



# Species Diversity of Sterculiaceae at Bangladesh Agricultural University Botanical Garden and their Ethnobotanical Uses

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## Authors' contributions

This work was carried out in collaboration between both authors. Author MA designed the study, performed the field survey and wrote the first draft of the manuscript. Author AKMGS wrote the protocol, managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

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## ABSTRACT

The study aimed at assessing and updating species diversity of the family Sterculiaceae conserved at the Bangladesh Agricultural University Botanical Garden (BAUBG). A total of 13 species belonging to 11 genera were recorded at BAUBG; out of these, the occurrence of 5 species is rare in nature/wild. Habits of the 13 species were different and the number of trees was 8, shrubs were 3 and herbs were 2. The conservation status, ethnobotanical uses e.g. medicinal, ornamental, food, fodder, etc. and phenology of these species have been presented here. Results of this study would be helpful to the BAUBG authority to set up their collection priority to conserve (threatened) plants species of this family.

**Keywords:** *Sterculiaceae*; *species diversity*; *valuation*; *BAUBG*.

## 1. INTRODUCTION

Botanic gardens are institutions holding documented collections of live plants for the

purpose of scientific research, conservation, display and education [1]. Bangladesh Agricultural University Botanical Garden (BAUBG) is an institution enriched with diverse

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plant species. It is located on the west bank of the Old Brahmaputra River, 5 km away from Mymensingh town and it lies between 24°43'27.9"N and 90°26'28.2"E. The BAUBG has been involved in the collection and conservation of plant genetic resources from home and abroad since its inception in 1963. With an area of about 10 ha of land, ca. 1,500 plant species under 287 genera and 200 families are being conserved here over a period of time for the study by students, academicians and researchers. Although BAUBG collection is enriching day by day and maintained a well-managed plant database, some of the plant collections were unidentified, lost due to different natural calamities, diseases and insect pest attack, theft, etc. Thus, a study on plant holding and conservation status at BAUBG is essential to update knowledge and priorities for future conservation planning.

Sterculiaceae, one of the most important families among flowering plants, consists of nearly 70 genera and 1,500 species, mainly of tropical and subtropical origin [2]. Many of its members demonstrate medicinal properties and have been used for the treatment of various ailments and wounds [3]. Hooker (1874) reported 20 species under 10 genera of the Sterculiaceae from the present Bangladesh territory. Ahmed et al. [4] added to our knowledge documenting 25 species of this family occurring in Bangladesh while Rahman et al. [5] mentioned the occurrence of 32 species under 15 genera of the family Sterculiaceae in Bangladesh. The study is an effort to provide updated information of BAUBG about the species diversity of the family

sterculiaceae and their conservation status and ethnobotanical uses.

## 2. MATERIALS AND METHODS

The field surveys were carried out during January 2019 to December 2019 to furnish the research work. Maximum identification was done at the observation sites and in case of confusion in identity, for each species 2-3 voucher specimens were collected along with certain field notes [6-8]. Confused specimens were identified with the help of available floras and in consultation with other relevant literature. Family, Sterculiaceae, have been determined according to Cronquist [2]. Nomenclature of each species has been updated following recent literature [4,9,10] and confirmed with consulting The Plant List <http://www.theplantlist.org/> [11]. The taxa are listed alphabetically along with their Vernacular name, habit and conservation status Table 1. Salient diagnostic characters, ethnobotanical uses and distributional notes have been furnished under each species studying available literatures [5,12–20].

## 3. RESULTS AND DISCUSSION

Taxonomically, a total of 13 species belonging to 10 genera were collected from the BAUBG and identified. In the study, 5 species under 5 genera belong to Sterculiaceae are identified as rare plants Table 1. Among the collected plants 8 were large trees, 3 were shrubs and the rest 2 were herbs (Fig. 1). Brief Description of the Recorded Species.

