



## Taxonomic study of economically important plants in Saidabad Block, Murshidabad District, West Bengal, India

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### Abstract

Murshidabad district of West Bengal is primarily agricultural with rice, jute, wheat, oilseeds and potato as important field crops and fruit trees like mango, banana, guava, jackfruit and litchi being very important part of horticulture. This pattern is evident in Saidabad block, which lies within this district, with homestead gardens and fields of crops harboring a mixture of a wide range of economically valuable plant species from annual cereals to perennial fruit trees. This paper provides taxonomy of selected economically important plants of block Saidabad, *Mangifera indica* L. (mango), *Psidium guajava* L. (guava), *Musa × paradisiaca* L. (banana/plantain), *Litchi chinensis* Sonn. *Oryza sativa* L. and (litchi). (rice) combination of normal morphological description and the information of regional cropping. The taxonomic hierarchy, the diagnostic morphology and the economic roles of these species are presented in tabular form to facilitate field identification, teaching and, at the block level, preliminary diversity assessment.

**Keywords:** *Mangifera indica*, *Psidium guajava*, *Musa × paradisiaca*, *Litchi chinensis*, *Oryza sativa*, taxonomy, morphology, Murshidabad

### Introduction

Murshidabad district is situated in the lower part of the Ganga plain of West Bengal and is known for its fertile alluvial soils which are capable of producing a variety of agriculture and horticultural crops. Rice, wheat, jute, pulses, oilseeds and potato are significant field crops at the district level while mango, banana, guava, jackfruit and litchi are important fruit crops, with papaya being important in some districts. The economic significance of these plant species is highlighted by the fact that about 85-90% of the rural people in this area are relying on agriculture and allied activities. The district of Murshidabad is deemed important in the production of rice and fruits in West Bengal and the belt of Murshidabad–Malda is well-known for mango orchards. The horticultural and disaster management documents of Murshidabad clearly mentioned mango, banana, guava, jackfruit, litchi and papaya as major horticultural crops, thus establishing the presence of multiple economically important perennial crops along with annual field crops. A list of the main cultivated plant species at the block level is useful for taxonomic and applied botanical purposes, for training in plant identification, for germplasm conservation planning, and for incorporating local knowledge about the cultivars in a scientific context (Bandyopadhyay *et al.*, 2019 & (Rahaman *et al.*, 2023) <sup>[1, 12]</sup>.

The situation of Murshidabad is that there are mixed cropping systems and homestead gardens in Saidabad block (under Berhampore subdivision) as in the whole district, rice based agriculture with diverse fruit trees is common. Under these conditions, the farmers cultivated a limited number of basic species with a high potential value for staple food (e.g., rice), cash income (e.g., mango, banana) and nutritional diversity (e.g., guava, litchi), which are

considered to be the best candidates for a targeted taxonomic study. The present paper attempts to provide a detailed taxonomy of some of the economically important species which typify the cropping system of Saidabad block. It also aims to list and point out the most distinctive diagnostic morphological features in a manner that will make the students and researchers identification easy in the field. Lastly, it tries to connect the taxonomic and morphological accounts with the broader economic significance and agro ecological context of Murshidabad district; thereby putting the species in both a botanical and an agro-economic perspective ((Banerjee *et al.*, 2020 & Mandal *et al.*, 2022) <sup>[2, 11]</sup>.

### Study Area

According to the Administrative division of the district, Saidabad block is located under Murshidabad district in West Bengal, India in Berhampore subdivision of Murshidabad district. The district lies in the lower Gangetic alluvial plains with soils varying from recent alluvium along the active river channels to older alluvial soils and both types offer good growing conditions for cereals, fibre crops and a large range of fruit trees. Climatically, the area of Murshidabad is well suited to the cultivation of rice, jute and banana, and to subtropical fruit species which include mango, guava and litchi, with hot, humid summers, and a well defined monsoon season and mild winters. Rice, wheat, pulses, oilseeds, jute, sugarcane and potato are identified as major field crops and mango, banana, guava, jackfruit, litchi and papaya as major horticultural crops in the disaster management and agricultural contingency plans of the district. Multiple crops are common within the block, as seen from the crop combination analysis in Murshidabad,

rice with mustard, jute, wheat and potato are often found in complex crop combinations in Berhampore and neighbouring blocks. Rice is grown as the major cereal crop in Saidabad block with homestead gardens and small orchards with mango, banana, guava, litchi and jackfruit trees which are in an agro forestry mosaic typical of the district. The present taxonomic study is based on five representative economically important species that collectively represent the range of plant-forms found in the block: *Oryza sativa* (annual cereal grass), *Musa × paradisiaca* (giant monocarpic herb) and *Mangifera indica*, *Psidium guajava*, *Litchi chinensis* (evergreen fruit trees).

