1). In southern Kansas fields, 5% severities were common on flag leaves and in few fields 70% severities were observed where rust overwintered. These overwintering sites were much more apparent this year than in previous years. Moderate leaf rust severities were observed on Triticum cylindricum (Aegilops cylindrica) across central and western Oklahoma, during the third week in May. In late May, leaf rust was increasing in wheat plots in northeastern Missouri and southwestern Indiana from exogenous rust inoculum.

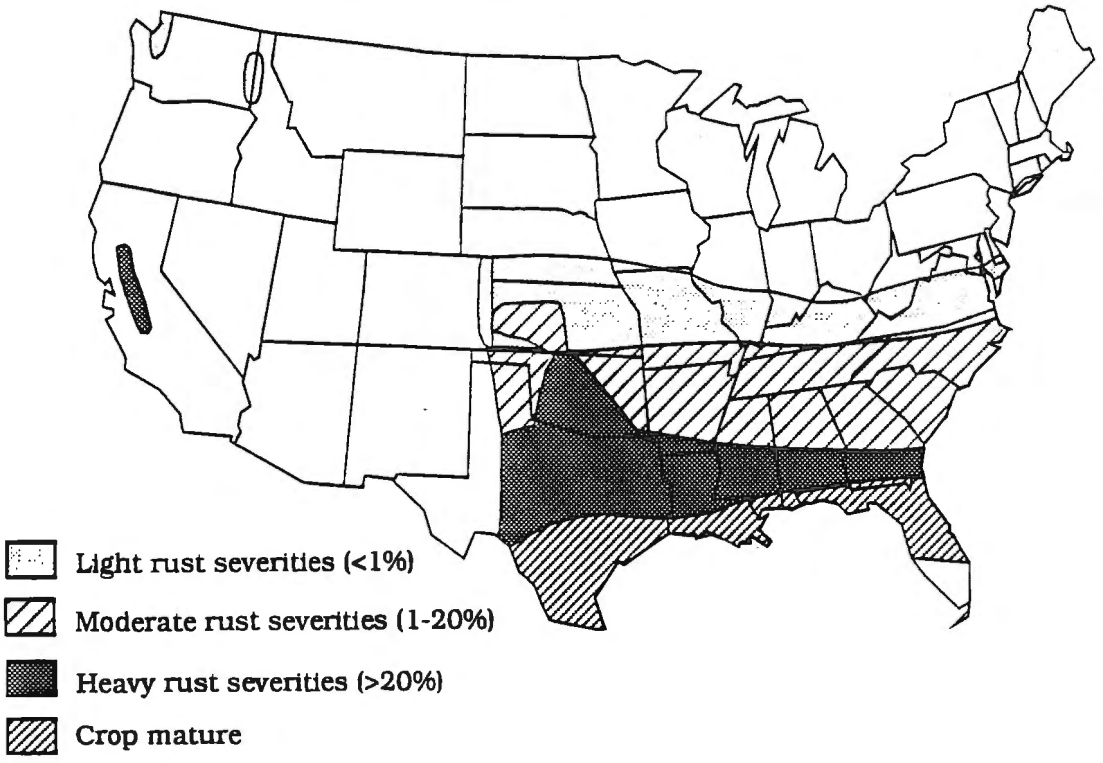
Trace amounts of leaf rust were observed in southeastern North Dakota winter wheat plots the third week in May. Light amounts of leaf rust were found scattered throughout the winter wheat plots at Rosemount, Minnesota on May 27. The initial pustules at these sites developed from spores that arrived 4-5 weeks ago.

Rye rusts. During the third week in May, in a north central Oklahoma rye field, 80% leaf rust severities were observed while 80 miles north in a south central Kansas rye field, 5% severities were reported. On May 27, traces of leaf rust were found in winter rye plots at Rosemount, Minnesota. No rye stem rust has yet has been observed on rye this year.

Barberry rust. There have been no new reports of rust on barberry since the last bulletin.

Other rusts. Uromyces hordeinus (leaf rust) was found on Hordeum pusillum in southwestern Georgia during the third week in May.

Fig. 1. Leaf rust severities in wheat fields on June 1, 1993.



CEREAL RUST BULLETIN

Report No. 5

June 15, 1993

From:
CEREAL RUST LABORATORY
US. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
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The small grain harvest is underway from northern Texas to southern Georgia. In much of the grain growing area from Kansas to Ohio the crop is 7-14 days behind normal maturity. In the spring sown small grain growing area the crop has emerged and maturity is near normal.

Wheat stem rust. During the last week in May severe stem rust (70-100% severities) were observed in wheat fields and plots in southwestern Arkansas. Heavy stem rust losses are expected in fields of CK 9835 in this area. In Arkansas major stem rust losses occurred in at least 10,000 acres this year.

During the second week in June stem rust foci were found in fields in southern Illinois, southern Indiana, and western Kentucky. In some fields foci were as frequent as one every 10 feet, with mid focus severities of 20%. In southern Illinois and Indiana the cultivar Clark was the most severely rusted cultivar grown in this area. Traces of stem rust were found throughout many of the plots and 20% severities were found in Pio 2580 and CK 9835 plots. In late May, in the Bootheel of Missouri fields, infection foci of 30-40% severity were found and by the second week in June traces of rust were found in the northwestern part of the state. This is the most severe and widely scattered stem rust in this area in the last 5 years. Large amounts of inoculum are being produced and could be deposited with rain in the main soft red wheat area of the Lake States.

In southeastern Kansas fields, during the last week in May, rust was scattered and in trace amounts. The first reported mean date for stem rust for the past 75 years in northeast Kansas was May 27 and in 1993 rust was first reported May 19. In early June a few stem rust pustules were found in commercial fields in northcentral Kansas.

Wheat leaf rust. By the second week in June severe leaf rust was observed in the area from eastern South Carolina to western Kansas (Fig. 1). Leaf rust throughout the state of Kansas is almost as severe as last year. Significant rust has developed on Karl, the most widely grown cultivar in the state. Significant losses will occur. In the soft red

winter wheat area from southern Indiana to northeastern Missouri there was less leaf rust than normal because less rust overwintered in this area. By the second week in June fields of Clark in southern Illinois had 20% severities while other cultivars in the same area had only traces of leaf rust. During the first week in June traces of rust were found in fields of soft red winter wheats in southcentral Wisconsin. Light leaf rust occurs through the Pacific Northwest and conditions have been favorable for more rust development.

In the Pacific Northwest leaf rust is spreading over the entire area and conditions are favorable for rust development so the rust is starting to increase rapidly.

Wheat stripe rust. During the third week in May light amounts of stripe rust were found in northeastern North Carolina at the Plymouth experiment station soft red winter wheat plots. This is the first report of stripe rust ever being found this far north along the east coast. Additional 1993 reports of stripe rust east of the Rockies, were made in Texas, Louisiana, Arkansas, Kansas and during the second week in June traces were found in a northeastern Missouri field.

In the Pacific Northwest stripe rust is uniformly light. A few exceptions were 30% severity readings in the Skagit Valley in western Washington and in a few club wheat fields in central Washington. Throughout most of the Pacific Northwest rust development is later than last year. Since conditions have been cool and moist the past two weeks more rust is expected.

