Phytology

The keystone species: emphasizing the conservation of Ficus (Fig) species at Kanha Shanti Vanam, Hyderabad, Telangana, India

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Abstract

Ficus species are globally recognized as keystone elements of tropical ecosystems. At Kanha Shanti Vanam (KSV), a Biodiversity Sanctuary in Telangana, 26 Ficus species were planted and conserved to enhance biodiversity and ecological stability. Observations revealed active plant-animal interactions, particularly during fruiting seasons, where birds, bats, and squirrels contributed to pollination and seed dispersal. These interactions facilitated natural regeneration and supported faunal diversity within the campus. The study documents the Ficus species established at KSV and highlights their ecological and cultural significance, demonstrating their role in sustaining ecosystem resilience and promoting harmony between nature and humans.

Keywords: Fig, Ficus, Biodiversity, Ecological restoration, Keystone species

Introduction

The Keystone species are in the intricate web of life; certain species play a disproportionately large role in maintaining the structure and balance of ecosystems. These Keystone species-organisms whose presence and ecological functions are critical to the survival of numerous other species with in their habitat. The removal of a keystone species can trigger cascading effects throughout the ecosystem, often leading to significant loss of biodiversity.

Among the most well-known examples of keystone species in tropical ecosystem is the genus Ficus, commonly known as figs. Widely distributed across tropical and subtropical regions, Ficus species play a critical role by providing a reliable food source for a broad spectrum of fauna. Their distinctive fruiting pattern-often bearing fruit multiple times a year or even year-round; ensures a steady supply of nourishment during periods when other food sources are limited. This consistent availability supports a diversity of wildlife, including birds, bats, primates, and insects, many of which depend heavily on figs during resources-scarce seasons.

Moreover, Ficus species are ecologically significant not only for their fruit but also for complex mutualistic relationship with fig wasps, which are their sole pollinators. This interaction is a classic example of coevolution and highlights the intricate dependencies that characterize natural ecosystems. In the bio-diversity-rich regions such as the Western and Eastern Ghats of India, Native Ficus species play an essential role in sustaining wildlife populations and supporting ecological resilience. Their inclusion in afforestation and restoration projects is therefore of great importance for maintaining ecological balance and enhancing biodiversity.

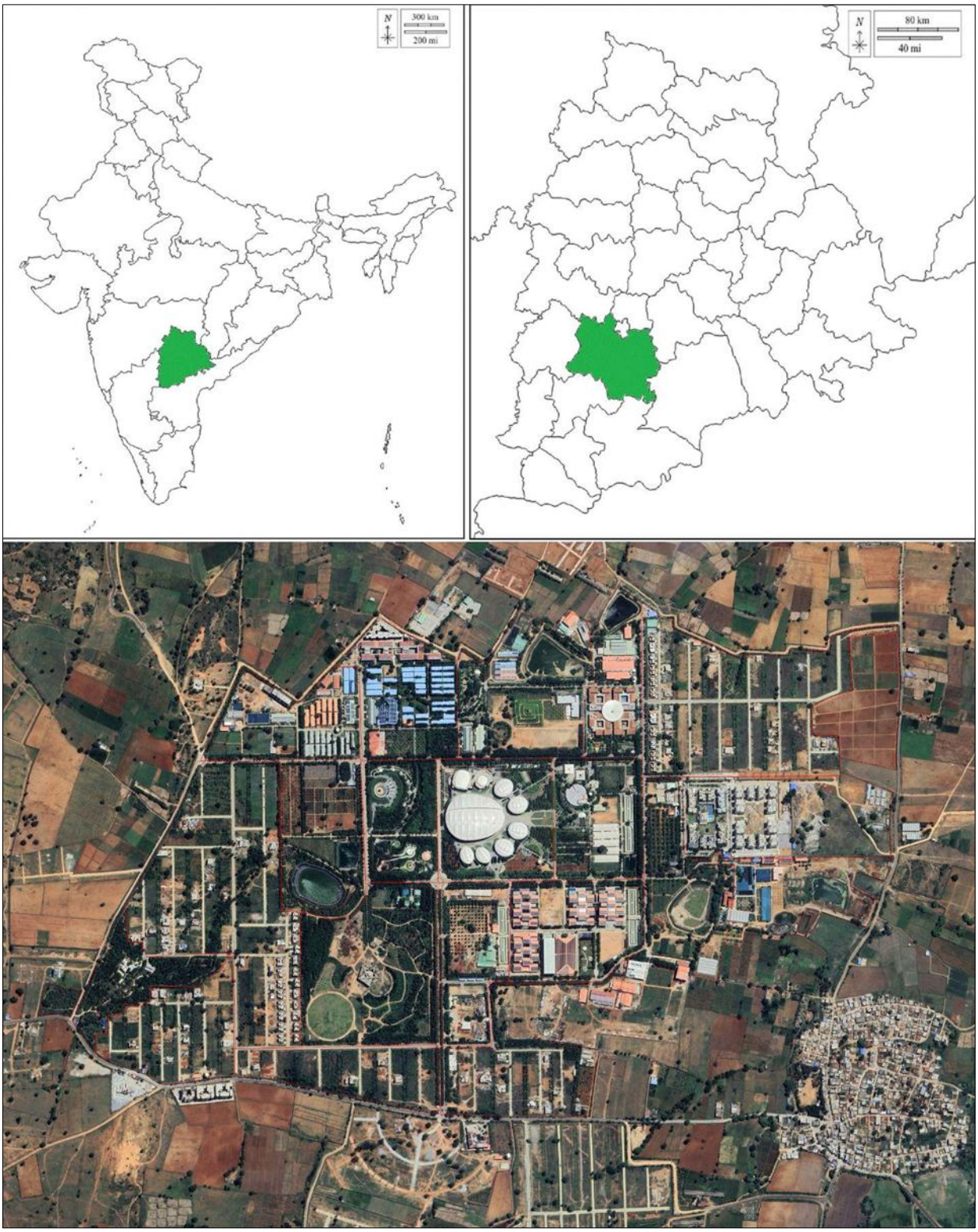
Figs (Ficus species) belong to the family Moraceae and grow in many different ways. Some start life on other trees as hemi-epiphytes, while others grow as big trees, shrubs or climbing plants. Their fruits are also unique-they can grow directly on the trunk, near the ground or among the leaves.

