



Virulence characterization of *Puccinia graminis* f. sp. *avenae* in Argentina

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Summary:

Oat stem rust, caused by *Puccinia graminis* f. sp. *avenae* Erikss and Henning (*Pga*), is a disease of global relevance that is highly destructive under favorable environmental conditions. Characterization of *Pga* populations can provide valuable insights into their size, diversity, and complexity, and allow for the identification of race-specific resistance genes potentially useful in oat breeding.

This study documents the structure and complexity of *Pga* populations collected from different sites in Argentina between 2021–2023 and compares the results to a population sampled in 2005. We identified 22 different races of *Pga* among the 70 isolates collected, showing a high level of diversity. Moreover, most of the races identified in 2021, and all of the races identified in 2022 and 2023, were different from those found in 2005. They were also more virulent and complex. The predominant race, “race 11”, demonstrated virulence against all 11 differential oat lines used in this study, emphasizing its potential to be a serious threat to oat cultivation in Argentina.

This change in population dynamics suggests that the use of only a few genes for resistance to stem rust in Argentinian oat germplasm has resulted in the continuous selection of *Pga* phenotypes with virulence to those resistance genes, leaving no resistance genes that are useful for oat breeding under Argentinian conditions. These findings underscore the pressing need to expand our search for new resistance genes. We must also deepen our understanding of the genetic mechanisms governing resistance to stem rust in oats. Moreover, our research highlights the dynamic nature of plant-pathogen interactions, emphasizing the evolution of *Pga* populations and their interaction with stem rust resistance genes.