Review article

Documenting conservation status and medicinal potential of selected non-edible fruit-bearing plants in the Bangladesh Agricultural University Botanical Garden

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ABSTRACT

Non-edible fruit-bearing plants are particularly fascinating due to their remarkable adaptability to diverse ecological conditions, their utilization in traditional medicine, and their potential contributions to pharmaceutical development. A total of 38 non-edible fruit plant species, spanning 36 genera and 20 families, were documented. The Euphorbiaceae family exhibited the highest diversity, with six species, followed by Fabaceae, Lecythidaceae, Malvaceae, and Bignoniaceae, each represented by three species. Families such as Annonaceae, Celastraceae, Clusiaceae, Fagaceae, and Rubiaceae had two species each, while ten families included only a single species. At the genus level, Lithocarpus and Mallotus were the most prominent, each represented by two species, while the other 34 genera were represented by a single species. The study revealed that 76% of the species were indigenous, whereas 24% were exotic. In terms of conservation status, 8% of the species were classified as vulnerable, 3% as endangered, 52% as least concern, 8% as data deficient, and 29% had not been evaluated globally. The plants were used to treat a wide range of common diseases, including cancer, cardiovascular, gastrointestinal, and respiratory disorders, as well as infections, and more. This paper provides the conservation status and collective information on the medicinal uses of these non-edible fruit plants.

Key words: BAUBG, conservation status**,** medicinal uses, non-edible fruit-bearing plants

INTRODUCTION

Plants have been an essential source of medicine throughout human history, playing a pivotal role in traditional and modern therapeutic systems. Fruit plants have long been recognized for their medicinal value, and their significance in both traditional and modern healthcare continues to grow. Fruits are a rich source of essential vitamins and minerals, antioxidants, dietary fiber, and natural bioactive compounds, e.g., alkaloids, flavonoids, and tannins, all of which are vital for maintaining health and preventing diseases (Ashrafuzzaman *et al.*, 2021, Kumar *et al.*, 2023). Across various cultures, fruit plants have traditionally been used to treat a wide variety of ailments such as skin disorders, infections, inflammation, and digestive

problems (Ragasa *et al.*, 2014; Shilpi *et al.*, 2016). While much research has focused on edible fruit plants due to their direct nutritional benefits, non-edible fruit plants remain an underexplored yet potentially rich source of bioactive compounds. These plants often contain unique phytochemicals that confer significant medicinal properties, including antimicrobial, antioxidant, anti-inflammatory, and anticancer activities.

Bangladesh is home to a diverse range of tropical and subtropical fruits. In addition to edible fruits, the country also has a significant variety of non-edible fruits. These non-edible fruits are less favored by the community compared to edible ones due to their unpleasant odor, lack of palatability, limited nutritional value, and a general lack of awareness regarding their potential uses. As a result, people are less concerned about their conservation in nature. Non-edible fruits are not consumed directly because they often contain toxic compounds that can be harmful to human health. However, many of these fruits are still utilized in traditional medicine in various forms, such as pastes, powders, and extracts. Despite their toxicity or unpalatable nature, they contain bioactive compounds with therapeutic potential when processed correctly. Extensive research has been conducted globally on the medicinal uses of non-edible fruits among various indigenous communities (Biswas *et al.*, 2018; Kumar *et al.*, 2023). Despite their promising potential in traditional medicine and pharmaceutical applications, these non-edible fruits remain largely undocumented. This study aims to analyze the conservation status and compile the medicinal potential of selected non-edible fruit-bearing plants found in the BAU Botanical Garden, with the goal of establishing a foundation for future pharmacological research.

STUDY AREA

The Bangladesh Agricultural University Botanical Garden (BAUBG), established in 1963, has been dedicated to the collection and conservation of plant species. BAUBG is located on the west bank of the Old Brahmaputra River and covers an area of 25 acres. Geographically, it lies at E90° 26' 29.6" and N24° 43' 26.8" at an elevation of 29 meters above the mean sea level. The region experiences a tropical monsoon climate, with summer humidity ranging from 80% to 90%, and winter humidity between 60% and 70%. The average annual rainfall in the area is approximately 2,000 mm.

