Original Research Article

Species diversity in the family Sterculiaceae at Bangladesh Agricultural University Botanical Garden and its ethnobotanical uses

Abstract

The present paper aimed to assess and update the species diversity of family Sterculiaceae conserved at the Bangladesh Agricultural University Botanical Garden (BAUBG). A total of 13 species belonging to 11 genera were recorded from BAUBG, out of these 5 species are rare in the nature/wild. Habit study revealed that 8 species are tree, three shrub and only two species are herb.The conservation status and ethnobotanical uses *viz*. medicinal, ornamental, food, fodder and others, 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, BAUBG

Introduction

Botanic gardens are institutions holding documented collections of living plants for the purpose of scientific research, conservation, display and education (Jackson, 1999). The Botanical Garden of Bangladesh Agricultural University (BAUBG) 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**.This botanical gardenhas been involved in the collection and conservation activities of plant genetic resources from home and abroad as well from its inception in 1963. Withan area of about 10 ha of land, *ca*. 1,500 plant species under 287 genera and 200 families are conserved here over a period of time for studies by the students, academicians and researcher; and the plant holding of BAUBG is ever increasing. Although the BAUBG maintained a (well-managed) plant database, some of the plant collections were unidentified/misidentified, lost/dead due to different natural calamities, diseases and insect pest attack, theft, etc. The detail study on plant holding of this botanical garden, therefore, necessitates to confirm and update our knowledge for future conservation planning and execution.

Sterculiaceae, one of the most important families among flowering plants, consists nearly 70 genera and 1,500 species, mainly of tropical and subtropical regions (Cronquist, 1981). Many

of its members demonstrate medicinal properties and have been used for the treatment of various ailments and wounds (Al-Muqarrabun and Ahmat, 2015).Hooker (1874) reported 20 species under 10 genera of the Sterculiaceae from the present Bangladesh territory. Ahmed *et al*. (2009) added to our knowledge documenting 25 species of this family occurring in Bangladesh.While Rahman *et al*. (2012) mentioned the occurrence of 32 species under 15 genera of the family Sterculiaceae in Bangladesh. The present study is an effort to provide updated information about the species diversity, their traditional uses, and conservation status of the family Sterculiaceae, and to uncover the gaps and potentials requiring further research opportunities regarding the conservation strategies.

MATERIALS AND METHODS

The field surveys were carried out during January, 2019 to December 2019. Maximum identification was done at the observation sites and in case of confusion in identity, fertile plant specimens have been collected (Hyland, 1972;Balick*et al.*,1982;Alexiades, 1996). For each species, 2-3 voucher specimens were collected, along with certain field notes. Specimens were identified with the help of available floras and consultation of other relevant literature. Families have been determined according to Cronquist (1981). Nomenclature has been updated following recent literature (Ahmed *et al*., 2009; Rashid and Rahman, 2011, 2012), and confirmed with consulting The Plant List <http://www.theplantlist.org/>. The taxa are listed alphabetically along with their Bangla name, habit and status of occurrence (Table 1). Salient diagnostic characters, ethnobotanical uses and distributional notes have been furnished under each species.

Results and Discussion

Taxonomically, a total of 13 species belonging to 10 genera were collected and identified from the BAUBG. In the present study 5 species under 5 genera of family Sterculiaceae are rare(Table 1). Among these, 8 are large trees, 3 are shrubs and rest 2 are herbs (Figure 1).

Brief Description of the Recorded Species.

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 ademulcent, abortifacient and anti-fertility agent. diabetes mellitus type-2 (Islam *et al*., 2012).

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

***Dombeya burgessiae* Gerrard *ex* Harv. (*Dombeya mastersii* Hook. f.)**

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. Planted in the gardens.

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 of stomach pain (in Kenya), applied to leprosy sores (in Tanzania).

Distribution: Tropical Africa, India and Pakistan.

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

A medium-sized spreading, deciduous tree with fluted stem. Leaves crowded at the end ofbranchlets, 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.

***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 new born baby. It also shows antioxidant, hypolipidaemic, antibacterial and antiplasmid activities, cardiac antioxidant, antiperoxidative potency, brain-antioxidation

potency, anticancer activity, antinociceptive activity, hepatoprotective activity, anti-diarrheal activity and wormicidal activity (Kumar and Singh 2014).

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

***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 paneling. Good charcoal is made from the wood. It is used for treating diabetes, hepatic disorders, gastrointestinal disorders, goiter, and skin diseases. Plant possesses significant antioxidant, antinociceptive, antihyperglycemic, antimicrobial, and anticancer activities (Mahmud *et al*., 2014).

Distribution: India, Myanmar and Thailand.

***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: Theplantis commonly weed of wasteland,fodder for cattle, source of very strong fiber 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 (Mamatha*et al*., 2018).

