

Alleviating water stress tolerance in *Aquilaria malaccensis* by using Biochar, *Bacillus altitudinis* (PGPR) and *Trichoderma asperellum*
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INTRODUCTION & AIM

- Aquilaria malaccensis* is also known as agarwood a tropical and evergreen tree species which is recognized as a fragrant wood.
- Water stress increased the oxidative damage which hamper in plant growth.
- For mitigating water stress biochar and microbes are beneficial for plant environment friendly.

Aim:

- To assess the response of *Aquilaria malaccensis* to water stress.

- To investigate the efficiency of Biochar, *Bacillus altitudinis* (PGPR) and *Trichoderma asperellum* in alleviating the water stress effect on *Aquilaria malaccensis*.



METHOD

Methodology

Biochar preparation and Characterization:

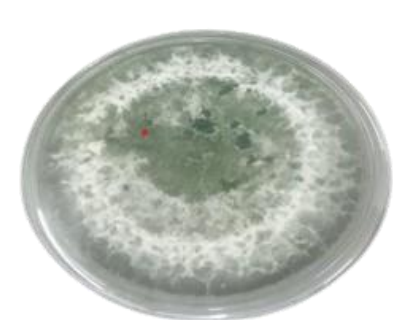


In 36 h at 350° – 400° C using designed pyrolyzed

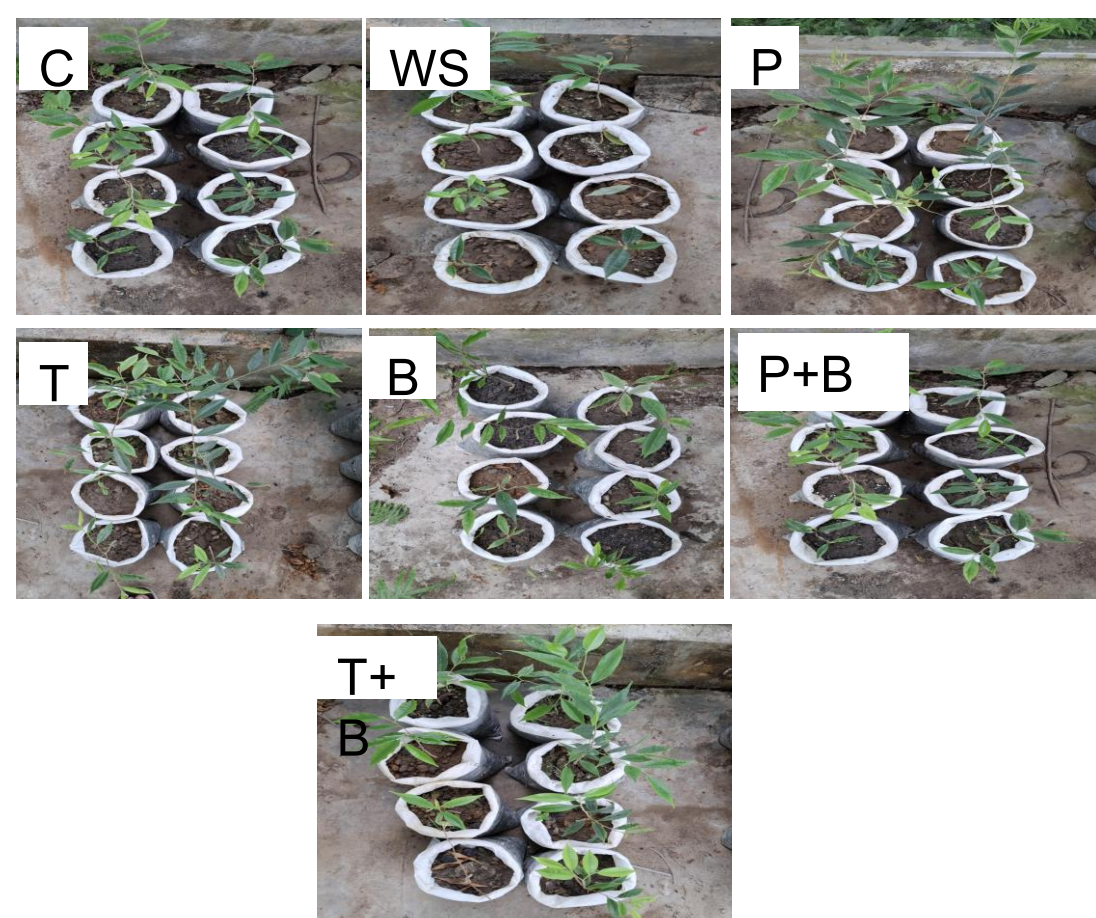


crushed and sieved in 2-5mm

Isolation of *Trichoderma asperellum* and *Bacillus altitudinis*



- Trichoderma asperellum* (OR551369)
- Bacillus altitudinis* (ON892500)
- Experimental Design: This experiment was conducted in a greenhouse.



C= No Stress

WS= Water Stress(14 days irrigation)

P= *Bacillus altitudinis* + Water Stress (14 days)

T= *Trichoderma asperellum* + Water Stress(14 days)

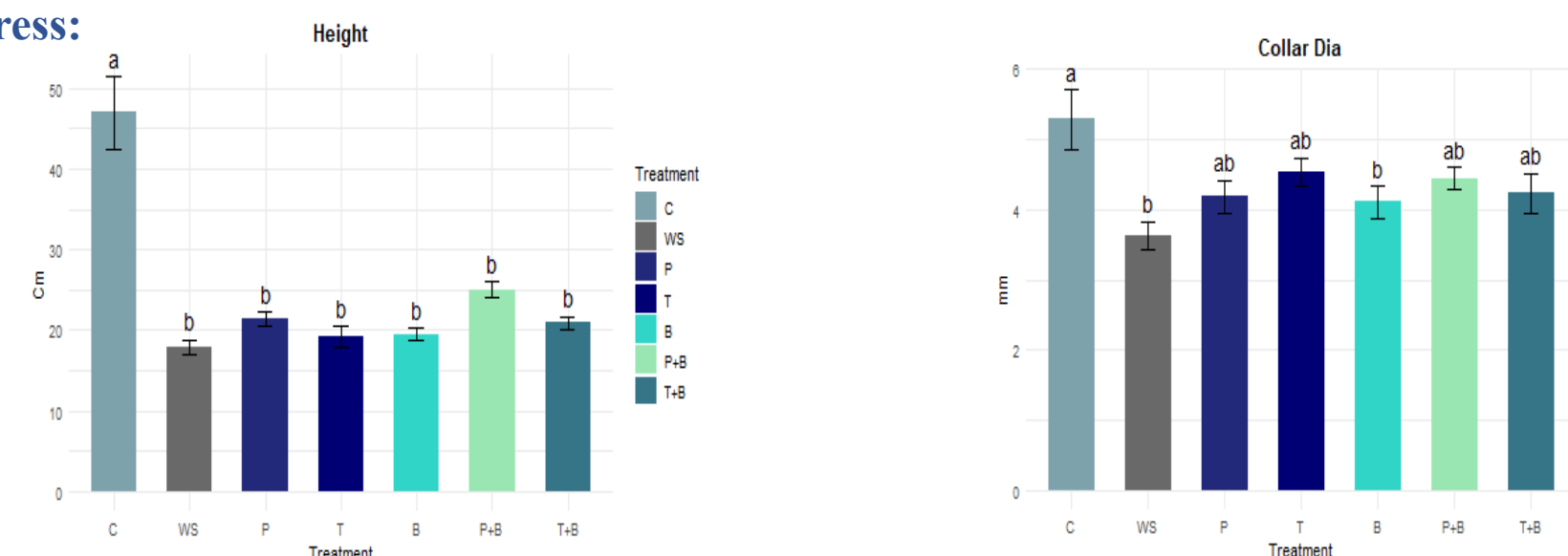
B= Biochar (8%) + Water Stress(14 days)

