

Monograph on *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet

Prepared by:

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LALI

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Taxonomy of Angiosperm & Biosystematics Laboratory,
Department of Botany

University of North Bengal

Raja Rammohunpur – 734013
Darjeeling, West Bengal

21st March, 2022

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INTRODUCTION:

Aglaia spectabilis (Miq.) S.S.Jain & S.Bennet (Cape York Cedar or Pacific Maple) is a huge, fast growing gigantic evergreen forested tree with drooping branches belong to the Meliaceae Juss. and its native range of origin is extended from Tropical forests of China (S. & SE. Yunnan) to Tropical Asia and N. Queensland. It occurs mainly in subtropical rain forests at an altitude upto 1200 m (Fig. 1). It is essentially a tree of moist warm climates. *Aglaia* is a tree widely distributed in the tropical rainforests of Southeast Asia, Indonesia, and Malaysia. This genus *Aglaia* belongs to Meliaceae family. The chemical composition of the species is considered as a remedy for various ailments like dysentery, skin diseases, leprosy, inflammation, leukoderma, and abdominal pain. It is also may have beneficial effects as cooling agents and is useful in burning sensation of the body and painful micturition. The plant is a large tree with bright red and good quality wood. *Aglaia spectabilis* is found from the Santa Cruz Islands in the southwest Pacific to Queensland (Australia), Southeast Asia, Yunnan and the Indian subcontinent. Its wood is commercially exploited as timber, but otherwise is of poor quality with limited use. The fruits are eaten, and also used in folk medicine. The seeds are large in comparison to other plants, and a major source of dispersal of the species is by birds as hornbills eating the fruit, flying away from the tree and regurgitating the seeds to other areas.

The Genus *Aglaia* Lour. is a large genus having 120 accepted species arborescent species, presents more taxonomic problems in species delimitation than any other genus of the family. The native distribution ranges of the species are from Tropical & Subtropical Asia to W. Pacific and mainly distributed in the tropical rainforests of southeast Asia (Sri Lanka, India, Burma, South China and Taiwan, Vietnam, Malaysia, Indonesia, Philippines, New Guinea), Solomon Islands, Vanuatu (New Hebrides), New Caledonia, Australia (Queensland, Northern Territory and Western Australia), Fiji up to the island of Samoa in Polynesia and north to the Marianne Islands (Saipan, Roti and Guam), and the Caroline Islands (Palau and Ponape) in Micronesia (Pannell, 2007). In India, 23 species of *Aglaia* are recorded from different bio-geographical zones.

Friedrich Anton Wilhelm Miquel was a Dutch botanist and renowned plant taxonomist who first time describe this species as *Amoora spectabilis* Miq., in the journal of *Annales Musei Botanici Lugduno-Batavi*, Amsterdam in 4 volume of page number 37 in the year of 18. Latter on various author publish or shifted this species in various genera under *Amoora*, *Aglaia*, *Aphanamixis* and *Sphaerosacme*. Finally S.S. Jain and Sigamony Stephen Richard Bennet, two famous Indian plant taxonomist was published the species as *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet in Indian Journal of Forestry, Dehra Dun in volume 9, no. 3 of page number 271 in the year of 1987. Presently, *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is an accepted name along with valid 12 synonyms (Pennell 2007).

The tree is nicely grown in subtropical and tropical rainy climate and can also well adopted in moist localities of terai, duars and hilly slopes of Himalaya (Fig. 2). *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is the handsome tree with beautiful canopy and mostly growing in primary and secondary dense forests. It is essentially a component of the moist warm climates and they can grow in temperature varies from 4 to 45 °C with average rainfall from 500 to 3000 mm. The species is nicely growing in moist sandy soil upto 1500 m of Himalaya. It is also introduced in various counties of Asia and Islands due to their red wood, canopy and as very soil binder species.

Protologue

Aglaia spectabilis (Miq.) S.S. Jain & Bennet, Indian J. For. 9: 271. 1986; Grierson & Long, Fl. Bhutan 2: 35. 1991. *Amoora spectabilis* Miq., Ann. Mus. Bot. Lugduno-Batavum 4: 37. 1868; Hiern in Hook. f., Fl. Brit. Ind. 1: 561. 1875. *A. wallichii* King, J. Asiat. Soc. Bengal Pt. 2, Nat. Hist. 64: 56. 1895. *Aglaia hiemii* Viswanathan & K. Ramachandran, Bull. Bot. Surv. Ind. 24: 212. 1983, *non* King 1895 nec Koord. & Valetton ex Koord. 1898. *Aphanamixis wallichii* (King) Haridasan & R.R. Rao, Forest Fl. Meghalaya 1: 206. 1985.

SCIENTIFIC CLASSIFICATION (APG IV, 2016)

Kingdom: Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Mesangiospermae

Clade: Eudicots

Clade: Rosids

Orders: Sapindales

Family: Meliaceae

Genus: *Aglaia*

Species: *A. spectabilis*

(Miq.) S.S. Jain & S. Bennet

TAXONOMY

Synonyms: (12 Accepted; POWO, 2022)

Aglaia dasyclada F.C.How & T.C.Chen

Aglaia gigantea (Pierre) Pellegr.

Aglaia hiernii M.V.Viswan. & K.Ramach.

Aglaia ridleii (King) Pannell

Amoora dasyclada (F.C.How & T.C.Chen) C.Y.Wu

Amoora gigantea Pierre

Amoora ridleii King

Amoora spectabilis Miq.

Amoora stellatosquamosa C.Y.Wu & H.Li

Amoora wallichii King

Aphanamixis wallichii (King) Harid. & R.R.Rao

Sphaerosacme spectabilis Royle

COMMON NAMES: Lali (*Bengali*) Amari (*Assamese*); Pathi (*Bingni/Nishi language, Arunachal Pradesh*); Goji nui. Goji nep (*Vietnam*); Surian batu, Bekak (*Malaysia*); Lantupak (*Sabah*); Nuk kuk (*Laos*); Mokken (*West Irian*); Tasua bailek (*Thailand*); Mokken (*Indonesia*)

DISTRIBUTION:

The native range of distribution of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is reported as native species from the Tropical to the sub-temperate forests of India and distributed to Himalayas to Andaman Island, Assam, Bangladesh, Bismarck Archipelago, Borneo, Cambodia, China South-Central, East Himalaya, India, Bhutan, Nepal, Laos, Lesser Sunda Island, Malaya, Myanmar, New Guinea, Philippines, Queensland, Santa Cruz Island., Solomon Island, Sulawesi, Sumatera, Thailand, Vietnam (Fig. 3). In China it is growing in dense forest in S and SE Yunnan (Xichou, Xishuangbanna) province at an altitude of 900-1800 m. (Grierson & Long, 1991; e-flora, 2022).