A survey was conducted at the Bangladesh Agricultural University Botanical Garden (BAUBG) between July 2019 and October 2021 to identify non-edible fruit-bearing plants with documented medicinal properties. Plant specimens were collected, processed, and preserved following standard herbarium techniques (Das, 2021) during field visits. These specimens underwent thorough examination in the laboratory of the Department of Crop Botany at Bangladesh Agricultural University. Their taxonomic identity was verified through expert consultation and published literature (Leeratiwong *et al.*, 2011). Binomial nomenclature was updated using two widely accepted botanical databases: Plants of the World Online (https://powo.science.kew.org/) and World Flora Online (http://www.worldfloraonline.org/). The conservation status of the identified species was determined using the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (https://www.iucnredlist.org/). The major medicinal uses of the collected species were compiled from several authoritative sources, including *Indian Medicinal Plants* (Kirtikar and Basu, 1999), *Encyclopedia of Flora and Fauna of Bangladesh* (Ahmed *et al.*, 2009 a,b), *Vascular Flora of Chittagong and the*

Chittagong Hill Tracts (Uddin and Hassan, 2018), *Traditional Uses of Ethnomedicinal Plants of the Chittagong Hill Tracts* (Uddin and Rahman, 2006), and *Medicinal Plants of Bangladesh* (Yusuf *et al.*, 1994). The identified genera and species are listed alphabetically, with each taxon's valid name, conservation status, nativity, and medicinal uses detailed in the text.

RESULTS OF SURVEY AND DISCUSSION

A total of 38 plant species, belonging to 20 families, were documented from BAUBG, Mymensingh. For each species, information on the local name, scientific name, family, conservation status, nativity, and medicinal uses was recorded (Tables 1 & 2). Among these 38-plant species, photographs of 32 species are presented in Plate I and Plate II, with 16 species featured in each plate. The family Euphorbiaceae was the most diverse, comprising six identified species. Other prominent families, including Bignoniaceae, Fabaceae, Lecythidaceae, and Malvaceae, were each represented by three species, highlighting the rich floral diversity of the region. Additionally, families such as Annonaceae, Celastraceae, Clusiaceae, Fagaceae, and Rubiaceae each contained two species, whereas ten other families were represented by only one species each (Table 1, Figure 1.a). Among the documented plant genera, Lithocarpus and Mallotus were the most represented, with two species each, while the remaining 36 genera were represented by a single species each (Table 1).

The nativity of the species shows that the majority (76%) of the plants documented in the region are native and 24% of the species were classified as exotic (Table 1, Fig. 1.b). This high proportion of native plants suggests a well-preserved local flora that contributes to the ecological balance and biodiversity of the region. Indigenous plants are often adapted to local conditions, supporting native fauna and maintaining ecological stability. However, the presence of 24% exotic plant species is noteworthy. While some exotic species may integrate into the ecosystem without causing harm, others can become invasive, outcompeting native species and disrupting local ecosystems. Exotic species often lack natural predators or controls in their introduced environment, which can lead to their rapid proliferation. The relatively high proportion of exotic species highlights the need for careful monitoring and management to prevent potential ecological impacts. Conservation efforts should prioritize the protection and restoration of indigenous plant populations while managing exotic species to prevent them from becoming invasive.

The study reveals a significant disparity in the conservation status of species. The majority (52%) are categorized as least concern, reflecting a relatively stable state for these species. However, the presence of species in categories such as vulnerable (8%) and endangered (3%) highlights ongoing conservation challenges and the need for targeted measures to address threats to biodiversity. The high percentage of species categorized as not evaluated (29%) underscores a critical knowledge gap in our understanding of biodiversity. This gap hinders effective conservation planning and suggests that additional resources and research efforts are essential to assess these species' statuses. Similarly, the 8% of species classified as data deficient signals a need for more robust data collection and monitoring systems to inform conservation decisions. Among these non-edible fruits species, *Heritiera fomes* (EN) of Malvaceae family was most recently assessed for the IUCN Red List of Threatened Species in 2008 at the global level (https://www.iucnredlist.org/). So, protecting these plants and their habitats should be a priority.

Although fruits are non-edible but have a wide range of potential uses following paste, oil,

extracts, or other modes of preparation. Many non-edible fruit species have traditional uses in medicine. These species may contain bioactive compounds that can be used to treat various ailments. In the present findings, most non-edible fruit were used to treat common diseases such as Cancerous; Cardiovascular and Liver; Dermatological; Gastrointestinal; Helminthiasis and Diabetes; Infectious; Inflammation and pain; Respiratory; Sexual and Anti-oxidative; Urogenital diseases. The most commonly reported medicinal uses of non-edible fruit plant species were categorized as- gastrointestinal purposes, with 15 species; inflammation and pain, 11 species; helminthiasis and diabetes, 10 species; dermatological conditions, 9 species; infectious diseases, 9 species; and respiratory purposes, 8 species (Table 3). The frequent use of plants for gastrointestinal treatments aligns with findings in other regions, where plants with digestive health benefits are highly valued. The use of these plants for inflammation, pain relief, and infectious diseases suggests they may contain bioactive compounds with therapeutic potential, which could be further developed into pharmaceutical products. This highlights the need for pharmacological studies to isolate and understand the compounds responsible for these medicinal effects.

