Monograph on

Ailanthus integrifolia ssp. calycina

(Pierre) Noot.

Prepared by:

Prof. (Dr.) Monoranjan Chowdhury

Research Scholars Contributed

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Date: 27th February, 2022

INTRODUCTION:

Ailanthus integrifolia subsp. calycina (Pierre) Noot.is a huge, gigantic evergreen forested tree belong to the family Simaroubaceae DC. and its native range of origin is extended from Tropical forests of Eastern Himalaya to Indo-China, Laos, Vietnam, Central & East Java of Indonesia. *Ailanthus integrifolia subsp. calycina* (Pierre) Noot.is one of the most important indigenous species among other three (*Ailanthus altissima* (Mill.) Swingle, *Ailanthus excels* Roxb., *Ailanthus triphysa* (Dennst.) Alston) species of *Ailanthus* grown in various tropical forests of India. Lamarck first time scientifically described this tree species, in 1789 as *Ailanthus integrifolia* in the book *Encyclopedie Methodique. Botanique ... Paris* page number 417 of volume 3. *Ailanthus integrifolia* subsp. *calycina* (Pierre) Noot.. Letter on, David Prain publish is as *Ailanthus grandis* in the journal of Indian Forester in volume 28, Page no, 131 in the year of 1902. Hans Peter Nooteboom a spermatophyte taxonomist of Netherland shifted or established *Ailanthus calycinus* as a sub species of *Ailanthus integrifolia* as *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. in the book of Flora Malesiana, Volume 6 and page number 218 in the year of 1962. Now the name *Ailanthus calycinus* that was earlier published by Jean Baptiste Louis Pierre, a French spermatophyte taxonomist in the year of 1893 in the book Flore Forestiere de la Cochinchine, published from Paris is a basionym of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. After the establishment of new sub species, *Ailanthus integrifolia* has two sub species one is *Ailanthus integrifolia* subsp. *calycin*a (Pierre) Noot. and another one is *Ailanthus integrifolia subsp. integrifolia*. The basic differences between these two sub species are mainly foliar morphology.

Various author published it as different species rank or varietal rank from various parts of the world in different years due to some noticeable character variations. But after critical investigation it was decided that the *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. is the correct name and rest 4 are the accepted synonyms (POWO, 2021).

The fastest growing giant erect stem scattered canopy and excellent wood quality of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. have largely been introduced elsewhere as a shade tree and planted in forested areas for their high value timber.

The tree is nicely grown in subtropical and tropical climate and can also well adopted in moist localities of terai and hilly slopes of Himalaya (Fig. 1).

It is also noticed that the species is grows best in cultivation and in small gaps in Fire-protected forest. This tree is mostly grown for its soft timber, which is quite popular for building houses, boats, high-value furniture's, musical instruments, packing boxes and as fire wood etc. The yellowish bark is bitter, astringent, anthelmintic, bitter tonic, taste bud stimulant.

Fig. 1: Field visit at Birik Forest of Sevok Range (Mahananda Wild life sanctuary) dated: 14.02.2022.

