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Musa aurantiaca and its genetic diversity in Nagaland

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ABSTRACT

This study focuses on *Musa aurantiaca* Baker (Musaceae), a *Musa* species found in Northeast India, Tibet, and Northern Myanmar. The research was conducted at the School of Agricultural Sciences (SAS), Nagaland University, to examine the morphology of the species and explore its genetic diversity in Nagaland. Through a comprehensive analysis, this study sheds light on the diverse attributes of *Musa aurantiaca*, providing valuable insights into its morphology and genetic composition in the Nagaland region. The findings contribute to the knowledge and conservation efforts of this species, highlighting its importance for biodiversity conservation and potential utilization in various applications. These findings have implications for further research, conservation strategies, and the sustainable utilization of this valuable plant species.

Key words: *Musa aurantiaca, Genetic diversity, Morphological characteristics, Biodiversity conservation, Utilization, Nagaland.*

Introduction

India is home to a diverse array of flora and fauna, and one notable botanical treasure found abundantly across the country is the *Musa* species, commonly known as bananas. In the northeastern region of India, which encompasses states such as Nagaland, Assam, Manipur, Meghalaya, Mizoram, Arunachal Pradesh, Tripura, and Sikkim, the *Musa* species thrives in the lush tropical and subtropical climatic conditions, making it a significant contributor to the region's rich biodiversity.

The *Musa* species, belonging to the Musaceae family, is characterized by its large herbaceous plants with fleshy stems and broad, elongated leaves that form a canopy over the landscape. Bananas, which are part of the *Musa* genus, are among the most widely cultivated and consumed fruits globally. In India, they hold great cultural, economic, and nutritional importance.

In Nagaland, located in the northeastern part of India, the cultivation of *Musa* species is prevalent. The region's unique agro-climatic conditions, which include ample rainfall, fertile soil, and moderate temperatures, provide an ideal environment for the successful growth of various wild species and some common cultivars. Local farmers in Nagaland have been cultivating and conserving *Musa* species for generations, contributing to the agricultural heritage of the state.

The *Musa* species in Nagaland encompasses a wide range of varieties, each with its distinct characteristics. Moreover, the *Musa* species in the northeastern region of India extends beyond its economic and dietary contributions. *Musa* species are deeply embedded in the cultural practices and traditional rituals of the local communities. They are incorporated into religious ceremonies, festivals, and vari-

ous culinary preparations, lending a unique flavour to the cultural heritage of the region.

In conclusion, the *Musa* species, particularly in the northeastern region of India and Nagaland, holds immense botanical, cultural, and economic significance. With its diverse range of varieties and their contributions to the local livelihoods, the *Musa* species plays a vital role in shaping the biodiversity and cultural identity of this enchanting region.

Musa aurantiaca was described by John Gilbert Baker, basedon a specimen collected by Gustav Mann, a German botanist and first conservator of Assam Province forests, in 1889 (Baker 1893, Häkkinen and Väre, 2008). The description was based on a specimen from Wendland's herbarium (Herrenhausen Botanic Garden, Hanover, Germany) currently held at Kew, which was designated as the lecotype by Häkkinen and Väre (2008). Although Baker gives Gustav Mann as the author of the species, the description was written by Baker alone (Häkkinen and Väre, 2008). J. G. Baker classified *M. aurantiaca* in *the Musa* sect. Later, based on molecular evidence *M.* sect. *Rhodochlamys* was merged with the sect. *Musa*, a classification followed by subsequent researchers (Häkkinen, 2013).

This beautiful wild banana was almost unknown to most botanists and had fallen into oblivion until Häkkinen and Väre's (2008b) revision of *M. aurantiaca*, which was based on cultivated living plants in the Xishuangbanna Tropical Botanical Garden, Yunnan. This plant was introduced in Mêdog County, Tibet, China.

Musa aurantiaca Baker (Musaceae) is commonly found growing in northeast India, Tibet and Northern Myanmar. Several studies of the Musaceae in India have recently been carried out by (Cheesman 1947; Simmonds, 1960; Hore *et al*., 1992, Singh *et al*., 2001; Häkkinen and Sharrock, 2002; Uma 2006, Uma *et al*., 2005, 2006; Gogoi, 2013; Gogoi and Rabha, 2013; Gogoi and Borah, 2013; Gogoi and Häkkinen, 2013a, b; Häkkinen *et al*., 2014; Joe *et al*., 2013; Joe *et al*., 2014; Kothareddy *et al*., 2013; Sabu *et al*., 2013; Joe *et al*., 2013). However, none of these studies specifically highlight the extensive diversity of *Musa aurantiaca* in Nagaland.

