ORIGINAL RESEARCH ARTICLE

CANOPY MANAGEMENT OF THE GREAT BANYAN TREE IN ACHARYA JAGADISH CHANDRA BOSE INDIAN BOTANIC GARDEN, HOWRAH

ABSTRACT

The present communication deals with the prof root training of Great Banyan Tree (GBT)of Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIBG), Botanical Survey of India, Howrah.The GBT spans an area of 4.86 acres and features over 4400 aerial prop roots, covering a canopy circumference of 543 meters. Notably, the tree has survived three major cyclones, including the latest one, Amphan, on May 20, 2020, which significantly impacted a major portion of the tree. To address the damage caused by all cyclones and facilitate the expansion of the GBT, the AJCBIBG authority is continuously working to train the prop roots for improvement of canopy management, using indigenous techniques developed by the staff over a decade for this age-old tree.

Keywords: Banayan, Prop root, training, technique

1. INTRODUCTION

The Great Banyan Tree (GBT) is a living legend, an 'emblem' of Botanical Survey of India, is situated at Division No. 23 of Acharya Jagadish Chandra Bose Indian Botanic Garden (AJCBIBG), Howrah [1, 2, 3] and it is botanically known as *Ficus benghalensis* L. (Moraceae) native to Indian subcontinent and also introduced into many subtropical areas due to it multiple uses [4]. Every year it attracts lakhs of visitors, including national and international delegates in to the AJCBIBG. The tree is also known as "Walking Tree", "Miniature Forest", and "Immortal Tree" and the garden is also considered as one of the best landscaped gardens of the world [9].

The area occupied by the tree is about 19667 sq. m.(4.86 acres) at present. The present crown of the tree has a circumference of 543 m and highest branch rises to 26 m. Presently it has 4412 aerial roots reaching down to the ground as prop roots (Plate 1). In 1925 the main trunk was removed due to a fungal attack; at that time, it attained a girth of 16.5 mat 1.7 m height from the ground [3]. It is also worth mentioning that the temperature under the canopy area always varies (low) 2 to 5 degrees Celsius from the outer area.

There is no clear history about the origin of this plant in the garden but scrutiny of literature [1, 5, 6, 7] reveals that the tree existed on a date palm tree (*Phoenix dactylifera* L.) in 1782 before the foundation of the garden in 1787 by Colonel Robert Kyd. By this way it is