There are about 755 species of Ficus spp. worldwide as reported by van Noort and Rasplus (2004-2012); Wilson & Wilson (2013) [9]. Out of these, 115 taxa (consisting of 89 species and 26 intraspecific taxa) have been recorded to occur in India (Chaudhary et al., 2012) [4]. The genus Ficus, playing critical roles in forest ecology as pioneer species, continuous fruit providers, and hosts to a wide array of fauna. Known for their mutualistic relationship with specific pollinator wasps, figs are central to many food webs.

Kanha Shanti Vanam (KSV), located in the Deccan Plateau region of Telangana, has evolved as a model ecological restoration site with over 1000 plant species, including a rich diversity of Ficus. According to Bagla and Menon (2000) [1], figs are massive trees that grow to a very great height and girth with spreading crowns and evergreen barges of tropical lowland rainforest. This article documents 26 fig species found at KSV, emphasizing their value for conservation, spiritual ecology, and restoration (Table-1).

Study area

Kanha Shanti Vanam is the Global Headquarters of the Sri Ram Chandra Mission (Heartfulness Institute), situated approximately 8 km from NH-44 Timmapur, in Nandhigama Mandal, Ranga Reddy District, Hyderabad, Telangana, India. The Heartfulness Institute (HFI) spans over 1400 acres, lies between 15° 48′ 32″ and 19° 55′ 46″ N latitude and 77° 09′ 02″ and 81° 18′ 51″ E longitude (Map-1), altitude around 450 m MSL, and features a diverse range of plantations, showcasing a successful model of semi-arid landscaping. The site includes rainforests, mounts, Yatra gardens, Mandala Garden and different types of Plantations.