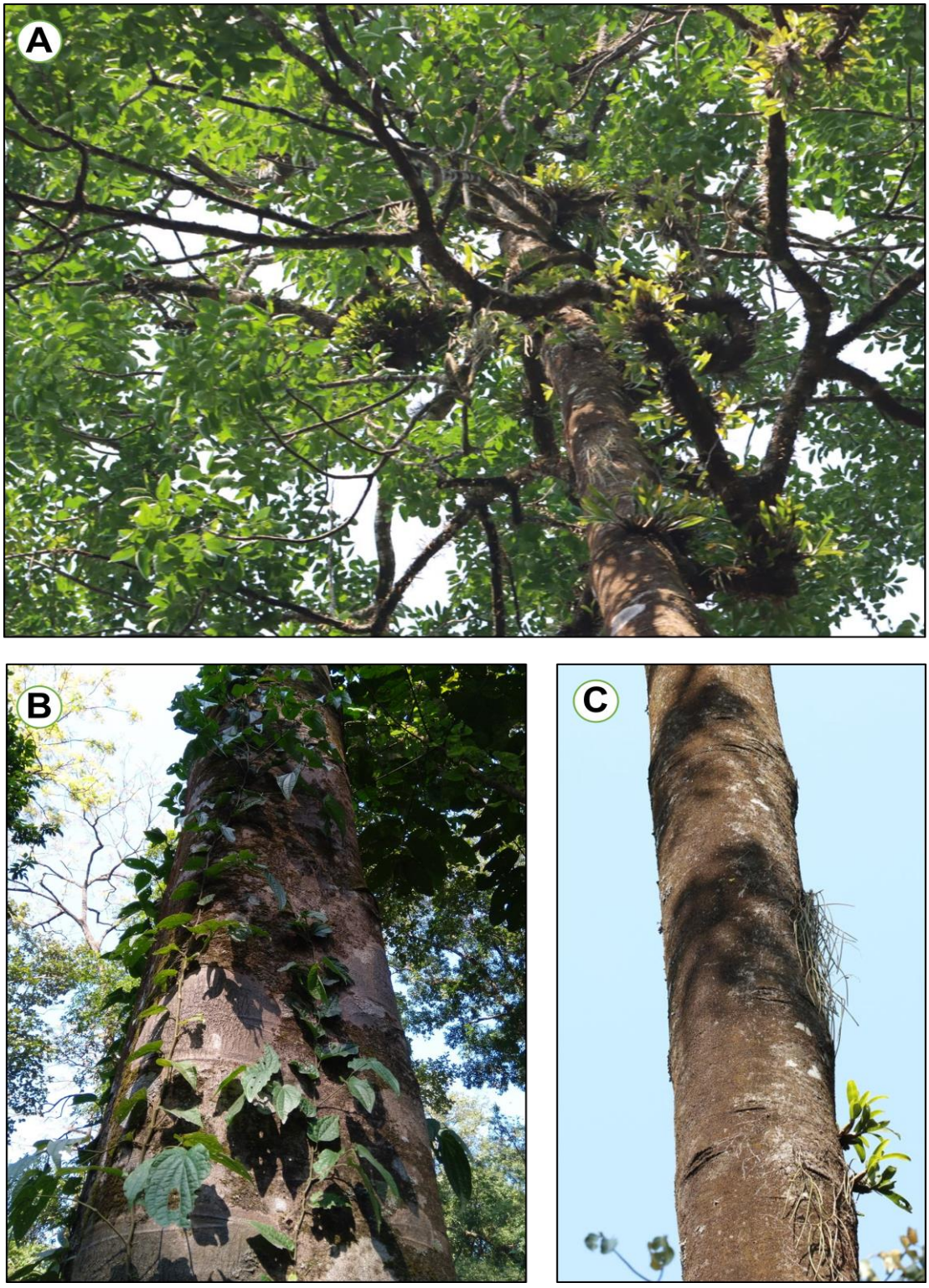


Fig. 2: *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. from Birik forest of Sevok range, Darjeeling. A) Tree canopy from below, B) Epiphyte orchids on branches, C) Orchid species inhabiting the tree trunk.

SCIENTIFIC CLASSIFICATION (APG IV, 2016)

Kingdom:Plantae

Clade: Tracheophytes

Clade: Angiosperms

Clade: Mesangiospermae

Clade: Eudicots

Clade: Rosids

Orders: Sapindales

Family: Simaroubaceae

Genus: *Ailanthus*

Species: *Ailanthus integrifolia*

Sub Species: *A. integrifolia*

ssp. calycina

TAXONOMY

Synonyms: (04 Accepted; POWO, 2021)

Ailanthus calycina Pierre

Ailanthus grandis Prain

Pongelion calycinum (Pierre) Pierre

Pongelion grande (Prain) Tiegh.

COMMON NAMES: Gokul (Nepali and *Bengali*); Actaluca, Borkesutu, Borpat, Koronga, Ring and Saragphula (*Assamese*); Bonpat (*Arinachali*) Diang-ehao (*Kannada*).

DISTRIBUTION:

The native range of distribution of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot.is reported from the Tropical forests of Eastern Himalaya to Indo-China, Laos, Vietnam, Central & East Java of Indonesia except less Sunda Island (Fig. 3). A. J. C. Grierson reported this species from the sub-tropical vegetation of Tamangdhara forest of Samchi district of Bhutan and Himalayan slops of Ryang subtropical forest of Darjeeling District of West Bengal, India ant was described in Flora of Bhutan (2.1: 23) in 1991 as *Ailanthus integrifolia* Lamark. The species is well adopted, growing nicely in sub-tropical and tropical forest of terai and hilly slopes of Himalaya, and available between 100-1000 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 in various islands of south East Asian countries.

Indian territories especially eastern and North Eastern parts (Sub-Himalaya West Bengal, Assam) are the native range of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. Apart from this it is commonly planted and naturally grown in tropical and sub-tropical climates of West Bengal, Sikkim, Arunachal Pradesh, Assam (Barak Valley, Darrang, Lakhimpur, Sivasagar), Nagaland, Mizoram, Tripura and Meghalaya of Eastern Himalaya of India and Western Ghats of Kerala (Malappuram, Thrissur Ernakulam district etc.) of Southern India.

Fig 3: Distribution map of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. (Green=Native Range) [www.powo.org]

BIOPHYSICAL LIMITS: *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. is easily grown in tropical to sub-tropical climate with mean temperature 15-45˚C with mean Mean annual rainfall 1000-3000 mm. It is grown in undulating sandy soils of Terai, duars and hilly slops at an altitude upto1000 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.

HABITATS:

In the Himalayan and sub-Himalayan tract of India, *Ailanthus integrifolia subsp. calycina* (Pierre) Noot.is found mostly in moist forest areas and also planted in moist forests of the Western Ghats of Kerala.

In India, the climate of the natural habitat comprises rainfall from 1500–4000 mm per year and temperatures range from about 4–35°C and can tolerate some frosts, but is somewhat sensitive to drought.

In China, it occurs in lime stone valleys of 300 m altitudes, typically on open hillsides in Guanjxi (eflora, 2022).

TAXONOMIC DESCRIPTION:

Macroscopic Characters: (Fig. 2, 4)