P+B=*Bacillus altitudinis* + Biochar (8%)+ Water Stress (14 days)

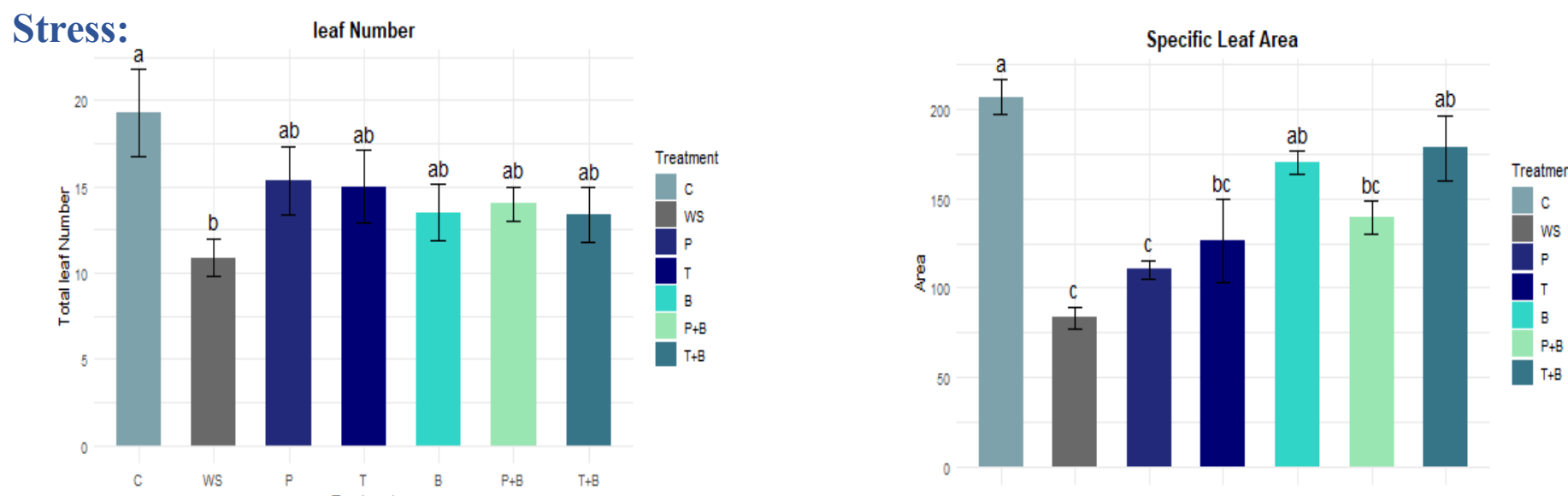
T+B = *Trichoderma asperellum* + Biochar (8%)+Water Stress(14 days)