In Flora of Bhutan, D. G. Long and S. J. Rae reported this species from districts like Samchi, Phuntsholing, Sarbhang, Gaylegphug, Deothang, Tongsa, Mongar Thashigang of Bhutan Himalaya and Tista and Rangit valley of Darjeeling and Sikkim Himalaya. The species is well adopted, growing nicely in sub-tropical and tropical forest of terai and hilly slopes of Himalaya, and available between the 50-1200 meter of altitudes. This species is also introduced in various tropical and subtropical forests in different Asian and Australian countries for its good quality woods and fast growing trees. It was introduced as popular fast growing trees in various islands of south East Asian countries.

Indian territories in Plains and Low hills of other hills and Himalayan tract of Eastern and NE India (North Bengal, Sikkim, Assam, Tripura, Meghalaya) *Aglaia*

spectabilis (Miq.) S.S. Jain & S. Bennet is found mostly in moist tropical forest areas and also planted in similar forest of forests of Orissa and the Andaman & Nicobar Islands.

BIOPHYSICAL LIMITS: *Aglaia spectabilis* (Miq.) S.S. Jain & S. Bennet is easily grown in sub-tropical and tropical climate with mean temperature of 15-45°C with mean annual rainfall 500-3000 mm. It is grown in plains, undulating sandy soils of Terai, duars and lower hilly slopes at an altitude upto 1500 m in Himalayas. For the better growth this species prefers well-drained, deep, fertile soils with humus, bhabar soil with small sand, humus and bolder of terai and duars for their luxurious growth (Fig. 1).

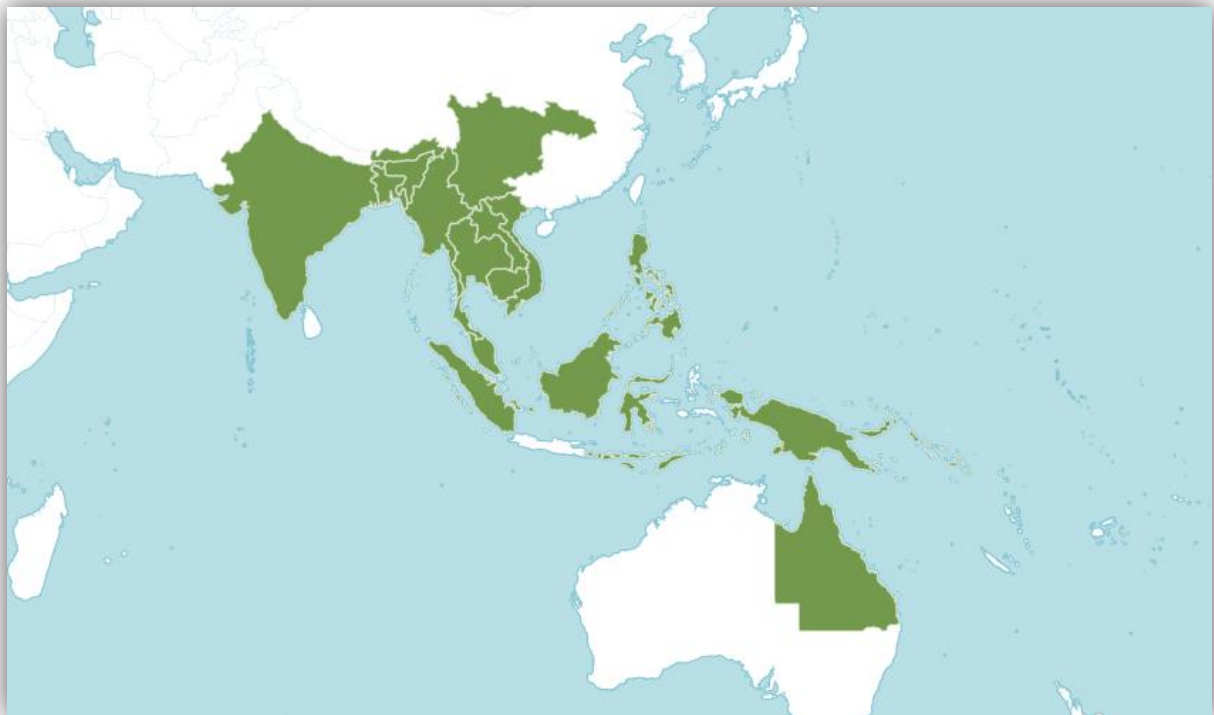


Figure 1: Distribution map of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet (Green=Native Range) [POWO 2022]

HABITATS:

Aglaia spectabilis (Miq.) S.S.Jain & S.Bennet is widely popular tree for afforestation program and due good upper canopy size it is a component of secondary forest, riverine forest, primary forest, alluvial flats, coastal swamp and along the seashore.

They grow on sandy clay, sand, loam, sandstone, alluvial, coral; at elevations from sea level up to 650 metres in Thailand.

Aglaia spectabilis (Miq.) S.S. Jain & S. Bennet grows in gallery forest, rainforests, coastal riverine, deciduous mesophyll vine forests, occurring on red soils resulting from jumble of basic rocks and ferruginous sandstone in Australia. In Southeast Asia and China it grows in dense forests, abundant on red soils, often cultivated as a fruit or shade tree. The species occurs from sea level to 100 m altitude.

In the Plains and Low hills of other hills and Himalayan tract of Eastern and NE India (West Bengal, Sikkim, Assam, Tripura and Meghalaya) *Aglaia spectabilis* (Miq.) S.S. Jain & S. Bennet is found mostly in moist tropical forest areas and also planted in similar forest of forests of Orissa and the Andaman & Nicobar Islands. In India, the climate of the natural habitat comprises rainfall from 500–3000 mm per year and temperatures range from about 4–45°C and can tolerate some frosts.

In Arunachal Pradesh, North-Eastern India has tropical semi-evergreen rainforest where *A. spectabilis* is an emergent trees, height may reach up to even 40 m tall. Fruit of the species appear from May to August, peaking in June and July. Investigating the hypothesis of Kitamura et al. that seed size influences, which frugivores eat fruit and how dispersal happens, various trees, were watched. The *A. spectabilis* seeds were eaten by various birds and small mammals.

Different village margin and forest patches of duars and terai is surrounded by a forest dominated by *A. spectabilis* is one of the second rank of dominant trees.

The population size of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is found significant component in different dense forests in the districts of Kalimpong, Jalpaiguri and Darjeeling of West Bengal and Sikkim in Subtropical, Tropical and sub-temperate climates. The infrequent populations of the species are observing in various moist forests of terai and duars of North Bengal. *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is common in valley forests, open places, especially on river banks at an elevation of 50 - 1,500 meters of Himalaya (Fig. 2, 3).

