A Review on Endangered plant of *Mallotus philippensis (Lam.)*M.Arg.

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Summary

Mallotus philippenesis (Lam.) M.Arg.is one of the endangered plant of central ecoregion.It belong to the (euphorbiaceae)family. It is a commonly dye yielding plant locally known as kamala, mostly found in India subcontinent. whole parts of the plants are rich in secondary metabolites, which impart medicinal uses to the plant. Extract of fruits of kamala from the glands and hairs yielded a resin a wax and the crystalline compound rottlerin. Kamala also contains a minute amount of essential oil . which when gently warmed emits a peculiar odour . The principal constituent , rottlerin, is found in the kamala resin. Its fruits contain Rottlerin (reddish-yellow resin) 47.80% fixed oil. 5.83-24% , citric acid , mallotoxin , kamalin.The principal constituent , rottlern, is from the kamala resin rottlerin.The seed contains a Fixed oil,camul oil and a bitter glucosidal .Betulin -3 acetate lupeol acetate , berginin acetylaleuritote acid ,sitosterol,bergenin , rottlerin resin . solid hydroxy acid , kamlonenic acid, linoleic. Oleic, lauric ,myristic , palmitic acid , stearic acid , crotoxigenin, rhamnoside , coroghcignin , octa cosanol,iso rottlerin , rottlerin , homorottlerin, tannins , citric , oxalic acid. The plants has found application in pharmaceuticals as it is one of the common plants used in Indian system of medicine. Various parts of the plant are used in the treatment of skin problem, bronchitis, antifungal, tape worm, eye-disease, cancer, diabetes, diarrhea, jaundice, malaria, urinogenital infection etc. In dispersing swellings of the joints from acute rheumatism and of the testes from suppressed gonorrhea. It also shows anti-oxidant,anti-bacterial,anti-fungal,anti-microbial insectidal /pesticide, anti-microfilaria ,anti-lithic, heptoprotctive activities [52] activities. Employment of techniques such as cell and tissue culture would provided means of rapid propagation and conservation of the plant species and from the point of view of phytochemistry give scope for enhancement of the quality and quantity of the bioactive secondary metabolites occurring in the plant.

Key words: MALLOTUS PHILIPPENESIS, CONSERVATION, ENDANGERED PLANT

Introduction

India has some of the world's most biodiverse regions. Biodiversity must be seen in the light of holding ethical value. Man holds great responsibility towards preserving and conserving other organisms. Some ecologists and philosophers feel that we have a moral obligation to preserve organisms with lesser powers. Because extinction of some species will threaten the very existence of menthe root cause of most of the biodiversity losses in the tremendous rise in human population; complicated life style featuring high consumerism ignorance, poor implementation of environmental education narrowing down of the use of a few high yielding varieties of species and a total ignorance of wild traditional varieties. Conservation of biodiversity is concerned with the protection of genes, species and their numbers in population, ecosystems habitats. ***Mallotus philipiensis* L.** Locally known as kamala is a large woody multipurpose medicinal tree (wealth of India 2003) belongs to family Euphorbiaceae consisting of herbs, shrubs and trees. Mallotus philippenesis is a medium sized much branched, tolerant and soil improving