RESULTS & DISCUSSION

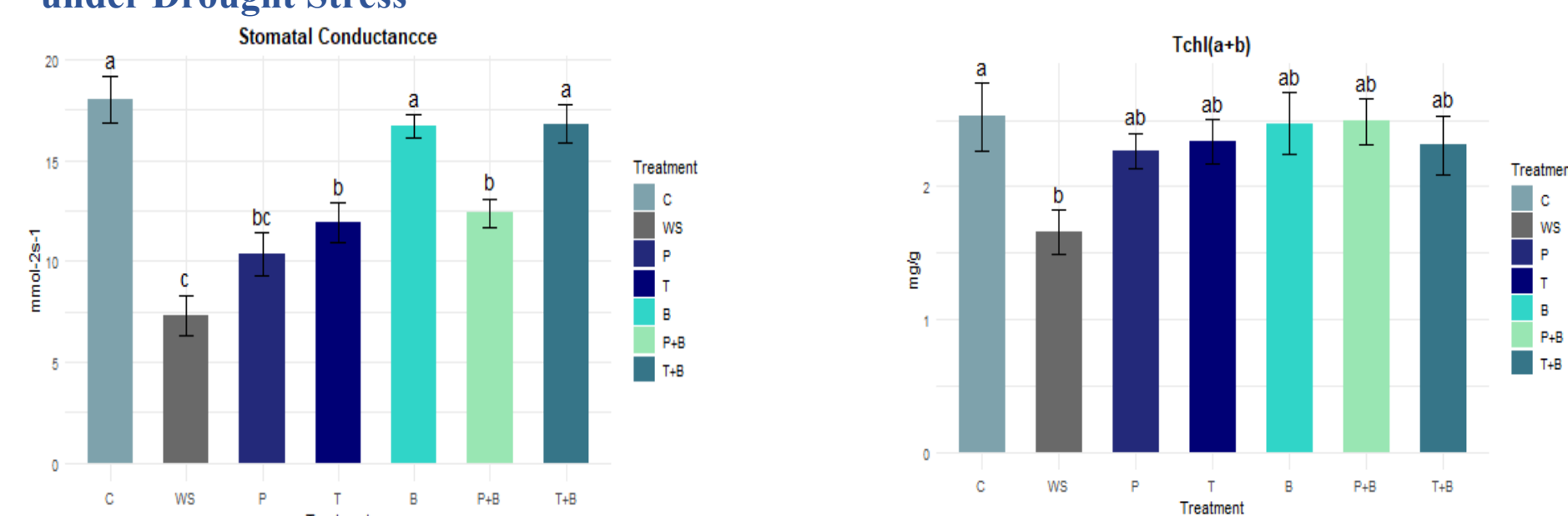
Morphological response of Biochar, PGPR and *T.asperellum* on *A. malaccensis* under Drought Stress:



