

Improving collections of the seasonal, herbaceous plants from the laterite plateaus (sky-islands) of the Western Ghats, India.

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The Western Ghats were formed almost at the same time as when India separated from the east coast of Madagascar about 88-90 million years ago. This region is known as a biodiversity hotspot for good reasons and is still a curiosity region for all evolutionary biologists for three main factors: i) floristic similarity with its mother tectonic plate, that is the African continent, ii) endemism, and iii) speciation and disjunction between Western Ghats and other pockets of biodiverse regions such as North East of India and Eastern Himalayas.

The separation of the Indian plate is marked by some of the most violent volcanic eruptions in the history of this region which covered the moving raft of the tectonic plate with basaltic lava. The Deccan volcanic land, as evident today is made up of basaltic rocks which are lava solidified into rocks, and this covers a large region from north of Phonda in Goa and it spreads east and north into Central India. As the Indian subcontinent drifted north towards Eurasia, it crossed past the equator and the entire region experienced an equatorial climate for several million years (fossil pollen record evidence). As this region experienced heavy rains it resulted in several unique drainage systems throughout the range of what we now identify as Western Ghats and resulted in several rivers running both eastwards as well as westwards. These waters flowing down the west facing escarpment of Western Ghats eroded the rocks, a process that has been going through at least 80-90 million years resulted in the formation of the lateritic rocks from the parent basalt rocks. As the Indian subcontinent collided with the Eurasian plate, rain-forests perished everywhere except in North-East and in southern Western Ghats, which experiences a long monsoonal season due to both westerly and easterly rains.

'Laterite' is Latin for brick and was first described by Francis Buchanan (1807) when he described it from the Malabar region while looking for iron ores. It is marked by the presence of large amounts of hydrated iron, aluminum and manganese oxides, these are vesicular rocks, having large pores, vesicles and tubular cavities, often filled with kaolin when it is underneath the soil. Laterite rocks are also characterized by the depletion of free silica, negligible or no bases and alkalies, hardening on exposure to air but in wet conditions it is softer.

There are mainly two types of laterites that are identified in the Western Ghats these are the high level laterite (only a few have been identified across the ghats) and the low level laterite (more common; Figure 1). Geologists consider most of

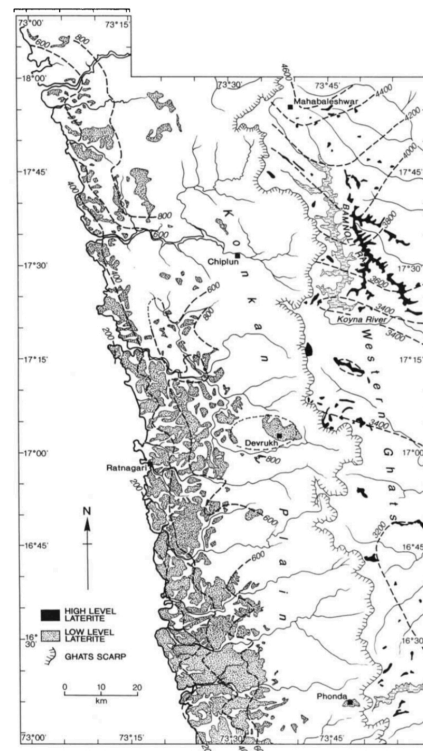


Figure 1. Laterite regions of Western Ghats.

these laterites to be the characteristic of the coastal region (western) of Peninsular India (especially Karnataka, Bourgeon 1989). The laterites can be found as laterite capped mesas (tablelands with steep sides) and are hardened flat topped hills, and these flat topped hills when they are away from the coast and at high elevations are called the high level laterites. Most of the laterite whether it be coastal or in high lands are barren, scarified, hard and black with exposed honey comb structure, with soil only present in the depressions or crevices. The vegetation may be found only after rains or the plants found on these rocks are hardy for harsh, hot and dry weather. However, after the first rains the entire lateritic regions becomes a carpet of green, followed by a 4-5 month cycle of plants flowering in some kind of a sequential rhythm (flowering phenology- multiple masters thesis from TrEE lab – see references).

