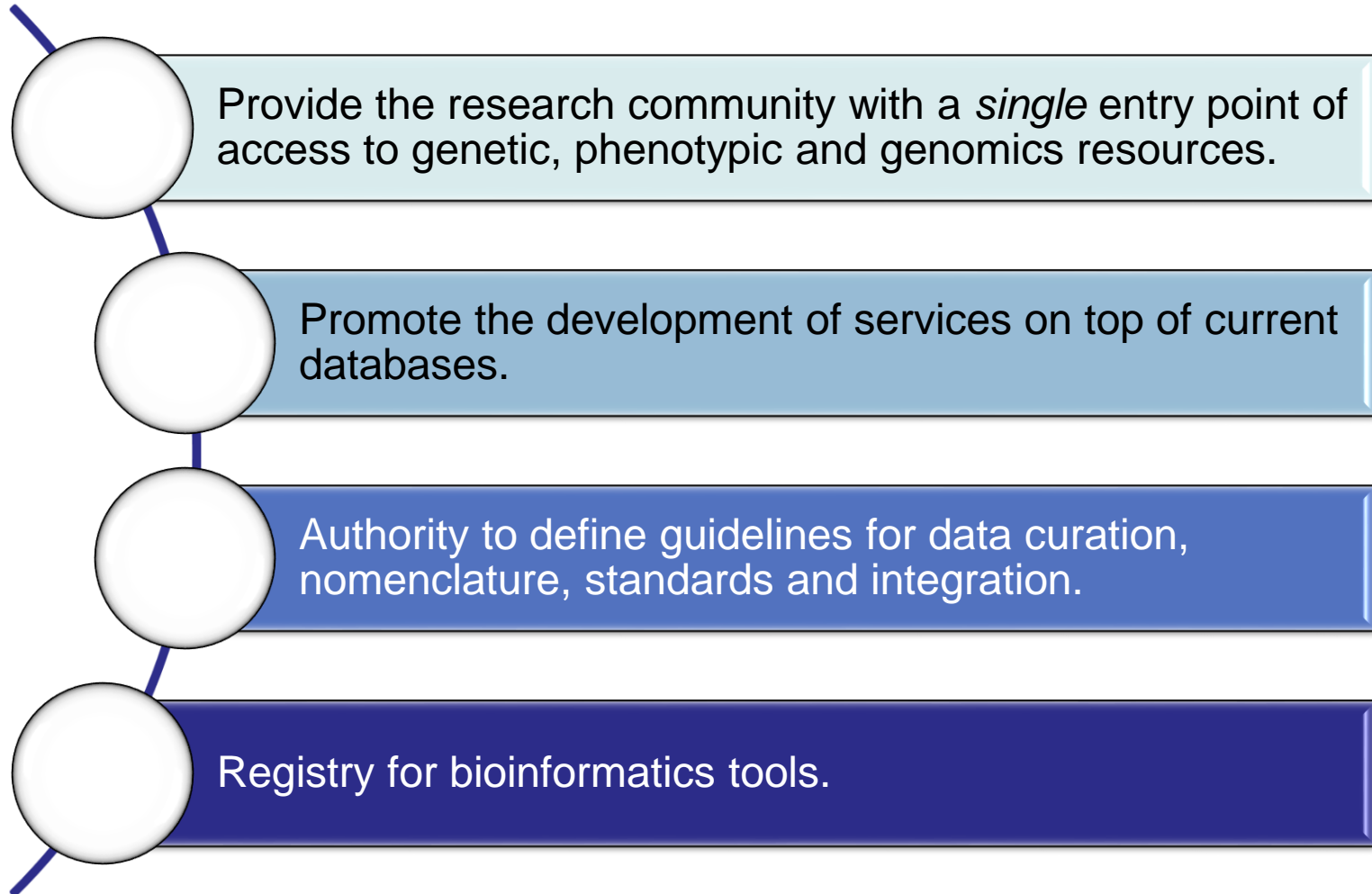
A person is seen from behind, walking away on a stone-paved path. They are carrying a large, heavy bundle of harvested wheat or grain on their back, secured with a long wooden pole. The path is flanked by lush green vegetation and small trees. In the background, there are rolling hills and a bright, hazy sky, suggesting a rural, agricultural setting. The overall tone is warm and golden, likely due to the lighting or a color filter.

