Phenotypic Evaluation of Barley Landraces (*Hordeum vulgare L.*) for Resistance to Net-Form Net Blotch Disease (*Pyrenophora teres f. teres*)

Presenting author's contact details:
Chaimae El Herch,
Email address: Ch.elherch@gmail.com
Phone number: +212 6 28 45 72 38.

Chaimae El Herch [1,2], Muamar Al-Jaboobi [1], Athanasios Tsivelikas[1], Zakaria Kehel [1], Tayeb Koussa[2], Seid-Ahmed Kemal[1], Mohamed Faize [2].

[1]International Center for Agricultural Research in the Dry Areas (ICARDA), Rabat, Morocco

[2]Laboratory of Plant Biotechnology, Ecology and Ecosystem Valorization, URL CNRST10, Faculty of Sciences, University Chouaib Doukkali, El Jadida, Morocco.

Introduction

- Globally cultivated on 49 million hectares, **barley** ranks fourth after maize, rice, and wheat. Dubbed the 'climate change crop', it thrives in extreme conditions, requires minimal resources, provides consistent yields, and is a key food and livestock feed source in many developing countries (Pesaresi, 2020).
- The foliar disease, **Net Form Net Blotch**, caused by ***Pyrenophora teres f. teres***, limits barley production by reducing grain yield, quality, and straw. **Global yield losses approach 40%, and in Morocco, it's up to 29%, especially in susceptible cultivars** (Afanasenko et al., 2022 ; Jebbouj et El Yousfi, 2006).
- **Fungicides** are one of the common methods used to minimize the effects of net blotch, but they pose issues like **high costs, environemntal concerns**, and the **emergence of resistant pathogen strains** (Alaoui & El Aissami, 2014). Effective management requires exploring alternatives : **Resistant barley cultivars** emerge as an **environmentally** and **economically sustainable approach** (Abebe, 2021).

Study Objectives

- The main aim of the study :

  Identify new sources of **resistance** to **net form net blotch disease** in **240 barley accessions**, of which 16 are from Morocco, selected from a barley landraces collection maintained in **ICARDA's gene bank**.

- Sub-objectives :
  - ⇒ To evaluate resistance diversity to net blotch disease across 240 barley accessions.
  - ⇒ To identify barley accessions with significant resistance to net form of net blotch disease.
  - ⇒ To compare the reaction of the 16 Moroccan-derived accessions to the broader accession set.

Materials and Methods

Fungal Material

- *4 virulent Ptt isolates from Morocco.*
- *Cultivated on V8 & PDA with barley leaves.*
- *Incubated for 3d in the dark then 7d under U.V light.*

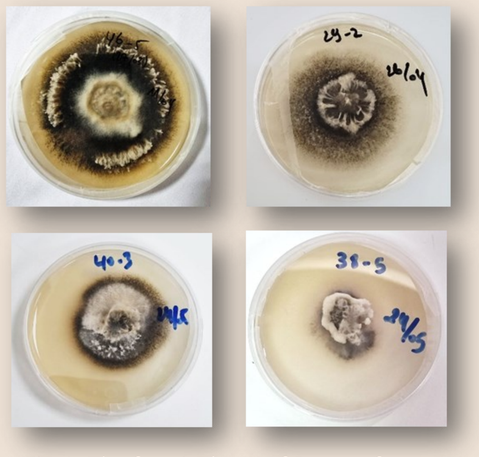


Fig.1: The four isolates of P. teres f. teres used for the evaluation of resistance to net blotch

Plant Material

- *240 barley accessions from ICARDA : 224 global via FIGS, NF & SF subsets, and 16 from Morocco.*
- *4 seeds/accession sown following an augmented design.*
- *Grown in a greenhouse at 20°C with a 16h/8h photoperiod.*
- *Inoculated after 12d, then incubated in the dark for 1d before moving to a humid growth chamber.*

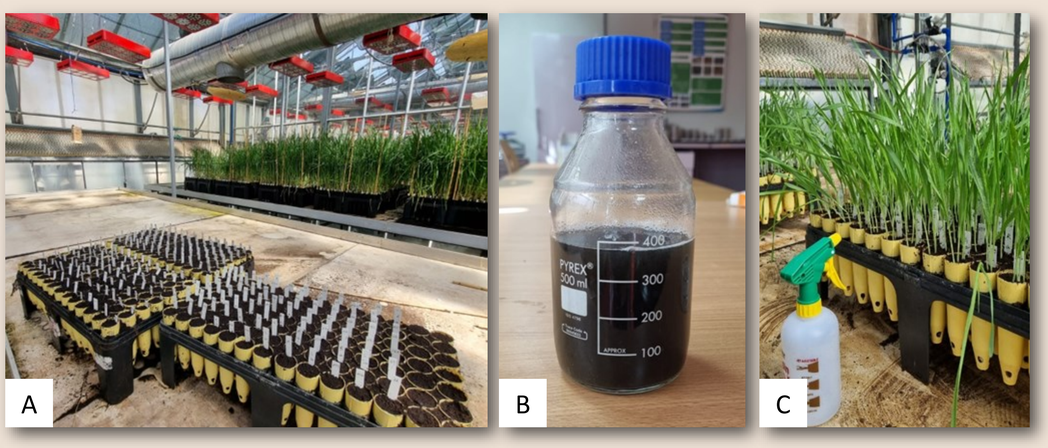


Fig.2 : A - Sowing of barley seedlings; B - Inoculum preparation; C - Spraying the inoculum onto barley leaves 12 DAS