small tree. It is up to 10-12 meters in height and is widely distributed throughout tropical India along with the Himalaya from Kashmir east wards up to 5000 ft.The plants are a rich source of biologically active compounds and are used as a common dye yielding plant.[55]
It is one of the common plants used in Indian system of medicine. Various parts of the plant are used in the treatment of skin problem, bronchitis, antifungal tape worm eye-disease, cancer, diabetes, diarrhea, jaundice, malaria, urinogenital infection etc. In dispersing swellings of the joints from acute rheumatism and of the testes from suppressed gonorrhea, It also shows anti-oxidant, insectidal /pestecidal, anti-microfilaria ,anti-lithic, heptoprotctive activities.[52]Mallotus is highly cross-pollinated and variations among the same species are limited. However, it is now well documented that some selections are rare and possess beneficial characteristics such as high yield, high oil content, drought resistance, photoperiod insensitivity, resistance/tolerance to major insect pests and diseases. This opens up the opportunities of breeding for hybrids. The current requirement in our country is to mitigate fatty oil import and produce our own cosmetics and pant-varnish through large scale cultivation of crops like *Mallotus*. Limitations for such activity are non-availability of quality planting materials seed, seedlings, bark and leaves. [10]. Mallotus philippenesis consist of male and female plant. .As the germination rate is often poor (either due to drought and insect attack) and viability is lost after 6 months. In natural conditions seeds germinate about 5% in 65-82 days.[10]natural reproduction is poor and in -vitro micro propagation is very necessary. The plants can be only propagated through seeds & the rate of natural reproduction is very poor (only 30%) due to hard seed coat. The bio-technological approach such as plant tissue culture is an alternative and variable method for propagation and conservation of this plants. This review discuss the investigation made by various workers related to its medicinal uses,chemical.constituents,pharmacological activities, micropopagation and other asepts considering this plant since years till date

Plant details

Distribution-:This plant is widely distributed in the tropical and sub-tropical region including all over the Punjab, Uttar-Pradesh, Bengal, Assam, Burma, Singapore, and from Sind south wards to Mumbai and Ceylon. It is also reported as growing n China, the Malaya Islands,Australia,Pakistan and Andaman Islands.(43)Natural reproduction takes place by seeds which fall to the ground in the beginning of the hot season and germinate in the rainy season. Artificial propagation is done by sowing fresh seeds in April. The more vigorous seedlings are ready for transplanting during the first year, smaller ones may be kept for another year in nursery. The tree also reproduces from root suckers but the growth is very slow. It can withstand considerable shade and is frost-hardy and drought-resistant. The tree is subject to attack by several rot-causing fungi, *Fomes conchatus, **I;:** rimosus, **E** caryophylli, Hexagonia discopoda, Polyporus adustus, Stereum hirsutum, Ganodema applanatum* etc
The growth is comparatively slow, mean annual girth increment being reported in India 0.65 cm, and mean girth after 16 years less than 15 cm. In the Philippines a mean annual diameter increment of 1.4 cm has been recorded for M. philippensis trees in the diameter class 10-20 cm. In India established M. philippensis is frost-hardy and resistant to drought and it coppices well and is capable of producing root suckers. M. philippensis is not resistant to fire.(10)

Plant description-:
Kamala is synonymous-: Kampillaka, Karkasha, Raktanga, Rechi, Kampilla, Raktaphala. Glandulae, Rottelerae, Kamcela, Spoon, Wood, Rottlera tinctoria**.**:-(56)
Common name-: Kamala, rohini, senduri ,gangai, shendri, monkey-puzzle ,monkey face, tree, rechanka, raktaang, kapila, sindooramaram, kuramedakku, kunrang umanjal, korangumanjanati(56).
Vernacular names-: i Eng.- Kamala tree. Hindi- Kamala, Sindur, Rohini, Kambhal. Beng.-Kamala, Kamalagundi. Guj.- Kapilo. Kan.- Kampillaka, Kunkumadamara.Ma1.- Sundry, Manawa, Kuramatakku, Kampipala, Ponnagam. Mar.-Shindur, Shendri, Kapila. Punj.- Kumila, Kamal, Kambal, Kamela. Tam.- Kapli, Kungumam, Kurangumanjanatti, Kamala, Manjanai, Kunkumam,Kamala. Te1.- Kunkuma,

Chendra-sinduri, Kapila, Vassuntagunda, Sundari,Vasanta, Kumkumamu. Arab.- Kinbil. Assam- Gangai, Puddum, Lochan.Oriya- Bosonto-gundi, Kumala, Sundragundi, Kamalagundi. Pers.- Kanbela.Santhal- *Rora.(56)*