This paper is based on field observations made by the author, during exploration in the year 2022-23 to Alichen in Mokokchung, and Old Chungliyimti Village in Tuensang, India.

Materials and Methods

Exploration method

A study on *Musa* exploration was conducted in the year 2022-23, covering randomly selected sampling areas in two districts: Mokokchung and Tuensang. The exploratory research utilized passport data from the National Bureau of Plant Genetic Resources (NBPGR) in New Delhi, along with direct surveys and observational methods. Information about targeted locations was gathered through open-ended interviews with local people and vendors in local fruit markets. Living specimens, in the form of suckers (a minimum of three suckers per accession), were collected for ex-situ conservation in the School of Agricultural Sciences at Nagaland University. The collection prioritized wild species available in Nagaland.

Identification of species

The diversity of species found at the exploration sites was noted, inventoried, characterized, and documented. The local names of *Musa* species in the tribal languages of specific areas, as well as their utilization, were derived through open-ended interviews with local farmers. Banana genomic group identification in the field was conducted using a taxonomic scorecard developed by Simmonds and Shepherd (1955) and Singh and Uma, (2000).

Habitat study

Site information was recorded following the passport data or surveyformat and fruit descriptor provided by the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. Additionally, data on plant morphological characterization was collected.

Results and Discussion

Musa aurantiaca specimens were collected from two distinct locations: Alichen in Mokokchung and Old Chungliyimti Village in Tuensang, situated at an elevation of 1000-1400 meters above sea level (MSL). The latitude and longitude coordinates for the collection sites are as follows: Alichen - 94.4855″E, 26.2993″N; and Old Chungliyimti Village - 94.8331″E, 26.3457″N. These sites represent natural wild habitats, and *Musa aurantiaca* is commonly encountered and abundantly available in these areas.

