



Life Finds a Way: Drought-Defying Plants Discovered in the Western Ghats

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The Western Ghats, often referred to as the Sahyadri Hills, are one of the eight hotspots of biological richness and a UNESCO World Heritage Site. They are home to India's two biosphere reserves, 13 national parks, wildlife sanctuaries, and reserve forests.

Scientists from the Agharkar Research Institute (ARI) in Pune, an independent institute of the Department of Science and Technology (DST) recently on an expedition to explore the region's rich flora, stumbled upon an astonishing find – 62 new plant species that can thrive without water. These drought-resilient marvels have revealed nature's survival strategies, giving agriculture's future hope and inspiration. Plant species that display the remarkable property known as desiccation-tolerance (DT). These plants have potential applications in agriculture, particularly in areas where water is scarce.

What are Desiccation-Tolerance (DT) Plants?

- Desiccation-tolerant vascular (DT) plants can tolerate the desiccation of their vegetative tissues. DT plants are the most common residents of tropical rock outcrops.
- DT plants can survive high dehydration, losing up to 95% of their water content.
- Dehydration in plants occurs when the plant loses more water than it takes in.

Unlike most other plants, desiccation-tolerant plants have the amazing ability to endure in severe, arid settings. They stand out because of their capacity to withstand severe dehydration. They can lose an incredible amount of water before reviving if water supplies are replenished. They are an interesting subject of study because of their special adaptation that allows them to survive in arid environments.

Habitation

- Both tropical and temperate climates are home to DT plants.
- They tend to grow on rocky outcrops in the tropics and can regenerate quickly when water supplies are restored.
- The ability of some organisms to flourish at greater temperatures is essential for reducing global warming.
- Hydration and desiccation resistance are two widely studied mechanisms for plants in harsh environments. Plant tissues can sustain a water content of more than 30% when they are hydrated.
- Plants that can withstand desiccation in India are mostly found on tree trunks and rock outcrops in forests. Basaltic plateaus, which are plateaus created by volcanic activity, and Ferricretes, a hard, erosion-resistant layer of sedimentary rock, appeared to be the preferred habitats.

- While the rest of the species were found on both Ferricretes and Basaltic plateaus. *Glyphochloa goaensis*, *Glyphochloa ratnagirica*, and *Glyphochloa santapau* were only found on Ferricretes.
- *Glyphochloa* was the most prevalent genus, with most of its annual species found on plateaus.

Characteristics

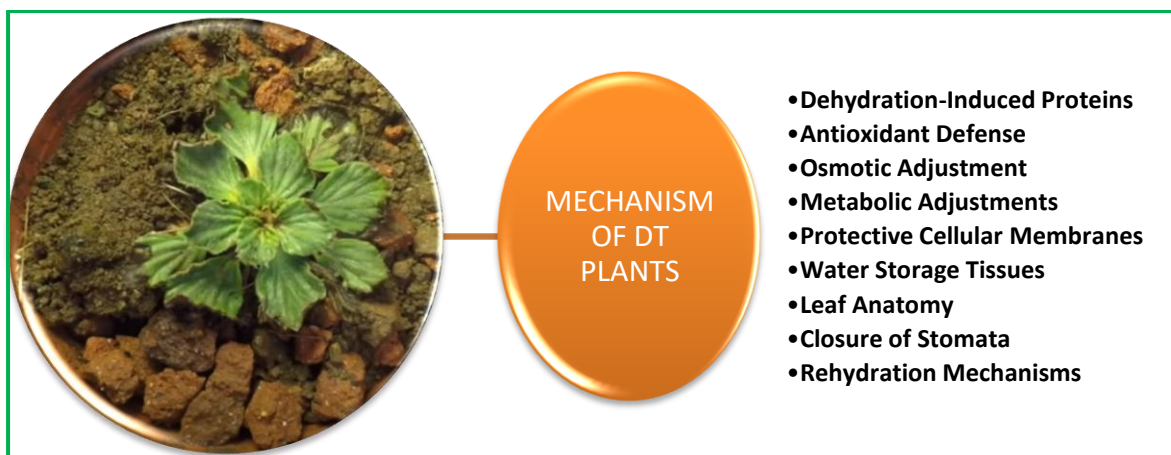
The DT species had morphological traits as well as colour differences.

