Never-Ending Battle Between Defense Metabolites Of Indian Oilseed Mustard And The Necrotrophic Fungal Pathogen

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ABSTRACT

Brassica juncea **the major oilseed crop of the Indian subcontinent contributes to >28% of the total oil production, but is under constant threat from environmental challenges, like the white-mold disease caused by the necrotrophic phytopathogen *Sclerotinia sclerotiorum*. White-mold proves a bottleneck to the cultivation of *B. juncea* where it causes >92% losses, leading to qualitative and drastic deterioration of the yield and seeds oil contents. The mustard species also house unique secondary metabolites called glucosinolates (GSLs) which along with their hydrolysis products (GHPs) govern defense against various phytopathogens, including *S. sclerotiorum*. Despite the reported toxicity of GSLs and their products, *Sclerotinia* is able to infect, colonize and cause significant yield losses on glucosinolates producing plants. Therefore in the present work, we establish the dynamics of *S. sclerotiorum-B. juncea* pathosystem in terms of the glucosinolate-myrosinase system. We in turn investigate the role of C3 aliphatic glucosinolate derived product, that has proven to be one of the most toxic to curtail the growth of *Sclerotinia*. In addition, we screen 250 natural accessions of *B. juncea* spanning a range of variation in different glucosinolate fractions, particularly C3 GSLs. This in turn will be useful to identify resistance and proposed roles of GSLs to control the menace of white-mold in polyploid mustard species.**

1. The disease dynamics of *S. sclerotiorum* infection in Indian oilseed mustard *B. juncea*

Dynamics of S. sclerotiorum - B. juncea Pathosystem

Selection of 8 Time Points Post Infection

1 hpi | 3 hpi | 4 hpi | 6 hpi | 8 hpi | 12 hpi | 24 hpi | 48 hpi

Time course of *Sclerotinia sclerotiorum* Infection

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Disease progression on *B. juncea* plants

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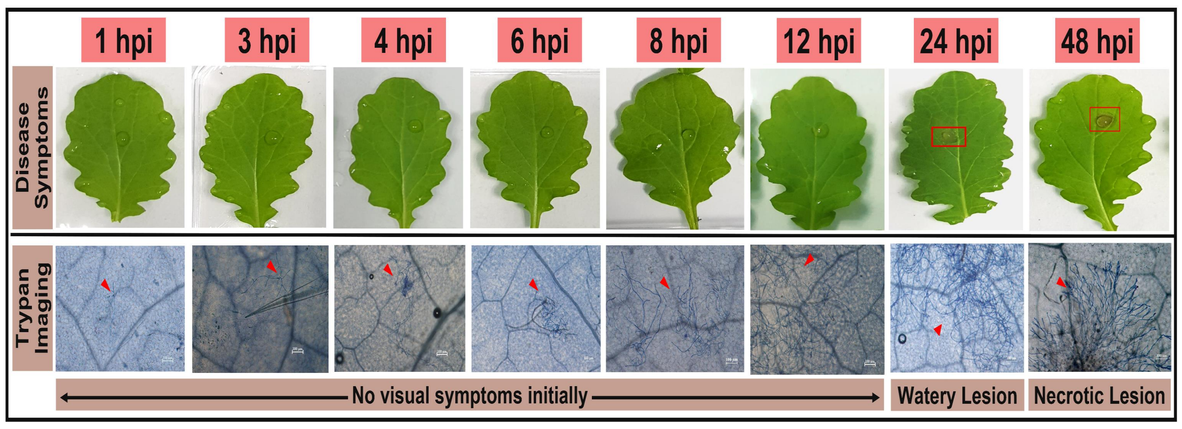
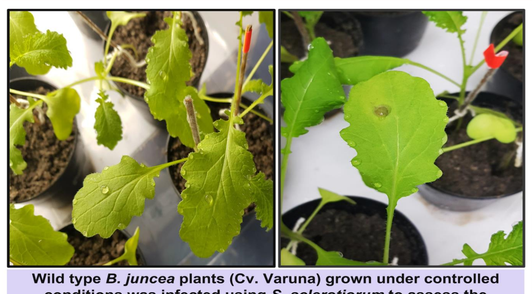
Assessment of disease progression & development of visual symptoms → GSL analysis during infection