**Table 1. Name of the taxa along with Bengali name, habit and status of occurrence**

Sl. No.	Bengali name	Scientific name	Habit	Status
1.	Ulatkambal	<i>Abroma augusta</i> (L.) L.f.	Shrub	Common
2.	Dombeya	<i>Dombeya burgessiae</i> Gerrard ex Harv.	Shrub	Lc
3.	Naichicha Udal	<i>Firmiana colorata</i> (Roxb.) R. Br.	Tree	Rare
4.	Atmora	<i>Helicteres isora</i> L.	Shrub	NE
5.	Sunduri	<i>Heritiera fomes</i> Buch.-Ham.	Tree	very rare
6.	Tikiokra	<i>Melochia corchorifolia</i> L.	Herb	common
7.	Dupurmoni, Surjamani	<i>Pentapetes phoenicea</i> L.	Herb	Lc
8.	Kanak champa	<i>Pterospermum acerifolium</i> (L.) Willd.	Tree	Rare
9.	Bonasra/Bonasar	<i>Pterospermum semisagittatum</i> Buch.-Ham. ex Roxb.	Tree	Lc
10.	Buddha-narkel	<i>Pterygota alata</i> (Roxb.) R. Br.	Tree	Lc
11.	Janglibadam, Box badam	<i>Sterculia foetida</i> L.	Tree	very rare
12.	Udal	<i>Sterculia villosa</i> Roxb. ex Smith	Tree	Lc
13.	Cocoa, Cacao	<i>Theobroma cacao</i> L.	Tree	Rare

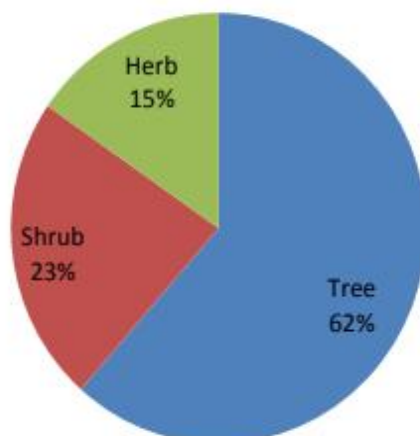


Fig. 1. Habit wise classification of plants in the family Sterculiaceae

### 3.1 *Abroma augusta* (L.) L.f.

A shrub or small tree; leaves cordate, repand-denticulate, with acuminate to cuspidate apex and cordate base, base 3-7 nerved; flowers dark red; fruit a capsule, conical, winged. Flowering and fruiting: June-December,

**Uses:** The plant (and plant parts) is used for the treatment of fever, food poisoning, hyperacidity; leaf stalks for dysentery, weakness, in burning urination; root bark for intra-uterine diseases, other gynaecological disorders such as dysmenorrhoea, amenorrhoea, and gonorrhoea, as a demulcent, abortifacient and anti-fertility agent, diabetes mellitus type-2 [12].

**Distribution:** Australia, Bhutan, China, India, Indonesia, Malaysia, Nepal, Pacific Islands, Philippines, Thailand and Vietnam.

### 3.2 *Dombeya burgesiae* Gerrard ex Harv.

A stellate tomentose shrub. Leaves broadly ovate, entire or occasionally obscurely 3-lobed, deeply cordate at the base, acute to acuminate at the apex. Flowers white or pinkish-white. Stigma included. Fruit a capsule, oblong, villous. Flowering and fruiting: December-April.

**Uses:** The bark fibre is widely used for binding and for making rope, baskets and bags. The wood is used for construction and for making bows, tool handles and for firewood. The bark is use as an aphrodisiac, cure for stomach pain (in Kenya), applied to leprosy sores (in Tanzania).

**Distribution:** Tropical Africa, India and Pakistan.

### 3.3 *Firmiana colorata* (Roxb.) R.Br.

A medium-sized spreading, deciduous tree with fluted stem. Leaves crowded at the end of branchlets, palmately 3-5 lobed, lobes triangular, with acute to cuspidate apex and cordate to truncate base. Flowers scarlet or orange-red, polygamous. Fruit a follicle, oblong. Flowering and fruiting: March-June.

**Uses:** Fresh young seeds are edible and taste like almond. The bark yields cordage used to tie cattle in Chittagong district of Bangladesh. It is used in the treatment of hysteria, jaundice, urine infection, stomach pain, seminal emission and spermaturia.

**Distribution:** India, Pakistan, Sri Lanka, Nepal, Bhutan, Myanmar, Indonesia, Malaysia, Thailand and Vietnam.

### 3.4 *Helicteres isora* L.

A large shrub or small tree, stellately hairy throughout. Leaves ovate, broadly elliptic or elliptic-obovate with cuspidate apex and cordate or rounded base. Flowers orange-red with black dots on inner part of the corolla. Fruit a follicle, cylindrical, spirally twisted with an apical beak. Flowering and fruiting: April-December.

