Summary of *Puccinia striiformis* f. sp. *tritici* (*Pst*, the Wheat Stripe Rust Pathogen) and *P. striiformis* f. sp. *hordei* (*Psh*, the Barley Stripe Rust Pathogen) Races in the United States in 2019

1. **Samples.** A total of 336 stripe rust samples were collected and received from wheat (274), barley (34), and grasses (28) from 15 states. From these samples, 226 *P. striiformis* f. sp. *tritici* (*Pst*) and 30 *P. striiformis* f. sp. *hordei* (*Psh*) isolates were obtained.

2. **Differential sets:** All of the *Pst* isolates were tested on 18 wheat differential lines each with a single *Yr* gene, and the *Psh* isolates were tested on 12 barley lines.

3. **Number of *Pst* races:** From the 226 *Pst* isolates, 25 races were identified. The virulence spectra of the races ranged from 0 to 13 with a mean of 8.2 on the 18 *Yr* genes.

4. **The top five *Pst* races:**

   1) PSTv-37 (Octal code: 171266) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrSP*, *Yr76*) with 43.2% frequency (No. 1), similar to 2018 (44.7%, No.1). This race was detected in 12 states (CA, ID, KS, KY, LA, MI, MN, OK, OR, SD, TX, WA) in 2019.

   2) PSTv-47 (Octal code: 571266) (virulent to *Yr1*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*; and avirulent to *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrSP*, *Yr76*) with 9.6% frequency (No. 2), increased from 1.8% in 2018. This race was detected in three states (CA, ID, and WA) in 2019.

   3) PSTv-41 (Octal code: 175766) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr10*, *Yr17*, *Yr24*, *Yr27*, *Yr32*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*); and avirulent to *Yr1*, *Yr5*, *Yr15*, *YrSP*, *Yr76*) with 8.0% frequency (No. 3), increased from 4.9% in 2018 (No. 5). This race was detected in two states (ID and WA) in 2019.

   4) PSTv-4 (Octal code: 511211) (virulent to *Yr1*, *Yr6*, *Yr9*, *Yr17*, *Yr27*, *YrSP*, *Yr76*, and avirulent to *Yr5*, *Yr7*, *Yr8*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*) with 4.0% frequency (No. 4), increased from 2.7% in 2018. This race was detected only in WA in 2019.

   5) PSTv-52 (Octal code: 171262) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrSP*, *YrTr1*, *Yr76*) with 3.2% frequency (No. 5), decreased from 10.2% (No. 2) in 2018. This race was detected in two states (OR and WA) in 2019.

   6) PSTv-322 (Octal code: 520000) (virulent to *Yr1*, *Yr8*; and avirulent to *Yr5*, *Yr6*, *Yr7*, *Yr9*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr27*, *Yr32*, *Yr43*, *Yr44*, *YrSP*, *YrTr1*, *YrExp2*, *Yr76*) with 3.2% frequency (No. 5), similar to 2018 (No. 5; 4.0%). This race was detected in two states (ID and WA) in 2019.

The remaining 19 races were all below 3.0% and 7 of them were detected only from one or two samples.

5. **New race.** In 2019, two new races (PSTv-323 and PSTv-324) were identified. PSTv-323 was identified from Montana and its virulence pattern (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrSP*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrTr1*, *Yr76*) is mostly similar to that of PSTv-52 (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrSP*, *YrTr1*, *Yr76*), except virulence to *YrSP*. PSTv-323 was identified from Washington and its virulence pattern (*Yr1*, *Yr6*, *Yr7*, *Yr9*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*, *Yr76*; and avirulent to *Yr5*, *Yr8*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr32*, *YrSP*) is mostly similar to that of PSTv-71 (*Yr1*, *Yr6*, *Yr7*, *Yr9*, *Yr27*, *Yr43*, *Yr44*, *YrExp2*, *Yr76*; and avirulent to *Yr5*, *Yr8*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr32*, *YrTr1*, *YrSP*), except virulence to *YrTr1*.

6. **Virulence frequencies.** High frequencies were found for virulence to *Yr8* (90.0%), *Yr27* (88.0%), *Yr6* (87.2%), *Yr9* (86.8%), *Yr7* (84.0%), *Yr44* (84.0%), *YrExp2* (84.0%), *Yr43* (79.6%), *Yr17* (78.8%), and *YrTr1* (72.4%); and low frequencies for virulence to *Yr1* (36.4%), *Yr76* (18.8%), *Yr10* (10.4%), *YrSP* (8.0%), *Yr24* (8.0%), and *Yr32* (7.6%). No virulence was found to either *Yr5* or *Yr15*, and therefore, these two resistance genes are still effective against all races identified so far in the U.S.

7. **Races of the barley stripe rust pathogen.** Barley stripe rust isolates were obtained from samples of California, Idaho, Oregon, and Washington in 2019. A total of 10 races of *P. striiformis* f. sp. *hordei* were identified. The first two predominant races with the same frequency (26.7%) were PSH-33 detected in Idaho and Washington (virulent on Topper and Abed Binder 12) and PSH-116 (virulent on Topper, Hiproly, Abed Binder 12, Trumpf, and Bigo) identified in Washington. PSH-116 was a new race. Both races PSH-54 (virulent on Topper, Abed Binder 12, Trumpf, and Bancroft) with frequency 10.0% was detected in Oregon and Washington. The other seven races were detected from one or two samples.

8. **Excel data and summary tables:**

    1. PSTsum19 including the following worksheets:
        1. Summary data of *Pst* isolates sorted by states
        2. Summary data of *Pst* isolates sorted by epidemiological regions
        3. All *Pst* races, code, virulence formulae, frequencies, and distributions
        4. *Pst* races and frequencies in different states
        5. *Pst* races and frequencies in different epidemiological regions
        6. Frequencies of virulence factors to the 18 *Yr* single-gene lines used as differentials
        7. New *Pst* races, code, virulence formula, type isolate, and detected states, regions and variety.

    2. PSHsum19 including the following worksheets:
        1. Summary data of *Psh* isolates

2. Summary data sorted by races
3. All *Psh* races, frequencies, and distributions
4. New *Psh* race, code, virulence formula, type isolate, and detected states, regions and variety.