

THE AYURVEDIC PHARMACOPEIA OF BANGLADESH

Part I: Volume V
MONOGRAPHS OF SINGLE DRUGS
First Edition



GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF HEALTH AND FAMILY WELFARE
DIRECTORATE GENERAL OF HEALTH SERVICES
DEPARTMENT OF HOMEO AND TRADITIONAL MEDICINE
& ALTERNATIVE MEDICAL CARE (AMC)
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Functions:

1. Prepare an Ayurvedic Pharmacopeia of single drugs and compound drugs.
2. Ayurvedic Pharmacopeia expert committee will be carried out scientific works to generate data on monographs of single drugs in which lay down standards for compound formulations.
3. Will prepare monographs on single herb or plant including about 250 in numbers in two years period will be included in the Pharmacopeia providing information on identity, vernacular names, descriptions, important formulations, therapeutical index and pharmacognostical standards.
4. The Ayurvedic Pharmacopeia of Bangladesh Part I comprise of monographs of Ayurvedic single drugs of plant origin, which go into one or more. In compiling the monographs, the title of each drug had been given in Bangla and then comes the definition of the drug giving its identity in scientific nomenclature and very brief information about its source, occurrence, distribution and precautions in collection.
5. The monograph then gives norms and limits under " Purity and Safety Test" like tolerance of foreign matter, total ash, acid insoluble ash, alcohol soluble extract, water soluble extract, volatile oil contents. Some of them have a direct bearing on the purity and strength. Where possible, assay of one constituent or group of constituents like total alkaloids or total volatile oils has been given. However, under the heading 'Major Chemical Constituents' one or more constituents or group of constituents like oleoresins, essential oils, alkaloids have been mentioned which only have an informative value based on published research work in phytochemistry. In the case of water soluble or alcohol soluble extract specification of lower limit has an added relevance to the maturity of the drug in addition to its authenticity.
6. It will however, be worth mentioning that there is always a wide variation in crude drugs (raw materials) of plant origin in respect of their chemical contents, due to varied climatic conditions, geographical distribution, source and season of collection and lack of scientific methods of storage and preservation. Therefore, the variation in the chemical data created a great difficulty in fixing the standards for single drugs. However, the data has been fixed up by working out as many samples as possible procured from different sources.

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Legal Notice

The Ayurvedic Pharmacopeia of Bangladesh (A.P.B.), Part I, Vol.V, is the book of standards for single drugs included therein and the standards prescribed in the A.P.B., Part I, Vol.V, would be official. If considered these standards can be amended and the Chairman of the Ayurvedic Pharmacopeia of Bangladesh.

Committee authorised to issue such amendments. Whenever such amendments are issued the A.P.B., Part I, Vol.V, would be deemed to have been amended accordingly.

General Definitions

Title: The title of the book is "The Ayurvedic Pharmacopeia of Bangladesh". Wherever the abbreviation A.P.B. is used, it may be presumed to stand for the same and the supplements thereto.

Title of the Drugs: The name given on the top of each monograph of the drug is in Bengali as mentioned in the Ayurvedic classics will be considered official. These names have been arranged in English alphabetical order. The latin name (taxonomical nomenclature) of each drug as found in authentic scientific literature has been provided in the monograph in the introductory paragraph. The official name will be the main title of the drug and its scientific name will also be considered as legal name.

Synonyms: Synonyms of each drug appearing in each monograph in Bangla, Hindi, Sanskrit, Urdu/Unani/Tibb and English have been mentioned as found in the classical texts, Ayurvedic Formulary of Bangladesh and as procured from the experts, scholars of Ayurveda.

Italic: Italic type has been used for scientific name of the drug appearing in the synonyms paragraph of each monograph.

Geographical Distribution: The geographical distribution emphasizes the locality or availability of particular single drugs within Bangladesh.

Organoleptic Properties: The organoleptic properties include Rasa (taste), Guna (attribute), Virya (potency), Vipaka (metabolism) and Karma (action). References were taken from various authentic Ayurvedic classics.

Purity and Safety Test: Under the heading "Purity and Safety Test" are provided as an aid to identification and are described in their respective monographs. The term "Foreign Matter" is used to designate any matter which does not form part of the drug as defamed in the monograph. Vegetable drugs used as such or in formulations, should be duly identified and authenticated and be free from insects, pests, fungi, micro-organisms, pesticides, and other animal matter including animal excreta, be within the permitted and specified limits for lead, arsenic and heavy metals and show no abnormal odour, colour, sliminess, mould or other evidence of deterioration. The quantitative tests e.g. total ash, acid insoluble ash, water soluble ash, alcohol soluble extract, water soluble extract; ether soluble extract, moisture content; volatile oil content and assays are the methods upon which the standards of Pharmacopeia depend. The methods for assays are described in their respective monographs and for other quantitative tests, methods are not repeated in the text of monographs but only the corresponding reference of appropriate appendix is given. The analyst is not precluded from employing an alternate method in any instance if he is satisfied that the method which he uses will give the same result as the Pharmacopeial method. In suitable instances the methods of microanalysis, if of equivalent accuracy, may be substituted for the tests and assays described. However, in the event of doubt or dispute the methods of analysis of the Pharmacopeia are alone authoritative. In Thin Layer Chromatography (TLC) wherever given, the number of spots and R_f values of the spots with their

colour have been mentioned as a guide for identification of the drug and not as Pharmacopeial requirement. However, the analyst may use any other solvent system and detecting reagent in any instance if he is satisfied that the method which he uses, even by applying known reference standards, will give better result to establish the identity of any particular chemical constituent reported to be present in the drug. The microbial contamination, heavy metals and pesticides residues were followed according to WHO guideline. Directorate General of Drug Administration (DGDA) has recently taken an initiative to enhance the quality of Ayurvedic medicine through implementation of "Test Criteria" prepared by an expert committee.

Major Chemical Constituents: It describes the important chemical constituents, groups of constituents that reported in research publications and have mentioned as a references and not as pharmacopeial requirement.

Percentage of Solutions: In defining standards, the expression percent (%), is used, according to circumstances, with one of the four meanings given below.

% w/w (percentage weight in weight) expresses the number of grams of active substance, in 100 grams of product.

% w/v (Percentage weight in volume) expresses the number of grams of active substance in 100 milliliters of product.

% v/v (percentage volume in volume) expresses the number of milliliters of active substance in 100 milliliters of product.

% v/w (percentage volume in weight) expresses the number of milliliters of active substance in 100 grams of product.

Percentage of Alcohol: All statements of percentage of alcohol (C_2H_5OH) refer to percentage by volume at 15.56°C.

Temperature: Unless otherwise specified all temperatures refer to centigrade (celsius), thermometric scale.

Solutions: Unless otherwise specified in the individual monograph, all solutions are prepared with purified water.

Reagents and Solutions: The chemicals and reagents required for the test in Pharmacopeia are described in Appendices.

Solubility: When stating the solubility of chemical substances, the term "Soluble" is necessarily sometimes used in a general sense irrespective of concomitant chemical changes. Statements of solubility which are expressed as a precise relation of weights of dissolved substance of volume of solvent, at a stated temperature, are intended to apply at that temperature. Statements of approximate solubility for which no figures are given, are intended to apply at ordinary room temperature. Pharmacopeial chemicals when dissolved may show slight physical impurities, such as fragment of filter papers, fibres, and dust particles, unless excluded by definite tests in the individual monograph. When the expression "parts" is used in defining the solubility of a substance, it is to be understood to

mean that 1 gram of a solid or 1 milliliter of a liquid is soluble in that number of milliliters of the solvent represented by the stated number of parts.

When the exact solubility of Pharmacopeial substance is not known, a descriptive term is used to indicate its solubility. The following table indicates the meaning of such terms:

Descriptive terms	Relative quantities of solvent
Very soluble	Less than 1 part.
Freely soluble	From 1 to 10 parts.
Soluble	From 10 to 30 parts.
Sparingly soluble	From 30 to 100 parts.
Slightly soluble	From 100 to 1000 parts.
Very slightly soluble	From 1000 to 10,000 parts.
Practically insoluble	More than 10,000 parts.

Therapeutic Usages: It indicates the particular plants may act on mentioned ailments.

Pharmacological Studies: It introduces the research based evidence of specific medicinal plants.

Posology: The doses mentioned in each monograph are in metric system of weights which are the approximate conversions from classical weights mentioned in Ayurvedic texts. A conversion table is appended giving classical weights of Ayurvedic System of Medicine with their metric equivalents. Doses mentioned in the A.P.B. are intended merely for general guidance and represent, unless otherwise stated, the average range of quantities per dose which is generally regarded suitable by clinicians for adults only when administered orally. It is to be noted that the relation between doses in metric and Ayurvedic systems set forth in the text is of approximate equivalence. These quantities are for convenience of prescriber and sufficiently accurate for pharmaceutical purposes.

Formulations: Important formulations mentioned in the Bangladesh National Formulary of Ayurvedic Medicine as well as authentic texts.

Abbreviations and Acronyms

AMC	: Alternative Medical Care
cm.	: Centimeter
DGHS	: Directorate General of Health Services
ECNEC	: Executive Committee of the National Economic Council
gm.	: Gram
HNPSP	: Health, Nutrition and Population Sector Program
HNPSDP	: Health, Nutrition and Population Sector Development Program
kg.	: Kilogram
l	: Liter
m	: Meter
mm.	: Millimeter
mg.	: Milligram
ml.	: Milliliter
OP	: Operation Plan
PIP	: Programme Implementation Plan
PM	: Program Manager
TLC	: Thin Layer Chromatography
v/v	: Volume by volume
v/w	: Volume by weight
w/w	: Weight by weight
w/v	: Weight by volume
μ	: Micron (0.001 mm)
%	: Percentage

:

Introduction

Pharmacopoeia literally means “drug-making”. Pharmacopoeia is a book describing drugs, chemicals and medicinal preparations; this pertains especially to one issued by an officially recognized authority and serving as a standard. The Ayurvedic Pharmacopoeia of Bangladesh is a legal document of standards for the quality of Ayurvedic medicine and substances included therein. More than 90% of ingredients used in Ayurvedic medicine from plant origin. Mankind has used and continue to use plants for their medicinal properties. Over thousands of years, the knowledge for the application and administration of plants in the prevention and treatment of human disease and illness has grown and developed in to holistic lifestyle system, such as Ayurveda. These systems are widely used, and traditional medicine remains a primary source of health care for up to 80% of the population of some African and Asian countries. Bangladesh, due to its unique variety of geographical and climatic factors, has a rich and varied flora of the medicinal plants since the Vedic period. Bangladesh contains about 5,700 species of higher plants being situated in a larger part of South-Asian center of plant genetic diversity. Of which 260 species are cultivated and the rest of the species are virtually left on growing in natural vegetation in forests and in village thickets.

In an estimate, the international market of medicinal plants related to trade stood at 60 billion US Dollar per year. The demand for medicinal plants based raw materials are growing at an approximate rate of 10-15% per year globally. Medicinal plant sector has traditionally occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives of Bangladesh. In recent years, the growing demand for Ayurvedic products has led to a quantum jumping in volume of plants materials trade within and across the country. Bangladesh there is no systematic cultivation process or conservation strategies about medicinal plants. The local people conserve traditional knowledge through their experience and practice, which is handed down orally without any documentation. A uniform nomenclature or common name or group used for the identification of plants which the ancients used as sources of drugs has yet not been established. Morphological species identification for monitoring adulteration in plant materials is a great challenge, especially when the plants are purchased as raw drugs (dried or powdered whole plant or plant parts), which often lack the key morphological diagnostic characters that are required for species identification. According to the demand of medical practitioner and manufacturers needs identification of medicinal plants include organoleptic methods (taste, smell, sight and touch), macroscopic and microscopic identification (shape, colour and texture), and chemical profiling (TLC, HPLC-UV, HPLC-MS) for authentication of medicinal plants and Ayurvedic drugs. So considering the necessity of standard legal document the Director, Homeo and Traditional Medicine, Directorate General of Health Services, Dhaka has been taken work plan to preparation the Ayurvedic Pharmacopoeia under HNPS since 2003–2006 which was recognized by Executive Committee of National Economic Council (ECNEC). Having regard to all these considerations the Line Director, Alternative Medical Care (AMC) and

Director Homeo and Traditional Medicine proposed a body of National Ayurvedic Pharmacopeia Committee headed by Director General of Health Services consisting of experts on Unani or Ayurvedic or Homeopathic and other sciences including experts of pharmacognosy, chemistry and pharmacy. Director General of Health Services was accepted that National Committee on 06 January 2005 and three separate subcommittee was formed by the National Committee for Unani, Ayurvedic and Homeopathic pharmacopeia. By a tremendous effort of that committee, the Ayurvedic Pharmacopeia of Bangladesh, Part I, Volume I consists of 50 medical plants. Volume II also consists of 50 monographs of single medicinal plants and that was published in June 2016 under HNPSDP. In that continuation, Volume III was published in June 2019, Volume IV was published in June 2020 and now Volume V is going to be published by June 2021 under 4th sector HPNSP which also consists of 50 monographs of single medicinal plants.

This pharmacopeia describes the macroscopic, microscopic characters along with their chemical standards on the protocol developed and designed by Ayurvedic Pharmacopeia Committee. It deals in detail about the permissible limits of foreign matter, total ash, acid insoluble ash, alcohol soluble extract, water soluble extract and chromatographic pattern of TLC. It also describes the Ayurvedic pharmacological properties like rasa, guna, virya, vipaka, karma in each monograph along with their therapeutic uses, some of the important classical formulations and therapeutic dose. Appendix of this volume contains the details of the protocols used in determination of various scientific standards. References of ancient Ayurvedic literature in its original form are added attraction in order to authenticate the Ayurvedic statements made in each and every monograph. In the end English equivalents of Ayurvedic terms have been used to make the volume more useful for the people who are not conversant with Ayurvedic terminologies.

Amrul Shak

Botanical Name: *Oxalis corniculata* Linn.

Family: Oxalidaceae

Synonyms:

Bangla: আমরুল শাক (Amrul shak), Amrul, Amrool

Hindi: Seh-patti, Tinpatiya, Anboti, Chuka tripati, Bhilmori, Khatari

Sanskrit: Ambashta, Amlalonika, Amlapatrika, Amlika, Amlotaja, Cangeri

Urdu/Unani/Tibb: Khatt-i-buti

English: Indian sorrel

Geographical Distribution: *Oxalis corniculata* is widely distributed in roadside, yards, gardens, parks, human settled areas and nearly all warmer parts of Bangladesh and it grows up to a height of 2500 m of the Himalayas. It is also widely found in all South-Asian countries, West Indies, South, Central and North America.

Plant Descriptions:

General Description: *Oxalis corniculata* is bushy in nature and creates a mat forming structure in its growing areas. The top portion of the plants are erected weakly smooth or bushy. They are branching from the bottom and rooted at the nodes. The leaves of the plants are trifoliate, thin and heart shaped. The leaflets have a distinct apical indentation. Along the stem the leaves are arranged alternately and leaflets have reticulate venation. The stem of the plant is slender in shape and covered with soft short hairs. The internodes are 5 to 9 cm in length. It is sour in taste and smells like acidic. The root is dark brownish, thin, branched, soft; with no odor and taste. The flowers are 6-12 mm wide and have 5 yellow petals. The fruits are capsule, 1-1.5 cm long, cylindrical, pointed and ridged. The seeds are oval in outline, rounded, basally pointed, flattened, light brown and have a surface distinctly ridged. It has stolons also.

Macroscopic Description:

Root: Dark brownish, thin, about 1-2 mm thick, branched, rough, soft; no odour and taste.

Stem: Creeping, brownish-red, soft, very thin, easily breakable; no odour and taste.

Leaf: Palmately compound, trifoliate; petiole-green, thin, about 3-9 cm long, cylindrical, pubescent; leaflet-green, 1-2 cm long, obcordate, glabrous, sessile or sub sessile; taste, somewhat sour.

Flower: Yellow, axillary, sub-umbellate.

Fruit: Capsules cylindrical, tomentose.

Seed: Tiny, dark brown, numerous, broadly ovoid transversely striate.

Microscopic Description:

Root: Shows 3-4 layers of cork, composed of thin-walled rectangular cells, brownish in appearance; cortex, a wide zone, consisting of rectangular and oval, thin-walled parenchymatous cells filled with simple starch grains, yellowish pigment and tannin; inner cortical cells rectangular and polygonal,

smaller in size than miter ones; cortex followed by thin strips of phloem consisting of sieve tubes, companion cells and phloem parenchyma, cambium not distinct; xylem consists of vessels, tracheids, fibres and xylem parenchyma; vessels cylindrical, pitted some with tail-like projection at one end; tracheids pitted with pointed ends; a few starch grains simple, round to oval measuring 3-11 μ in diameter, present scattered throughout the region.

Stem: Shows single layered epidermis, composed of rectangular to oval cells, some of which are elongated to become unicellular covering trichomes; cortex consists of 4-5 layers of thin-walled, circular and polyhedral parenchymatous cells; endodermis single layered of thin-walled rectangular cells; pericycle composed of two or three layers of squarish and polygonal sclerenchymatous cells; vascular bundles 6-7 in number, arranged in a ring, composed of a few elements of phloem towards outer side and xylem towards inner side; xylem composed of pitted vessels, tracheids, fibres and xylem parenchyma; central region occupied by pith composed of thin-walled, parenchymatous cells, a few simple, round to oval starch grains measuring 3-11 μ in diameter, scattered throughout the region.

Leaf: Petiole: Shows rounded or plano-convex outline consisting of single layered epidermis of rectangular or circular, thin-walled cells; cortex 3-4 layers of thin-walled, circular, oval or polygonal parenchymatous cells, generally filled with green pigment; endodermis single layered followed by 2-3 layers of sclerenchymatous pericycle, less developed towards upper side of petiole; vascular bundles 5 in number, arranged in a ring, consisting of phloem towards outer side and xylem towards inner side; centre occupied by a small pith; a few simple, round to oval starch grains, measuring 3-11 μ in diameter, scattered throughout.

Lamina: Shows single layered epidermis on upper and lower surfaces, composed of rectangular cells; covering trichomes unicellular; palisade single layered composed of thin-walled, columnar cells, filled with green pigment; below palisade 2-3 layers of thin walled, spongy parenchyma consisting of circular to oval cells filled with green pigment; stomata paracytic.

Powder: Greenish-brown; shows fragments of trichomes, parenchymatous, sclerenchymatous cells, fibres, epidermis showing irregular cell walls in surface view; a few simple, rounded to oval starch grains, measuring 3-11 μ in diameter.

Part Used: Whole plant

Organoleptic Properties

Rasa (Taste)	: Amla (Sour), Kashaya (Astringent)
Guna (Attribute)	: Ruksha (Dry), Laghu (Light)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Amla (Sour)
Karma (Action)	: Deepana, Grahi, Kaphahara, Rucikara, Vatahara, Pittakara, Agnivardhaka



Figure 1. *Oxalis corniculata* Linn.

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 20 % w/w
Acid insoluble ash	: Not more than 10 % w/w
Alcohol soluble extractive	: Not less than 5 % w/w
Water soluble extractive	: Not less than 13 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (8 :2) shows under UV (366 nm) one fluorescent zone at Rf. 0.65 (blue). On exposure to Iodine vapour three spots appear at Rf. 0.27, 0.53 and 0.65 (all yellow). On spraying with 5% methanolic-sulphuric acid reagent and heating the plate for ten minutes at 110°C three spots appear at Rf. 0.27, 0.53 and 0.65 (all grey).

Major Chemical Constituents: It contains tannins, flavonoids, polyphenols, steroids, alkaloids, volatile oil, fatty acid, glycosides etc. Essential fatty acids like palmitic acid, linoleic acid, linolenic acid, stearic acid and oleic acid presence also detected in this plant. The plant leaves are the huge source of vitexine-2-O-beta-D-glucopyranoside and vitexine. The stem and leaves are the huge source of citric and tartaric acid and the stem contains mallic acid also. The plant parts are also containing Vitamin C and carotene.

Therapeutic Use: Kamla (jaundice), grahani (IBS), arsa (piles), kustha (skin diseases), atisara (diarrhoea) etc.

Pharmacological Studies: Antiinflammatory, anxiolytic, antiepileptic, antifungal, antiulcer, antinociceptive, anticancer, antidiabetic, hepatoprotective, antidiarrhoeal, hypolipidemic, antioxidant, hypolipidemic, steroidogenic, cardioprotective, nephrotoxicity, diuretic, antimicrobial and wound healing etc.

Contraindications: Should not be used during pregnancy, lactation, bleeding disorders, and known allergy to the plants of the Oxalidaceae family.

Adverse Effects: There are no side effects observed.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 1-3 gm in divided dosages, decoction 5-10 ml.