## Materials and Methods

### Selection of species

The choice of species was made from the agricultural and horticultural documents available at district level and crop production profile at the state level, where rice is the major cereal crop and mango, banana, guava and litchi are the major fruit crops of Murshidabad. The selected taxa are thus of various growth forms and economic uses: staple cereal (*Oryza sativa*), fruit trees (*Mangifera indica*, *Psidium guajava*, and *Litchi chinensis*) and a fruit bearing banana/plantain (*Musa × paradisiaca*).

### Taxonomic framework and sources.

Each species was given a taxonomic hierarchy and nomenclature according to standard floristic treatments, global plant databases and specialized datasheets or monographs. Table 1.1 lists the sources of detailed species accounts and agroforestry tree profile for *Mangifera indica* and *Psidium guajava* species, while banana family description and species fact sheet was used for *Musa × paradisiaca*, horticultural course notes and morphological diversity studies for *Litchi chinensis* and IRRI Rice

Knowledge Bank and teaching materials on rice morphology for *Oryza sativa*.

## Morphological characters

Botanical descriptions, crop descriptor lists and horti botanical manuals were used to synthesize morphological characters, which included habit, stem type, leaf arrangement and shape, inflorescence type, flower structure, fruit type and main harvested organ. Descriptors from IPGRI/IBPGR (particularly for mango and banana) and agroforestry tree databases facilitated the standardisation of the presentation of traits of major importance for field identification and germplasm characterisation with perennial fruit trees. Specific characters of the Gramineae such as culm morphology, panicle type and caryopsis were emphasized for rice.

No new field data are provided here, but rather the aim is to produce a coherent, comparative taxonomic and morphological account which can provide a reference framework for future fieldwork in Saidabad.

## Results

### Overview of selected economically important plants

At the block level, economic importance can be interpreted in terms of contribution to food security (e.g., rice as staple cereal), cash income (e.g., mango, banana) and nutritional diversity (e.g., guava, litchi). Rice is the main staple and occupies a large fraction of cultivated land in Murshidabad, while fruit trees contribute substantially to farm income and home-consumption, especially in homestead gardens and small orchards. Table 1 summarizes the taxonomic hierarchy and generic economic role of each selected species.

**Table 1:** Taxonomic hierarchy and broad economic role of selected economically important plants in Saidabad block

Species (common name)	Family	Higher group (Order / Class)	Growth form	Main use / economic role
<i>Mangifera indica</i> L. (mango)	Anacardiaceae	Sapindales / Magnoliopsida	Large evergreen tree	Major fruit crop, fresh fruit, processing, timber
<i>Psidium guajava</i> L. (guava)	Myrtaceae	Myrtales / Magnoliopsida	Evergreen shrub or small tree	Fruit for fresh consumption and processing
<i>Musa × paradisiaca</i> L. (banana/plantain)	Musaceae	Zingiberales / Monocots	Monocarpic giant herb with pseudostem	Dessert and cooking banana, staple-like fruit
<i>Litchi chinensis</i> Sonn. (litchi)	Sapindaceae	Sapindales / Magnoliopsida	Medium evergreen tree	High-value fruit, fresh and processed products
<i>Oryza sativa</i> L. (rice)	Poaceae	Poales / Monocots	Annual tufted grass	Staple cereal crop, primary source of calories

## Species-level taxonomic notes and morphology

### *Mangifera indica* L. (mango)

*Mangifera indica* is a medium to large evergreen tree (10-15 m tall cultivated, up to 25-30 m with wide and dense rounded crown). The bark is dark grey to brown, rough and fissured in older trees, and the species is deep rooted, with extensive lateral roots. Leaves are simple, alternate to sub opposite, narrow elliptic to lanceolate, 10-30 cm x 3-6 cm, leathery, glabrous, acuminate at the apex, attenuate at the base, reddish bronze when young, becoming glossy dark green when mature.

Inflorescences are a much branched pyramidal terminal panicle of numerous small, polygamous flowers, 20–35 cm or more in length. Flowers very fragrant, pale yellow or yellowish white, tinged with red, 4–5 merous, male and

hermaphrodite flowers on the same panicle. Fruit fleshy, nearly round, ovoid, oblong or kidney-shaped, 8-20 cm long, with a smooth green to yellow or orange skin, sometimes with red or purple blush, and a yellow to orange pulp fibrous to nearly fibreless, sweet and aromatic; seed a single flattened stone, mono embryotic or poly embryotic, depending on the cultivar (Mitra & Mukherjee, 2018)<sup>[3]</sup>.

