

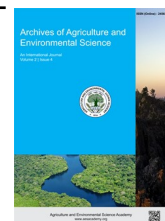


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ORIGINAL RESEARCH ARTICLE



## Ethnobotanical study of the family Marantaceae R. Br in Bangladesh Agricultural University Botanical Garden

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### ABSTRACT

The Marantaceae family is a diverse group of plants that has drawn the interest of scientists and researchers worldwide due to their distinctive morphological characteristics, ecological and economic relevance. The Bangladesh Agricultural University Botanical Garden is home to an abundance of Marantaceae species, making it a useful resource for examining the diversity and significance of this plant family. This present study was designed to survey and document the family Marantaceae with an overview of the family emphasizing its morphological, economic, and ethnobotanical relevance based on a literature review. During the study, we found 25 species (two of which have two varieties each) belonging to 8 genera of which *Goepertia* contributed the most species, with 16, followed by *Maranta* with 4 (including varieties) and *Thalia* with 2; the remaining 5 genera each contributed one species. Our findings reveal the remarkable diversity and significance of Marantaceae plants in this region, highlighting the necessity for their conservation and protection.

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### INTRODUCTION

The Marantaceae is a family of perennial herbaceous plants characterized by sympodially branched rhizomes that produce erect, short-lived, green, and blooming shoots. The Marantaceae, often known as the arrowroot family and the prayer-plant family, consists of 29 genera and 627 species of flowering plants renowned for their huge starchy rhizomes and widely distributed throughout the tropics, excluding Australia (Andersson, 2003). Unique morphological characteristics, such as jointed stems, spectacular inflorescences, and patterned leaves, have made these plants appealing choices for decorative purposes. Typically, the plants are perennial herbaceous perennials with subterranean rhizomes or tubers. Stems may or may not be present. The leaves are distichous, big, petioled, and pinnately veined, and the lateral veins are parallel (Andersson, 2003). In the family Marantaceae, variegated leaves are ubiquitous, as shown in the numerous species of *Maranta* and *Goepertia* that are popular houseplants due to their

ornamental foliage. Generally, the variegation consists of white, yellow, or pale green stripes or spots that run along the longitudinal veins. Furthermore, the purple colouring of the aerial portions is frequent. Inflorescences are terminal or axillary, spicate or paniculate, and surrounded by bracts that resemble spathes. Flowers are typically paired, bisexual, and asymmetrical. Three sepals are free. There are three connate petals. Staminodes and stamens are arranged in two whorls, with the outer whorl containing one or two petaloid staminodes, which are infrequently absent, and the inner whorl containing one hooded staminode that encloses the terminal section of the pistil at anthesis. The ovary has three loculi and is inferior. Ovules are one per locule. The styles are cylindrical and attached to the corolla and staminode tube. Stigmas are either bowl-shaped or blunted and three-cleft. Fruit is a loculicidal capsule that is rarely indehiscent or berrylike. One to three hard, typically arillate seeds are produced by hooded staminodes (Xu and Chang, 2017).

The economic significance of the Marantaceae family has also

been explored in several studies, with a particular focus on their potential as sources of novel therapeutic compounds. There is a growing demand for the species of *Goepertia* and *Maranta* as ornamentals. Although the family contains several edible species, only one, *M. arundinacea* L., or West Indian arrowroot, is economically significant. In cookery, it is used as a thickener in soups, sauces, puddings, and desserts. It produces a transparent, odourless, pleasant-tasting jelly when boiled in water. The fresh leaves of *Goepertia* and *Phrynium* are used for wrapping foods, covering cargo, and as bottle stoppers. The split petioles of *Schumannianthus dichotomus* (Roxb.) Gagnep. are used for making baskets, matting, and strings for musical instruments. Furthermore, arrowroot contains several phytochemicals that have antidiarrheal, antiulcer, antioxidant, antibacterial, vibriocidal, and immunostimulatory properties.