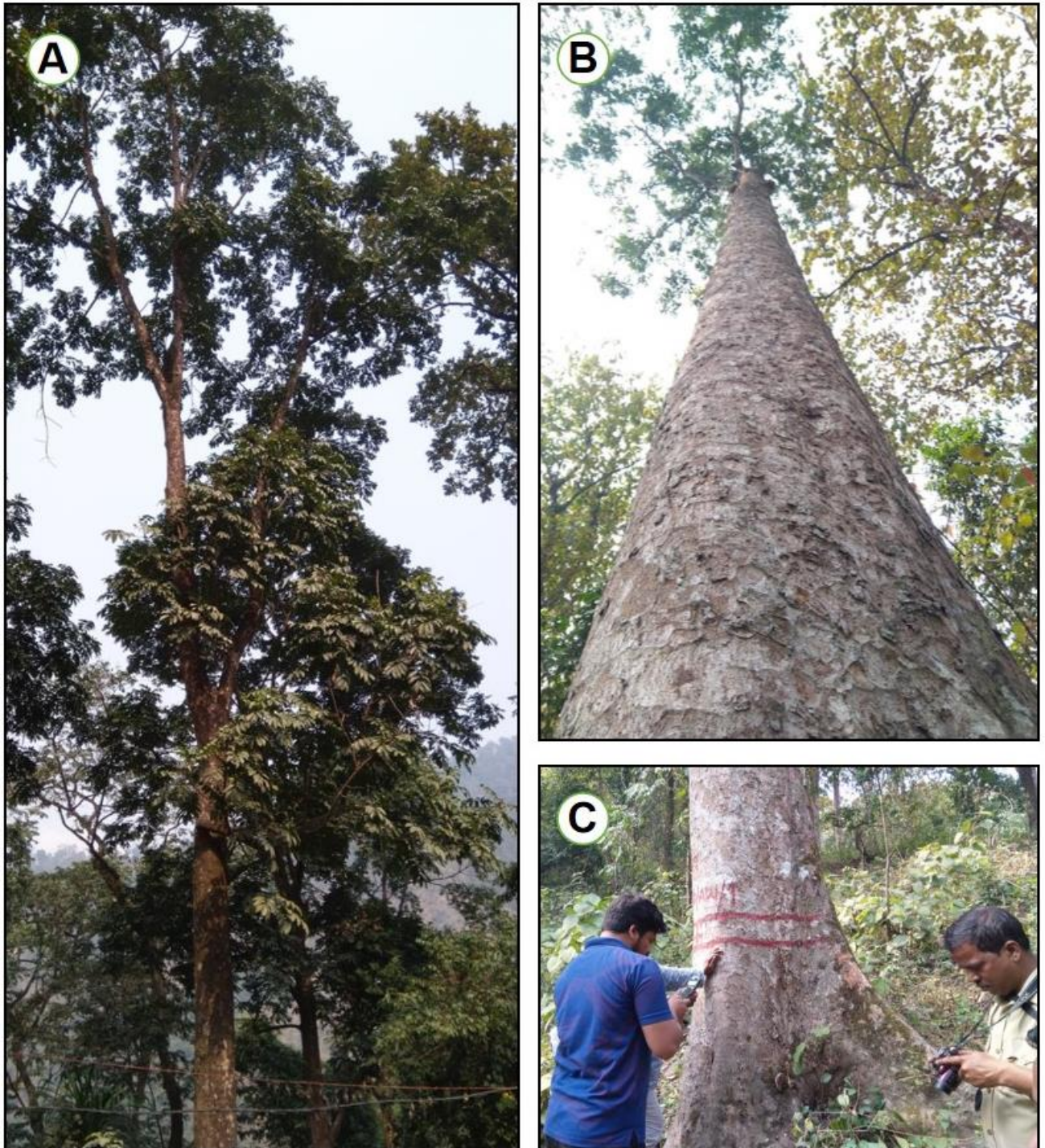


Figure 2: *Aglaia spectabilis*. A, tree trunk from side; B, tree trunk from below; C, tree trunk base



Figure 3: *Aglaia spectabilis*. A, tree canopy association; B, close up the canopy.

TAXONOMIC DESCRIPTION:**Macroscopic Characters: (Figs. 3-5)**

Habit: Evergreen, large sized, grows up to 25 m high, young parts with milky sap; bark grey, nearly smooth; young shoots and inflorescence covered with rusty-brown fimbriated scales and stellate hairs, buttressed. **Stem:** Main trunk 18-25 m tall, Erect, terete, straight, girth ranges 2-2.7 m d.b.h. for mature trees; bark 3-5 mm thick, brownish, creamy yellow beneath, exfoliating in small flakes at base, fibrous; canopy mostly round, not much spreading; sap-wood reddish-white. Twigs glabrescent, inconspicuously lenticellate with small lenticels. **Bark:** Brownish, not cracked, irregularly flaking in older trees. **Root** buttresses present, root network quite elaborate, nice soil binder. **Leaves:** Leaves 30 - 85 cm long; rachis greyish or rusty, with lepidote scales and stellate hairs. Leaflets 9 - 19, rarely 3 - 7, close to panicles, opposite or alternate, elliptic or ovate-oblong, rounded or slightly cuneate at base, entire along margins, acuminate at apex, 15 - 25(-30) x 7 - 9(-15) cm, almost glabrous except on nerves beneath when mature, subcoriaceous; secondary nerves 12 - 20 on each side; petiolules 1 - 2 cm long, that of the odd leaflet the longest, to 3 cm long. **Inflorescence:** Thyrses axillary, 20-25 cm long, stellately lepidote, branches thick and often pendulous. **Flowers** about 2-7 x 2-6 mm. Calyx lobes rounded at the apex.. Outer surface of the calyx lobes densely clothed in stellate hairs or scales, petals partly clothed. Male panicles much-branched and many-flowered, 30 - 45 cm long; female panicles 7 - 10 cm long. Male flowers smaller than female flowers. Calyx minute, obtusely 3-lobed, lepidote-stellate. Petals 3, free, orbicular, concave, ca 2 mm long, tomentose. Stamens about nine per flower, staminal tube urceolate, glabrous; mouth 8 10-lobed or toothed; anthers usually 8, rarely 10, slightly exserted. Ovary in female flowers depressed, pyramidal, prominently 3-angled, yellow-brown-tomentose, 3 - 4-locular; style short or absent; stigma 3 - 4-lobed, large, purple. Pistillode in male flowers similar but slender and with depressed, tawny-pubescent ovary and thick, fleshy, 3-grooved stigma. Capsules subglobose or broadly pyriform, 3 - 5 x 3 - 4 cm, yellowish-orange, tomentose, 2 - 3-seeded, Aril or sarcotesta completely enclosing the seed.

