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"A Review on Chemical Constituent and Pharmacotherspeutic Action on Wood Apple"

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ABSTRACT: Plant are the primary sources of vast arry of Traditional medicine that have been in existence for thousands of years in countries such as india. Limonia acidssim. L has been traditionally used as as ayurvedic medicine.This genus has no other species in the Rutaceae family.Limonia acidssimhas distrinct part such as leaves bark, fruit, pulp, rind,roots, flowers contains variety of phytoconstituents such as alkaloids, phenols, tannins, flavonoides ,saponin , esters, fat, calcium, iron,coumarin, tyramine etc., and possess multipotent pharmacological activities. The focus of this review is on the identification standarizaton phytochemical and pharmacological action of medicinal uses in different part of limonia acidssima

KEY WORDS: LIMONIA ACIDSSIMA, Pharmcological Activities,,Phytochemical investigation,Rutaceae

I. INTRODUCTION:

Many plants are used in India's Ayurveda siddha , Unani and homeopathic system to heal illness in people and animals. The plants that were utilized were known as therapeutic plants utilize the for their therapeutic or medicinal properties are referred to as medicinal plants.

Many plants are utilize for their medicinal and therapeutic properties interms of abundance of traditional , valuable source of treatment or plants that may be valuable sourses of therapies or curative assistance , india is the one of the top Asian counties .India is well known worldwide for its extensive knowledge of Ayurveda. Many different ailment have been treated using knowledge of ayurveda

Limonia acidissima l. belonges to a monotypic genus limonia and is classified under the family Rutaceae. This exotic deciduous tree may be found in Southasia, Pakistan, Sri Lanka, and India. The plants leaves, barks, and roots are used to treat diseases cause by biological imbalance. The L,. Acidissimafruit are well known uses in indian traditional medicine.They are also known as wood apple, elephant-apple, monkey fruit, vilampazham, keth bel, and kaitha. The Raw fruit pulp of L Acidssima can be used totreat gastrointestinalissues such as flatulence, diarrhea, dysentery, and piles. The plant is said to be adaptogenic activity against blood impurities, leucorrhoea, and dyspepsia and snake bites, as well asthroat infections.

Wood apples are very valuable medicinally. Each component in fruit has therapeutic value. By bringing down bloodglucose levels, wood apples against diabetic and cell reinforcement properties. Because of its potential revolutionary searching action of different phytochemical wood apple organic product is viewed as one of the normal wellsprings of cancer prevention agent. Its antioxidant properties using various extracts have been studied.

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(a) (b)

Figure: 1imonia acidissima: a. Tree b. sources of phytochemicals in L,.acidissima.

Plant Description

Limonia acidissima L. (Syn, Feronia elephantum Hesperethusa crenulata, Schinus limonia) is the just species of its genus, of the family Rutaceace. It is local in Bangladesh, India, Pakistan, Sri Lanka, and Vietnam.

Taxonomic Position:
Kingdom: Plantae
Sub-kingdom: Tracheobionta
Super-division: Spermatophta
Division: Magnoliophta
Class: Magnoliospida
Subclass: Rosidae
Order: Sapindales
Family: Rutaceae
Genus: Limonia L.
Species|: L.acidissima.

Synonyms:
Feroniaele phantom correa,
Feronia limonia (L.) Swingle,
Schinus limonia L.

Vernacular names:
English: Wood Apple, elephant apple, Monkey fruit or curd fruit
Hindi: kaitha , kath bel or kabeet
Oriya: kaitha
Sanskrit: kapittha or Dadhistha
Telugu: vellaga pandu
Tamil: vilam palam
Malayalam vilam kai
Bengali: koth bel
Gujrati:kothu
Malaysia: belingai

Distribution:
Limonia acidissimqa is local to India and furthermore developed in Bangladesh, Pakistan and Sri Lanka.

Ecology:

The wood apple is local and normal in dry fields. It favors a storm environment with a particular dry season. In the western Himalayas, the tree grows to an elevation of 450 meters. It is evidently dry season open minded and best adjusted to light soils.

Morphological Characteristics:-

Limonia acidisssimA L. is a deciduous erect tree of moderate size with a few upward slender throughout india. It is a slow growing tree that can reach 9 meters in height grows in dry and warm areas up to 450 meters above sea levels and frequently has rough, spiny bark on same of the zigzag twigs the spines are axillary short , straight and 2-5 cm long.