Formulations: Bal Changeri Grita

References:

1. Anika AK, Shorna F, Upoma SSK, Singh T and Dash PR: Therapeutic potentials of *Oxalis corniculata* Linn. as a medicinal plant: a review. *Int J Pharmacognosy* 2020; 7(4): 87-95.
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4. Badwaik H, Singh MK, Thakur D, Giri TK, Tripathi DK. The Botany, Chemistry, Pharmacological and Therapeutic Application of *Oxalis Corniculata* Linn– A Review. *International Journal of Phytomedicine.* 2011; 3: 01-08
5. Mushir A, Jahan N, Ashraf N, Khan MI. Pharmacological and therapeutic potential of *Oxalis corniculata* Linn. *Discovery Phytomedicine.* 2015; 2 (3):18-22.

Amada

Botanical Name: *Curcuma amada* Roxb.

Family: Zingiberaceae

Synonyms:

Bangla: আম আদা (Amada)

Hindi: Aamaa-haldi, Amiyaa haldi

Sanskrit: Amradrakam, Amragandha-haridra, Karpura Haridra

Urdu/Unani/Tibb: Aamba Haldi, Daarchob

English: Mango-ginger

Geographical Distribution: *Curcuma amada* is distributed throughout Bangladesh. *Curcuma amada* originated in the Indo-Malayan region and distributed widely in the tropics from Asia to Africa and Australia. It is usually found in Sri Lanka and South and East Asian countries. It also found in the wild parts of West Bengal, and is cultivated in Gujarat, Uttar Pradesh, Kerala, Karnataka, Tamil Nadu and the north-eastern states of India.

Plant Descriptions:

General Description: The plant grows to a height of 1 m. The leaves are long, oblong, lanceolate, radical, sheathed, petiolate and in tufts. Each plant bears 5 to 6 pairs of leaves. The rhizomes are fleshy, buff coloured, 5–10 cm long, 2–5 cm in diameter and demarcated into nodes and internodes. At the rhizome nodes scaly leaves are arranged circularly giving the appearance of growth rings with scars on the surface. The rhizomes are branched, and the branching is sympodial. The rhizomes emulate a raw mango flavour and taste pungent.

Macroscopic Description: Rhizome laterally flattened, longitudinally wrinkled, 2 to 6 cm long, 0.5 to 2 cm in diameter, branched, remnant of scaly leaves arranged circularly giving the appearance of growth rings; cut pieces 1.5 to 3.5 cm in diameter, circular, punctate scars on the surface, branching sympodial, horizontal; roots long, unbranched, tapering, thread like, yellowish-brown; rhizome buff coloured with short and smooth fracture; odour and taste like raw mango.



Figure 2. *Curcuma amada* Roxb.

Microscopic Description: Transverse section of rhizome circular in outline; epidermal cells rectangular-oval; cuticle thick, long unicellular trichomes present, storied suberized cork cells interrupted by lysigenous oil glands; a wide cortex having irregularly scattered vascular bundles, each vascular bundle with a prominent fibrous sheath; inner limit of cortex marked by endodermis followed by pericycle; vascular bundles devoid of sheath, arranged in a ring; schizogenous canals and abundant oil cells with suberized walls found in cortex and in central region; most of the parenchymatous cells filled with starch grains, which are oval-ellipsoidal, sometimes polygonal in shape, 10 to 60 μ m, simple, hilum circular or a 2 to 5 rayed cleft, lamellae distinct and concentric; vascular bundles in the central cylinder are similar to those in the cortex, scattered, closed, collateral, surrounded by sheath of thick walled cells; secondary wall thickening reticulate; fibres thin walled lignified, lumen narrow.

Powder: Powder light yellow, sweet, raw mango like odour; shows fragments of storied cork, xylem vessels with reticulate thickenings, lignified xylem fibres, oil cells, patches of parenchymatous cells filled with starch grains which are oval-ellipsoidal, sometimes polygonal in shape, 10 to 60 μ m, simple, hilum circular or a 2 to 5 rayed cleft, lamellae distinct and concentric. Powder when treated with 1N aqueous NaOH becomes green with yellowish tinge under UV 254 nm; with 1N HCl and nitrocellulose in amylacetate added one after the other, powder becomes orange in daylight.

Part Used: Rhizome

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Madhura (Sweet)
Guna (Attribute)	: Laghu (Light)
Virya (Potency)	: Sheet (Cool)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Improves digestion and appetite, Kaphahar, Pittahar, increase virility; aphrodisiac.

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 12 % w/w
Acid insoluble ash	: Not more than 2% w/w
Alcohol soluble extractive	: Not less than 9 % w/w
Water soluble extractive	: Not less than 14 % w/w
Starch	: Not less than 16 % w/w
Essential oil	: Not less than 1 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not

	more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thick) using toluene: ethyl acetate: methanol (5: 0.5: 0.05) shows fluorescent zones at Rf. 0.10 (green) and 0.34 (blue) under UV (366 nm). On spraying with anisaldehydesulphuric acid reagent and heating the plate for ten minutes at 120°C, spots of purple colour appear at Rf. 0.16, 0.32, 0.72 and 0.97.

Major Chemical Constituents: The major chemical components include starch, phenolic acids, volatile oils, curcuminoids and terpenoids like difurocumenonol, amadannulen and amadaldehyde.

Therapeutic Use: Kandu (itching), vrana (abscess), kasa (cough), swasa (asthma), hikka (hiccup), jwara (fever), abhighataja sotha (injurious edema), karnasula (earpain), sannipata (typhoid fever).

Pharmacological Studies: Antioxidant, antibacterial, antifungal, anti-inflammatory, platelet aggregation inhibitory activity, cytotoxicity, antiallergic, hypotriglyceridemic, enterokinase inhibitory, CNS depressant and analgesic activity etc.

Contraindications: Should not be used during pregnancy, bleeding disorders, kidney disease, and known allergy to the plants of the Zingiberaceae family.

Adverse Effects: No side effects observed.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 2-4 gm, Decoction 1-3 ml

Formulations: Mango-Ginger Churna

References:

1. Lalit RS. Curcuma amada Roxb.: A Phytopharmacological Review, Journal of Pharmacy Research 2012,5(4),1992-1993
2. Policegoudra RS., Aradhya SM., Singh L. Mango ginger (Curcuma amada Roxb.) – A promising spice for phytochemicals and biological activities. J. Biosci. 2011;36(4):739–748.
3. Jatoi SA, Kikuchi A, Gilani SA, Watanabe KN. Phytochemical, pharmacological and ethnobotanical studies in mango ginger (Curcuma amada Roxb.; Zingiberaceae). Phytother Res. 2007 Jun;21(6):507-16.
4. Mata YM, Saravanan KK. Phytochemical Analysis and Antioxidant Potential of Rhizome Extracts of Curcuma amada Roxb and Curcuma caesia Roxb, Journal of Drug Delivery and Therapeutics.2019; 9(5):123-126
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Atibala

Botanical Name: *Abutilon indicum* Linn.

Family: Malvaceae

Synonyms:

Bangla: অতিবলা (Atibala)

Hindi: Kanghi

Sanskrit: Atibala, Balika, Balya, Bhuribala, Ghanta

Urdu/Unani/Tibb: Kanghi, Kangahi, Kakahiya, Kakahi, siyah

English: Indian mallow

Geographical Distribution: The species occurs in number of tropical and subtropical areas and subtropical zones. The plant is found in India, Sri Lanka, topical regions of America and Malaysia. It is found as a weed in sub-Himalayan tracta, hills upto 1200m and in hotter parts of India. An example occurrence is within parts of the ‘Great barrier Reef’ islands of the ‘Coral sea’.

Plant Descriptions:

General Description: The leaves are ovate, acuminate, toothed and rarely subtrilobate having a length that varies from 1.9 to 2.5 cm. The flowers are yellow in color with peduncle jointed above the middle. The petioles are 3.8 to 7.5 cm long; stipules 9 mm long; pedicels often 2.5 to 5 mm long, axillary solitary and jointed very near the top; calyx is 12.8 mm long, divided into middle, lobes ovate, apiculate and corolla 2.5 cm diameter, yellow, opening in the evening. The fruits are capsule and densely pubescent, with conspicuous and horizontally spreading beaks. The stems are stout, branched, 1 to 2 m tall and pubescent. The seeds are 3 to 5 mm, reniform, tubercled or minutely stellate-hairy, black or dark brown.



Figure 3. *Abutilon indicum* Linn.

Macroscopic Description: Tap roots, fairly long with a number of lateral branches, 1.5-2 cm in diameter, light brown, outer surface smooth with dot like lenticels, bark thin and can be easily peeled off, odour, feeble, taste, astringent and bitter.

Microscopic Description: Transverse section of root shows a thin cork of 4-7 or more tangentially elongated rectangular cells, cork cambium, single layered, and at the lenticel regions followed by 2-3 layers of secondary cortex of thin-walled, almost cubical or rectangular cells, containing small clusters of calcium oxalate in most of cells, phellogen followed by 3-4 layers of thin-walled cells of cortex, some cells of cortex which are above the conical strands of bast, crushed, small starch grains, 6-9 μ in diameter, present in some of the cells, phloem forms the major portions of bark and present as conical strands with their bases towards the wood and with dilate distal ends of the primary medullary ray in between them, fibres, present in groups of 10-12 in these conical strands, in tangential rows, alternating with thin-walled phloem elements, towards wood fibre groups, element in between the fibres mostly consists of phloem parenchyma, Some cells contain cluster crystals of calcium oxalate and a few others have starch grains, some phloem cells towards periphery appear compressed and crushed, inner to phloem, a cambium present, consisting of 1-2 rows of narrow, thin-walled rectangular cells, wood composed of vessels, wood fibres, wood parenchyma and medullary rays vessels vary in diameter and arranged in radial groups of 2-4, also occur in singles, some cells show tyloses formation, parenchyma thick-walled and slightly wider than fibre cells, but less thickened, single or rarely compound starch grains present, tetrarch bundle or primary xylem present at the centre of wood, medullary rays uni or biseriate widen much towards distal ends, most of the ray cells contain starch grains and some contain cluster of calcium oxalate, starch grains present in wood larger than those of bark region, a few ray cells at centre of the root contain rhomboidal crystals.

Part Used: Leaves, Root, Fruits, seeds, bark

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet)
Guna (Attribute)	: Snigdha (Unctuous)
Virya (Potency)	: Shita (Cooling)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Balya, vatahara, grahi, shukral, mutral.

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 8 % w/w
Acid insoluble ash	: Not more than 3 % w/w
Alcohol soluble extractive	: Not less than 3 % w/w
Water soluble extractive	: Not less than 9 % w/w

Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: Thin layer chromatography of methanolic extract of both abutilon leaf and leaf derived callus showed presence of quercetin. When the developed plates were sprayed with 5% ethanolic ferric chloride solution, bluish grey spots were visualized which coincided with that of the standard reference quercetin. Rf value of quercetin isolated from the extracts coincided with the Rf value of standard quercetin.

Major Chemical Constituents: The major constituents are hescoses, n-alkane mixtures, alkanols, B sitasterol, vanillic, p-coumaric, fumaric and amino acids, alantolactone and iso alantolactone etc.

Therapeutic Use: Bleeding disorders (Raktapitta), gout (Vatrakta), and urinary disorders (Meha).

Pharmacological Studies: Hepatoprotective, hypoglycemic, immunomodulatory, analgesic, antimicrobial, antimalarial, antifertility and wound healing activity.

Contraindications: Should not be used during pregnancy, lactation, bleeding disorders, and known allergy to the plants of the Malvaceae family.

Adverse Effects: Higher doses, may cause nausea and vomiting. At 6.0 mg/kg dose, it also caused remarkable increase in salivation and diarrhoea. Chronic toxicity showed (3.0 mg/kg) an increase in sedation, hypnosis, salivation and diarrhoea.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Root powder 3-6 gm.

Formulations: Bala Taila, Narayan Taila, Mahanarayan Taila

References:

1. Sajjalaguddam RR, Paladugu A. Phenylalanine enhances Quercetin content in In vitro cultures of *Abutilon indicum* L. J App Pharm Sci, 2015; 5 (10): 080-084.
2. Mahanthesh MC, Jalalpure SS. Pharmacognostical evaluation and anticonvulsant activity of stem of *abutilon indicum* linn sweet. Int J Pharm Pharm Sci 2016;8(8):58-70.
3. Singh D, Singh VS, Phytochemical Analysis and Antimicrobial Activity of Chloroform Extract of *Abutilon indicum*, American Journal of Applied Chemistry. 2016; 4(6):242-246.
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5. Reyad-ul-ferdous M, Rahman M, Mahamud MK, Ayshi SS, Sohel MD. Pharmacologicals and Phytochemicals Potential of *Abutilon indicum*: A Comprehensive Review. American Journal of BioScience. 2015; 3(2):5-11.
6. Mohite MS, Shelar PA, Raje VN, Babar S., Sapkal RK. Review on Pharmacological Properties of *Abutilon indicum*. Asian J. Pharm. Res. 2012; 2(4):156-160

Ayapan

Botanical Name: *Eupatorium triplinerve* Vahl.

Family: Asteraceae

Synonyms:

Bangla: আয়াপান (Ayapan) Vishalyakarni, Ayapani

Hindi: Ayapan, Ayaparna

Sanskrit: Vishalyakarni, Ayaparnah

Urdu/Unani/Tibb:

English: Ayapana tea

Geographical Distribution: *Eupatorium triplinerve* (Vahl.) is popularly called as ayapana (synonyms-ayapana triplinerve and eupatorium ayapana) is an ornamental herb. Ethnomedical studies reveal that plant and its decoction widely used for medicinal purpose in countries like Brazil, India, Sri Lanka, Bangladesh, Mauritius, West Indies, Peru and Europe.

Plant Descriptions:

General Description: Ayapana is an ornamental erect perennial herb with aromatic leaves that grows 20 to 30 cm high. The 5-8 cm long leaves are smooth, lanceolate, and borne on purple stems. It produces many flowering heads with about twenty pink flowers, which are 6 to 7 mm long. Fruits achenes, narrowly oblong, 5-angled, and about 2 mm long. Pappus about 3 mm long.

Macroscopic Description: Stem is reddish in colour. Leaves are purple, sub sessile, lance late, 3-nerved, acuminate, subentive, and glabrous. In floescence, few headed corymb, head pedicel late about 20 flowered. Flowers are pale pink colour and the thin hairless Fruit are achenes, narrowly oblong, 5-angled, and about 2 mm length. The leaves resemble like the ear of goat. Ayapana is small herb having strong odour and growing to the height of 2-4 feet. The flowers are pale pink and the thin, hairless stem is reddish in colour, flower slaty blue. The plant is a native of Brazil and American continent. It grows all over India in the temperature climate.

Microscopic Description: Microscopic examination of leaf powder showed lower epidermal fragments with corrugated walls, anisocytic stomata, compositae glandular hair, upper epidermal fragments with polygonal walls, oil drops, glandular hair, multicellular hair, and vessels with spiral thickening.



Figure 4. *Eupatorium triplinerve* Vahl.

Part Used: Whole plants

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kashaya (Astringent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Pitta and Khapha Nashok (alleviate pitta and khapha)

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 3.5% w/w
Acid insoluble ash	: Not more than 0.7% w/w
Alcohol soluble extractive	: Not less than 2% w/w
Water soluble extractive	: Not less than 4% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of),

azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract on Silica gel 'G' plate using Ethylacetate: Methanol (90:10) v/v shows under U.V. (366 nm) six fluorescent zones at Rf. 0.06, 0.20, 0.69, 0.80, 0.90 (all blue) and 0.92 (yellow). On spraying with 5% Methanolic Sulphuric acid six spots appear on heating the plate at 105°C for about ten minutes at Rf. 0.06, 0.22, 0.30, 0.80, 0.88 and 0.92 (all grey).

Major Chemical Constituents: Leaves contain an essential oil, coumarins ayapanin and ayapin, stigmasterol, esculetin methylene ether (the methylene ether and esculatine), vitamin c and carotene. Ayapanin and ayapin are non-lethal, neamostatic properties and powerful when applied locally or when directed by subcutaneous infusion or orally. Leaves of the plant contain ayapanin and ayapin long with carotene and vitamin C. The plant yields many chemicals such as coumarins chemicals, cineol, alpha phellandrene, alphatereneol, ayapanin. ayapin, coumarine, sabinene, umbiferone and many others.

Therapeutic Use: Gastric and duodenal ulcers, crohn's disease, haemorrhoids, fever due to cough or excess pitta/bile, malaria fever, wound, insect bite, bleeding, internal haemorrhages, snake bite and vomiting, gingivitis, mouth ulcers.

Pharmacological Studies: Analgesic, antianxiety, antibacterial, anticoagulant, antidepressant, antifungal, antiinflammatory antioxidant, antiparasitic, antitumorous, antiulcerous, anthelminthic, CNS depressant, hemostat, hepatoprotective, pesticidal, sedative etc.

Contraindications: Ayapana leaves contain naturally occurring coumarins. Coumarin has an anti-coagulant and blood thinning effect and is a precursor to coumadin drugs. Consult with your physician before taking this plant if you are taking coumadin drugs or if coumadin anticoagulant type drugs are contraindicated for your condition.

Adverse Effects: No adverse effect is reported after the normal use.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Fresh juice 5-10 ml.

Formulations: Ayapan Leaves Extract, Ayapan Tablet

References:

1. Sari SR, Elya B, Basah K. Specific and non-specific parameters of simplicia and ethanolic extract of prasman leaves (Ayapana Triplinervis). *International Journal of Applied Pharmaceutics*. 2020; 12 (1):122-125.
2. Cherian BV, Scarlet S, Joshi PS, Santhseelan SM. Eupatorium triplinerve (Vahl): An Ethnobotanical Review. *Asian J. Pharm. Res.* 2019; 9(3):200-202
3. Mamatha. C, Thangavel M. Phytochemical Analysis of Ayapana triplinervis and Thespesia populnea : The Wonder Plants of Traditional Medicine. *Ijppr.Human*, 2018; 11 (2):174-180.
4. Haddad JG, Picard M , Bénard S, Desvignes C, Desprès P, Diotel N, Kalamouni CE. Ayapana triplinervis Essential Oil and Its Main Component Thymohydroquinone Dimethyl Ether Inhibit Zika Virus at Doses Devoid of Toxicity in Zebrafish. *Molecules* 2019;24:3447
5. Gupta M, Mazumder UK, Chaudhuri I, et al. Antimicrobial activity of Eupatorium ayapana. *Fitoterapia*. 2002 Apr;73(2):168-170.

Banshalochana

Botanical Name: *Bambusa bambos* (L.) Voss.

Family: Poaceae

Synonyms:

Bangla: বংশলোচন (Banshalochana)

Hindi: Vanshalochana

Sanskrit: Vanshalochana, Vanshlochan, Vanshrochan, Vansharochana, Banslochan

Urdu/Unani/Tibb: Tabasheer, Tabaashir, tabaschir

English: Bamboo manna, Eye of Bamboo

Geographical Distribution: Bamboo is a very important forest product mainly for forest dependent poor people. It is one of the fastest growing, versatile, productive, sustainable and useful plants which are widely used by poor people in rural areas of Asia, Africa and Latin America. No country in South East Asia is without indigenous bamboo flora. It is a cultural feature of South-East Asia. It is widely distributed in India, Myanmar, Sri Lanka, and Bangladesh.

Plant Descriptions:

General Description: Found most abundantly in mixed moist deciduous forest. Thorny giant grass in tree form, perennial; caespitose –growing in clusters or tuft grows upto 30-meter-high; culms 15-18cm across; nodes prominent, the lower emitting horizontal almost naked shoots armed at the nodes with 2-3 stout recurved spines; internodes upto 45 cm. long. Leaves 17.5 –20.5 X 2-2.5 cm, linear or linear-lanceolate, tip stiff, glabrous or puberulous beneath, margins scabrous, base ciliate, mid-rib narrow, leaf-sheath ending on a thick callus and shortly bristly auricle. Inflorescence, an enormous panicle often occupying the whole stem. Caryopsis (grain) oblong, 5-8 mm long, grooved on one side. Flowering and Fruiting: Once in life time, often during September–May.

Macroscopic Description: The dried cut pieces of tender shoot are light in weight and vary in size and shape. The outer surface is smooth, brown in colour, the inner surface is rough, longitudinally striated and granular at places, buff in colour; fracture fibrous, odour not characteristic; taste slightly bitter and pungent.

Microscopic Description: Detailed transverse section shows an outer thick walled radially elongated cells of epidermis covered with thin cuticle, traversed with stomata; underneath this lies 2 to 4 rows of thick walled, compactly arranged sclereidal cells of hypodermis followed by wide zone of parenchymatous ground tissue traversed with conjoint collateral vascular bundles of various sizes. The vascular bundles in the outer region consist of two metaxylems lying side by side with one to two protoxylem rows lying in between them at the lower side and phloem tissue at its opposite side, mostly consisting of phloem parenchyma, the whole being encircled by thin walled fibrous sheath. The vascular bundles at places, especially those located in the middle region of the ground tissue are associated with a huge bundle of groups of lignified parenchymatous tissue at its

lower side adjacent to the vessels which in mature shoot develops into a lysigenous cavity. The parenchymatous tissues of ground tissue encircling the vascular bundles are thick and beaded walled, and forms a characteristic network throughout.