# *Apprendre à lire aux ordinateurs pour améliorer le blé*

Hadi Quesneville

Journées Nationales de la Science Ouverte  
6 Décembre 2018

# Wheat e-infrastructure goals



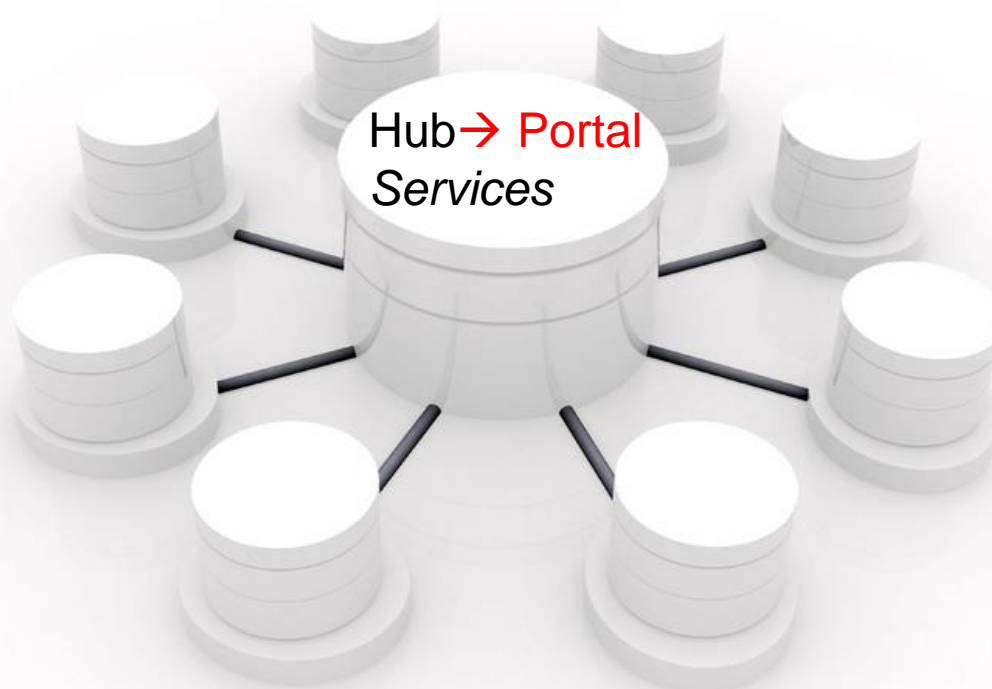


# WheatIS nodes (#12)



# Distributed information system

- A network of bioinformatics platformes



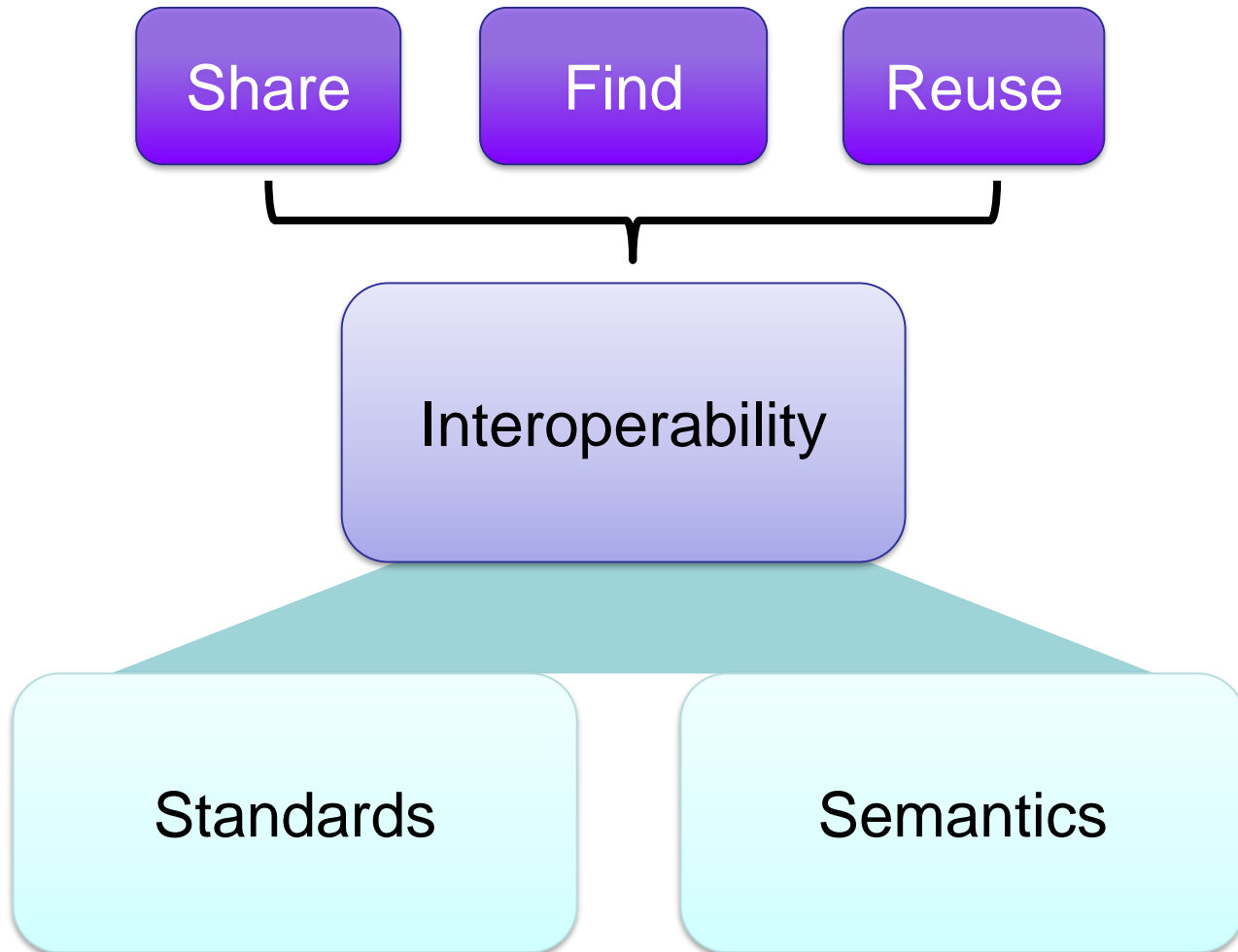
Node (Platform) → resources

*Computes / Storage*

*Integrative database:*

*genomic, genetic, and phenotypic  
information, comparative genomics,  
and functional genomics*

# E-infrastructures key issues



# FAIR principles

## To be **F**indable:

- **Persistent identifier** (like a DOI or Handle)
- **Rich metadata** to describe the data (*making sure it is findable through disciplinary discovery portals.*)

## To be **A**ccessible:

- **Data open** using a standardised protocol  
*Clarity and transparency around the conditions governing access and reuse.*

## To be **I**nteroperable:

- Use community agreed **formats, language** and **vocabularies**.
- **Contain links** to related information using identifiers.

## To be **R**eusable:

- Maintain its **initial richness** (*not diminished for explaining the findings in one publication*).
- Clear machine readable **licence** and **provenance** information on how the data was formed.

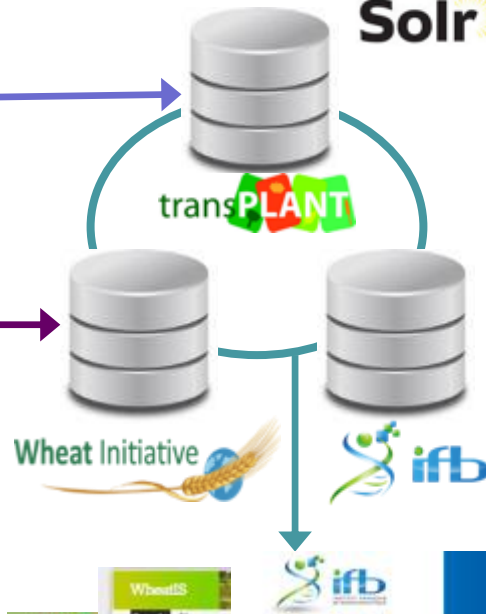




**FINDABLE:**  
→ ***DATA DISCOVERY***



# Full text search of distributed databases





[About](#)
[Collaborators](#)
[Search](#)
[Data Standards](#)
[Submit Data](#)
[Tools](#)
[Links](#)
[WheatIS Nodes](#)

## WheatIS

@ PRATT J.C. / INRA

## WheatIS

Filters

[Clear](#)

**Database**

- ☐ TRITICEAE TOOLBOX (64)
- ☐ CR-EST (7)
- ☐ GNPI (3)
- ☐ ENSEMBL PLANTS (1)
- ☐ GNPI JBROWSE (1)
- ☐ PLANTPHENODB (1)

**Type**

- ☐ ACCESSION (42)
- ☐ PHENOTYPE (14)
- ☐ EXPERIMENT (9)
- ☐ EXPRESSED SEQUENCE TAGS (7)
- ☐ SEQUENCE FEATURE (2)
- ☐ PHENOTYPE (1)
- ☐ QTL (1)
- ☐ SEQUENCE FEATURE (1)

**Species**

- ☐ TRITICUM AESTIVUM (69)
- ☐ HORDEUM VULGARE (6)
- ☐ TRITICUM AESTIVUM L. (1)
- ☐ TRITICUM DURUM (1)

**Search**

**About**

**WheatIS nodes:**

**transPlant-MIPS (UP):**

- CrowsNest: 13324

**transPlant-IPK (UP):**

- CR-EST: 199220
- GEBIS: 52878
- MetaCrop: 355

Help desk: If you have questions regarding this Wheat Information System project, please contact: wheatis-contact @ wheatis.org

