Resistance in winter wheat to stripe rust and virulence of the pathogen in eastern United States from 1990 to 2014

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Before 2000, stripe (yellow) rust caused by *Puccinia striiformis* f. sp. *tritici* (*Pst*) was not considered an important disease in the hard red winter wheat (HRWW, approximately 12.5 million ha annually) and soft red winter wheat (SRWW, approximately 3.3 million ha annually) regions east of the Rocky Mountains. There were no direct breeding efforts to incorporate stripe rust resistance, but the 1BL:1RS translocation with resistance gene *Yr9* was in several cultivars and the 2NS:2AS translocation with *Yr17* was in several breeding lines. These translocations were used primarily for resistance to leaf (brown) rust provided by resistance genes *Lr26* and *Lr37*, respectively. However, each translocation also conferred resistance to the regional *Pst* population described as race CDL-3 (now PST-3) with narrow virulence. In 2000, an exotic strain of *Pst* (based on AFLP fingerprint patterns) emerged. The new strain overcame *Yr9* resistance, was more aggressive, more adapted to warm temperatures, and had enhanced overwintering capabilities. These and other unknown traits conferring superior fitness allowed the new strain to immediately and permanently replace the old strain in eastern United States. Stripe rust then became the most important disease across most of both regions. The objective of this presentation is to document the effective resistance genes in regional cultivars and the virulence changes on those genes in the *Pst* population from 1990 to 2014. In 2000, the new strain caused severe disease on many cultivars and breeding lines. However, diverse cultivars and lines, including lines with *Yr17*, had no disease. The effective resistance genes in these cultivars and lines were easily selected in the field and were used by breeders to develop a large number of resistant cultivars. In 2010, *Yr17* virulence emerged in combination with *Yr9* virulence, and all contemporary cultivars were susceptible at the seedling stage. However, many cultivars and lines were highly resistant at adult stages in the field, indicating adult-plant resistance (APR). Using 12 regional cultivars as differentials and regional isolates from 1990 to 2013, five major adult-plant virulence patterns were characterized, indicating that these resistance genes are race specific. The cultivar 'Mason' was susceptible to the old strain but had effective APR to all regional isolates since 2000. SRWW had a greater number of diverse sources of effective resistance than HRWW. The findings of this study indicate that race-specific APR is protecting HRWW and SRWW from stripe rust in eastern United States. Furthermore, these findings support the use of resistances found in contemporary regional cultivars and breeding lines for identifying virulence changes that are important in the field.