The Asian taxa (8 genera and 46 species) are the least understood. Taxonomic research has been hindered by the small, fragile character of the flowers, the relative rarity of specimens in both herbaria and the field and the absence of local experts to assist with identification. Comparatively little systematic research has been undertaken on Marantaceae in various regions of the globe (Ngamriabsakul et al., 2000; Rangsiruji et al., 2000a,b; Searle and Hedderson, 2000; Andersson and Chase, 2001; Kress et al., 2002; Prince and Kress, 2006; Clausager and Borchsenius, 2003; Suksathan and Borchsenius, 2003; Saka and Lombardi, 2014), but no such research in Bangladesh. Owing to its increasing demand and value, the present study was conducted to document the taxonomic diversity and ethnobotanical uses of this family available in Bangladesh Agricultural University Botanical Garden (BAUBG). This comprehensive information will help botanists, ethnobotanists, and pharmacologists in collecting and identifying plants for research purposes and in isolating plant compounds that are helpful to human health. This publication serves as a basis for future research on the Marantaceae family and as a call to action for the conservation of these valuable plants.

## MATERIALS AND METHODS

The study was conducted in the BAUBG, which covers an area of 25 acres in Mymensingh, Bangladesh. The garden has a rich collection of plants including the Marantaceae family, making it an ideal site for the study. The BAUBG is a valuable resource for researchers and plant enthusiasts interested in the Marantaceae family, providing a glimpse into the remarkable diversity and ecological significance of these plants. The Marantaceae family plants were collected from different locations within the garden. Samples of the leaves, stems, roots, and flowers were collected from each plant species for morphological analysis. To identify the species, all accessible taxonomic resources, including literature, herbarium specimens, and botanical illustrations, were considered. Moreover, digital images of the species were used to supplement plant identification and record their habitats. Updated nomenclature, description, photographs, and ethnobotanical uses are provided for

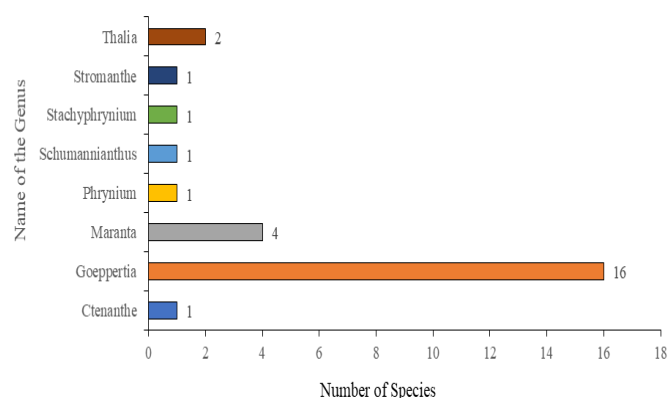
each species. Ethnobotanical information was gathered by searching relevant papers online.

## RESULTS AND DISCUSSION

There were found 25 species (two of which have two varieties each) belonging to 8 genera (Table 1). The largest contributor was the genus *Goepertia* with 16 species, followed by *Maranta* with 4 species (including varieties) and *Thalia* with 2 species; the remaining five genera each provided one species (Table 1 and Figure 1).