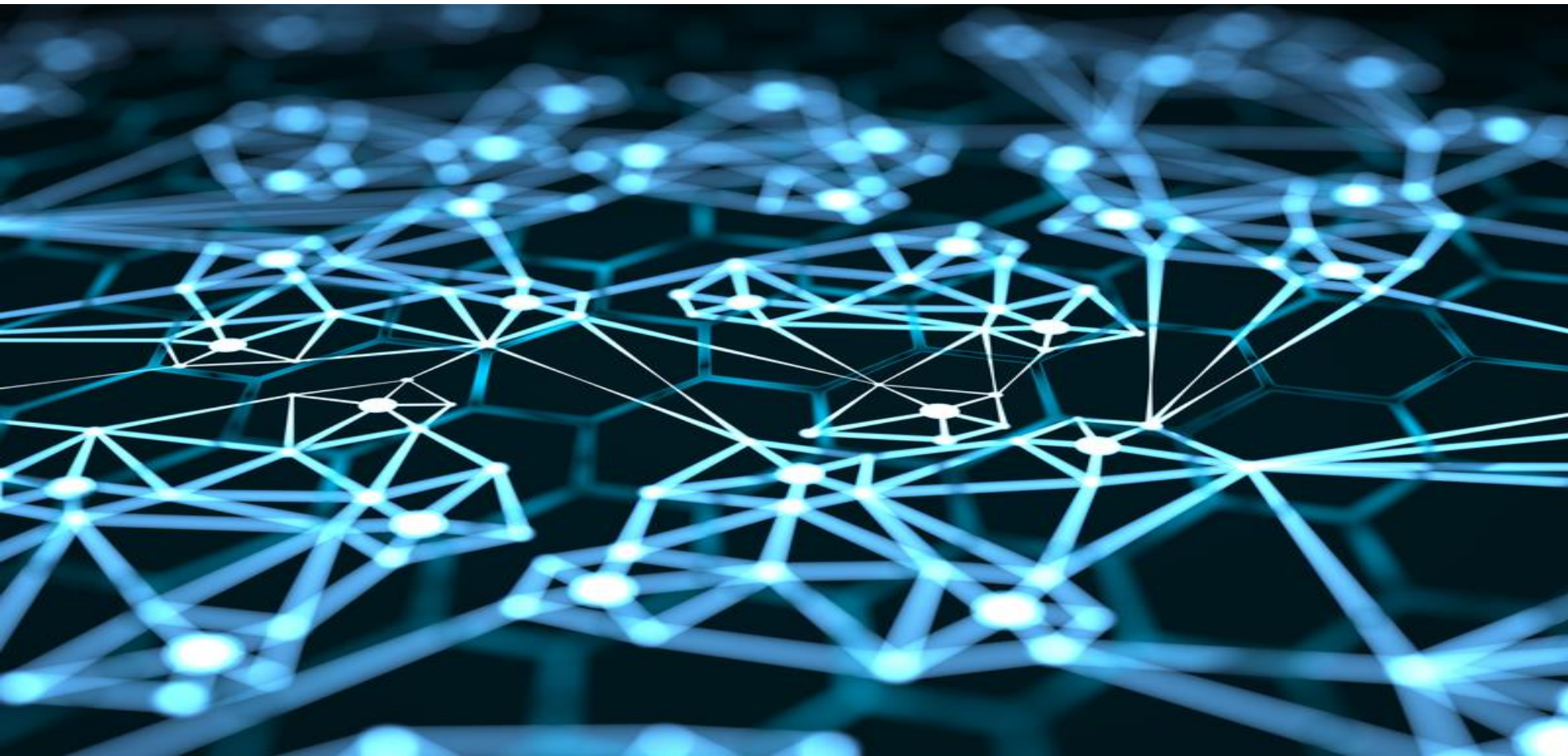
hfb

1-10 of 77

10 results per page

ID	Source	Type	Taxon	Description
<a href="#">Traes_5DL_E12C501B4</a>	Ensembl Plants	-	Triticum aestivum	Sequence feature, Ensembl Plants, Traes_5DL_E12C501B4, Traes_5DL_E12C501B4, Multiple inositol polyphosphate phosphatase Phylla1 [Source:UniProtKB/TrEMBL;Acc:A0FHB0], Triticum aestivum, protein_coding, 5D
<a href="#">HDP14M22T</a>	CR-EST	-	Hordeum vulgare	HDP14M22T, expressed sequence tags, CR-EST, Hordeum vulgare, gi 26248924 ref NP_754964.1  Hypothetical protein yfB [Escherichia coli CFT073] Hypothetical protei; gi 28951047 gb AAO63447.1  At2g37930 [Arabidopsis thali[...]
<a href="#">HDP20D01w</a>	CR-EST	-	Hordeum vulgare	HDP20D01w, expressed sequence tags, CR-EST, Hordeum vulgare, gi 15604676 ref NP_221194.1  SFHB PROTEIN HOMOLOG (sfhB) [Rickettsia prowazekii str. Madrid E] SFHB ; gi 34906406 ref NP_914550.1  P0710E05.16 [Oryza sativa [...]
<a href="#">HDP20D01T</a>	CR-EST	-	Hordeum vulgare	HDP20D01T, expressed sequence tags, CR-EST, Hordeum vulgare, gi 15604676 ref NP_221194.1  SFHB PROTEIN HOMOLOG (sfhB) [Rickettsia prowazekii str. Madrid E] SFHB ; gi 34906406 ref NP_914550.1  P0710E05.16 [Oryza sativa [...]
<a href="#">HDP21C08T</a>	CR-EST	-	Hordeum vulgare	HDP21C08T, expressed sequence tags, CR-EST, Hordeum vulgare, gi 15604676 ref NP_221194.1  SFHB PROTEIN HOMOLOG (sfhB) [Rickettsia prowazekii str. Madrid E] SFHB ; gi 31979237 gb AAP68831.1  bone morphogenetic protein 1[...]
<a href="#">HDP31N10w</a>	CR-EST	-	Hordeum vulgare	HDP31N10w, expressed sequence tags, CR-EST, Hordeum vulgare, gi 15604676 ref NP_221194.1  SFHB PROTEIN HOMOLOG (sfhB) [Rickettsia prowazekii str. Madrid E] SFHB ; gi 34906406 ref NP_914550.1  P0710E05.16 [Oryza sativa [...]
<a href="#">HDP35A10T</a>	CR-EST	-	Hordeum vulgare	HDP35A10T, expressed sequence tags, CR-EST, Hordeum vulgare, gi 26248924 ref NP_754964.1  Hypothetical protein yfB [Escherichia coli CFT073] Hypothetical protei; gi 28951047 gb AAO63447.1  At2g37930 [Arabidopsis thali[...]
<a href="#">TS034O07u</a>	CR-EST	-	Triticum aestivum	TS034O07u, expressed sequence tags, CR-EST, Triticum aestivum, Gi 15233419 ref NP_192328.1  hypothetical protein [Arabidopsis thaliana] gi 7487460 pir T01820 hypo; Gi 15604676 ref NP_221194.1  SFHB PROTEIN HOMOLOG (sf[...]
<a href="#">HWW FHB</a>	Triticeae Toolbox	Experiment	Triticum aestivum	Experiment, Triticeae Toolbox, HWW FHB, phenotype experiment, Includes trials FHB_2014_Lincoln, HWWFHB_2014_Brookings, HWWFHB_2014_Fargo, Triticum aestivum, phenotype
<a href="#">URSN_2012_BrookingsSD</a>	Triticeae Toolbox	Experiment	Triticum aestivum	Experiment, Triticeae Toolbox, URSN_2012_BrookingsSD, phenotype trial, traits=Fusarium head blight incidence, Fusarium head blight severity, Fusarium head blight disease index, visually scabby kernels URSN, descript[...]

