

Wheat Rusts Project

Development and use of strategies for the effective deployment of genetic resistance to rusts as a factor for the sustainability of wheat production in Brazil

Márcia Soares Chaves

Embrapa

Trigo

Wheat Rusts Project



Research Team

PI: Márcia Soares Chaves – Embrapa

Co-PIs: Paulo Roberto da Silva – UNICENTRO

Sandra Scagliusi – Embrapa

José Martinelli – UFRGS

Sandra Brammer – Embrapa

Ana Lucia S. Chaves – UFPEL

Financial support



Wheat Rusts Project

Collaborating institutions



Why it is so difficult to EFFECTIVELY deploy APR in commercial varieties?

Major constraints for Brazilian breeding programs are:

- ✿ APR is generally a quantitative trait



Phenotype can be affected by G x E interactions

- ✿ Selection under low pressure of virulent inoculum can cause 'false-positive' phenotypes



Materials showing RPA phenotype can be selected without actually having the trait

- ✿ Rust resistance is JUST ONE among many traits to be selected



Genotypes carrying desirable APR genes may be discarded in breeding programs if they carry any other undesirable agronomic traits

- ✿ APR genes for which DNA Markers are available (eg: *Lr34*, *Lr46*) ALONE do not provide enough protection to rusts under South American environment → 3-4 minor genes are necessary

Objective and Structure

Develop and implement strategies for the effective deployment of genetic resistance to wheat rusts as a factor for the sustainability of wheat production in Brazil

SP1 – Project management

SP2 – Virulence and genetic diversity of pathogens causing wheat leaf and stem rust occurring in Brazil

SP3 – Phenotyping and validation of APR in wheat lines and cultivars under field conditions

SP4 – Identification of resistance genes to leaf and stem rust in APR wheat lines and popular Brazilian cultivars

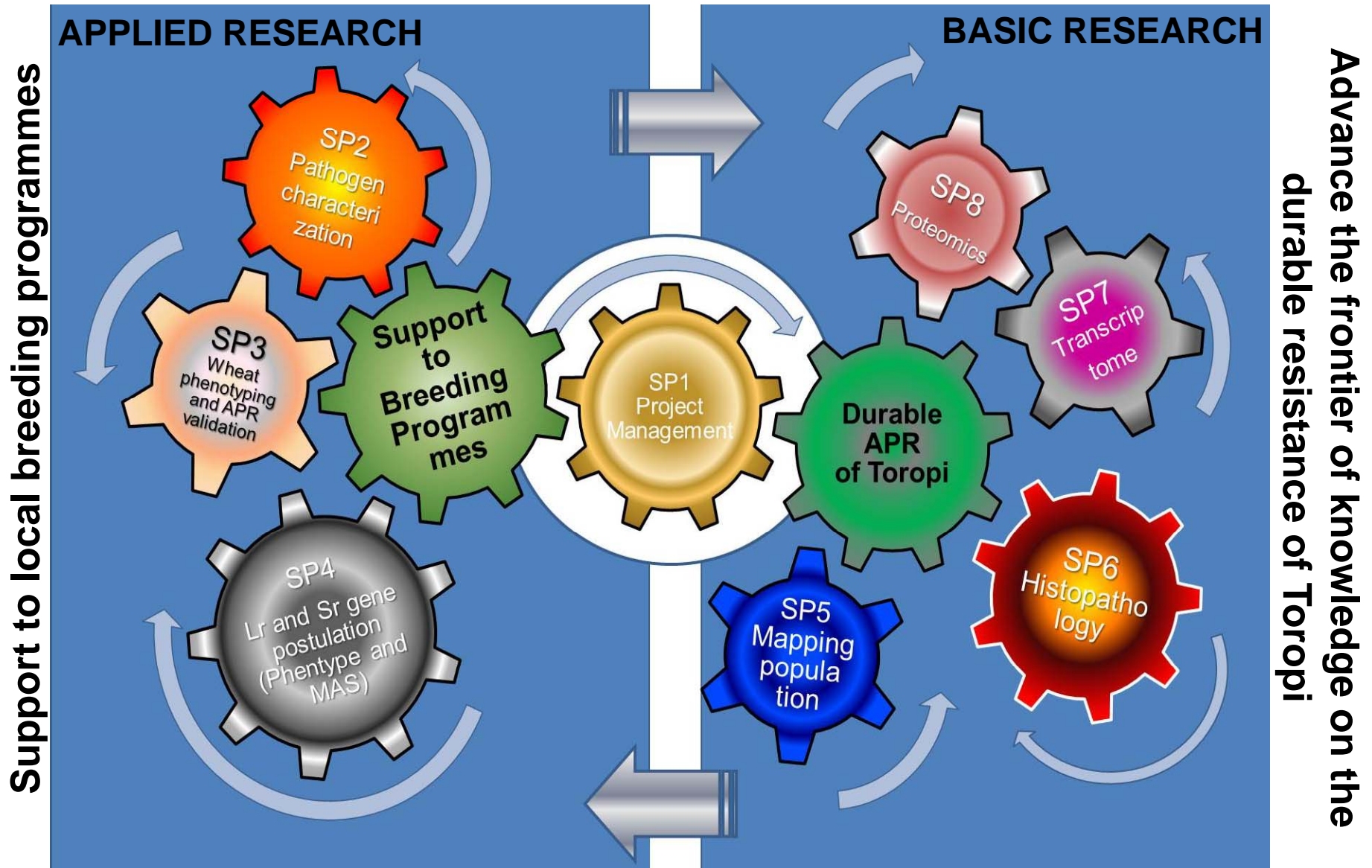
SP5 – Development of double haploid population for mapping adult plant resistance genes to leaf rust from cultivar Toropi