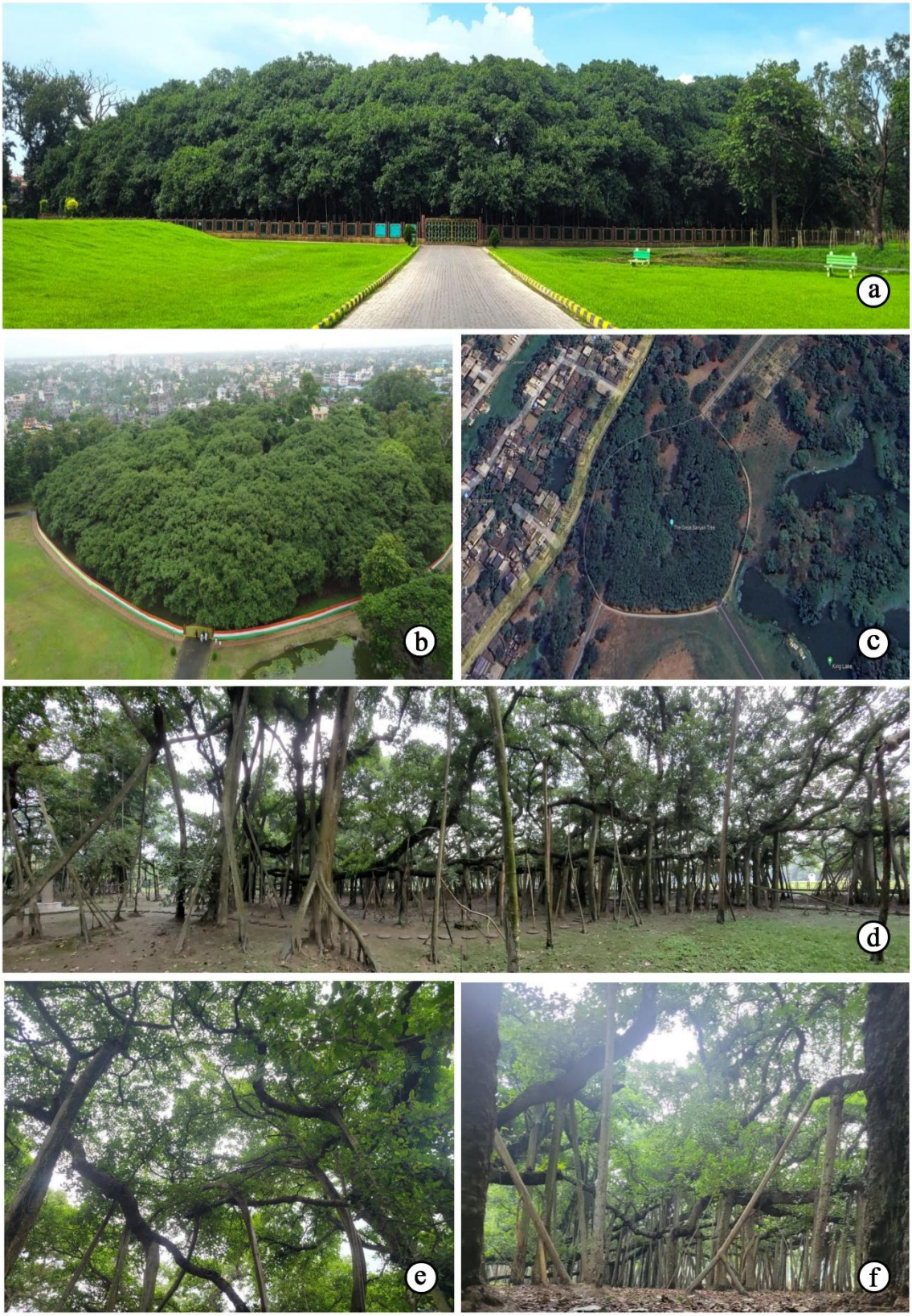

Plate 1: a-b. A view of Great banyan tree; c. Satellite image of GBT; d & f. Inside view showing prop roots; e. Canopy view from inside.

assumed that the tree is more than 250 years old. The tree also survived and its clonal colonies remained healthy after the three cyclones of 1864, 1867 and 2020. The GBT is standing tall and as senior most citizen of the garden thereby enhancing the beauty and serenity of garden. With this significance of GBT and to increase massive dimension, canopy circumference and increase number of prop roots, continuous training is warranted to prop roots to give mechanical strength of the tree in desirable area. Hence, in the present communication a methodology has been standardized for prop root training of GBT.

2. Importance of Prop Roots Training

Prop roots synonymously known as columnar roots in *Ficus* spp., are a type of adventitious roots that grow above ground from the stem of a plant. They reach down and anchor the plant firmly into the soil. These roots play a vital role in stabilizing and providing mechanical support to the tall or heavy aerial branches and the canopy of the plants [8]. These prop roots help to keep the tree balanced and prevent it from toppling over, especially in strong winds or heavy rain. So, prop roots are trained as it will help to divert the different prop roots at desired positions strengthening of mechanical support to the plant. If it is not properly trained the prop roots will come at haphazard positions and also get damages naturally or even physically by the outside people.Prop roots can also help in gaining better canopy coverage area through nutrient absorption. Since they are in direct contact with the soil, they can take up water and minerals for the plant, in some cases, they even form additional root systems, making the plant even more efficient in gathering nutrients.

As it has fungus attack history, new prop roots will get physical damage and tip get easily dried in summer, and they become very prone to environmental hazards. So, it is very essential to protect the prop roots in a right way through caging the roots with bamboos.So, in a nutshell, prop roots are like nature's way of giving plants a helping hand to stand tall and strong while also ensuring they have a constant supply of essentials but training those prop roots is like giving the right direction to the natural growth of the tree.