Habit**: E*vergreen, large sized, gigantic trees, grows upto 60 m high. ***Stem:Main trunk 30-55 m tall, mostly straight, girth ranges 2 m-3 md.b.h. for mature trees. ***Root*** buttresses prominent in mature trees (upto 7-10m); bark 3-5 mm thick, whitish grey, creepy yellowish beneath, smooth, exfoliating in large flakes at base, fibrous; canopy mostly round, spreading, large, loose; sap-wood white -yellow. Twigs glabrescent, inconspicuously lenticellate with small lenticels. ***Leaves:*** Leaves compound, paripinnate, alternate, clustered at the tips of branchlets, estipulate; rachis not winged, 10-20 cm long, slender, glabrous, swollen at base; leaflets 7-14, opposite or alternate, estipellate; petiolules 10-15 mm, slender, grooved above, glabrescent, rarely pilose to velutinous; leaflet lamina 20-28 x 8-12-8 cm, ovate-lanceolate or oblong-lanceolate, oblique, cuneate at base, apex acuminate, margin entire-sinnate, glabrous, abaxially light green; secondary nerves 7-12 pairs, chartaceous, glossy above; lateral nerves pinnate, slender, prominent, intercostae reticulate. ***Inflorescence:*** Inflorescences in long, branched panicle, upto 40 cm, pendent; rachis pilose short to long spreading. ***Flowers:*** Flowers creamy white, in terminal or axillary drooping panicles; sepals spatulate, 1-2 × 0.8-2 mm, margins shortly ciliate. *Calyx* 1.5-2 mm, outside usually glabrescent, lobes 5, ovate, tomentose; *Corolla* creamy white, 5, 4 x 1.5 mm, usually glabrescent, margin shortly ciliate, oblong, spreading, ciliate, imbricate; stamens 4, hairy beneath;

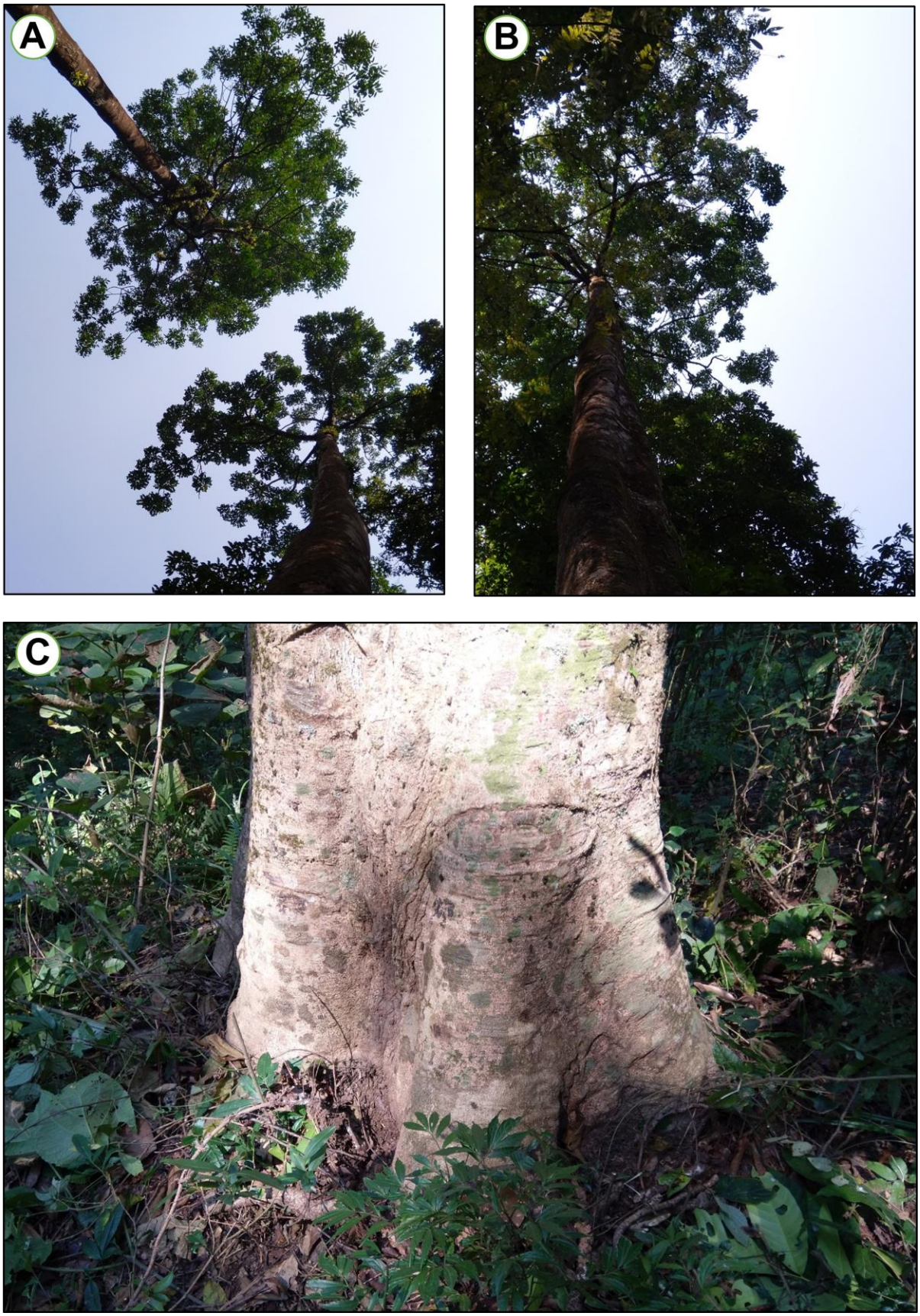


Fig. 4: *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. from Birik forest of Sevok range, Darjeeling. A & B) Tree canopy C) Root buttress.

Fig. 5: *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. from Birik forest of Sevok range, Darjeeling. A) Measuring Tree girth B & C) Recording GPS Reading.