Oat stem rust. During the first week in June heavy stem rust was found in oat plots in eastern Tennessee at Knoxville. Thirty percent severities were observed in Sacramento Valley fields the last week of May. No oat stem rust has been reported in Kansas, Nebraska or Iowa.

Oat crown rust. In oat plots in western Tennessee and northeastern Arkansas severe rust was found the first week in June. From aecial infections on buckthorns crown rust development was observed on oats growing in close proximity to the buckthorn bushes on the University of Minnesota St. Paul campus. No crown rust has been reported in commercial oats in the northern oat growing area.

Barley stem rust. There have been no new reports of stem rust on barley since the last bulletin.

Barley leaf rust. In early June barley leaf rust was found in the Rosemount, Minnesota. nursery.

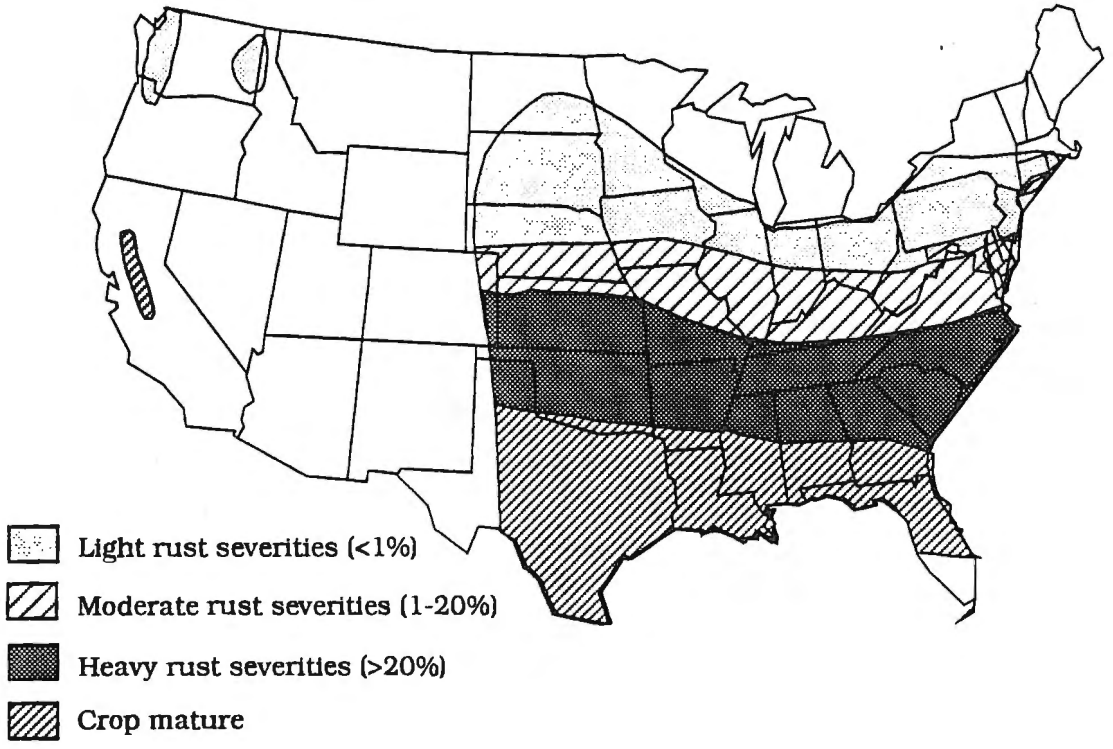
Barley stripe rust. In late May stripe rust of barley, which was reported in Bulletin #2, was spreading onto other cultivars in a Solano County, California nursery.

Rye rusts. During the second week in June 40% rye leaf rust severities were found in southern Indiana and southern Illinois fields. In early June traces of rye leaf rust were found in east central Minnesota. In late May stem rust was found in southwestern Georgia rye plots.

Barberry rust. During the first week in June the aecial stage of stem rust was found on barberry bushes in southeastern Minnesota.

Other rusts. In early June crown rust was found on ryegrass (Lolium) growing alongside oat plots in western Tennessee.

Fig. 1. Leaf rust severities in wheat fields on June 15, 1993.



CEREAL RUST BULLETIN

Report No. 6

June 29, 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
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U.S. DEPARTMENT OF AGRICULTURE
(In cooperation with the Minnesota
Agricultural Experiment Station)

In late June, winter wheat harvest had commenced in southwestern Kansas. This is two weeks later than normal. Spring-sown small grains are in good condition and moisture is adequate in most of the northern Great Plains. Excess moisture and flooding has damaged oats in northern Iowa and southern Minnesota.

Wheat stem rust. During the week of June 21, traces of stem rust were found in north central Kansas and south central Nebraska fields. In this area 5% severities were found in plots of Karl and a focus of 10% was in Karl plots in the Nebraska panhandle. Traces of stem rust were observed on some of the other hard red winter wheat cultivars while 20% severities were found on the soft red winter wheat cultivars Clark and Cardinal in these plots. In northwestern Kansas plots 10% severities were observed in both 2157 (susceptible to Pgt-QCCJ race) and McNair 701 (susceptible to races other than QCCJ). In a south central Nebraska irrigated winter wheat plot 10 or more stem rust pustules per flag leaf were common. This infection was due to a heavy spore shower in mid-June. On June 18, traces of stem rust were found in a winter wheat nursery at Rosemount, Minnesota, this was 5 days earlier than the mean date for the first reported observation in this area. On June 25, traces of stem rust were found on the susceptible spring wheat Baart in Fargo, North Dakota; Morris, Lamberton and Waseca, Minnesota plots which is the normal mean date of observation for these areas. The cool weather has slowed the spread of stem rust. Since only light amounts of stem rust were found in the central Great Plains, wheat stem rust is not expected to be a problem on susceptible wheats in the northern Great Plains. Stem rust has been reported in soft red winter wheat fields in central and southern Wisconsin.

Pgt races QCCQ and QCCS, which do not infect barley, were identified from collections made in south Texas in early spring (Table 1). Race Pgt-TPMK continues to be the most common race in the Great Plains.

TABLE 1. Wheat stem rust races identified through June 29, 1993.

State	Number of collections	Number of isolates	Number of isolates of Pgt- race QCCQ	QCCS	QFCS	TPMK
Alabama	1	3			3	
Louisiana	1	3			3	
Texas	14	35	1	6	6	22

Set 4 consists of Sr9a, 9d, 10 and Tmp.

Wheat leaf rust. As reported in the previous bulletin, considerable loss to leaf rust will occur in Kansas. During the fourth week in June, 60% leaf rust severities were observed in winter wheat fields in south central and panhandle of Nebraska (Fig. 1). In winter wheat plots in central and eastern South Dakota 10% severities were observed. Losses will vary with local conditions but some southern Nebraska fields will suffer losses in yield. During the fourth week in June, traces of leaf rust were observed in spring wheat fields in west central Minnesota and 10% severities in the susceptible cultivar Baart in southern Minnesota. During late June in southeastern North Dakota winter wheat plots, 20-30% severities were observed on the flag-2 leaf. By the fourth week in June, leaf rust was observed throughout the soft red winter area in southern Wisconsin.