Powder Microscopy: Shows fragments of epidermal cells with beaded walls and stomata; hypodermal cells in surface view; fragments of annular and spiral vessels with pitted parenchyma from protoxylem; pitted vessels from metaxylem; vessels associated with fibre and parenchyma cells.

Part Used: Leaf, root, shoot, seed, vanshalochana (siliceous crystalline deposition in the nodal part of female plants).

Organoleptic Properties

Rasa (Taste)	: Kashaya (Astringent), Madhura (Sweet)
Guna (Attribute)	: Laghu (Light), Tikshna (Sharp), Ruksha (Dry)
Virya (Potency)	: Sita (Cooling)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Vata-PittaShamak, Kushthahar, Vrishya, Balya



Figure 5. *Bambusa bambos* (L.) Voss.

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 15% w/w
Acid insoluble ash	: Not more than 2% w/w
Alcohol soluble extractive	: Not less than 6 % w/w
Water soluble extractive	: Not less than 4 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively

	for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of chloroform and methanol solvents showed that the chief phytoconstituents found in the plant are catechutannic acid; acacatechin, catechins, epicatechin, isorhamnetin, quercetin, phlobatannins, tannic acid, quercetin, catechu-red and gum. But in the present phytochemical analysis two known compounds (catechin/epicatechin and quercetin) are identified based on their R_f values. The R_f value of catechin is 0.15 and that of quercetin is 0.6-0.7, and there was no overlap with any other component in the analyzed sample at 200–450nm.

Major Chemical Constituents: The silicious substance found near the joint inside is a white camphor like crystalline in appearance, slightly sticky to the tongue and sweet in taste. Shoot contains oxalic acid, reducing sugar, resins, waxes, benzoic acid, diferuloyl arabinoxylanhexasaccharide, diferuloyl oligosaccharide. Seed contain arginine, cysteine, histidine, isoleucine, leucine, lysine, methionine, phenylamine, threonine, valine, tyrosine, niacin, riboflavin, thiamine. Leaves mainly contain protein, gluteline, contains lysine, methionine, betain, cholin, proteolytic enzyme, nuclease, urease.

Therapeutic Use: Hridroga (heart diseases), Mutrakrichchhra (UTI), Raktavikara (Haemopoetic diseases), Yakshma (tuberculosis), Shwasa (asthma), Kasa (cough), Kushtha (leprosy) etc.

Pharmacological Studies: Analgesic, antipyretic, antidiabetic, antiinflammatory, antimicrobial, antioxidant, antiviral, diuretic, hepatoprotective, abortifacient, antianxiety etc.

Contraindications: It should not be used in small children, very old persons, pregnant women, lactating mother and known allergy to the plants of the Poaceae family.

Adverse Effects: Banshlochan is high in mineral content which in excess may produce side-effects. Therefore, always take in the recommended dosage.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Decoction 50-100 ml, powder 1-3 gm.

Formulations: Sitopaladi churna, Taleesadi churna, Chyavanprasha, Drakshavaleha

References:

1. Nirala DP, Ambasta N, Kumari P. A Review on Uses of Bamboo Including Ethno-Botanical Importance, Int. J. Pure App. Biosci. 5(5): 515-523 (2017).
2. Kaikini AA, Dhande SR, Kadam VJ. Overview of Indian medicinal tree: *Bambusa bambos* (Druce). Int. Res. J. Pharm 4 (2013): 52-56.
3. Vijayalakshmi KM. Vamsha (*Bambusa Bambos* (L.) Voss.)– A Panoramicview. ayurpub; 2018, III (2): 808-821
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5. Das S, Rizvan M., Basu SP, Das S. Therapeutic Potentials of *Bambusa bambos* Druce. Indo Global Journal of Pharmaceutical Sciences, 2012; 2(1): 85-87

Bet

Botanical Name: *Calamus rotang* Linn.

Family: Arecaceae

Synonyms:

Bangla: বেত (Bet)

Hindi: Beta, Vet, Bent

Sanskrit: vetagra, vetasa, vetasah, vetasi, vetra

Urdu/Unani/Tibb: Baqqam

English: Cane, Common rattan

Geographical Distribution: The is a plant native to India, Sri Lanka and Myanmar. It is also located in South-West Asia region. It is available in southern part of Bangladesh.

Plant Descriptions:

General Description: The basal part of the plant grows vertically for 10 metres, after which the slender, tough stem of a few centimeters in diameter, horizontally for 200 feet or more. It is extremely flexible and uniform in thickness, and often the sheaths and petioles armed reverse side of the spikes, which allow it to clamber over other plants. It has pinnate, alternate leaves, 60-80 cm long, armed with two rows of spines on upper face. Plants dioecious, the flowers are clustered in attractive inflorescences, surrounded by spiny spathes. Edible fruit top-shaped, covered with shiny, reddish-brown imbricate scales, and tart exude a red resin known in medicine and industry as "dragons blood".

Macroscopic Description: Rhizome horizontal and branched; woody, stiff and rough in texture; light grey to brown in bulk; individual pieces tortuous in shape, size ranging from 1 to 5 cm long and 1 to 4 cm in cross section; cut surface shows an inner creamy ring and an outer brownish narrow ring; rhizome marked with wavy annulations at the nodes; internodal length ranges from 3 to 12 mm; with roots arising from the internode; fracture, very tough, fibrous; no characteristic odour bitter in taste..

Microscopic Description: Transverse section of rhizome circular in outline; epidermis single layered; cortical cells thin walled, parenchyma polygonal towards the epidermis and gradually become circular, with intercellular spaces; cortex shows many resin canals which are red in colour; scattered circular patches of sclerenchymatous cells, about 200 μ in diameter present, followed by an endodermis of a single layer of elongated cells; vascular bundles many, scattered, each circular in outline and has a sclerenchymatous cap; phloem consists of phloem parenchyma, sieve tubes and companion cells; xylem with a large vessel of 62 to 88 μ diameter. and with 1 to 3 smaller vessels; starch grains oval or circular in shape and present in many cells in cortex and stele.

Powder: Cream to brown, bitter to taste and with no characteristic odour; microscopic observation shows starch grains of about 5 μ across and round to oval in shape; stone cells of about 35 μ width

and triangular to oval in shape with a narrow lumen; reddish resinous masses; slender and wiry fibres of approximately 10 μ width; pitted and spiral vessels and wood parenchyma.

Part Used: Rhizome

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light)
Virya (Potency)	: Sita (Cool)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Cedana, Dipana, Kaphahara, Mutrala, Pittahara, Visaghna



Figure 6. *Calamus rotang* Linn.

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 3% w/w
Acid insoluble ash	: Not more than 1% w/w
Alcohol soluble extractive	: Not less than 10 % w/w
Water soluble extractive	: Not less than 9 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp.</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the methanolic extract on precoated silica gel 'G' plate (0.2 mm thickness) using n-hexane: chloroform (3:7) as after spraying with anisaldehyde sulphuric acid reagent and heating at 105° for 5 minutes shows spots at 0.28 (yellow), 0.33 (pink), 0.45 (light pink), 0.51 (yellow), 0.67 (light pink), 0.72 (yellow), and 0.88 (pale yellow).

Major Chemical Constituents: The analysis of phytoconstituents of *Calamus rotang* Linn. root indicated the presence of flavonoids, steroids/triterpenoids and glycosides.

Therapeutic Use: Arsa (piles), Aruci (tastelessness), Asmari (calculus), Daha (burning sensation), Jvara (fever), Kāsa (cough), Kustha (leprosy/diseases of skin), Mutrakricchra (dysuria), Prameha (metabolic disorder), Pravahika (dysentery), Raktapitta (bleeding disorder), Sotha (inflammation), Trisna (thirst), Tvakroga (skin diseases), Visarpa (erysepales), Yoniroga (disease of female genital tract) etc.

Pharmacological Studies: Antioxidative, antiallergic, anti-inflammatory, antibiotic, hypoglycemic, and anticarcinogenic activities etc.

Contraindications: It should not be used in small children, very old persons, pregnant women, lactating mother and known allergy to the plants of the Arecaceae family.

Adverse Effects: The most common side effect from calamus is vomiting. Fast heart rate and slowed intestinal movements have also been reported if not maintaining proper doses.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Decoction 50-100 ml, powder 5-10 gm.

Frmulations: Mahadrabak Ras, Amritadi Kwath, Kadaladya Grita

References:

1. Pallavi Y, Hemalatha KPJ. Phytochemical studies and high-performance thin-layer chromatography analysis of Calamus rotang linn leaf extracts. Asian J Pharm Clin Res, 2018; 11(2): 269-275.
2. Gupta A, Chaphalkar SR. Assessment of immunomodulatory activity of aqueous extract of Calamus rotang. Avicenna J Phytomed, 2017; 7 (3): 199-205.
3. Gupta A, Shaikh AC, Chaphalkar SR. Aqueous extract of Calamus rotang as a novel immunoadjuvant enhances both humoral and cell mediated immune response. J Herbmed Pharmacol. 2017;6(1):43-48.
4. Gupta A, Chaphalkar SR. Assessment of immunomodulatory activity of aqueous extract of Calamus rotang. Avicenna J Phytomed. 2017;7(3):199-205.

Banpiaaj

Botanical Name: *Urginea indica* (Roxb.) Kunth.

Family: Liliaceae

Synonyms:

Bangla: বন পিয়াজ (Banpiaaj) Janglipiaaj

Hindi: Ban piaz, Jangli piaz, Janglikanda, Bon Pollundu

Sanskrit: Asmantaka, Kolakanda

Urdu/Unani/Tibb: Jangli pyaz

English: Indian squill, Sea onion, White squill

Geographical Distribution: It has a wide distribution in India, Africa, and the Mediterranean region. It is found from eastern tropical Africa west to Mauritania, from Senegal to Somalia and south to South Africa, and in northern Nigeria, India, Pakistan, Myanmar, Vietnam, and various other parts of the Indian subcontinent.

Plant Descriptions:

General Description: *Urginea indica* is a perennial herb having fibrous roots. The roots proceed from the base of the bulb (pear-shaped and conical) and are about six to ten inches in length. The bulbs had transparent outer scales, resembling the size of a big onion, comprising fleshy coats that are orange-brown or papery red in colour, encircling each other fully, is engrossed in the sand by three fourth. Leaves having smooth-edged grow from the bulbs in the shape of a rosette about 1–2.5 cm wide and 15–30 cm long. The flowers blossom in the month of April and May. A long, stiff, smooth succulent flower rises from the middle of the leaves with a high of about one to three feet, having close spike of whitish flowers, which stand on purplish peduncle.



Figure 7. *Urginea indica* (Roxb.) Kunth.

Macroscopic Description: The dried slices of the bulb scales occur in concavoconvex curved strips, frequently tapering at both ends, 1 to 5 cm long. They are slightly translucent and pale yellow in colour with longitudinal furrows. The dried pieces are brittle and have a short fracture. But they are tough and flexible when moist. The fractured surface is mucilaginous. The transversely cut surface shows a number of scattered vascular bundles. The drug has a slight odour and possesses a bitter mucilaginous and acrid taste. Occasionally the entire fresh bulb is sold in the market. The entire bulb is ovoid in shape, 18 to 20 cm high and 12 to 15 cm in diameter. It is often crowned with the bases of the aerial leaves at the upper end and bases of the adventitious roots at the lower end. The dry thin scale leaves of the bulb are removed during cleaning of the drug.

Microscopic Description: The epidermal cells are axially elongated and quadrangular or polygonal in shape. Nearly circular stomata are present on the lower (outer) surface of the scale leaves in very small number. They also occur very rarely on the upper (inner) surface. The bulk of the mesophyll tissue is made up of parenchymatous cells, some of which are occasionally filled with raphides of calcium oxalate embedded in mucilage. Vascular bundles are also present in the mesophyll. They are composed of spiral vessels and phloem with parenchyma in between. Rarely rounded starch grains and prisms of calcium oxalate occur in the mesophyll tissue.

The powdered drug is yellowish white in colour and contains abundant, large, thin walled cells of the mesophyll parenchyma. Idioblasts containing raphides of calcium oxalate and mucilage are present in the powder. Free single acicular crystals and very occasional prisms of calcium oxalate are also present in the powdered drug.

Part Used: Rhizome

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Tikshna (Sharp)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Vatashamak (reduces vitiated vata dosha)

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 27 % w/w
Acid insoluble ash	: Not more than 0.5 % w/w
Alcohol soluble extractive	: Not less than 24 % w/w
Water soluble extractive	: Not less than 10 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively

	for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC was carried out in two solvent system for poly phenols [Tolune:Ethylacetate (9.3:0.7)] and fats, oils [Benzene:Ethylacetate (6:1)]. Differences in Rf value was observed in the methanol extractives by using the mobile phase Tolune: ethyl acetate of sunken and floated fruits. The Rf values were 0.09, 0.17, 0.31, 0.52, 0.66 and 0.06, 0.24, 0.22, 0.60, 0.66 for sunken and floated respectively.

Major Chemical Constituents: It contains a large number of related steroidal cardioactive glycosides. Scillaren A and proscillaridin A, are the major glycosides found in the bulb in greatest concentration. Other constituents found flavonoids, carbohydrates, antifungal glycoproteins, steroids, alkaloids, esters and saponins. Main active ingredients of squill are steroidal glycosides.

Therapeutic Use: Kasa (cough), Agnimandya (indigestion), Swasa (asthma,) dropsy, Vatavyadhi (rheumatism), Kustha (leprosy/skin ailments) etc.

Pharmacological Studies: Anticancer, antidiabetic, anthelmintic, analgesic, antibacterial, antifungal, anti-angiogenic, anti-arthritis, antioxidant, antiinflammatory, spasmodic and cardiac stimulant activities etc.

Contraindications: It should not be used in small children, very old persons, pregnant women and individuals of predominant pitta constitution.

Adverse Effects: Increase dose administration of the rhizome can lead to nausea, vomiting and abdominal cramps.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 100-200 mg, cold infusion 40-60 drops, syrup 30-60 drops.

Formulations: Squill Capsule, Squill Tablet, Squill Syrup

References:

1. Rahman MM, Chowdhury JA, Habib R, Saha BK, Salauddin ADM, Islam MK. Anti-inflammatory, anti-arthritic and analgesic activity of the extract of the plant *Urginea indica* Kunth. *IJPSR*, 2011; 2(9): 2320-2324
2. Nath J. Studies on the Numerous Medicinal utilities of the Plant *Urginea indica*: A Comprehensive Overview. *Int J Curr Pharm Res*, 2020; 12(6):1-4
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5. Kameshwari MNS, Saraswathi KJT, Muniyamma M. Morphological variations in populations of *Urginea indica* Kunth. Liliaceae. *Journal of Applied and Natural Science.* 2010; 2(2):280-289

Bakul

Botanical Name: *Mimusops elengi* Linn.

Family: Sapotaceae

Synonyms:

Bangla: বকুল (Bakul), Bakal, Bohl, Bukal

Hindi: Bakul, Bolsari, Maulsarau, Maulser, Maulsari

Sanskrit: Anangaka, Chirapushpa, Dhanvi, Kesha, Madhupushpa, Bakulah Bakulah, Keshu kesara, Madhugandha, Udumbara

Urdu/Unani/Tibb: Maulsiri

English: Spanish-Cherry, West Indian Medlar, Bullet Wood

Geographical Distribution: *Mimusops elengi* is native in India, Myanmar and Sri Lanka but cultivated across the tropics including Malaysia, Singapore, and Australia. It is cultivated in Bangladesh, South India and central India especially in Madhya Pradesh, Jammu, Bihar, and Andaman Islands.

Plant Descriptions:

General Description: It is a moderate to large size evergreen tree, generally about 15 m high. Stem is ash coloured dark, fissured with densely spreading crown. Leaves are 6.3-10 cm long and 3.2-5 cm broad pointed with serpentine ends or elliptic or obovate and leathery with wavy margins with petioles 1.3-2.5 cm long. Petioles and twigs produce a watery milky exudate. Calyx is 1 cm long, fulvous pubescent. Corolla white coloured, sweet in fragrance, corolla longer than calyx, tube 1.5 mm long, lobes 8 mm long and are twenty-four in numbers in two series; filaments short, glabrous, anthers glabrous, slightly twisted, acuminate; staminodes eight in number alternate with the stamens. Ovary silky pubescent; style grooved, slightly longer than corolla. Berry about 2.5 cm long, ovoid, yellow when ripe, contains a juicy pulp. Seeds are solitary, ovoid, compressed, brown and shining.



Figure 8. *Mimusops elengi* Linn.

Macroscopic Description: Dried flowers and flowering buds with pedicel; flower white to yellowish brown, fragrant, nearly 2.5 cm across, pedicel upto 2 cm long; buds ovoid; bisexual, actinomorphic, bracteolate, sepals 4 to 12, imbricate in bud, base connate; corolla gamopetalous into whorls, imbricate in buds, lobes about 8 to 10 in inner whorls and 12 to 16 in outer whorl; stamens epipetalous opposite petals in the inner whorls; anthers 2 celled, style often apically lobed, ovary superior, carpels typically 4 or 5 in a range of 1-14, placentation axile; ovule one in each carpel, anatropous; characteristic aromatic odour and sweet acrid taste.

Microscopic Description:

Pedicel – Transverse section of pedicel shows circular in outline with ridged surface; epidermis consisting of single layer of polygonal parenchyma cells with multicellular trichomes; cortex consists of parenchyma and some laticiferous cells; the vascular bundles around 8, conjoint, collateral and closed, arranged in a circle, abundant prismatic and rhombohedral calcium oxalate crystals present. Petal – Transverse section of petal shows an upper and lower epidermis consisting of closely packed rectangular cells of uniform size; ground tissue consists of irregular, spongy parenchyma cells; vascular bundles of various sizes consisting of xylem and phloem elements, surrounded by bundle sheath; upper surface shows closely packed, slightly wavy walled, thin laterally elongated epidermal cells without intercellular spaces; lower surface shows closely packed, thick and wavy epidermal cells without intercellular spaces.

Sepal – Transverse section of sepal shows glandular uniseriate; 'T' shaped and multicellular trichomes on upper and lower epidermis; middle portion of the upper epidermis devoid of any type of trichomes, ground tissue parenchymatous; several conjoint, closed vascular bundles surrounded by bundle sheath present; epidermal cells in surface view sinuous on the upper less sinuous on the lower; stomata ranunculaceous, laticifers and crystals present.

Androecium – Anther lobes tetrasporangiate, dehiscence extrose; the wall of the anther lobe consists of epidermal layer of rectangular parenchymatous cells, followed by a layer of epithelial cells and a subsequent layer of endothecium; the pollen grains about 15 to 25 μ in diameter, single or in groups, spherical, pores 4, the exine smooth and thick.

Gynoecium – The ovary is hexa to octa carpellary, syncarpous and superior with a long style and insignificant stigma. It is covered by long 'T' shaped, branched, multicellular, uniseriate multicellular and unicellular glandular trichomes; placentation axile, showing single large bundle in the centre; ovules anatropous.

Powder – Powder dark brown colored; numerous parenchyma cells containing laticiferous cells; long 'T' shaped, branched, multicellular trichomes; uniseriate multicellular trichomes; unicellular glandular trichomes; scalariform, pitted and reticulate vessels; fibres long thin walled and thick walled with narrow lumen; endothelial layer of anther; pollen grains upto 35 μ , spherical, exine smooth with four distinct germ pores.

Part Used: Stem bark, leaves, flowers, fruit and seed.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Kashaya (Astringent), Madhura (Sweet)
Guna (Attribute)	: Guru, Snigdha, Vishada
Virya (Potency)	: Sita (Cool)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Dantya, Stambhana, Grahi.

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 12.5 % w/w
Acid insoluble ash	: Not more than 7.0 % w/w
Alcohol soluble extractive	: Not less than 66.73 % w/w
Water soluble extractive	: Not less than 2.0 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of methanolic extract of the roots on precoated silica gel G plate using methanol - chloroform (20: 80) showed a blue fluorescent spot under UV (365nm) along with number of other spots of very weak intensity. Due to the presence of very negligible amount of alkaloids in the roots these could not be isolated. However, methanolic extract of *A. nervosa* seeds was prepared and TLC compared with *A. nervosa* roots extract. The TLC pattern of root and seed extracts (prepared in methanol) was similar although the intensity of spots in case of root extracts was very poor.

Major Chemical Constituents: Flowers contain D mannitol, β -sitosterol, β -sitosterol- β D-glucoside, quercetin, quercitol, dihydroquercetin, triterpene alcohol, α -spinasterol, ursolic acid, lupeol, fatty oils comprising capric, lauric, myristic, palmitic, stearic, arachidic, oleic and linoleic acid, gallic acid, kaempferol, sterols, phenolics, flavonoids and alkaloids are present in flowers, but pyrrolizidine type of alkaloid is absent in flowers.