**Table 1.** Marantaceae plant species conserved at the Bangladesh Agricultural University Botanical Garden.

Local name	Scientific name
Fishbone Prayer plant	<i>Ctenanthe burle-marxii</i> H.A. Kenn.
Silver cluster-leaf	<i>Goepertia bachemiana</i> (É.Morren) Borchs. & S.Suárez
Pinstripe plant	<i>Goepertia elliptica</i> (Roscoe) Borchs. & S.Suárez
Rattlesnake plant	<i>Goepertia insignis</i> (W.Bull ex W.E.Marshall) J.M.A.Braga, L.J.T.Cardoso & R.Couto
Mosaic Calathea	<i>Goepertia kegeljanii</i> (É.Morren) Saka
Calathea	<i>Goepertia leonia</i> (Boon bis) Borchs. & S.Suárez
Calathea	<i>Goepertia lindeniana</i> (Wallis) Borchs. & S.Suárez
Louisa's Calathea	<i>Goepertia louisae</i> (Gagnep.) Borchs. & S.Suárez
Peacock plant	<i>Goepertia makoyana</i> (É.Morren) Borchs. & S.Suárez
Prayer plant	<i>Goepertia orbifolia</i> (Linden) Borchs. & S.Suárez
Pinstripe Prayer Plant	<i>Goepertia ornata</i> (Lem.) Borchs. & S.Suárez
Silver Calathea	<i>Goepertia picturata</i> (K.Koch & Linden) Borchs. & S.Suárez
Rose painted Calathea	<i>Goepertia roseopicta</i> (Linden ex Lem.) Borchs. & S.Suárez
Velvet Calathea	<i>Goepertia rufibarba</i> (Fenzl) Borchs. & S.Suárez
Silver Plate Calathea	<i>Goepertia stromanthifolia</i> (Rusby) Borchs. & S.Suárez
Calathea	<i>Goepertia undulata</i> (Linden & André) Borchs. & S.Suárez
Zebra Calathea	<i>Goepertia zebrina</i> (Sims) Nees
Sitalpati, Muktapati	<i>Maranta arundinacea</i> L.
Arrowroot	<i>Maranta arundinacea</i> 'Variegata'
Prayer plant	<i>Maranta leuconeura</i> var. <i>erythroneura</i> G.S.Bunting
Rabbit's Foot Plant	<i>Maranta leuconeura</i> var. <i>kerchoveana</i> Petersen
Maranta	<i>Phrynium imbricatum</i> Roxb.
Pitulipata	<i>Schumannianthus benthamianus</i> (Kuntze) Veldkamp & I.M.Turner
Dong leaves	<i>Stachyphrynium placentarium</i> (Lour.) Clausager & Borchs.
Never-Never Plant	<i>Stromanthe thalia</i> (Vell.) J.M.A.Braga
Red stemmed thalia	<i>Thalia dealbata</i> Fraser
The bent alligator	<i>Thalia geniculata</i> L.



**Figure 1.** Species distribution of available plants under different genera.

These species were primarily found in shaded woodland margins, pond borders, canal banks, and swampy places. By evaluating the plant materials collected during the study areas with the aid of identification techniques, medicinal information was gathered and is outlined below.

#### Genus: Ctenanthe

**Origin:** Native to tropical regions of America.

**Botanical description:** Herbs with perennial evergreen foliage exhibits sympodial growth. Large, simple leaves with elongated petioles allow them to move in reaction to light intensity and direction. Flowers inconspicuous, fruit capsules.

**Economic and ethnobotanical uses:** As ornamental plants, *Ctenanthe* species are economically significant due to their attractive foliage, which ranges in colour from green, silver, and grey to purple, depending on the species. They are widely cultivated as indoor and outdoor plants throughout the world. Several species, including *C. setosa* and *C. lubbersiana*, have been reported to possess potential therapeutic qualities, including anti-inflammatory and antioxidant activity. In traditional medicine, *C. lubbersiana* leaves are used to cure rheumatism, discomfort, and inflammation (Van Andel et al., 2012). The leaves' decoction is employed as a diuretic, fever reducer, and general tonic (Ayyanar and Ignacimuthu, 2011). *C. setosa* leaves are also utilized in traditional Brazilian medicine to treat ailments such as rheumatism and fever.

#### Genus: Goepertia

**Origin:** *Goepertia* is indigenous to the tropical parts of the Americas, such as South America and the Caribbean.

**Botanical description:** Huge, broad leaves develop in the form of rosulate from the rhizomes located underground. Leaves are decorative, with striking patterns and hues. Little, inconspicuous flowers have white or yellow petals, glandular bracteoles, and interphylls; cymules with two or three flowers; and ovaries with three viable locules.

**Economic and ethnobotanical uses:** *Goepertia* plants are well-known for their ornamental and economic importance. Many varieties, such as *G. insignis* and *G. zebrina*, are popular as houseplants due to their gorgeous leaf, which frequently displays stripes, dots, or other complicated patterns (Govaerts et al., 2021). Some species have leaves that can be used to make baskets and wrap food. Many species of *Goepertia* generate wax, and certain species have edible blooms and tubers. Many species are maintained as houseplants due to their distinctively patterned foliage. In certain regions of Brazil, the leaves of *G. tubispatha* are used to prepare tea claimed to have therapeutic characteristics and to alleviate stomach issues and headaches.

