The interactive effects of drought and heat stress on photosynthetic efficiency and biochemical defence mechanisms of Amaranthus species

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Abstract

Drought and heat stress are major abiotic stress factors that limit photosynthesis and other related metabolic processes that hamper plant growth and productivity. Identifying plants that can tolerate abiotic stress conditions is essential for sustainable agriculture. *Amaranthus* plants can tolerate adverse weather conditions, especially drought and heat, and their leaves and grain are highly nutritious. Because of these traits, amaranth has been identified as a possible crop to be grown in marginal crop production systems. Therefore, this study investigated the photochemical and biochemical responses of *Amaranthus caudatus*, *A. hypochondriacus*, *A. cruentus* and *A. spinosus* to drought stress,heat shock treatments and a combination of both. After six-leaf stage in a greenhouse, plants were subjected to drought stress, heat shock treatments and a combination of both. Chlorophyll *a* fluorescence was used to evaluate the photochemical responses of photosystem II to heat shock while subjected to drought stress. It was found that heat shock and a combination of drought and heat schock damages photosystem II, but the level of damage varies considerably between the species. We concluded that *A. cruentus* and *A. spinosus* are more heat and drought tolerant than *A. caudatus* and *A. hypochondriacus*.

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