Ovary hairy, ovary superior, ovules 8-12 per cell, pendulous; style 5, connate, stigma spreading. *Fruits*: Fruits are samara, 10 x 3.5 cm, light green when young and brownish when dry. *Seeds*: Seeds one, oblong, 1.1-1.5 cm across, central, compressed, winged at both ends; wings equal, apex narrowly obtuse. (Fig. & 5)

Floral Formula: $\oplus$ ⚥ $K_{(5)}\ \overbrace{C_{(5)}\ A_{(5)}}\ G_{(2)}$

Microscopic Characters:

<u>Micromorphological study </u>(Fig: 6)

Leaf: Young and matured both types of leaflets are used for this study. Leaflets are glabrous in adaxial surface, but pubescent only in midrib region of abaxial surface. Greyish white hairs are present at mid vein areas of abaxial surface and its density increases towards petiolar region. Both glandular and non-glandular trichomes are present in this plant. Glandular trichomes are capitate type. Non glandular trichomes are 26–83 µm length, uniseriate, unicellular type. Leaflets are amphistomatic. stomata are anomocytic type. Stomatal pore size are 18.13 ± 12.53 μm^2, Guard cell kidney shaped, length 13.25 ± 2.75 µm, Breadth 8.63 ± 2.29 µm. Epidermal cells of are polygonal, very slightly sinuous (in adaxial surface) to straight pattern (in abaxial surface). During LM and SEM study, few druse crystals are found in abaxial surface.
Petiole: Petiole is slightly pubescent and covered with straight, upright, uniseriate, non – glandular, greyish white hairs, 0.5 – 1 mm length.

Stem: Stem terete, glabrous.

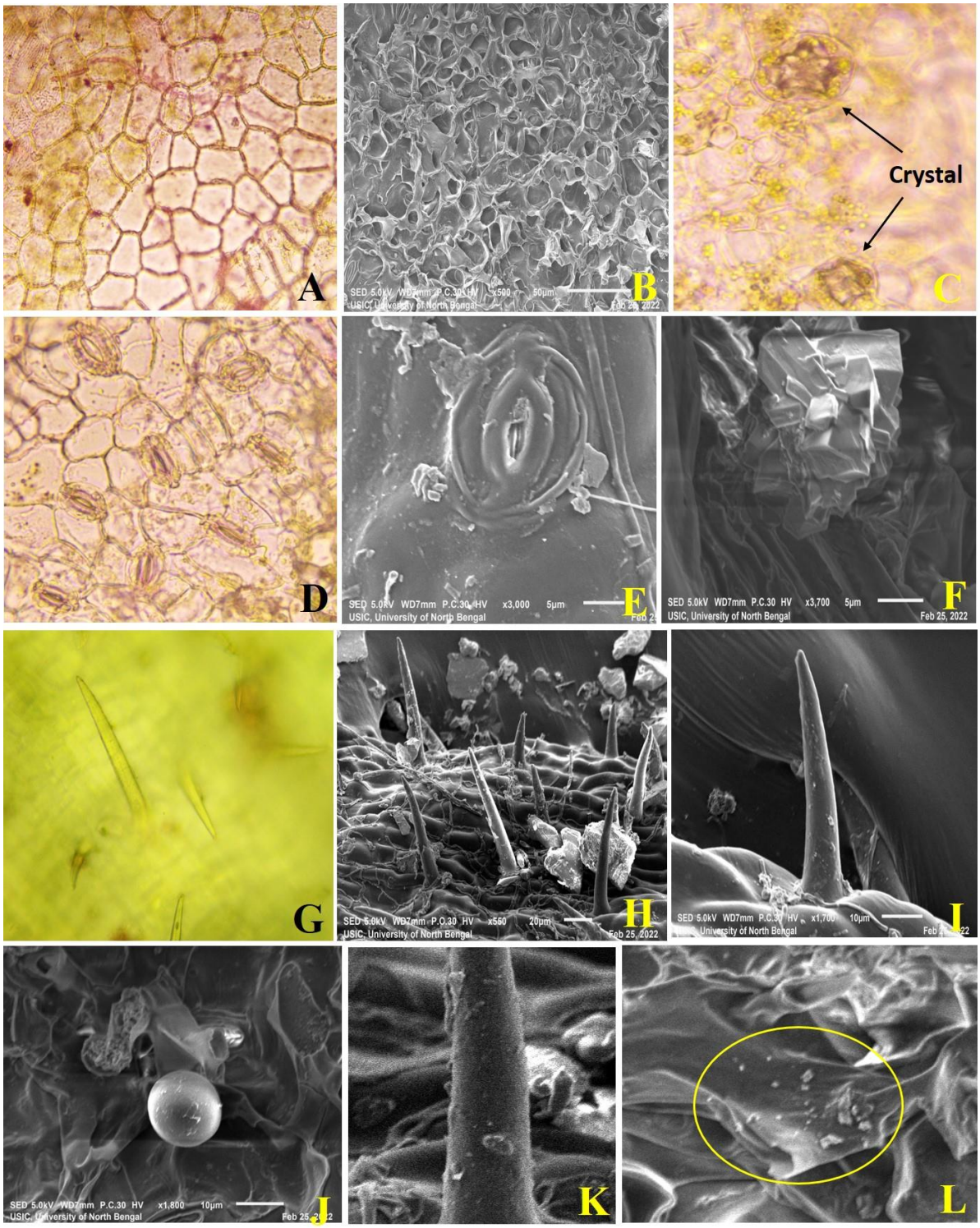


Fig. 6: LM & SEM images. of Ailanthus integrifolia subsp. calycina (Pierre) Noot. leaf, petiole. A. & B. Epidermal cell, C. & F. Druse crystal, D. & E. Anomocytic stomata, G. & H. I. Non-glandular, uniseriate, upright trichome of abaxial surface and petiole, J. Glandular, capitate trichome of abaxial surface, K. Enlarge view of abaxial smooth surface trichome, L. Scattered prismatic crystals.

