Institute of Agricultural Sciences in the Tropics (Hans- Ruthenberg-Institute) Water stress Management (490g)

Leaf pigment composition in wheat (*Triticum aestivum* L.) exposed to water deficit and heat stress

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Introduction

- Photo protective pigments are essential in shielding the plant from effects of excess light, which are exacerbated under environmental stress such as drought and high temperatures.
- However, leaf pigments composition in wheat are not well documented.
- We determined the pigment profile of 16 wheat lines from the Best PT panel of CIMMYT under drought and heat stress.

Conclusions

- ❑ Drought and heat stress activate photoprotective mechanisms in wheat.
- ❑ There is evidence of differential response of genotypes to water deficit and heat (significant G x E).
- ❑ Spectral reflectance indices related to carotenoids could detect stress induced responses in pigment composition but could not detect genotypic differences.
- ❑ Laboratory analyses were able to determine genotypic pigment composition and changes in wheat

Results and Discussion

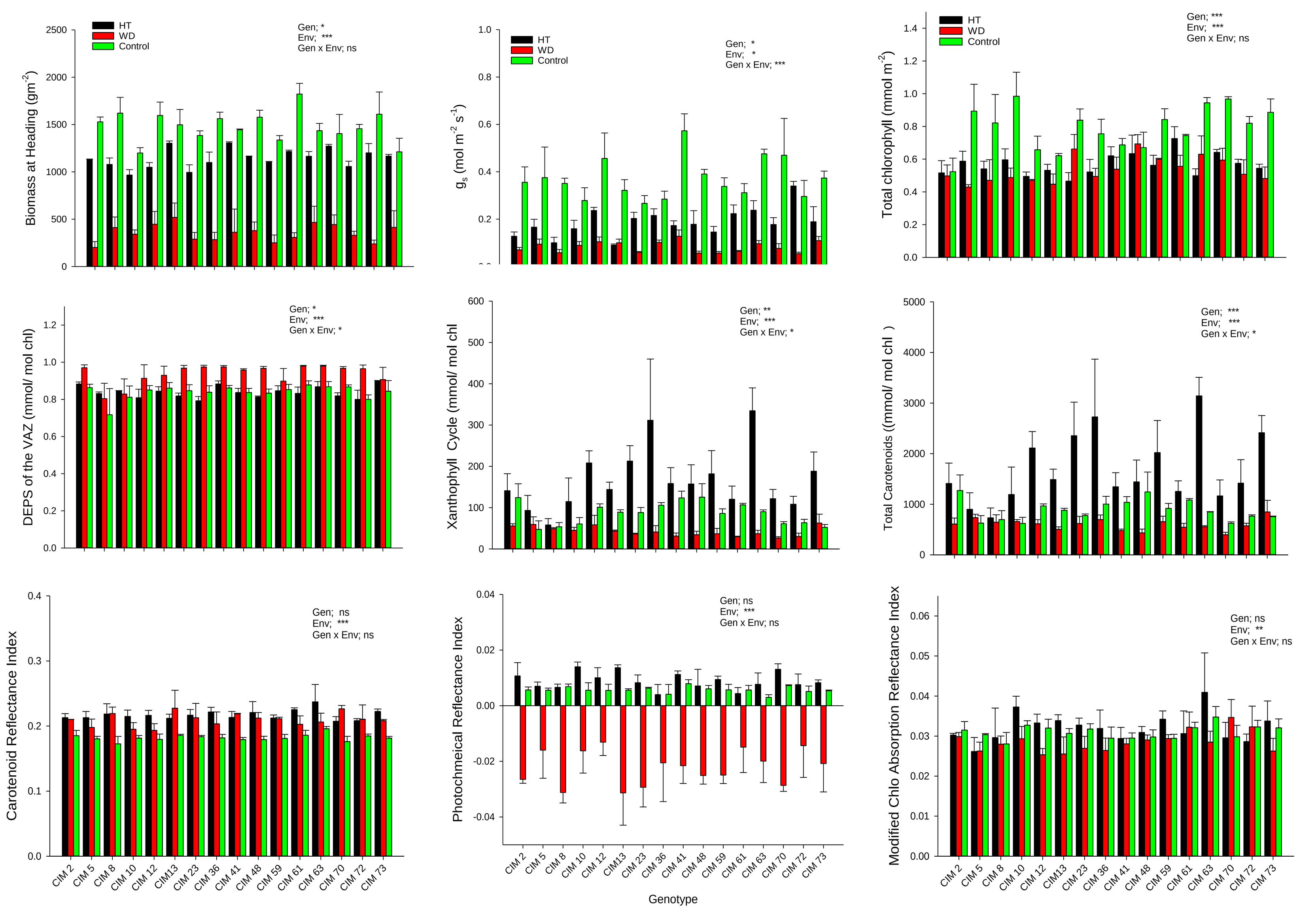


Fig 1. Biomass at heading, stomatal conductance, total Chlorophyll, de-epoxidation state (DEPS) of the xanthophyll cycle, xanthophyll cycle pigments, total carotenoids. Reflectance Indices related to pigment composition and photoprotection measured at the canopy level of sixteen wheat genotype under different environments.