CONCLUSION

Detailed observations reveal that many of these non-edible fruit species possess noteworthy medicinal properties, paving the way for their potential application in plant-based therapeutics. Future research should prioritize assessing the ecological impacts of exotic species, developing effective conservation strategies to protect the region's unique flora, and scientifically validating the medicinal properties of these plants through clinical trials.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Table 1: Inventory of Non-Edible Fruit-Bearing Plants in the Bangladesh Agricultural University Botanical Garden

Sl No.	Local Name	Scientific name	Family	Cons. Status	Nativity
1.	Amur	*Aglaia cucullata* (Roxb.) Pellegr.	Meliaceae	DD	Indigenous
2.	Kakra	*Aporosa cardiosperma* (Gaertn.) Merr.	Euphorbiaceae	VU	Indigenous
3.	Agarwood	*Aquilaria malaccensis* Lam.	Thymelaeaceae	NE	Indigenous
4.	Kathali chapa	*Artabotrys hexapetalus* (L.f.) Bhandari	Annonaceae	NE	Indigenous
5.	Fish poison tree	*Barringtonia asiatica* (L.) Kurz	Lecythidaceae	LC	Exotic
6.	Moos	*Brownlowia elata* Roxb.	Malvaceae	VU	Indigenous
7.	Sultana Champa	*Calophyllum inophyllum* L.	Clusiaceae	LC	Indigenous
8.	Mayna kanta	*Catunaregam longispina* (Link) Tirveng.	Rubiaceae	NE	Indigenous
9.	Dahur/Dagor	*Cerbera odollam* Gaertn	Apocynaceae	NE	Indigenous
10.	Javanikapu	*Cleidion javanicum* Blume	Euphorbiaceae	NE	Indigenous
11.	Bowler gach	*Cordia dichotoma* G.Forst.	Boraginaceae	LC	Indigenous
12.	Naglingam	*Couroupita guianensis* Aubl.	Lecythidaceae	LC	Exotic
13.	Kalabos	*Crescentia cujete* L.	Bignoniaceae	LC	Exotic
14.	Singra	*Cynometra ramiflora* L.	Fabaceae	LC	Indigenous
15.	Tamal	*Diospyros montana* Roxb.	Ebenaceae	NE	Exotic
16.	Gilalota	*Entada rheedii* Spreng.	Fabaceae	NE	Indigenous
17.	Behala bot	*Ficus lyrata* Warb.	Moraceae	LC	Exotic
18.	Gustva/dadra	*Gustavia augusta* L.	Lecythidaceae	LC	Exotic
19.	Sundori	*Heritiera fomes* Buch-Ham.	Malvaceae	EN	Indigenous
20.	Chalmogra	*Hydnocarpus kurzii* (King) Warb.	Achariaceae	DD	Indigenous
21.	Kigelia	*Kigelia africana* (Lamk.) Benth.	Bignoniaceae	LC	Exotic
22.	Kali batna	*Lithocarpus acuminatus* (Roxb.) Rehder	Fagaceae	DD	Indigenous
23.	Boro batna	*Lithocarpus elegans* (Blume) Hatus. ex Soepadmo	Fagaceae	LC	Indigenous
24.	Roktan	*Lophopetalum wightianum* Arn.	Celastraceae	LC	Indigenous
25.	Mahua	*Madhuca longifolia* (L.) J.F.Macbr.	Sapotaceae	NE	Indigenous
26.	Pitali/Latim	*Mallotus nudiflorus* (L.) Kulju & Welzen	Euphorbiaceae	LC	Indigenous
27.	Sindur	*Mallotus philippensis* (Lam.) Müll.Arg.	Euphorbiaceae	LC	Indigenous
28.	Nageshwar	*Mesua ferrea* L.	Clusiaceae	VU	Indigenous
29.	Gandhi-gazari	*Miliusa velutina* (Dunal) Hook.f. et Thoms.	Annonaceae	LC	Indigenous
30.	Cuajilote	*Parmentiera aculeata* (Kunth)	Bignoniaceae	LC	Exotic