Anatomy Root:

Epidermis: It is the outermost single layer with several unicellular root hairs. It consists of thin walled, compactly arranged living parenchymatous cells. Epiblema is characterised by absence of stomata and cuticle. It provides protection to the roots due to presence of unicellular root hairs it also helps in absorption of water and minerals from soil. ***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. ***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 bundlearranged in ring. Xylem and phloem bundles are separated from each other by parenchymatous cells. Xylem is exarch i.e. protoxylem towards the periphery and metaxylem towards the centre. Pholem 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.

Anatomical Study (Fig. 7)

Anatomy of Stem

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. ***Pericycle:*** It lies Just below the endodermis. 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 form on the inside of the pericycle.It is made up of xylem, phloem, and cambium. ***Pith:*** The pith holds the large central part of the stem.

Anatomy of petiole:

Epidermis: It is single layered and include elongated compact and barrel-shaped cells. Stomata may be present in it. ***Hypodermis:*** It is usually 3-4 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:*** The bundles are arranged in a semi-circular manner and are of different sizes in the same petiole. Generally, the lowest bundle is of the biggest size. Each 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.

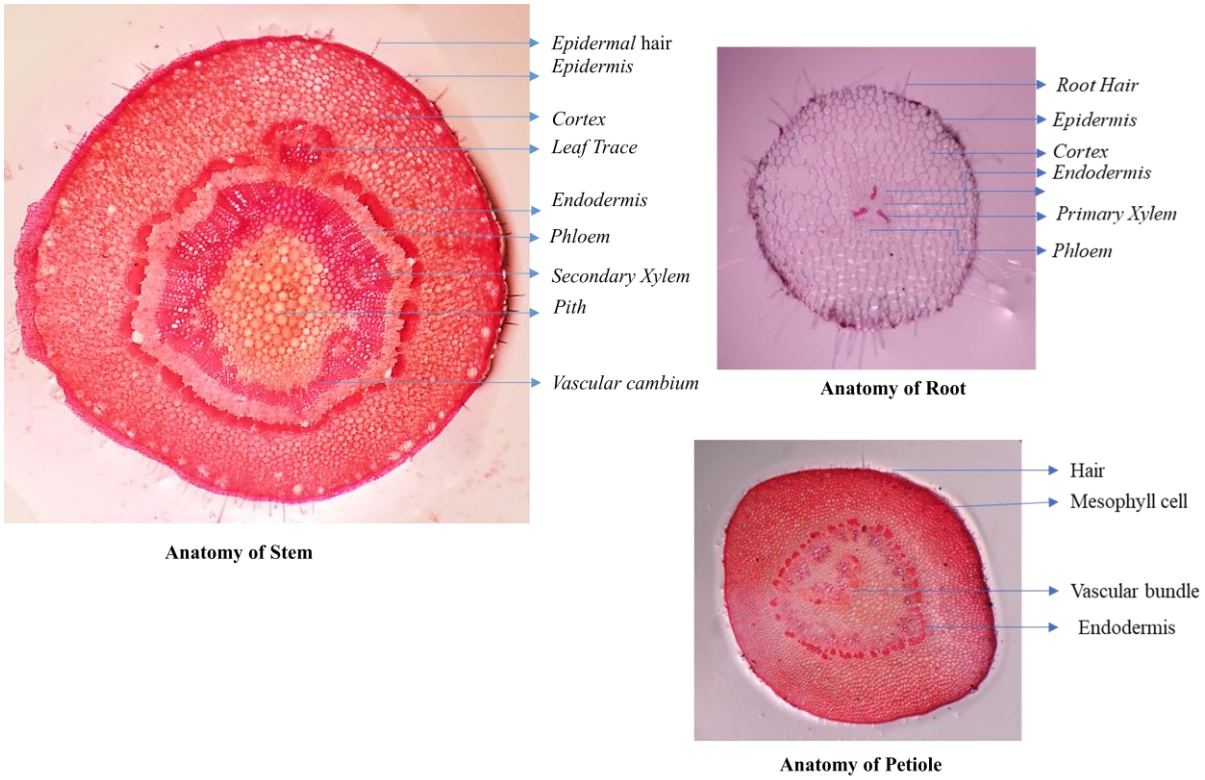


Fig. 7: *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. Left. T.S. of the stem; Right Top-T.S. of Root & Right Bottom- T.S. of the Petiole.

FLOWERING AND FRUITING:

As the tree are evergreen, complete leaf fall never occur during lifetime. The species remain sterile with dense healthy leaves throughout the year. Fertile stage observed with the flowering that starts blooming from first week of April in pendulous dense panicles. The trees are in full bloom with huge green dense canopy till the month of May. From May to June each branches bears cluster of dry clusters of fruits and fruits dehiscing through longitudinal slits and winged samara light seeds are dispersed.

SPECIMENS EXAMINED: North Bengal Terai and Duars are good habitat for the growth of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. and habitat extended to the hilly slops of Himalaya of Darjeeling and Kalimpong upto 1000 m. For details study about the species out of several trees of *Ailanthus integrifolia subsp. calycina*

(Pierre) Noot., seven mature individual five (Fig. 4) from lower hill slops of Darjeeling Himalaya (Sevok Range of Mahananda Wildlife Sanctuary) and two individuals from University of North Bengal campus near to State Bank of India (NBU branch) were considered. Details of sample coordinates, altitude, and locations for the studied specimens were as follows:

SITE 1(Hill Slopes): Coordinates-26˚56′52.04"& 88˚26′00.89"; Altitude 510 M; CPT-1, Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sactuary.

SITE 2(Hill Slopes): Coordinates-26˚56′51.91"& 88˚26′00.25"; Altitude 511 M; CPT-1, Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sactuary.