Evaluating Barley Resistance: Tekauz's Scale

- *One week after inoculation, barley seedlings was assessed visually using a 1-10 Tekauz's scale with:*

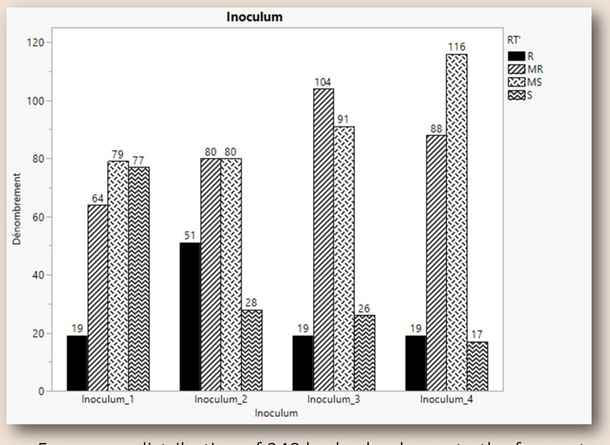
  1-3: 'Resistant' ; 4-5: 'Moderately Resistant' ; 6-7: 'Moderately Susceptible'

  8: 'Susceptible' ; Above 8: 'Very Sensitive'

Fig.3: Evaluation Scale for Barley Net Blotch Disease Based on Inoculated Barley seedlings, 7 Days After Inoculation.