Map 1: Showing location of Kanha Shanti Vanam, Ranga Reddy District, Telangana

Table 1: Catalogue of Ficus species at Kanha Shanti Vanam

S. No	Scientific Name/Common Name	Conservation Status (IUCN)	Phenology pattern
1	*Ficus arnottiana* (Indian Rock Fig)	Rare	Oct-Dec
2	*Ficus amplissima* (Indian Bat Fig)	LC	Nov-Jan
3	*Ficus anamalayana* (Anamalai Fig)	NE	June-Dec
4	*Ficus auriculata* (Elephant ear)	NE	Jan -March
5	*Ficus beddomei* (South-Indian Fig)	EN	March-May
6	*Ficus benghalensis* (Banyan Tree)	LC	Feb and Sep
7	*Ficus benjamina* (Weeping Fig)	LC	Feb- May and Aug-Oct
8	*Ficus carica* (Anjeer)	LC	April - June

9	*Ficus drupacea* (Mysore fig)	LC	June & Dec
10	*Ficus elastica* (Rubber Fig)	NE	Nov -Feb
11	*Ficus heterophylla* (Creeping Fig)	NE	Mar-Oct
12	*Ficus hispida* (Hairy Fig)	LC	Throughout Year
13	*Ficus krishnae* (Krishna Butter Cup Fig)	VU	Mar-May & Oct-Dec
14	*Ficus lacor* (Java Fig)	LC	Mar-May
15	*Ficus lyrata* ((Fiddle-leaf fig)	NE	Feb-April
16	*Ficus maclellandii* (Banana leaf Fig)	LC	Mar-May & Oct-Dec
17	*Ficus natalensis* (Natal Fig)	LC	Feb-May
18	*Ficus nervosa* (Veined leaf fig)	DD	Feb-May
19	*Ficus platypoda* (Rock Fig)		April to June
20	*Ficus pumila* (Straggling Fig)	LC	Throughout Year
21	*Ficus racemosa* (Cluster Fig)	LC	April
22	*Ficus religiosa* (Peepal Tree)	LC	Mar- May and Aug-Dec
23	*Ficus retusa* (Indian Laural Fig)	LC	April-May
24	*Ficus rumphii* (Kabai Peepul)	NE	July-Sep
25	*Ficus tinctoria* (Humped Fig)	NE	Jan-Feb
26	*Ficus virens* (White Fig)	LC	Dec-Feb

Results

The concise overview of the diversity, conservation status and phenological patterns of Ficus species, emphasizing their vital role in both natural and managed ecosystems. Even most Ficus species are classified as Least Concern (LC), indicating broad distribution and adaptability. However, the presence of Vulnerable (VU), Near Threatened, Data Deficient, Rare, and Not Evaluated categories particularly among endemic species such as *Ficus krishnae, F. beddomei*, and *F. anamalayana* highlights the need for targeted conservation efforts, especially in biodiversity-rich regions like the Western Ghats.

Ecologically, the table reinforces Ficus species as Keystone resources, providing staggered fruiting that supports a wide range of wildlife throughout the year. Species like *F. benghalensis, F. religiosa*, and *F. drupacea* contribute significantly to habitat formation, soil stability, forest regeneration, and pollinator survival through the fig-wasp mutualism. The phenological data shows that the asynchronous flowering and fruiting ensure continuous food availability, enhancing ecological stability in fragmented and urban landscapes. The distinction between native and cultivated figs further highlights that native species play a much greater role in supporting biodiversity.

Significance of Ficus in biodiversity and restoration

Ficus species are ecologically foundational, and their conservation deserves priority in restoration initiatives, sanctuary management, and broader biodiversity planning. At Kanha, Ficus species perform multiple interconnected roles: ecologically, their continuous and staggered fruiting ensures a reliable food source for birds, bats, bees, and other mammals; culturally and spiritually, species such as *Ficus benghalensis, F. religiosa, and F. krishnae* hold deep significance in Indian traditions and folklore. From a restoration perspective, many Ficus species act as pioneer plants, rapidly colonizing degraded landscapes and facilitating ecosystem recovery. Additionally, the rich diversity of figs at Kanha offers valuable opportunities for education, ecological monitoring, pollination biology, and conservation research. Strengthening phenological documentation and IUCN assessments, particularly for Not Evaluated species, will further enhance informed and effective conservation decision-making.

Ecological functions

Provide year-round fruits for over 60 frugivorous species (bats, birds and small mammals at Kanha). Host-specific pollinator wasps (Agaonidae) maintain tight evolutionary relationships. Enhance soil fertility and moisture retention in degraded lands.

Phenological insights (Deccan Plateau)

KSV, located on the Deccan Plateau, Ficus species exhibit an asynchronous fruiting pattern, providing a continuous food source for frugivorous fauna throughout the year. Field observations indicate that peak fruiting occurs during the pre-monsoon (February–May) and post-monsoon (August–October) periods. This staggered phenological behavior plays a crucial ecological role by sustaining local and migratory bird populations during resource-scarce seasons, thereby maintaining trophic continuity and promoting ecosystem stability within the dry tropical landscape.