		Seem.			
31.	Koronj	*Pongamia pinnata* (L.) Pierre	Fabaceae	LC	Indigenous
32.	Salacia	*Salacia diandra* Thwaites	Celastraceae	NE	Indigenous
33.	Hurmoi	*Shirakiopsis indica* (Willd.) Esser	Euphorbiaceae	LC	Indigenous
34.	Udal	*Sterculia villosa* Roxb.	Malvaceae	LC	Indigenous
35.	Kuchilla	*Strychnos nux-vomica* L.	Loganiaceae	NE	Indigenous
36.	Bon narangy	*Suregada multiflora* (A. Juss.) Baill.	Euphorbiaceae	LC	Indigenous
37.	Piralu	*Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre	Rubiaceae	LC	Indigenous
38.	Bhuikakur	*Trichosanthes tricuspidata* Lour.	Cucurbitaceae	NE	Exotic

EN – Endangered; VU – Vulnerable; LC - Least Concern; DD - Data Deficient; NE - Not Evaluated

Table 2. List of Non-Edible Fruit plants with medicinal uses

Sl No.	**Scientific name**	**Medicinal uses**	**References**
1.	*Aglaia cucullata* (Roxb.) Pellegr.	Skin diseases, Dysentery, Anti-inflammatory	Das *et al.*, 2005
2.	*Aporosa cardiosperma* (Gaertn.) Merr.	Antibacterial	Abdul *et al.*, 2024
3.	*Aquilaria malaccensis* Lam.	Laxative, Carminative, Asthma	Yusuf *et al.*, 1994
4.	*Artabotrys hexapetalus* (L.f.) Bhandari	Cholera, Cardiac stimulant	Yusuf *et al.*, 1994
5.	*Barringtonia asiatica* (L.) Kurz	Stomach ache, Rheumatism	Ragasa *et al.*, 2014
6.	*Brownlowia elata* Roxb.	Skin ailments, Rheumatism, Urinary problem	Hasnat *et al.*, 2019
7.	*Calophyllum inophyllum* L.	Astringent, Rheumatism	Yusuf *et al.*, 1994
8.	*Catunaregam longispina* (Link) Tirveng.	Gastrointestinal, Hepatic problems Anti-inflammatory	Timalsina *et al.*, 2021 Kirtikar & Basu, 1999
9.	*Cerbera odollam* Gaertn	Anti-cancerous, Antifungal	Saxena *et al.*, 2023
10.	*Cleidion javanicum* Blume	Anti-infectious	Phumthum & Balslev, 2020
11.	*Cordia dichotoma* G.Forst.	Cough, Chest diseases	Yusuf *et al.*, 1994
12.	*Couroupita guianensis* Aubl.	Anti-inflammatory, Anti-ulcer, Anti-cancer	Gousia *et al.*, 2013
13.	*Crescentia cujete* L.	Anti-inflammatory, Antibacterial	Parvin *et al.*, 2015.
14.	*Cynometra ramiflora* L.	Antioxidant	Sookying *et al.*, 2013
15.	*Diospyros montana* Roxb.	Fever, Pneumonia, Diarrhea	Yusuf *et al.*, 1994
16.	*Entada rheedii* Spreng.	Anti-ulcerogenic, Antimicrobial	Okba *et al.*, 2018
17.	*Ficus lyrata* Warb.	Anti-diabetic, Anticancer, and antimicrobial	Khan, 2017
18.	*Gustavia augusta* L.	Vomiting	Rovira *et al.*, 1999