Leaves-:Alternate, ovate-lanceolate,*8-22* x 3-8 cm, 3-nerved at base, glabrous above, pubescent and with numerous red glands beneath; petiole bearing two small glands near apex. , borne on long stalks, size about 5-20 cm long.(44)

Flowers-: Small; males in erect terminal spikes forming elongated paniculate racemes; females solitary in short spikes, ovary covered with red glands. female flowers in erect 5-9 cm long, long spikes: male flowers are yallow in cooler , in 7-15 cm long. In the Philippines mallotus phil. Flowers from march to April and fruits mature in July – august m. phil. has extra floral nectarines attracting ants.(44)

Fruits-: Globose, 3-lobed, 8-10 mm in diameter, covered with bright red powder. . fruits are 5-15 mm , , roundish, -3lobed and densely covered with reddish brown , powdery substance and minute hairs which are easily rubbed out.(44)

Seeds-: subglobose, black, 3-4 mm across. seeds 4 mm.in diameter, subglobose,thick,black in cooler and about 7000 mounds can be collected annually in India. In the Philippines mallotus philippensis.(44)

Substitutes and adulterants

Mallotus philippensis is commonly adulterated with Annato dye *(Bixa orellana* Linn.), ferric oxide, brick dust and ferruginous sand. *Casearia tomentosa* (stem bark powder), *Carthamus tinctorius* (flower powder), *Ficus benghalensis* (fruit powder) and *Flemingia macrophylla* (hairs of fmits) are also reported to be used as adulterant or substitute of *Kampillaka.(56)*

Ethno botanical and medicinal uses

The crude powder of kamala obtained as a glandular pubescence from the exterior of fruits is found to be useful in case of worm, hook worms, round and earth worms,anthelminitic activity is due to rottlerin and isollorotterin.It has been found than rottlerin is toxic but isoallorottlerin exhibits greater activity than rottlerin.A50:50 mixture of rottlerin and isoallorottlrin is more active than either of them alone. The pent methyl ester of rottlerin possess no anthelminitic activity. The drug was found to be 100% effective against tape worms. (43).The granular brick red kamala powder was tried in the from of a liquid extract in doses of 1 to 3 fluid drachms every three hours until three dose were administered.

Theglandsonfruitsarebitterpungent,heatingpurgative,.cathartic,styptic,anthelmintic,vulnerary,detergent,maturant. Carminative, heal ulcers and wounds,tumours,stone in the bladder& useful in bronchitis, enlargement of spleen. The hairs and glands are also useful in scabies, ringworm and other skin diseases. In Unani system, lessen intestinal pain & also useful in jaundice and as a constituent of Arshina ointment which is used to cure piles. Oral administration in the form of effect is however temporary and the animal return to normal. when the drug is withdrawn. Kamala was formerly used in India for dyeing silk and wool to a bright orange colour and it is still used for this purpose to a limited extent and for colouring soaps,oils.ice-cream,and drinks. The rottlerin and its pent potassium derivatives are employed for colouring foodstuffs,lemonades,lime juice and other beverages. It is also used as a sindhur or kumkum by woman in India. The fruits of the plant are used for making dyes and insect repellents, kernels effective as anthelmintic,& in treatment of rheumatism and snake bite .The red powder of fruits when mixed with some oil is good remedy for ulcers. The leaves are bitter, cooling increase appetite, cause flatulence and constipation. The decoction of bark is used in abdominal pain. Among the tribe of chhota Nagpur the root, well ground is rubbed on the painful parts in articular rheumatism In katha..,Burma,the seed are ground to paste and applied to wounds and cuts.Thepowdered seed are mixed with sulphur sandalwood oil and the mixture is very effective when applied externally in rheumatic joints and also in dermatitis. Seeds are also used as a source of dye(1.4-3.7%).(43)