2. *S. sclerotiorum* infection modulates the levels of *in planta* glucosinolates in *B. juncea*



Wild type *B. juncea* plants (Cv. Varuna) grown under controlled conditions was infected using *S. sclerotiorum* to assess the modulation of *in planta* GSL levels

Modulation of GSLs during time course of *S. sclerotiorum* Infection in *B. juncea*

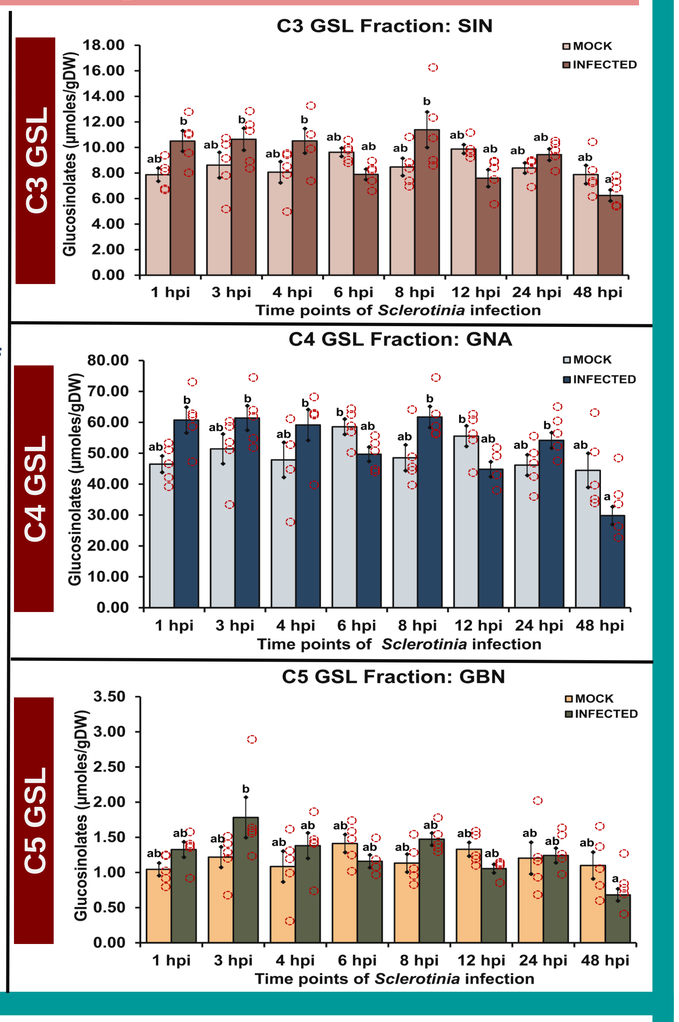
TOTAL GLUCOSINOLATES POOL

ALIPHATIC GSL (~95-99%) | INDOLIC GSL (<1-5%)