During late June 100% severities were observed on susceptible wheats in the Pacific Northwest. Leaf rust was found June 18 in winter wheat plots at the Winnipeg, Canada station.

The detection of Prt-PNM, virulent to *Lr*9 and 24 was the most important new virulence combination found. This combination has caused significant leaf rust infection on Coker 9877 which is grown throughout the southern soft red winter wheat area.

TABLE 2. Wheat leaf rust races identified through June 29, 1993.

Prt code	Virulence formula[1]	Number of isolates by state				
		AL	AZ	LA	MS	TX
CLG-10	3,9,10,11			1		
FBB-10	2c,3,10					1
FBM-18	2c,3,3ka,18,30					1
MBG-	1,3,11	1				
MBG-10	1,3,10,11	2		8	2	7
MBG-10,18	1,3,10,11,18					1
MBR-10	1,3,3ka,10,11,30			2		1
MDB-10	1,3,10,24					3
MFB-10	1,3,10,24,26			1		5
PLR-10,18	1,2c,3,3ka,9,10,11,18,30			2		
PNM-10	1,2c,3,9,3ka,10,24,30			1		
PNM-10,18	1,2c,3,9,3ka,10,18,24,30		1	4		
PNR-10,18	1,2c,3,3ka,9,10,11,18,24,30			2		
TBB-10	1,2a,2c,3,10					1
TBG-10	1,2a,2c,3,10,11					1
TBJ-10	1,2a,3,10,11,17			1		
TDB-10	1,2a,2c,3,10,24					2
TDG-10	1,2a,2c,3,10,11,24					1
TFB-10	1,2a,2c,3,10,24,26					1
TLG-18	1,2a,2c,3,9,11,18			1		
Number of isolates		3	1	23	2	25
Number of collections		2	1	19	2	25

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

Wheat stripe rust. During the fourth week in June light amounts of stripe rust were found in plots in the panhandle of Nebraska. Rust development had ceased because of the dry windy conditions in mid-June in this area. During late June stripe rust was noted on wheats in a Fort Collins, Colorado nursery.

Overwintering stripe rust foci were found in late June in the Bozeman, Montana area. A major rust increase is expected within the next 2 weeks. In the Willamette Valley of the Pacific Northwest, stripe rust is light and the major wheat disease is Septoria. In the central basin of Washington stripe rust severity has reached 100% on the cultivar Tres. In the Pullman area stripe rust is increasing rapidly on the winter wheats and now is found on spring wheats.

Oat stem rust. The only report of oat stem rust in the past two weeks was in southern Wisconsin fields. Currently it appears that oat stem rust should not cause a problem in the northern oat growing area. Race NA-27 comprised 100% of the isolates from collections made in early spring in the southern U.S .(Table 3) This has been the most common race identified for many years. From a collection made in California, NA-10 was identified, this race is frequently found in this area.

TABLE 3. Oat stem rust races identified through June 29, 1993.

State	Number of collections	Number of isolates	Number of isolates of NA race 10	27
Alabama	1	3		3
California	1	3	3	
Florida	1	3		3
Georgia	1	3		3
Texas	1	2		2

Oat crown rust. During the fourth week in June, 10% crown rust severities were found on oats in plots in southern Minnesota, east central South Dakota and in northwestern Iowa fields. In Minnesota and Wisconsin the aecial development was heavy on buckthorn (alternate host). The spread from buckthorn to oats has been occurring the past two weeks.

Barley stem rust. During the fourth week in June, traces of stem rust were found in plots in south central Nebraska. Traces of barley stem rust were found in south central Minnesota plots of Robust on June 21. Trace-1% severities were observed in clumps of Hordeum jubatum (wild barley) growing alongside the road in south central Nebraska.

Barley leaf rust. During late June, 60% barley leaf rust severities were observed in plots in south central Nebraska and traces were found in south central and west central Minnesota plots.

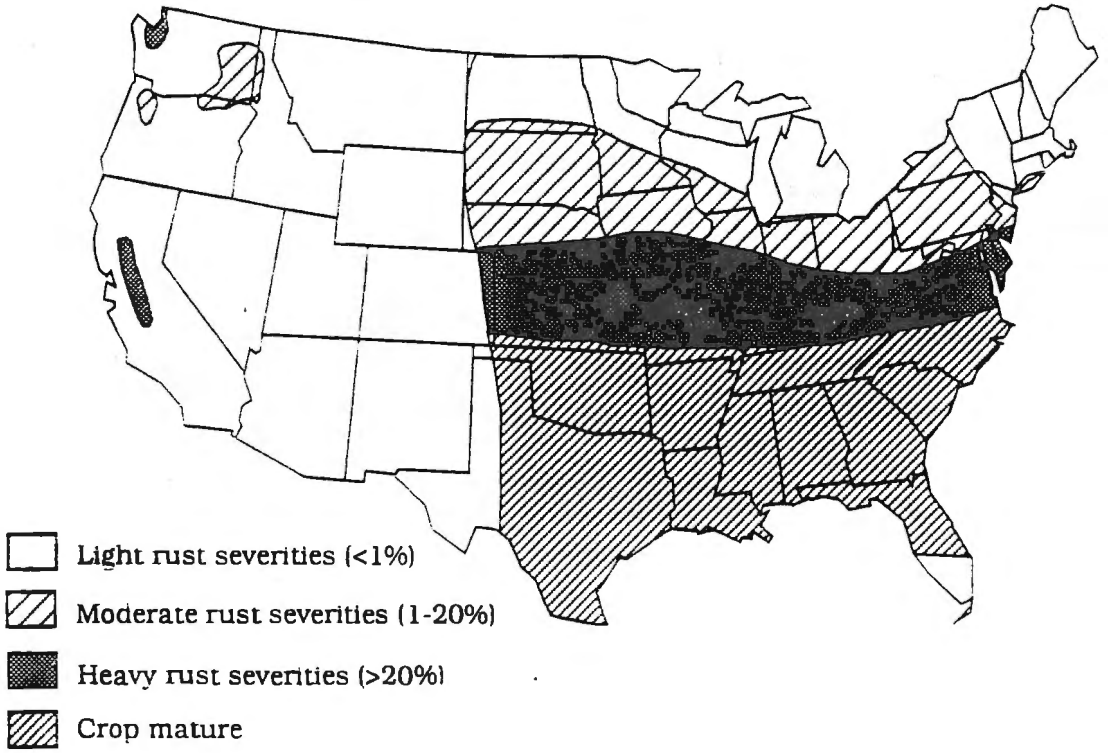
Barley stripe rust. During the fourth week in June, stripe rust was found on barley in a nursery in Fort Collins, Colorado. Currently it has not been verified whether this is the barley stripe rust pathogen or the wheat stripe rust pathogen. In CRB # 5 it was reported that stripe rust of barley was spreading in a Solano County, California nursery, no further increase was observed. No culture was obtained from the collection submitted to the Cereal Rust Laboratory.