If we have missed a link  
The site is supported by



# ONTOLOGIES MAPPING

# Ontologies

## •WIPO:

- The Wheat INRA **Phenotypes** Ontology is developed in the frame of the BreedWheat project.
- Observations variables
- The WIPO v1.3 contains 262 variables.

## WTO:

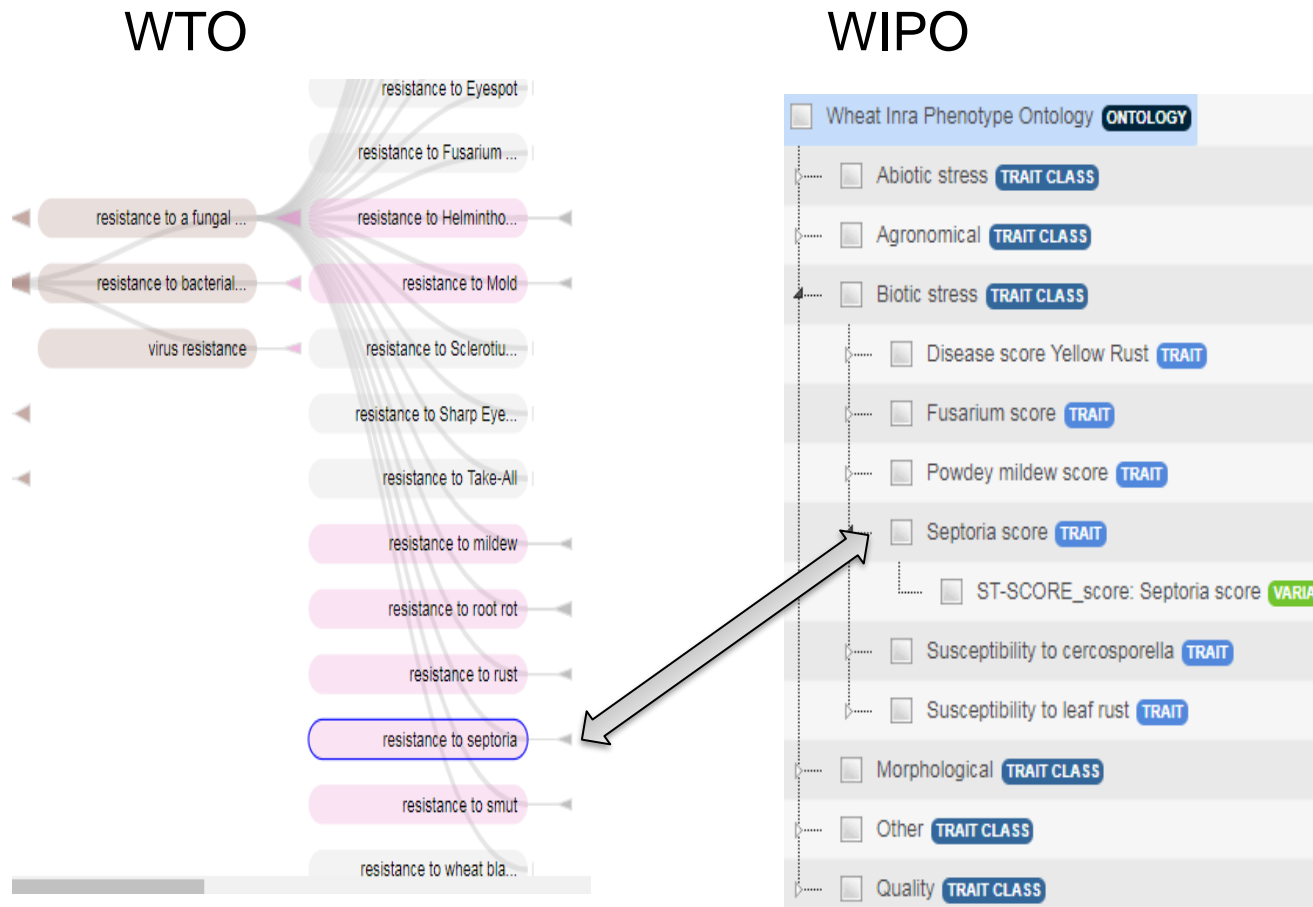
- Wheat Trait Ontology
- General **traits found in the literature**: traits of resistance, development, nutritional, baking quality, etc.



# Goal

1. Link wheat phenotyping data to the literature
  2. Semantic enrichment of the wheat phenotyping data
- Align the traits of agronomical interest (WTO) and experimental data (WIPO)
- ➔ finds correspondences between semantically related entities of the ontologies

# Alignment example



# Alignment example

## WIPO

## WTO

WIPO:0000101	Fusarium score, Susceptibility to fusarium head blight	FUS-SCORE_score	WIPO:Biotic stress/Fusarium score/Fusarium score, Susceptibility to fusarium head blight/FUS-SCORE_score	ID:0030905	resistance to Fusarium head blight	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to Fusarium head blight
WIPO:0000105	Spikes with fusarium at 350DD post fusarium inoculation (INOC+350DD)	FUS-SPK.350DD_score	WIPO:Biotic stress/Spikes with fusarium post fusarium inoculation/Spikes with fusarium at 350DD post fusarium inoculation (INOC+350DD)/FUS-SPK.350DD_score	ID:0030905	resistance to Fusarium head blight	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to Fusarium head blight
WIPO:0000106	Spikes with fusarium at 450DD post fusarium inoculation (INOC+450DD)	FUS-SPK.450DD_score	WIPO:Biotic stress/Spikes with fusarium post fusarium inoculation/Spikes with fusarium at 450DD post fusarium inoculation (INOC+450DD)/FUS-SPK.450DD_score	ID:0030905	resistance to Fusarium head blight	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to Fusarium head blight
WIPO:0000113	Septoria tritici - Field Disease Index	ST-FDI	WIPO:Biotic stress/Septoria tritici - Field Disease Index/Septoria tritici - Field Disease Index/ST-FDI	ID:0000107	resistance to Septoria Leaf Blotch	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to septoria/resistance to Septoria Leaf Blotch
WIPO:0000114	Septoria score on leaf 1	ST-F1-SCORE_score	WIPO:Biotic stress/Septoria score on leaf/Septoria score on leaf 1/ST-F1-SCORE_score	ID:0000107	resistance to Septoria Leaf Blotch	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to septoria/resistance to Septoria Leaf Blotch
WIPO:0000115	Septoria score on leaf 2	ST-F2-SCORE_score	WIPO:Biotic stress/Septoria score on leaf/Septoria score on leaf 2/ST-F2-SCORE_score	ID:0000107	resistance to Septoria Leaf Blotch	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to septoria/resistance to Septoria Leaf Blotch
WIPO:0000145	Powdery mildew score, Susceptibility to powdery mildew	PM-SCORE_score	WIPO:Biotic stress/Powdery mildew score/Powdery mildew score, Susceptibility to powdery mildew/PM-SCORE_score	ID:0030907	resistance to Powdery Mildew	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to mildew/resistance to Powdery Mildew
WIPO:0000152	Brown rust score	BR-SCORE_1 to 9 score	WIPO:Biotic stress/Brown rust score/Brown rust score/BR-SCORE_1 to 9 score	ID:0031017	resistance to Leaf Rust	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to rust/resistance to Leaf Rust
WIPO:0000162	Yellow rust score, Susceptibility to stripe rust	YR-SCORE_score	WIPO:Biotic stress/Disease score Yellow Rust/Yellow rust score, Susceptibility to stripe rust/YR-SCORE_score	ID:0000089	resistance to Stripe Rust	/FSOV Concept/plant property/response to environmental condition/response to biotic stress/pest resistance/pathogen resistance/resistance to a fungal pathogen/resistance to rust/resistance to Stripe Rust

