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Genetic Diversity and Conservation Strategies for Bamboo Populations

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Introduction:

In the context of this article, genetic diversity refers to the heritable variation within and between populations of organisms, and specifically, among species of bamboo. There is an enormous supply of bamboo resources in India. A member of the Bambusoideae subfamily of the grass family Poaceae, bamboo has a significant economic impact.Bamboo is commonly known as "poor man's timber", keeping in mind the variety of its end use from cradle to coffin Bamboo is a very genetically diverse plant that is found all over the world. This genetic variation serves as the foundation for both selection and plant improvement. Thus, the identification, characterization and documentation of genetic diversity of bamboo are essential for this purpose. During recent years, multiple endeavors have been undertaken for characterization of bamboo species with the aid of molecular markers for sustainable utilization of genetic diversity, its conservation and future studies. This germplasm may act as a soul resource for further development, research and sustainable management of bamboo resource in this particular area.

Bamboo in India

India is considered as one of the largest reserves of bamboos in the World (Bahadur & Jain 1981; Tewari 1992; Seethalakshmi & Kumar 1998). On a conservative estimate the forest area under bamboo in India (including plantations) is 10.03 million hectares and this is about 12.8 per cent of the total forest area in the country (Bahadur & Jain 1981; Biswas 1994). Bamboos are naturally distributed in almost all the states except Jammu and Kashmir and form an important constituent of deciduous and evergreen forests and spread from tropical to temperate regions, extending from sea level in the coasts to altitudes upto 3700m in the Himalayas. Although bamboos prefer regions of high rainfall ranging from 1270mm to about 6350mm yet some species also occur in regions where rainfall is about 700-1000mm. Different species of bamboos have different optimum temperature, humidity, soil types, altitudes and physiography for their best performance. In well drained parts of

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tropical and subtropical habitats they, however, form rich belts of vegetation (Varmah & Bahadur 1980; Tewari 1992; Bedell 1997.

Genetic Diversity in Bamboo

Due to their unpredictable flowering, bamboos' growth habits and floral appearance are the basis of traditional taxonomic research, which can make identification challenging. It is crucial for the adaptability and resilience of species to environmental changes and stressors, such as diseases, climate change, and habitat destruction.

Taxonomy Classification

Kindom: Plantae, **Family:** Poaceae, **Order:** Poales, **Tribe:** Bambuseae, **Subtribe:** Bambusinae, **Genus:** Bambusa, **Species:** Bambusabalcooa, **Chromosome number:** 2n = 70, aneuploid (Sobita Devi & Sharma 1993).

Source of Genetic Diversity

Natural Variation: Genetic recombination during sexual reproduction, mutations, and gene flow between populations are the sources of natural variation.

Human Activities: Genetic diversity can be increased or decreased by the introduction of new kinds and farming techniques.

Assessement Methods-

Morphological Markers

Clums: Bambusa balcooa culms have a diameter of 8–16 cm and a height of 15–25 m. Green tender culms eventually turn a drab grayish green as they mature. Wall thickness at the basal part is approximately 3.5 cm. Internodes vary in length according to where they are located. In contrast to top internodes, which are 40–45 cm long, lower internodes are shorter (10–12 cm). Cavities are bigger and hairy in the higher internodes than in the lower internodes (Barooah et al., 2003).

Culm-sheath: Two varieties of culm-sheaths are found in Bambusa balcooa. The culm sheaths of lower internodes are wider and shorter than those of upper internodes, and they have densely packed dark hairs on their outside. (Barooah and others, 2003).

Leaf: Leaf characteristics include oblong-lanceolate leaves, a conspicuous main vein, scabrous-ciliate margins, striate leaf sheaths, a membrane ligule, and a widely triangular shape. (Barooah and others, 2003).

Flowers: The flower has a big compound panicle as the inflorescence, flattened, ovoid, lanceolate, and empty glumes that are ovate-acute, many nerved, and palea as long as the blooming glumes. The anthers are glabrous, the stamens are barely exerted, and the ovary is broadly ovoid, acuminate, and hairy. (Barooah and others, 2003)

Type of genetic Molecular Marker used in bamboo :

- RAPD (Random Amplified Polymorphic DNA)

- AFLP (Amplified Fragment Length Polymorphism)
- SSR (Simple Sequence Repeats)
- SNP (Single Nucleotide Polymorphisms)
- Sample Collection and DNA Extraction, PCR Amplication, Marker Analysis.
- Gel Electrophoresis: Separate PCR products using gel electrophoresis to visualize the DNA fragments.

Analysis of Data:

Determine the genetic diversity indexes, such as allelic richness, anticipated heterozygosity, and observed heterozygosity and examine population structure and gene flow,.Utilize phylogenetic analysis to comprehend the relationships between organisms.

Recognizing Conservation Units:

Utilizing patterns of genetic diversity and population structure, define conservation units and determine which populations need extra care because of particular genetic features.

Strategies for Conservation:-

Conservation in situ:

Provide protection for Bambusa balcoa's natural habitats by creating protected zones. Encourage sustainable methods of harvesting to reduce the negative effects on natural populations.

Conservation ex situ:

To preserve genetic material, create botanical gardens and gene banks and Create procedures

forseed storage and tissue culture for long-term preservation.

Reconstruction and Reintroduction:

Restoration and reintroduction of bamboo, specifically Bambusa balcoa, in India involve using genetically diverse plant material to revitalize degraded ecosystems. This process includes habitat restoration through planting bamboo in eroded areas, promoting soil stabilization, and enhancing biodiversity. Local communities play a crucial role in these efforts, as their involvement ensures sustainable harvesting and management practices. Additionally, establishing protected areas and integrating bamboo into agroforestry systems contribute to both ecological and economic benefits. Government policies supporting bamboo conservation and sustainable use are essential for the long-term success of these initiatives, ensuring the resilience and sustainability of bamboo populations in India.

Community Engagement and Policy:

Involve local communities in conservation efforts through education and incentive and advocate for policies that protect bamboo habitats and promote sustainable use.

Conculsion

This conservation program serves as a foundation, a method for the preservation and identification of plants, especially bamboos.It was intended to replicate and generate the fastestgrowing bamboos possible for commercial use.Additionally, this is being exploited as a location to draw visitors improvement.The primary goal of the work's presentation was to inform the public about this extensive collection and conservation strategy.This will guarantee the availability of this valuable natural resource in the near future and aid in enhancing for increased productivity by helping to comprehend the ecosystem.