Tannin or dyestuff: The granules which cover the ripe fruit are used in India as a dye ('kamala') for dyeing silk and wool bright orange. A red dye has been extracted from the roots. Food: Kamala also

serves as a preservative for vegetable oils and dairy products. Kamala also recorded to be used as a dye for food-stuffs and beverages, which seems unlikely because it is generally known as a purgative. Kamala is also known to affect the fertility of animal and man. All parts of the tree can be applied externally to treat parasitic infections of the skin. The fruits and bark have been reported to be used medicinally to treat stomach ulcers and tapeworm. Lipids: The seeds yield kamala seed oil which can be used as a substitute for tung oil, obtained from Aleurites spp., in the production of rapid-drying paints and varnishes. The seed oil is also used as a fixative in cosmetic preparations. The oil is also used as a fixative in cosmetic preparations and for colouring foodstuffs and beverages. Timber: The wood is sometimes used as timber for implements. Fibre: The wood is suitable for paper pulp. The fibrous bark is used to make rope and artificial fur. Fuel: The wood is often used as fuel wood. Fodder: The leaves are used as fodder.(10) Handling after harvest: The red granules are usually separated by beating and shaking the ripe fruits, or by stirring the fruits vigorously in water. The yield of kamala powder is only 1.5-4% of the weight of the fruit, which makes the product very expensive. Kamala is often adulterated with other vegetable dyes or minerals. To dye silk and wool, 4 parts of kamala, 1 part of alum and 2 parts of sodium bicarbonate are mixed in the powdered state with a small quantity of sesamum oil, and boiled in a pan. The bright orange to red colour is fairly fast to soap, acids and alkalies, but fades somewhat when much exposed to sunlight. The seed oil can be extracted with light petroleum, benzene, ethyl ether or ethyl acetate. A high vacuum is used for stripping the solvent, as the oil polymerizes even at ambient temperature. Kamala oil can also be extracted by mixing with linseed oil or other vegetable oils and heating and filtering the mixture. Kamala oil solidifies when the extract is cooled. Kamala is now rarely used as a dye. It is much too expensive to compete with synthetic dyes, but might have prospects in the food industry as an antioxidant. More research on the properties and nature of the dye is necessary to find its potential applications in the food industry. The oil from the seeds is another product worth attention. Kamala tree also has some interesting medicinal properties. It is suprising that the uses of this plant, which is common in many parts of its large area of distribution, are almost unknown outside India. It has been suggested to use M. philippensis to protect soil and simultaneously produce wood, possibly for pulp, wood-based panels or firewood.(10)

Toxicology

The approximate lethal dose of rottlerin in rat was 750 mg/kg.The plant extract was found lethal to trematodes; alcoholic extract being most effective in vitro and in vivo. Death of worms commenced 60 and 90 min after addition of alcoholic extract (1:100 concentration) and aqueous extract (1:25 concentration) respectively. This herb may cause nausea or gripping before purging. No other information about the safety of this herb is available. Use caution. Ayurvedic herbs are often taken in combination with others to neutralize the toxicity one herb with the opposing effect of other.(56)

Photochemistry

The tree is mainly known for the kamala powder which consists of glandular and stellate non-glandular hairs from the capsules of the plant, and has long been used as an anthelmintic and as an orange dye for silk. According to early chemical investigation, kamala contains phenolic compound of which rottlerin(malotoxin)is the man compound. The compound was first isolated by Anderson[52](1855).As a result of extensive studies by British[33-35].India[12-13]and German –[13-14] investigator before world war II The structure(Ia) was accepted for rottlerin[32]. The structure of isoallorottlern (II) was determined by synthesis by Brock Mann and Mater(13) and McGookin et al[35] but its natural occurrence could,however,not be conclusively confirmed,Cardillo et.al[17] (1965) iolated two additional compound from kamala, which they called 3-hydroxy rottlerin (Ib)and 3,4 dihydroxyrottlerin (Ic).No isoallorottlerin (II)was found.Crombie et al [18](1968)isolated two new compounds from kamala extract, lacking the methylene bridge, which they called" red compound" and "yellow compound". The structures(III)and(IV),respectively, ware proposed for these compounds. The leaves of mallotus philippinensis Muell Arg.cotains nitrogen and ash. The nitrogen content was estimated by kjeldahl's