Therapeutic Use: Shirashoola, Pooyadanta, Atisara, Pravahika, Jwara, Shukrameha, Dantachala.

Pharmacological Studies: Antiviral, antibacterial, antifungal, anthelmintic, anticariogenic, antihyperlipidemic, antihyperglycemic, diuretic effects, free radical scavenging, antioxidant, cognitive enhancing, cytotoxic activities etc. due to presence of a variety of active phytochemicals.

Contraindications: It should not be used in small children, very old persons, pregnant women, lactating mother and known allergy to the plants of the Sapotaceae family.

Adverse Effects: Overdose can cause side effects such as nausea, vomiting, dizziness, hallucinations, blurred vision, dilated pupils, rapid movement of eyeballs, sweating, fast heart rate, and increased blood pressure.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Decoction (bark) 50 to 100 ml; flower powder 1 to 2 gm.

Formulations: Jatyadya Taila

References:

1. Rani S, Rahman K: Molsari (*Mimusops elengi* Linn.): a boon drug of traditional medicine. Int J Pharm Sci Res 2017; 8(1):17-28.
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3. Shivatare RS et al. Pharmacognostic Standards for *Mimusops elengi* Linn – A Review. Journal of Pharmacognosy and Phytochemistry 2013;2 (3):12-18.
4. Amir F, Wong KC, Eldeen I, Asmawi MZ, Osman H. Evaluation of Biological Activities of Extracts and Chemical Constituents of *Mimusops elengi*. Tropical Journal of Pharmaceutical Research August 2013; 12 (4): 591-596
5. Kadam PV, Yadav KN, Deoda1 RS, Shivatare RS, Patil MJ. *Mimusops elengi*: A Review on Ethnobotany, Phytochemical and Pharmacological Profile. Journal of Pharmacognosy and Phytochemistry.2012; 1(3):64-74.

Jasmin

Botanical Name: *Jasminum grandiflorum* Linn.

Family: Oleaceae

Synonyms:

Bangla: জেসমিন (Jui, Jasmin)

Hindi: Juhi, Chameli

Sanskrit: Juthika, Mugdhee, Suchinallika

Urdu/Unani/Tibb: Yaasmin

English: Spider wort Spanish or common jasmine

Geographical Distribution: It was native to Asia: Georgia, China, Tajikistan, Afghanistan, Iran, Iraq, Turkey, Bhutan, India, Nepal and Pakistan. The plant is cultivated throughout India and Bangladesh for its fragrant flowers.

Plant Descriptions:

General Description: Leaves opposite, imparipinnate, 5-12.5cm long, petiole and rhachis margined. Leaflets 7-11, the terminal 2.5 – 3.8 by 1.3 – 1.8 cm, rhomboid-ovate or lanceolate, acute or acuminate; the lateral ovate, usually obtuse, mucronate, the intermediate sessile. Flowers 3-3.8cm across, white, often tinged [or streaked] with pink outside, in lax, axillary and terminal cymes longer than the leaves; pedicels 1.3- 2.5 cm long; bracts, the lower often large, ovate to spatulate-oblong, foliaceous, the upper small, linear. Calyx 5-10 mm. long, Glabrous, tube 2.5mm long or less; lobes 5, subulate 2-8 times long as the tube. Corolla - tube 1.8-2.5 cm long; lobes 5; elliptic or obovate.



Figure 9. *Jasminum grandiflorum* Linn.

Macroscopic Description: Leaf single or in groups of 2-7 leaflets, upto 7.5 cm long and upto 2.5 cm broad; imparipinnately compound; terminal leaflet larger; ovate or lanceolate, acuminate; lateral leaflets shorter, acute, sessile or shortly petiolate; brownish-green; taste, bitter.

Microscopic Description:

Rachis - Rachis shows more or less convex outline with two lateral wings; epidermis single layered covered by thick cuticle; hairs mostly unicellular with pointed apex, glandular rarely found only on the upper surface; collenchyma 2 - 5 layered; pericycle represented by slightly lignified small fibre groups; vascular bundles three, median crescent-shaped, small accessory bundle present in each wing. Midrib - shows similar structure as rachis; 3 - 5 layers of collenchymatous cells towards lower surface; pericycle present in the form of non-lignified fibre groups; vascular bundle single and crescent-shaped.

Lamina - shows dorsiventral structure, epidermis single layered on either side, covered by a thick striated cuticle; hairs as in rachis; palisade 1- 2 layered; spongy parenchyma 4-6 layers; stomata anomocytic only in lower surface.

Powder - Yellowish-green; shows palisade and spongy parenchyma, unicellular hairs, fibres and vessels with spiral thickening, polygonal epidermal cells and anomocytic stomata in surface view.

Part Used: Whole plant

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Mrdu (Slight), Snighda (Unctuous)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Caksusya, Sirovirecana

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 6% w/w
Acid insoluble ash	: Not more than 0.5% w/w
Alcohol soluble extractive	: Not less than 18% w/w
Water soluble extractive	: Not less than 25 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene. Ethylacetate (9 :1) shows under UV (366 nm) three fluorescent zones at Rf 0.44 (blue), 0.52 (light blue) and 0.91 (blue). On exposure to Iodine vapours ten spots appear at Rf. 0.08, 0.18, 0.38, 0.44, 0.49, 0.53, 0.59, 0.67, 0.81 and 0.91 (all yellow). On spraying with Dragendorff reagent followed by 5% Methanolic-Sulphuric acid reagent four spots appear at Rf. 0.08, 0.18 (both orange), 0.44 and 0.91 (both light orange). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C many spots of brown, yellow, blue and violet colour appear from the point of application to the solvent front.

Major Chemical Constituents: The phytochemical analysis presence of *Jasminum officinale* indicated the alkaloids, coumarins, flavonoids, tannins, terpenoids, glycosides, emodine, leucoanthcyanins, steroids, anthocyanins, phlobatinins, essential oil, and saponins.

Therapeutic Use: Siroroga, Aksiroga, Visaroga, Kustha Vrana, Arsa, Mukhapaka, Putikarna, Stana sotha, Raktavikara etc.

Pharmacological Studies: Anti-inflammatory, anti-microbial, antioxidant, antiulcer, antidepressant, antistress, cytoprotective, chemoprotective, wound healing and anti-acne activity etc.

Contraindications: It should not be used in small children, very old persons, pregnant women, lactating mother and known allergy to the plants of the *Oleaceae* family.

Adverse Effects: Not known any adverse effects.

Precautions: Do not confuse it with Yellow-Jasmine which is *Gelsemium sempervirens* (toxic plant).

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 10-20 gm of powder for decoction.

Formulations: Jatyadi Taila, Vasanta Kusumakara Rasa

References:

1. Bharathi PR, Sripathi SK, Lakshmi AN. Jasmin Grandiflorum Linn.-An Updated Review. IJPSR, 2020; Vol. 11(5): 1994-2010.
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4. Radha R, Aarthi CK, Santhoshkumar V and Thangakamatchi G: Pharmacognostical, phytochemical and anthelmintic activity on flowers of Jasminum grandiflorum Linn. (Oleaceae). Int J Pharmacognosy 2016; 3(10): 455-60.
5. Pradhan S. Pharmaceutically important uses of Chameli (Jasminum grandiflorum Linn): A Review; Int J Ayu Pharm Chem. 2015; 3(1):79-92.

Cha

Botanical Name: *Camellia sinensis* (L.) Kuntze.

Family: Theaceae

Synonyms:

Bangla: চা (Cha)

Hindi: Chaay

Sanskrit: Syamaparni

Urdu/Unani/Tibb: Chaay

English: Tea Plant

Geographical Distribution: *Camellia sinensis* is home-grown from mainland china, south and Southeast Asia but it is at the present period of time cultivated across the world.

Plant Descriptions:

General Description: An evergreen shrub or tree grows up to 15 meters in height (60-150 cm in height owing to pruning during cultivation). Leaves are simple alternate, ovate-lanceolate, with serrate margins, usually glabrous, leathery. Flowers are white, fragrant, solitary or 2-4 together, fruits are capsule, slightly depressed, 3 cornered and 3 seeded.



Figure 10. *Camellia sinensis* (L.) Kuntze.

Macroscopic Description: Chemical name of tea leaf is *Camellia sinensis* and belonging Theaceae family. It is a small evergreen tree or bush which reaches 1.0-1.5 meters in height, while wild-growing plants reach up to 6.0 meters.

Shrub- 1-5 M tall. Young branches of tea plant garish yellow in colour and terminal buds silvery gray.

Leave- The leaf are long 4-15 cm and broad 2-5 cm, older leaves are dark green in colour and glabrous. Young leaves are light green in colour and hairy, upper surface elliptical or lanceolate, blunt or acuminate at apex base is tapering margin shortly serrate.

Petiole 4-7 mm.

Diameter- It is a 5 sepals, 6-8 petals, stamens numerous and 0.8-1.3cm, ovary globose, capsule oblate.

Fruit-Is a flattened, smooth

Seed- It is a brown in colour, and subglobose, 1-1.4cm in diameter.

Microscopic Description: Transverse section of a leaf through the midrib contains epidermis, cuticle, mesophyll, calcium oxalate crystals, sclereid cell, and trichomes, stomata. The top epidermis formed by a thick cuticle is composed of strongly wavy polygonal cells. Consists of its self stomata and hairs like structure present in both surfaces of a leaf is known as unicellular trichomes (Irregular and branched). That is lower epidermis surface larger than the upper. Two rows of palisade cells and large lignified cells are produced in the Mesophyl Zone, which emerge from one epidermis to the other at certain intervals and spread throughout the mesophyll. It contains crystals of calcium oxalate that are scattered in vascular bundle and parenchyma. In the Midrib region there is a prominent ridge both above and below and a vascular bundle consisting of xylem and phloem, with a slightly lignified band of pericyclic fibres covering the whole region. In the widest area, pericyclic fibres are up to four in width. The rest is spongy parenchyma with broken lignified sclereids.

Powder microscopical characters of powdered tea are: Trichomes (Irregular and branched), sclerenchymatous cells, petiole, midrib, stomata and Calcium oxalate crystals is present.

Part Used: Leaves

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Ruksha (Rough)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Dipana (Digestive), Pitta-Kaphahara (Pitta-Kapha alleviator)

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 13.5% w/w
Acid insoluble ash	: Not more than 2.5% w/w
Alcohol soluble extractive	: Not less than 2% w/w
Water soluble extractive	: Not less than 10 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total

yeast and mould count, total *Enterobacteriaceae* are not more than 10^4 cfug⁻¹, 10^3 cfug⁻¹ and 10^4 cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total *Enterobacteriaceae*, *Salmonella spp*, *S. aureus*, *Pseudomonas aeruginosa* and *Coliforms* will be absent.

Heavy metals : In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.

Pesticides residues : According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: Thin layer chromatography of the methanolic extract of plant on silica gel 60 F254 plate using toluene: ethyl acetate: methanol (7:3:0.5) as mobile phase shows six spots at R_f 0.28 (purple), 0.41 (faint purple), 0.63 (purple), 0.75 (purple, spot for stigmasterol), 0.82 (yellowish green) and 0.89 (blue) on spraying with anisaldehyde- sulphuric acid reagent and heating the plate, for five minutes at 105 °C. The percentage of stigmasterol ranged from 0.36 to 0.44 in the various samples analyzed by HPTLC densitometric method using precoated plates of silica gel 60 F254 as stationary phase, toluene: ethyl acetate: methanol (7: 3: 0.5) as mobile phase and scanning at 656 nm. Analysis of the mineral contents of plant collected from Ashafa, Toroba, Wahat and Wehait (Saudi Arabia) indicated that aluminum is in higher concentration (shoots and roots) followed by copper, manganese and zinc. The concentration of Zn found higher in shoots than in roots, but the concentration of Zn was less in shoots than in roots.

Major Chemical Constituents: *Camellia sinensis* leaves are high worldwide in yield and consumption. A number of alkaloids, amino acids, carbohydrates, Polyphenols, pigments, volatils, fluoride compounds, trace minerals and unknown compounds form the chemical composition of a whole plant. Tea leaves are a rich caffeine source. It is derived from waste or sweeping waste from tea and tea leaf. Theobromine, theophylline are also found small amount. The color of the leaves is caused by gallotanic acid (15%). The aggravated smell caused by volatile yellow oil. The enzyme mixture called thease is also found in the tea leaves.

Therapeutic Use: Migraine, headaches, asthma, diabetes, low blood pressure, swelling of the liver caused by the hepatitis C virus, skin cancer, Parkinson's disease, etc.

Pharmacological Studies: Antiviral, antibacterial, antimutagenic, antimicrobial, anticoccidial, antihypertensive, antiaging, hypocholesterolemic, antistress, antileishmanial, anticariogenic, antioxidant, anti-inflammatory, anticancer activity. etc.

Contraindications: It should not be used in small children, very old persons, pregnant women, lactating mother and known allergy to the plants of the Theaceae family.

Adverse Effects: These side effects can range from mild to serious and include a headache, nervousness, sleep problems, vomiting, diarrhea, irritability, irregular heartbeat, tremor, heartburn, dizziness, ringing in the ears, convulsions, and confusion.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: A daily intake of 3 to 5 cups/day (1,200 mL) of green tea will provide at least 250 mg/day of catechins.

Formulations: Green Tea Powder Drink, Green Tea Tablet

References:

1. Chopade VV, Phatak AA, Upaganlawar AB, Tankar AA. Green tea (*Camellia sinensis*): Chemistry, Traditional, Medicinal uses and its Pharmacological activities- a review. *Pharmacognosy Reviews*. 2008; 2(3):167-162.
2. Agarwal U, Pathak DP, Bhutani R, Kapoor G, Kant R. Review on *Camellia sinensis* – Nature’s Gift. *International Journal of Pharmacognosy and Phytochemical Research* 2017; 9(8); 1119-1126
3. Bhatt PR, Pandya KB, Sheth NR. *Camellia Sinensis* (L): The Medicinal Beverage: A Review. *International Journal of Pharmaceutical Sciences Review and Research*; 2010; 3(2):6-9.
4. Chaudhari S, Gupta SK, Yadav S, Yogi B. A Review on Phytochemical and Pharmacological Activity of *Cemellia Sinensisi* (Tea Leave). *World Journal of Pharmaceutical Research*. 2020; 9(11):332-348.
5. Vishnoi H, Bodla RB and Kant R: Green Tea (*Camellia sinensis*) and its antioxidant property: A review. *Int J Pharm Sci Res* 2018; 9(5):1723-36.

Digitalis

Botanical Name: *Digitalis purpurea* Linn.

Family: Scrophulariaceae

Synonyms:

Bangla: ডিজিটালিস (Digitalis)

Hindi: Digitalis

Sanskrit: Hrtapatri, Tilapuspi

Urdu/Unani/Tibb: Digitalis

English: Foxglove, Purple foxglove, Common Foxglove

Geographical Distribution: It is mainly found in England, Germany, France, North America, India, Iraq, Japan, Kurdistan, Mexico, Nepal, Spain, Turkey.

Plant Descriptions:

General Description: Digitalis is a biennial or perennial herb that grows up to about 1.2 meters height. Flower and Fruit: The flowers are carmine red with white edged spots on the inside. The flowers appear in long hanging racemes. They have 5 free, short-tipped sepals. The corolla is about 4 cm long, campanulate, bilabiate with an obtuse upper lip and an ovate tip on the lower lip. The flower is glabrous on the outside and has a white awn on the inside. There are 2 long and 2 short stamens, and 1 superior ovary. The fruit is a 2-valved, ovate, glandular, villous capsule. The

plant with a branched tap root. In the first year it develops a leaf rosette. In the second it produces a 2 m high, erect, unbranched, gray, tomentose stem. The leaves are alternate, ovate, tapering upward and petiolate. Almost all leaves are crenate; only the highest ones are entire-margined.



Figure 11. *Digitalis purpurea* Linn.

Macroscopic Description: General appearance: Usually broken and crimped. Shape: Ovate-lanceolate. Size: 10 to 40-cm. Long and 4 to 10 cm. Wide Margin: Crenate or dentate. Apex: obtuse or rounded. Base: Tapering, decurrent. Upper Surface: Slight pubescent, dark green, little wrinkled, one water pore present near each tooth. Lower surface: Grayish-green, very pubescent. Venation: Pinnate, mid-rib, lateral vein, veinlet and still smaller veinlets prominent on the under-surface; lateral vein leaves the mid-rib, at an acute angle and anastomoses on the margin. Petiole: Winged, 2.5 to 10 cm. long

Microscopic Description: The fragments of the lamina in surface view revealed that the upper epidermis is composed of slightly thickened wall, irregularly shaped cells with slight beading and pitting. Few or no stomata are present. Fairly large and loosely packed underlying palisade cells are present. The lower epidermis is composed of thin-walled, visibly sinuous smaller cells. Circular anomocytic stomata are found abundantly. Infrequent cicatrices are found in both epidermises where trichomes were attached. Calcium oxalate and pericyclic fibres are absent. Covering and glandular trichomes are found scattered as well as attached to fragments of the epidermis. Thin-walled parenchyma was found in the form of infrequent fragments from the cortex of the midrib and larger veins. Slight pitting was observed on the side walls of the epidermal cells. The glandular hairs have a unicellular or occasionally a short uniseriate pedicel with unicellular or bicellular terminal gland.

Part Used: Dried leaf

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Rooksha (Dry)
Virya (Potency)	: Sheeta (cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kapha and vata shamak

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 6% w/w
Acid insoluble ash	: Not more than 2.5% w/w
Alcohol soluble extractive	: Not less than 3% w/w
Water soluble extractive	: Not less than 65 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic

	count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of *Digitalis purpurea* extract showed in two different solvent systems chloroform-methanol-water (80:20:2) and ethyl acetate-methanol-water (100:16.5:13.5) and observed at two different wave lengths (254 & 366 nm). At 254 nm in CHCl₃: MtOH: H₂O solvent system R_f 191 values obtained at 0.01, 0.06, 0.08, 0.17, 0.22, 0.28, 0.32, 0.38, 0.47, 0.53, 0.57 and 0.67. At 365nm peaks obtained at 0.01, 0.08, 0.14, 0.50, 0.60, 0.69 and 0.87. In Et acetate: MtOH: H₂O, at 254 nm R_f values observed at 0.01, 0.07, 0.23, 0.30, 0.43, 0.52, 0.54, 0.57, 0.73, 0.83 and 0.90 and at 366nm R_f values found at 0.04, 0.11, 0.28, 0.42 and 0.56.

Major Chemical Constituents: The glucosides digitoxin, digitalin, digitalein, digitonin, and digitin (inert); digitalic and antirrhnicacids, volatile oil. *Purpurea* glycoside A, digitoxin, glucodigitoxigenin-bis-digitoxoside, gluco-evatromonoside, *Purpurea* glycoside B, gitoxin, gluco-gitoroside, fatty matter, starch, gum, sugar etc.

Therapeutic Use: Cough, epilepsy, asthma, tuberculosis, paralysis, swelling of lymph nodes, sores, skin ulcers, wounds, heart failure, palpitations, headache etc.

Pharmacological Studies: Cardioprotective, hepatoprotective, neuroprotective, cytotoxic, antidiabetic, antioxidant, insecticidal effects etc.

Contraindications: Pregnancy, lactation, kidney disease. Do not allow children to come into contact with the potentially lethal plant.

Adverse Effects: Inappropriate use may cause Confusion, irregular pulse, loss of appetite, nausea, vomiting, diarrhea, palpitations, visual changes (unusual), decreased consciousness, decreased urine output, difficulty breathing when lying down, excessive nighttime urination, overall swelling, arrhythmias, which may be deadly and heart failure.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 500 mg of the drug in powder form.

Formulations: Foxglove Powder, Foxglove Tablet

References:

1. Al-Snafi AE, Phytochemical Constituents and Medicinal Properties of Digitalis Lanata and Digitalis Purpurea- A Review, Indo Am. J. P. Sci, 2017; 4(02):225-234
2. Zahid H, Rizwani GH. Digitalis purpurea L.: A Concise Drug Review with Probable Clinical Uses. Hamdard Medicus, 2016; 59(2):5-12.
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4. Whayne TF. Clinical Use of Digitalis: A State of the Art Review. Am J Cardiovasc Drugs. 2018 Dec;18(6):427-440.
5. Negi JS, Bisht VK, Bhandari AK, Sundriyal RC. Determination of mineral contents of *Digitalis purpurea* L. and *Digitalis lanata* Ehrh. Journal of Soil Science and Plant Nutrition, 2012;12(3):463-470

Eucalyptus

Botanical Name: *Eucalyptus globulus* Labill.