**Uses:** The bark is used to treat diarrhoea and dysentery. The fruit is believed to be medicinally important in the treatment of gastric, intestinal

disorders, malnutrition, snake bite, diarrhoea and constipation of newborn baby. It also shows antioxidant, hypolipidaemic, antibacterial and antiplasmodial activities, cardiac antioxidant, antiperoxidative potency, brain-antioxidation potency, anticancer activity, antinociceptive activity, hepatoprotective activity, anti-diarrheal activity and wormicidal activity [13].

**Distribution:** Australia, Cambodia, China, India, Indonesia, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam.

### 3.5 *Heritiera fomes* Buch.-Ham.

A moderate-sized evergreen tree. Leaves spirally arranged, elliptic-lanceolate or ovate, with acute to mucronate apex and tapering to rounded base. Male flowers with 5-10 stamens. Female flowers with 4-6 carpels; epicarp dull. Fruits ellipsoid or globular, woody. Flowering and fruiting: September-December

**Uses:** Timber is used for bridge and house construction, electric and telephone utility poles, bodies of buses, launches and trucks, anchor logs, scaffolding, pilings, house posts, tool handles, flooring and panelling. Good charcoal is made from the wood. It is used for treating diabetes, hepatic disorders, gastrointestinal disorders, goitre, and skin diseases. Plant possesses significant antioxidant, antinociceptive, antihyperglycemic, antimicrobial, and anticancer activities (Mahmud *et al.*, 2014).

**Distribution:** India, Myanmar and Thailand.

### 3.6 *Melochia corchorifolia* L.

Annual herb, young parts sparsely hairy. Leaves ovate, ovate-lanceolate, oblong-ovate or suborbicular with truncate or obtuse base and acute apex. Flowers pinkish, fruit a globose or subglobose capsule. Flowering and fruiting: March-June.

**Uses:** The plant is commonly weed of wasteland, fodder for cattle, source of very strong fibre for making dilly bags and other objects, used in the treatment of ear problems, dysentery, gingivitis, irregular menstruation and snake bite. The leaves have been utilized to reduce ulcers, and headache and chest pain. The sap (plant juice) can be treated on wounds due to antaris. The leaves and roots are used to treat urinary disorders, sores, abdominal swelling, dysentery and snakebites. The extract of plant possesses anthelmintic, hepatoprotective, antioxidant,

antibacterial, anticancer, diuretic, antiurolithiatic and CNS stimulant activities [14].

**Distribution:** Australia, China, India, Indonesia, Malay Peninsula, Myanmar, Philippines, Polynesia, Thailand and Vietnam.

### 3.7 *Pentapetes phoenicea* L.

Annual herb to undershrub with few scattered stellate hairs on the bark. Leaves linear lanceolate, with acuminate or cuspidate apex and cuneate obtuse base. Flowers pink to red. Fruit a globose or subglobose capsule, 5-valved. Flowering and fruiting: September-January.

**Uses:** Fruit extract is emollient, used in gastropathy, fever and vitiated conditions of vata and pitta [15]. Roots are astringent, antibilious, reduces wind formation and is given in fever, constipation diarrhoea, antiphlegmonous, demulcent, burning sensation, psychopathy, snake bites and to alleviate fever. It is also grown as an ornamental plant, a source of fibre.