19.	*Heritiera fomes* Buch-Ham.	Anti-diabetic, Anti-oxidative	Sultana *et al.*, 2022
20.	*Hydnocarpus kurzii* (King) Warb.	Leprosy, Skin diseases, Cancer	Yusuf *et al.*, 1994
21.	*Kigelia africana* (Lamk.) Benth.	Skin disorders, Cancer, Gynecological complaints	Nabatanzi *et al.*, 2020
22.	*Lithocarpus acuminatus* (Roxb.) Rehder	Skin infection, Scabies	Singh *et al.*, 2015
23.	*Lithocarpus elegans* (Blume) Hatus. ex Soepadmo	Skin infection, Scabies	Singh *et al.*, 2015
24.	*Lophopetalum wightianum* Arn.	Antibacterial, Antifungal	Bharadwaj *et al.*, 2018
25.	*Madhuca longifolia* (L.) J.F.Macbr.	Bronchitis, Diabetes	Jodh *et al.*, 2022
26.	*Mallotus nudiflorus* (L.) Kulju & Welzen	Rheumatism	Jena *et al.*, 2024
27.	*Mallotus philippensis* (Lam.) Müll.Arg.	Anthelmintic, Bronchitis, Rheumatism	Yusuf *et al.*, 1994
28.	*Mesua ferrea* L.	Purgative, Asthma	Sharma *et al.*, 2017
29.	*Miliusa velutina* (Dunal) Hook.f. et Thoms.	Anti-inflammatory, Anti-bacterial	Phrompanya *et al.*, 2024
30.	*Parmentiera aculeata* (Kunth) Seem.	Diabetes, Asthma, Diarrhea	Santiago Ruiz *et al.*, 2021
31.	*Pongamia pinnata* (L.) Pierre	Skin diseases, Piles	Al Muqarrabun *et al.*, 2013
32.	*Salacia diandra* Thwaites	Diabetes	Karunaratne, 2013
33.	*Shirakiopsis indica* (Willd.) Esser	Gastritis	Mokmued *et al.*, 2021
34.	*Sterculia villosa* Roxb.	Diuretic, Urinary problem, Rheumatism	Yusuf *et al.*, 1994
35.	*Strychnos nux-vomica* L.	Diabetes	Bhati *et al.*, 2012
36.	*Suregada multiflora* (A. Juss.) Baill.	Sore, Stomach troubles	Yusuf *et al.*, 1994
37.	*Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre	Antidiarrheal, Antimicrobial, Anti-inflammatory, Antidiabetic	Kalita *et al.*, 2023
38.	*Trichosanthes tricuspidata* Lour.	Anti-Inflammatory	Ahuja *et al.*, 2019

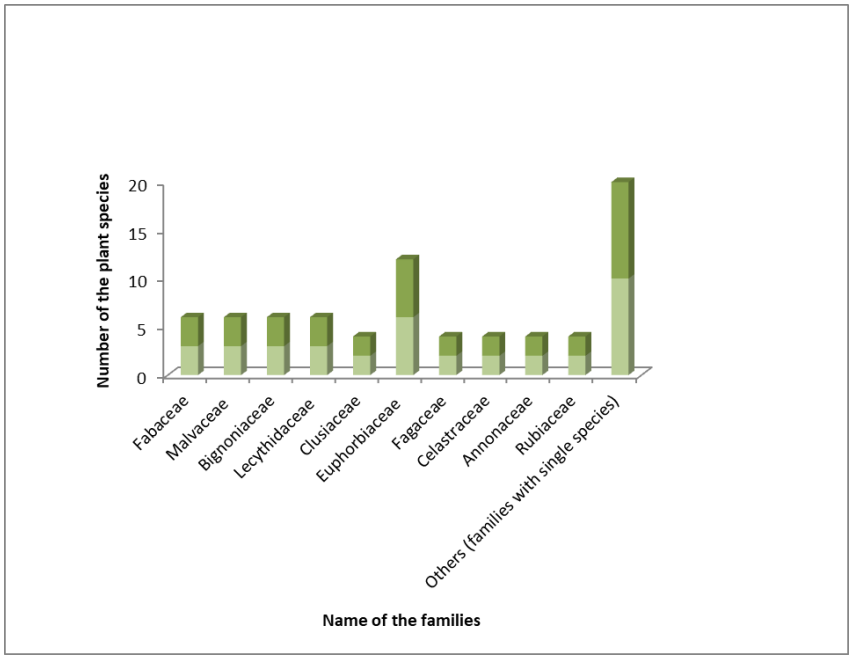

Figure 1(a): Family wise distribution of selected non-edible fruit plant species in BAUBG.