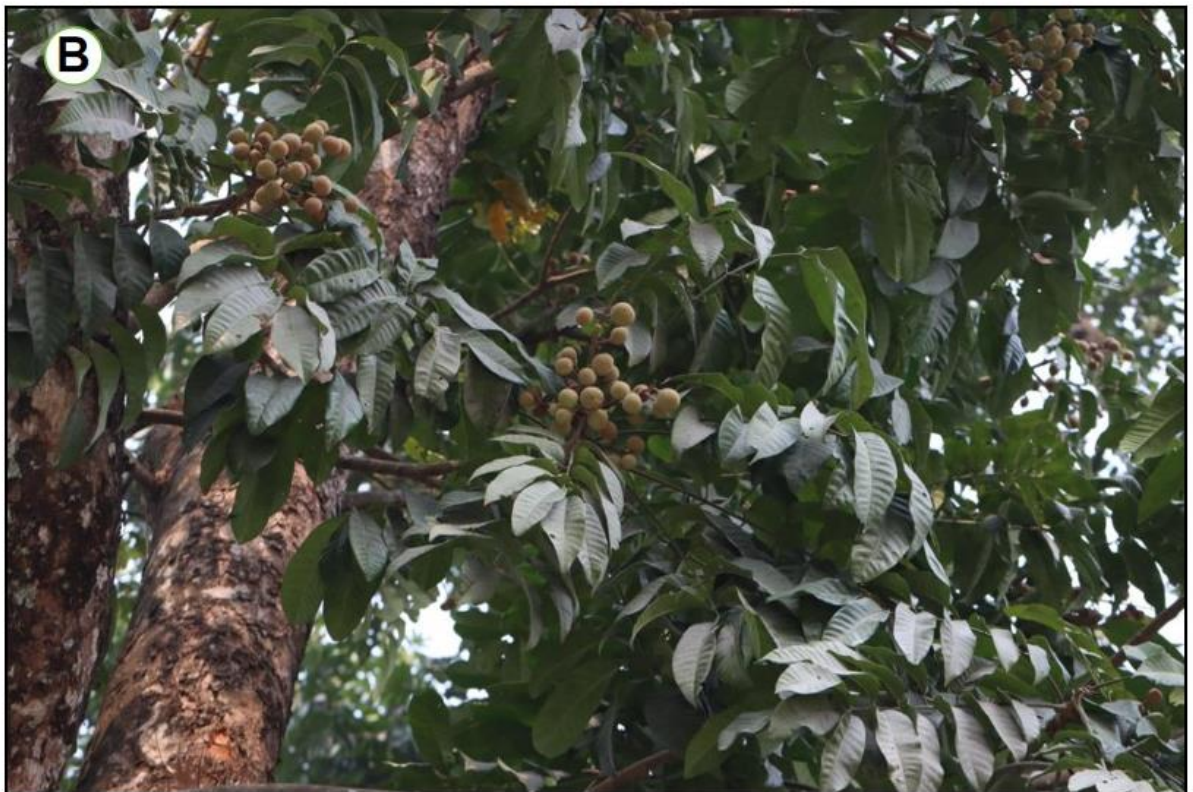
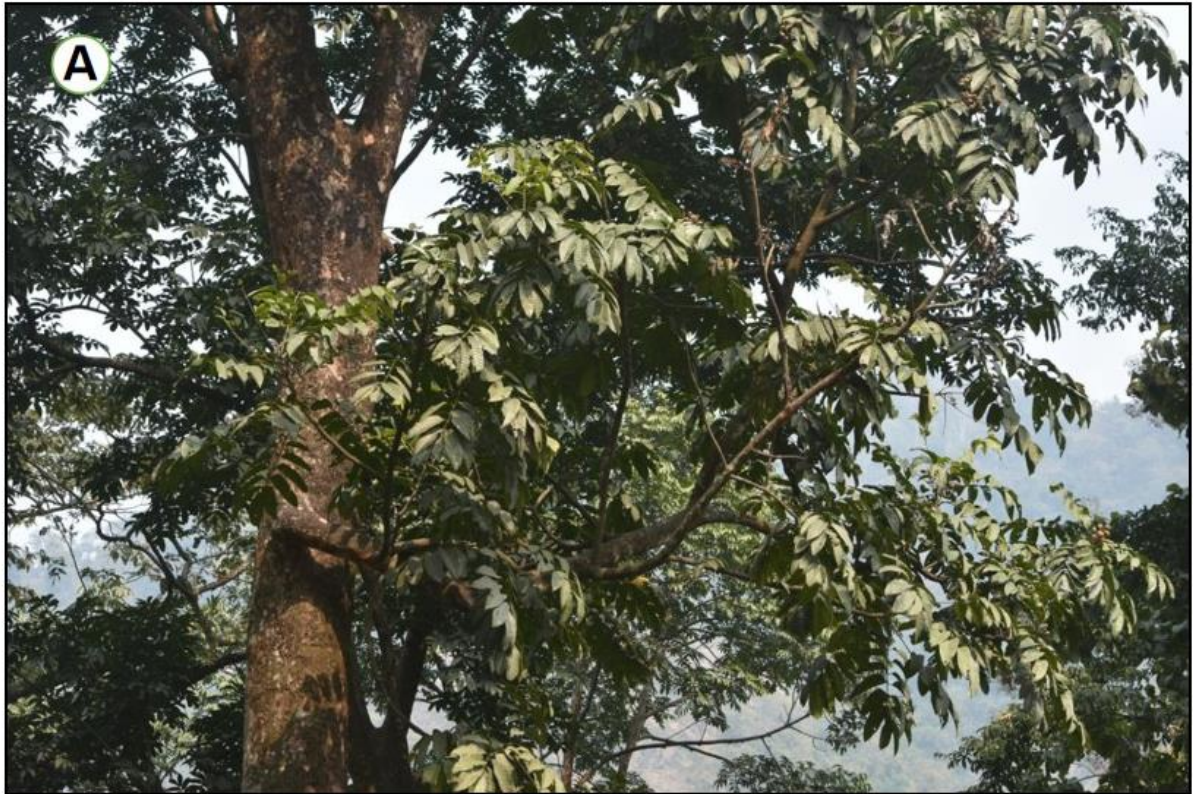


Figure 4: *Aglaia spectabilis*. A, branches and leaves; B, infructescence

Floral Formula: Female Flower: $\oplus \ominus K_{(3)} C_{(3)} \underline{A}_{(0)} \underline{G}_{(3)}$

Male Flower: $\oplus \ominus K_{(3)} C_{(3)} \underline{A}_{(8-10)} \underline{G}_0$