The local community utilizes various parts of

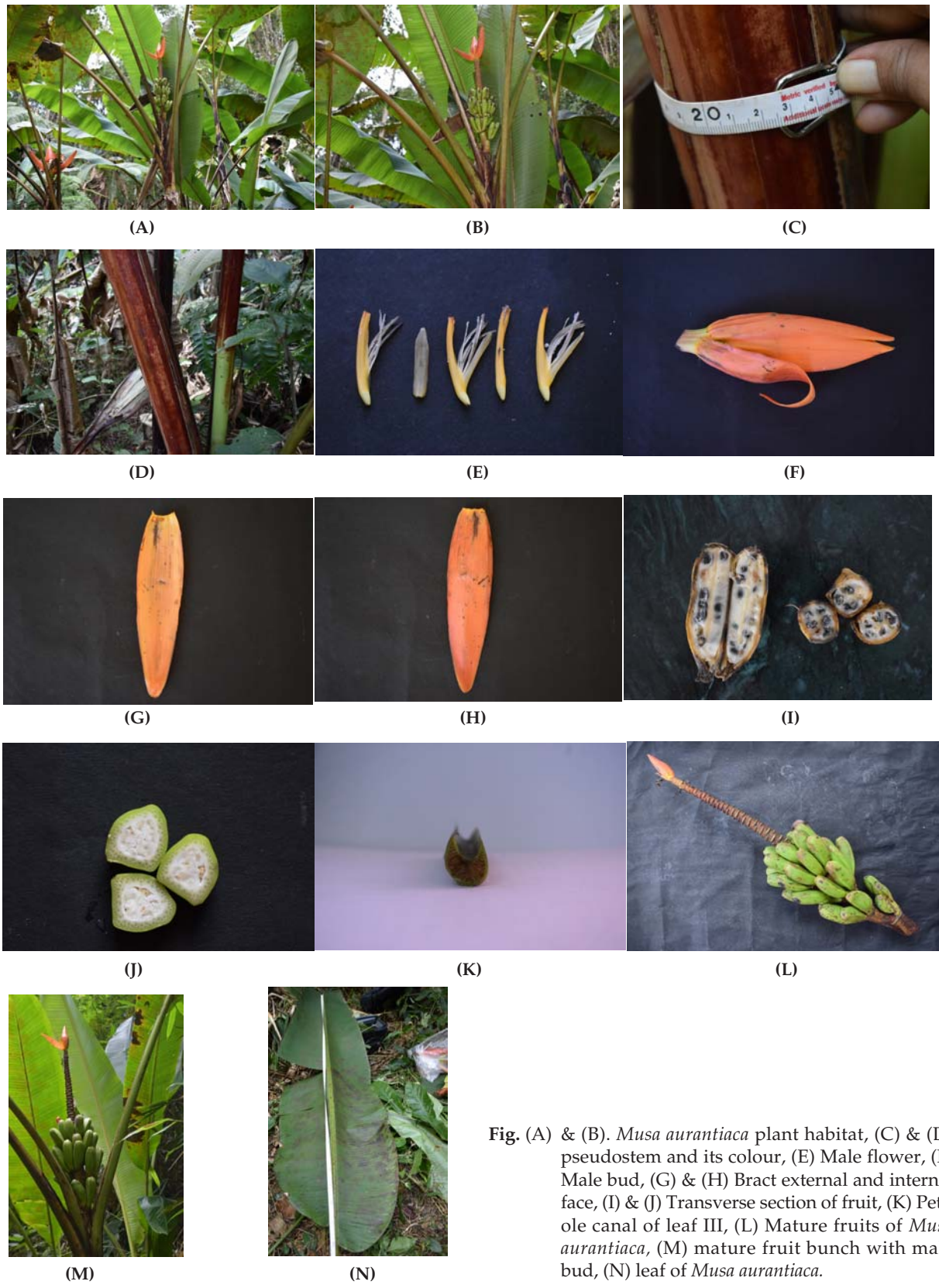

Fig. (A) & (B). *Musa aurantiaca* plant habitat, (C) & (D) pseudostem and its colour, (E) Male flower, (F) Male bud, (G) & (H) Bract external and internal face, (I) & (J) Transverse section of fruit, (K) Petiole canal of leaf III, (L) Mature fruits of *Musa aurantiaca,* (M) mature fruit bunch with male bud, (N) leaf of *Musa aurantiaca.*

Musa aurantiaca for ethnobotanical purposes. The male inflorescence and the heart of the stem are utilized in culinary endeavours, while the fruit and stem serve as fodder for domestic animals, which are commonly raised by the locals for personal consumption.

Based on the taxonomic scorecard developed by Simmonds and Shepherd (1955) and Singh and Uma (2000), the detected score for *Musa aurantiaca* is 44, classifying it under the AAB genome type.

Musa aurantiaca plants exhibit slender to medium vertical growth, typically producing 2-3 suckers closely positioned to the parent plant. The pseudostem can reach a height of 280 cm with a girth size of 22.6 cm. The pseudostem displays a predominantly red colour, transitioning to green at the basal end. The leaves have an erect habit, with a dark green colour on the upper surface. The leaf blade base shape is rounded on one side and pointed on the other. The petiole canal margins curve inwards, and the petiole itself measures approximately 64.3 cm in length. Leaf blades have a length ranging from 150-160 cm and a width ranging from 28-35 cm.

The male bud of *Musa aurantiaca* is lanceolate in shape, with an obtuse-shaped bract apex and a large shoulder-shaped bract base. Both the external and internal bracts exhibit an orange colour. The free tepals have an oval shape with a yellow tint, while the compound tepals are orange in colour. The ovary is straight, and the stigma displays a creamy colour.

The fruit of *Musa aurantiaca* has a straight shape with a rounded apex. The immature fruit peel is green, transitioning to yellow when fully mature. The pulp colour is orange-yellow, and the flesh texture is firm, with seeds present within the fruit. The thickness of the fruit peel measures 2.30 mm. Bunch weight is recorded as 1.35 kg, with 5-6 hands per bunch and 6-7 fingers per hand. The individual fruit weight is approximately 21.33 grams, with a pulp weight of 13 grams.

Conclusion

Nagaland, a region known for its rich biodiversity, boasts a diverse array of *Musa* spp., encompassing species such as *Musa balbisiana*, *Musa cheesmanii*, *Musa sikkimensis*, *Musa itinerans*, *Musa rubra* and more. These species hold great potential for both ornamental and ethnobotanical applications. However, further research is necessary to fully explore their potential in areas such as hybridization and other scientific studies.

In-depth investigations into these *Musa* species can provide valuable insights into their genetic characteristics, ecological adaptations, and potential uses. Such research endeavours have the potential to advance the field of horticulture, contribute to conservation efforts, and find applications in various industries. Additionally, by delving into the unique properties and cultural significance of these species, we can preserve and honour the rich cultural heritage of Nagaland.

The local communities in Nagaland have long recognized the value of conserving these *Musa* species. They appreciate their ornamental beauty and utilize them for culinary purposes. Notably, the male inflorescence of these species is highly regarded for its distinct and excellent taste compared to other *Musa* species. These factors further emphasize the importance of preserving and studying the diverse *Musa* spp. in Nagaland.

Overall, by embracing research and conservation efforts focused on these *Musa* species, we can unlock their full potential, benefitting both scientific understanding and the cultural heritage of Nagaland.

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