3. MATERIALS AND METHODS

*Materials required for prop root training:*Bamboo shoots [Shelf-life durability, hardening and hollow core structure bamboo (*Dendrocalamus* spp.) of 3-5 ft. of length shoots were used to give mechanical support]; leaf moulds (Natural leaf moulds collected as organic

litter from the GBT were used as the manure along with soil and sand inside the hollow bamboo structure); coconut rope; pruning knife; coir; soil; water; funnel.

Techniques: The step wise standardized methodology is discussed below for the establishment of prop roots (Plates 2 & 3).

- First bamboo shoots were cut vertically into desired length (3-5 ft.). Then it was also cut longitudinally into 2 to 4 halves and the internodes were removed to make the outer and inner surface smooth for better handling. A groove was also cut at the edge on larger half of the shoot.
- Now coconut rope was tied at two to three places on the bamboo shoots to hold the halves and to make a tube-like structure.
- A manure mixture containing leave molds, soil and sand in specified ratio was prepared. The proportion of each material was indigenously decided by the experienced staff of AJCBIBG.
- Roots were checked from the hanging branches of the tree whether they are ready for insertion or not. After checking, the healthy roots were selected depending upon its nature, growth, size, etc.
- Secondary and tertiary branching of the prop roots were removed by cutting through a knife to insert into the hollow bamboo tube. It is performed for easy penetration, direction as well as considering the growth of one over multiple. [It is noted that, if multiple branches of the prop roots were selected then the tip of the root become prone to infection and gets easily dried, so to prevent this, only one healthy primary branched prop root is selected].
- One side of the bamboo tube was blocked with banyan leaves, so that it will hold the manure mixture and provide better drainage. It is done keeping in view that if water is logged then growth of the root can be hampered and manure mixture become soggy so it will deprive the root from getting the necessary oxygen and dilute the nutrients in the manure mixture.
- Now half of the bamboo tube was filled with the manure mixture. It is finally ready for insertion of the desired prop root.
- A selected healthy prop root was inserted within the hollow bamboo tube. Then on top of it, manure mixture is poured and it was shaken properly to make it tight inside without any gap.

Plate 2: a. Selected bamboos shoots; b. Cutting of selected bamboo shoots into desired length; c. Two halves of bamboo joined together to make a hollow tube-like structure; d. Preparation of manure mixture; e. Removal of secondary and tertiary branches of prop root with knife; f. One side of tube blocked with banyan leaves.

Plate 3:a. Filling up of bamboo tube with manure mixture; b. Insertion of selected prop root inside bamboo tube; c. Dripping of water through the bamboo tube; d. Tying-up of prop root with the grooved part of the tube; e. Prop roots emerges from the lower side of the hanging tube; f. A view of a branch showing trained prop roots.

- Water was poured inside it until it dripped down from the other side of the tube. It is done to check whether drainage is working properly or not. If it is not dripping then the tube was shaken until adjusted. Prop root is now set for growth inside the tube.
- The groove that was cut on the upper side of the bamboo shoot was now tied up with the inserted prop root so that it could not move. After that the whole bamboo tube was tied at two to three places for better holding and also that the whole structure remains intact and withstand several environmental hazards. Now, the whole bamboo along with its inserted prop root is attached with the main branch through a coconut rope in a hanging condition.
- Once it was observed that the tip comes from other side of the tube, if it doesn't touch the ground the whole process was repeated depending upon the distance of the branch from the top to the ground the repetition can be twice, thrice and so on.
- Before touching the soil, the bamboo pole was slanted for providing better mechanical strength and to increase the more canopy area.

4. RESULTS AND DISCUSSIONS

The canopy circumference is directly depending on the proper establishment of prop roots of GBT. Hence, the continuous attention has paid to GBT to increase number of prop roots. While reviewing literature, it has been observed that canopy circumference of this tree increases throughout its age. Chakraverty et al. [7]reported that the canopy circumference was 240 m in 1850, which increased 377 m in 1900, in 1986 it reached 420 m. The latest recorded data for canopy circumference of the tree is 543 m in October, 2023. The detailed changes in canopy circumference are presented below (Plate. 4).