Figure 5: *Aglaia spectabilis*. A, a fruit; B, seed

Microscopic Characters (Fig. 6):

Leaf: Young and matured both types of leaflets are used for this study. Non-glandular trichomes are present only in abaxial surface of this plant. Both glandular and non-glandular trichomes are found in the present study. Glandular trichomes are peltate type (Plate 6C), whereas non-glandular trichomes are of two types in the recent

work; stellate type and unbranched, multicellular type trichome. Three types non glandular, stellate trichomes are found:

- Simple, sessile, porrect, stellate type (Plate 6G)
- Sessile, fused, multicellular, non- glandular stellate trichome (Plate 6H)
- Multiangulate, lepidote stellate trichome (Plate 6I)

Leaflets are amphistomatic. Stomata are cyclocytic type. Stomatal pore size is $40.89 \pm 5.74 \mu\text{m}^2$, Guard cell kidney shaped, length $24.28 \pm 4.38 \mu\text{m}$, Breadth $15.4 \pm 2.88 \mu\text{m}$, size $373.84 \pm 12.59 \mu\text{m}^2$.

Adaxial epidermal cells are polygonal in shape; cell walls are in straight pattern. Abaxial cells are axially rectangular shaped, and cell wall pattern is straight type.

Petiole: Petiole is glabrous. Cells are mostly rectangular and few are square shaped, anticlinal wall straight pattern. A linear series of prismatic crystals are seen in petiolar parenchymatous cells.

Branchlets: Terete, glabrous.

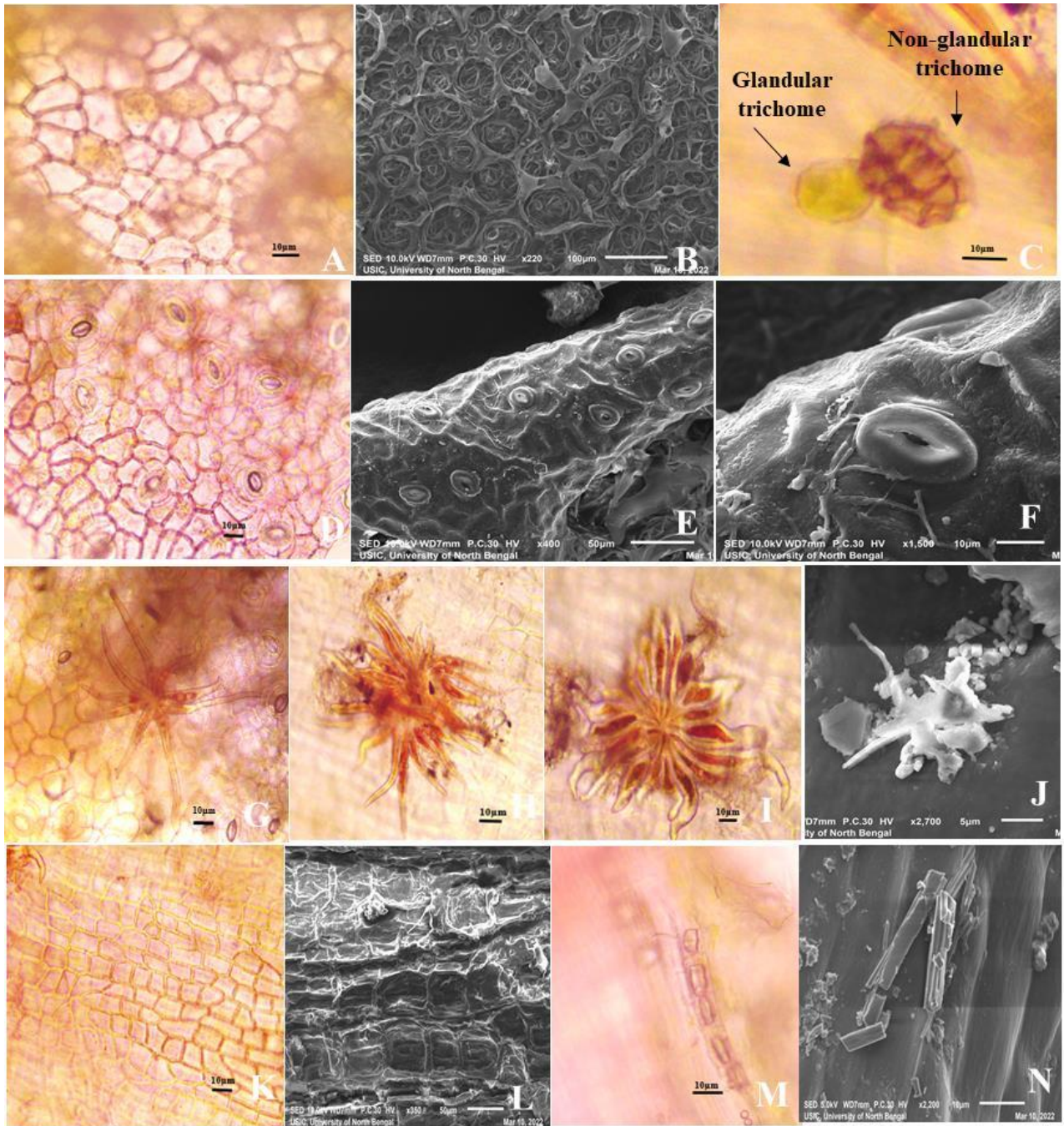


Fig. 6: Plate 1. LM & SEM images of *Aglaia spectabilis* leaf, petiole. A. & B. Epidermal cell pattern, **C.** Non-glandular, unbranched, multicellular trichome and glandular peltate trichome of abaxial surface, **D. & E.** Cyclocytic stomata, **F.** Enlarge view of Stomata, **G.** Simple, sessile, porrect stellate trichome of abaxial surface, **H.** Sessile, fused, multicellular, non glandular stellate trichome in abaxial surface, **I.** Multiangulate, lepidote stellate trichome, **J.** SEM of simple stellate trichome, **K. & L.** Epidermal cells of petiole, **M.** Linear arrangement of prismatic crystals in petiolar cells., **N.** SEM of prismatic crystals.

Anatomical Features:

Fresh plant parts like stem, mature roots and leaf petioles of *Aglaia spectabilis* were dissected, double stained and mounted on slides. The prepared slides were studied under trinocular microscope and necessary photograph taken. The anatomical features were described in detailed below (Fig. 7).

The T.S. of Root show following characters:

Epidermis: It is the outermost single layer with several unicellular root hairs. It consists of thin walled, compactly arranged living parenchymatous cells.

Cortex: It is thin walled, multi layered region made from parenchymatous cells. they usually have intercellular spaces. The cortex is responsible for transportation of *water and salts* from the root hairs to the center of the root. Resin duct present.