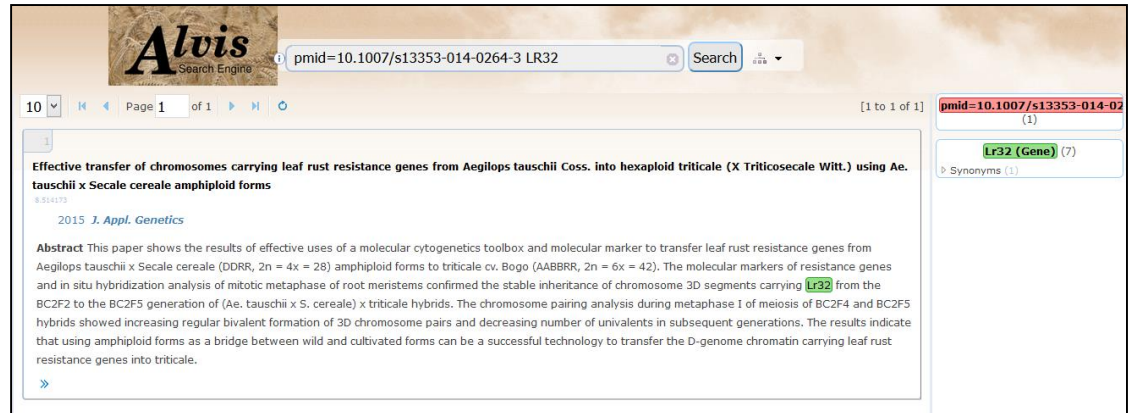
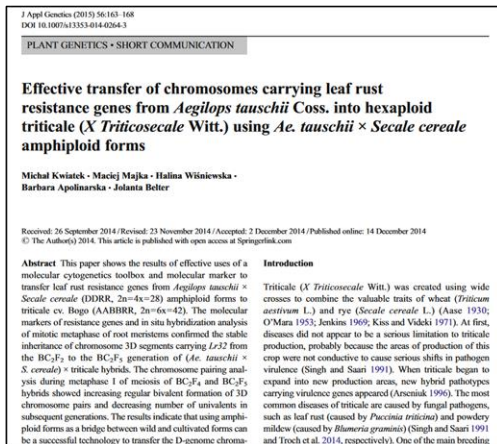


# Processing PubMed

- Publication data from the European OpenMinTed project

## Processing PubMed collection

Documents	3 881
Genes	10 254
Taxa	14 853
Phenotypes	8 792
Markers	1 941



# Parsing literature



10
Page 1 of 1
[1 to 3 of 3]

1
**Identification and location of *Stb9*, a gene for resistance to septoria tritici blotch in wheat cultivars *Courtot* and Tonic**  
0.7264512  
Authors: Chartrain, L Sourdille, P Bernard, M Brown, JKM  
2009 *Plant Pathol.*  
**Abstract** This study reports the discovery of a gene for resistance to septoria tritici blotch (STB) in two spring wheat cultivars, *Courtot* and Tonic. The gene, named *Stb9*, confers resistance to *Mycosphaerella graminicola* isolate IPO89011. It was mapped by quantitative trait loci (QTL) analysis using an existing map of *Courtot* x Chinese Spring and was located between markers Xfbb226 (3.6 cM) and XksuF1b (9 cM) on the long arm of chromosome 2B. Markers linked to *Stb9* in *Courtot* were then shown to be linked to resistance to IPO89011 in F 3 families of Tonic x Longbow. Allelism tests in which Tonic was crossed with *Courtot* confirmed that Tonic has a gene for resistance to IPO89011 at or very close to the *Stb9* locus. SSR markers flanking *Stb9* may be used in marker-assisted selection to introgress this gene into winter cultivars or in spring wheat breeding programmes outside Europe.

2
**Powdery mildew resistance of Nordic spring wheat cultivars grown in Estonia**  
0.39632618  
Authors: Peusha, H Enno, T Jakobson, I Tsombalova, J Ingver, A Jarve, K  
2008 *Acta Agric. Scand. Sect. B-Soil Plant Sci.*  
**Abstract** A group of spring wheat cultivars originating from Sweden, Finland, Norway, Germany, and the Netherlands was analysed for powdery mildew resistance. Using functional molecular markers, two alleles of the major resistance gene *Pm3* were detected among the cultivars under the study. One of the alleles, Pm3d, was detected in the resistant cultivars 'Vinjett', 'SW Estrad', and 'Zebra', and in 'Tjalve', a cultivar of earlier release susceptible to the local population of powdery mildew. The second allele of *Pm3* detected in the analysed group of cultivars was the allele Pm3f, rarely used in Europe. It was identified in the resistant cultivars

# Integrating results

## WheatIS

### Filters

Clear

#### Database

- ☐ OPENMINTEd (138)
- ☐ GRAMENE (1)

#### Type

- ☐ BIBLIOGRAPHY (138)
- ☐ INTERPRO FAMILY (1)

#### Species

- ☐ TRITICUM (138)
- ☐ AEGILOPS TAUSCHII (1)
- ☐ BRACHYPODIUM DISTACHYON (1)
- ☐ HORDEUM VULGARE SUBSP. VULGARE (1)
- ☐ TRITICUM AESTIVUM (1)
- ☐ TRITICUM URARTU (1)