For the past nine years at least 12 masters and two doctoral students have been

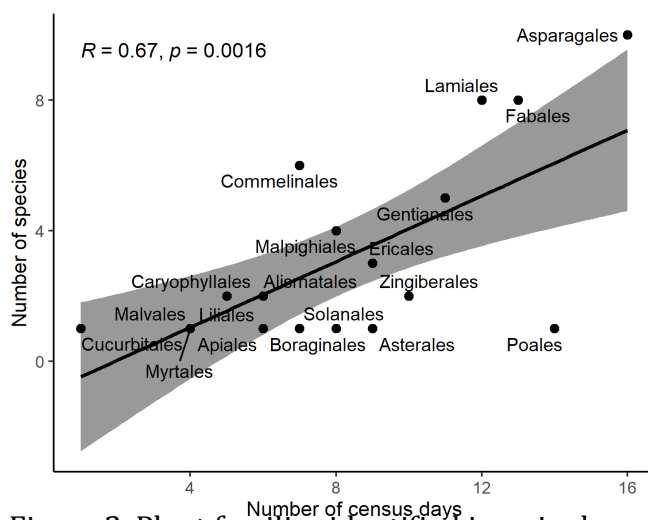


Figure 2. Plant families identified in a single Laterite plateau plotted by their flowering phenology (census days).

collecting and studying the ecology of plants across a few laterite plateaus across the Western Ghats (Kaas plateau being the center of most studies), and we now have a good understanding of flowering phenology and plant composition for at least 4 plateaus (Kaas, Raireshwar, Rajapuri and Khamda dev, all from the state of Maharashtra, India, Figure 2). We identify the high-elevation laterite plateaus as sky-islands and the low elevation laterite plateaus as coastal plateaus and

propose to carry out a detailed and focused collection of plants from these

plateaus over a period of 2-3 years starting in 2023 (2023-2026). The reason a three year period is being proposed is because many of these plateaus are inaccessible and the flowering phenology of the plateaus are so short that in one field season not more than 10-12 plateaus can be covered at the most, by a team of 4-5 collectors.

The primary goals for the proposed project are as follows:

1. Collecting and documenting local flora, specifically focused across the laterite plateaus in the Western Ghats.
2. Maintaining and upgrading the current collection at BHPL (Bhopal herbarium located at IISER Bhopal under my curatorial supervision). This collection currently holds over 2000 specimens from NE of India (major) and the Western Ghats (minor).
3. Funds will also be utilized towards mounting the specimens (30-40% need mounting, most specimens are mounted as part of training regime for masters and doctoral students).

4. Initiate repatriation of specimens from small colleges spread across the western coast of India or encourage colleges to build their own collection with duplicates deposited at BHPL. This will also involve conducting workshops and giving talks in tier 2 and tier 3 colleges and universities spread across the west coast of India.

From our preliminary studies and literature we have identified several plant families and unique plant species that are endemic and restricted to these laterite plateaus of habitats. Some of these plants are *Curcuma caulina* (Zingiberaceae), several species of *Murdannia* (Commelinaceae), *Utricularia spp.*, *Drosera spp.*, root parasites such as *Striga*, *Spubia*, *Rhamphicarpa* (Scrophulariaceae), *Eriocaulon*, *Weisneria triandra*, a few perennials such as *Lepidagathis prostrate*, *Euphorbia fusiformis*, *Curculigo orchiodes*, and others. In total at least 124 plant families with unique laterite-specific taxa have been identified and we hope to improve the collections and confirm these numbers with this study.

Methods: The plant collections are planned from June to end of November over several 1 month or 2 month long expedition bouts. All plants collected will be deposited at BHPL (IISER Bhopal), with possible duplicates also being submitted in the nearest Botanical Survey of India (BSI – Pune), or similar institutes (state universities or central universities in the region who may be interested). Once the specimens are dried, a dedicated short-term technician who will be hired on a part-time basis will mount the rest of the specimens. A website will also be built to host the plant images (field image), as well as close-up and dried specimen details. Currently, a book is already being designed which focuses on the plants of Kaas plateau and this is being sponsored by a local donor and the field book is expected to be out by the end of 2022.

Declaration and outcome: All publications will acknowledge IAPT contributions and all the information will be hosted on a public domain (IISER Bhopal is a publicly funded institute) and herbarium access will also be made available to the public. Research permits for two of the four states are available with me (Vinita Gowda and a few students within the lab).

The major outcomes are : 1. Comprehensive collection and understanding of plants from the laterite plateaus (high and low elevation laterite rocks) from the Western Ghats. 2. Training of students from local colleges and universities to not only expose them to botanical explorations but also bring about awareness and conservation of local flora. 3. Improving collection of BHPL and using collections to not only carry out floristic study but use this to eventually build a pollen atlas as well as an ecological network to study ecological interactions as well as flowering phenologies of plants on the laterite plateaus.

Reference:

Bourgeon, G. 1989. Explanatory booklet on the reconnaissance soil map of forest area: Western Karnataka and Goa, 1st ed. Institut Francais de Pondecherry.

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