Endodermis: It is the innermost layer of cortex and covers the stele. It composed of barrel shaped parenchymatous cells. These cells allow radial diffusion of water and minerals through the endodermis.

Vascular bundles: Several vascular bundle arranged in ring. Xylem and phloem bundles are separated from each other by parenchymatous cells.

Xylem is exarch: protoxylem towards the periphery and metaxylem towards the centre. Phloem forms oval masses beneath the pericycle, alternating with xylem bundles.

Pith: Centrally located. It consists of thin walled, polygonal parenchyma cells with intercellular spaces. It helps in storage of food materials.

The T.S. of Stem show following characters:

Epidermis: Epidermis is the outermost and the single layer of cells. Epidermis is without intercellular spaces, cuticle present.

Cortex: This zone lies just beneath the hypodermis. The cells of this zone are parenchymatous and multi-layered.

Endodermis: This zone lies beneath the cortex and is made up of a single layer of barrel-shaped cells. It is the innermost layer of the cortex.

Medullary rays: It lies in between the vascular bundles and is made up of parenchymatous cells that constitute medullary rays.

Vascular bundles: The vascular bundles are present in a ring. It is made up of xylem, phloem, and cambium.

Pith: The pith holds the large central part of the stem.

The T.S. of Leaf petiole show following characters:

Epidermis: It is single layered and includes elongated compact and barrel- shaped cells. Stomata may be present in it. In upper epidermis cuticle present.

Hypodermis: It is usually many layered, made up of collenchymatous cells.

Ground Tissue: Below the hypodermis there is present a uniform, parenchymatous tissue with intercellular spaces; endodermis and pericycle are not differentiated. The cell can have chloroplasts.

Vascular Bundles: Vascular bundle is similar to that of leaf in structure and orientation, that is, there is present xylem towards the upper or inner side and phloem on the lower or outer side. There is a great variation in the distribution of the vascular tissues within the petiole.

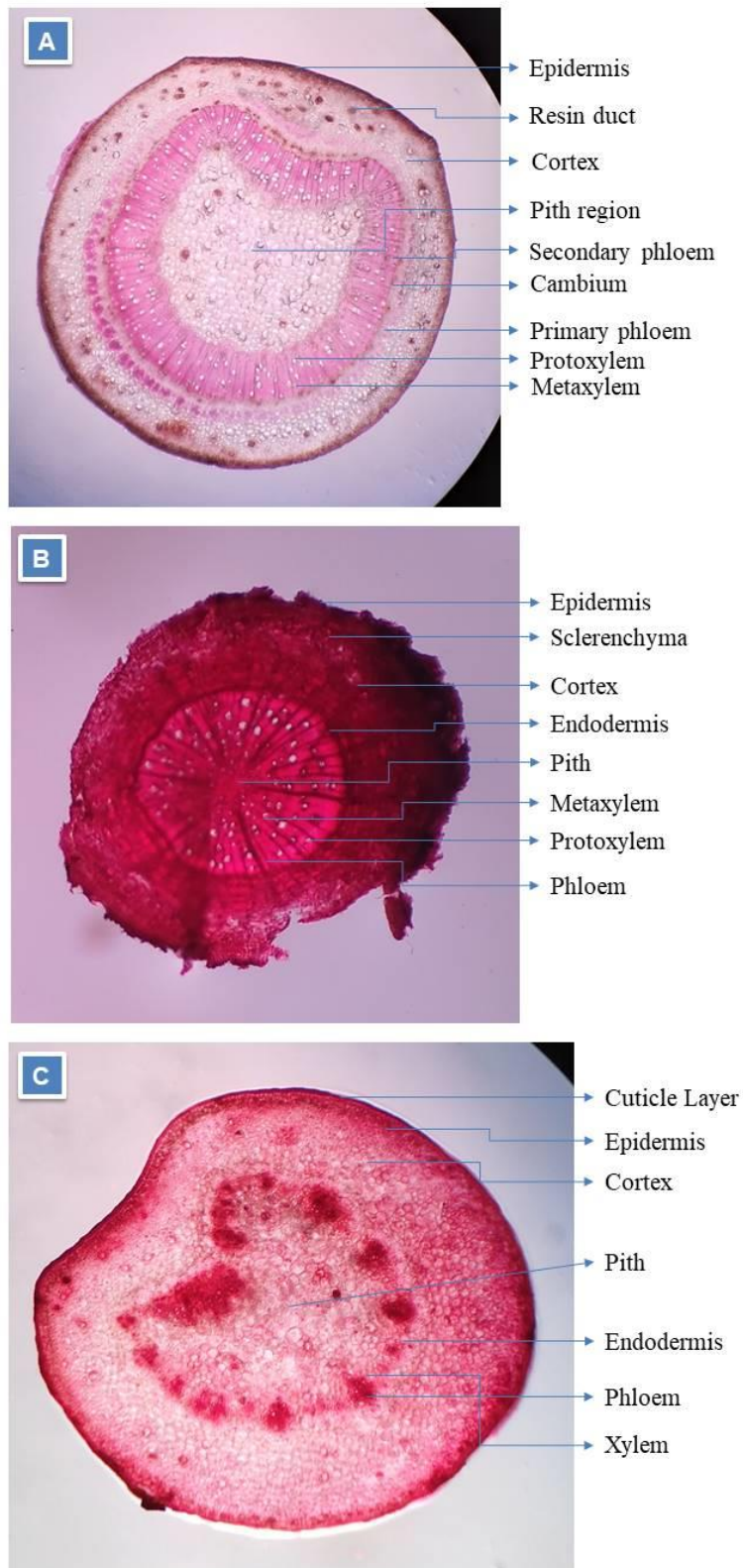


Fig. 7: *Aglaia spectabilis*. A, Anatomy of stem; B, anatomy of root; C, anatomy of petiole.

ANATOMIC DESCRIPTION OF WOOD

Wood diffusely porous and reddish titch deposits in heartwood vessels. Tangential diameter of vessel lumina varies from 100 to 200 μm . Vessel-ray pits similar to inter-vessel pits and plates are simply perforation. Inter-vessel pits small, 7 μm or less. Ray width varies from 1 to 3 cells.

FLOWERING AND FRUITING:

Aglaia spectabilis (Miq.) S.S.Jain & S. Bennet is an evergreen tree with large canopy. The species remain sterile with dense healthy leaves during April to June. Fertile stage observed with the flowering that starts blooming from first week of June in pendulous dense terminal or axillary thyrses. The trees are in full bloom with huge green dense canopy till the month of July. From November to March each branches bears dry clusters of hard covered fruits and fruits dehiscing through slits and reddish- brown seeds are dispersed.