- Our results show a higher impact of stress under drought on total carotenoids, the xanthophyll pool, and reduced PRI which might have led to low photosynthetic activity resulting in low biomass.
- Further, results show pigment and genotype interaction compared to the spectral reflectance indices at the canopy level.
- Hyperspectral reflectance using pigment-related indices were able to detect differences due to water deficit and heat stress.
- Genotypic differences were detected in photosynthetic pigments and stomatal conductance but not in reflectance indices.

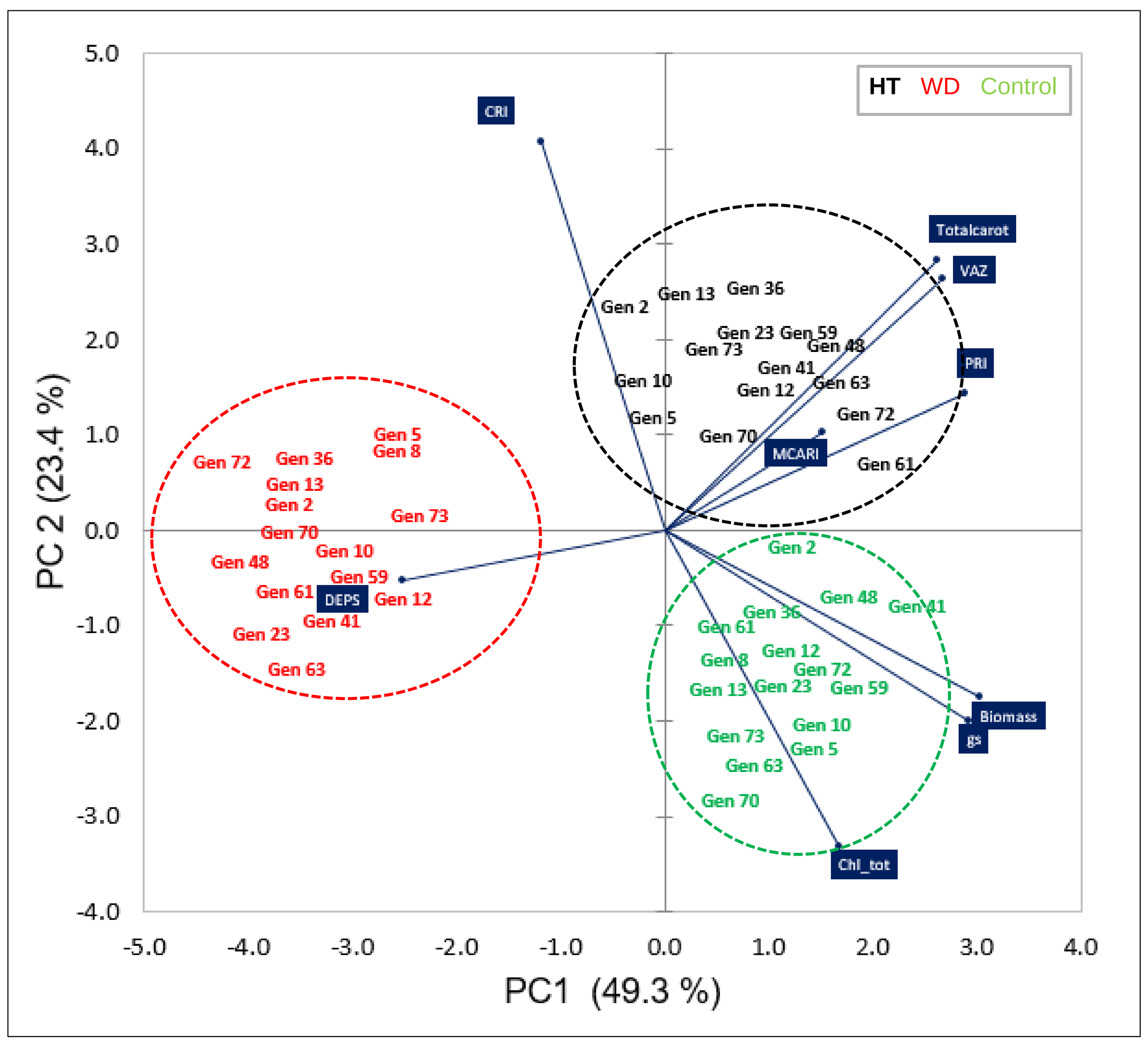


Fig 2. PCA Biplot of photoprotective pigments and reflectance indices measure in 16 wheat genotypes cultivated under control, water deficit and heat stress conditions in the field.

- The PCA explained 72.7% and segregated the three environments (Control, WD and HT).
- Plants under heat stress were associated to higher carotenoids and xanthophylls concentrations.
- Water stressed plants were associated to a higher de-epoxidation state of the xanthophyll cycle but not to higher carotenoid or xanthophylls.

