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 2022

1. **Samples.** A total of 330 stripe rust samples were collected and received from wheat (256), triticale (5), barley (54), and grasses (15) from 12 states. From these samples, 283 *P. striiformis* f. sp. *tritici* (*Pst*) and 48 *P. striiformis* f. sp. *hordei* (*Psh*) isolates were obtained.

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

3. **Number of *Pst* races.** From the 283 *Pst* isolates, 22 races were identified. The virulence spectra of the races ranged from 0 to 13 with a mean of 8 on the 18 *Yr* genes.

4. **Top *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 50.5% frequency (No. 1), decreased from 76.4% in 2021 (No. 1). This race was detected in all states (CA, ID, IL, KS, LA, MD, MT, OH, OR, TX, and WA) except GA in 2022.

   2) PSTv-39 (Octal code: 175266) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr10*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr15*, *Yr24*, *Yr32*, *YrSP*, *Yr76*) with 12.7% frequency (No. 2), increased from 2.0% in 2021. This race was detected mostly in the Pacific Northwest (ID, OR, and WA) plus MD in 2022.

   3) PSTv-36 (Octal code: 170266) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr32*, *YrSP*, *Yr76*) with 7.4% frequency (No. 3), increased from 1.2% in 2021. This race was detected only in the western United States (CA, ID, OR, and WA) in 2022.

   4) PSTv-18 (Octal code: 000000) [virulent to none; and avirulent to all 18 *Yr* genes (*Yr1*, *Yr5*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr27*, *Yr32*, *Yr43*, *Yr44*, *YrSP*, *YrTr1*, *YrExp2*, *Yr76*) with 5.7% frequency (No. 4), increased from 2.4% in 2021 (No. 5). This race was detected in only in the Pacific Northwest (OR and WA) in 2022.

   5) PSTv-40 (Octal code: 174766) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr10*, *Yr24*, *Yr27*, *Yr32*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*); and avirulent to *Yr1*, *Yr5*, *Yr15*, *Yr17*, *YrSP*, *Yr76*) with 3.2% frequency (No. 5), increased from not detected in 2021. This race was detected only from WA in 2022.

   6) PSTv-52 (Octal code: 171262) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrSP*, *Yr76*)

with 3.2% frequency (No. 5), increased from 0.4% in 2021. This race was detected in three states (LA, OR, and WA) in 2022.

The remaining 16 races were all below 2.5%, and 7 of them each were detected from only one sample.

5. **New race.** No new *Pst* races were identified in 2021.

6. **Virulence frequencies.** High frequencies were found for virulence to *Yr6* (96.8%), *Yr27* (95.6%), *Yr8* (94.4%), *Yr17* (94.0%), *Yr9* (93.2%), *Yr7* (92.8%), *Yr44* (92.8%), *YrExp2* (92.8%), *Yr43* (92.4%), and *YrTr1* (89.2%); and low frequencies for virulence to *Yr1* (9.6%), *Yr10* (6.4%), *Yr76* (4.8%), *Yr24* (4.4%), *Yr32* (4.4%), and *YrSP* (3.2%). 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.** In 2022, *Psh* isolates were obtained from California and Washington, and 12 races were identified. Five races had frequencies above 2%: 1) **PSH-33** (virulent on Topper and Abed Binder 12) at 62.5% frequency, increased from 24.2% in 2021; 2) **PSH-46** (virulent on Topper, Abed Binder 12, and Trumpf) at 10.4% frequency, increased from not detected in 2021. 3) **PSH-54** (virulent on Topper, Abed Binder 12, Trumpf, and Bancroft), **PSH-81** (virulent on Topper, Abed Binder 12, and Bigo), and **PSH-118** (virulent on Topper, Abed Binder 12, Trumpf, and Bigo) all at 4.2% frequency and only from Washington. The other seven races each were detected from only one sample and all from Washington. No new races were detected in 2022.

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

   1) PSTsum2022 including the following worksheets:
      1. Summary data of *Pst* isolates sorted by state
      2. Summary data of *Pst* isolates sorted by epidemiological region
      3. All *Pst* races, codes, virulence formulae, frequencies, and distributions
      4. *Pst* races and frequencies in each state
      5. *Pst* races and frequencies in each epidemiological region
      6. Frequencies of virulence factors to the 18 *Yr* single-gene lines used as differentials

   2) PSHsum2022 including the following worksheets:
      1. Summary data of *Psh* isolates
      2. Summary data sorted by races
      3. All *Psh* races, frequencies, and distributions