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

***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 orobtuse 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 (Sharma *et al*., 2014). Roots are astringent, antibilious, reduces wind formation and is given in fever,constipation diarrhoea, antiphlegmonous, 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.

***Pterospermumacerifolium* (L.) Willd.**

A medium-sized to large evergreen tree. Leavespolymorphous, peltate, withcordate 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,antihelmentic and anticancer activity. It is believed to be used in inflammation, abdominal pain, ascites, cures ulcers, leprosy, constipation, urinary discharges and tumours (Deshwal and Sharma, 2019).

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

***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 possese antioxidant (Taraquzzaman *et al*., 2014). 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.

***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 braches possess anti-hyperglycemic and antioxidative activity (El-Shereie*t al*., 2018). The bark juice was used in the management of hemorrhoids, 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 andVietnam.

***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. Petalsabsent. Fruit a follicle,woody, boat-shaped.

Flowering and fruiting: November-April.

Uses: After removing the black seed coat, the tasty yellowish cotyledons are edible.*S. foetida* 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.

***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. Fruit a folicle,oblong, rusty pubescent.

Flowering and fruiting: February-May.

Uses: Coarse fiber 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, antiinflammatory, cytotoxic and thrombolytic action (Anwar et al. 2018).

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

***Theobroma cacao* L.**

A small evergreen tree. Leaves entire, unlobed, oblong. Flowers yellowish white to pale pink. Petal ligule stipitate; staminodeserect, subulate; stamens 2-antheriferous; calyx 5-parted,thelaciniae 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 anemia, angina, bruises, chapped skin and burns, diarrhea, leprosy spots, cosmeceuticals, protect the skin from premature aging, dermatitis and eczema, antioxidant and anti-inflammatory (Singh et al. 2020).

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

CONCLUSION

The present study is a preliminary contribution on the diversity, conservation status and ethnobotanical uses of the family Sterculiaceae conserved in the BAUBG. Results of this studywould be helpful to the BAUBG authority to set up their collection priority to conserve (threatened) plants species of this family, that will be helpful to save plants from extinction in the nature.This information would be helpful to pharmacognosist, botanist, ethnobotanist and pharmacologist for the collection and identification of the plant for their research work and isolation of plant products benefitting human health.

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Table 1. Name of the taxa along with Bangla name, habit and Status of occurrence

Sl. No.	Bangla name	Scientific name	Habit	Status
1.	Ulatkambal	*Abromaaugusta* (L.) L.f	Shrub	Common
2.	Dombeya	*Dombeyamastersii* Hook. f.	Shrub	Lc
3.	FaisaUdal/NaichichaUdal	*Firmianacolorata* (Roxb.) R. Br.	Tree	Rare
4.	Atmora	*Helicteresisora* L.	Shrub	NE
5.	Sunduri	*Heritierafomes*Buch.-Ham.	Tree	very rare
6.	Tikiokra	*Melochiacorchorifolia* L.	Herb	common
7.	Dupurmoni, Surjamani	*Pentapetesphoenicea* L.	Herb	lc
8.	Kanak champa	*Pterospermumacerifolium* (L.) Willd.	Tree	rare
9.	Bonasra/Bonasar	*Pterospermumsemisagittatum*Buch.-Ham. *ex*Roxb.	Tree	Lc
10.	Buddha-narkel	*Pterygotaalata* (Roxb.) R. Br.	Tree	lc
11.	Janglibadam, Box badam	*Sterculiafoetida*L.	Tree	very rare
12.	Udal	*Sterculiavillosa*Roxb. *ex* Smith	Tree	lc
13.	Cocoa, Cacao	*Theobroma cacao* L.	Tree	Rare