Family: Myrtaceae

Synonyms:

Bangla: ইউকেলিপ্টাস (Eucalyptus)

Hindi: Yukeliptas, Neelgir

Sanskrit: Tail Parn, Sugandh Patra

Urdu/Unani/Tibb:

English: Gum Tree, Gum Eucalypt

Geographical Distribution: The Eucalyptus is native to Australia and Tasmania. As a decorative and wood-producing tree, it is now found in all subtropical climate zones.

Plant Descriptions:

General Description: The Eucalyptus is a fast-growing tree that can reach a height of 20 m within 8 years. About 70 m high at maturity, it is among the tallest trees on earth. The straight trunk has an ash grey bark. The wood beneath is white to reddish, very hard, and rot-resistant. The leathery, blue-green-grey leaves of the young tree are roundish, later turning long and sickle-shaped with a distinctive central vein and point-shaped oil glands. The leaves can be up to 30 cm long. The flowers form apical, erect clusters and thick-walled capsules. When the flowers wither, the cover bursts open, revealing whitish to reddish tufts of filaments. Eucalyptus trees flower from February to July.



Figure 12. *Eucalyptus globulus* Labill.

Macroscopic Description: Drug consists of mature leaves, more or less scimitar shaped, thick, leathery, greyish-green, petiolate, upto 26 cm long and 4 cm broad; petioles 2.0 to 3.5 cm long and 0.5 to 1.5 mm thick, sometimes twisted; apex acute to acuminate, base obtuse; midrib prominent,

particularly on the lower surface; margin of leaf entire and somewhat thickened, brittle and possess numerous brown to dark brown corky warts. In transmitted light, numerous oil glands can be seen as translucent dots; upper surface smooth, lower surface slightly rough due to the presence of projecting veins; venation – unicostate reticulate; lateral veins anastomose near the margin forming a continuous line; odour strong and characteristic.

Microscopic Description: Leaf- Transverse section shows typical isobilateral structures with two or three rows of palisade cells on both upper and lower sides, surfaces show thick cuticle; numerous sunken stomata. and large ovoid schizogenous oil cavities of 160 to 200 μ diam.; idioblasts present with rosettes or prismatic calcium oxalate crystals; rosette crystals 25 to 35 μ in size, prismatic crystals 15 to 25 μ in size; vascular bundle of midrib are crescent shaped with one vascular strand present on each side, all having interrupted patches of sclerenchyma; corky warts comprising of 10 or more layers of cells; laminary bundles enclosed in bundle sheath, the cells of which extend to the epidermis on both sides; upper and lower epidermal cells have straight walls; stomata anomocytic; stomatal index on both upper and lower surface 5 to 10; the palisade ratio on upper surface 5 to 17 and lower surface 3 to 6.

Powder-Yellowish brown, free flowing, characterized by the presence of cluster and prismatic crystals of calcium oxalate; epidermis straight walled with sunken stomata; fibers present.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter), Kashaya (Astringent)
Guna (Attribute)	: Laghu (Light), Snigdha (Slimy)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Dipana, Hrdya, Kaphahara, Mutrala, Pacana, Vatahara, Durgandhinasa, Agnimandya, Balaprada

Part Used: Leaves, Oil extract from leaves and tree

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 9% w/w
Acid insoluble ash	: Not more than 1% w/w
Alcohol soluble extractive	: Not less than 14% w/w
Water soluble extractive	: Not less than 21 % w/w
Essential oil	: Not less than 2% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic

	count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of hexane extract on silica gel 60 F 254 plate using Toluene: Acetone (95:05) shows four spots at Rf 0.22, 0.35, 0.41 and 0.49 on spraying with VanillinSulphuric acid reagent and heating the plate for 15 minutes at 110°C.

Major Chemical Constituents: Essential oil containing terpenes such as 1,8 - cineole, camphene, sabinene, myrcene, p-menthone, α - and γ -terpinene, fenchone, α - β - thujone, citral, verbenone.

Therapeutic Use: Sula (pain), Agnimandya (dyspepsia), Swasa (astham), Hrdroga (heart diseases), Jvara (fever), Krimi (worm infestation), Ksaya (emiacion), Puyameha (gonorrhoea), Pratisaya (sinusitis), Pravahika (dysentery), Svarabheda (sore throat), Visamajvara (malaria fever) etc.

Pharmacological Studies: Antiinflammatory, anthelminitic, wound healing activity, anticancer, antibacterial, antifungal, antiviral, larvicidal, antiplaque, antioxidant, antimalrial, antiseptic and astringent etc.

Contraindications: Use of eucalyptus oil during pregnancy and breast-feeding is not recommended. Never apply this oil around the eyes. There is the risk of a spam or respiratory arrest for infants and toddlers up to 2 years old, so do not apply in face.

Adverse Effects: In rare cases, nausea and vomiting, and diarrhoea.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Eucalyptus oil and cineole: 0.3-0.6 gm for internal intake, for inhalation 12 drops into boiling water.

Formulations: Eucalyptus oil

References:

1. Kassahun A, Feleke G. Chemical Composition and Physico-Chemical Analysis of Eucalyptus Globulus Leave and Oil. Science Journal of Chemistry, 2019; 7(2): 36-38.
2. Kaur G, Uddin IM, Aulakh JS. An approach on phytochemistry and pharmacological studies of Eucalyptus globulus plant parts. Research Journal of Material Sciences, 2017; 5(4):1-9.
3. Kesharwani V, Gupta S, Kushwaha N, Kesharwani R, Patel DKM. A review on therapeutics application of eucalyptus oil. International Journal of Herbal Medicine 2018; 6(6):110-115
4. Kassahun A, Feleke G, Chemical Composition and Physico-Chemical Analysis of Eucalyptus Globulus Leave and Oil. Science Journal of Chemistry. 2019; 7(2): 36-38.
5. Hayat U., Jilani, MI., Rehman, R, Nadeem F. A Review on Eucalyptus globulus: A New Perspective in Therapeutics. International Journal of Chemical and Biochemical Sciences. 2019; 8(2015):85-91

Genda Phul

Botanical Name: *Tagetes erecta* Linn.

Family: Asteraceae

Synonyms:

Bangla: গাঁদাফুল (Genda Phul)

Hindi: Genda, Hajara, Hajari, Jhandu

Sanskrit: Jhandu, Sthulapushpa, Zandu, Zanduga

Urdu/Unani/Tibb:

English: African marigold

Geographical Distribution: The plant *Tagetes erecta* Linn. locally known as Genda Phul (Marigold). It is stout, branching herb, native to Mexico and other warmer parts of America and naturalized elsewhere in the tropics and subtropics including India and Bangladesh.

Plant Descriptions:

General Description: Marigold is a common garden plant which is rather coarse, erect, branched and grows to about 1 meter high. However there is short or dwarf varieties as well. The leaves are very deeply incised and sharply toothed. Flower heads are solitary, long stalked and thickening upward. The flowers are bright yellow, brownish-yellow or orange.

Macroscopic Description: *Tagetes erecta* flower has bright colour, an aromatic odour and distinctly bitter taste. It has the length of 2-3 cm and of thickness 3-5.5 mm. Corolla is bright orange and calyx of dark green ovate type.

Microscopic Description: The transverse section of calyx contains cortical portions and fibrovascular bundles. In the cortical portion the cells are rectangular and compactly arranged. The transverse section of the corolla contains epidermis, veins and vein reaches through the semen portion.



Figure 13. *Tagetes erecta* Linn.

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kashaya (Astringent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Tikshna (Sharp)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kapha-vatahara

Part Used: Leaf and flower

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 4.95% w/w
Acid insoluble ash	: Not more than 0.2% w/w
Alcohol soluble extractive	: Not less than 16.8% w/w
Water soluble extractive	: Not less than 72 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC studies showed that the presence of highest numbers phytoconstituents with different colors. TLC of n-Butanol: Glacial acetic Acid: Water (4:1:2v/v/v) shows three spots at Rf. 0.39, 0.48 and 0.61 (both light yellow) in visible light Under U.V. (366 nm).

Major Chemical Constituents: The whole plant contains an essential oil limonene, α,β pinene, dipentene, ocimene, linalyl acetate, linalool, geraniol, tagetone, nonanal and n- nonyl aldehyde as major components. The flowers contain lutein esters of dipalmitate, dimyristate and monomyristate. The fresh petals contain tagetin and hydroxyflavones.

Therapeutic Use: Kustha (skin diseases), Sotha (inflammation), Kasa (cough), Antrasula (intestinal colic), Suryavarta (sinusitis), Prameha (urinary disorders) etc.

Pharmacological Studies: Anti-inflammatory, antioxidant, insecticidal, larvicidal, hepatoprotective, antipyretic, wound healing, antibacterial, antimicrobial, antiepileptic and antifungal etc.

Adverse Effects: No adverse effects is reported after the normal medicinal use of *Tagetes erecta*.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 10-20 ml fresh juice.

Formulations: Marigold Powder, Merigold Ointment, Marigold Cream

References:

1. Singh Y, Gupta A, Kannoja P. *Tagetes erecta* (Marigold) - A review on its phytochemical and medicinal properties. *Current Medical and Drug Research*; 2020; 4 (1):1-6.
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3. Singh N, Mrinal, Thakur R; A Review on Pharmacological aspects of *Tagetes erecta* Linn; *PharmaTutor*; 2019; 7(9):16-24;
4. Gopi G, Elumalai A, Jayasri P. A Concise Review on *Tagetes erecta*. *International Journal Phytopharmacy Research*. 2012; 3(1):16-19.
5. Gauri Karwani and Siddhraj S. Sisodia. *Tagetes erecta* plant: Review with significant pharmacological activities. *World J Pharm Sci* 2015; 3(6):1180-1183

Ghora Neem

Botanical Name: *Melia azedarach* Linn.

Family: Meliaceae

Synonyms:

Bangla: ঘোড়া নিম (Ghora Neem), Ghoranim, Mahanim, Gora-Nim

Hindi: Bakayan, Bakain, Mahanimb

Sanskrit: Mahanimba, Himadruma, Paratanimba, vraksha

Urdu/Unani/Tibb: Maghz-E-Bakain, Bakaayan

English: Persian Lilac, Chinaberry, Bead Tree, Bastard Cedar, Indian Barbados, Bakain, Drek.

Geographical Distribution: *Melia azedarach* is native to tropical Asia. It is widely distributed in Banglaesh, Pakistan, India, Indonesia, Southeast Asia and Australia. It has become naturalized in Philippines, United States of America, Brazil, Argentine and many African and Arab countries.

Plant Descriptions:

General Description: It is a small to medium size deciduous tree or shrub of 5-15 meter in height. Branches are stout, with purplish bark and dotted with buff-colored lenticels. Leaves are compound, alternate, and puberulent to glabrous. Leaves are long, serrate, dark green above, often with sparse hair along the veins and lighter green and generally smooth below. Inflorescence is a panicle, flowers are 5-parted. Sepals are green. Petals are pinkish lavender, lingulate with ten anthers. Fruit is drupe, one seeded, stalked greenish yellow to yellowish tan, globose and 1-1.5 cm in diameter.



Figure 14. *Melia azedarach* Linn.

Macroscopic Description: Bark comparatively thin, about 0.2 to 0.6 cm thick; outer surface black and rough being slightly fissured and exfoliating in small slightly woody pieces light and dark-grey to greyish-black in colour; inner bark made up of creamy layer alternating with whitish ones; fracture, fibrous; taste, extremely bitter.

Microscopic Description: Mature bark shows outer zone of rhytidoma, formed of alternating strips of dark brown cork cells and dead secondary phloem; cork cells compressed, almost rectangular and many layered; secondary phloem multilayered and compressed; cork cambium and secondary cortex almost absent; beneath rhytidoma a wide zone of secondary phloem present, with sieve tubes with compound sieve plates, and with groups of fibres; phloem parenchyma oval to irregular, thin-walled, colourless with intercellular spaces; phloem rays 2 to 5 cells wide; rosette and prismatic crystals of calcium oxalate present in phloem parenchyma and ray cells; a few very small, simple, round to oval, starch grains measuring 5 to 11 μ in diameter, having 2 or 3 components.

Powder -Greyish-yellow; shows fragment of cork cells, phloem fibres, rosette and prismatic crystals of calcium oxalate and small, simple round to oval, starch grains measuring 5 to 11 μ in diameter.

Organoleptic Properties

Rasa (Taste)	: Kashaya (Astringent), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Ruksha (Dry)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Dahanasaka, Grahi, Pittakaphahara, Raktadahahara

Part Used: Leaves, bark and fruit

Purity and Safety Test

Foreign matter	: Not more than 1 % w/w
Total ash	: Not more than 11 % w/w
Acid insoluble ash	: Not more than 1 % w/w
Alcohol soluble extractive	: Not less than 6 % w/w
Water soluble extractive	: Not less than 7 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of),

azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract on Silica gel 'G' plate using Chloroform: Methanol (9: 1) under U.V. (366 nm) shows eight fluorescent zones at Rf. 0.10, 0.26, 0.34, 0.50, 0.68, 0.76, 0.86 (all blue) and 0.95 (bluish green). On exposure to Iodine vapour nine spots appear at Rf. 0.10, 0.18, 0.26, 0.34, 0.50, 0.64, 0.76, 0.86 and 0.95 (all yellow). On spraying with Dragendorff reagent followed by 5% Methanolic-Sulphuric acid reagent two spots appear at Rf. 0.26 and 0.95 (both orange).

Major Chemical Constituents: It contains a number of organic molecules i.e. flavonoids, terpenoids, steroids, acids and anthraquinones. A variety of compounds have been detected in *M. azedarach* leaf extract including Kampherol, Quercetin (Flavonoids), stigmasterol, Campesterol (phytosterols), β -sitosterol, Pyhtol (Diterpene), 3-Methyldecane, Heptadecane (alkane hydrocarbon), hexadecanic acid, Pentadecanoic acid (n-alkanoic acids), β -Carotene, tocopherol (Vitamin-E) and saqulene, 1-Eicosanol (triterpene), 3,5,11,15- Tetramethyl-2-hexadecen-1-ol (Terpene alcohol).

Therapeutic Use: Arsa (piles), Bhrama (vertigo), Chardi (vomiting), Gulma (tumour), Kustha (skin disaeses), Prameha (urinary disorders), Svasa (asthma), Visamajvara etc.

Pharmacological Studies: Antifungal, antimalarial, antibacterial, hepatoprotective, antioxidant, anti-fertility, anthelmintic, antipyretic and cytotoxic activities etc.

Adverse Effects: Overdose of root bark or stem bark may cause diarrhea, vomiting, pain in the abdomen, respiratory paralysis, tachycardia (rapid heart rate), blue coloration of the lips, muscle weakness, ptosis (drooping or falling of the upper eyelid), increased the liver enzymes, etc.

Contraindications: It is contraindicated in pregnancy and breastfeeding.

Precautions: Oil must not be used internally.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Leaf juice (30 - 50 ml) and Leaf powder (3-6 gm).

Formulations: Manjisthasav, Brihat Kiratadi Taila

References:

1. Sharma D, Paul Y. Preliminary and Pharmacological Profile of *Melia azedarach* L.: An Overview. *J App Pharm Sci*, 2013; 3 (12): 133-138.
2. Vishnukanta, AC. Rana. *Melia azedarach*: A phytopharmacological review. *Pharmacognosy Reviews*, 2008; 2(13):173-179.
3. Shamim. *Bakayan (Melia azedarach)* pharmacological actions, therapeutic uses and phytochemistry: A review. *The Pharma Innovation Journal* 2019; 8(7): 86-92
4. Vekariya S, Taviyad K, Nishteswa K. A Review on Therapeutic Potentials of Mahanimba (*Melia Azedarach* Linn.). *Anveshana Ayurveda Medical Journal*. 2015; 1(6): 461-467
5. Azam MM., Mamun-Or-Rashid AN., Towfique NM, Sen M.K, Nasrin. S. Pharmacological Potentials of *Melia Azedarach* L. A Review. *American Journal of BioScience*. 2013; 1(2):44-49

Ghosalata

Botanical Name: *Luffa echinata* Roxb.

Family: Cucurbitaceae

Synonyms:

Bangla: ঘোঁসালতা (Ghosalata), Deyatada

Hindi: Bindal, Ghagharbel, Kakoda

Sanskrit: Akhuvishaka, Chaturangaka, Dali, Deodalika

Urdu/Unani/Tibb: Kukarabel

English: Bristly Luffa, Bitter luffa, Rag gourd

Geographical Distribution: It is a spreading climber herb, with bifid bristly or smooth tendrils and extremely bitter taste, grows widely in Pakistan, India, Bangladesh and Northern Tropical Africa. In India, it is mainly found in Gujarat, Bihar, Rajasthan and Madhya Pradesh.

Plant Descriptions:

General Description: The plant is a climber but not extensively, with bristly or smooth tendrils. Stem is slender, slightly hairy or smooth, branched, furrowed, glabrous. Leaves are kidney-shaped, round, shallow or deeply 5-lobed, the lobes are rounded or rarely sub-acute at the apex, 3.8-6.3 cm, broadly cordate at base, margin minutely denticulate, petioles 2.5-5cm long, striate. Flowers are usually dioecious, white, stalked, about 2.5cm across. Male flower peduncles 7.5-15cm long, usually in pairs, one 1-flowered and other with a raceme of 5-12 flowers at the apex, pedicels 1-2 cm long bracteate near the base. Female flower peduncles 1.3-5 cm long, Petals are white, spreading, ovate, 1-1.2 cm long, blunt, hairy at base. Stamens are 3, with filament united, 3-9mm long. Ovary is ovoid. Fruit is ashy, broadly ellipsoid, not winged, oblong, ovoid, 2-5 cm long, densely covered with 4-7 mm long bristles. Seeds are ovate, black 4-5 mm long, 3-5 mm broad and 2 mm thick.



Figure 15. *Luffa echinata* Roxb.

Macroscopic Description: Stem pieces are slender, yellowish-brown to blackish-brown in color, longitudinally furrowed, glabrous, measuring 1.5–17 cm in length and 5–8 mm diameter. Stems are odorless, bitter in taste, and fracture is short.

Microscopic Description: The transverse section of young stem shows a quadrangular outline whereas the mature stem shows five prominent ridges and furrows. The young stem shows single-layered epidermis covered with a thin cuticle and is followed by three to four layers of collenchymatous cells facing ridges and two layers facing furrows showing more prominent angular thickening in cells below ridges. Beneath the collenchyma is one to three cells wide layer of parenchymatous cells. The endodermis is single layered and is followed by sclerenchymatous pericycle two to seven layers wide. Facing each ridge below the pericycle, a large conjoint bi-collateral open vascular bundles is present besides one small developing conjoint collateral vascular bundle facing developing ridge showing few xylem and a few sieve elements. The pith is large consisting of cells, which are lignified showing mostly simple pits except a few which show reticulate thickening. The mature stem shows a single-layered epidermis covered with a moderately thick cuticle. The cortex is represented by two to eight layers of collenchyma followed by one to three layers of parenchymatous cells in the region facing the ridges and either one to two layers of collenchyma followed by one to two layers of parenchyma or only one to two layers of parenchyma in the remaining portion. Pericyclic cells show less lignification as compared to young or slightly matured stem.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Tridosahara, vishagna

Part Used: Fruits, flowers

Purity and Safety Test

Foreign matter	: Not more than 0.5% w/w
Total ash	: Not more than 8.33% w/w
Acid insoluble ash	: Not more than 6.66% w/w
Alcohol soluble extractive	: Not less than 8.10 % w/w
Water soluble extractive	: Not less than 15.20 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively

	for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC using the mobile phase Ethyl acetate: formic acid: glacial acetic acid: water (100:11:11:26) for ethanolic flower extracts of four morphotypes of *Hibiscus rosa-sinensis* Linn showed the presence of various phytochemical constituents such as flavonoids glycosides, tannin, glycosides, phenolic compound, terpenoids, triterpenoids and phytosterols.

Major Chemical Constituents: Aerial parts of *Luffa echinata* revealed the presence of alkaloid, glycoside, carbohydrate, protein, and flavonoid; while that of the roots revealed sterols, triterpenes, reducing sugars, glycosides, flavones and tannin. Fruits contain a no. of compound such as cucurbitacin-B, elatarin (cucurbitacin-E), elatarin-2-glucoside, isocucurbitacin B, β -sitosterol glucoside, chrysiro-7- glucoside, chysirol-7-epiglucoside, echinamol A, echinamol B, echinatin. It also contains luteolin-7-glucoside, chrysoeriol-7-glucoside. The seeds contain cucurbitacin-B, triterpene, fatty acid, saponin.

Therapeutic Use: Kustha (leprosy), Sotha (oedema), Kasa (cough), Arsa (piles), Svayathu (odema), Prameha (urinary disorders), Pilahayakritroga (hepato splenic infections) etc.

Pharmacological Studies: Antioxidant, analgesic, anti-inflammatory, antidepressant, anxiolytic, antiepileptic, hepatoprotective, antibacterial, antifungal, antiulcer and anticancer activity etc.