Observation of avian and mammalian foraging diversity on banyan trees

Banyan tree, a keystone species at Kanha Shanti Vanam, supports local wildlife with its year-round fruiting and large canopy. Six banyan trees are present at KSV. One the oldest stands near the Forests by Heartfulness office; the remaining five are scattered within a 1 km radius. Several studies have highlighted the significance of figs in supporting wildlife populations (Barua & Tamuly, 2011) [2]; the spreading branches of figs with dense foliage also provide shelter to many canopy dwelling vertebrates or on land surface and help to retain moisture under the canopy (Vanitharani *et al*., 2009) [8].

Banyan tree fruiting was observed by the end of February, 2025 and lasted until the end of May 2025. During this period an observation was made to record foraging by birds, small mammals and few insects. A wide range of bird species attracted by the nutritional fruit and microhabitats provided by the aerial roots and foliage. The pre dominant to less sighted

birds per day includes the Common Myna (*Acridotheres tristis*) 12 sightings, Red-vented Bulbul (*Pycnonotus cafer*) 10 sightings, Asian Koel (*Eudynamys scolopaceus*) 8 sightings, Golden Oriole (*Oriolus kundoo*) 3 sightings, Greater Coucal (*Centropus sinensis*) 3 sightings, Rufous Treepie (*Dendrocitta vagabunda*) 3 sightings. Rest all the birds like White browed bulbul (*Pycnonotus luteolus*), Jungle crow (*Corvus macrorhynchos*), Coppersmith (*Psilopogon haemacephalus*), Grey Babbler (*Turdoides malcolmi*) and Grey Hornbill (*Ocyceros birostris*) are observed twice to one time.

The lesser sightings attribute to resource partitioning among the birds, in addition to birds, few mammalian species like Three-striped Palm Squirrel (*Funambulus palmarum*) and the Giant fruit Bat (*Pteropus giganteus*) are frequently seen feeding on the ripe figs. This also evidenced from the excreta of both as well as birds dropping. This multi species interaction underscores the critical ecological role of Ficus benghalensis in sustaining faunal diversity and maintaining tropic networks with restored ecosystems like Kanha.

During the fruiting season of *Ficus benghalensis*, active plant–animal interactions are evident within the ecosystem. The ground beneath the trees is often scattered with excreta of fruit bats, squirrels, and bird droppings, indicating their frequent feeding activity on the figs. Trail studies reveal that seeds obtained from these excreta and droppings show a higher germination percentage compared to directly fallen fruits. Additionally, natural germination of *Ficus benghalensis, F. religiosa,* and *F. amplissima* is frequently observed in abandoned or undisturbed areas, confirming the crucial role of frugivorous animals in seed dispersal and regeneration of fig species at KSV.