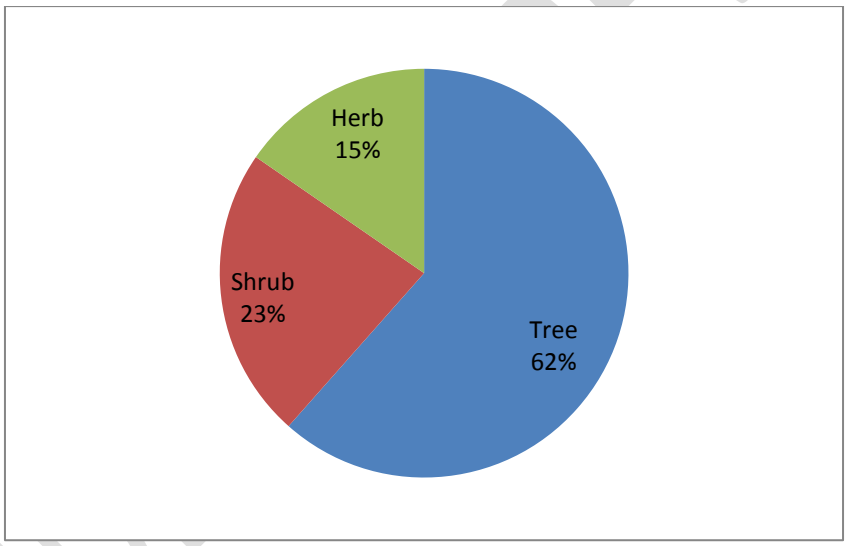

Figure 1. Habit wise classification of plants in the family Sterculiaceae

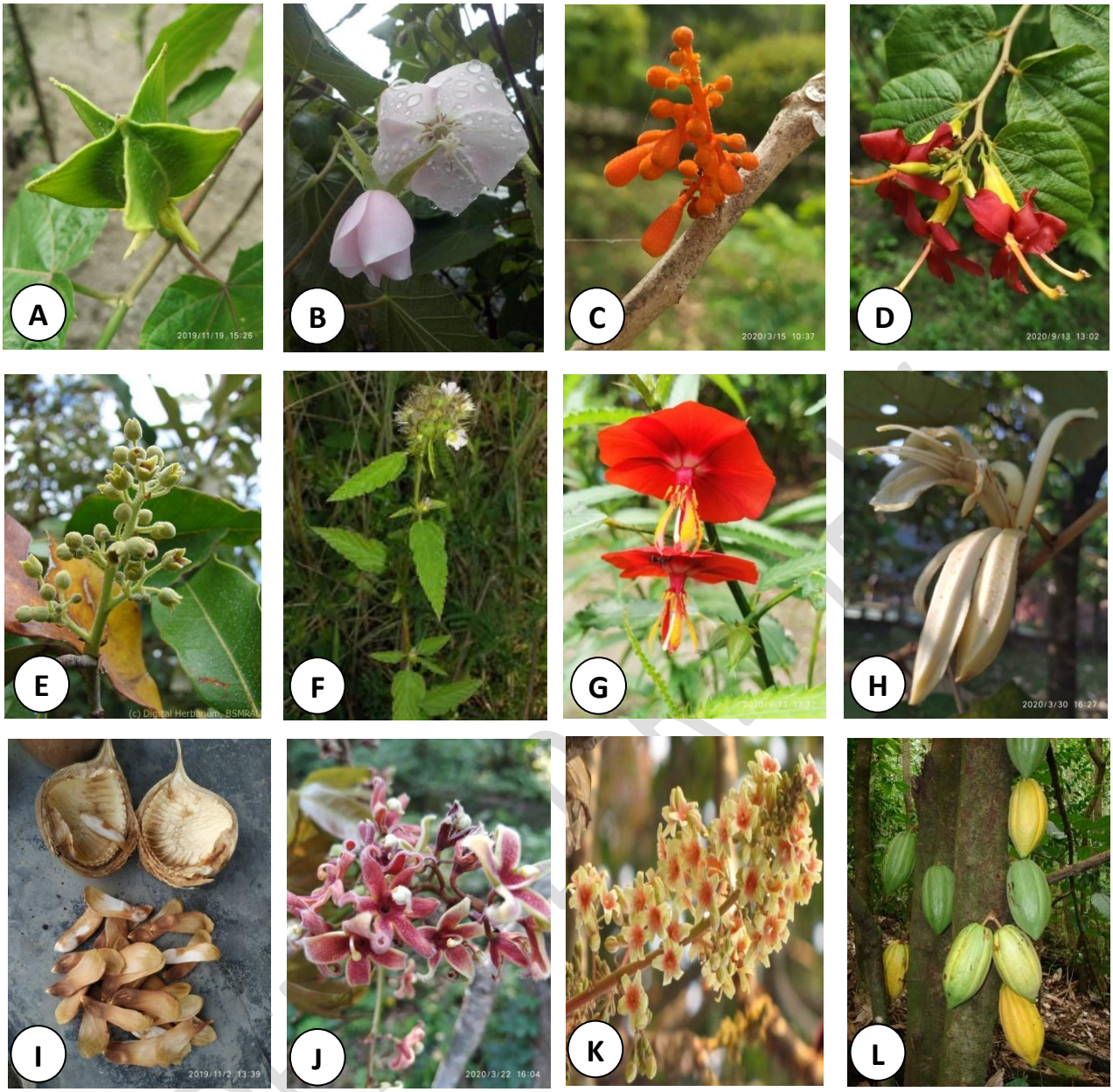

Figure 2. Reproductive parts of different members of family Sterculaceae. A) *Abroma augusta*, B) *Dombeya mastersii*, C)*Firmiana colorata*, D)*Helicteres isora*, E) *Heritiera fomes*, F) *Melochia corchorifolia*, G) *Pentapetes phoenicea*, H) *Pterospermum acerifolium*, I) *Pterygota alata*, J)*Sterculia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