SITE 3 (Plains): Coordinates-26˚56′52.19"& 88˚26′00.32"; Altitude 512 M; Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sactuary.

SITE 4 (Plains): Coordinates-26˚56′52.52"& 88˚26′00.70"; Altitude 547 M; Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sactuary.

SITE 5 (Plains): Coordinates-26˚56′44.57"& 88˚26′00.55"; Altitude 576 M; Kadung block, Sevok Range, Birik Beat, Mahananda Wildlife Sactuary.

SITE 6 (Plains):Coordinates-26˚42′33.20"& 88˚21′33.20"; Altitude 32 m; Plant 1, State Bank of India, University of North Bengal, Raja Rammohunpur, Darjeeling (Age not determined).

SITE 7 (Plains):Coordinates-26˚42′31.80"& 88˚21′33.37"; Altitude 32 m; Plant 2, State Bank of India, University of North Bengal, Raja Rammohunpur, Darjeeling (Age not determined).

ECOLOGICAL IMPORTANCE: In natural forest *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. is a significant components in primary as well as secondary forest. The species grown faster in plains and moist riverine and wet forests and occur up to 1000 m altitude in different part of the world and prefers average range of 2000–3000 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. This species is not showing any alellopathic 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 Lower hills of Darjeeling Himalaya and Terai-Duars *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. grows with many other associated species and that includes *Mecaranga denticulata, Mecaranga peltata, Calamus spp., Clerodenreum japonicum, C. infortunatum, Cinnamomum sp., C. tamala, Oplishmenus compositus, Dalbergia stipulacea, Maesa indica, Leea indica, Leea asiatica, Piper peepuloides, Dioscorea prazeri, Carex sp, Tebarnemontana divericata, Coffea benghalensis, Bauhunia valli, Musanda roxburghi, Mellotus philipensis, Tunbergia grandiflora, Smilex zeylanika, Strobilanthus sp., Callicarpa arborea, Lepidagathis imbrecata, Panicum repens, Amoora wallichii, Artocarpus chaplasha, Pterygota alata, Atrocarpus lakocha, Tectona grandis, Uncaria sp., Pandanus nepalensis, Zanthoxylum armatum, Z. budrunga.,* etc.

Provide shelters epiphytes: The bark of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. is thin and can absorb and hold 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, Microsorum punctatum* and angiosperms like species of *Raphidophora sp, Dendrodium sp, Papiliolanthe sp, Pholidota sp, Bulbophyllum sp* and *Ceologyne sp*.

POTENTIAL MEDICINAL USE:

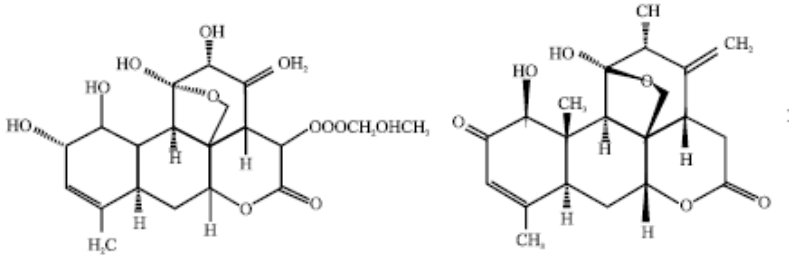
The berk and root contains several alkaloids and terpinoids that have potential medicinal uses. The highly oxygenated triterpenens and bitter taste called as quassinoids, which is a common in the members of family simaroubaceae, especially Ailanthus genus. Physician Quassi used the bark of plants for the treatment of fever. Quassinoids have shown their effective role as therapeutic agents as an antitumor, antiviral, anti-inflammatory, antiamoebic, antimalarial, insecticidal, antitubercular,

anticancer, antiviral, antimalarial, antileukemic, amoebicidal, antiulcer, herbicidal and antifeedent, etc. (Polonsky, 1973, Lavhale and Mishra, 2007).

Ailanthone is another active compound common in the genus *Ailanthus* having toxic to some fungi and may therefore acts to protect plants against fungal pathogens and is associated with the observed toxicity of this species.

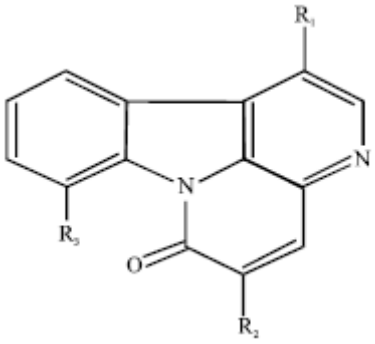
Active Components:

The key phytoconstituents present in *Ailanthus* genus are triterpenoids like Quassinoids, 1,4-dihydroexcelsin, 18 dehydroexcelsin, glaucarubin, glaucarubol, ailanthinone, 1,12-deoxy-13-formyl ailanthiol, ailanex A, ailanex B.



13.18-dehydroexcelsin Ailatnthone

Alkaloids like canthin- 6-one, 1-methoxy canthin -6-one, 5-methoxy canthin -6-one and 8-hydroxy canthin-6-one (Fig. 8).



TIMBER USES: The heartwood is yellowish white and soft. The wood is moderately hard, lightweight with satisfactorily stained. The timber takes water and oil-based paints. The wood has great extent of uses and that includes carvings, boat building, cabinet making, decorative plywood, food containers, joinery, cigar boxes, matchboxes, building materials, plywood and ornamental work, panelling, and boxes.

OTHER USES: The wood of this species considered as valuable firewood among the forested villagers of Himalaya and terai-duars of North Bengal and Assam. The people of North East Indian states also use the wood as house building materials as pillar and/or wood.