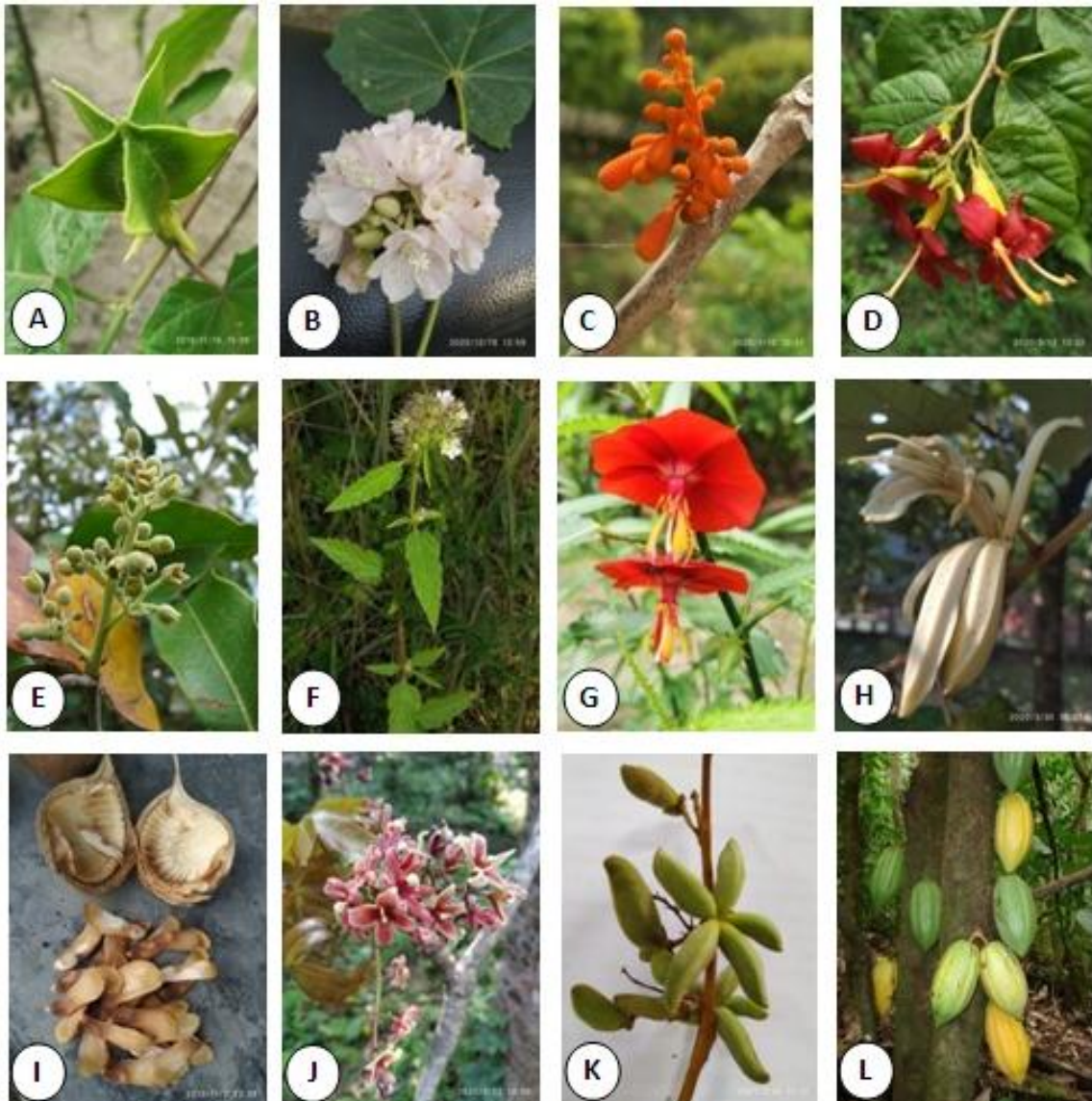
**Distribution:** Australia, China, India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand and Vietnam.

### 3.8 *Pterospermum acerifolium* (L.) Willd.

A medium-sized to large evergreen tree. Leaves polymorphous, peltate, with cordate base. Flowers white or yellowish, fragrant. Fruit a capsule, oblong, woody, rusty brown, glabrescent. Flowering and fruiting: February-June.

**Uses:** It is planted in gardens and along roadsides as avenue tree. Flowers are used as a general tonic and as a cure for leucorrhoea, suppurating smallpox, gastralgia, blood diseases, tumours, ulcers, leprosy and inflammations. The leaves of the plant are widely used for the treatment of diabetes and as a haemostatic. The plant possesses beneficial effects as wound healing, antioxidant, antiulcer, anti-inflammatory, analgesic, hypoglycaemic, antimitotic, immunosuppressive, hepatoprotective, antihelmintic and anticancer activity. It is believed to be used in inflammation, abdominal pain, ascites, cures ulcers, leprosy, constipation, urinary discharges and tumours [16].

**Distribution:** Bhutan, China, India, Laos, Malaysia, Myanmar, Nepal, Pakistan and Thailand.



**Fig. 2. Reproductive parts of different members of family Sterculiaceae. A) *Abroma augusta*, B) *Dombeya burgessiae*, C) *Firmiana colorata*, D) *Helicteres isora*, E) *Heritiera fomes*, F) *Melochia corchorifolia*, G) *Pentapetes phoenicea*, H) *Pterospermum acerifolium*, I) *Pterygota alata*, J) *Sterculia foetida*, K) *Sterculia villosa*, and L) *Theobroma cacao***

### **3.9 *Pterospermum semisagittatum* Buch.-Ham. ex Roxb.**

A small to moderate-sized tree. Leaves oblong to oblong-lanceolate, with acute to cuspidate apex and sagittate base. Flowers white, fragrant. Fruit a capsule, cylindrical or elliptical, rusty-tomentose. Flowering and fruiting: April-August.

