Enhancing resilience of *Brassica napus* plants to high temperature and drought through manipulation of Phytoglobins (Pgbs)

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Global warming poses a significant threat to plant productivity, as rising air temperatures often coincide with a decrease in soil moisture. Consequently, plants face the dual challenges of heat stress and water scarcity, which negatively impact their growth and reproduction. *Brassica napus*, a plant known for its oil production, is highly vulnerable to both forms of stressors, known to elevate the level of nitric oxide (NO) and reactive oxygen species (ROS) contributing to cellular and tissue damage. Our work has shown that through their ability to scavenge NO and limit the accumulation of ROS, Phytoglobins (Pgbs) exercise a protective role. Imposition of high temperature (35^{o}C) to *Brassica napus* plants depresses seed production by reducing pollen viability. Pollen collected from heat stressed plants accumulates high levels of NO and ROS, exhibit signs of cellular damage, and displays limited ability to germinate *in vitro*. Similarly, roots of water stressed plants deteriorate because of increases in NO and ROS. Cellular degradation is mainly visible within the root apical meristem (RAM), harboring the stem cells responsible for the generation of all cell types. Over-expression of Pgbs relieves both heat and water stress; it restores pollen viability and seed production during high temperature stress, and it reestablishes a functional root during water shortage. It is therefore suggested that manipulation of Pgbs can be used as an effective tool to enhance the ability of plants to cope with the combined effects of high temperature and water deficit stress. Furthermore, Pgbs can serve as valuable molecular markers for identifying the most resilient *Brassica napus* lines under such stressful conditions.

Keywords: Phytoglobin, Climate change, Drought, Heat.