#### Genus: Maranta

**Origin:** *Maranta* is native to the tropics of the Americas.

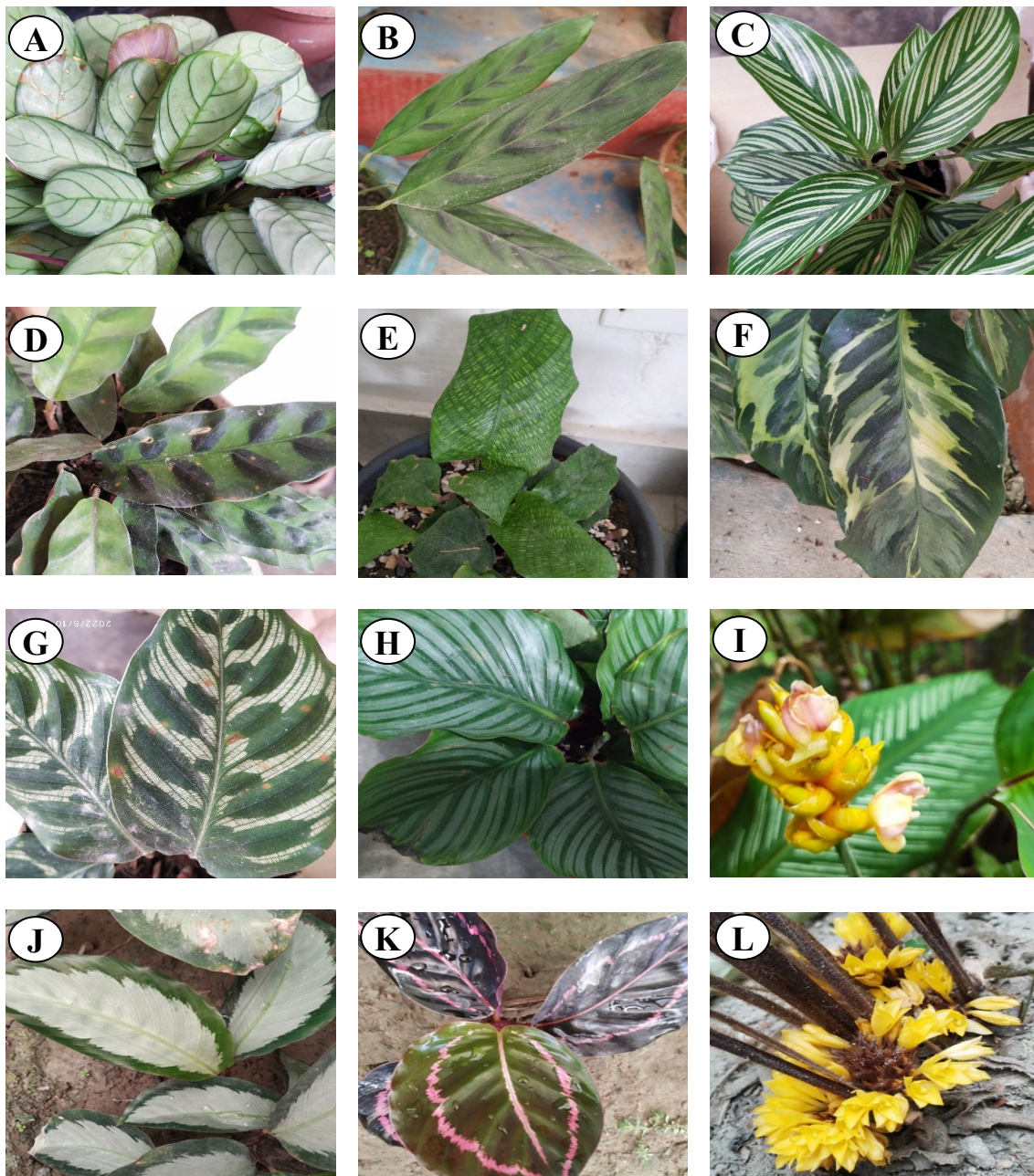
**Botanical description:** Large, ovate leaves, often different colours or patterns, supported by lengthy petioles and develop from underground rhizomes that are short and fleshy. Small to medium size plants, require well-drained soil and partial shade for optimal growth (Armitage, 2013). Corolla tube long, two outer staminodes, petaloid. Perennial herbs have a tuberous or creeping rootstock, a leafy stem that is either short or tall. On the sheaths, the ovate leaves have nearly separate petioles. Terminal and laxly dichotomous, inflorescence cyme. Fruit ovoid-oblong, oblique, and indehiscent, pericarp juicy. Seed erect, embryo curved.