PESTS AND DISEASES: The leaf of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. is infected by some fungus and moth species. The insect and pest like *Atteva fabriciella, A. niveigutta,* Eri Silkworm (Samia ricini). and *Eligma narsissus* are very common and cause defoliate the tree. Borers that infect the tree include *Batocera rufomaculata* Ahmed et al. (2015). Leaf spot is the common disease that are observed frequently and causal organism are fungi like *Cercospora glandulosa* and *Alternaria* sp.

PROPAGATION AND CULTIVATION:

Ailanthus integrifolia subsp. calycina (Pierre) Noot. reproduce through wind dispersed seeds and seed dispersal starts with detachments of fruits from the mother tree (Fig. 8). The capsules maturation period varies in different climatic zone and it was reported that the fruits maturation period in India is April –May. Seeds of *A. integrifolia* are small and circular (approx. 1 cm dia.) and are quite light in weight. Quantity of seeds required for raising seed is one kg that includes 1250 seeds (approx.). After collection of seeds, it viability may persist from 3 month to 12 month based on preservation quality.

Method of collection of seed: Mature ripen fruits are usually collected from the tree during the month of April to May. After the collection, the seeds are separated from winged samaras.

Method of treating seed: No special treatment is required for the seeds. Mature fruits and the seeds are sun dried for few days.

Sowing: Seed sowing is on polypot. 4 to 6 seeds are sown in each pot and kept under shade.

Germination (time & percentage): Germination rate is 60% without any treatment. Treatment with 1% potassium phosphate, 1% potassium nitrate and gibberelic acid 100 ppm. observable to be 80% germination rate.

Treatment in nursery: No special treatment is required except the standard method of weeding and slight watering.

Method of propagation: The species mainly propagates by means of seed. During month of April–May the mature fruits are collected. The fruits are spread out for 3–4 days under the sun for complete drying. The seeds are separated manually.

Treatment after transplanting: Just after transplanting weeding & cleaning in one month or two months interval is necessary followed by two soil mulches at a suitable interval in order to ensure better growth of the seedlings (Fig. 9). Regular weeding, cleaning, climber cutting operations are to be carried out up to 5th year after planting, because in North Bengal Plain weed growth is a major problem in the course of establishing a successful plantation.

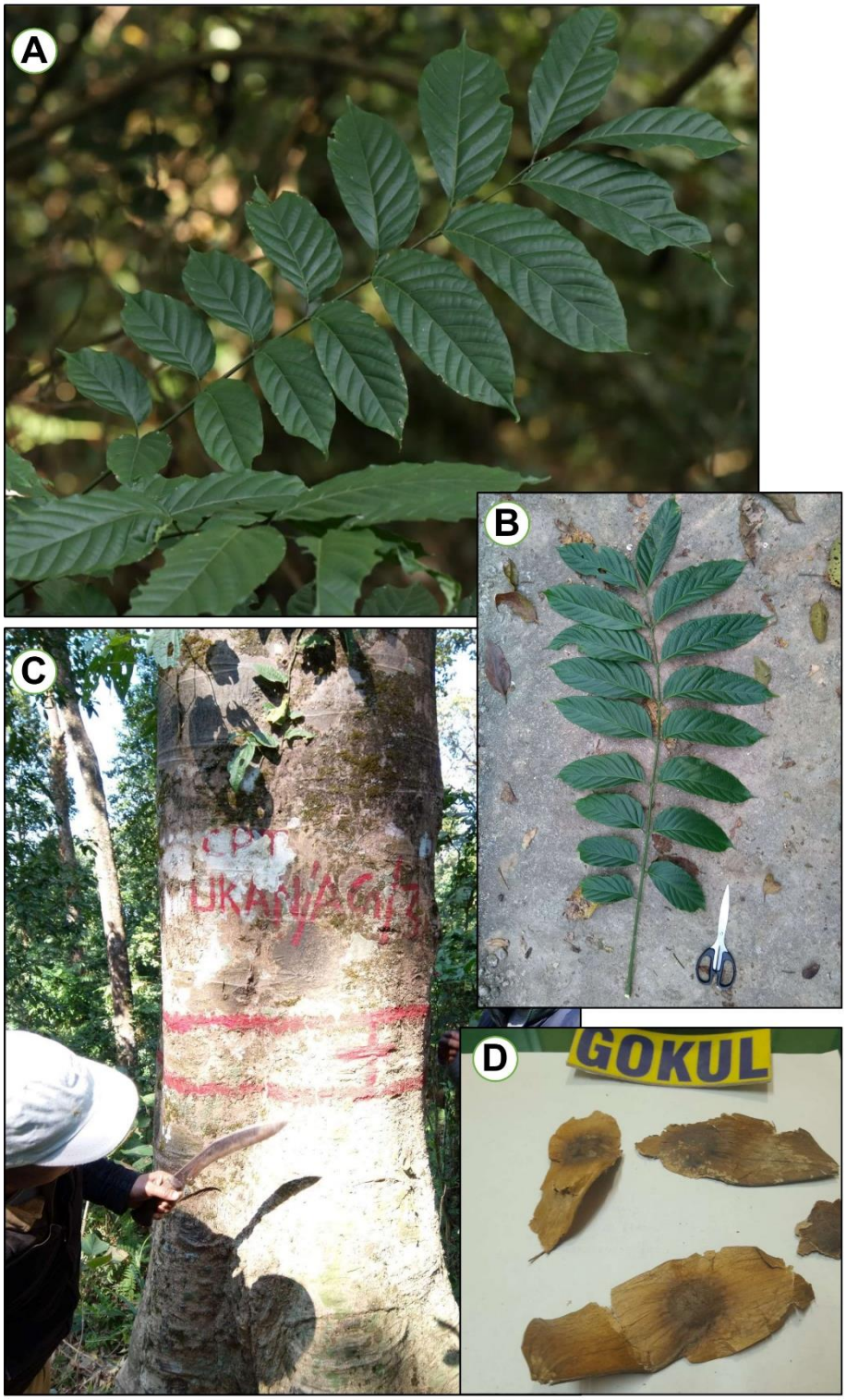


Fig. 8: *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. A & B) Leaf C) Tree Bark, B) Samara type Fruits & seeds.