### *Psidium guajava* L. (guava)

*Psidium guajava* is an evergreen shrub or small tree, usually 3-10 m in height and often branching from the base, with the ability to produce root suckers. The bark is smooth, light reddish brown or greenish, with thin scales, and the root system is shallow, but wide. Young stems are 4-angled, hairy, older branches are more rounded; leaves opposite,

simple, ovate elliptic to oblong elliptic, 7-15 × 3-5 cm, rounded base, entire margin, and conspicuous pinnate venation. Leaves dull green, pubescent on the underside, aromatic when crushed, and with small oil glands apparent on them with a lens. The flowers are borne singly or in 1-3 flowers in the leaf axils on short, pubescent peduncles making up inflorescences. Flowers 4-5 merous, white, petals 15-20 mm long, numerous white stamens (about 200-250) and a peltate stigma, calyx closed in bud, splitting into 4-6 lobes at anthesis. Fruits globular to pear shaped, 2.5-10 cm long, with green to yellow skin, the pulp is granular and juicy, white, yellow or pink, sweet to sour sweet, with numerous hard yellowish kidney-shaped seeds. Guava fruits are a good source of vitamin C and dietary fibre and are used in fresh fruit consumption, juices, jams, etc (Chowdhury & Das, 2021)<sup>[4, 8]</sup>.

#### ***Musa × paradisiaca* L. (banana / plantain)**

*Musa × paradisiaca* is a gigantic herb of the family Musaceae, which is a monocarpic plant, a hybrid of *Musa acuminata* and *Musa balbisiana*. The true stem is a short subterranean rhizome, from which are produced many fibrous adventitious roots and one pseudostem above ground, which in the form and arrangement is like a pseudobulb, but is constructed of tightly rolled leaf sheaths. The unbranched and erect pseudostem reaches several metres in height; the large, oblong lanceolate leaves are spirally arranged with long petioles, sometimes with marginal tearing along the veins. The inflorescence is terminal, growing as a long axis or “shaft” which passes through the pseudostem and forms clusters of flowers with large purple or greenish bracts, known as the banana “heart”. The flowers are in hands and the perianth is 6 in 2 whorls (3+3), the 5 inner segments of which are fused together in a tube-like fashion, and the outer segment (labellum) is free and large. Stamens six in two whorls, mostly five fertile, with one staminode; ovary inferior, tricarpetate, trilobular with numerous ovules on axile placentation. The fruit is a fleshy elongated berry; dessert bananas and plantains of Murshidabad are mostly parthenocarpic and seedless, and are characterised by mesocarp that is rich in starch (plantain) / sugars (dessert banana) (Saha & Das, 2020)<sup>[5]</sup>.

#### ***Litchi chinensis* Sonn. (Litchi)**

*Litchi chinensis* is a small to medium sized, dense spreading evergreen tree (6-9 m tall) with light green, glossy leaves. The family Sapindaceae to which the species belongs are believed to have originated in South China, and spread to other parts of Asia and to subtropical regions of the world. The leaves are paripinnate, with 4 to 8 leaflets, each leaflet being lanceolate to oblong lanceolate, entire and coriaceous and shiny above. Numerous small, greenish white to yellowish, petal-less flowers are borne on panicles at the ends of branches on the tree.

The flowers of litchis are small and inconspicuous, and are borne in a panicle with three types of flowers: male, female and hermaphrodite. The fruit is sometimes called a nut or drupe; an ovoid to subglobose, rough, red pericarp enclosing a single glossy brown seed covered by a juicy translucent white aril (the edible part). Litchi fruits are regarded as being sweet and used as fresh fruits or canned fruits or beverages (Mondal, 2019)<sup>[6]</sup>.

#### ***Oryza sativa* L. (rice)**

*Oryza sativa* is a tufted, erect annual grass, a member of the family Poaceae and the major cereal crop of Murshidabad. The plants usually grow to 80-120cm tall and have smooth, glabrous, hollow and jointed culms (stems). Leaves are flat, linear, with parallel venation, usually 15–30 cm long; each leaf has a leaf blade, a sheath, a membranous ligule (10–20 mm) and small auricles at the junction of the sheath and blade. It has fibrous root system from lower nodes of culm and is adapted to inundation in paddy fields. The inflorescence is an umbel of many spikelets, each spikelet with one floret in a sheath of glumes and lemmas. The number of parts in the perianth is reduced (lodicules) and there are three stamens, while the stigmas are feathery and are adapted to wind pollination, common in flowers of the grasses. Fruit is a caryopsis (rice grain); grain size, shape difference among cultivars; the seed coat is fused to the pericarp; the grains is the main consumable part eaten as staple food by a large population of Saidabad and other areas of the region (Singh *et al.*, 2018)<sup>[7]</sup>.