- *Tripogon* species had a colour spectrum that ranged from green in hydrated conditions to grey in dry ones.
- When *Oropetium thomaeum* species is hydrated, the leaf cloud changes from green to a dark purple or orange colour, and when it was desiccated, it changed from brownish to ash.
- Ferns (fronds) exhibited a range of traits, such as curling inwards towards the costa and exposing spores towards the beginning of the dry season and during brief dry spells.

But this wasn't the case for all species. When *C. lanuginosus* was in the desiccation phase, the leaves curled and shrivelled inward to protect the chlorophyllous region from direct sunlight exposure.

Mechanism

Vascular plants' ability to tolerate desiccation is mediated by a complex array of cellular, metabolic, and morphological adaptations.. These adaptations allow these plants to survive extreme dehydration and bounce back to life when water becomes available again. Overall, the desiccation tolerance mechanisms in vascular plants are intricate and multifaceted, allowing these remarkable organisms to survive in harsh and arid environments and contributing to their significance in ensuring food security in water-scarce regions. Here are some key mechanisms involved:



Sources: Smrithy, V., Kulkarni, A., Shigwan, B. K., Porembski, S., & Datar, M. N. (2023).

A review: Desiccation-tolerant vascular plants from Western Ghats, India prospects, and new insights. *Nordic Journal of Botany*

Diversity in Species

The study found that these species had a 300–1,500 person population range worldwide. Twelve(12) of the 62 species discovered are only found on outcrops in the Western Ghats, including 16 that are indigenous to India. India contributed a total of 9 generic entries to the global list: *Pyrrosia*, *Aleuritopteris*, *Corallodiscus*, *Arundinella*, *Bhidea*, *Bothriochloa*, *Danthonidium*, *Dimeria*, and *Glyphochloa*.

The Potential Application in Agriculture and Conservation

The desiccation-tolerant vascular plant species found in India's Western Ghats hold significant potential for various applications in agriculture and conservation.

- **Climate-Resilient Crops:** Identifying the genetic characteristics of desiccation-resistant plants can help breeders create agricultural types that are more tolerant to climate change. Agriculture in the Western Ghats can become more climate-adaptive and less vulnerable to droughts and water scarcity by incorporating these characteristics into regularly farmed crops.
- **Preservation of Biodiversity:** The discovery and protection of desiccation-tolerant plant species helps to save the Western Ghats' distinctive biodiversity. These resilient plants are essential elements of the sensitive ecology because they have evolved to the unique environmental circumstances of the area.
- **Food Security:** By providing a reliable source of food during water scarcity and extreme temperatures, DT crops contribute significantly to food security, especially in vulnerable regions.
- **Water Conservation:** DT plants require less water compared to traditional crops, reducing the strain on water resources. In water-scarce areas, cultivating these water-efficient plants can contribute to sustainable water management and conservation efforts.
- **Expanded Growing Areas:** DT plants enable agriculture in marginal lands that are not suitable for traditional crops due to water limitations. By expanding the arable land, these plants can increase food production potential and improve food security.
- **Indicator Species:** Desiccation-tolerant plants can serve as indicators of environmental health. Monitoring their presence and abundance can help assess the impacts of climate change and human activities on the Western Ghats' ecosystems.

In conclusion, as climate change continues to impact our planet, water scarcity has become a pressing concern in many regions. Traditional agriculture is often heavily dependent on consistent water availability, which can be challenging in areas prone to droughts or facing water shortages. Introducing and cultivating DT Vascular Plants in agricultural practices could revolutionize farming in such regions. The Desiccation-Tolerant Vascular Plant Species found in the Western Ghats stand as exceptional examples of nature's ingenuity and adaptability. Their astounding ability to withstand severe dehydration and recover upon rehydration holds enormous promise for revolutionizing agriculture in water-stressed regions. By harnessing the potential of these resilient plants, we can secure a more sustainable and food-secure future while safeguarding the biodiversity of this magnificent biodiversity hotspot.

References

1. Vijayan, S., Kulkarni, A., Shigwan, B. K., Porembski, S., and Datar, M. N. (2023). Desiccation-tolerant vascular plants from Western Ghats, India: review, updated checklist, future prospects and new insights. *Nordic Journal of Botany*, 2023(5). <https://doi.org/10.1111/njb.03939>
2. Ministry of Sciences and Technology (2023). New study discovers 62 desiccation-tolerant vascular plant species in India's Western Ghats, with potential applications in agriculture & conservation