### Search

### About

pathogen resistant



1-20 of 139



20 results per page



ID	Source	Taxon	Description
<a href="#">IPR002812</a>	Gramene	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	InterPro Family, Gramene, IPR002812, DHQ_synth, 3-dehydroquinase synthase, 3-Dehydroquinase synthase () is an enzyme in the common pathway of aromatic amino acid biosynthesis that catalyses the conversion of 3-deoxy-D-[...]
<a href="#">10.1007/s00122-015-2514-0</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s00122-015-2514-0, Identification of a <a href="#">stem rust resistance</a> locus effective against Ug99 on <a href="#">wheat</a> chromos[...]
<a href="#">10.1016/j.fgb.2015.03.018</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1016/j.fgb.2015.03.018, A gene locus for targeted ectopic gene integration in Zymoseptoria tritici Understanding the cellular organization and biology of fungal pathogens requires accurate [...]
<a href="#">10.1094/PHYTO-08-14-0224-R</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1094/PHYTO-08-14-0224-R, <a href="#">Resistance to Puccinia graminis</a> f. sp avenae in <a href="#">Barley</a> Is Associated with the Rpg5 L[...]
<a href="#">10.1007/s00122-015-2460-x</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s00122-015-2460-x, Fine mapping and characterization of <a href="#">Sr21</a> , a temperature-sensitive diploid <a href="#">wheat</a> resistanc[...]
<a href="#">10.1007/s13313-014-0339-y</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s13313-014-0339-y, Races of Puccinia tritici detected on <a href="#">wheat</a> in Zimbabwe, Zambia and Malawi and <a href="#">regional ge[...]</a>
<a href="#">10.1007/s00122-014-2442-4</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s00122-014-2442-4, Identification and mapping of <a href="#">Sr46</a> from Aegilops tauschii accession Clae 25 conferring <a href="#">resist[...]</a>
<a href="#">10.1007/s10658-014-0556-9</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s10658-014-0556-9, Identification of new sources of <a href="#">adult plant resistance to Puccinia hordei</a> in international [...]
<a href="#">10.1007/s11032-015-0198-4</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s11032-015-0198-4, Mapping of two loci conferring resistance to <a href="#">wheat</a> stem rust pathogen races TTKSK (Ug99) and TRTTF in the elite hard red spring[...]
<a href="#">10.1094/PHYTO-12-13-0340-R</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1094/PHYTO-12-13-0340-R, Genetic Characterization of Resistance to Wheat Stem Rust Race TTKSK in Landrace and Wild <a href="#">Barley</a> Accessions Identifies the rpg[...]
<a href="#">10.1007/s10658-014-0509-3</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s10658-014-0509-3, Population genetic structure of Microdochium majus and Microdochium nivale associated with Fusarium head blight of <a href="#">wheat</a> in Hok[...]
<a href="#">10.1007/s10681-014-1157-6</a>	<a href="#">OpenMinTeD</a>	Triticum	Bibliography, OpenMinTeD, 10.1007/s10681-014-1157-6, Genetic mapping of quantitative trait loci (OTL) for <a href="#">resistance to septoria tritici blotch</a> in a winter multiregional adaptation to host partial resistance in a plant pathogenic oomycete: Evidence from European pop[...]





# SEARCH EXAMPLES

# Exact match

## Filters

### Clear

#### Database

- ☐ GRAMENE (1844)
- ☐ WHEAT PANENOME (1669)
- ☒ OPENMINTED (1607)
- ☐ GRAMENES (210)
- ☐ IWGSC@GNPIS (167)
- ☐ TRITICEAE TOOLBOX (34)
- ☐ GNPIS (2)
- ☐ PLANTPHENODB (1)

#### Type

- ☐ GENE (1751)
- ☐ SEQUENCE FEATURE (1669)
- ☒ BIBLIOGRAPHY (1607)
- ☐ LIT (328)
- ☐ GENOME ANNOTATION (94)
- ☐ GENE ANNOTATION (73)
- ☐ INTERPRO DOMAIN (33)
- ☐ EXPERIMENT (32)
- ☐ INTERPRO FAMILY (29)
- ☐ GO PROCESS (27)

#### Species

- ☐ TRITICUM AESTIVUM (2582)
- ☐ TRITICUM (1607)
- ☐ AEGILOPS TAUSCHII (787)
- ☐ TRITICUM URARTU (631)
- ☐ HORDEUM VULGARE SUBSP. VULGARE (219)
- ☐ BRACHYPODIUM DISTACHYON (90)
- ☐ TRITICUM AESTIVUM L. (47)
- ☐ TRITICUM AESTIVUM; TRITICUM SPELTA (32)
- ☐ TRITICUM TURGIDUM SSP. DURUM (14)
- ☐ TRITICUM AESTIVUM AESTIVUM (1)

resistance



1-10 of 5,673

10 results per page



Link to source	Source	Type	Taxon	Description
<a href="#">GO:0009862</a>	Gramene	GO process	Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0009862, systemic acquired resistance, salicylic acid mediated signaling pathway, The series of molec[...]
<a href="#">GO:0046686</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	response to cadmium, Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0046686, response to cadmium ion, Any process that results in[...]
<a href="#">GO:0009816</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Gramene, GO:0009816, defense response to bacterium, incompatible interaction, A response of an organism to a bacterium that prevents the occurrence or spread of disease., defence response to bacterium, incompatible int[...]
<a href="#">GO:1902479</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	positive regulation of response to pathogenic bacteria (incompatible interaction), positive regulation of response to pathogenic bacterium (incompatible interaction), up regulation of defence response to bacterium, inc[...]
<a href="#">GO:1901672</a>	Gramene	GO process	Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	GO process, Gramene, GO:1901672, positive regulation of systemic acquired resistance, Any process that activates or increases the frequency, rate or extent of systemic acquired resistance., activation of salicylic acid[...]
<a href="#">GO:0009870</a>	Gramene	GO process	Triticum aestivum, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	defence response signalling pathway, resistance gene-dependent, defense response signalling pathway, resistance gene-dependent, Triticum aestivum, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulg[...]
<a href="#">GO:0007568</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	ageing, Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0007568, aging, A developmental process that is a deterioration and loss of[...]
<a href="#">GO:0009635</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0009635, response to herbicide, Any process that results in a change in state or activity of a cell of[...]
<a href="#">GO:0009817</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	GO process, Gramene, GO:0009817, defense response to fungus, incompatible interaction, A response of an organism to a fungus that prevents the occurrence or spread of disease., defence response to fungus, incompatible [...]
<a href="#">GO:0009627</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	salicylic acid-dependent systemic resistance, Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0009627, systemic acquired resistanc[...]