SPECIMENS EXAMINED: North Bengal plains, Terai and Duars are good habitat for the growth of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet and habitat extended to the hilly slops of Himalaya of Darjeeling and Kalimpong districts upto 1200 m in roadside and in deep forest. For details study about the species, out of several trees of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet three mature individual were studied from lower hill slops of Darjeeling Himalaya (Sevok Range of Mahananda Wildlife Sanctuary). Details of sample coordinates, altitude, and locations for the studied specimens were as follows:

SITE 1 (Hill Slopes): Coordinates-26°57'38.30"& 88°26'00.02"; Altitude 258 M; CPT-1, Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sanctuary. Darjeeling, WB.

SITE 2 (Hill Slopes): Coordinates-26°57'32.22"& 88°26'06.16"; Altitude 239 M; CPT-1, Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sanctuary. Darjeeling, WB.

SITE 3 (Hill Slopes): Coordinates- 26°56'28.10" & 88°26'29.30"; Altitude 227 M; CPT-1, Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sanctuary, Darjeeling, WB.

ECOLOGICAL IMPORTANCE: In natural forest *Aglaia spectabilis* (Miq.) S.S. Jain & S. Bennet is a significant component in primary as well as secondary Low-Montane Evergreen Broadleaf Rain and dry Forest in plains and lower hilly region of Himalaya and other parts of India. Very fast growing pioneer species preferring moist areas in all types of forest. Often growing together with *Anthocephalus chinensis*, *Mallotus* spp. can be planted as a framework species for restoring forest ecosystems. The species grown faster in plains and moist riverine and riverine forests along the rivers and streams bank and occurs up to 1500 ft. altitude in different part of the world and prefers average range of 500–3000 mm annual rainfall. The seeds are well germinated in shade but also well capable of regeneration in full sunlight. For the growth of the species, fertile soils with humus are preferable. The root network system of the species is quite elaborate, strong that can hold the trees in loose, and sand wet soils even in hill erect slops. It is a very good to control soil erosion. This species is not showing any allelopathic effects on other associated plant species. The species is growing nicely along the several other tree species and allows epiphytes and climbers on it along with dense floor cover.

Association: In the Lower hills of Darjeeling Himalaya and Terai-Duars *Aglaia spectabilis* grows with many other associated species and that includes *Anthocephalus chinensis*, *Melia dubia*, *Gmelina arborea*, *Chukrassia tabularis* var. *velutina*, *Cassia siamea*, *Pterospermum lanceaefolium*, *Mecaranga denticulata*, *M. peltata*, *Clerodenreum japonicum*, *C. infortunatum*, *Albizia procera*, *Artocarpus chama*, *Toona ciliata*, *Magnolia champaca*, *Pterygota alata*, *Chukrasia tabularis*, *Albizia procera*, *Bombax ceiba*, *B. insignis*, *Oplishmenus compositus*, *Dalbergia stipulacea*, *Maesa indica*, *Leea indica*, *Leea asiatica*, *Piper peepuloides*, *Dioscorea prazeri*, *Tebernemontana divericata*, *Coffea benghalensis*, *Bauhunia valli*, *Mellotus philipensis*, *Tunbergia grandiflora*, *Smilex zeylanika*, *Panicum repens*, *Tectona grandis*, *Pandanus nepalensis*, *Zanthoxylum armatum*, etc.

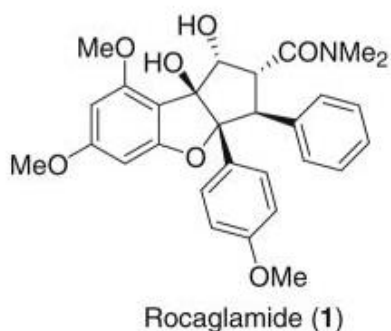
Provide shelters epiphytes: The bark of *Aglaia spectabilis* is thin and can absorb sufficient amount of moisture. Although bark is thin and quite smooth, this species allows to grow several epiphytes on varies high on its trunk. The soft cork tissue of bark allows a good population of various epiphytes that includes unidentified mosses, crustose and fruticose lichens, pteridophytes like *Dryneria quercifolia*, *Pyrrosia lanceolata*, *Microsorium punctatum* and angiosperms like species of *Raphidophora sp*, *Dendrodium sp*, *Papiliolanthe sp*, *Pholidota sp*, *Bulbophyllum sp* and *Ceologyne sp*.

ECONOMIC IMPORTANCE: This family is economically important from the standpoint of ornamental value. The fruits of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet are edible and sometimes gathered from the wild for local use. The tree is exploited in the wild for its timber. Various ethnic community as a fish poison uses the crushed fresh bark (Manandhar, 2002). The fruits and leaves are boiled to make a black dye.

ACTIVE COMPONENTS:

There are various secondary metabolites reported from the wood and leaves of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet. Wide variety of biological activities ranges from insecticidal, antifungal, antiprotozoal, and anti-inflammatory properties, especially to pronounced anticancer and antiviral activities were reported. Flavaglines having high insecticidal activity is reported from *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is more effective rather than the well-known natural insecticide azadirachtin.

Aglaia spectabilis (Miq.) S.S.Jain & S.Bennet contains cyclopenta[b]benzofuran derivative, rocaglamide (Rocaglamides) exhibit potent insecticidal and antiproliferative activities. In addition, antiviral, antifungal, and anti-inflammatory activities were also reported for these compounds, which are so far only known from *Aglaia* species. Many terpenoids have been reported from the genus *Aglaia* Lour. The fruits of *Aglaia spectabilis* contain two rocaglamide derivatives, namely, 1-O-formylrocagloic acid and 3'-hydroxyrocagloic acid, Aglaiastain. The absolute stereochemistry of 37 was defined as having the (1R, 2R, 3S, 3aR, 8bS)-configuration by comparing its CD spectrum, which revealed a prominent negative Cotton effect at 274 nm, with that of rocaglamide (1) (Watanabe, 2006; Chumkaew, 1998).



TIMBER USES:

The heartwood of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is reddish-brown and the sapwood is pinkish. The wood is quite hard and close-grained. Yields a timber of superior quality which is red in colour and used for planks and furniture and this magnificent timber, it is used for making furniture, wall panelling, decorative work, boat building, housing general, boards, furniture and cabinets, cabinets, plywood and veneer, turning, sports, tools and tool handles. The sawdust is very fine and can cause dermatitis.

MEDICINAL USES:

The *Aglaia* genus is the only source of the group of about 50 known representatives of various active compounds that bear a unique compound cyclopenta[b]tetrahydrobenzofuran skeleton. These compounds are more commonly known as rocaglate or rocaglamide derivatives, or flavaglines, and most have been found to have potent insecticidal properties, antifungal, antiviral, antibacterial or anthelmintic bioactivity. Several of them exhibit pronounced cytotoxic activity against a range of human cancers. Since the first representative in this group was only discovered in 1982, this is one of the few recent examples of a completely new class of plant secondary metabolites of biological promise (Wang et al. 2004).