Barley crown rust. This disease which has appeared on barley in Nebraska and North Dakota cycles to barley from the buckthorn (Rhamnus cathartica). The pathogen is virulent to Agropyron repens and Hordeum jubatum as well as cultivated barley. This pathogen is not virulent to cultivated oats or wild oats. Crown rust has been observed on Hordeum jubatum at St. Paul, Minnesota near a buckthorn hedge which may indicate the presence of this disease.

Rye stem rust. During the fourth week in June traces of rye stem rust were found in fields in Sauk and Waushara Counties in Wisconsin.

Rye leaf rust. During the fourth week in June severe leaf rust (20% severities on lower leaves) were observed in winter rye fields in west central Wisconsin, southeastern Minnesota and east central South Dakota.

Fig. 1. Leaf rust severities in wheat fields on June 29, 1993.



CEREAL RUST BULLETIN

Report No. 7

July 20 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
Tel. 612/625-6299 Fax: 612/649-5054

Issued By:
AGRICULTURAL RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE
(In cooperation with the Minnesota Agricultural Experiment Station)

The winter wheat harvest has begun from central Indiana to south eastern South Dakota. In the northern Great Plains, most of the spring-sown grains are in good condition and 7-10 days behind normal crop development.

Wheat stem rust. In early July the prevalence of stem rust varied from 100% in southern Wisconsin soft red winter wheat fields to traces in western New York nursery plots. During the week of July 12th, traces of wheat stem rust were found on the susceptible spring wheat Baart, in west central Minnesota and central and north central North Dakota. In the west central Minnesota plot' stem rust was found three weeks ago but very little increase has occurred. This is the least amount of stem rust in the northern plains on this date in the past six years. Commercial spring wheats have a high level of stem rust resistance. In mid-July, wheat stem rust was increasing in eastern Washington and could cause some damage in the late maturing susceptible spring wheat cultivars. Race Pgt-TPMK continues to be the most common race in the Great Plains (Table 1). Pgt races QCCQ and QCCS, which do not infect barley, were identified from collections made in Texas.

TABLE 1. Wheat stem rust races identified through July 20 1993.

State	Number of collections	Number of isolates	Number of isolates of Pgt- race QCCQ	QCCS	QFCS	TPMK
Alabama	1	3				3
Arkansas	5	15				15
Georgia	10	29				29
Kansas	1	1				1
Louisiana	3	9				9
Missouri	3	7				7
Texas	16	44	1	6	6	31

Set 4 consists of Sr9a, 9d, 10 and Tmp.

Wheat leaf rust. By early July, leaf rust was extensive throughout winter wheat fields in central New York and southern Wisconsin; however, in most cases the wheat matured before the disease caused extensive damage. In mid-July, 40% severities were observed in winter wheat plots in east central South Dakota and 5% severities were observed in a north central North Dakota plot. In the susceptible spring wheat Baart, in west central Minnesota, 40% severities were reported while in north central North Dakota plots 5% severites were reported. In early July wheat leaf rust was increasing on spring wheats in the Pacific Northwest. Except for the PNM and CLG Prt code combinations all of the other races have been identified in the previous three years (Table 2).

TABLE 2. Wheat leaf rust races identified through July 20 1993.

Prt code	Virulence formula[1]	Number of isolates by state							
		AL	AZ	FL	GS	LA	MS	OK	TX
CBB-10	3								2
CLG-10	3,9,10,11					1			
FBB-10	2c,3,10								1
FBM-18	2c,3,3ka,18,30								1
KFB-10	2a,2c,3,10,24,26								2
MBG-	1,3,11	1				1			
MBG-10	1,3,10,11	8		1	1	10	2		9
MBG-10,18	1,3,10,11,18								1
MBR-10	1,3,3ka,10,11,30					2			1
MDB-10	1,3,10,24								4
MFB-10	1,3,10,24,26					1			6
PLR-10,18	1,2c,3,3ka,9,10,11,18,30					2			
PNM-10	1,2c,3,3ka,9,10,24,30					1			
PNM-10,18	1,2c,3,3ka,9,10,18,24,30		1			8			
PNR-10,18	1,2c,3,3ka,9,10,11,18,24,30					2			
SBB-10,18	1,2a,2c,10,18								3
TBB-10	1,2a,2c,3,10								1
TBD-10,18	1,2a,2c,3,17								1
TBG-10	1,2a,2c,3,10,11				1				2
TBJ-10	1,2a,2c,3,10,11,17					1			
TDB-10	1,2a,2c,3,10,24							3	5
TDG-10	1,2a,2c,3,10,11,24								1
TDM-10,18	1,2c,2c,3,3ka,10,18,30								1
TFB-10	1,2a,2c,3,10,24,26							2	1
TLG-18	1,2a,2c,3,9,11,18	7		4	7	7			
Number of isolates		16	1	5	9	36	2	5	43
Number of collections		13	1	3	7	27	2	3	38

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

Wheat stripe rust. In mid-July throughout the Pacific Northwest stripe rust was increasing on the spring wheats. Traces of wheat stripe rust were found in nurseries at Ft. Collins, Colorado and Hettinger, North Dakota.

Oat stem rust. The only reports of oat stem rust in the past three weeks were a 1% severity in a southeastern Minnesota field and traces in a south central Wisconsin field. This is much less oat stem rust than normal. Currently it appears that oat stem rust should not cause a problem in the northern oat growing area. Race NA-27 comprises over 70% of the isolates(Table 3).

TABLE 3. Oat stem rust races identified through July 20, 1993.

State	Number of collections	Number of isolates	Number of isolates of NA race 5	10	27
Alabama	1	3			3
Arkansas	1	3			3
California	3	9	6	3	
Florida	1	3			3
Georgia	2	4			4
Tennessee	1	3			3
Texas	1	2			2

Oat crown rust. In mid-July 10% severities were found in scattered fields throughout the eastern Dakotas while the majority of the fields had no crown rust. In a west central Minnesota plot 80% severities were observed. In some southern Wisconsin oat fields, severities were 40%, while in fields adjacent to them only traces were noted even though they were at the same maturity. The alternate host for crown rust, buckthorn, grows in close proximity to oat fields in southern Wisconsin and often provides rust inoculum for early season development of crown rust. In mid-July severities on Avena fatua (wild oats) growing in small grain fields ranged from 0 to 20% throughout the northern plains oat growing area.

Barley stem rust. During the week of July 12th, traces of barley stem rust were found in plots in west central Minnesota. In mid-July 1% severities were observed in south eastern Minnesota fields and traces of stem rust were found on 60% of the plants in a south central Wisconsin field. During the week of July 12th trace-5% stem rust severities were observed in clumps of Hordeum jubatum (wild barley) growing alongside roads throughout northeastern South Dakota and southeastern North Dakota.

Barley leaf rust. In mid-July in a south central Wisconsin barley field 40% severities were observed.

Barley stripe rust. There have been no new reports of barley stripe rust since the last bulletin. Barley stripe rust has been confirmed at the Ft. Collins, Colorado nursery.

Rye stem rust. There have been no new reports of rye stem rust since the last bulletin.