Contraindications: It is contraindicated in old age, pregnancy and breastfeeding.

Adverse Effects: Overuse may cause purgation or emesis.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 1-3 gm and juice 10-15 ml.

Formulations: Plehantak Ras, Avya Lavana

References:

1. Modi A, Kumar V. *Luffa echinata* Roxb.-A review on its ethnomedicinal, phytochemical and pharmacological perspective. *Asian Pac J Trop Dis* 2014; 4(Suppl 1): S7-S12
2. Dogar R, Yadav SK, Nagori BP, Mathur K, Goyal M. A Survey on Therapeutic Utility of *Luffa Echinata* Roxb. (Ethnomedicinal uses and Pharmacological activity). *Indian Journal of Drugs*, 2018; 6(1): 62-67
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4. Jayalakshmi S, Patra A, Wahi AK. Cytomorphological Studies on Stem of *Luffa echinata* Roxb. *J Young Pharm*. 2010;2(3): 252-254
5. Rachana GA, Kumar PA, Mukul T. Pharmacognostical Evaluation and Preliminary Phytochemical Screening of *Luffa echinata* (Roxb.) *World Journal of Pharmaceutical Research*; 2015; 4(8): 1366-1382

Gaab

Botanical Name: *Diospyros peregrina* Gurke.

Family: Ebenaceae

Synonyms:

Bangla: গাব (Gaab)

Hindi: Tendu, Gaabh, Maakaatendu

Sanskrit: Tindukah, Tinduki

Urdu/Unani/Tibb: Tendu

English: Indian Gaub, Persimon

Geographical Distribution It is indigenous to Bangladesh and India, and is also found in many other countries of Asia and America.

Plant Descriptions:

General Description: A medium sized spreading evergreen tree about 15m in height with dark grey or black bark, exfoliating in rectangular scales and young parts clothed with grey or tawny tomentum; leaves simple, alternate or subopposite, oblong, coriaceous, glabrous, main nerves oblique, reticulation prominent, bright red when young; flowers unisexual, males 3-12 together in paniced drooping cymes, females considerably longer than the males, solitary, subsessile; fruits ovoid or globose, yellow when ripe, fruiting calyx thickly coriaceous and flat; seeds compressed, 2-8, oblong, shiny.



Figure 16. *Diospyros peregrina* Gurke.

Macroscopic Description: Fruit globose, ovoid or ellipsoid berry, 3.5 to 5 cm in width, with a much large and thickened, often woody calyx; cuticle thick and shiny; green when unripe, yellowish orange when ripe; nearly smooth or covered with a rusty mealiness; fleshy and possessing a viscid, glutinous pulp when fresh, hard when dried, 6 to 10 celled; both unripe and ripe fruits cut longitudinally in to 3 to 4 pieces along with persistent calyx and dried for use; seed solitary in each cell, thin, flat, and oblong; testa hard, separable; endosperm prominent.

Microscopic Description:

Fruit-Transverse section through the fruit shows a thick, stratified cuticle supported on a many-layered exocarp; outermost layer of small, rectangular or rounded cells forms the epidermis; hypodermal region of exocarp possesses abundant groups of stone cells mixed with parenchymatous patches; mesocarp constitutes many layers of parenchymatous cells possessing abundant, large cavities having reddish brown colouring matter; innermost layer of pericarp lined with the cuticle and constituting the endocarp.

Seed-Testa, thick, many layered and lined externally by cuticle; outermost layer of squarish or angular, thick cells forms the outer epidermis of testa; many layers of parenchymatous, sub epidermal zone contain abundant brown colouring matter; innermost layer of testa consists of thin walled, parenchymatous cells; endosperm prominent and cartilaginous with cells having very thick, wavy or straight walls.

Powder-Dull brick red, coarse and granular; taste and odour not distinct; microscopy shows abundant stone cells 60 to 120 μ in size and cells of cartilaginous endosperm.

Organoleptic Properties

Rasa (Taste)	: Ripe-Madhura (Sweet), Unripe-Kashya (Astringent)
Guna (Attribute)	: Ripe-Guru (Heavy), Snighda, Unripe-Ruksha (Rough), Usna (Hot), Tiksna (Sharp)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Ripe-Madhura (Sweet), Unripe-Katu (Pungent)
Karma (Action)	: Ripe-Pittahara, Kaphahara, Durjara, Pustikara Unripe: Vataprokopa, Grahi, Lekhana

Part Used: Seeds, Root, Root Bark, Leaves, Bark

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 6% w/w
Acid insoluble ash	: Not more than 2% w/w
Alcohol soluble extractive	: Not less than 10 % w/w
Water soluble extractive	: Not less than 16% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total

yeast and mould count, total *Enterobacteriaceae* are not more than 10^4 cfug⁻¹, 10^3 cfug⁻¹ and 10^4 cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total *Enterobacteriaceae*, *Salmonella spp*, *S. aureus*, *Pseudomonas aeruginosa* and *Coliforms* will be absent.

Heavy metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.

Pesticides residues

: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract of the drug on silica gel 'G' F254 plate using ethyl acetate: n-hexane (7:3). On spraying the plate with anisaldehyde-sulphuric acid reagent and heating the plate for 10 minutes at 105°, spots appear at Rf. 0.41 (light blue) 0.49 (brownish zone) 0.61 (bluish) and 0.83 (dark blue).

Major Chemical Constituents: Alkanes and triterpenoids. Seed contains hexacosane and β -sitosterol, β -sitosterol glucoside, gallic acid and betulinic acid. Fatty oil (32%), unsaponified matter and β -amyrin.

Therapeutic Use: Ripe: Asmari (calculus), Aruci (tastelessness), Kapharoga (disease due to Kapha dosa), Prameha (metabolic disorder), Raktadosha (disorders of blood). **Unripe:** Atisara (diarrhoea), Bhagna (fractures), Daha (burning sensation), Kustha (leprosy /diseases of skin), Sotha (oedema), Medoroga (obesity), Pravahika (dysentery), Raktapitta (bleeding disorder), Udarda (urticaria), Vrana (ulcer).

Pharmacological Studies: Antioxidant, hypoglycemic, antidiarrheal, antiviral, antiprotozoal, anthelmintic, anticancer etc.

Contraindication: Contraindicated in small children, old age, pregnant mother, lactating women.

Adverse Effects: Higher dose may cause Vamana (induce vomiting), Virechana (induce purgation).

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 5-10 gm

Formulations: Tinduk Bati, Kadaladya Grita

References:

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4. Maridass M, Ghanthikumar, Raju G. Preliminary Phytochemical Analysis of *Diospyros* Species. *Ethnobotanical Leaflets*, 2008; 12:868-72.
5. Sinha BN, Bansal SK. A review of phytochemical and biological studies of *Diospyros* species used in folklore medicine of Jharkhand. *Journal of Natural Remedies*, 2008; 8(1):11-17

Isharmul

Botanical Name: *Aristolochia indica* Linn.

Family: Aristolochiaceae

Synonyms:

Bangla: ঐশ্বরমূল (Ishormul), Isheri

Hindi: Isharmul, Hooka bel

Sanskrit: Ahigandha, Arkamula, Ishvara, Nakuli, Sunanda

Urdu/Unani/Tibb: Zarawand Hindi

English: Indian Birthwort, Snake root

Geographical Distribution: It is native of India and Eastward, plains of India from Nepal and lower Bengal to Chittagong in Bangladesh and the hilly region of Odisha, India.

Plant Descriptions:

General Description: A perennial climber growing up to 20 meters long, scrambling over the ground or supporting itself by twining around other plants, with greenish white woody stems. Leaves: Variable, in the broad form 10-12.5 by 7.5 cm; in the narrow form 3.8-10 by 1.3 to 2.5 cm from linear oblong to obovate –oblong or sub-panduri form, usually obtusely acuminate, glabrous, entire with somewhat undulate margins, base cuneata, rounded, subtruncate or subcordate. Flowers: Flowers are few-flowered axillary racemes; bracts small, ovate, acuminate, opposite the pedicels; pedicels long, thickened above perianth greenish white, reaching 4.5 cm long, with globose inflated base, then bent at a right angle and suddenly narrowed into a cylindric tube with oblique trumpet shaped mouth gradually passing into a long narrow, linear- oblong obtuse brownish lip. Anthers 6 style 6- lobed, capsule 3.8 to 5cm long, oblong or globose-oblong, opening from below upwards, 6 valved, the pedicles splitting into 6 filaments. Seeds: Deltoid-ovate, acute, flat, winged.



Figure 17. *Aristolochia indica* Linn.

Macroscopic Description: Root considerably long, cylindrical, a few irregularly bent; 2-10 mm in dia; surface almost smooth with fine longitudinal wrinkles and transverse cracks; external surface, light greyish-brown; inner whitish; fracture, short and splintery; odour, camphoraceous; taste, strongly bitter.

Microscopic Description: Cork 8-10 layers, composed of tabular, thin-walled cells excepting the outer most layer, having thick-walled cells externally and filled with brownish content; cork cambium single layered; secondary cortex 15 to 17 layers of thin-walled, somewhat rounded and isodiametric cells in the outer region but tangentially elongated in the inner region; plenty of simple, round to oval starch grains measuring 5-18 μ in diameter And compound starch grains having 2-4 components measuring 10-15 μ in diameter and oil globules present in a few cells; in the middle region stone cells round, rectangular, oval or elongated present in small irregular patches having simple pits and radiating canals; centre occupied by xylem, split into strips of radiating arms by wedged shaped masses of parenchyma; each xylem arm is capped by thin patches of phloem consisting of sieve elements and phloem parenchyma, phloem fibres, and occasionally stone cells also found in this region; a ring of cambium present between phloem and xylem; xylem consists of large vessels, tracheids, fibres tracheids and parenchyma, all being lignified; in older roots, tyloses formation takes place in vessels; medullary rays 8 to 10 in number, multiseriate and dilating towards periphery and alternating with radiating arms of wood; scattered group of stone cells present in a few wider rays; micro-crystals with a few appearing as elongated small prisms and unaffected by acids, are present in a few cortical and ray cells.

Powder - Brownish-yellow; fragments of cork cells, very few, oval to rectangular, lignified, thick-walled stone cells having distinct striations with narrow lumen, vessels with spiral thickenings, non-lignified, thick-walled tracheids, numerous simple, round to oval, starch grains measuring 5-18 μ in diameter, and compound grains having 2 to 4 components, measuring 10 – 15 μ in diameter, a few crystals and oil globules.

Organoleptic Properties

Rasa (Taste)	: Kashaya (Astringent), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Ushna (Heating)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphavatashamaka (Pacifies Kapha, and Vata), Shothahara (Reduces swelling), Grahabadhaghna (Destroys pregnancy)

Part Used: Root and leaf

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 4% w/w
Acid insoluble ash	: Not more than 1 % w/w

Alcohol soluble extractive	: Not less than 2% w/w
Water soluble extractive	: Not less than 3% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene. Ethylacetate (85:15) shows under UV (366 nm) four fluorescent zones at Rf 0.21, 0.60 (both blue), 0.89 (red), 0.96 (blue). On exposure to Iodine vapour six spots appear at Rf 0.11, 0.21, 0.50, 0.63, 0.96 and 0.98 (all yellow) On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C three spots appear at Rf 0.14, 0.63 (both violet) and 0.96 (brown).

Major Chemical Constituents: β-caryophyllene; α-humulene; β-sitosterol; Alkaloids; Aristolactams; Aristolochic acid; Essential oils; Fixed oil.

Therapeutic Use: Sarpavisa, Jalagardabha, Vrscikavisa, Jvara, Krmi, Vrana etc.

Pharmacological Studies: Abortifacient, antibacterial, antidiabetic, antifertility, antiinflammatory, antioxidant, antispermatogenic, antivenom, carcinogenic, hepatoprotective, nephropathic; oxytocic etc.

Adverse Effects: In high doses, aristolochic acid causes severe necrosis of renal tubules, atrophy of the lymphatic organs and large areas of superficial ulceration in the fore stomach.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Roots: 1-2 gm (for external use also).

Formulations: Kandaprasar Taila, Brihat Marichyadi Taila

References:

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2. Michl J, Jennings HM, Kite GC, Ingrouille MJ, Simmonds MSJ, Heinrich M. Is aristolochic acid nephropathy a widespread problem in developing countries? A case study of *Aristolochia indica* L. in Bangladesh using an ethnobotanical–phytochemical approach, *Journal of Ethnopharmacology*, 2013; 149(1):235-244
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4. Kuo PC, Li YC, Wu TS. Chemical Constituents and Pharmacology of the *Aristolochia* (mădōu ling) species. *J Tradit Complement Med*. 2012;2(4):249-266.
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Jhau

Botanical Name: *Tamarix gallica* Linn.

Family: Tamaricaceae

Synonyms:

Bangla: ঝাউ (Jhau)

Hindi: Badimayi, Jhao, Jhav

Sanskrit: Jhavu, Jhavuka, Macika, Shavaka

Urdu/Unani/Tibb: Burg-o-bikh Jhao, Chobgaz, Kazmazi, Kazmazij, Mayeen kalan,

English: Tamarisk galls

Geographical Distribution: *Tamarix gallica* is distributed in the coast forests of Bangladesh, Pakistan, Ceylon, Burma, Malay and Andamans. It is mainly found in the salty regions, between interdunal areas of the desert.

Plant Descriptions:

General Description: Indian Tamarisk is a tall hairless shrub or small sized tree, 2-6 m tall with reddish-brown bark. Leaves are tiny, stalkless, ovate with triangular base, stem-clasping or eared, pointed, 1-2 mm long, without coherent margins. Flower racemes are 3-12 cm long, 3-4 mm broad. Rachis is minutely papillose or entirely hairless. Bract triangular, acuminate, somewhat irregularly toothed at the margin, sometimes slightly keeled, 1 mm long. Flower-stalk is shorter than bract, 0.5 mm long. Sepals are 5, fused at the base inner somewhat broader than the outer, outer more acute, ovate to somewhat circular, deeply toothed at the tip, margin somewhat membranous, 0.75-1 mm long, about 0.5 mm broad. Petals are 5, free, elliptic or elliptic-obovate, blunt, 1-2 mm long, 0.75-1 mm broad. Stamens are 5, filaments threadlike. Capsule is about 6 mm long, conical, triangular.



Figure 18. *Tamarix gallica* Linn.

Macroscopic Description: Dried syconus fruit, ovoid with a central circular hole and short stalk, 1-2 cm in diameter, wrinkled; greyish-brown; seeds less than 1 mm in diameter and yellowish-brown in colour, odour and taste not characteristic.

Microscopic Description: Fruit shows a single layered epidermis, covered with thick cuticle having a few unicellular trichomes, epidermis, followed by 4-6 layers of hexagonal to polygonal, collenchymatous cells, a few cells contain rosette crystals of calcium oxalate; mesocarp composed of large, oval to polygonal, thick-walled parenchymatous cells, a few vascular vessels showing spiral thickening.

Powder-Greyish-brown; shows groups of oval to polygonal, thin-walled cells of mesocarp and endosperm, fragments of polyhedral, thick-walled epidermal cells in surface view, spiral vessels and abundant unicellular trichomes.

Organoleptic Properties

Rasa (Taste)	: Kashaya (Astringent), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Ushna (Heating)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Pittanashak

Part Used: Whole Plant

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 13% w/w
Acid insoluble ash	: Not more than 1.5% w/w
Alcohol soluble extractive	: Not less than 3% w/w
Water soluble extractive	: Not less than 12% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of cis,

trans and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the alcoholic extract of the drug on Silica gel 'G' plate using n-Butanol: Acetic acid: water (4:1:5) shows under U.V. (366 nm) two fluorescent zones at Rf 0.36 and 0.92 (both blue). On exposure to Iodine vapour four spots appear at Rf. 0.20, 0.36, 0.41 and 0.92 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 105°C two spots appear at Rf. 0.20 (grey) and 0.92 (brown).

Major Chemical Constituents: The phytochemical analysis of this plant shows that it is rich in antioxidants such as tannin (50%), tamarixin, tamarixetin, troupin, 4- methylcoumarin and 3, 3'-di-O-methylellagic acid. The principle constituents are tamarixin and its traces of aglycone, tamarixetin, Tamarixetin-3-glucoside, Quercetin and Kaempferol. The plant contains a high level of tannin (ellagic and gallic) and quercetol (methyllic ester). Furthermore, the Tamarix is found to be rich in polyphenolic compounds such as flavonoids, phenolic acids and coumarins etc.

Therapeutic Use: Pachana, Jwara, Raktadosha, Sotha, Kasa, Antrasula, Arsha, Prameha etc.

Pharmacological Studies: Antimalarial, expectorant, antidiarrheal, anthelmintic, antihaemorrhoid, diuretic, hepatoprotective, antioxidant, antihyperlipidemic, anticancer, antimicrobial, etc.

Adverse Effects: No any adverse effects found in proper doses.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 1-2 gm, decoction 5-10 ml.

Formulations: Tamarisk galls Powder, Tamarisk galls Tablet

References:

1. Urfi MK, Mujahid M, Akhtar BJ, Khalid M, Khan MI, Usmani A. Tamarix gallica: For traditional uses, phytochemical and pharmacological potentials. Journal of Chemical and Pharmaceutical Research, 2016; 8(1): 809-814
2. Abu S, Chaturvedi S, Sharma M. Tamarix gallika-An Overview. Asian J Pharm Clin Res, 2012; 5(3): 17-19.
3. Drabu S, Chaturvedi S, Sharma M. Tamarix gallica –An Overview. Asian J Pharm Clin Res, 2012;5(3):17-19
4. Ksouri R, Falleh H, Megdiche W, Trabelsi N, Mhamdi B, Chaieb K, Bakrouf A, Magné C, et al. Antioxidant and antimicrobial activities of the edible medicinal halophyte Tamarix gallica L. and related polyphenolic constituents. Food Chem Toxicol. 2009 Aug; 47(8):2083-91
5. Chaturvedi S, Drabu S, Sharma M. Anti-inflammatory and Analgesic Activit of Tamarix gallica. Int J Pharm Pharm Sci, 2012; 4(3): 653-658

Jivanti

Botanical Name: *Leptadenia reticulata* (Retz.) Wight & Arn.

Family: Apocynaceae

Synonyms:

Bangla: জীবন্তী (Jivanti), Jiwanti

Hindi: Dodi Shak, Jivanti

Sanskrit: Jivanti, Jivaniya, Jivapushpa, Hemavati, Jivana

Urdu/Unani/Tibb: Mukku-tu-mudu

English: Leptadenia

Geographical Distribution: It is mainly found in India. Apart from India, it is also reported to be distributed in the tropical and subtropical parts of Africa, Burma, Nepal, Sri Lanka, Malay Peninsula, Cambodia, the Philippines, Mauritius, and Madagascar.

Plant Descriptions:

General Description: *Leptadenia reticulata* is a twining shrub; stems with corky deeply cracked bark; with an ash coloured or buff white exterior, bears vertically elongated lenticels, whitish smooth interior and possesses camphor like smell. Branches numerous, leaves thinly coriaceous or lanceolate with hairy surface and leathery texture. 3.8-7.5 by 2- 4.5 cm, ovate, acute, glabrous above, more or less finely pubescent (specially on the nerves) beneath, base rounded or subcordate (rarely sub-acute); petioles 6-20 mm. long, puberulous. Flowers are greenish – yellow. [4] Mainly, the roots and the whole plant are used for medicinal purposes.

Macroscopic Description: Roots cylindrical, 5 to 7 cm in length and 1 to 3 cm in thickness, surface light brown to greyish brown with longitudinal wrinkles; fracture, tough; fractured surface creamish and horny; odour and taste indistinct.

Microscopic Description: Root shows cork consisting of rectangular and tangentially elongated cells, phellogen 1 to 2 layered; phelloderm consists of thin walled parenchyma cells with groups of stone cells and fibres scattered in the central and lower regions; phloem made up of sieve tubes, companion cells, parenchyma, fibres and stone cells being transversed by uni to multiseriate medullary rays, groups of fibres and stone cells present in outer phloem region, stone cells are about 60 μ in length and 20 μ in width, fibres are upto 1300 μ in length; xylem represented by vessels, tracheids, fibres, parenchyma, interxylary phloem and uni to multi seriate medullary rays, all xylem elements except interxylary phloem thick walled and lignified; vessels drum shaped or elongated with bordered pits or scalariform thickenings, bordered pitted tracheids, fibres elongated with tapering or bifurcated ends present; xylem parenchyma simple pitted; rosettes of calcium oxalate crystals present in some of the parenchyma cells of phloem and phelloderm.

Powder- Powder shows rectangular to polygonal stone cells, vessels with bordered pits or scalariform thickenings, border pitted tracheids, fibres with tapering or bifurcated ends, thick walled parenchyma cells with simple pits and thin walled parenchyma cells with rosettes of calcium oxalate crystals.