Nutritional value:

Pulp from wood apples has 140 kcal. Protein and carbohydrates are found in the fruit. It is also high in riboflavin, vitamin B6, vitamin c, and beat – carotene. The tannin content of wild-grown wood apple fruits is typically higher than that of commercially grown ones.

Biology:-

Blossoms are regularly sexually unbiased, in India the organic products age from early October through spring. Cultivating's won't prove to be fruitful until 15 years of age.

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Table 1: Chemical Constituents of Different Parts ofLimonia Acidissima L.

Plant Part	Chemical Constituents
Fruit	Polyphenols, Vitamins ,Saponins,Coumarins, Amino Acids, Tri-Terpenoids, Phytosterols, Tannins, Flavonoids, Steroids, Glycosides, Fat, Calcium,Magnesium,Iron,Umbelliferone,Dictammine, Xanthotoxol, Scoparone,Xanthotoxin,Isoipinnellin, Isoimperatorin And Marmin
Leaves	Acidissimi, Acidissiminol, Alkaloids, Phenolsresins, Gum And Mucilage, Fixed Oils And Fats, Stigmasterol, Psoralen,Bergapten, Orientin, Vitedin, Saponarin,Tannins,Essential Oil.
Bark	Marmesin,Feronolide,Feronone
Fruit Pulp	Carbohydrates ,Proteins, Fatand Dietary Fibre
Seed	Fixed Oil ,Carbohydrates ,Proteins, Amino Acid
Roots	Bargapten, Osthol, Isopimpinellin, Marmesin, Marmin, Feronia Lactone, Geranylum, Belliferone
Shell	Psoralene , Xanthotoxin ,2,6-Dimethoxybenzoquinone,Osthenol Amino Acid,
Unripe Fruit	Stigmasterol
Pulp	5,4,-Dihydroxy-3-(3-Methyl-But-2-Enyl)3,5,6-Trimethoxyflavone 7-O-B-D-Glucopyranoside,Citric Acid,Fruit Acids, Mucilage,Minerals,Alkaloids, Coumsrins, Fatty Acids, Sterols,Umbelliferone,Dictamnine,Xanthotoxol,Scoparone,Xanthotoxin,Isopimpertorin,Marmin

Table 2: Medicinal Uses of Limonia Acidissima L.

Plant Part	Medicinal Uses
Fruit	Liver Tonic, Astringent,Cardic Tonic, Sore Throat And Diseases Of The Gum, Peptic Ulcer, Tumors, Hepatitis, In Blood Purification , Stomachic,Stimulant,Diuretic, Aphrodisiac, Liver Tonic, Anti-Asthmatic,Antidiarrheal,Leuorrhoeal,Antidiarrheal,Leuorrheal
Leaves	Astringent, Flatulence, Diarrhoea, Dysentery(Especially In Children) And Haemorrhoids, Indigestion, Breast Cancer, Uterus Cancer,Infertility, Progesterone Deficiency,Flu And Respiratory Disorders, Astringent,Carminative And Hepatoprotective Activity
Bark	Venomous Wounds, Poncrushing ,Demulcent, Constipatin, Anti-Diarrheal And Anti-Haemorrhoidal

NUTRITIONAL IMPORTANCE:-

Wood apple pulp has 140 kcal per 100mg. The fruit has carbohydrates and proteins in it.Beta carotene, vitamin B, vitamin C, thiamin and riboflavin are also abundant in it. Wild Wood apple typicaly contain higher levels oftannin than commercially grown varieties.

L, acidissima is a nutrient –rich fruit with a fairy high protein content (10%) and a good phenolic content, both of which indicate that dried powder is a useful source of antioxidant .In addition, the fruit pulp has a 3-8% pectin concentration. the fruits chemical components include triterpnoids,flavonoids,glycosides, phytosteroids, saponins, tannins,carbohydrate, and vitamins. certain tyramine derivative and coumarins gave reportedly also been identified.