method and found to be 2.14% and for the determination of ash content, the leaves were ashed n silca crucible in a muffle furnace at 600-700C and was found to be 13.37%[25],Leaves also contain bergenin in very minute amounts. The bark of the tree contains about 6-10% tannins[8] and the petroleum ether extract on chromatography over silica gel yielded cetylaleuritolic acid (0.006%)[16].Kamala is used as dye by local people. It is harmless and odorless and I very stable. Kamala dye when dissolved in fats in small amount gives a light yellow colour which is natural to b An extract of the leaves and flowers is traditionally used for the remedy of toothache because of anesthetic properties, stomatitis, flu, cough, rabies diseases and tuberculosis and throat complaints[5]. It has also used in remedy of rheumatism and fever[6,7]. It has strong diuretic activity and the ability to dissolve urinary calculi[2]. It also exhibits antimalarial, antisepticutterfat of good quality. Kamala also contains other compounds like wax. traces of volatile oils,tannins,suger, gum, starch,cellulosic materials. Oxalic acid and mineral matter[21].The composition of phloroglucinol derivatives is relatively constant in materials of different origins. Composition of phlorglucinol derivatives isolated from kamala [34]S.V. Puntambekar : F.A.S.C. forest research Institute and collages. Dehara dun (1951). Chemical examination of the fatty oil from the seeds of *Mallotus philippensis* muel. Arg. [11] Maeda: Mitsuru, Fukami : Harukazu Namikawa,Koshi The established method for producing; *Mallotus philippenses* dye composition and the composition when a dye extract is extracted with water and alcohol and from a *Mallotus philippenses* plant body.3 Nov.(2005).[41] Phytochemicals works of kamala (*Mallotus phlilippenses*) using thidiazurun has been reported by Muhammad Arfan. Hazrat Amin, Magdlena, Karamaca, Gnieszka Kosinska, Wieslaw Wiczkowski and Ryszard Amarowcz (2009) to efficient works was for Antioxidant Activity of phenolic fractions of *Mallotus philippenses* bark extract of the gene *mallotus* are a rich source of biologically active compounds such as phloroglucinals : tannins, terpenos. using methanol(2009).[42]

Pharmacological Studies

The kamala powder was tested for anthelmintic activity Aqueous, ethereal and alcoholic extracts were tested against cestodes,trematodes and nematodes and it was found that the drug taenicidal acts both in-vitro and in vivo-[39-49].The purgative activity of drug was tested on rats. One group of rats fasted over night, was given the suspension of M.philippinensis 10mg/150gm rat. Another group of similar rats were fed with gum acacia mucilage in same quantity to serve as control. The faeces were collected on blotting paper and the wet area marked on the paper was measured and it was found that the powder has a significant purgative activity.

The anthelmintic activity of the powder has been investigated in rats naturally infested with Taenia solium.The resin in 60 and 120mg/kg.dose exhibited lethal anthelmintic affects (35.69%and 78.2% respectively) on the population of tape worms(26-54).Gujral et al.[12](1960)found that M.philippinensis possesses antifertility effects when tested on rats. The active principle was rottlerin.Many workers also found that powder of fruits reduces fertility in albino rats[36-50].Gupta et al.[27](1946) studied that kamala is used as a coloring agent for hydrogenated vegetable oils and its toxicity was studied on white rats and it was found that there were no histological changes in the structure of liver,kidney,and suprarenal's of rats examined at different intervals(one or half month.3 and 6 month) indicated the absence of toxicity of the drug even when given in fairly high concentration(27).Extract of fruit was found to possess hypoglycemic activity when tested on albino rats, A single dose of 250mg/kg was used and the estimation of sugars was done by the method of Nelson[19]. Ainapure.et [9](1985)found that this drug along with other indigenous drug produces hypoglycemia in dogs. Kamala powder was found to be effective in Hymenolepiasis in childhood 96% patients were cured after a single dosage for 2 days. Besides acting on worms in the intestinal lumen, the drug also acts on the cysticercoids stage lodging in the intestine. The kamala powder at 1:10[30] temporarily paraliysed the cestode Taenia hydatigena in-vitro and at 1:10-1:10 the substance relaxed rat intestine segments and paralysed rabbit intestine segments (37)Sharma et. Al.[51]. Antiallergic activity-: Antiallergic agents from .Natural sources: Inhibition of Nitric oxide production by Novel chalcone. Derivatives from *Mallotus philippensis* (Euphorbiaceae) [7]The present study was designed to investigate the adverse effects of indigenous. kamala seed ethereal

