Integrative genetics and genomics for multi-pest resistance in grain legumes

Marie-Laure Pilet-Nayel, Jean-Christophe Simon, Akiko Sugio, Julia Buitink, Olivier Leprince, Isabelle Lejeune-Hénaut, Marion Prudent, Grégoire Aubert, Anthony Klein, Sandie Barbot,, et al.

▶ To cite this version:

Marie-Laure Pilet-Nayel, Jean-Christophe Simon, Akiko Sugio, Julia Buitink, Olivier Leprince, et al.. Integrative genetics and genomics for multi-pest resistance in grain legumes. ILS4 Fourth International Legume Society Conference 2023, Sep 2023, Grenade (Espagne), Spain. , Book of abstracts. hal-04650172

HAL Id: hal-04650172
https://hal.inrae.fr/hal-04650172v1

Submitted on 16 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

ILS4 Fourth International Legume Society Conference 2023
19-22 September
Granada Conference Center
Granada Spain

Ref. No. 606/31

INTEGRATIVE GENETICS & GENOMICS FOR MULTI-PEST RESISTANCE IN GRAIN LEGUMES

Marie-Laure Pilet-Nayel[1*], Jean-Christophe Simon[1], Akiko Sugio[1], Julia Buitink[2], Olivier Leprince[2], Isabelle Lejeune-Hénaut[3], Marion Prudent[4], Grégoire Aubert[4], Anthony Klein[4], Sandie Barbot[4], Nadim Tayeh[4], Judith Burstin[4]

[1] IGEPP, INRAE, Institut Agro, Univ Rennes, 35653, Le Rheu, France; [2] IRHS, INRAE, Institut Agro, Univ Angers, 49071 Beaucouzé, France
[3] BioEcoAgro, INRAE, Univ Lille, Univ Liège, Univ Picardie Jules Verne, 80200, Estrées-Mons, France; [4] Agroécologie, INRAE, Institut Agro, Univ Bourgogne, 21065, Dijon, France

OBJECTIVES

Grain legumes are key players in agro-ecological and food transitions, but are susceptible to multiple diseases and pests. Aphanomyces root rot, ascochyta blight, and seed weevils have been the most damaging and studied stresses in France over the last 20 years. Other pests, including weeds, aphids and sitona, are currently becoming problematic for grain legumes in the light of new regulations on pesticide use. Breeding varieties for multi-pest resistance is a major challenge for grain legume development.

A major objective of the French national project SPECIFICS (2021-2027) is to generate and integrate knowledge on the diversity, genetics, genomics and mechanisms of **resistance to multiple pests** for innovative grain legume cropping systems.

'SPECIFICS' WorkPackage1 AIMS AT:

- Characterizing genetic resources for resistance to multiple stresses and managing related information;
- Identifying genetic loci, genes, mechanisms underlying resistance to multiple stresses using GWAS and omics approaches;


Pea, Faba bean, Lentil

6 TARGET PESTS

- Using translational approaches to transfer knowledge on resistance determinants to and between grain legumes;
- Introducing relevant genetic loci into elite material to create multi-resistant pea lines.