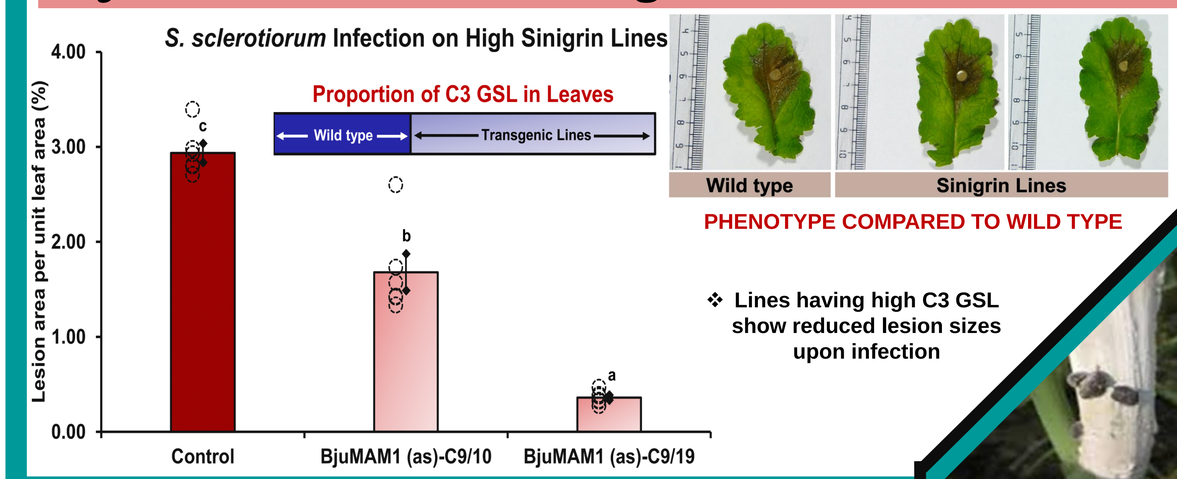
↓

C3, C4 & C5 Fractions

- Right panel shows changes in the *in planta* levels of three major aliphatic GSL fractions (C3, C4 & C5) of *B. juncea* during *S. sclerotiorum* infection.
- Our results suggest that *Sclerotinia* infection activates the glucosinolate-myrosinase system by modulating changes in component glucosinolates of *B. juncea* plants throughout the time course of infection.



3. High sinigrin content in the genetic background of *B. juncea* shows tolerance against *Sclerotinia*

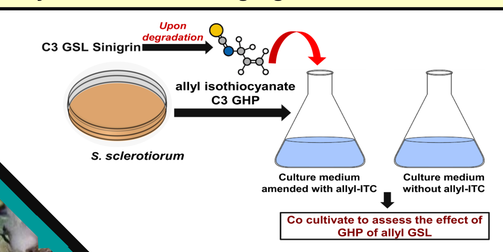


PHENOTYPE COMPARED TO WILD TYPE

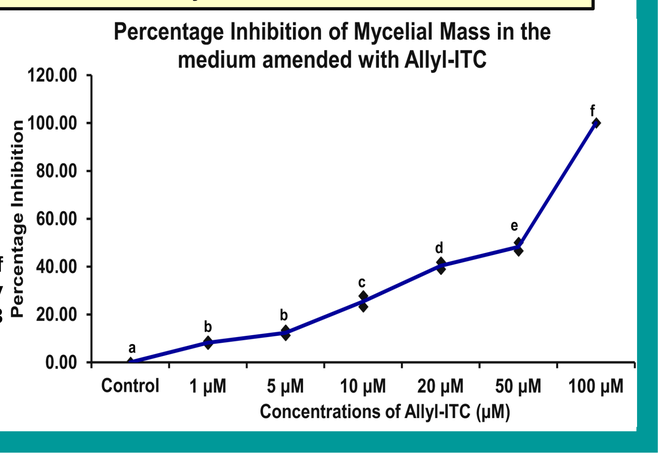
- Lines having high C3 GSL show reduced lesion sizes upon infection

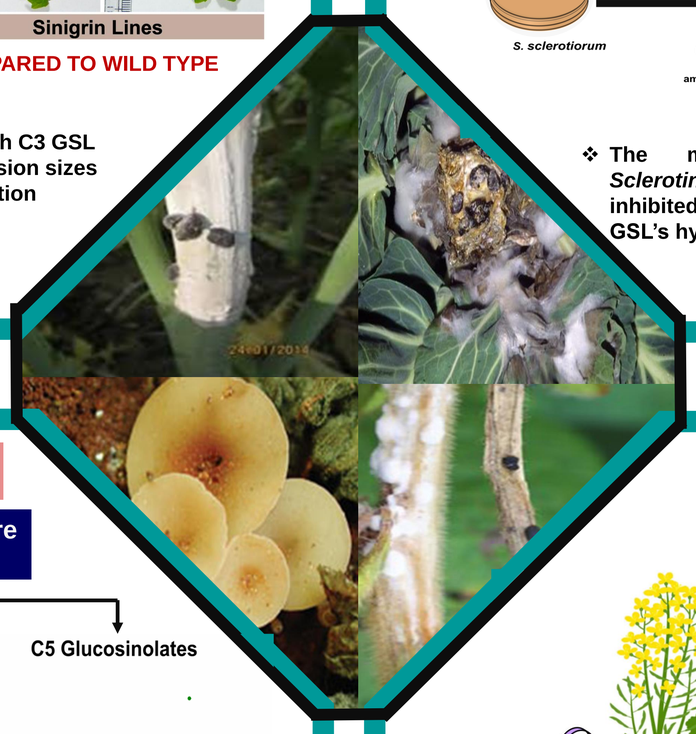
4. *S. sclerotiorum* mycelial growth inhibition in the presence of C3 GSL hydrolysis product