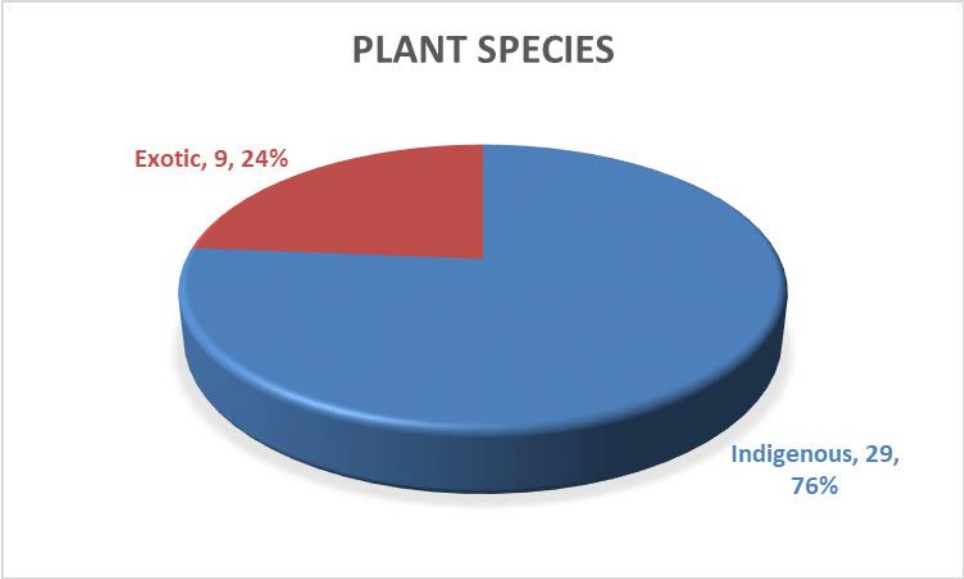

Figure 1(b): Indigenous vs. Exotic trees in BAUBG

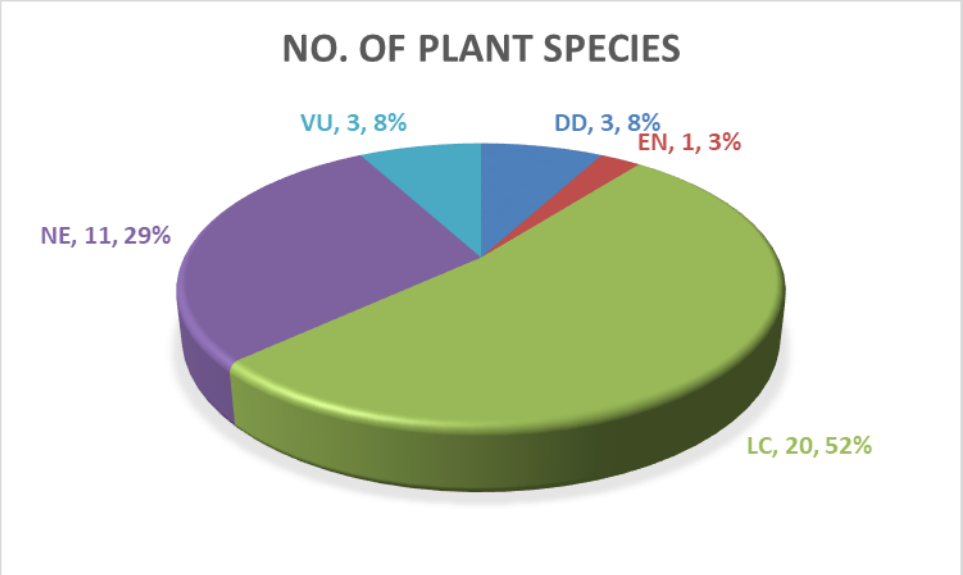

Figure 1(c): IUCN red list categories of the plant species where, EN– Endangered; VU– Vulnerable; LC- Least Concern; DD- Data Deficient; NE- Not Evaluated

Table 3: Diseases grouped by major diseases categories

Category	**Common diseases/Medical terms**	**No. of species used**
Cancerous	Cancer	5
Dermatological	Skin diseases, Scabies, Leprosy	9
Gastrointestinal	Stomach disorders, Stomach ulcer, Appetite, Diarrhea, Cholera, Acidity, Vomiting, Dysentery Gastric troubles, Carminative, Astringent, purgative, Laxative	15
Helminthiasis and Diabetes	Anthelmintic, Diabetes	10
Infectious	Malarial fever, Viral fever, Bacterial and Fungal diseases	9
Inflammation and pain	Inflammation, Rheumatic pain	11
Respiratory	Cough, respiratory disorders, Asthma, Bronchitis, Pneumonia	8
Sexual and Anti-oxidative	Gynecological disorders, anti-oxidative	3
Urogenital	Urinary problems, Diuretic, diaphoretic, Piles	3