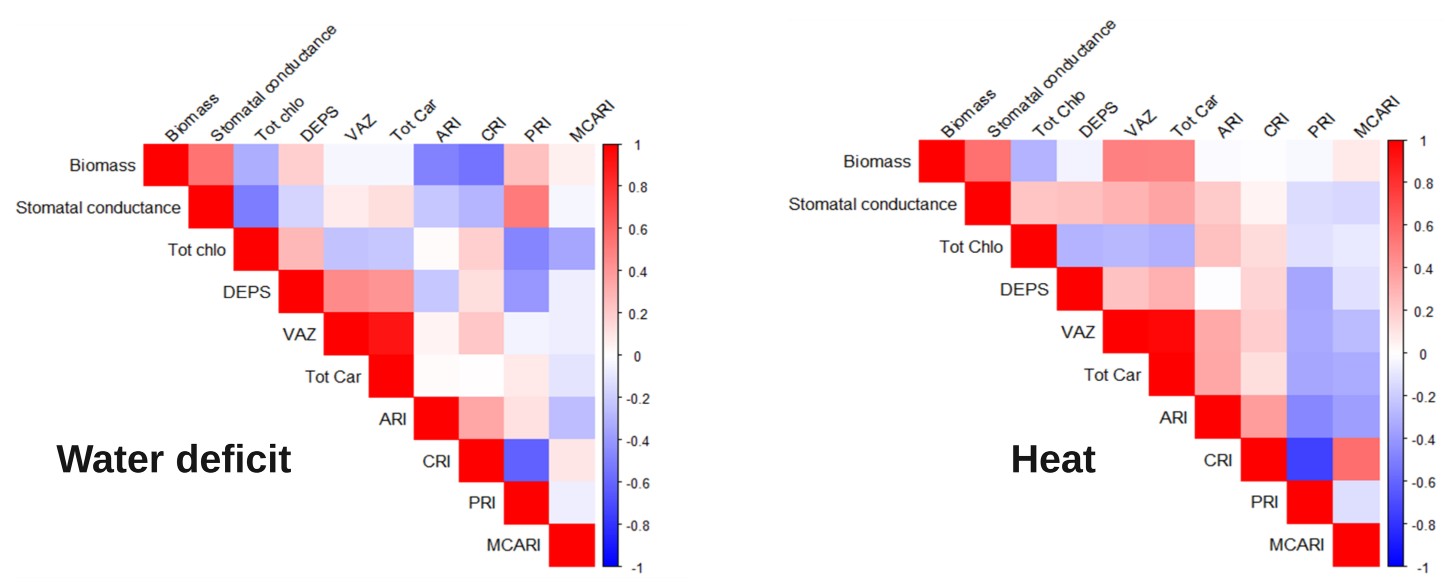
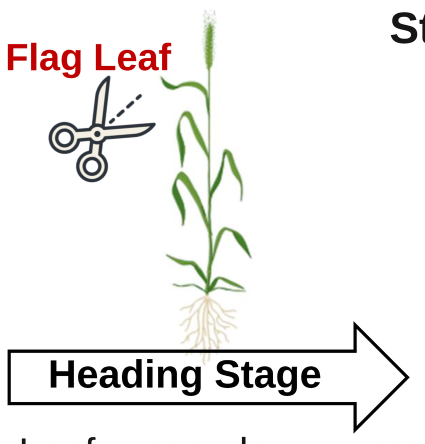


Fig 3. Relationship between photoprotective and photosynthetic pigments and spectral reflectance indices in wheat genotypes under water deficit and heat stress.

Materials and Methods

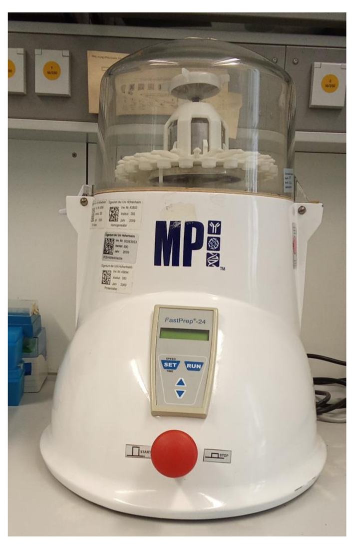
Step 1: Field Experimental setup

Sixteen wheat genotypes were grown in the field at CIMMYT's Campo Experimental Norman E. Borlaug (CENEB) field station in Ciudad Obregon, Sonora, Mexico during the 2021/2022, and 2022/2023 growing seasons under three treatments, **drought stress (WD), heat stress (HT), and Control.**



Leaf samples were collected in the field. Frozen in liquid nitrogen and freeze dried until analysis

Step 2: Leaf Sample preparation



Leaf sample were processed in the fast prep.

Step 3: Chlorophyll determination

Chlorophylls were determined using infiniteM200Pro Tecan.

Step 4: Pigment Analysis

Pigments were determined, separated and quantified in high performance liquid high-chromatography (HPLC)