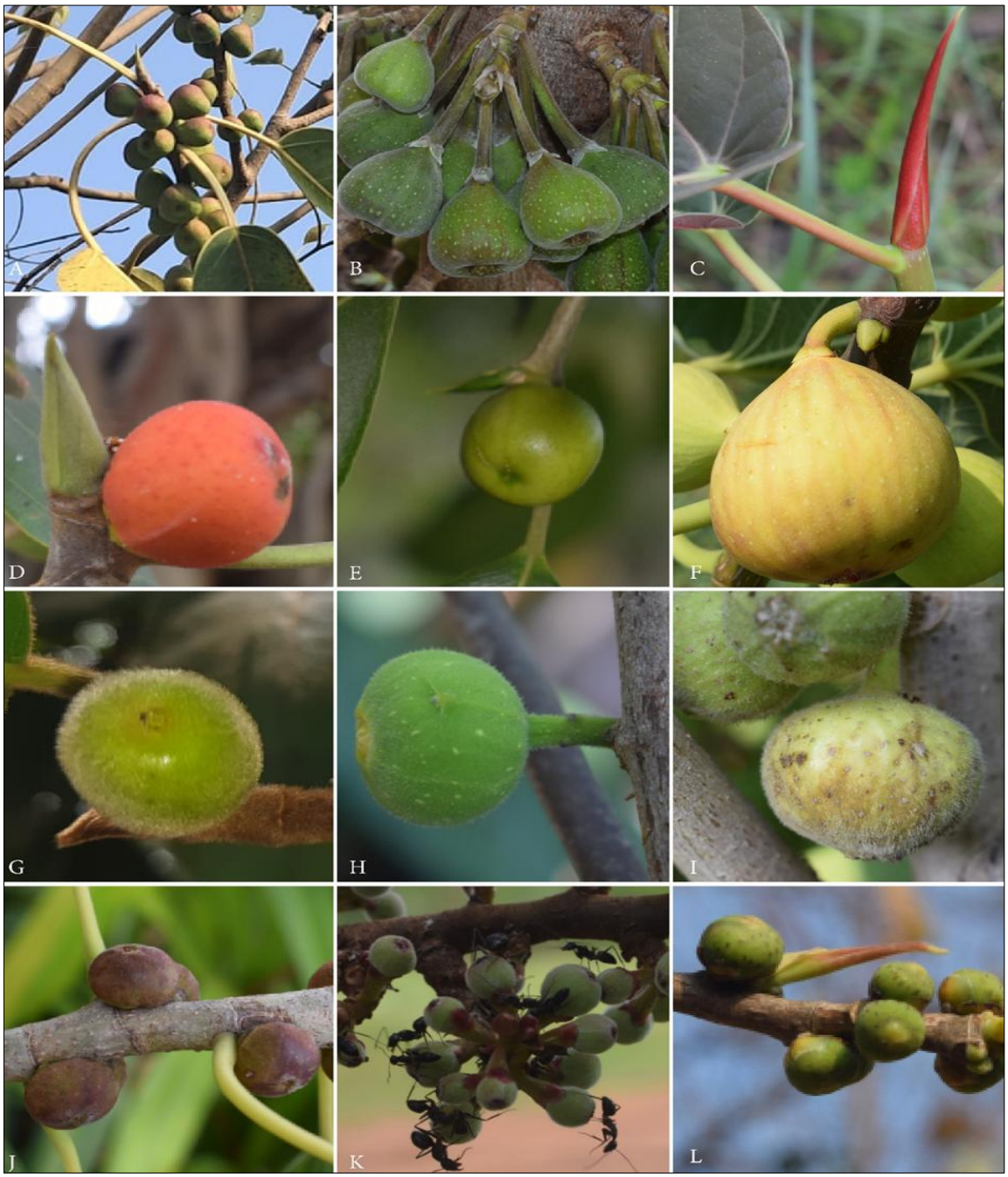


Plate-1: A *Ficus amplissima,* B. *Ficus auriculata,* C. *Ficus beddomei,* D. *Ficus benghalensis,* E. *Ficus benjamina,* F. *Ficus carica* G. *Ficus drupacea* H. *Ficus heterophylla* I. *Ficus hispida,* J. *Ficus krishnae,* K. *Ficus racemosa* and L. *Ficus religiosa*

Discussion

Similar patterns of plant-animal interactions have been reported in various parts of India, highlighting the ecological importance of frugivory in Ficus species. Studies conducted in the Western Ghats (Ganesh & Devy, 2000; Shanahan et al., 2001) [6] and Eastern Ghats (Chandra Mohan Reddy et. al., 2020; Murugan et al., 2013) [3, 5] regions documented that fruit bats (*Pteropus giganteus*), myna birds (*Acridotheres tristis*), barbets (*Megalaima spp*.), and palm squirrels (*Funambulus palmarum*) serve as primary dispersers of Ficus seeds. These animals consume the figs and excrete viable seeds at varying distances from the parent tree, enhancing spatial distribution and colonization in new habitats.

Observations at Kanha Shanti Vanam align with these findings, reinforcing the role of Ficus species as keystone resources supporting diverse frugivorous fauna and sustaining natural regeneration cycles in semi-arid Deccan ecosystems.

Conclusion

The curated collection of fig species at Kanha Shanti Vanam highlights the institute's commitment to integrating traditional ecological knowledge with modern conservation science. The integration of fig diversity at Kanha Shanti Vanam demonstrates a unique approach to spiritual ecology and scientific conservation. As keystone species, figs enhance ecological resilience, support faunal diversity, and serve as symbols of sacredness and sustainability. Documenting and conserving rare species like *Ficus anamalayana* and *Ficus beddomei* also support national biodiversity goals.

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