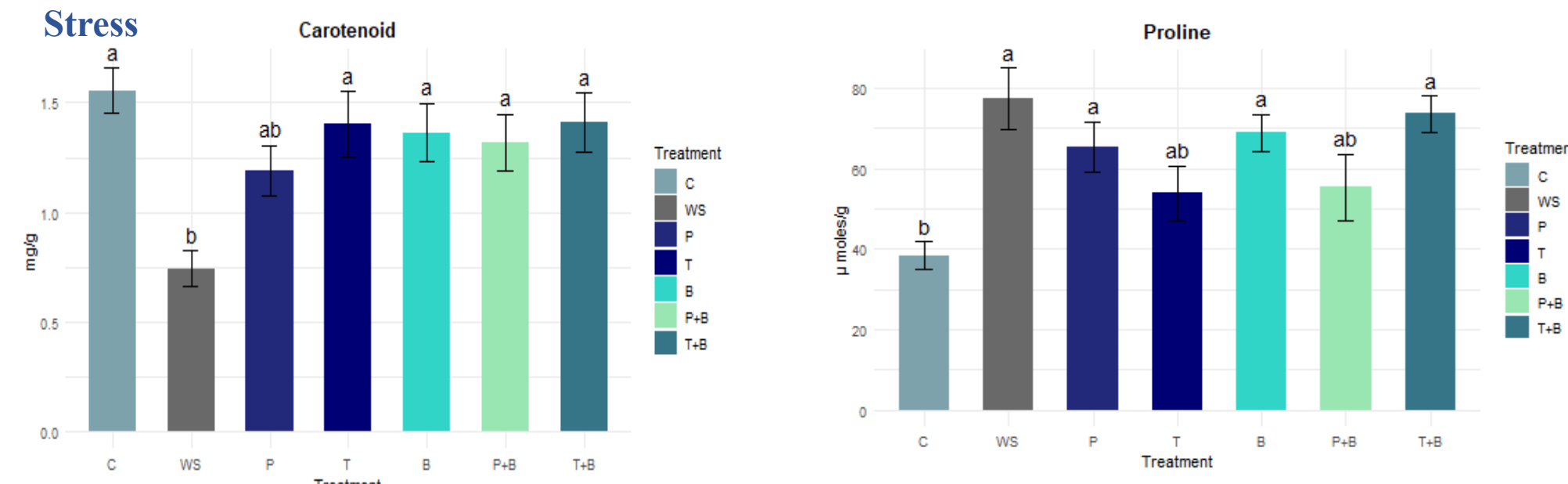
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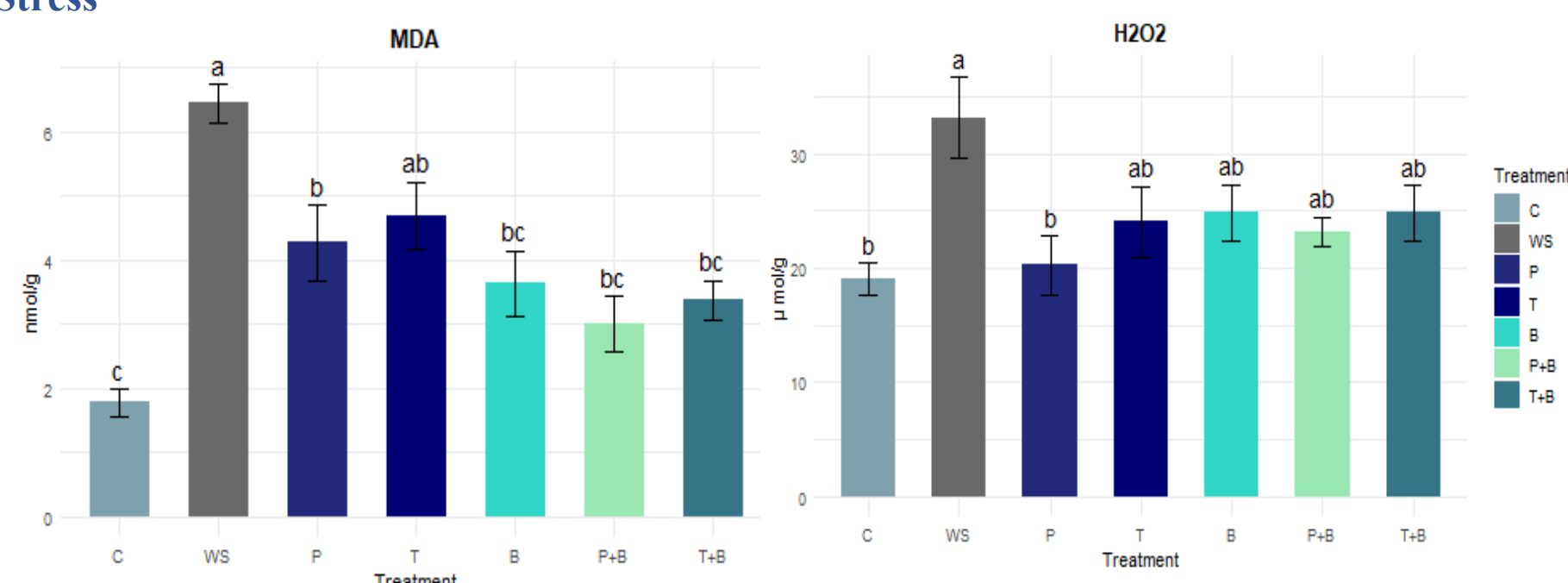
Physiological and Biochemical response of Biochar, PGPR and *T.asperellum* on *A. malaccensis* under Drought Stress



Biochemical response of Biochar, PGPR and *T.asperellum* on *A. malaccensis* under Drought Stress



Stress Marker response of Biochar, PGPR and *T.asperellum* on *A. malaccensis* under Drought Stress



CONCLUSION

- Water stress significantly reduced growth and pigment content.
- Biochar, PGPR and *Trichoderma* treatments improved stress tolerance by increasing proline and reducing MDA and H₂O₂.
- Combined treatments showed moderate positive effects, indicating potential for *A. malaccensis*.

FUTURE WORK / REFERENCES

- Root architecture
- Phenolic component and Total flavonoids content
- Nutrient uptake analysis
- Molecular (Gene expression) Mechanisms Elucidation.

Statistical Analysis