extract onariuos. reproductive parameters of female rats. An ethernal of kamala seed induce adverse effect son reproductive parameters of female rats.4 Feb.(2005).[46]Antioxidant activity of phenolic fractions of *Mallotus philippenses* bark extract from using methanol; *Mallotus philippensis* bark extract: natural antioxidants : phenolic compounds: tannins, antioxidant activity :antiradical activity.[45]Ramakrishna is reported by Hepatoprotective activity of methanolic extract of *Mallotus philippensis* [LAM.] Muell. Arg. leaves in rats.(2010)[43]

Biological activity

Antibacterial activity-:Tomentosos is a medicinal plant. which was tested. phytochemical screening and antibacterial evaluation of stem bark of *Mallotus philippensis.25 April(2005). [31]*]

Antimicrobial activity-:Jayaraman velanganni, Devarenapathi kadamban, Arumugame chanemougame, Tangavelou (2011) reported by phytochemical screening and antimicrobial activity of the stem of *Mallotus philippensis* [LAM.] [Euphorbiaceae]. [29]

Micro propagation

Micro propagation has become a reliable and routine approach for large-scale rapid plant multiplication, which is based on plant cell, tissue and organ culture on well defined tissue culture media under aseptic conditions. A lot of research efforts are being made to develop and refine micro propagation methods and culture media for large-scale plant multiplication of several number of plant species. Micro propagation has superiority over conventional method of propagation because of high multiplication rate and disease free plants. But, field performance of these tissue cultured plants depends on the selection of the initial material, media composition, growth regulators, cultivar and environmental factors. Some well developed *in vitro* techniques are currently available to help growers to meet the demand of the spices and pharmaceutical industry

Micropropagtion through leaf-: In vitro propagation of *Mallotus philippenses* has been achieved. By Abbes (1993).by leaf & using obtained a continuously growing callus on MS+2-4D+kn: This callus when sub-cultured. on MS+BA+CH (CASIN HYROLYSATE)gave rise to four type of morphologically distinct cell lines : Among these four lines: only the green compact. cell line was responsive for organogenesis differentiation: shoot regeneration occurred in this callus when sub cultured on MS+BA+NAA.[5]

Endosperm culture-:Sehgal and Abbas (1996), induced triploid plants from the endosperm cultures of *Mallotus philippensis*. (6)

Theoretic Evaluation

A study on 214 school children in five villages indicated the presence of one or the other intestinal parasite in most of the children. The roundworm,giardia and hookworm were most frequently noted. A clinical trial to study the effect of *Kampillaka* on 76 school children showed fairly good effect.
The effect was relatively more pronounced on roundworm infestation. Clinical trial of *Kampillaka* on 52 children infested with hookworm *(Hymenolepis nana)* administering a single dose for 2 days, showed satisfactory conversion of stools from positive to negative in 96 percent patients. The drug perhaps acted not only on the worms in the intestinal lumen, but also on the cysticercoids stage lodging in the intestinal villi. *Kampillaka* powder in combination with *Butea monosperma* and *Embelia ribes,* when given in a single dose for 4 days (in the same dose schedule)was found to be effective in 89 percent children. During the follow up period (1 month), hematological investigations showed a significant fall in the

eosinophil count. The only side effects observed were mild nausea, occasional vomiting and loose motions in 11 children.(56)

