Middle East Research Journal of Biological Sciences
ISSN 2789-7710 (Print & ISSN 2958-2091 (Online)
Frequency: Bi-Monthly
DOI: 10.36348/merjbs.2023.v03i03.006

KUWAIT SCHOLARS PUBLISHER
Website: http://www.kspublisher.com/
Email: office@kspublisher.com

Response and Impact of Environmental Stress on Crop Reproduction

Narendra Kumar Ahirwar[1*]
[1]Department of Biological Sciences, Mahatma Gandhi Chitrakoot Gramodar Vishwavidhyala, Chitrakoot Satna, MP, India

EDITORIAL NOTE

***Corresponding Author:**
Narendra Kumar Ahirwar
Department of Biological Sciences, Mahatma Gandhi Chitrakoot Gramodar Vishwavidhyala, Chitrakoot Satna, MP, India

How to cite this paper:
Narendra Kumar Ahirwar (2023). Response and Impact of Environmental Stress on Crop Reproduction. *Middle East Res J Biological Sci*, *3*(3): 72-73.

Article History:
| Submit: 06.11.2023 |
| Accepted: 07.12.2023 |
| Published: 08.12.2023 |

Crop plants experience significant yield losses due to environmental stresses during their reproductive development. While much research has been dedicated to understanding how plants' vegetative tissues respond to stress, it's crucial to recognize that the reproductive phase is even more vulnerable. This stage is directly linked to crop productivity, with efficient photosynthesis and nutrient distribution in the early reproductive stages being vital for forming reproductive organs and accumulating dry matter. Although certain traits enhancing vegetative growth have been leveraged to improve a plant's overall stress resistance, these do not always translate to better resilience during the reproductive phase or guarantee higher yields under stress in the final growth stages. Additionally, the ability of a plant to withstand stress during the seedling or vegetative phase doesn't necessarily predict its stress tolerance during reproduction. This indicates that different gene sets may be responsible for managing stress during the reproductive stage of a plant's life cycle. Enhancing grain yield in crops under adverse environmental conditions hinges on pinpointing specific target traits relevant to the reproductive stage and unraveling how crop reproductive tissues physiologically and molecularly respond to environmental stresses, whether these stresses occur alone or in combination. This knowledge is vital for creating stress-resilient crop varieties, which is a key factor in maintaining global food security. Additionally, leveraging the inherent genetic diversity in crop species for stress tolerance during the reproductive stage is crucial in aiding plant breeders to develop cultivars that are both stress-tolerant and high-yielding. This reviews and research articles that advance our understanding of plant stress tolerance during the reproductive stage. It includes comprehensive reviews that synthesize and critically analyze existing literature, offering new and broad perspectives on the topic. The research articles in this issue shed light on the genetic and physiological processes that underpin plant reproductive health and yield in varying environmental scenarios.

Jeger's 2023 review offers an in-depth and unified exploration of the concept of 'tolerance,' defined as a host plant's capability to lessen the impact of infection on its reproductive and survival fitness, independent of the pathogen load. This review underscores the necessity for more focused research on disease tolerance during the reproductive phase. Jeger stresses the importance of clearly distinguishing between interactions and responses to both biotic and abiotic stresses. The review also delves into the potential of virus infections to mitigate the impact of various abiotic stresses and explores how abiotic stress tolerance can reduce susceptibility to plant pathogens. Jeger calls for more field-based studies and the use of mathematical models to advance disease management strategies. Van Haeften *et al.*,'s 2023 review provides a thorough assessment of the effects of different abiotic stresses on the reproductive growth and yield of mungbeans from a physiological standpoint. They discuss the traits that enable adaptation and reproductive fitness in mungbeans, advocating for the expanded use of new biotechnological approaches to hasten the development of climate-resilient mungbean varieties. The authors also highlight the limitations in the number of available genotypes and the scarcity of field studies and detailed experimental data as significant challenges in enhancing mungbean reproductive resilience.