ETHNIC USES: Various tribal communities use the plant parts to treat different ailments. The plant is a tonic, acting on the spleen. The roots are boiled to cure indigestion. Preventative and tonic, barnyard grass is a folk remedy for treating

carbuncles, haemorrhages, sores, spleen trouble, cancer and wounds. The plant extract is used in diseases of the spleen. The shoots and/or the roots are applied as a styptic to wounds. Various ethnic communities of NE India use the plant parts as medicine. Pounded leaves are applied as a poultice for stomachache and other abdominal diseases. The soft Timber is used for making crates and furniture.

The Bangni people of East Kameng District, Arunachal Pradesh, northeast India, eat the raw fruit in their ethno-medicine to give relief from cough (Gupta, 2006).

Ethnic communities of Chirang Reserve Forest of Manas Biosphere Reserve, Assam, use leaves and fruits of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet to make a cold or hot infusion to treat worm infection and the leaf infusion was also used to treat fever. The leaf infusion is also used to treat skin allergies and diarrhoea, while the bark infusion has been reported to treat cough.

OTHER USES:

In Southeast Asia various ethnic people eat the fruit, and the larger roots/buttrresses are used to make oxen-cart wheels (Pauline, 2000). Otherwise, the wood is of inferior quality, suitable only for interior use. The species is however logged for timber to be used in housing construction, plywood and veneer, and to produce sports equipment, and tools. It is used widely to make furniture (Barstow, 2018). In West Bengal's Buxa Tiger Reserve, the villagers living there harvest Lali fruit to use for decorative purposes in the months of February and March. Brown oil is also obtained from the seeds.

PESTS AND DISEASES: The moth caterpillar, *Prasinozena monospila* Meyr (Pyralidae) is the major insect that attacks the bark. It forages on the bark and it may causes the tree completely girdled in several places. A plantation at Rajabhatkhawa was practically entirely destroyed by this pest at the age of 8 years old. A species of a longicorn larva (*Monochamus*) was found in the pith of one of the young plants, killed by the pest. Fruits are badly damaged by rats and monkeys. The shoot-borer *Hypsipyla robusta* attacks the leading shoots. The bark of young saplings is very badly damaged by deer.

PROPAGATION AND CULTIVATION:

Aglaia spectabilis (Miq.) S.S.Jain & S.Bennet reproduce through animal dispersed seeds and seed dispersal starts with detachments of fruits from the mother tree (Fig. 4). The capsules maturation period varies in different climatic zone and it was reported that the fruits maturation period in India is April–May. Mature fruits with viable seeds for the seedling production are collected during April and May.

Aglaia spectabilis reproduce through dehiscent fruits and seed dispersal starts with dehiscence of fruits (Fig. 4, 5). The capsules maturation period varies in different climatic zone and it was reported that the fruits maturation period in India is May to July. Seeds of *A. spectabilis* are quite prominent and spherical to ovoid (approx. 1 cm dia) and are quite heavy in weight, almost 7.5 gm. Quantity of seeds required for raising seedling is one kg that includes 60–70 seeds (approx.).

Method of collection of seed: Preferably mature ripen fruits are usually collected from the tree during mid-June to mid-July in various forest. Although due to height of the trees sometimes fruits are collected from the ground.

Method of treating seed: No special treatment is required for the seeds. Fruits are dried in the sun which causes them to open. The seeds are then removed from fruits by hand, washed and dried.

Method of seed storage: Best to store directly after collection.

Sowing: In Nursery sown seeds are dibbled with the long axis horizontal 6" x 6" block in June after collection. Shades are not required for the germination of seeds. Direct sowing in plastic tubes has proved better than transplanting, as the seeds in the nursery are badly attacked by rats and also as transplanting much; 2-year appears to check the growth very plants from direct sowing averaged 5'–6", best 8'–4", while transplants of the same age averaged 3', best 5'5". Direct sowing in lines has not been tried but should be preferable to sowing in tubes.

Germination (time & percentage): In shaded beds, germination good, 80–85 %, and takes place from 10 to 20 days. In unshaded beds, germination is poor and only up to 35 % is reported.

Treatment in nursery: When dibbled 6"x6", no pricking out is required.

Seedlings

The average seed germination time for *Aglaia spectabilis* is 21 to 28 days. Both the cotyledon of *Aglaia spectabilis* are +/- paraboloid in shape and the face of the cotyledon forming the base of the paraboloid. Germinated seed ling bears first pair of leaves with about 10–15 cm long and prominent tap root system. At the tenth leaf stage, terminal bud clothed in stellate hairs or scales. (Fig. 8)

Method transplanting: Transplanting of one year old or even 2 years old seedlings from nursery beds in the latter part of June and July has proved successful, but growth appears to be checked by transplanting. Seedlings have also been collected from the natural forest and put out in the plantation.



Figure 8: *Aglaia spectabilis*. A, juvenile seedlings; B, mature seedlings

INVADER TENDENCY:

Aglaia spectabilis is naturally growing from the seeds and quite dominating the forest areas. One mature tree can produce large amount of seeds and the seeds are not so spreading due its large sizes. The 30 % successful germination process huge individuals but that much huge successful individual is not noticed in wild. So, its aggressive invasive tendency is not observed in the forested areas of sub-Himalayan region though, it has great capability to spread over short and medium distances through wind-dispersal (anemochory). Allopathic effect of the species is also not observed severely on other native species that are grows nicely around them and the tree trunk allows the growth of several epiphytes on it.

CONSERVATION STATUS

The reddish pink timber of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet is quite good and it has great medicinal and ecological importance. The population size of *Aglaia spectabilis* (Miq.) S.S.Jain & S.Bennet in different natural and planted forested areas are quite high and IUCN (2022) keep this species in Lower Risk and/or least concern status in their Red List of Threatened Plants. Due to high quality timber and as the plant is growing various habitat, the species is highly exploited and population size reduces by destruction of habitat due to agricultural expansion that threatens the tree. The species is included in the Red Data Book in Vietnam as the species is listed as vulnerable. The Forest department of different Eastern and North eastern states keep this species in their preferred list for afforestation plan especially for hilly slops as they are very good soil binder and landslides may be controlled. Due to low level of extinction risk no such specific conservation measure yet not been initiated anywhere. A good number of individuals of varies age group are frequently observed in all the in situ and ex situ conservatories of North Bengal along with seedlings. Apart from the conservatories, the species are also frequently planted in various public and Govt. occupied areas of various districts of Northern West Bengal.

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