MEDICINAL PROPERTIES:-

1. In india limonia acidissimia l. is commonly used as a tonic for the liver and heart. The pulp is applied as a poultice to poisonous bug bites and strings.
2. Limonia acidissima l. is used to curve gum disease, sore throats, diarrhea and dysentery. It is also a good treatment for hiccups.
3. The components (in paste form) from limonia acidissima stem bark are traditionally combined with water and used mostly on the face (Yoganarasimhan, 2000), regular application is through to maintain a cool ,smooth, fair and well- textured complexion on the skin (patra , misra and chaudhuri, 1988) by preventing uv rays it is also known to protect against skin cancer.

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4. 'Thanaka', is a facial cosmetic prepared from the pulp of l. acidissima.

OTHER USAGE:-

The fruit of wood apples can be consumed raw, blended into a range of drinks and sweet, or canned and used as jam. The sticky pulp that has been scooped out can be frozen as an ice cream or combined with coconut milk and palm sugar syrup to be consumed for breakfast in Indonesia. While the pulp is used in savory chutneys in India, leaves are consumed in salads, in Thailand. The wood is used as fuel.

PHYTOCHEMICALS:-

Preliminary phytochemical study of the plant componets. Of limonia acidissima revealed the presence of steroids, lipids alkaloids, flavonoids, phenols,terpenoids,tannins ,gum, mucilage and fixed oil. Stigmasterol is present in the immature fruits, fruits pulp is rich in nutrients mucilage and other fruit acids, including citric acid. The pericarp has been shown to contain sterols, fatty acid coumarins and alkaloids umbelliberone, diotamine, scoparone, xanthotoxin , xanthotoxol ,isoimperatorin and marmin are also present. The leaves contain tannins orientin, vitedin, psoralen, bergpten, stigmasterol and as essential oil from the bark marmesin feronolide and feronone have been identified seeds have set oil and carbs in them amino acids and protein .feronia, lactone, geranylum beliferone bargaten , as thol isopimpinellin , marmmesin and marmin are aal found in roots.

TABLE NO3:- Essential Oil from Leaves of Limonia Acidissima L.

Sr No.	Constituent	Composition
1	Caryophyllene Oxide	1.7%
2	Veratraldehyde	0.3%
3	3,4-Dimethyl Cinnamic Alcohal	0.1%
4	Germacrene-D	1.2%
5	Aromadendrene	0.1%
6	Elemicin	0.9%
7	Eudesma-4(!4)11-Diene	46.3%
8	Cis-Anethole	2.8%
9	Caryophyllene	1.3%
10	1,5- Cyclodecandine	29.6%
11	Linalool	0.1%
12	Carvacrol	13.4%
13	α -Pinene	0.2%
14	α-Thujene	0.4%

Table No 4: - Essential Oil from Fruit Pulp of Limonia Acidissima L.

Sr No	Constituents	Composition
1	Thymol	52.22%
2	Dodecanoic acid	19.34%
3	α -Pinene	4.02%
4	Carvacrol	3.86%
5	Camphoric acid	3.25%
6	Caryophyllene oxide	3.06%

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PHARMACOLOGICAL ACTIVITY OF WOOD APPLE:-

The extract and pure chemical obtained from wood apple have demonstrated a range of pharmacological activity, including anti- tumor, antibacterial, anti-diabetic, anti- inflammatory, and analgesic, antioxidant, and hepatoprotective, ant mutagenic and antimalarial properties. Below is an overview of the research findings from these studies.

Anti-cancer activity:-

Fruit exreact l.acidissima . L demonstrated anticancer activity fruit fraction (1) to (4) as well as the crude extract (ethanolic extract) were used to evaluate ED50(50%in inhibition of cancer cell growth) in two breast cancer cell lines (SKBR3) and (MDAMB -435) Bioassy Limonia AcidissimaL. a fraction from ethanolic extract demonstrared anticancer activity in

Anti-diabetic activity:-

The methanoic fruit pulp extract of limonia acidissima l. was found to improve the glucoset tolerance of alloxan induced diabetic rats compared to control (0.01). The extract of the plant significantly reduced blood urea levels and creatinine levels. It also increased total protein levels in rats (llango et Al., 2009). A significant dose- dependent antibiotic action of methanolic fruit extract and aqueous leaf extract of limonia acidissmia l. has been well-documented in streptozolokin induced diabetic rats (Mohan Priya et Al., 2012; joshi R K et al., 2019).