Pests and diseases

Several fungi causing rot have been reported to attack kamala tree. Pests: The wood is susceptible to attack from insects, especially beetles, such as Monochamus bimaculatus, Xylotrechus smei, Agrilus malloti, Sinoxylon spp., Lyctus Africans, and Stromatium barbatum.(10)

Conclusion

Literature search has shown that this plant has immense medicinal & economic uses in different systems of Medicine in India as well as throughout the world.
Though it has such medicinal & economic property it is now rarely available and has been categorized as an endangered plant could be unawareness about its uses in general public as well as its difficulty in natural reproduction. So different methods of its conservation & propagation should be adapted so as to prevent its extinct

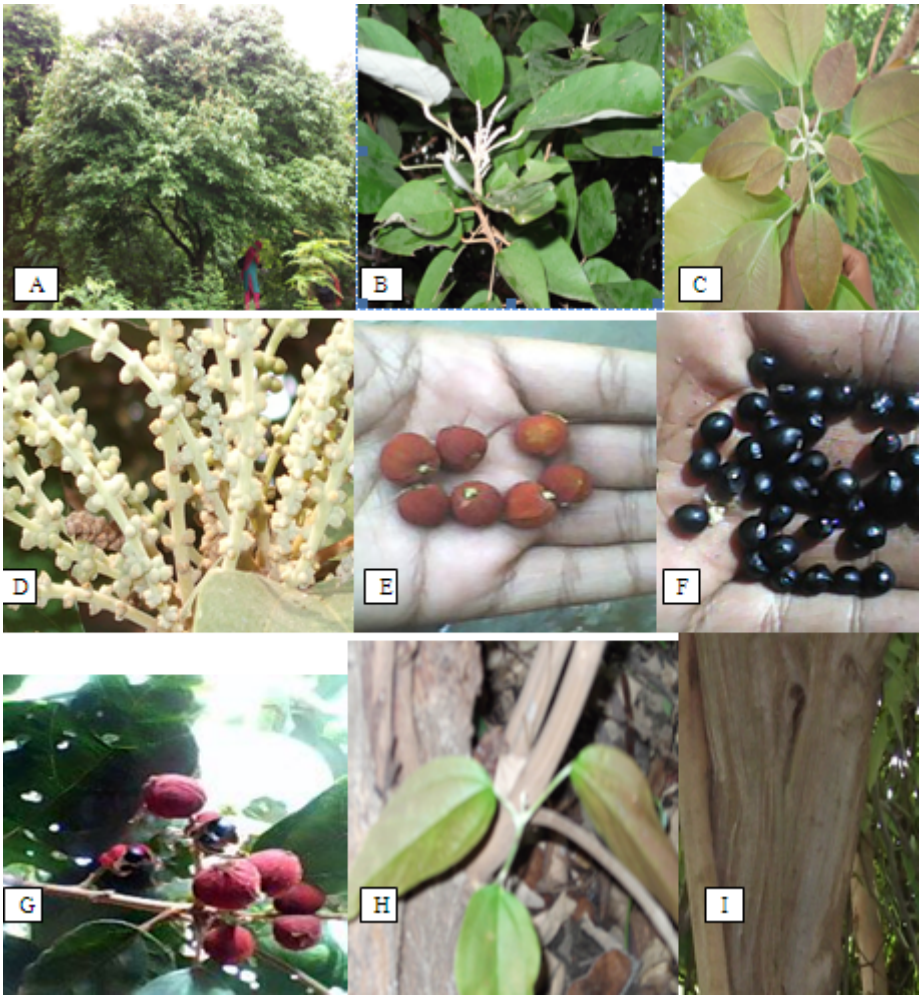

Figure 1: (A) Mature pant of *Mallotus Philippnsis(LAM.)*M.ARG (B)Flowering twig (C) Apical twig (D) Primary condition of seed setting (E) Fully mature fruits (F) Fully mature seeds (G) Fruiting twig (H) New leaves (I) Stem with bark

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