SP6 – Histopathology of the adult plant resistance to leaf rust expressed in cultivar Toropi

SP7 – Study of wheat transcriptome during the process of infection and APR resistance to *Puccinia triticina* in cultivar Toropi

SP8 – Identification and characterization of candidate proteins involved in adult plant resistance of Toropi

Strategy



Subproject 2

Virulence and genetic diversity of pathogens causing wheat leaf and stem rust occurring in Brazil (Leader: Márcia Chaves - Embrapa)

Objectives:

- Characterize the population of *Puccinia triticina* (leaf rust) occurring in Brazil in relation to its composition, virulence to resistance genes, geographical distribution and evolution;
- Monitor the occurrence of *Puccinia graminis* f.sp. *tritici* (stem rust) in Brazil, especially in regard to virulence to the genes *Sr31*, *Sr24* and *Sr36* e *Sr38* (races of Ug99 lineage);
- Characterize the effectiveness of resistance genes to the virulence of *P. triticina* and *P. g. f. sp. tritici* occurring in Brazil;
- Maintain and expand the collections of isolates of the pathogen.

Subproject 3

Phenotyping and validation of APR in wheat lines and cultivars under field conditions (Leader: Márcia Chaves – Embrapa)

Objectives:

- Phenotyping a regional wheat germplasm collection for field resistance to *P. triticina* and *P. g. f.sp. tritici*
- Validate the expression of adult plant resistance (APR) to leaf rust in previously characterized and selected lines of Embrapa's Wheat Breeding Program Wheat

Subproject 4

Postulation of rust resistance genes *Lr* and *Sr* in APR wheat lines and popular Brazilian cultivars (Leader: Paulo Roberto da Silva – UNICENTRO)

Objectives:

- Characterize the reaction of wheat genotypes previously selected to 25 races of *P. triticina* and postulate the presence of *Lr* genes
- Estimate the potential vulnerability of wheat crop to *P. triticina* and *P.g. tritici* considering the *Lr* and *Sr* gene background of popular cultivars

Subproject 5

Development of a double haploid population for mapping adult plant resistance genes to leaf rust from cultivar Toropi (Leader: Sandra Mansur Scagliusi – Embrapa)

Objectives:

- Develop double haploid wheat lines from the cross BRS 194 (S) x Toropi (APR)
- Characterize the reaction at adult plant stage to leaf rust under field conditions and agronomic traits of DH lines produced and select superior material
- Integrate the selected APR DH lines to the crossing blocks of regional breeding programs

Present Situation: Production of F1 ongoing

Subproject 6

Histopathology of the adult plant resistance to leaf rust expressed in cultivar Toropi (Leader: José Martinelli – UFRGS)

Objectives:

- Characterize the biological events involved in infection and reaction of adult plant resistance to leaf rust in the APR wheat cultivar Toropi
- Characterize the nature of the APR in wheat cultivar Toropi
 - structural or biochemical?
 - pre-or post-haustorial mechanism?

Subproject 7

Study of wheat transcriptome during the process of infection and APR resistance to *Puccinia triticina* in cultivar Toropi (Leader: Sandra Brammer – Embrapa)

Objectives:

- Understanding the molecular mechanism of defense against *P. triticina*;
- Identify genes that are related to the mechanism of plant defense against pathogens;
- Assemble a probable cascade of signals that trigger the resistance of wheat to leaf rust;

Subproject 8

Identification and characterization of candidate proteins involved in adult plant resistance of Toropi (Leader: Ana Lucia S. Chaves – UFPEL)

Objectives:

- Produce "in vitro" proteins corresponding to two genes related to the adult plant resistance of Toropi previously identified and characterized;
- Determine the spatial structure of the proteins produced according to the predicted functions in silico
- Select "in vivo" candidate proteins to be involved in adult plant resistance to leaf rust of Toropi

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e Abastecimento



Thank you!



mchaves@cnpt.embrapa.br



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