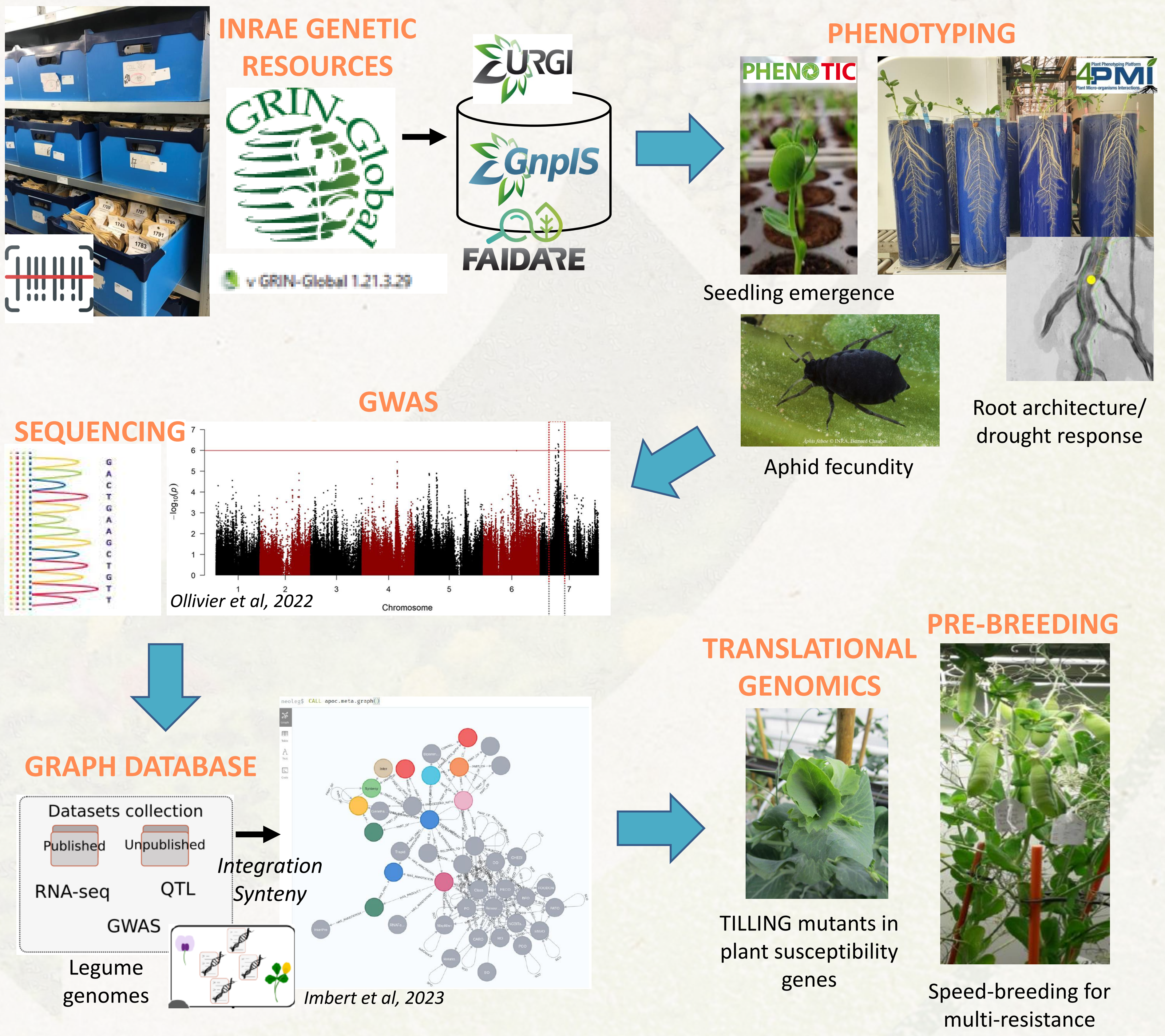
MAIN ACHIEVEMENTS

A Grin-Global database is being deployed to manage datasets related to pea and faba bean genetic resources hosted at INRAE (>12000 accessions, >22000 seed samples, >200 trait codes).

Automated or manual phenotyping of exome-sequenced pea and faba bean collections is performed for seedling emergence, drought tolerance, aphid resistance, as well as plant root and nodule architecture.

A NoSQL graph database is being developed to integrate QTL, RNA-Seq and gene annotation data for five legume species. The database aims at connecting data obtained in the project and previously for resistance to diseases and pests, seedling establishment and pest or disease-related root/aerial architectural traits, in order to identify putative pleiotropic or syntenic genes.

Pea mutant lines in susceptibility genes conserved from other plant species and speed breeding introgression lines are produced to identify and combine key genes and loci for multi-pest resistance.



CONCLUSION

SPECIFICS is a driving force for acquiring knowledge and tools to accelerate grain legume breeding for pesticide-free cropping systems.

BIBLIOGRAPHY

SPECIFICS: Sustainable PEst Control In Fabaceae-rich Innovative Cropping Systems. French Priority Research Program "Growing and Protecting Differently". https://www6.inrae.fr/specifics_eng/
Ollivier et al. (2022). TAG 135:1511-1528 https://doi:10.1007/s00122-022-04050-x
Imbert et al. (2023). Front. Artif. Intell. https://doi.org/10.3389/frai.2023.1191122

FRANCE 2030 INRAE CULTIVER PROTÉGER autrement