Allyl-ITC's effect on fungal growth was studied as the reduction in the mycelial mass at different concentrations



- The mycelial growth of *Sclerotinia* was significantly inhibited in presence of C3 GSL's hydrolysis product



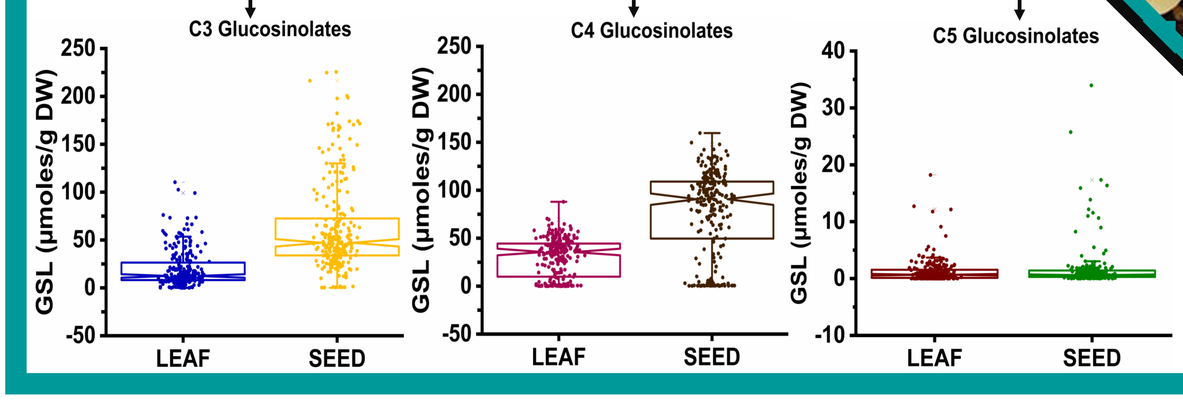


THE WHITE-MOLD DISEASE IN OILSEED BRASSICA CROPS

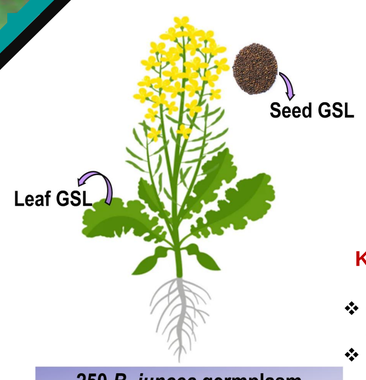
5. GSLs across the *B. juncea* germplasm

n=250 germplasm accessions

Variations in Fractional GSLs Across The Core Germplasm Accession Panel



Conclusions & Future Perspectives

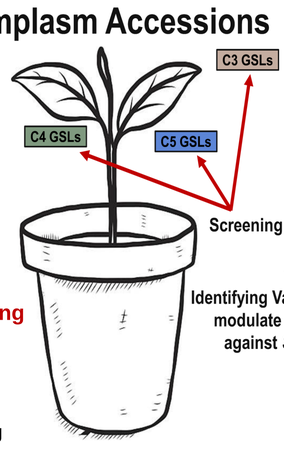


250 *B. juncea* germplasm accessions from across the globe

Germplasm Accessions

Valuable Natural Resource of GSL Diversity

Within the same genetic background



Screening the fractions

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Identifying Variations in GSLs to modulate disease severity against *S. sclerotiorum*

Key Thrust of *Brassica* Breeding Programmes

- Germplasm Screenings Against SSR
- Identifying Tolerant Cultivars in Natural Accessions for Breeding White-Mold Resistance

References

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