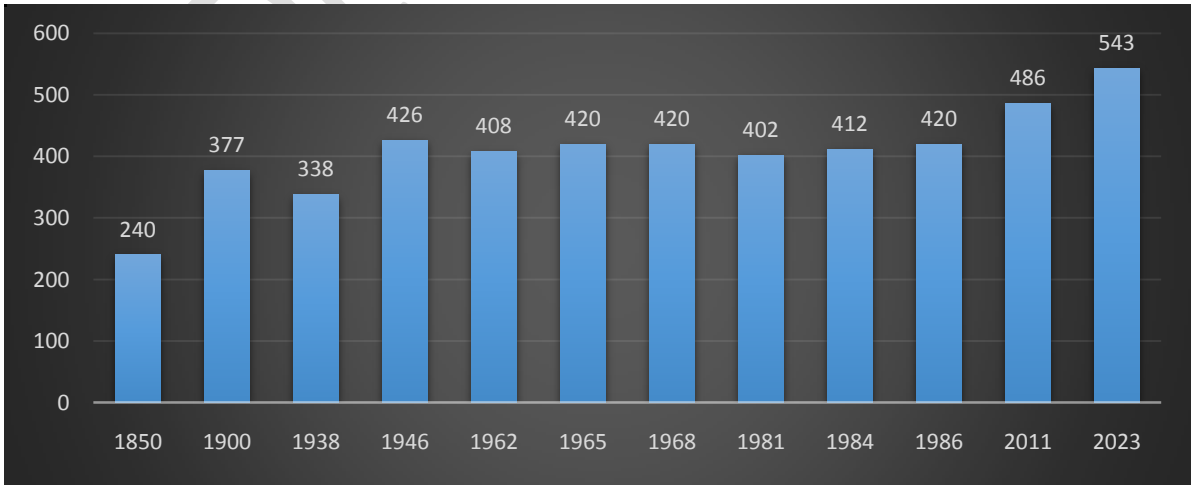

Plate 4: Changes in Canopy Circumference (m) during 1850-2023

The changes in number of prop root shows variation from 1850 to 2023. In 1850, it was only 89 prop roots, which increased 464 prop roots in 1900 and 1825 prop roots in 1986 [7] and as per recent data in October, 2023, the prop root counts 4412. The detailed changes in number of prop roots are presented below (Plate 5).