Heat stress significantly disrupts the reproductive development of many crops, particularly affecting pollen development and seed formation. In 2023, Smith *et al*., revealed new insights into the negative impacts of heat stress on the early and late developmental stages of sorghum anthers (Sorghum bicolor (L.) Moench), which leads to reduced grain yield. Their study indicates that the booting stage of sorghum is more vulnerable to prolonged heat stress compared to the pollen mother cell development stage. This research suggests that the heat-induced effects on auxin might influence apical and basal tiller formation during these two critical reproductive phases, potentially safeguarding grain yields under heat stress. In the context of global food security, genetic diversity is crucial as it enables plant species to adapt to diverse environmental stresses. Shokat *et al*.,'s 2023 review thoroughly examines the role of genetic variation and pre-breeding characteristics in a broad population of bread wheat (Triticum aestivum L.) genotypes for enhancing tolerance to drought and heat stress during the flowering stage. The review delves into various physiological aspects like eco-physiology, antioxidant and carbohydrate metabolism, osmoprotection, and endogenous phytohormone levels. It also explores novel genes associated with reproductive stage-specific yield-related traits in plants under drought and heat stress. Shokat *et al*., argue that leveraging the wide array of wheat genetic resources and the identified pre-breeding traits can be instrumental in breeding wheat varieties that are more resilient to challenging environmental conditions.

Alongside genetic diversity, genomic resources are pivotal for crop enhancement. Recent advancements in genomic technologies have led to the creation of novel genomic resources, which are key in crop improvement efforts aimed at ensuring future global food security. In their 2023 study, Pruthi *et al*., identified several quantitative trait loci (QTLs) and candidate genes linked to salt tolerance in rice during the flowering stage. Interestingly, these differ from those involved in seedling stage salt tolerance, indicating unique genetic pathways governing salt tolerance at different developmental stages in rice. This discovery emphasizes the need to combine various QTLs/genes to enhance salt tolerance across both stages. Pruthi *et al.*, also discovered introgression lines with improved salt tolerance at both the seedling and flowering stages. Advanced techniques like whole genome sequencing, transcriptomics, and metabolomics will enable a more comprehensive understanding of salt tolerance mechanisms at these stages in rice. This reviews and research articles that shed light on the impact of environmental stresses on the reproductive fitness of crops. These contributions offer invaluable insights into reproductive stage-specific traits, stress responses at the physiological and molecular levels, and the role of genomic resources and natural genetic variation in crops and their wild counterparts. This knowledge is instrumental in guiding plant breeding strategies that utilize technologies such as marker-assisted selection, high-throughput phenotyping, genome editing, and genomic selection. Overall, this Special Issue is a rich resource for developing crop varieties more resilient to stress during the reproductive phase, thereby enhancing crop yield stability.

Funding Information: There are no funders

Conflict of Interest Statement: The authors have stated explicitly that there are no conflicts of interest in connection with this article.

Data Availability Statement: Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

REFERENCES

- Jeger, M. J. (2023). Tolerance of plant virus disease: Its genetic, physiological, and epidemiological significance. *Food and Energy Security*, 12, e440. https://doi.org/10.1002/fes3.440
- Pruthi, R., Chapagain, S., Coronejo, S., Singh, L., & Subudhi, P. K. (2023). Quantitative trait loci, candidate genes, and breeding lines to improve salt tolerance at the flowering and seedling stages in rice. *Food and Energy Security*, 12, e433. https://doi. org/10.1002/fes3.433
- Shokat, S., Großkinsky, D. K., Singh, S., & Liu, F. (2023). The role of genetic diversity and pre-breeding traits to improve drought and heat tolerance of bread wheat at the reproductive stage. *Food and Energy Security*, 12, e478. https://doi.org/10.1002/ fes3.478
- Smith, A., Gentile, B. R., Xin, Z., & Zhao, D. (2023). The effects of heat stress on male reproduction and tillering in Sorghum bicolor. *Food and Energy Security*, 12, e510. https://doi.org/ 10.1002/fes3.510
- Van Haeften, S., Dudley, C., Kang, Y., Smith, D., Nair, R. M., Douglas, C. A., Potgieter, A., Robinson, H., Hickey, L. T., & Smith, M. R. (2023). Building a better Mungbean: Breeding for reproductive resilience in a changing climate. *Food and Energy Security*, 12, e467. https://doi.org/10.1002/fes3.467