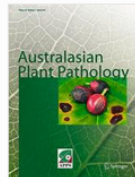
# Access to bibliographie

[10.1007/s13313-014-0339-y](https://doi.org/10.1007/s13313-014-0339-y)

[10.1007/s11032-015-0293-6](https://doi.org/10.1007/s11032-015-0293-6)

[10.1007/s00122-014-2442-4](https://doi.org/10.1007/s00122-014-2442-4)

[10.1007/s00122-014-2445-1](https://doi.org/10.1007/s00122-014-2445-1)



[Australasian Plant Pathology](#)

March 2015, Volume 44, [Issue 2](#), pp 217–224 | [Cite as](#)

## Races of *Puccinia triticina* detected on wheat in Zimbabwe, Zambia and Malawi and regional germplasm responses

Authors

[Authors and affiliations](#)

Z. A. Pretorius , B. Visser, T. Terefe, L. Herselman, R. Prins, T. Soko, J. Siwale, B. Mutari, T. I. Seling, D. P. Hodson

Original Paper

First Online: 11 December 2014

226

4

Downloads Citations

### Abstract

To identify races of *Puccinia triticina* in southern Africa, samples of infected wheat leaves obtained from Zimbabwe, Zambia and Malawi were analysed at the University of the Free State, Bloemfontein and the Agricultural Research Council-Small Grain Institute, Bethlehem, South Africa (SA). Four races were identified from 63 isolates obtained during 2011–2013. Using the North American notation, these races coded to MCDS (74.6 %), TCPS (12.7 %), FBPT (6.3 %) and SCDS (6.3 %). MCDS and TCPS occurred in both Zimbabwe and Zambia whereas FBPT and SCDS were only detected in Zimbabwe and Malawi, respectively. Three of these races (MCDS, FBPT and SCDS) are also known in SA. SSR analysis of races detected in southern Africa suggested that MCDS and FBPT are more closely related to CCPS (3SA45), a race identified in

presence of gene

nce gene

on

/s13313-014-03

(1)

nce (1692)



# Semantic match

## Filters

### Clear

### Databases

- ☒ OPENMINTED (1160)
- ☒ GRAMENE (331)
- ☐ WHEAT PANGENOME (46)
- ☐ IWGSC@GNPIS (7)
- ☐ GRAINGENES (6)
- ☐ PLANTPHENODB (1)
- ☐ TRITICEAE TOOLBOX (1)

### Type

- ☐ BIBLIOGRAPHY (1160)
- ☐ GENE (262)
- ☐ SEQUENCE FEATURE (46)
- ☐ INTERPRO DOMAIN (24)
- ☐ INTERPRO FAMILY (23)
- ☐ GO PROCESS (20)
- ☐ QTL (5)
- ☐ GENOME ANNOTATION (4)
- ☐ GENE ANNOTATION (3)
- ☐ EXPERIMENT (2)

### Species

- ☐ TRITICUM (1160)
- ☐ TRITICUM AESTIVUM (174)
- ☐ AEGILOPS TAUSCHII (147)
- ☐ HORDEUM VULGARE SUBSP. VULGARE (130)
- ☐ TRITICUM URARTU (128)
- ☐ BRACHYPODIUM DISTACHYON (67)
- ☐ TRITICUM AESTIVUM L. (2)

## Search

## How To Join

## About

## WheatIS nodes:

pathogen					
1-10 of 1,552					
10 results per page					
Link to source	Source	Type	Taxon	Description	
<a href="#">GO:0010599</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0010599, production of double-stranded RNA to form siRNA (long small interfering RNA), a clas[...]	
<a href="#">GO:0045087</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Reactome:REACT_31297 "Innate Immune System, Xenopus tropicalis", Reactome:REACT_32992 "Innate Immune System, Gallus gallus", Reactome:REACT_6802 "Innate Immune System, Homo sapiens", Reactome:REACT_78575 "Innate Immune[...]	
<a href="#">GO:0052169</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0052169, pathogen-associated molecular pattern dependent modulation by symbiont of host innate immune response, Any process that involves recog[...]	
<a href="#">GO:0052308</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0052308, pathogen-associated molecular pattern dependent modulation by organism of innate immune response in other org[...]	
<a href="#">GO:0009405</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare, GO process, Gramene, GO:0009405, pathogenesis, The set of specific processes that generate the ability of an organism to induce an abnormal, g[...]	
<a href="#">GO:0009816</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	resistance response to pathogenic bacterium, response to pathogenic bacteria (incompatible interaction), response to pathogenic bacterium (incompatible interaction), Triticum aestivum, Triticum urartu, Brachypodium dis[...]	
<a href="#">GO:1902479</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	activation of resistance response to pathogenic bacteria, activation of resistance response to pathogenic bacterium, activation of response to pathogenic bacteria (incompatible interaction), activation of response to p[...]	
<a href="#">GO:0009817</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	resistance response to pathogenic fungi, resistance response to pathogenic fungus, response to pathogenic fungi (incompatible interaction), response to pathogenic fungus (incompatible interaction), Triticum aestivum, T[...]	
<a href="#">GO:0052257</a>	Gramene	GO process	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	PAMP dependent induction of innate immunity of other organism, PAMP-dependent induction of innate immunity of other organism, pathogen-associated molecular pattern dependent induction by organism of innate immunity of [...]	

# Semantic match

## Filters

Clear

### Database

☒ OPENMINTED (1160)

### Type

☐ BIBLIOGRAPHY (1160)

### Species

☐ TRITICUM (1160)

## Search

## How To Join

## About

### WheatIS nodes:

#### UWA (UP):

- Wheat Pangenome: 167167

#### GrainGenes (UP):

- GrainGenes: 14968

#### Gramene-WheatIS (UP):

- Gramene: 229851

#### transplant-IPGPAS (UP):

- PlantPhenoDB: 2

#### T3 (UP):

Link to source	Source	Type	Taxon	Description
<a href="#">10.1007/s10681-014-1343-6</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Silva, P et al. (2015). Effects and interactions of genes Lr34, Lr68 and Sr2 on wheat leaf rust adult plant resistance in Uruguay. Euphytica Effects and interactions of [...]
<a href="#">10.1007/s10681-014-1349-0</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Zhou, XL et al. (2015). Identification of QTL for adult plant resistance to stripe rust in Chinese wheat landrace Caoxuan 5. Euphytica Identification of QTL for adult p[...]
<a href="#">10.1007/s00122-015-2532-y</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Suzuki, T et al. (2015). Resistance to wheat yellow mosaic virus in Madsen wheat is controlled by two major complementary QTLs. Theor. Appl. Genet. Resistance to wheat y[...]
<a href="#">10.1007/s00122-015-2533-x</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Du, ZY et al. (2015). A QTL with major effect on reducing leaf rust severity on the short arm of chromosome 1A of wheat detected across different genetic backgrounds and diverse environments. Theor. Appl. Genet. [...]
<a href="#">10.1007/s00122-015-2536-7</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Liang, Y et al. (2015). Dynamic evolution of resistance gene analogs in the orthologous genomic regions of powdery mildew resistance gene MIW170 in Triticum dicoccoides and Aegilops tauschii. Theor. Appl. Genet. [...]
<a href="#">10.1016/j.cropro.2015.04.006</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Ma, DF et al. (2015). Inheritance and molecular mapping of stripe rust resistance genes in Chinese winter wheat Zhongliang 16. Crop Prot. Inheritance and molecular mappi[...]
<a href="#">10.1016/j.jcs.2015.04.005</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Kumar, A et al. (2015). Real-time quantitative PCR based method for the quantification of fungal biomass to discriminate quantitative resistance in barley and wheat genotypes to fusarium head blight. Cereal Sci. [...]
<a href="#">10.3835/plantgenome2014.08.0040</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Harrison, NR et al. (2015). Y Using RNA Sequencing and In Silico Subtraction to Identify Resistance Gene Analog Markers for Lr16 in Wheat. Plant Genome Y Using RNA Seque[...]
<a href="#">10.3835/plantgenome2015.01.0002</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Juliana, P et al. (2015). Genome-Wide Association Mapping for Leaf Tip Necrosis and Pseudo-black Chaff in Relation to Durable Rust Resistance in Wheat. Plant Genome Geno[...]
<a href="#">10.1007/s00122-015-2502-4</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Khanna, A et al. (2015). Development and evaluation of near-isogenic lines for major blast resistance gene(s) in Basmati rice. Theor. Appl. Genet. Development and evalua[...]