Rye leaf rust. During the July 12th week 5% severities were observed in rye plots from west central Minnesota to north central North Dakota and 1% severities in a south central North Dakota field.

Other grasses. In mid-July 10% rust severities were found on Agropyron repens (quackgrass) in west central Minnesota and 60% rust severities on Lollium perenne (perennial ryegrass) in east central South Dakota.

CEREAL RUST BULLETIN

Report No. 8

August 11, 1993

From:
CEREAL RUST LABORATORY
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF MINNESOTA, ST. PAUL 55108
Tel. 612/625-6299 Fax: 612/649-5054

Issued By:
AGRICULTURAL RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE
(In cooperation with the Minnesota
Agricultural Experiment Station)

Small grains in the northern Great Plains are mostly in good condition despite being well behind normal development due to the wet and cool weather. Barley and winter wheat harvest has begun in southeastern North Dakota and northeastern Montana.

Wheat stem rust. During 1993, wheat stem rust overwintering sites were found in the southern portions of Texas, Louisiana and Georgia. During the last week in March, severe stem rust was found in fields southwest of Houston. Conditions were similar to 1986, when stem rust spread from soft red winter wheat fields south of Houston to the southern Great Plains. In late April, in central Texas, traces of stem rust were found scattered throughout fields of Wintex and 5% severities were found in plots of McNair 701. By the third week in May, traces of wheat stem rust were found in southwestern Oklahoma fields and south central Kansas and northeastern Missouri plots. In southeastern Kansas fields, during the last week in May, rust was scattered and in trace amounts. Spore movement was limited because frequent rains kept the infected leaves wet and scrubbed the air of spores.

By late May, severe stem rust had developed in southwestern Arkansas and heavy losses had occurred in fields of CK 9835. Traces of stem rust were found in northeastern Missouri plots of Cardinal and of the old cultivars Knox and Riley 67. This was the most severe and wide spread stem rust in this area in 5 years. During the second week in June, stem rust foci were found in fields in southern Illinois, southern Indiana, and western Kentucky. In Illinois and Indiana, Clark was the most severely rusted commercial cultivar. By late June, traces of stem rust were reported in a few fields in central and southern Wisconsin. In early July, traces of stem rust were found in western New York plots.

During the third week in June, traces of stem rust were found in north central Kansas and south central Nebraska fields. In this area, 5% severities were found in plots of Karl and a one yard diameter focus with a 10% severity was found in a Karl plot in the Nebraska panhandle. Traces of stem rust were observed on some of the other hard red winter wheat cultivars while 20% severities were found on the soft red winter wheat cultivars Clark and Cardinal in these plots. In northwestern Kansas plots, 10% severities were observed in both 2157 (susceptible to Pgt-QCCJ race) and McNair 701 (susceptible to races other than QCCJ). In a south central Nebraska irrigated winter wheat plot 10 or more stem rust pustules per flag leaf were common. This infection was due to a heavy spore shower in mid-June.

In mid-June, traces of stem rust were found in a winter wheat nursery in southeastern Minnesota. By early August 10-40% severities were found in east central and northwestern North Dakota plots of susceptible cultivars. During the fourth week in June, traces of stem rust were found on susceptible spring wheat plots in southeastern North Dakota and south central Minnesota, which is normal for the first observation of rust at these locations. The cool weather and frequent rain slowed the spread of stem rust. During the second week in July traces of wheat stem rust were found on susceptible spring wheats in central and north central North Dakota. Commercial spring and durum wheat cultivars in this area have a high level of stem rust resistance, so losses to stem rust were negligible. In mid-July

wheat stem rust increased in eastern Washington and caused some damage in late maturing susceptible spring wheat cultivars.

Race Pgt-TPMK continues to be the most common race on wheat in the Great Plains (Table 1). Pgt races QCCQ and QCCS, which do not infect barley, were identified from collections made in south Texas in early spring. The barley-attacking race Pgt-QCCJ has been found in Minnesota, Mississippi, Missouri, and Oklahoma in 1993. Many of the Kansas collections have not been identified yet.

TABLE 1. Wheat stem rust races identified through August 10, 1993

State	Number of		Number of isolates of Pgt- race [1]						
	collections	isolates	QCCJ	QCCQ	QCCS	QFCS	RCRS	RKCS	TPMK
Alabama	1	3							3
Arkansas	17	51							51
Georgia	12	34							34
Illinois	10	29							29
Indiana	9	27					1		26
Kansas	1	1							1
Kentucky	1	3							3
Louisiana	3	9							9
Minnesota	5	15	3			2			10
Mississippi	1	3	3						
Missouri	26	76	13		3	8		4	48
Nebraska	3	9							9
Oklahoma	16	47	12			15			20
Tennessee	1	3							3
Texas	21	52		1	6	6			39

[1]Set 4 consists of *Sr* 9a, 9d, 10 and Tmp.

Wheat leaf rust. In early March, moderate (10-40%) leaf rust severities were reported on wheat growing in northeastern Mexico fields. In late March, even though leaf rust was widespread across southern Texas, it was less severe than normal. In the southern plains of Texas, wheat fields were planted late (December), therefore, less leaf rust overwintered than normal and only light amounts of rust were found the last week of March in most of the winter and spring wheat fields in southern Texas. During late April, it was common to observe 20% leaf rust severities on susceptible wheat cultivars in central and north central Texas fields at the late flowering to quarter berry stage. There was less rust observed this year than last year on the same date, which probably was due to the cooler than normal temperatures and less leaf rust overwintering in 1993. In north central Texas, a 60% severity was observed in clumps of Triticum cylindricum (Aegilops cylindrica) growing along the roadside. By mid-May in south central and central Oklahoma, leaf rust severities ranged from 20-60% where the rust

overwintered but in other fields in the same area only traces were found. In north central Oklahoma, by mid-May, leaf rust was light with a few fields rated at 5% severities.

By early April, leaf rust was generally light on southern soft red winter wheat from southern Louisiana to eastern Virginia (Fig. 1). The winter was mild and rainfall was above normal, creating favorable conditions for rust infection. However, by late March, rain and cool temperatures slowed leaf rust spore production and movement. In early April, severe rust (40% severity) was observed on Coker 9877 in a Baton Rouge, Louisiana nursery. This cultivar has *Lr* 9 + 24. This combination of resistance would have been effective in previous years. By late April, significant rust was noted in commercial fields of Coker 9877 throughout the southern soft red winter wheat area. The race Prt-PNMQ was identified from Coker 9877 collections (Table 2). On other cultivars, leaf rust was moderate to heavy throughout Louisiana. In Arkansas, severe leaf rust occurred in isolated fields of susceptible cultivars. In most fields, leaf rust was present in the low to mid canopy and was very seldom found on the flag leaf. In the southern soft red winter wheat area from central Mississippi to central Georgia, rust was severe on susceptible cultivars in plots but moderate to light in fields in late April.