**Uses:** The plant is used in the treatment of jaundice, lipoma (tumour), rheumatism and possesses antioxidant [17]. Wood is used for making agricultural implements, traditional house columns, household furniture and as firewood. The bark fibres have been used for cordage.

**Distribution:** Cambodia, India, Laos, Myanmar, Sri Lanka and Thailand.

### 3.10 *Pterygota alata* (Roxb.) R.Br.

A large deciduous tree with narrow conical crown. Leaves broadly ovate with acute to broadly acute apex and cordate or truncate base, usually clustered at the end of branchlets. Flowers brownish-yellow. Fruit a woody follicle, globose to ellipsoid, pubescent. Flowering and fruiting: December-May.

**Uses:** The leafy branches possess anti-hyperglycemic and antioxidative activity [18]. The bark juice was used in the management of haemorrhoids, dropsy, swelling oedema, gout, leprosy and pain. Seeds are eaten after roasting. Wood is white and has great potential for pulping because of long fibres.

**Distribution:** Bhutan, China, India, Malaysia, Myanmar, Pakistan, Philippines, Thailand and Vietnam.

### 3.11 *Sterculia foetida* L.

A medium to large deciduous tree. Leaves elliptic, elliptic-lanceolate or elliptic-oblong, crowded at the end of branchlets. Flowers dull red, purplish or yellow. Petals absent. Fruit a follicle, woody, boat-shaped. Flowering and fruiting: November-April.

**Uses:** After removing the black seed coat, the tasty yellowish cotyledons are edible. They are used as laxative, diuretic, anti-epileptic, purgative, insect repellent and effective for the alleviation of rheumatism. Its seed oil is used externally to treat itches and other skin diseases for illuminating and painting.

**Distribution:** Cambodia, China, India, Indonesia, Malaysia, Myanmar, Pakistan, Philippines, Sri Lanka, Thailand, Vietnam, Eastern Africa and North Australia.

### 3.12 *Sterculia villosa* Roxb.

A moderate-sized deciduous tree. Leaves palmately lobed, oblong with acuminate to cuspidate apex and cordate base. Flowers pinkish-yellow. Petals absent. Male flowers with 10 stamens and female flowers with 5 free

carpels. Fruits follicle oblong, rusty pubescent. Flowering and fruiting: February-May.

**Uses:** Coarse fibre obtained from the inner bark is used for making ropes, cordage and bags. Seeds are eaten baked or roasted. The wood is soft and used for paper pulp, possess significant antidiabetic, anti-inflammatory, cytotoxic and thrombolytic action [19].

**Distribution:** Bhutan, Cambodia, China, India, Myanmar, Nepal, Pakistan and Thailand.

### 3.13 *Theobroma cacao* L.

A small evergreen tree. Leaves entire, unlobed, oblong. Flowers yellowish-white to pale pink. Petal ligule stipitate; staminodes erect, subulate; stamens 2-antheriferous; calyx 5-parted, the laciniae equal. Ovate-oblong fruit. Flowering and fruiting: February-May.

**Uses:** The seeds are the main ingredient of chocolate, while the pulp is used in some countries to prepare refreshing juice, smoothies, jelly, and cream. It is used to stimulate the nervous system, lower blood pressure, dilates the coronary arteries, and soothes and softens damaged skin. It is also used against anaemia, angina, bruises, chapped skin and burns, diarrhoea, leprosy spots, cosmeceuticals, protect the skin from premature aging, dermatitis and eczema, antioxidant and anti-inflammatory [20].

**Distribution:** Native to South America, probably on the equatorial slopes of the Andes; now cultivated pantropically, especially in West Africa.

## 4. CONCLUSION

The study provides preliminary information on the diversity and conservation status of the species belong to the family Sterculiaceae in BAUBG and their ethnobotanical uses. The results would be helpful to the BAUBG authority to set up their collection priority to conserve (threatened) plants species of Sterculiaceae family. This information would be helpful to pharmacognosist, botanist, ethnobotanist and pharmacologist for collection, identification and isolation of plant parts/products for the betterment of human health.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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