

Rooted in Time: The Living Fossil of the Himalayas

-Shikhar Kaushik



A deep gorge in middle Himalayas with moisture loving species and surrounding area dominated by pine forest

The Himalayas are home to an extraordinary diversity of flora, ranging from the subtropical Sal forests of the Shivaliks to the oaks and pines of the mid-Himalayas, the birch and fir forests of the upper Himalayas, and the alpine meadows above the timberline. This rich vegetation pattern is shaped by a variety of factors, including topography, slope, aspect, climate, soil types, and species dispersal. Among these, topography plays a pivotal role in defining microclimates and influencing the exposure of a site to other environmental factors. The formation of gorges and rivulets is a common feature in the Himalayas, creating unique habitats for a wide array of plant species. Amidst the phyto-diversity of angiosperms and gymnosperms lies another fascinating group of plants: the pteridophytes. These ancient plants, which include ferns, were the first vascular plants. Unlike flowering plants, ferns lack woody growth and do not produce seeds or flowers. Instead, they reproduce via spores and are commonly found in moist, shady habitats, such as the floors of dense forests, groves, and gorges.

Within the deep gorges of the Himalayas thrive a charismatic plant whose [origin dates back to the Paleozoic era \(300 mya\)](#): The Cyatheoid ferns, or tree ferns. These sub-arboreal pteridophytes are distinguished by their trunk-like structures, which give them the appearance of trees. Their “trunks” are actually modified rhizomes supported by a dense mass of fibrous roots. Tree ferns belong to the order Cyatheaales, which includes three major families:

Cyatheaceae, Dicksoniaceae, and Cibotiaceae. [Globally, there are an estimated 500 to 600 species of tree ferns](#), primarily found in tropical forests. However, some species have established themselves in subtropical and temperate Himalayan forests.



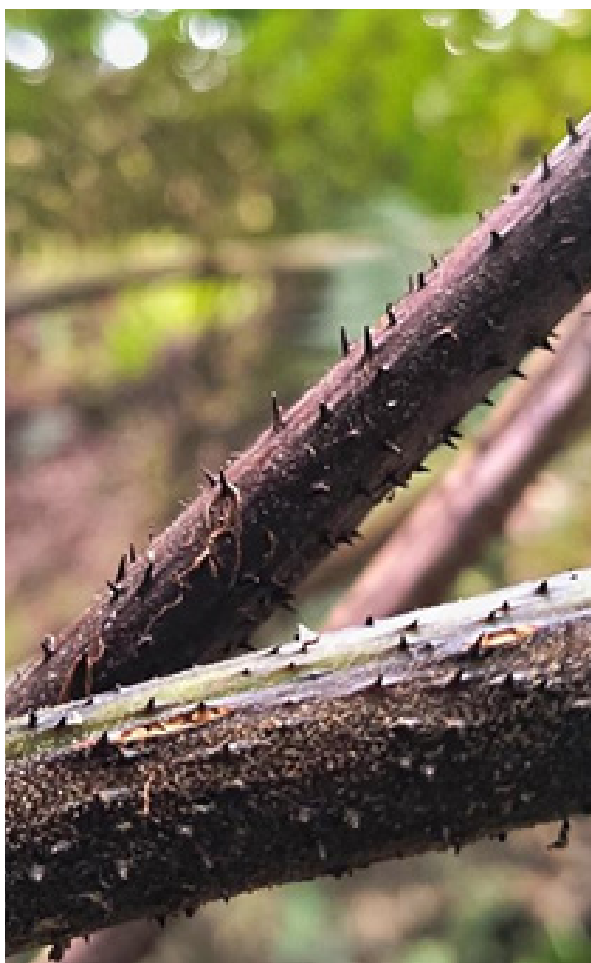
Large Spiny Tree Fern (*Cyathea spinulosa*)

In India, 12 species of tree ferns (*Cyathea*) are known, of which only one, the Large Spiny Tree Fern (*Cyathea spinulosa*), is found in some parts of Uttarakhand. Commonly referred to as the [Sala Tree](#), this species exhibits a sporadic distribution in the districts of Chamoli and Pithoragarh. Tree ferns, like other typical pteridophytes, thrive in moist, damp, and shady gorges along rivulets nestled within the inner folds of the Himalayas. These gorges are often surrounded by Chir Pine (*Pinus roxburghii*) and Oak (*Quercus spp.*) forests. Species commonly found in gorges along with the Large Spiny Tree ferns include *Acer laevigatum*, *Brassaiopsis aculeata*, *Goodyera procera*, *Hoya lanceolata*, *Macaranga indica*, *Machilus odoratissima*, *Macropanax dispermus*, *Maesa indica*, *Rhaphidophora sp.*, and *Saurauia napaulensis*.

The [Large Spiny Tree Fern](#) can be recognized by its thick, rhizomatous trunk covered with hair-like structures. The stipe (stalk) has spines, giving the species its name 'spinulosa'. The fronds, or laminae, are large and bear numerous pinnae, on which spore-producing structures called 'sori' are formed. The species exhibits a deciduous nature; as the plant matures, older fronds dry up and fall off, sometimes remaining attached to the stipe. This creates the illusion of a wider trunk. Like all ferns, the Large Spiny Tree Fern reproduces via spores rather than seeds. The spores are encapsulated in sporangia, with each sporangium containing around 20 spores.

Tree ferns exhibit a dual life cycle, also called “alternation of generations,” which alternates between a diploid sporophyte (mature plant) and a haploid gametophyte (smaller plant). The sporophyte produces spores, which are released into the air. When spores settle in moist, favorable habitats, they grow into a small, heart-shaped structure called a gametophyte. This gametophyte produces male sperm from the antheridium and female eggs from the archegonium, which fertilize to form a zygote (sporophyte) that grows again into a mature tree fern.

The Large Spiny Tree Fern holds significant ecological and conservation importance as the only tree fern species in Uttarakhand. Due to its ornamental value, [the species is listed under CITES Appendix II](#),



The stipe with spines.

which regulates its trade and requires prior permission for its transportation.

However, the future of this living fossil is uncertain due to climate change and land-use alterations in the Himalayas. One of the oldest recorded populations of *Cyathea spinulosa* is located near Pamtori Village, between Sandev and Thal in Pithoragarh District.

This population consists of seven to eight individuals and is critically important from a conservation perspective. One of the potential threats to this population could be the development of a double-lane road between Thal and Sandev in the future. The population lies perilously close to the existing road, within a gorge. If road widening proceeds without proper mitigation measures such as careful disposal of excavated rocks, this fragile population could be wiped out.



The underside of pinna with sori.

These living fossils hold many untold mysteries, including their dispersal from tropical to temperate regions and their remarkable ability to adapt and thrive in a rapidly changing world alongside today's highly evolved plants and animals. They offer a unique window into the evolutionary history of plant life, providing insights into how ancient species have persisted through millennia. With a changing world, conservation efforts for such species are necessary. Protecting the Large Spiny Tree Fern is not merely about saving this species. It is also about preserving the delicate ecosystems that support it. The pine and oak forests surrounding these ferns create the perfect microclimatic conditions within their gorges, allowing this ancient plant to flourish. Therefore, conservation needs to extend beyond the fern itself to include the entire habitat that sustains it. Only by safeguarding these interconnected ecosystems can we ensure the survival of this living fossil for generations to come.

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Magnified image (15x) of sori.