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Kashaya (Astringent)
Guna (Attribute)	: Laghu (Light), Snigdha (Unctuous)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Rasayana, Balya, Caksusya, Grahi, Vrsya, Brmhana, Stanyajanana, Visaghna, Tridosahara

Part Used: Whole plant



Figure 19. *Leptadenia reticulata* (Retz.) Wight & Arn.

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 14% w/w
Acid insoluble ash	: Not more than 1.5% w/w
Alcohol soluble extractive	: Not less than 5 % w/w
Water soluble extractive	: Not less than 3% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract on precoated silica gel 'G' plates using chloroform: methanol: water (4:3:1) as mobile phase under UV 254 nm shows spots at Rf. 0.01, 0.21, 0.26 (all blue), 0.54, and 0.75 (both white).

Major Chemical Constituents: It contains acetyl alcohol, β -sitosterol, β amyryl, lupanol 3-O diglucoside, leptidine, saponin, flavonoid, luteolin, diosmetin and tannin. Leaves contain two resins and also contain bitter neutral principal, albuminous and colouring matter, and tartaric acid.

Therapeutic Use: Atisara (diarrhoea), Daha (burning sensation), Jvara (fever), Ksaya (pthisis), Kāsa (cough), Sosa (cachexia), Mukharoga (disease of mouth), Netraroga (diseases of the eye), Raktapitta (bleeding disorder), Trsna (thirst), Urhksata (pulmonary cavitation), Vrana (ulcer).

Pharmacological Studies: Antidepressant, antiepileptic, antimicrobial, antitumor, antioxidant, antipyretic, anti-inflammatory, anxiolytic, diuretic, hepatoprotective, immunomodulatory etc.

Adverse Effects: No adverse effects was found in usual.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 3-6 gm.

Formulations: Chyabanprash, Pippaldya Grita, Kumar Kalyan Grita, Sharabindu taila

References:

1. Dhawan P, Kour M, Damor S. A Review on Phytochemical and Pharmacological Profile of Endangered Medicinal Plant *Leptadenia Reticulata* (Retz) Wight & Arn. *International Journal of Scientific Research*; 2013; 2(10):1-4
2. Hewageegana SP, Arawwawala M, Dhammaratana I, Ariyawansa H, Tissera A. Proximate Analysis and Standardization of Leaves: *Leptadenia Reticulata* (Retz) Wight and Arn. (Jeevanti); *World Journal of Pharmaceutical Research*; 2014; 3(10):1603-1612.
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5. Dhalani JM, Nariya PB. A Pharmacological Review: *Leptadenia reticulata* (Wight & Arn.); Jivanti: the Real Life Giving Plant. *Folia Med (Plovdiv)*. 2017 Dec 20;59(4):405-412.

Jinti

Botanical Name: *Barleria prionitis* Linn.

Family: Acanthaceae

Synonyms:

Bangla: ঝিঁটি (Jinti), Kantajinti, Peetjhanti

Hindi: Katsareya, kinti, kala bans

Sanskrit: Kurantaka, Koranda, Kerandaka, Sahachara

Urdu/Unani/Tibb: Katsaraiya, Piyabaasa

English: Yellow Hedge Barleria, Porcupine Flower

Geographical Distribution: *Barleria prionitis* also known as the porcupine flower, which belongs to the family Acanthaceae and genus *Barleria*. It is native to India, also distributed widely throughout Asia including Malaysia, Pakistan, Philippines, Sri Lanka, Bangladesh, Yemen and tropical Africa.

Plant Descriptions:

General Description: *Barleria prionitis* is developed as a decorative and restorative plant in Asia. It is an erect, thick, thorny under shrub coming to up to 0.6-1.5 m high. *Barleria prionitis* considered yearly or perpetual plant amid the dry season. Its stems, leaves and blooms pass on yet roots alive. The vegetation develops stormy season. Stem: Erect 1.8mm thick, terete, hard, glabrous, hubs swollen, spreading at hubs, youthful stem dark, somewhat four calculated with 3-4 divariate spines at hub of leaf. Stem tube shaped with longitudinally orchestrated remotely greyish to light dark coloured. A couple of develop stems marginally empty. Flowers: Tubular yellow-orange 4.0 cm long blooms with distending stalks. Leaf: Oval-ellipsoid moulded, variable in scrutinize to 10 cm long and 4 cm wide, elliptic whole, intense reticulate, unicostate, labours above, underneath petiole short. Seeds: Oval took care of business to 2cm since a long time ago seed, case containing two expansive 8mm long, 5mm wide level seeds with plush hairs.



Figure 20. *Barleria prionitis* Linn.

Macroscopic Description: Macroscopic study reveals that leaves are dorsiventral, variable in size, 6-9.5 cm long, 2.5 - 3.5 cm wide, simple, elliptic, acuminate, entire, acute, reticulate, unicostate, glabrous above, glabrous or pubescent beneath petiole short and the young stem grey, slightly four angled, usually with 3-4 divaricate spines at axil of leaf mature stem cylindrical with longitudinally arranged or scattered dot-like lenticels externally greyish to light brown a few mature stem slightly hollow.

Microscopic Description: Lower epidermis; parenchyma many layered in upper surface and no. of layers in lower surface towards proximal end, circular to polygonal and thin-walled; some contain raphides of calcium oxalate; vascular bundle semilunar, situated centrally in arenchymatous ground tissue; xylem vessels arranged in radial rows, protoxylem towards centre; two smaller vascular bundles present on either sides of central vascular bundle. Midrib - Single layered epidermis on both surfaces covered externally with thick cuticle. Collenchyma, parenchymatous cells shows single vascular bundle Lamina Single layered epidermis covered with thick cuticle on both surfaces, glandular.

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter), Amla (Sour)
Guna (Attribute)	: Snigdha (Unctuous)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kasahar, Keshya, Mutral, Vatahar, Vishahara

Part Used: Whole plant especially leaf.

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 19.33% w/w
Acid insoluble ash	: Not more than 10.2% w/w
Alcohol soluble extractive	: Not less than 17.6% w/w
Water soluble extractive	: Not less than 4.05% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) one fluorescent zone at Rf. 0.83 (green). On exposure to Iodine vapour three spots appear at Rf. 0.30, 0.83 and 0.90 (all yellow). On spraying with 5% Methanolic Sulphuric acid reagent and heating the plate for ten minutes at 105°C six spots appear at Rf. 0.13, 0.23, 0.30 (all dull yellow), 0.69, 0.83 and 0.90 (all grey).

Major Chemical Constituents: A wide variety of biologically active constituents such as glycosides, flavonoid, saponin, steroid and tannins are present in his plant. The plant contains balerenone, prioniside A and B, lupeol, 6- hydroxyflavone, barlerin.

Therapeutic Use: Danta Roga (gum and teeth problems), Kandu (itching), Kushta (chronic skin diseases), Mutra Roga (obstinate urinary disorders), Palita (hair greying), Vatarakta (gout) etc.

Pharmacological Studies: Antioxidant, antibacterial, antiinflammatory, hepatoprotective, antifungal, antiviral, antifertility and gastoprotective activity etc.

Adverse Effects: The leaves and flowering tops are diuretics, rich in potassium salts. It increases urination.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: The leaf juice is given internally in a dose of 5-20ml. A decoction prepared from the plant are given in a dose of 50-100ml.

Formulations: Rasnasav, Brihat Batnasini

References:

1. Singh K, Sharma D Gupta RS. A Comprehensive Review on Barleria prionitis (L). Asian J Pharm Clin Res, 2017; 10(12): 22-29.
2. Singh A, Navneet. A Review: Traditional, Ethnomedicinal Utilization, Pharmacological Properties and Phytochemistry of Barleria prionitis Linn._Int. J. Pharm. Sci. Rev. Res., 2017; 44(2): 19-26
3. Gupta BK, Gavatia NP, Tailang M. Pharmacognostical and phytochemical investigation of Barleria prionitis Linn leaves. Journal of Pharmacy Research 2012; 5(2): 807-809
4. Vasoya U. Pharmacognostical and Physicochemical Studies on the Leaves of Baleria Prionitis (L). IJPSR, 2012; 3(7): 2291-2295
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6. Vyas MK, Patel K, Soni KV. A Contribution on the Microcharacters of Barleria prionitis L. Useful in Pharmcognosy. UK Journal of Pharmaceutical and Biosciences, 2016; 4(4):80-84.

Jayanti

Botanical Name: *Sesbania sesban* Linn.

Family: Fabaceae

Synonyms:

Bangla: জয়ন্তী (Jayanti), Jainti, Jayant

Hindi: Jainti, Jait, Rawasan

Sanskrit: Jayanti, Jayantika

Urdu/Unani/Tibb:

English: Common Sesban, Egyptian rattle pod, Frother, Iver bean, Sesban, Sesbania

Geographical Distribution: *Sesbania sesban* Linn. is very common throughout Africa and in Asian countries such as India, Malaysia, Indonesia and Philippines.

Plant Descriptions:

General Description: It is small, slender, soft wooded tree reaching up to 6-m. The leaves are paripinnate and the leaflets are numerous. Flowers occur in axillary 2 – 4-flowered racemes. Calyx is campanulate, 5-toothed and two-lipped. Corolla is sickle-shaped, red, pink or white. Petals are 5 and long clawed. Stamens are 9. Fruit is long and tetragonous pod. Pod is about 50 cm long with numerous seeds.



Figure 21. *Sesbania sesban* Linn.

Macroscopic Description: Leaves pinnately compound, 7.5-15.5 cm long, rachis shortly produced above last pair of leaflet; paripinnate, leaflets 6-16 pairs, opposite, linear, oblong, glabrous, entire, mucronate to acuminate, very shortly stalked, 1.0-3.3 cm long, 0.3-0.8 cm wide.

Microscopic Description:**Leaflet**

Rachis - shows single layered epidermis, followed by 2-3 layered collenchymatous and 4- 7 layered round, thin-walled parenchymatous cells; vascular bundles arranged in a ring, having secretory cavities in phloem, each bundle covered externally with sclerenchymatous sheath, one smaller vascular bundle present in both the wings; pith small, consisting of thin-walled, polygonal, parenchymatous cells.

Lamina-shows single layered epidermis on both surfaces, stomata anisocytic, present on both surfaces, palisade single layered, spongy parenchyma consisting of round cells, small veins situated between palisade and spongy parenchyma cells, stomatal index on upper surface 11-20 and on lower surface 11-25, palisade ratio 3.25-4.50 and vein islet number 27-36 per square mm.

Powder-Dull green; shows spongy parenchyma, palisade cells; xylem vessels with scalariform thickening and stomata.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	:Kaphahara, Pittahara, Rasayan, Vatahara, Kanthasodhana

Part Used: Leaves, flowers, bark, roots, shoots, fruits

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 11% w/w
Acid insoluble ash	: Not more than 2% w/w
Alcohol soluble extractive	: Not less than 7% w/w
Water soluble extractive	: Not less than 25% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.

Pesticides residues : According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (90: 10) shows under U.V. (366 nm) six fluorescent zones at Rf. 0.05, 0.11, 0.19, 0.29, 0.56 (all pink) and 0.97 (yellow). On exposure to Iodine vapour ten spots appear at Rf. 0.05, 0.11, 0.19, 0.29, 0.37, 0.48, 0.56, 0.69, 0.91 and 0.97 (all yellow). On spraying with 5 % Methanolic Phosphomolybdic acid reagent and heating the plate at 105°C for ten minutes nine spots appear at Rf. 0.05, 0.11, 0.19, 0.29, 0.37, 0.48, 0.56, 0.91 and 0.97 (all grey).

Major Chemical Constituents: The chemical constituents of this plant as reported are saponins, tannins, alkaloid, phenolic compounds, and flavonoids and oleanolic acid 3-β-D-glucuronide.

Therapeutic Use: Mutrakrcchra, Galaganda, Visaroga etc.

Pharmacological Studies: Antimicrobial, antiinflammatory, antidiabetic, antifertility, CNS stimulant effects etc.

Contraindication: It should not be used in small children, very old persons, pregnant women, lactating mother and known allergy to the plants of the Fabaceae family.

Adverse Effects: Excess dose may cause may aggravate vata and can cause diarrhea.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 3-6 gm in powder form.

Formulations: Parijatadi Kwath, Basarudra Guduchi Taila

References:

1. Usman MRM, Patil SB, Pati SS, Patil RS. *Sesbania sesban* Linn.: An overview, Int. J. of Pharm. & Life Sci., 2013; 4(5):2644-2648.
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4. Goswami S, Mishra KN, Singh RP, Singh P, *Sesbaniasesban* PS, A Plant with Diverse Therapeutic Benefits: An Overview. Journal of Pharmaceutical Research & Education, 2016; 1(1):111-121
5. Samajdar S, Ghosh AK; Pharmacological effects of *Sesbania sesban* Linn: An overview; Pharma Tutor; 2017; 5(7):16-21

Kakrashingi

Botanical Name: *Pistacia integerrima* Stew. ex Brand

Family: Arecaceae

Synonyms:

Bangla: কাকড়াশঙ্গী (Kakrashingi), Kandashringi

Hindi: Srngi, visani kakdashingi, kakarsingi, kakra, kakkatasimgi

Sanskrit: karkata, karkatakhyā, karkatasringi, karkatasrangi, karkati

Urdu/Unani/Tibb: Kakrasinghi, kakra

English: Crab's claw

Geographical Distribution: Natural distribution is obscured in native Asia temperate zones (Afghanistan), Asia tropical (India, Pakistan, Nepal, and Indochina) and United States of America. Its plant requires dry slopes with shallow soils and in valleys along rivers at 2400 m. The tree does not tolerate fire and is strongly susceptible to acidic soils.

Plant Descriptions:

General Description: *Pistacia integerrima* tree has low, dense crown base and roots deeply. Single stemmed. The bark is light brown colour. Leaves 6 to 9-inch-long and 1 to 3 inch broad, they are ovate shaped and are present in pairs. Leaves are pinnate (frequently paripinnate) and bearing 2 to 6 pairs of lanceolate, long leaflets. The terminal leaflet is much smaller than the lateral ones or even reduced to a mucro, inflorescence red. The fruit are shiny, globular, apiculate and 5 to 6mm in diameter. The fruit arises in early summer, brown in colour and become purplish or blue at maturity. The fruit have bony endocarp and after maturity followed by fruiting.

Macroscopic Description: Dried galls hard, hollow, horn-like, thin-walled, generally cylindrical, tapering at both the ends, greyish brown externally and reddish brown internally, size varies from 2.5-30.0 cm or more, each gall contains numerous dead insects, odour, terebinthine, taste of powdered galls, strongly astringent and slightly bitter.

Microscopic Description: Transverse section of gall shows the collapsed epidermis on both the sides, epidermal cells thin-walled, tangentially elongated, ground tissues thin-walled and oval or circular, the outer two layers tangentially elongated while between vascular bundles radially elongated, outer few layers and some of cells of ground tissue filled with yellowish brown contents, vascular bundle scattered throughout the ground tissues in two rows, consist of phloem accompanied by a large tannin sac in each vascular bundle.

Powder-Powder greyish brown, under microscope, shows orange yellow colour isolated or associated fragments of xylem vessels and ground tissues.

Organoleptic Properties

Rasa (Taste) : Tikta (Bitter), Kasaya (Astringent)

Guna (Attribute) : Guru (Heavy), Snigdha (viscous)

Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Madhura (Sweet), Amla (Sour), Katu (Pungent)
Karma (Action)	: Kasahara, Kaphavatahara (balances kapha and vata), Urdhvavatajit, Hikkani-grahana.

Part Used: Galls



Figure 22. *Pistacia integerrima* Stew. ex Brand

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 7% w/w
Acid insoluble ash	: Not more than 0.2% w/w
Alcohol soluble extractive	: Not less than 30 % w/w
Water soluble extractive	: Not less than 30% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.

Pesticides residues : According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract on Silica Gel 'G' using n-Butanol: Acetic acid: Water (5:1:4) shows in visible light one spot at Rf. 0.12 (grey). On exposure to Iodine vapour two spots appear at Rf. 0.12 and 0.25 (both yellow). On spraying with 5% Methanolic Sulphuric acid reagent four spots appear at Rf. 0.12, 0.25 (both black), 0.33 and 0.62 (both grey).

Major Chemical Constituents: It contains resin two isomeric triterpenic acids-pistacienoic acids A and B, tannins, a triterpene alcohol-tirucallol, beta-sitosterol, tetracyclic triterpenes, pistacigerrimones A,B,C (galls); alpha-piene, beta-piene, camphene, dlimonene, 1:8-cinol, alpha-terpineol, beta-terpineol, aromadendrene, lactonic stearoptene, caprylic acid, alpha-d-pinene, alpha & beta phallandrene, amino acids, dihydromalylic acid, protein (seeds); hydrocarbons, sterols, triterpenoids (seeds oil), tannins (leaves, bark).

Therapeutic Use: Aruci, Swasa, Chardi, Hikka, Jvara, Kasa, Ksaya.

Pharmacological Studies: Antimicrobial, antioxidant, analgesic, antiinflammatory, antidiarrheal, anti-asthmatic, expectorant etc.

Adverse Effects: Higher dosages may cause depression of the central nervous system that can result in decreased rate of breathing, decreased heart rate, and loss of consciousness.

Dosage Forms: Semisolid, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 3-6 g of the drug in powder form.

Formulations: Shringiadi chura, Talisadi churna, chayanprash-awaleha, Dashmularista, Siva gutika.

References:

1. Rauf A. A Mini Review on a Pistacia Integerrima Well-Known Medicinal Plant: its Active Phytochemicals with Exciting Pharmacological Profile. *Acta Scientific Nutritional Health*, 2019;3(4)45-48.
2. Bibi Y, Zia M, Qayyum A. An overview of Pistacia integerrima a medicinal plant species: Ethnobotany, biological activities and phytochemistry, *Pak. J. Pharm. Sci.*, 2015; 28(3):1009-1013.
3. Kaur B, Singh S. A review on gall karkatshringi. *Journal of Medicinal Plants Research*. 2015; 9(21): 636-640.
4. Jeet K, Baldi A. A Comprehensive Review on *Pistacia integerrima*. *Current Traditional Medicine*, 2019; 5(2): 98-113
5. Islam NU, Jalil K, Shahid M, Naveed Muhammad, Abdur Rauf, Pistacia integerrima gall extract mediated green synthesis of gold nanoparticles and their biological activities, *Arabian Journal of Chemistry*, 2019;12(8): 2310-2319.

Kasni

Botanical Name: *Cichorium intybus* Linn.

Family: Asteraceae

Synonyms:

Bangla: কাসনী (Kasni), Kashi, Kaasni

Hindi: Kashi, Kaasni, Kssni, Hinduba

Sanskrit: Kaasani, Hinduba, Kasni

Urdu/Unani/Tibb: Beikh kasni (roots)

English: Chicory, Indian Endive

Geographical Distribution: The plant grows almost on all types of soil and occurs throughout North West India upto 6000 feet Punjab, Kashmir, Andhra Pradesh, Karnataka and Maharashtra other countries which produce chicory are Baluchistan, Belgium, Europe, France, Germany, Persia, Netherlands, Switzerland, South Africa Waziristan, West Asia, United Kingdom.

Plant Descriptions:

General Description: Herbs 40-110 cm tall, perennial, with a strong taproot. Stem usually solitary, erect; branches spreadingascending, subglabrous. Basal leaves rosulate, obovate to oblanceolate, $15\ 34 \times 2-4$ cm, attenuate into a petiolelike basal portion, undivided to usually runcinately pinnatipartite, sparsely covered with long multicellular hairs, base attenuate, margin dentate; lateral lobes 3-6 pairs, triangular; terminal lobe distinctly larger than lateral ones, apex rounded to acute. Stem leaves similar to basal leaves but smaller and less divided, gradually reduced toward stem apex, base clasping, apex acute. Synflorescence of main axis and larger branches spiciformpaniculiform. Capitula axillary and terminal, solitary or in clusters of a few, sessile or on a several cm long, thick, and apically slightly inflated peduncle, with usually 15-20 florets. Involucre cylindric, 0.9-1.4 cm. Phyllaries abaxially sparsely with glandular or simple hairs, apex $\pm$ acute; outer phyllaries lanceolate, longest $> 1/2$ as long as to approaching inner ones in length, spreading-erect, margin ciliate; inner phyllaries linearlanceolate. Florets blue or exceptionally pink or bluish white. Achene brown, subcylindric to obovoid, 2-3 mm, stout, rugulose, apex truncate. Pappus 0.2-0.3 mm.

Macroscopic Description: The root is about 8-10 cm long tapering fleshy somewhat branched and at the top about 1cm wide. Both externally and internally it is white in colour when fresh and densely covered by rootlets. The bark is rather thin, radially striate from the bark covered with vessels and separated by a brown cambium line from the finely porous wood. The root tastes sweetish and mucilaginous initially and then very bitter.