**Economic and ethnobotanical uses:** Many species are grown as decorations in gardens and indoor spaces because their leaves look nice and easy to grow. South American indigenous groups weave baskets and mats from *Maranta* leaves. Starch from *M. arundinacea* leaves is used in infant food, puddings, and sauces (Govaerts et al., 2000). *M. ramosissima* roots are used to generate a black dye for traditional fabrics (Lorenzi et al., 2008). Rhizome vulnerability. It produces high-quality arrowroot for youngsters and invalids. In Bandarban, tribal people eat the rhizome uncooked to alleviate hot urination and other urinary issues (Yusuf et al., 2009). *Maranta* herbs are employed in Panamanian Kuna healing ceremonies as protecting agents. Herbs are used in traditional medicine to alleviate inflammation, indigestion, and respiratory infections (Balick and Cox, 2020). This plant treats dysuria, menorrhoea, and strangury (Uddin, 2006). Planters, hanging baskets, mass planting, and edging. This plant is widely utilized in shopping centres.

#### Genus: Phrynium

**Origin:** They are native to tropical Asia and Australia

**Botanical description:** Perennial herbs with creeping rootstocks. Tall, thin stems resemble bamboo and are popularly referred to as "bamboo gingers" Large leaves emerge from the stem nodes. The leaves are radical, petiolate, with long,



**Figure 2.** A. *Ctenanthe burle-marxii* B. *Goeppertia bachemiana* C. *G. elliptica* D. *G. insignis* E. *G. kegeljanii* F. *G. louisae* G. *G. makoyana* H. *G. orbifolia* I. *G. ornata* J. *G. picturata* K. *G. roseopicta* L. *G. rufibarba*.

sheathing petioles that resemble stems and broad, oblong blades.

Midribs and parallel veins are prominent. Flowers are arranged in a complex spike, with no bracteoles and interphylls present. Stamen 1, perfect, with a staminal tube that is longer than the corolla tube and exterior staminodes that are petaloid. Fruit globose, dehiscent. 1–3 seeds accompanied by a short, fleshy arillus. Favour wet, well-drained, partially shaded soil.

