

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 2017

1. **Samples.** A total of 393 stripe rust samples were collected and received from wheat (330), barley (52), and grasses (11) from 20 states, plus Ontario, Canada. From the samples, 218 *P. striiformis* f. sp. *tritici* (*Pst*) and 42 *P. striiformis* f. sp. *hordei* (*Psh*) isolates were obtained. One hundred twenty three samples were not recovered due to poor quality, from fungicide-sprayed fields, and/or our problems of handling.
2. **Differential sets:** All of the *Pst* isolates were tested on 18 differential lines each with a single *Yr* gene and the barley isolates were tested on 12 barley lines.
3. **Number of *Pst* races:** From the 218 *Pst* isolates, 64 races were identified. The virulence spectra of the races ranged from 1 to 13 at a mean of 8.3 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 45.0% frequency (No. 1), increased from 22.1% (No. 2) in 2016.
 - 2) **PSTv-318** (Octal code: 171267) (virulent to *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, *YrExp2*, *Yr76*; and avirulent to *Yr1*, *Yr5*, *Yr10*, *Yr15*, *Yr24*, *Yr32*, *YrSP*) with 5.1% frequency (No. 2), increased from 1.5% in 2016. Note: This race is similar to PSTv-37 with additional virulence to *Yr76* (= *YrTye*) that is in many club wheat cultivars grown in the Pacific Northwest. This race was detected from six samples only from Washington in 2016, but found in 7 states including Louisiana, Montana, Nebraska, Oklahoma, Virginia and Ontario, as well as Washington.
 - 3) **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 4.6% frequency (No. 3), decreased from 22.6% (No. 1) in 2016.
 - 4) **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 3.2% frequency (No.4). This race is different from PSTv-37 only by the virulence to *Yr1*. It increased from 0.8% in 2016.
 - 5) **PSTv-322** (Code: 420000) (virulence to *Yr1*, *Yr8*; and avirulent to *Yr5*, *Yr6*, *Yr7*, *Yr9*, *Yr10*, *Yr15*, *Yr17*, *Yr24*, *Yr27*, *Yr32*, *Yr43*, *Yr44*, *YrSP*, *YrTr1*, *YrExp2*, *Yr76*) with 2.3% frequency (No. 5), increased from 0.3% in 2016, the first year detected.

The top four races (PSTv-37, PSTv-318, PSTv-52, and PSTv-47) had a wide distribution whereas No. 5 (PSTv-322) was detected in eastern Washington and northeastern Oregon.

The remaining 59 races were all below 2% and 44 of them were detected only from one sample.

5. **New races.** In 2017, 31 new races were identified, similar to 2016 (32 new races). The 2017 new races and their virulence formulae and collection information are given in TABLE 17PST8 (the last worksheet) of file PSTsum17.xlsx. All new races were detected from one sample except race PSTv-354 (code 531211) with virulence factors to *Yr1*, *Yr6*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *YrSP*, and *Yr76* was detected from 3 samples (1 from Oregon and 2 from Washington).
6. **Virulence frequencies.** High frequencies were found for virulence to *Yr6* (94.5%), *Yr9* (91.7%), *Yr8* (90.4%), *Yr27* (87.6%), *Yr7* (84.4%), *Yr17* (84.4%), *Yr44* (84.4%), *YrExp2* (81.2%), *Yr43* (77.5%), and *YrTr1* (73.9%); and low frequencies for virulence to *Yr1* (29.4%), *Yr76* (24.8%), *YrSP* (12.8%), *Yr10* (7.8%), *Yr32* (4.6%), and *Yr24* (1.6%). 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 samples were obtained from California and Washington. A total of 14 races of *P. striiformis* f. sp. *hordei* were identified in 2017, higher than 2016. The first predominant race (23.8%) was PSH-114 (virulent to Topper, Heils Franken, Emir, Astrix, Varunda, Abed Binder 12, Trumpf, and Bancroft). This race is similar to previously identified race PSH-60, except the additional virulence on Varunda. The race was first identified in 2017 from both California and Washington. PSH-76 (virulent to Topper, Hiproly, Varunda, Abed Binder 12, Trumpf Mazurk, Bigo, and Bancroft) was the second predominant race (21.4%). PSH-33 (virulent on Topper and Abed Binder 12) was the third most common race at a frequency of 14.3%, decreased from 50% (No. 1) in 2016.

Excel data and summary tables:

1. PSTsum17 including the following worksheets:
 1. Summary data of *Pst* isolates
 2. Summary data of *Pst* isolates sorted by states
 3. Summary data of *Pst* isolates sorted by epidemiological regions
 4. All *Pst* races, code, virulence formulae, frequencies, and distributions
 5. *Pst* races and frequencies in different states
 6. *Pst* races and frequencies in different epidemiological regions
 7. Frequencies of virulence factors to the 18 *Yr* genes used as differentials
 8. New *Pst* races, codes, virulence formulae, type isolates, and detected states, regions and varieties.
2. PSHsum17 including the following worksheets:
 1. Summary data of *Psh* isolates
 2. Summary data sorted by races
 3. *Psh* races, frequencies, and distributions