In late May, leaf rust was increased in wheat plots in northeastern Missouri and southwestern Indiana from exogenous rust inoculum. In the soft red winter wheat area, from southern Indiana to northeastern Missouri, there was less leaf rust than normal because less overwintered. By the second week in June, fields of Clark in southern Illinois had 20% severities while other cultivars in the same area had only traces of leaf rust. During the first week in June, traces of rust were found in fields of soft red winter wheat in western New York and by early July leaf rust was widespread throughout winter wheat fields in central New York, However, in most cases the wheat matured before the disease caused more than light losses. In early June, leaf rust was observed throughout the soft red winter area in south central Wisconsin and by late June leaf rust was widespread in southern Wisconsin.

During the 1992-93 winter, leaf rust survived in much of western and southern Kansas, but overwintering in southern Kansas was lighter than during the 1991-92 winter. In northwestern Kansas, leaf rust was heavy on volunteer wheat last fall and in late March 1% severities occurred on TAM 107. During the last week in April, normal amounts of leaf rust were observed in Kansas even though temperatures were cooler than normal. However, severities and incidences were much higher in western Kansas where more volunteer wheat existed last fall. By early May, in scattered TAM 107 fields in western Kansas, leaf rust had moved up the plant and 20% severities were common. In southern Kansas fields, 5% severities were common on flag leaves and in a few fields 70% severities were observed where rust overwintered. The overwintering sites were more apparent this year due to the reduced inter-field spread. Leaf rust observed by the first of June in western Kansas was as severe as occurred in 1992. Leaf rust losses in Kansas varied with local conditions but many fields suffered 10 to 20% reductions in yield and the state averaged an 11% loss. Significant rust developed on Karl, the most widely grown cultivar in Kansas. During June, 60% leaf rust severities were observed in winter wheat fields in the south central and panhandle areas of Nebraska. Losses varied with local conditions but some southern Nebraska fields suffered light losses.

Trace amounts of leaf rust were observed in southeastern North Dakota and east central Minnesota winter wheat plots the third week in May. During late June in southeastern North Dakota winter wheat plots, 20-30% severities were observed on the flag minus 2 leaf. In mid-July, 40% severities were observed in winter wheat plots in east central South Dakota and 5% severities were observed in a north central North Dakota plot. Most of the winter wheat cultivars grown in this area are leaf rust susceptible, and in severely infected fields 1-10% losses occurred. During late June, traces of leaf rust were observed in spring wheat fields in west central Minnesota and 10% severities on

Fig. 1. Leaf rust severities in wheat fields on April 14, 1993.

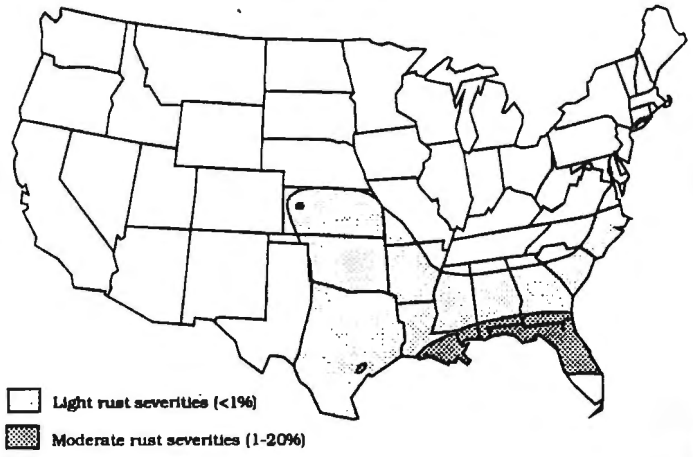


Fig. 1. Leaf rust severities in wheat fields on May 4, 1993.

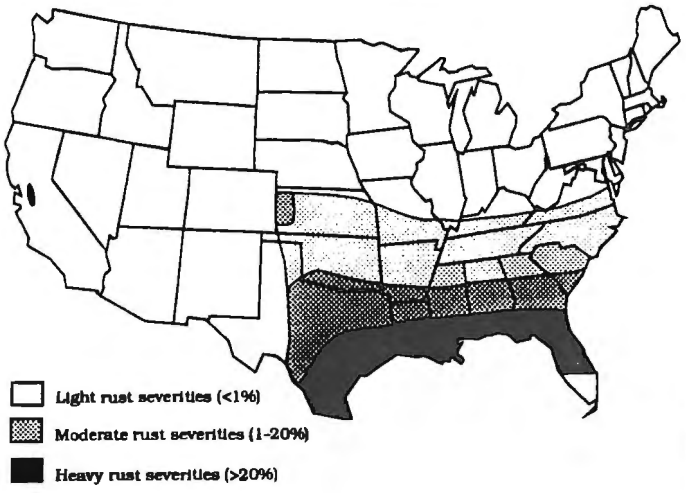


Fig. 1. Leaf rust severities in wheat fields on May 18, 1993.

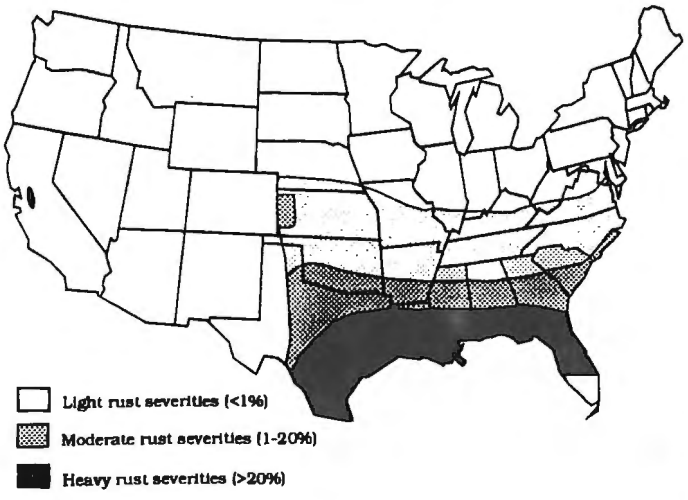


Fig. 1. Leaf rust severities in wheat fields on June 1, 1993.

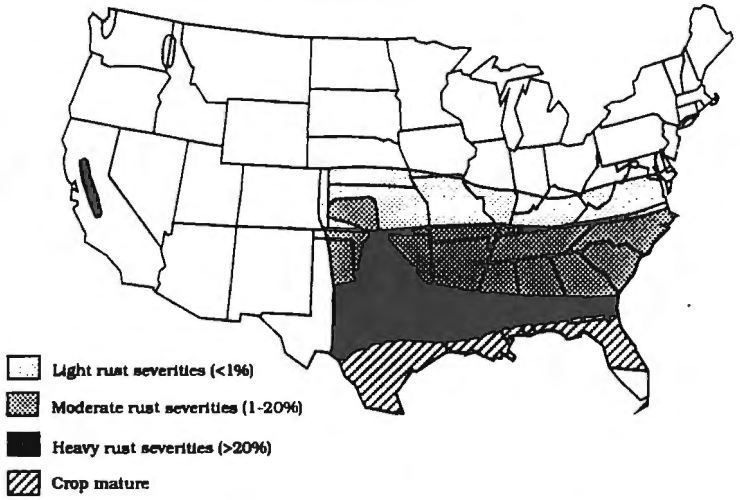


Fig. 1. Leaf rust severities in wheat fields on June 15, 1993.