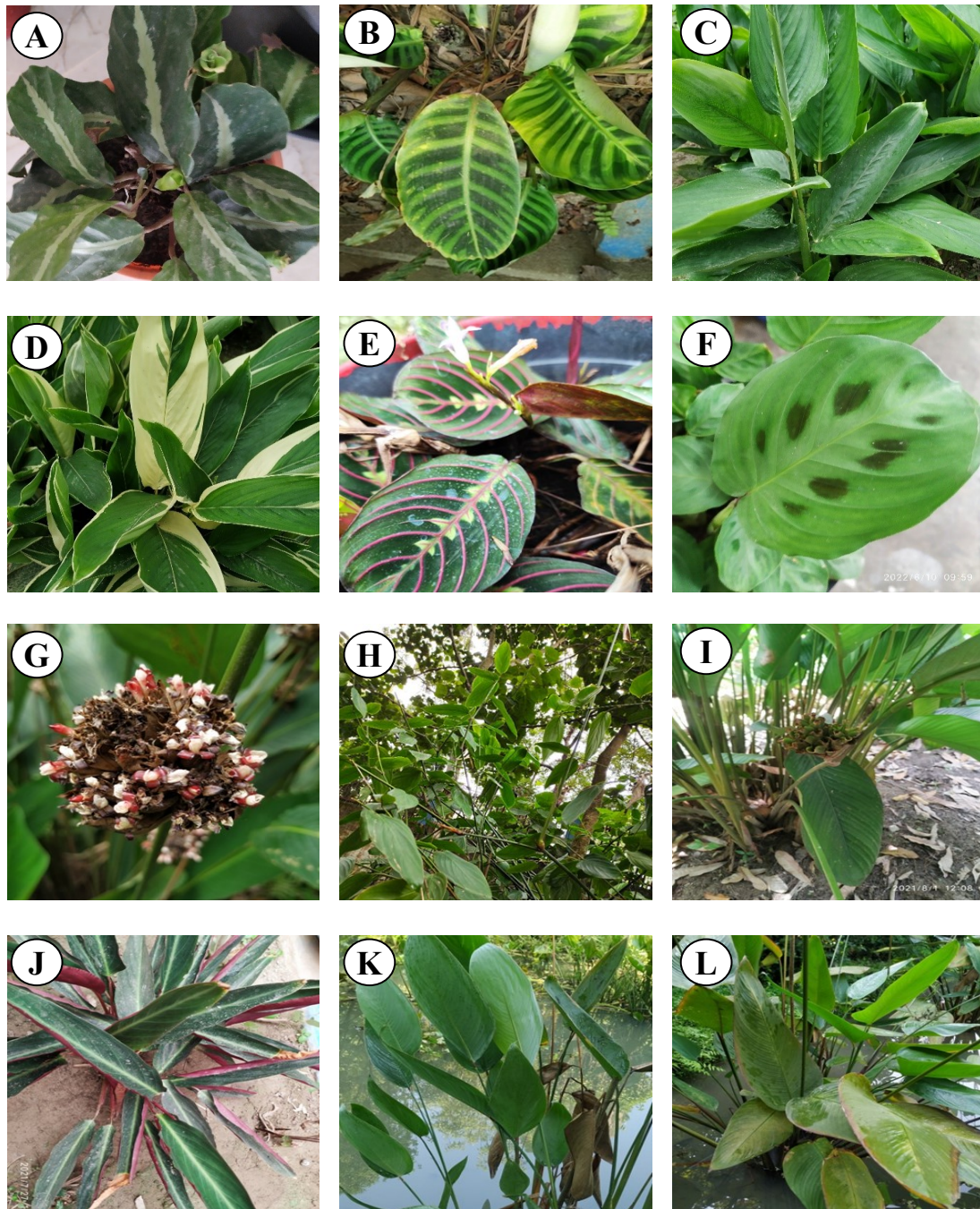
**Economic and ethnobotanical uses:** In traditional medicine, the leaves of plants like *P. capitatum* and *P. pubinerve* are used to cure a variety of illnesses such as inflammation, fever, and gastrointestinal issues. Moreover, the leaves of some species, such as *P. oliganthum*, are used by indigenous communities in Southeast Asia to wrap food and serve as plates (Uddin and Hassan, 2004). *Phrynium* plants have ornamental value and are cultivated in

many regions as garden plants. They are valued for their remarkable foliage, which is often big, textured, and patterned with vivid hues. The plants are relatively simple to cultivate and are frequently utilized in shady garden beds and as houseplants.

#### Genus: *Schumannianthus*

**Origin:** Only two species are found in tropical Africa, primarily in Cameroon, Gabon, Equatorial Guinea, and Congo.

**Botanical description:** Shrubs with leafy cane-like stems have abundantly dichotomously branched, underground tuberous rhizomes. Oblong to oblong-lanceolate leaves with pronounced veins and midribs. The inflorescence is a lax-flowered terminal panicle. Flowers in pairs, with long, narrow, and stiff bracts. Stamen 1, perfect, staminal tube cylindrical, segments obovate, petaloid. Fruit 1-3 seeded, indehiscent, seeds with aril.



**Figure 3.** A. *Goeppertia undulata* B. *G. zebrina* C. *Maranta arundinacea* D. *M. arundinacea* 'Variegata' E. *M. leuconeura* var. *erythronera* F. *M. leuconeura* var. *kerchoveana* G. *Phrynium imbricatum* H. *Schumannianthus benthamianus* I. *Stachyphrynium placentarium* J. *Stromanthe thalia* K. *Thalia dealbata* L. *Thalia geniculata*.

**Economic and ethnobotanical uses:** Occasionally grown as houseplants in tropical climates. The outermost portion of the split stem is commonly utilized as a fibre and for weaving mats and baskets. The expensive *Shital Pati*, bed mats, are noted for their superior quality. On occasion, the arillus seeds are consumed. The leaves of *S. dichotomus* are used to cure a variety of diseases, including fever, stomachache, and intestinal worms.