Antifungal activity:-

Feronia limonia linn fruit pulp contains a variety of extracts such as petroleum ether chloroform, methanol and water. The fruit pulp of this plant has been shown to have anti- fungal properties against a variety of pathogenic fungi. The leaves of this plant contain essential oil which has been found to have anti-foaming properties against eight of the tested fungi.

Anti-Larvicidal Activity:-

Acetone extract of the dried leaves found to be effective against larvae of cuexquinque fasciatus, anopheles, stephensi and acedesaegypti.

Wound Healing Activity:-

Wood apple is traditionally as a medicine. Various extracts of l, acidissmia has significant and dose- dependent, wound healing activity, this supports the traditional claim that the plant heals wounds.

Hepato-Protective Activity:-

A hepatoprotective effect of an ethanolic extracts from the pulp of l. acidissima against liver damage caused by carbon tetrachloride (CCL4) in rats has been reported. It showed a siginificant dose-dependentpprotective effecf against CCL4-induced liver injury, which was mainly attributed to the antioxidant properties of the extract.

Diuretic Activity:-

The diyretic effect of methanolic extracts obtained by microwave extraction (MAE) and (BSE) of limonia acidissima was tested. These results support the traditional use of limonia acidissima leaves as diuretics.

Anti – inflammatory activity:-

Wood apple is also rich in anti-inflammatory properties, helping reduce the risk of cardiovascular diseases. Having wood apples during monsoons will help prevent infections due to bacteria and viruses. Wood apple is also known to improve and boost your metabolism.

Analgesic activity:-

A daily spoonful of dried apple peels for 12 weeks resulted in subjects with moderate loss of range of motion in their joints and related chronic pain experiencing improvements in their necks, shoulders, backs and hips, as well as lower pain scores.

Neuroprotective activity:-

Wood apples neuroprotective properties were examined, and it was discovered that at doses of 205 mg and 500 mg per kilogram of body weight, it was discovered that at doses of 250 mg and 500mg per kilogram of body weight, it protects eats brains forms damage caused by ischemia and reperfusion.

Spermatotoxic Activity:-

By administering ethanolic extracts at 250 and 500 mg/kg to adult male rats for 55 days, researchers were able to study the wood apple fruit pulps antispermatogenic activities and determine that they were thecause of the drop insperm count, motility, and viability moreover, by 24.58% and 29.86% respectively,they increased the fraction of defective sperm and decresed testicular protein content.

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Antiulcer Activity:-

The fruits phenolic compounds are responsible for protecting against ulcer on gastric wall and leucocytes infiltration of submucosal layers.

Antimicrobial Action:-

According to reports, gram-positive and gram-negative bacteria, which cause most bacterial illnesses, are both sensitive to ethanolic extract from Limonia Acidissima L. leaves.

Anti-Hyperlipidemic Activity:-

Fruit powder administered for 28 days at doses of 2.5,5, and 10 g/kg body weight decreased lipid profiles and hepatic glucose-6-phosphatase while significantly raising hepatic glycogen, hexokinase and HDL. The presence of fibres, phytosterols, saponins, polyphenols, flavonoids, and ascorbic acid may cause it.

Antibacterial Activity:-

It was discovered that limonia acidissima. Leaves ethanolic extract has a wide range of action against both gram-positive and gram-negative bacterial illnesses. The antibacterial activity was assessed against gram-positive and gram-negative microoragnisms using the agar well diffusion technique. Hexane extract showed strong antibacterial activity with substantial inhibition zones.

Adsorbent:-

Limonia acidissima l. leftover fruit shell is employed as an adsorbent. In this procedure, activated carbon made from the shell of the methylene blue dye from any solution. The agitation time, dye concentration, adsorbent dosage, and temperature 24 significantly influence the adsorptive removal of the dye methylene blue.

Biosorbent:-

As a biosorbent, limonia acidissima's leftover fruit shell is employed. To eliminate methylene blue from the aqueous solution, powdweed raw materisals and treated materials of certain micron sizes were utilized. The outcomes show thast chemically treated material at higher temperatures. The latter is a reluating element for adsorption. The highest amount of dye is removed from treated material (35℃) and raw material (25℃).

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