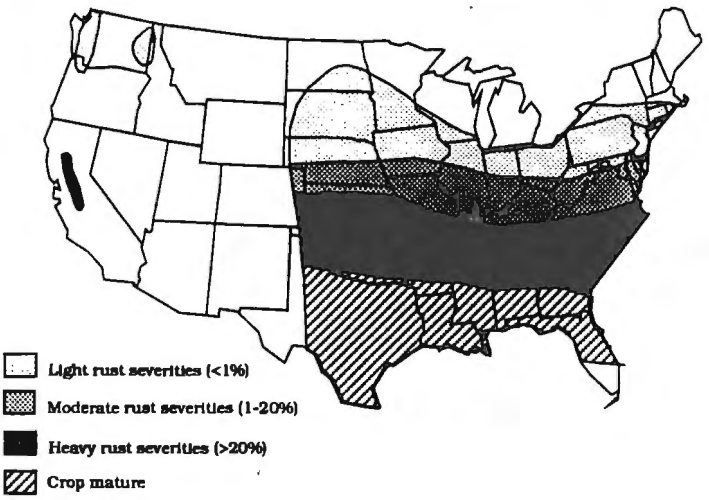


Fig. 1. Leaf rust severities in wheat fields on June 29, 1993.

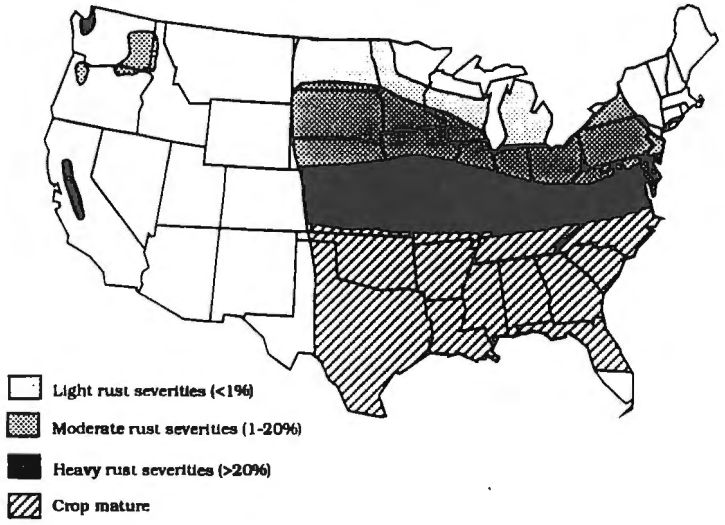


TABLE 2. Wheat leaf rust races identified through August 10,1993

Prt code	Virulence formula[1]	Number of isolates per state												
		AL	AR	AZ	CA	FL	GA	KS	LA	MS	OK	SC	TX	VA
CBB-10	3,10												2	
CLG-10	3,9,10,11								1					
FBB-10	2c,3,10												1	
FBM-18	2c,3,3ka,18,30												1	
KBG-10	2a,2c,3,10,11							1						
KDB-10	2a,2c,3,10,24							2						
KFB-10	2a,2c,3,10,24,26												2	
LBB-10,18	1,10,18													1
LCB-10,18	1,10,18,26											2		
MBB-10	1,3,10				4						1			
MBG	1,3,11	1							1			1		
MBG-10	1,3,10,11	21			3	3	4	1	8	2		2	14	
MBG-10,18	1,3,10,11,18												1	
MBJ	1,3,11,17	2												
MBR-10	1,3,3ka,10,11,30	1							2				3	
MCB-10	1,3,10,26				11									
MCP-10	1,3,3ka,10,17,26,30													
MDB-10	1,3,10,24												3	
MFB-10	1,3,10,24,26	1							3		1		11	
PLM-10,18	1,2c,3,3ka,9,30												3	
PLR-10,18	1,2c,3,3ka,9,10,11,18,30								2					
PNM-10	1,2c,3,3ka,9,10,24,30								1					
PNM-10,18	1,2c,3,3ka,9,10,18,24,30		2	1					8					
PNR-10,18	1,2c,3,3ka,9,10,11,18,24,30	1							2					
SBB-10,18	1,2a,2c,10,18												3	
TBB-10	1,2a,2c,3,10												1	
TBD-10	1,2a,2c,3,10,17										1			
TBD-10,18	1,2a,2c,3,10,17,18												1	
TBG	1,2a,2c,3,11	1												
TBG-10	1,2a,2c,3,10,11						1						2	
TBG-18	1,2a,2c,3,11,18											2		
TBJ-10	1,2a,2c,3,10,11,17								1					
TDB-10	1,2a,2c,3,10,24							3			3	1	5	
TDG-10	1,2a,2c,3,10,11,24										1		5	
TDJ-10,18	1,2a,2c,3,10,11,17,18,24												2	
TDR-10,18	1,2a,2c,3,3ka,10,11,18,24,30												1	
TFB-10	1,2a,2c,3,10,24,26										4		1	
TLG-18	1,2a,2c,3,9,11,18	8				2	9		9			18	2	
Number of isolates		36	2	1	18	5	14	7	38	2	11	26	64	1
Number of collections		25	2	1	16	4	7	4	25	2	6	14	48	1

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

the susceptible cultivar Baart in southern Minnesota. Due to resistance only traces of leaf rust developed and therefore losses were minimal in the spring wheats. No rust was reported on durum wheat.

In the western U.S. in late March, leaf rust was observed in irrigated plots at Chandler, Arizona where leaf rust does not occur every year. In early April, 30% leaf rust severities were found in wheat fields in the San Joaquin Valley in California and 50% severities were observed by the third week in May on susceptible cultivars in the Sacramento Valley. In the Pacific Northwest by the end of May, more leaf rust than normal was present. In early July, wheat leaf rust increased on spring wheat resulting in light losses in this area. Losses on highly susceptible cultivars were greater.

Preliminary data (Table 2) indicate that new races are CLG-10, PNM-10, PNM-10,18, and PNR-10,18. As in 1991 and 1992, race MBG-10 was the predominate race identified from the southern soft red winter wheat area. Race TLG-18 was more widespread and more common than in previous surveys.

Wheat stripe rust. In early March, heavy stripe rust was found on many cultivars and lines in a central Louisiana and eastern Arkansas nurseries; however, by late March stripe rust development had slowed. In some cases the entire leaf surface area was diseased and in a few cases many pustules were found on the head. In southeastern Arkansas in late April, stripe rust increased again in severity and incidence. During the third week in May, light amounts of stripe rust were found in northeastern North Carolina at the Plymouth experiment station soft red winter wheat plots. This was the first report of stripe rust this far north along the East Coast.