**Genus: Stachyphrynium**

**Origin:** Tropical regions of Central and South America.

**Botanical description:** The plants of the genus *Stachyphrynium* have huge, wide leaves that develop from underground rhizomes. Frequently, the leaves are quite decorative, with striking patterns and hues. *Stachyphrynium* blooms are often modest and unassuming, with white or yellow petals. Rosulate, bracteoles missing, interphylls present or absent. Short calyx and lengthy corolla tube; hood-like anther appendages; dehiscent fruit with 1-2 seeds.

**Economic and ethnobotanical uses:** *Stachyphrynium* plants are largely valued for their decorative qualities, frequently grown as attractive plants in gardens and indoor environments. Popular species like *S. sagittarioides* and *S. spicatum* have lovely leaves

and are simple to cultivate (Govaerts *et al.*, 2021). Leaves are used to wrap food. *S. griffithii* leaves are used to brew tea in Colombia which is considered to have therapeutic characteristics and is used to cure stomach disorders and fevers.

### Genus: *Stromanthe*

**Origin:** Tropical regions of Central and South America.

**Botanical description:** Caulescent, typically clustered, bracteoles, if present, are scale-like. Huge, lance-shaped leaves that develop from underground rhizomes are often exceedingly beautiful, with vivid patterns and hues. The flowers are often tiny and inconspicuous, with white or pink petals. The Corolla tube is shorter than the Corolla's width, and the Corolla and inner staminodes do not typically reach the calyx. Callose staminode, entirely firm/fleshy.

**Economic and ethnobotanical uses:** These species are used as decorative plants because of their magnificent leaves. Due to their lovely leaves and capacity to flourish in low-light environments, they are frequently grown as indoor houseplants. Some of the most popular species are *S. sanguinea* and *S. thalia*, which have bold, striped leaves (Govaerts *et al.*, 2021). In traditional medicine, *Stromanthe* species have been used to cure a wide range of conditions, including fever, infections, and gastrointestinal problems. In certain regions of Colombia, the leaves of certain *Stromanthe* species, such as *S. stromanthoides*, have been used to prepare a traditional tea.

### Genus: *Thalia*

**Origin:** It is native to the Americas and is found throughout tropical and subtropical regions, particularly in wetland habitats.

**Botanical description:** Thalias, big wetland herbs, have rosulate or caulescent leaves, bracteoles, and no interphylls. Large, lanceolate leaves with parallel veins alternate down the stem. Zigzag-axed panicle-like inflorescences. In tight, bract-enclosed pairs without bracteoles, purple flowers have one conspicuous, spectacular outer petaloid staminode, a very small corolla tube, minute sepals, and a cucullate staminode with a double appendage. Floating fruit. Bent alligator flag or arrowroot has petioles up to 3 feet long and lance-shaped leaves 1-2 feet long and half as wide. Lax, branched inflorescences of blue and purple blooms may reach 3 feet. The plant grows 6-10 feet. Long-leaved perennial herb with open panicles of tiny flowers. Flags are named after their bright green stalks. They're banana-canna relatives.

**Economic and ethnobotanical uses:** Certain species, like *T. dealbata*, have leaves and stems that can be used to make mats and baskets (Pullaiah, 2006). Moreover, several species of *Thalia* are used medicinally to treat a variety of conditions, including inflammation, fever, and renal issues. Ducks are said to eat the seeds of *T. geniculata* in Florida. It is said that the inner part of

the boiling rootstock of *T. geniculata* can be consumed by humans (Morton, 1977). Sometimes aquatic gardens are used to cultivate *T. dealbata*.

### Conclusion

The Bangladesh Agricultural University Botanical Garden is home to a diverse range of Marantaceae species. These plants are characterized by their unique morphological features, making them popular choices for ornamental purposes. Beyond their aesthetic appeal, Marantaceae plants have also been recognized for their ecological and economic importance. The diversity of Marantaceae in the BAUBG reflects the rich biodiversity of the region and underscores the importance of conserving and protecting these valuable plants. Further studies could explore the genetic diversity of Marantaceae populations in the garden, as well as the potential for these plants to contribute to sustainable agriculture and economic development in the region.

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