Ukrainian Journal of Ecology

Ukrainian Journal of Ecology, 2024, 14(2), 20-22, doi: 10.15421/2024_546

COMMENTARY

Telomere length variation in model bryophytes: Insights into evolutionary significance and molecular mechanisms

Senalik Grzebelus*

Department of Biotechnology & Crop Improvement, University of Horticultural Sciences, Bagalkot 587103, Karnataka, India

**Corresponding author E-mail: grzeb.us@senalik.in*

***Received:** 04 March, 2024, Manuscript No: UJE-24-131675; **Editor assigned:** 06 March, 2024, PreQC No: P-131675; **Reviewed:** 18 March, 2024, QC No: Q-131675; **Revised:** 23 March, 2024, Manuscript No: R-131675; **Published:** 30 March, 2024*

Telomeres, the repetitive DNA sequences at the ends of linear chromosomes, play pivotal roles in maintaining genomic stability and integrity. Telomere length maintenance is crucial for cellular functions, including DNA replication, cell division and senescence. While extensively studied in various model organisms, telomere dynamics in bryophytes, comprising mosses, liverworts and hornworts, remain relatively understudied. However, recent advancements in genomic technologies have enabled researchers to unravel telomere length variation in model bryophytes, shedding light on their evolutionary significance and underlying molecular mechanisms. Bryophytes represent an ancient lineage of land plants, offering unique insights into the evolution of telomere biology. Telomeres in bryophytes exhibit conserved features, including the presence of telomeric repeats typically composed of TTAGGG sequences, akin to other eukaryotes. However, variations in telomere length and structure have been observed across different bryophyte species, reflecting diverse evolutionary trajectories and adaptive strategies.

Keywords: Telomeres, Bryophytes, Molecular mechanisms, Urban environment.

Introduction

The repeated DNA sequences known as telomeres, which are found at the ends of linear chromosomes, are essential for preserving the stability and integrity of the genome. The preservation of telomere length is essential for all cellular processes, including cell division, DNA replication and senescence. Although telomere dynamics is well understood in many model species, it is still mostly unknown in bryophytes, which include mosses, liverworts and hornworts (Fulnecková, J., et al., 2013). Recent developments in genomic technologies, however, have made it possible for scientists to understand the evolutionary importance and underlying molecular mechanisms of telomere length variation in model bryophytes. Bryophytes are a primitive group of land plants that provide special insights into the development of telomere biology. Bryophytes' telomeres share characteristics with other eukaryotes, such as the existence of telomeric repeats made up of TTAGGG sequences.

Description

Telomere length variation in bryophytes has been linked to diverse ecological and physiological factors. Studies have revealed associations between telomere length and environmental conditions, such as habitat type, temperatur moisture levels. Additionally, telomere dynamics have been implicated in life history traits, reproductive strategies and responses to biotic and abiotic stressors (McClintock, B. 1941). Understanding the evolutionary implications of telomere length variation in bryophytes provides valuable insights into their adaptation to changing environmental conditions and evolutionary diversification. The regulation of telomere length in bryophytes involves a complex interplay of various molecular components, including telomerase, telomere-binding proteins and epigenetic modifiers. Telomerase, a specialized reverse transcriptase enzyme, plays a central role in telomere elongation by adding telomeric repeats to chromosome ends (Fitzgerald, M. S., et al., 1996). Studies have identified telomerase activity in bryophytes, although its regulation and mode of action may differ from higher plants. Furthermore, telomere-binding proteins, such as shelterin complex components, contribute to telomere protection and length regulation. Epigenetic mechanisms, including chromatin modifications and non-coding RNAs, also influence telomere dynamics in bryophytes, highlighting the complexity of telomere regulation at the molecular level.

Comparative genomics approaches have facilitated the exploration of telomere length variation across diverse bryophyte taxa. Phylogenetic analyses have revealed evolutionary relationships and divergence patterns in telomere-related genes and regulatory elements (Riha, K., et al., 1998). By integrating genomic data with functional studies, researchers aim to decipher the evolutionary forces shaping telomere dynamics in bryophytes and their implications for plant evolution and adaptation. Understanding telomere biology in model bryophytes holds promising implications for biotechnological applications, including crop improvement, conservation biology and biomedicine. Harnessing the unique features of bryophyte telomeres may offer novel strategies for enhancing stress tolerance, extending cellular lifespan and combating age-related diseases. Future research directions may focus on elucidating the mechanistic basis of telomere length variation, exploring evolutionary transitions in telomere dynamics and leveraging bryophyte models for translational research (Shakirov, E. V., et al., 2022).

On the leaves of *Quercus robur* , we found isolated foci of *Corythucha arcuata*, an invasive and quite harmful oak pest. This species causes significant damage to oak plantings in Europe. Therefore, the city's municipal services need to monitor the spread of this species.

Conclusion

Telomere length variation in model bryophytes represents a fascinating yet understudied aspect of plant biology. By unraveling the evolutionary significance and molecular mechanisms underlying telomere dynamics in bryophytes, researchers can gain deeper insights into the fundamental principles of genome stability, adaptation and evolution. Continued interdisciplinary efforts combining genomic, functional and ecological approaches are essential for advancing our understanding of telomere biology in bryophytes and its broader implications for plant science and beyond.

Acknowledgement

None.

Conflict of Interest

The authors declare no conflict of interest.

References

Fulnecková, J., Sevcikova, T., Fajkus, J., Lukešova, A., Lukes, M., Vlcek, C., Sykorova, E. (2013). A broad phylogenetic survey unveils the diversity and evolution of telomeres in eukaryotes. Genome Biology and Evolution 5:468-483.

McClintock, B. (1941). The stability of broken ends of chromosomes in *Zea mays*. Genetics 26:234.

Fitzgerald, M. S., McKnight, T. D., Shippen, D. E. (1996). Characterization and developmental patterns of telomerase expression in plants. Proceedings of the National Academy of Sciences 93:14422-14427.

Riha, K., Fajkus, J., Siroky, J., Vyskot, B. (1998). Developmental control of telomere lengths and telomerase activity in plants. The Plant Cell 10:1691-1698.

Richards, E. J., Ausubel, F. M. (1988). Isolation of a higher eukaryotic telomere from *Arabidopsis thaliana*. Cell 53:127-136.

Shakirov, E. V., Chen, J. J. L., Shippen, D. E. (2022). Plant telomere biology: The green solution to the end-replication problem. The Plant Cell, 34:2492-2504.

Citation:

Grzebelus, S. (2024). Telomere length variation in model bryophytes: Insights into evolutionary significance and molecular mechanisms. *Ukrainian Journal of Ecology.* 14:20-22.