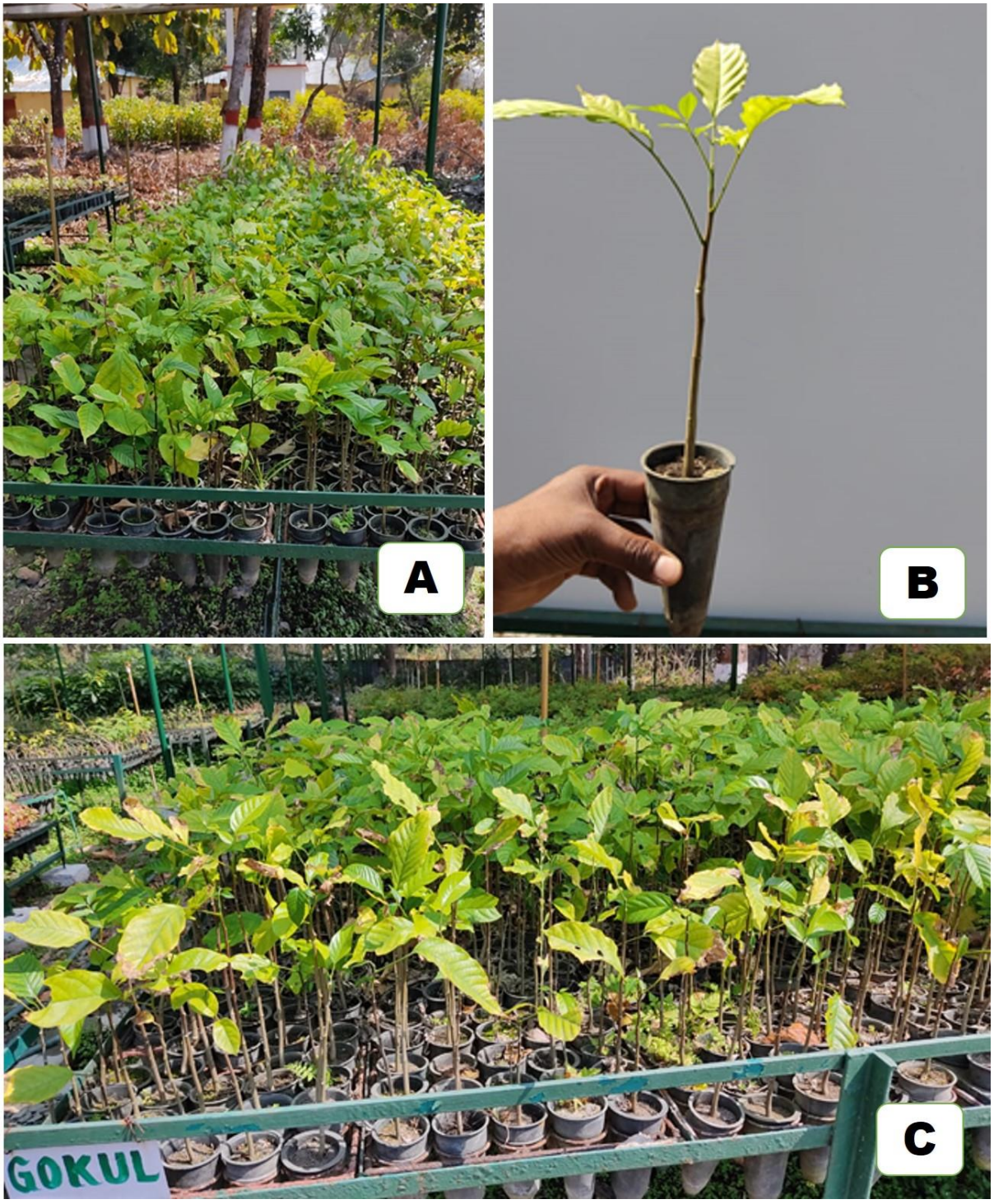


Fig. 9: *Ailanthus integrifolia* subsp. *calycina* (Pierre) Noot. A. & C. Seedling Bed at Salugara Lab Range Silviculture North division, B. Seedling ready of Transfer

INVADER TENDENCY:

Wide spreading superficial root system of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot.absorbed huge soil moisture that may have adverse effects on the growth of other species. One mature tree can produce large amount of seeds and the seeds are winged that helps the species in successful long distance seed dispersal. The 40-60 % 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

In many regions within the natural area of distribution of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot., the timber is quite good. The white siris timber one of the valuable in South-East Asia and exported in small amounts to China and Japan. The species is well adopted in tropical and sub-tropical climates and propagate through winged seeds. The population of *Ailanthus integrifolia subsp. calycina* (Pierre) Noot. in different 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. The Forest department of different Eastern and North eastern states keep this species in their preferred list for afforestation plan. 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 different conservatories like Mahananda WLS, Gorumara NP, Buxa NP, Jaldapara NP. 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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