# TDM enrichment

## Filters

### Clear

#### Database

- ☐ OPENMINTED (1634)
- ☐ IWGSC@GNPIS (911)
- ☐ GNPIS (459)
- ☐ GRAMENE (46)

#### Type

- ☐ BIBLIOGRAPHY (1634)
- ☐ GENOME ANNOTATION (836)
- ☒ EXPERIMENT (457)
- ☐ GENE ANNOTATION (75)
- ☐ GENE (45)
- ☐ INTERPRO FAMILY (1)
- ☐ MARKER (1)
- ☐ PHENOTYPE (1)

#### Species

- ☐ TRITICUM (1634)
- ☐ TRITICUM AESTIVUM (865)
- ☐ TRITICUM AESTIVUM AESTIVUM (458)
- ☐ TRITICUM AESTIVUM L. (48)
- ☐ TRITICUM URARTU (22)
- ☐ HORDEUM VULGARE SUBSP. VULGARE (21)
- ☐ AEGILOPS TAUSCHII (5)
- ☐ BRACHYPODIUM DISTACHYON (1)

cold resistance					1-10 of 3,050		10 results per page		
ID	Source	Type	Taxon	Description					
<a href="#">IPR026057</a>	Gramene	InterPro Family	Triticum aestivum, Triticum urartu, Brachypodium distachyon, Aegilops tauschii, Hordeum vulgare subsp. vulgare	InterPro Family, Gramene, IPR026057, PC-Esterase, The PC-Esterase family [] is comprised of Cas1p, the Homo sapiens C7orf58, Arabidopsis thaliana PMR5 and a group of plant freezing resistance/cold acclimatization proteins typified by Arabidopsis thaliana ESKIMO1 [.,], animal FAM55D proteins, and animal FAM113 proteins [...]					
<a href="#">10.1017/S0021859614000409</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1017/S0021859614000409, Wang, L et al [...]					
<a href="#">10.1080/13102818.2014.944401</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1080/13102818.2014.944401, Todorovska, EG et al [...]					
<a href="#">10.1007/s00217-015-2630-8</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1007/s00217-015-2630-8, Gawronska, K et al [...]					
<a href="#">10.1038/srep28702</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1038/srep28702, Kovi, MR et al [...]					
<a href="#">10.2135/cropsci2006.11.0712</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.2135/cropsci2006.11.0712, Al-Abed, D et al [...]					
<a href="#">10.1094/PHYTO-97-9-1083</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1094/PHYTO-97-9-1083, Hulbert, SH et al [...]					
<a href="#">10.1007/s00122-005-0119-8</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1007/s00122-005-0119-8, Shinozuka, H et al [...]					
<a href="#">10.1139/gen-2015-0122</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1139/gen-2015-0122, Upadhyaya, HD et al [...]					
<a href="#">10.1104/pp.003046</a>	<a href="#">OpenMinTeD</a>	Bibliography	Triticum	Bibliography, OpenMinTeD, 10.1104/pp.003046, Choi, DW et al [...]					

# TDM enrichment

## Phenotypes

### Filters

[Clear](#)

#### Database

☐ GNPIS (457)

#### Type

☒ EXPERIMENT (457)

#### Species

☐ TRITICUM AESTIVUM AESTIVUM (457)

### Search

### How To Join

### About

cold resistance

ID

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[TRIAL\\_BTH\\_Chau des Prés](#)

[Back to Form](#)

**Trial name** BTH\_Chau des Prés\_2000\_SetA

**Trial code** BTH\_Chau des Prés\_2000\_SetA

**Site name** [Chau des Prés](#)

**Trial date** from 1999/10/20 to 2000/07/31

**Phenotyping campaign** 2000

**Project** INRA Wheat Breeding Network

**Phenotyping data** [Go to trial's phenotyping data](#)

Lot number	Accession number	Accession name	Taxon
Charger	<a href="#">CHARGER</a>	CHARGER	<a href="#">Triticum aestivum aestivum</a>
Isengrain	<a href="#">ISENGRAIN</a>	ISENGRAIN	<a href="#">Triticum aestivum aestivum</a>
Tremie	<a href="#">TREMIE</a>	TREMIE	<a href="#">Triticum aestivum aestivum</a>
AO00001	<a href="#">AO00001</a>	AO00001	<a href="#">Triticum aestivum aestivum</a>
Voltige	<a href="#">VOLTIGE</a>	VOLTIGE	<a href="#">Triticum aestivum aestivum</a>
CF9804	<a href="#">CF9804</a>	CF9804	<a href="#">Triticum aestivum aestivum</a>
CF9825	<a href="#">CF9825</a>	CF9825	<a href="#">Triticum aestivum aestivum</a>

### Genotypes

### Variables

Name	Notator	Comments
<a href="#">fr: Frost susceptibility</a>		mark on a 1 to 9 increasing scale

### Contact

Type	Name	Email	Institution
Coordinator of experiments Network	Gilles CHARMET	charmet at clermont.inra.fr	UMR Amélioration & Santé des Plantes INRA-UBP
Coordinator of experiments Network	Emmanuel HEUMEZ	emmanuel.heumez at mons.inra.fr	Mons
Coordinator of experiments Network	Francois-Xavier OURY	Francois-Xavier.OURY at clermont.inra.fr	INRA
Coordinator of experiments Network	Bernard ROLLAND	bernard.rolland at inra.fr	INRA

Arnaud

Hadi Quesneville



# Conclusion

- **Text mining vocabulary closer to natural language**
- **Data findable by non-specialists of the data production**
- **Fill the gap between community**

# Availability

- Tools are open access

[www.weatis.org/search.php](http://www.weatis.org/search.php)

[openminted.eu](http://openminted.eu)

- Ontologies

[agroportal.lirmm.fr](http://agroportal.lirmm.fr)

[www.weatis.org/DataStandards.php](http://www.weatis.org/DataStandards.php)

[fairsharing.org/collection/WheatDataInteroperability  
Guidelines](http://fairsharing.org/collection/WheatDataInteroperabilityGuidelines)

# Acknowledgment



T. Letellier,  
R. Flores,  
C. Pommier,  
M. Alaux,  
*et al.*



S. Aubin,  
C. Nedellec,  
*et al.*



D. Edwards,  
G. Lazo,  
M. Caccamo,  
*et al.*



E. Dzalé Yeumo Kadoré,  
R. Fulss,  
*et al.*