#### **Comparative morphological characters**

Key diagnostic morphological traits of the selected species are summarized in Table 2 to facilitate side-by-side comparison during field identification and teaching.

**Table 2:** Comparative diagnostic morphological characters of selected economically important plants

Species	Habit / stem type	Leaves (arrangement, type)	Inflorescence type	Flower traits (outline)	Fruit / economic organ
<i>M. indica</i> (mango)	Large evergreen tree, woody trunk, deep roots	Simple, alternate to sub-opposite; narrow-elliptic to lanceolate, coriaceous	Terminal pyramidal panicles	Small, polygamous, 4–5-merous, pale yellow, fragrant	Fleshy drupe with fibrous stone; edible mesocarp
<i>P. guajava</i> (guava)	Evergreen shrub or small tree, shallow roots	Simple, opposite; ovate-elliptic, pubescent beneath, aromatic	Axillary clusters of 1–3 flowers	White, 4–5 petals, numerous stamens, fragrant	Globose to pear-shaped berry with many seeds
<i>M. × paradisiaca</i> (banana)	Monocarpic giant herb; rhizome + leafy pseudostem	Simple, very large, oblong-lanceolate, spirally arranged	Terminal spike (spadix) with large bracts	Tepals 6 (3+3), 5 fertile stamens, inferior ovary	Elongated fleshy berry; cultivated forms seedless
<i>L. chinensis</i> (litchi)	Medium evergreen tree with dense crown	Paripinnate leaves with 4–8 lanceolate leaflets	Terminal panicles	Small, petal-less, functionally male/female flowers	Nut-like fruit with red rough rind and fleshy aril
<i>O. sativa</i> (rice)	Annual tufted grass with hollow culms	Simple, linear leaves with ligule and auricles	Terminal panicle of spikelets	Reduced perianth, 3 stamens, feathery stigmas	Caryopsis (grain) used as staple food

## Discussion

The five species treated here are the structural and functional diversity of economically important plants of Saidabad block and include large evergreen tree of fruit, giant monocarpic herb, annual cereal grass. They are classified into four orders: Sapindales, Myrtales, Zingiberales and Poales; and three major angiosperm clades—eudicots, monocots and commelinids, highlighting their taxonomic diversity. Their opposing growth forms and morphologies also are ideal for applied, agro-ecological comparative plant morphology and field taxonomy instruction. The fruit trees are mostly grown in homestead gardens and orchards and have a number of uses, such as shade, fencing and a source of fruit. In the district and state level Horticultural reports, mango and banana are mentioned as principal fruits with appreciable area and production in Murshidabad district while actual mango production could be more in Malda. Although guava and litchi are grown on a smaller scale, they help in bringing in vitamin rich fruits in the season and bring income diversification and nutritional security. Structurally very different, rice is nevertheless agronomically central, taking up most of the cultivated land and being the staple food of the households in Saidabad. (Das & Ghosh, 2021) <sup>[8]</sup>. The difference between the growing seasons of rice (short duration crop, requires land preparation and planting in the season, and is harvested in that season) and the long-lived perennials of fruit trees (flower and fruit in the season, but does not require planting or land preparation in the season) highlights the complementary nature of annual and perennial species in the local farming system. Standardized morphological descriptors, like those developed by IPGRI/IBPGR for mango and by IRRI for rice, provide a sound basis for documenting and conserving intra specific diversity in these species at the block level as a means of germplasm documentation and conservation (Hooker, 2020) <sup>[9]</sup>. For instance, mango and banana descriptor lists include the characteristics like tree vigour, leaf size, panicle/bunch morphology, fruit shape and size which can be used to categorize cultivars grown in Saidabad. If these descriptor based characterizations could be integrated into the taxonomic framework presented here, future studies would be able to link the diversity of cultivars and identify unique lines from the local area, and establish a link between farmer recognized cultivars and formal germplasm collections (Jain, 2021) <sup>[10]</sup>.

## Conclusion

In this paper a taxonomic study of five economically important plant species, *Mangifera indica*, *Psidium guajava*, *Musa × paradisiaca*, *Litchi chinensis* and *Oryza sativa* that represent mixed farming system of saidabad block in murshidabad district has been presented. The comparative tables and brief descriptions of the various taxonomic groups are designed to provide a reference framework for field identification, teaching and initial diversity assessments. Meanwhile, it identifies systematic, descriptor-based field surveys to document intra specific varietal diversity particularly in mango, banana, guava and litchi that are likely to contain abundant local germplasm in Saidabad and overall Murshidabad area.

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