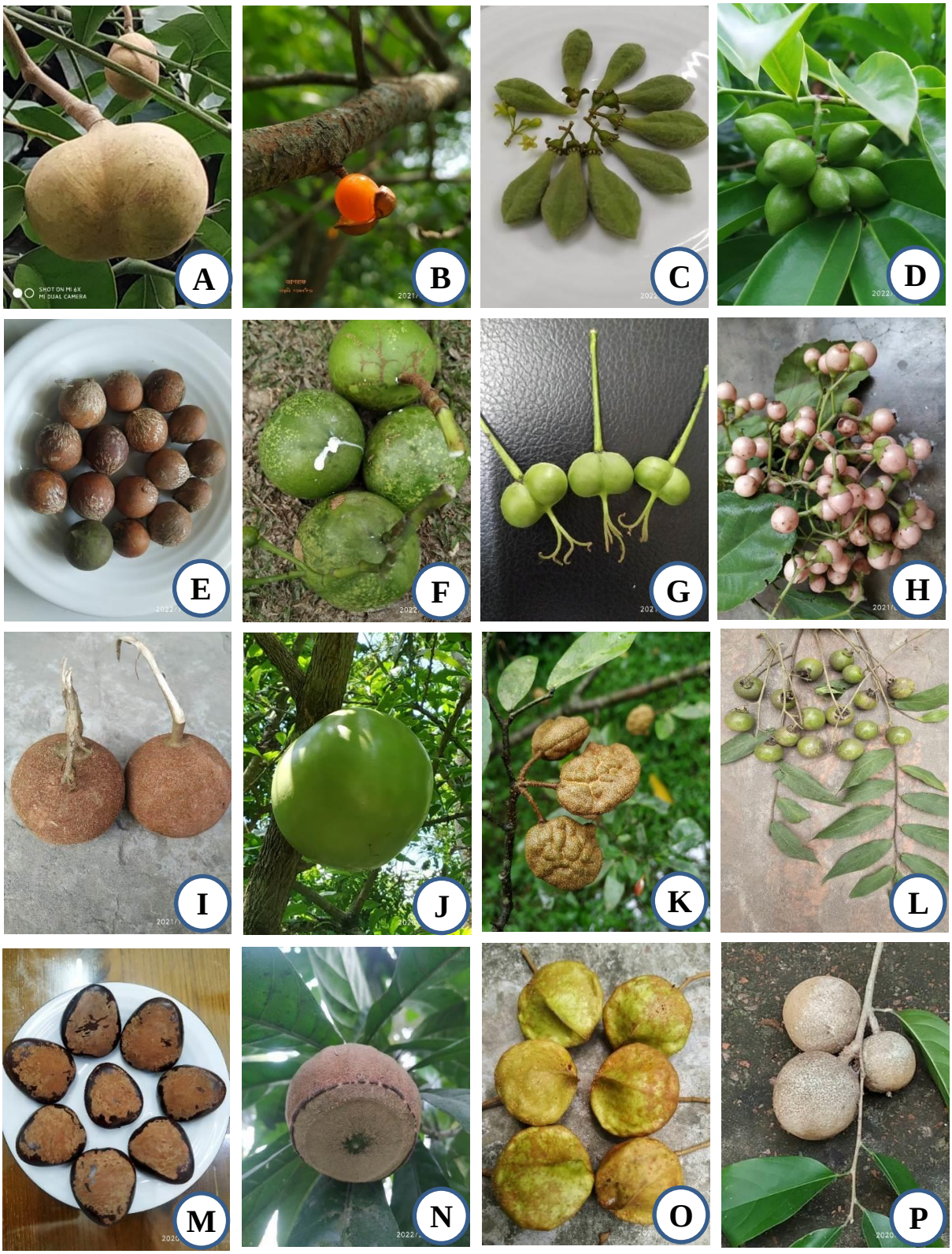

Plate-I: (A) *Aglaia cucullata* **(B)** *Aporosa cardiosperma* **(C)** *Aquilaria malaccensis* **(D)** *Artabotrys hexapetalus* **(E)** *Calophyllum inophyllum* **(F)** *Cerbera odollum* **(G)** *Cleidon javanicum* **(H)** *Cordia dichotoma* **(I)** *Couroupita guianensis* **(J)** *Crescentia cujete* **(K)** *Cynometra ramiflora* **(L)** *Diospyros montana* **(M)** *Entada rheedii* **(N)** *Gustavia augusta* **(O)** *Heritiera fomes* **(P)** *Hydnocarpus kurzii*