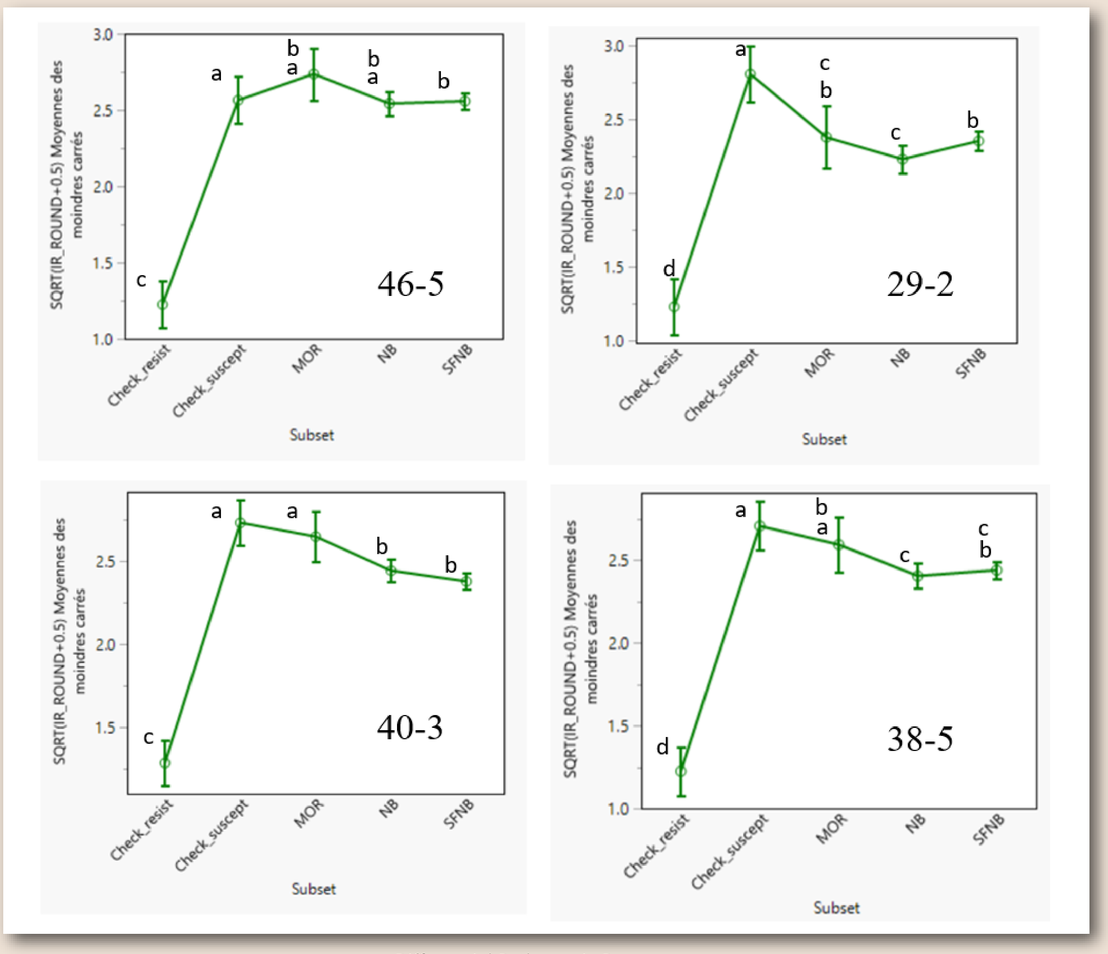
Results and Discussion

Variability of Barley Accession Responses to Net Blotch Disease:
A: Susceptible Barley Seedling, **B**: Resistant Barley Seedling, **S**: Susceptible Control, **R**: Resistant Control.

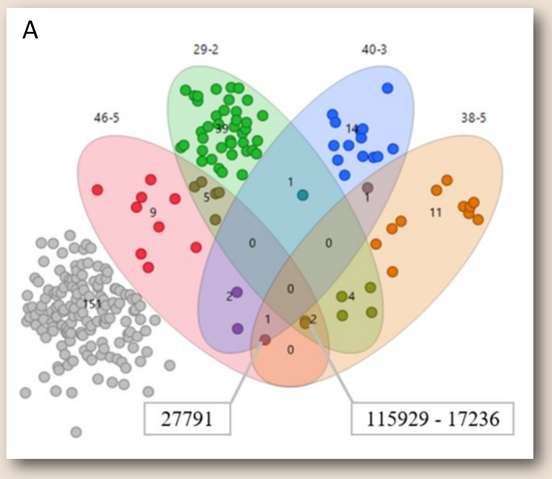


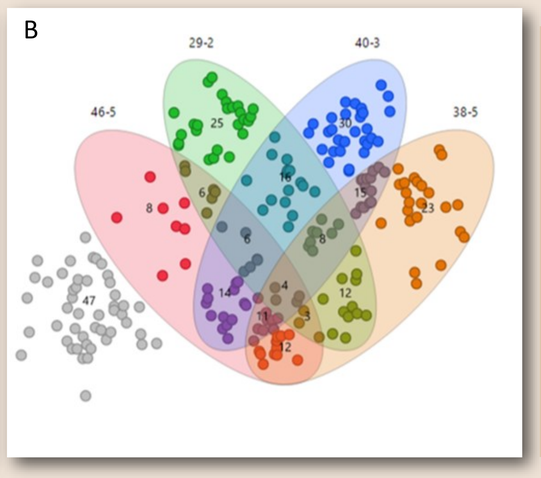
Frequency distribution of 240 barley landraces to the four net form net blotch isolates : Inoculum_1: 46-5, Inoculum_2: 29-2, Inoculum_3: 40-3, and Inoculum_4: 38-5.

- **Seedling evaluation of 240 barley landraces with four Ptt isolates resulted in a wide range of infection types.**
- **Of the 240 accessions we tested, 19 were found to be resistant to the first isolate, 51 to the second isolate, 19 to the third isolate and another 19 to the fourth and last isolate .**



Differential Pathogenic Responses:
Evaluating Moroccan Versus Global Barley Accessions to *P. teres f. teres* Isolates





Venn Diagrams for Combined Analysis: A- **Resistant Accessions** Intersections ; B- **Moderately Resistant** Accessions

- No accession exhibited a resistance reaction against all four isolates of the pathogen at the same time.
- Four accessions were moderately resistant to all isolates at the same time.

- **Moroccan barley accessions exhibited susceptibility to Ptt isolates 46-5, 40-3, and 38-5, despite all isolates being of Moroccan origin.**
- **only one Moroccan accession was found resistant to Ptt isolate 29-2.**

- ⇒ A considerable variability exists among barley landraces in terms of the reaction to *P. teres f. teres* isolates (Yitbarek et al., 1998).
- ⇒ The FIGS is well suited for the identification of accessions with resistance to fungal pathogens (Endresen et al., 2012).
- ⇒ In North Africa, the search for barley landraces resistant to the net blotch disease caused by *P. teres f. teres* is a major challenge for the region (Harrabi, 1990 ; Taibi et al., 2016)

Conclusion and Recommandations

- Barley landraces (Hordeum vulgare) serve as a promising source of resistance to NFNB disease.
- Assessing the resistance of the 240 barley accessions under field conditions and across various environements.
- Genome-Wide Association Study (GWAS) to identify associations between the evaluated phenotypic characteristics and the corresponding specific genetic variations.
- Considering the emergence of new variants for the development of resistant barley varieties

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