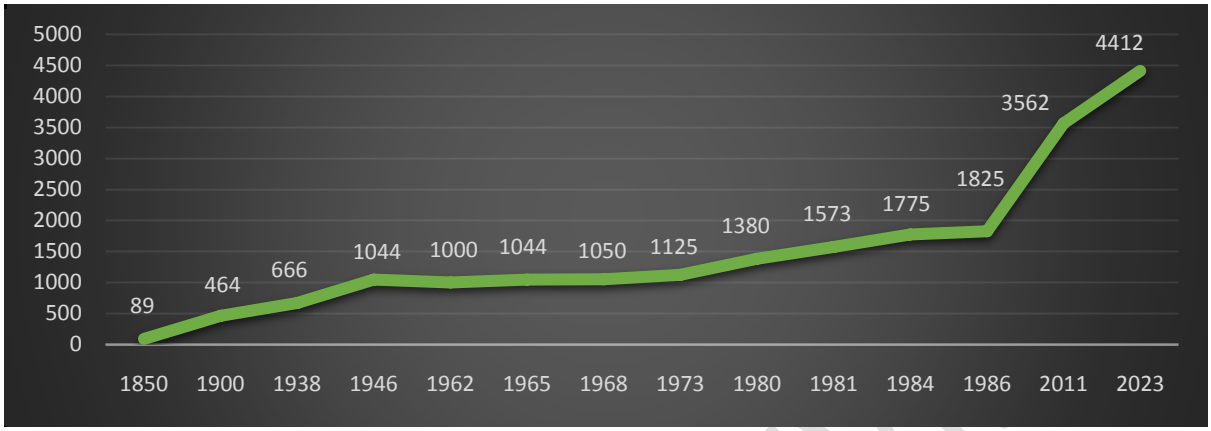

Plate 5: Changes in number of Prop roots from 1850 to 2023

Throughout its life the tree shows great variation in its highest branch due to ageing and different natural calamities. In 1850, it was 20.5 m, which increased up to 30.5 m in 1968 (Highest till date) and 24.5 m in 1986 [7]. Recent survey shows the highest branch of the tree from ground is 26 m in October, 2023. The changes in height of the tallest branch are presented below (Plate 6).

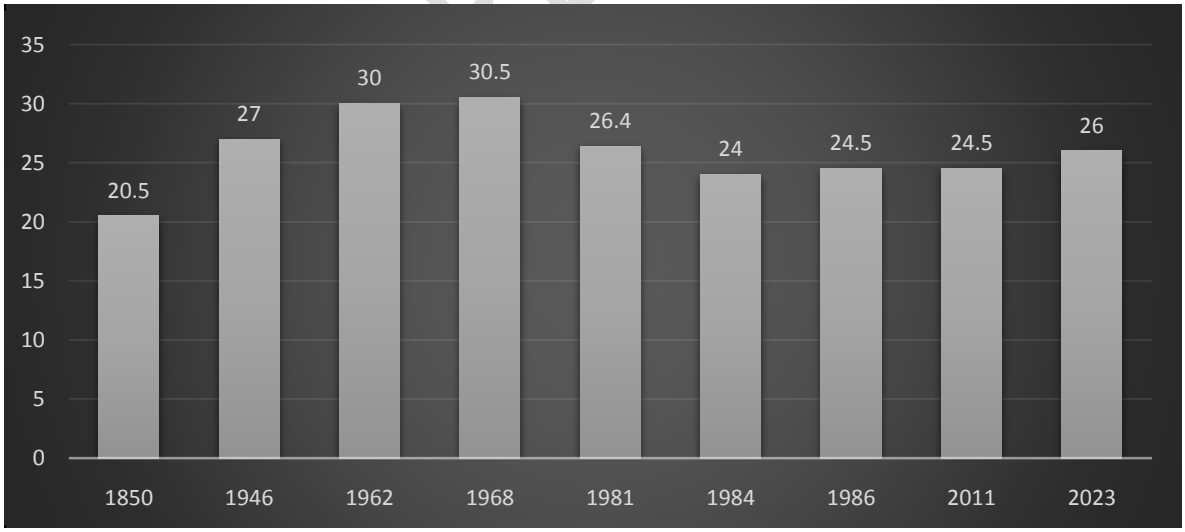

Plate6: Changes in height(m) of the tallest branch during 1850-2023

5. CONCLUSION

The Great Banyan Tree (GBT) at AJCBIBG stands as a botanical marvel, recognized globally for its monumental size and significance. With its sprawling canopy covering 19667 sq. m. and boasting 4412 aerial prop roots, the GBT symbolizes resilience and longevity. Despite facing various natural challenges and even losing its main trunk to a fungal attack in 1925, the tree has continued to thrive, standing tall as a testament to nature's enduring strength.The continuous efforts of the garden staff to manually train the prop roots have played a crucial role in maintaining and enhancing the tree's structural integrity. By employing indigenous techniques, such as the innovative method standardized for prop root training detailed in this communication, the garden authorities have successfully improved canopy management and provided essential mechanical support for the GBT.Moreover, the meticulous documentation of the tree's growth over the years reflects its remarkable resilience and adaptability.

From its humble beginnings as a sapling on a Date Palm tree in the late 18th century to its current stature as a towering presence in the garden, the GBT continues to captivate visitors from around the world.Overall, the success of the prop root training methodology and the continued growth and expansion of the GBT underscore its significance as a botanical treasure and a living testament to the power of nature's resilience and human ingenuity in conservation efforts.

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