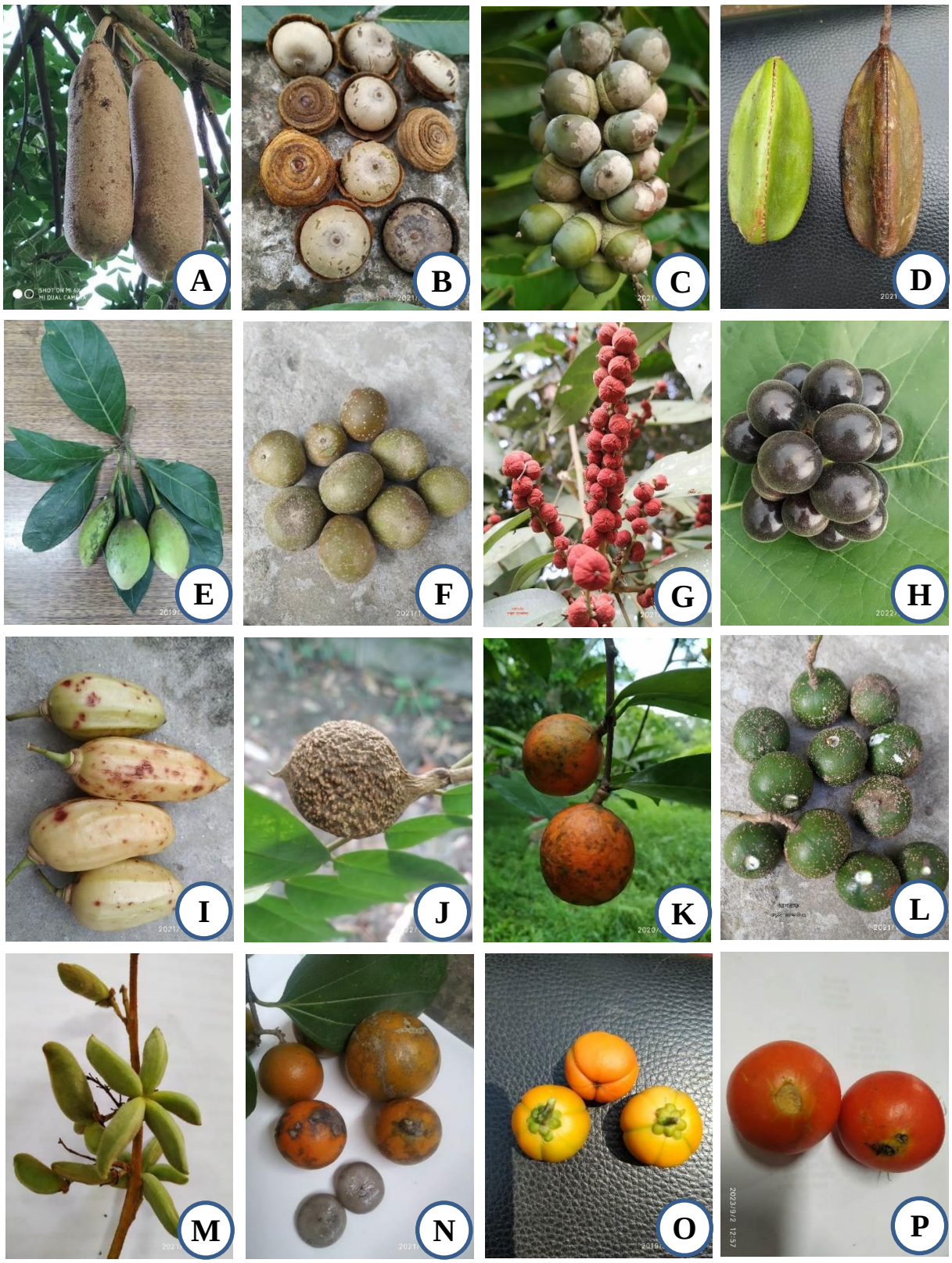

Plate-II: (A) *Kigelia africana* **(B)** *Lithocarpus elegans* **(C)** *Lithocarpus acuminatus* **(D)** *Lophopetalum wightianum* **(E)** *Madhuca longifolia* **(F)** *Mallotus nudiflorus* **(G)** *Mallotus philippensis* **(H)** *Miliusa velutina* **(I)** *Parmentiera aculeata* **(J)** *Pongamia pinnata* **(K)** *Salacia diandra* **(L)** *Shirakiopsis indica* **`(M)** *Sterculia villosa* **(N)** *Strychnos nux-vomica* **(O)** *Suregada multiflora* **(P)** *Trichosanthes tricuspidata*