College of Agriculture & Environmental Sciences

AgroBioSciences

Screening for black Aphid resistance in quinoa genotypes

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Aphis Fabae :

The black bean aphid (Aphis fabae) is a major agricultural pest in Morocco, affecting crops such as faba beans, sugar beets, and solanaceous plants. Aphids inflict direct harm on the host plant by sucking its sap, which includes vital nutrients necessary for their growth. A significant portion of the sap is excreted as honeydew.
(McKinlay, 1992; Hail, 2007).
Aphids induce abscisic acid (ABA) pathway signalling in the host plant, leading to stomatal closure. Stomatal closure leads to reduced gas exchange, which in turn reduces photosynthetic activity.

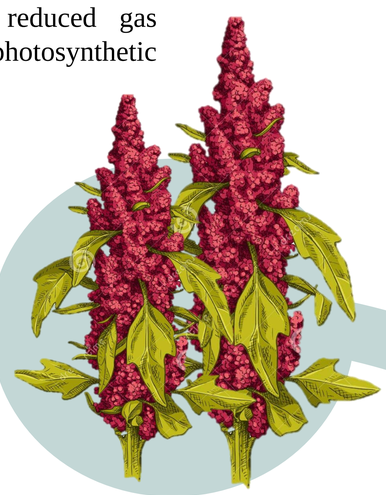
Quinoa Damage

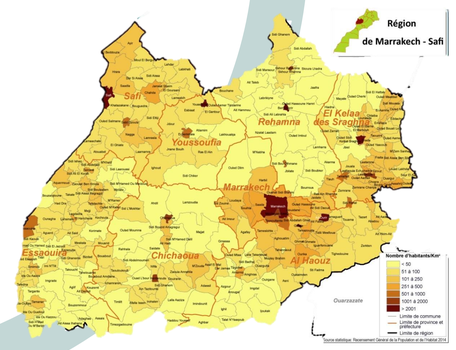
Quinoa cultivation is expanding in Morocco due to its resilience to drought and poor soils.

Originally from the Andes, quinoa (*Chenopodium quinoa*) is gaining popularity as a **climate-resilient crop**, offering a high-nutrient alternative to traditional cereals. However, pests like *Aphis fabae* pose a challenge, requiring sustainable pest control strategies to ensure successful production.

Objectives
The objective of screening quinoa genotypes for resistance to *Aphis fabae* is to identify and select tolerant or resistant genotypes that can withstand aphid infestations. The study aims to support breeding programs and enhance food security by developing resilient quinoa cultivars.

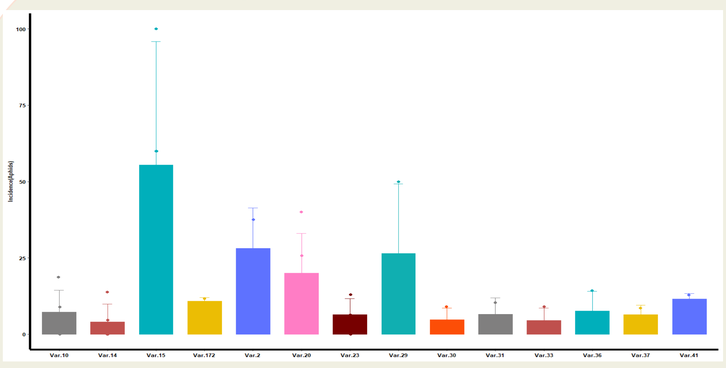
Methods
Primary screening involves the observation of symptoms, assessment of infestation incidence, and evaluation of resistance levels corresponding to each genotype in the Benguerir region.
The effect of aphids on stomatal conductance by the Porometer measurement and chlorophyll by the SPAD instrument compared to the treated insect's conditions gives us an overall idea of the stress induced by aphids



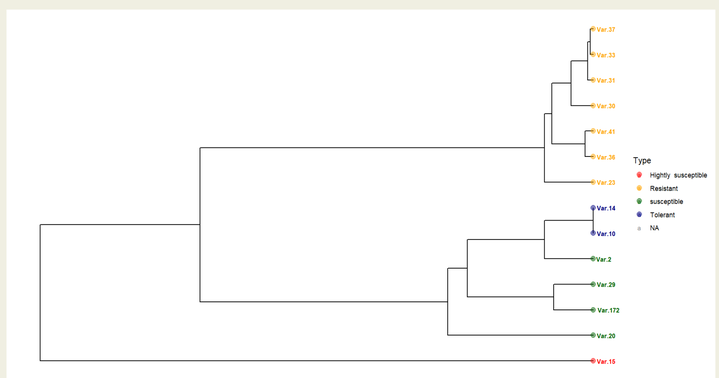


Grade	Damage Index
Resistant	0 - 1.0
Tolerant	1.1 - 3.0
Susceptible	3.1 - 5.0
Hightly Susceptible	5.0 - 10

Table1. Table of the analyses scales



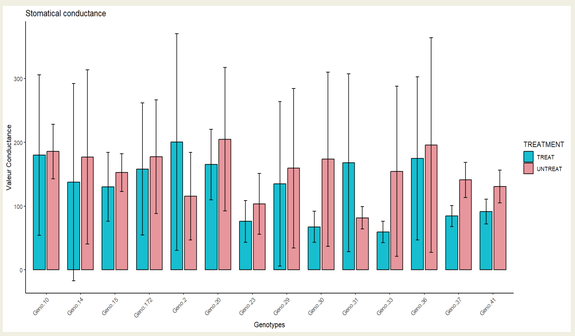
Incidence of aphids/geno



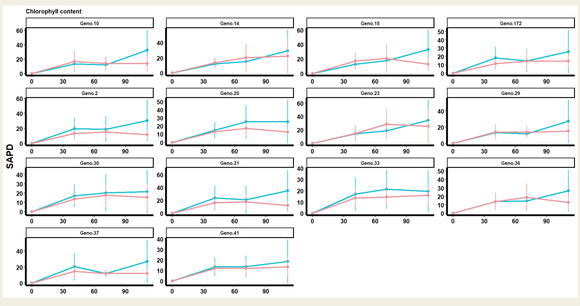
Categorical hierarchy dendrogram based on the resistance of the genotypes

Results:

The findings demonstrate that stomatal closure is not automatically induced by aphid infection. However, this relies on each genotype's ability to regulate stress.
The aphids attack significantly reduces chlorophyll content, and the profile of this reduction varies by genotype.
Additionally, it correlates with each genotype's resistance type.
To withstand the stress caused by an aphid attack, some genotypes, however, attempt to maintain open stomata.



Stomatical conductivity



Evolution of the Chlorophyll content

Conclusions

The resistance of genotypes towards black aphids vary according to the strategy adopted by each genotypes. Stomatal closure can be triggered by the plant in response to the intensity of infestation.

The activation of signaling pathways in response to phloem-feeding aphids alters gene expression, leading to changes in molecular composition within the cell.

The NB-LRRn proteins are stimuled by the aphid and induce defense responses from phytohormones such as salicylic acid, jasmonic acid (JA), ethylene (ET), abscisic acid (ABA), gibberellic acid (GA) and free radicals (ROS). this system can therefore act antagonistically or synergistically. And this will depend on the genotype, its resistance and the level of environmental stress.

Perspectives
-Use of high-throughput system for phenotyping quinoa resistance to black aphids based on several Behavioral phenotyping parameters.
- Evaluate the secondary metabolites involved in resistance to aphids.
- Investigate the difference in metabolism between resistant and non-resistant genotypes.