During late March, light amounts (trace-5% severities) of stripe rust were found in two fields in southern Texas at the berry stage. At the Uvalde nursery in southern Texas, 40% severities were observed on March 31 on the soft red winter wheat cultivar McNair 701. During the last week in April, foci of stripe rust were found in soft red winter wheat plots in central and north central Texas. Generally, 10% of the leaf area was covered and 10% of the plants were infected. In late May in central Kansas, stripe rust was reported in plots of soft red winter wheat. Little increase or spread occurred as expected as temperatures exceeded the optimum for stripe rust. During late June traces of stripe rust were found in plots in the Nebraska panhandle, Fort Collins, Colorado and Hettinger, North Dakota. Overwintering stripe rust foci were found in late June in the Bozeman, Montana area. It is unusual for stripe rust to exist to this extent in the northern plains. In part it relates to the cool and wet conditions and the late maturity of the crop. Losses were light in commercial fields.

During the last week in April, severe stripe rust was found in a few entries in plots in California's San Joaquin Valley and in wheat cultivars in the northwestern Washington area. Severities of 20% were observed on the most susceptible lines in the Mount Vernon nursery. By early June stripe rust was uniformly light throughout the Pacific Northwest. By late June, stripe rust had reached 100% severity in the central basin of Washington and in the Pullman area stripe rust was increasing rapidly on the winter wheats and was being found on spring wheats. In mid-July, throughout the Pacific Northwest stripe rust severities were still increasing. Losses to stripe rust were variable, ranging from traces to 10% in the Pacific Northwest.

Oat stem rust. In early March, oat stem rust was reported in a northeastern Mexico field. During the last week in March the only stem rust observation in Texas was traces in the nursery at Beeville. This was less rust than usual at this time of the year. Late planting and perhaps less inoculum in the fall were the main factors in the low level of disease. By late April, oat stem rust was increasing rapidly at

Beeville, Texas and severe oat stem rust was found within 75 miles of the Gulf Coast in nurseries at Quincy, Florida, Fairhope, Alabama and Baton Rouge, Louisiana. By the second week in May, severe oat stem rust was found on a few lines in the southern Georgia nursery at Plains. In late May, severe stem rust was found on wild oats (Avena fatua) growing in fields in the Sacramento Valley of California. During the first week in June, heavy stem rust was found in oat plots in eastern Tennessee at Knoxville. The first report of oat stem rust in the northern oat growing area was traces in southern Wisconsin fields in mid-June. By mid-July, 1-5% severities were found in southeastern Minnesota and south central Wisconsin fields. In late July, 10-20% severities were reported in south central Minnesota. In general, in the Northern Plains, oat stem rust appeared late in the season and developed slowly because of cool weather. Rust severities were light and little loss occurred. Race NA-27, virulent to Pg-1,-2,-3,-4 and -8, remains the predominant race of the population (Table 3).

TABLE 3. Oat stem rust races identified through August 10, 1993

	Number of		Number of isolates of NA race		
State	collections	isolates	5	10	27
Alabama	1	3			3
Arkansas	1	3			3
California	3	9	6	3	
Florida	1	3			3
Georgia	2	4			4
Tennessee	1	3			3
Texas	2	5			5

Oat crown rust. During the last week in March, severe crown rust was observed in southern Texas nurseries and fields at heading through the milk growth stage. Many fields in this area suffered yield losses and/or greatly reduced grazing value due to the loss of foliage. By the last week in April crown rust was severe in oat fields and central and north central Texas oat plots. This widespread crown rust is comparable to the rust development of last year in the southern U.S. Crown rust that overwintered on wild oats was found in south central Oklahoma in late May. In late March, crown rust was severe on oats in the Baton Rouge, Louisiana and southern Alabama plots. In oat plots in western Tennessee and northeastern Arkansas severe rust was found the first week in June. During early May, crown rust was severe in oat plots in the San Joaquin Valley .

In early May, the aecial stage of crown rust was found on buckthorn in southern Wisconsin and pycnia were found at the St. Paul, Minnesota nursery. Moderately heavy infections of aecia were observed on buckthorn throughout southern parts of Wisconsin and Minnesota during late May. Throughout Minnesota and Wisconsin aecial development was moderately heavy on buckthorn in Minnesota and Wisconsin and rust spread to oats during June. By late June, 10% crown rust severities occurred on oats in plots in southern Minnesota, east central South Dakota and in oat fields.

In mid-July, 10% severities were found in scattered fields throughout the eastern Dakotas, while the majority of the fields had no crown rust. In southern Wisconsin, some oat fields had 40% severities while adjacent fields of similar maturity had only traces. The alternate host for crown rust, buckthorn, grows in close proximity to oat fields in this area and often provides inoculum for early season development of crown rust. In mid-July, severities on Avena fatua growing in small grain fields ranged from 0 to 20% throughout the northern plains oat growing area. By early August, severe crown rust was found in northeastern North Dakota and northwestern Minnesota. Light to moderate losses due to crown rust occurred in southeastern Minnesota and southern Wisconsin.

Barley stem rust. The first report of barley stem rust was during late May in a southwestern Georgia nursery. The next report of barley stem rust was during the fourth week in June, when traces of stem rust were found in plots in south central Nebraska and south central Minnesota. In mid-July 1% severities were observed in southeastern Minnesota and south central Wisconsin fields. During mid-July, trace-5% stem rust severities were observed in clumps of wild barley (Hordeum jubatum) throughout northeastern South Dakota and southeastern North Dakota. During the first week in August traces of barley stem rust were found in fields from northwestern North Dakota to northwestern Minnesota. In early August, stem rust was reported at several Idaho sites. In both 1992 and 1993 there was less rust reported on barley when compared to the previous four years, which can be related to lower levels of initial inoculum and cool June and July temperatures. Losses will be limited to thin stands.

Race Pgt-QCCJ was identified from the first collection made from barley in Minnesota while from the Georgia and Nebraska collections race Pgt-TPMK was identified. Most of the collections from barley are now being processed and are not included in Table 1.

Barley leaf rust. Severe barley leaf rust was found in Mesa, Arizona winter increase plots in late March. Leaf rust overwintered in light amounts in eastern Virginia. By the second week in May leaf rust was widespread in fields and severe on susceptible cultivars in nurseries in Virginia and adjoining states. Since the advent of Rph-7 virulence in the barley leaf rust population along the Atlantic Coast, losses have been severe. In the San Joaquin Valley, leaf rust was severe in mid-May in plots where it had overwintered. Near Guelph, Ontario, barley leaf rust overwintered in plots and had increased in severity by late May.

During late April, light amounts (1% severity) of barley leaf rust were found in plots and fields in north central Texas. The next reported leaf rust was in early June in a southeastern Minnesota nursery. During late June, 60% barley leaf rust severities were observed in plots in south central Nebraska and traces were found in south central and west central Minnesota. By mid-July, severe barley leaf rust (20%) was observed from south central Wisconsin, to east central North Dakota. Losses due to barley leaf rust were generally light.

Barley stripe rust. During the third week in March moderate amounts of stripe rust were noted on many entries in a Chandler, Arizona barley nursery. By late March, stripe rust was found in barley plots at Uvalde (40% severity), Dallas and Amarillo, Texas. During late April, stripe rust was severe in barley plots in central and north central Texas. In early May, severe stripe rust was observed in irrigated barley plots at Maricopa, Arizona. During late June, stripe rust was found on barley in a nursery in Fort Collins, Colorado. These have been confirmed as barley stripe rust, Puccinia striiformis f. sp. hordei.