Microscopic Description: The mature root in cross section reveals a typical dicotyledonous structure and also secondary growth. The lateral root shows a simple structure with a central core of a tri or pent arch xylem and the phloem lying between two xylem arms. The vascular tissues are

limited by a double end. It is followed by a cortical zone, which is externally lined by a single layered epidermis. In older roots the radiating secondary xylem occupied about 2/3rd of the total thickness which mainly consists of xylem vessels (either scattered or in group of 2 or 3) and rest of the area is occupied by xylem fibres. Few tracheids are also found. A narrow band of secondary phloem shows distinct groups of sieve tubes, few fibres and parenchymatous medullary rays traverse radially from xylem to phloem. The mature roots are elongated cork cells which develop superficially and laticiferous vessels are also found in the region of secondary phloem.

Fruits powder shows polygonal epicarp cells in surface and oblique views; pitted as well as normal parenchyma; parenchyma containing oil globules; cells of cotyledons containing aleurone grains; bundle of fibre and pitted vessels (Plate 3); odor and taste nil.

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dryness)
Virya (Potency)	: Sita (Cooling)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Pacifies Pitta, and Kapha

Part Used: Leaf, Root, Seed



Figure 23. *Cichorium intybus* Linn.

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 28.88% w/w
Acid insoluble ash	: Not more than 2.7% w/w
Alcohol soluble extractive	: Not less than 5.13 % w/w
Water soluble extractive	: Not less than 2.75% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp.</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: Successive chloroform extract showed 6 bands with Rf 0.10, 0.21, 0.32, 0.51, 0.73 and 0.79 (green) under short UV; 7 bands with Rf 0.14, 0.21, 0.28 (blue), 0.32 (red), 0.53 (violet), 0.64 and 0.73 (red) under long UV; 10 spots with Rf 0.07, 0.09 (violet), 0.14 (grey), 0.16, 0.37, 0.54 (purple), 0.61, 0.70, 0.75 and 0.81 (violet) under white light (post derivatization). In case of successive ethanol extract of 6 bands with Rf 0.04, 0.11, 0.22, 0.37, 0.53, 0.85 (green) were found under short UV, 6 spots with Rf 0.11, 0.34 (blue), 0.40 (fluorescent blue), 0.58 (blue), 0.82 and 0.90 (red) were seen under long UV and 9 bands with Rf 0.18 (grey), 0.21, 0.36 (violet), 0.49 (brown), 0.53, 0.66, 0.74, 0.79 and 0.93 (violet) were found under white light (post derivatization).

Major Chemical Constituents: The phytochemical or plant constituents are distributed throughout the whole chicory plant, but the main contents are present in the root. Analysis of fresh roots of chicory gave water 77%, gummy water 7.5%, cellulose, inulin and fibre 9% and ash 7.8%. The bitter substances are lactucin and lactucopicrin esculetin, esculin, cichoriin, umbelliferone, scopoletin and 6,7-dihydroxycoumarin from the racemes. The bitter principle is probably a glucoside of fructose and

catechuic acid. The presence of stearin, mannites and tartaric acids in the juice of the roots has been reported. Betaine and choline are present in small concentrations.

Therapeutic Use: Ajeerna (indigestion), Jvara (fever), Kamla (jaundice), Yakrita Roga (liver disease), Pandu (anaemia), Tamakashvasa (asthma) etc.

Pharmacological Studies: Antiulcerative, hepatoprotective, antibacterial, cardioprotective, antioxidant, anti-malarial, anti-fungal, gastroprotective, antihelminthic, analgesics, tumour protective, anti-allergic and other miscellaneous activities etc.

Contraindication: Pregnant women should avoid consuming chicory as it could up the risk of having a miscarriage by stimulating menstruation.

Adverse Effects: People suffering from gallstones should not consume this plant in excess as it would aggravate the situation.

Precautions: Do not use in a high dose or for longer periods of time.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: 3-5 gm root powder.

Formulations: Chicory Powder, Chicory Tablet

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Keya

Botanical Name: *Pandanus tectorius* Soland.ex Parkinson.

Family: Pandanaceae

Synonyms:

Bangla	: কেয়া (Keya), Katki
Hindi	: Kevada, Kewda, Kewra
Sanskrit	: Sucikapuspa
Urdu/Unani/Tibb	: Karanjwa
English	: Screw pine

Geographical Distribution: The distribution of *Pandanus tectorius* stretches from the coast of South and Southeast Asia eastward through Papua New Guinea and tropical northern Australia, and extends into the Pacific islands of Oceania. In Oceania, *P. tectorius* is an important fruit crop that occurs in Marshall Islands, Kiribati, Papua New Guinea, New Caledonia, Fiji and most of Polynesia.

Plant Descriptions

General Description Growing up to 15 m in height, *Pandanus tectorius* is a stout, branching and multi-stemmed plant. Stems are greyish- or reddish-brown, smooth or flaky, ringed by leaf scars and produce prop roots at the base. Leaves are spirally arranged in three rows, sword-like with spiny margins and midribs, and apices with flagella. In the afternoon, plants have a characteristic drooping appearance with the leaves hanging downwards. The species is dioecious with male and female flowers occurring in separate plants. Male flowers are tiny, pendulous and fragrant with white spathes. Female flowers are single spikes with yellow spathes. Resembling pineapples, fruits are globular and contain tightly bunched, wedge-shaped fleshy keys. They are green when young turning orange-red when ripe. Seeds are obovoid, ellipsoid, or oblong, reddish-brown outside and whitish gelatinous inside. Propagation is by raising branch cuttings.



Figure 24. *Pandanus tectorius* Soland.ex Parkinson.

Macroscopic Description: Root pieces, 2-6 cm long, 0.3-2 cm in diameter, cylindrical, rusty or yellowishbrown, to grey, surface smooth except for protuberances at certain places, papery cork, surface uneven, easily peelable exposing a fibrous surface, fracture, usually unbreakable.

Microscopic Description: Transverse section of mature root shows a wide zone of stratified cork, exfoliating at places, consisting of rectangular, thin-walled, tangentially elongated, radially arranged cells, upper few layers filled with reddish-brown contents, remaining cells colourless, cortex, a wide zone of rounded cells with fibre groups towards central and middle region, cells obliterated at places, endodermis barrel-shaped, slightly thickwalled, pericycle and phloem not distinct, xylem forms bulk of root consisting of vessels, fibres and parenchyma, medullary rays not distinct, vessels show annular or pitted thickening, fibres thick-walled, elongated having a few simple pits.

Powder-Yellowish-brown, under microscope shows fragments of corks, xylem vessels and fibres.

Part Used: Root, flower

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Snigdha (Slimy)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kapha-pitta shamaka

Purity and Safety Test

Foreign matter	: Not more than 2%w/w
Total ash	: Not more than 11%w/w
Acid insoluble ash	: Not more than 2%w/w
Alcohol soluble extractive	: Not less than 9%w/w
Water soluble extractive	: Not less than 16%w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of),

azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: Thin layer chromatography (TLC) analysis using 5:3:1:1 toluene-ethyl acetate-acetone-formic acid solvent of *P. tectorius* extracts identified various compounds. The dominant compounds are terpenoids, revealed by pink and purple bands under white light, chlorophylls as green bands and flavonoids as yellow and orange bands (data not shown). UV detection at 365 nm demonstrated the difference in phytochemical composition of stem bark, leaf and fruit extracts.

Major Chemical Constituents: It contains phytochemicals, namely, lignans and isoflavones, coumestrol, alkaloids, steroids, carbohydrates, phenolic compounds, glycosides, proteins, amino acids as well as vitamins and nutrients.

Therapeutic Usages: Gulma (tumor), Netraroga (eye diseases), Kapharoga (cough).

Pharmacological Studies: Antimicrobial, antidiabetic, antiviral, antineoplastic, antioxidant, antidiuretic, analgesic and neuroprotective.

Contraindications: Known allergy to the plants of the Pandanaceae family.

Adverse Effects: No adverse effects was found in usual.

Precautions: Do not use in a high dose or for longer periods of time. Precaution may be taken during concomitant use of anti-diabetic drugs.

Dosage Forms: Crude drug, capsules, tablets and pills.

Posology: 3-5 gm in the form of powder.

Formulations: Sri Gopal Taila

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Khirui

Botanical Name: *Euphorbia hirta* Linn.

Family: Euphorbiaceae

Synonyms:

Bangla: ক্ষীরুই (Khirui)

Hindi: Dudhi, Badi dudhdi

Sanskrit: Dugadhika, Amampatchairaisi

Urdu/Unani/Tibb:

English: Asthma weed

Geographical Distribution: *Euphorbia hirta* is distributed throughout the hotter parts of India, Australia, Central America and subtropical parts of world. It is found in waste places along the roadsides, field as a weed. It is also found in through the Bangladesh.

Plant Descriptions:

General Description: It is a slender- stemmed, annual hairy plant with many branches from the base to top, spreading upto 40 cm in height, reddish or purplish in color. Leaves are opposite, elliptic -oblong to oblong- lanceolate, acute or subacute, dark green above, pale beneath, 1- 2.5 cm long, blotched with purple in the middle, and toothed at the edge. The fruits are yellow, three-celled, hairy, keeled capsules, 1-2 mm in diameter, containing three brown, four-sided, angular, wrinkled seeds.



Figure 25. *Euphorbia hirta* Linn.

Macroscopic Description:

Root –Six to 9 cm long, 2 to 3 mm in diameter, almost cylindrical with tapering ends, small rootlets, surface smooth, except for small protuberances at certain places.

Stem –Erect, usually branched, terete, branches often compressed, covered with crisp hairs, stem pieces 3 to 5 mm thick in diameter, very thin bark, fracture short.

Leaf –Petiolate, petioles about 3 mm long; occasionally reddish, simple, opposite, superposed, subsessile, 1 to 4 by 0.5 cm. oblong, lanceolate or obovate lanceolate, acute or sub acute, dentate, minutely stipulate, dark green above pale beneath, venation reticulate.

Flower –Inflorescence shortly pedunculate, axillary cymes; bracteate; perianth absent, involucre numerous, less than 1 to 1.5 mm long on single stalked stamen, anthers two celled; pistil trilocarpellary, ovary superior, axile placentation.

Microscopic Description:

Root –Transverse section shows outermost region of cork consisting of 4 or 5 layers of thin walled, brown suberized rectangular parenchymatous cells; cork cambium seen; cortex consists of 6 to 8 layers of tangentially elongated parenchymatous cells without intercellular spaces; some of these cells contain simple starch grains and prismatic calcium oxalate crystals; the vascular cylinder has thin walled polygonal phloem cells, xylem consists of vessels and thick walled parenchyma, traversed by uniseriate medullary rays; pith absent.

Stem –TS shows nearly circular outline, epidermal cells slightly elongated laterally with thick cuticle; multicellular, uniseriate covering trichomes about 30 to 200 in length; cortex consists of 6 to 8 layers of rounded or oval shaped parenchymatous cells, a few cells containing simple, oval shaped starch grains and prismatic calcium oxalate crystals; next to the cortex is a broad vascular cylinder separated by an endodermis and a single layer of pericycle; phloem narrow and xylem has reticulate vessels; pith consists of circular cells with intercellular spaces, prismatic calcium oxalate crystals measuring about 8 to 25 μ are seen in a few cells.

Leaf –

Petiole –TS shows somewhat circular outline; epidermis single layered, externally covered with thick cuticle and have covering trichomes similar to that of stem; stele composed of vascular bundle located in center, xylem composed of vessels with protoxylem facing towards upper surface and phloem on the abaxial side, enclosed within a bundle sheath; ground tissue composed of thin walled parenchymatous cells, a few having prismatic calcium oxalate crystal and starch grains.

Midrib –Strongly projects on the lower side; epidermis single layered with thick cuticle on both surfaces; collenchyma single layered present only on lower surface just adjacent to lower epidermis; stele shows similar structure as described in petiole except bundle sheath is very prominent and shows starch grains in a few cells; prismatic calcium oxalate crystal and starch grains in a few cells of ground tissue.

Lamina –Shows dorsiventral structure; epidermis single layered on either surface, upper epidermis consists of tabular cells, walls slightly wavy in surface view; whereas walls of lower epidermal cells straight; trichomes similar to those of stem; palisade two layered; spongy parenchyma 2 to 4 layered, loosely arranged; vascular bundles embedded in spongy parenchyma; stomata anomocytic present on both surfaces; palisade ratio 5 or 6, stomatal index 27 to 36 on lower surface and 25 to 30 / mm² on upper surface, vein islet number 1 to 2, veinlet termination number 6 to 9.

Powder –Yellowish brown, shows abundant fragments of parenchymatous cells, a few filled with starch grains; vessels with reticulate and spiral thickenings; phloem fibres; crystals of calcium oxalate in the form of prism; abundant covering, multicellular trichomes, and a few parenchymatous cells with brownish contents.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter), Madhura (Sweet)
Guna (Attribute)	: Ruksa (Dry), Guru (Heavy), Tiksna (sharp)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Garbhakaraka, Kaphahara, Mutrala, Slesmanissaraka, Stanya, Vrsya, Vistambhi

Part Used: Whole plant, fresh or dried

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 12% w/w
Acid insoluble ash	: Not more than 7% w/w
Alcohol soluble extractive	: Not less than 3% w/w
Water soluble extractive	: Not less than 10% w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10 ⁴ cfug ⁻¹ , 10 ³ cfug ⁻¹ and 10 ⁴ cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp.</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3 mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> ,

trans and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of the alcoholic extract on silica gel 'G' plate using toluene: ethyl acetate (95:5) under UV 366 nm shows fluorescent zones at Rf. 0.15 (grey), 0.32 (pink) and 0.36 (green). On spraying with vanillin-sulphuric acid reagent and heating the plate for five minutes at 105o four spots appear at Rf. 0.22 (pink), 0.36 (violet), 0.70 (pale violet) and 0.91 (purple).

Major Chemical Constituents: The chemical investigation of *Euphorbia hirta* has led to the isolation of rutin (IV), quercetin (V), euphorbin-A (VI), euphorbin-B (VII), euphorbin-C (VIII), euphorbin-D (IX), 2,4,6 tri-O-galloyl- β -D-glucose, 1,3,4,6-tetra-O-galloyl- β -D-glucose, kaempferol, gallic acid, and protocatechuic acid. It also contains β -amyrin, 24-methylenecycloartenol, β -sitosterol, heptacosane, nonacosane, shikmic acid, tinyatoxin, choline, camphol, and quercitol derivatives containing rhamnose and chtolphenolic acid.

Therapeutic Use: Dadru (taeniasis), Krimi (worm infestation), Kasa (cough), Kustha (leprosy/ diseases of skin), Mutrakricchra (dysuria), Puyameha, Sula (colic), Tamaka swasa (bronchial asthma).

Pharmacological Studies: Anti-inflammatory, antimicrobial, anti-diarrheal, sedative, analgesic, anti-pyretic, anti-oxidant, antiasthmatic, anti-tumor, larvicidal, diuretic etc.

Contraindication: It should be avoided during pregnancy.

Adverse Effects: In high doses it has antifertility effect. It reduces sperm motility and testis sperm suspension significantly and thus leading to infertility.

Dosage Forms: Crude drug, capsules, tablets and pills.

Storage: Storage in a well-closed container, protected from light and moisture.

Posology: Powder 1 to 3 gm and fresh juice 10 to 20 drops.

Formulations: Amasayantak

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Kulekhara

Botanical Name: *Asteracantha longifolia* (L.) Nees.

Family: Acanthaceae

Synonyms:

Bangla	: কুলেখাড়া/ইকসুরা/কোকিলক্ষ (Kulekhara)
Hindi	: Talmakhana
Sanskrit	: Iksura, Iksuraka, Kokilaksi
Urdu/Unani/Tibb	: Talmakhana
English	: Hygrophila

Geographical Distribution: *Asteracantha longifolia* is an herb growing in wet places distributed throughout India, Srilanka, Myanmar, Bangladesh, Malaysia and Nepal.

Plant Descriptions

General Description: The *Asteracantha longifolia* (L.) Nees, Acanthaceae, finds mention in Ayurvedic treatise like ‘Sushruta Samhita’ and ‘Charak Samhita’ as Rasayan or rejuvenator. *A. longifolia* is described in ayurvedic literature as Ikshura, Ikshugandha, and Kokilasha “having eyes like the Kokila or Indian Cuckoo”.

Macroscopic Description:

It is a spiny, stout, annual herb, common in water logged places. Leaves sessile, oblong-lanceolate or linear lanceolate, spines yellowish brown, 2-3 cm long, Flower yellowish brown, fruit two celled, linear oblong, compressed about 8 cm long, pointed, 4-8 seeded. Seed ovate, flat or compressed, 0.2-0.25 cm long and 0.1-0.15 cm wide, hairy but appearing smooth; when soaked in water immediately get coated with mucilage, light brown: taste slightly bitter and odour not distinct.



Figure 26. *Asteracantha longifolia* (L.) Nees.

Microscopic Description:

Root - Root shows a single layered epidermis of thin-walled, rectangular to cubical, parenchymatous cells having unicellular hairs; secondary cortex composed of round to oval or oblong, thin-walled cells having large intercellular spaces; most of these cells divided longitudinally and transversely with walls forming 4-6 or more chambers; size of these cells and intercellular spaces gradually reduce towards the inner region, where these cells are mostly radially elongated, arranged in radial rows, a few thick-walled cells found scattered singly throughout secondary cortex; secondary phloem narrow

consisting of small, thin-walled, polygonal cells; phloem fibres thick-walled, occur in groups of 2-6 or singles, scattered throughout the phloem region; secondary xylem forms continuous ring; vessels angular, broader towards centre, arranged radially having spiral thickenings, surrounded by thick-walled parenchyma and xylem fibres; fibre walls uniformly thickened; multi and uniseriate medullary rays occur from primary xylem region upto secondary cortex; ray cells thin walled, radially elongated in xylem region, circular to transversely elongated in phloem region.

Stem-Shows somewhat sub-quadrangular outline; cork consists of 5-10 rows of rectangular, radially arranged, moderately thick-walled, brownish cells; collenchyma 4-8 layered consisting of isodiametric cells; a few thick-walled, isolated cells found scattered in this zone; cortical cells thin-walled, round, oblong, variable in size, with a number of large air cavities; a special feature of these cells is the formation of tangential and radial walls within the cell dividing it into 4-5 or more parts; most of cells contain numerous acicular crystals of calcium oxalate; endodermis single layered, composed of transversely elongate, thin-walled cells; phloem narrow, consisting of round to polygonal cells, peripheral ones larger, inner cells smaller; fibres thick-walled, single or in groups of 2-3, some cells contain calcium oxalate crystals similar to those found in cortical cells; xylem present in a ring; vessels with spiral thickenings, arranged radially; fibres elongated with wide lumen and pointed tips, medullary rays uni to multi seriate extend upto secondary cortex; ray cells thin-walled, radially elongated in secondary xylem, transversely elongated in secondary phloem; pith large, composed of polygonal, thin-walled parenchymatous cells, having small intercellular spaces; a few cells contain calcium oxalate crystals similar to those found in secondary cortex.

Leaf-

Midrib-Shows concavo-convex outline; epidermis on either surface covered with thick cuticle; collenchyma 2-5 layered; stele composed of small strands of xylem and phloem having some groups of fibre; rest of tissues composed of thin-walled, parenchymatous cells, a few of them containing acicular crystals of calcium oxalate ; cystolith present beneath upper and above the lower epidermal cells.

Lamina-Shows epidermis single layered on either surface, composed of thin-walled, parenchymatous, tangentially elongated cells, covered with thick cuticle; stomata diacytic, 1-5 celled hairs present on both surfaces; palisade 1-2 layered; spongy parenchyma composed of 3-5

layered, loosely arranged cells traversed by a number of veins; palisade ratio 6.25-15.75; stomatal index 17.24-30.78; vein islet number 17-42.

Fruit - Shows single layered epidermis covered with striated cuticle followed by 5-10 layered, thick-walled, and oval to hexagonal, lignified, sclerenchymatous cells.

Seed - Shows hairy testa composed of thin-walled, tangentially elongated cells covered with pigmented cuticle; embryo composed of oval to polygonal, thin-walled, parenchymatous cells containing oil globules.

Powder - Light brown; shows aseptate, elongated fibres; vessels with simple pits and spiral thickening; palisade, acicular crystals of calcium oxalate, unicellular hairs and globules.

Part Used: The whole plant, roots, seeds, and ashes of the plant are extensively used

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Amla (Sour), Tikta (Bitter)
Guna (Attribute)	: Picchil (Slimy), Snigdha (Smooth)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Balya, Mutrala, Rucya, Vajikara, Vrsya, Santarpana

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 9 %w/w
Acid insoluble ash	: Not more than 1%w/w
Alcohol soluble extractive	: Not less than 4 %w/w
Water soluble extractive	: Not less than 20 %w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E. coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S. aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more

than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: The TLC separation was performed on silica gel 60 F₂₅₄ HPTLC plate using Toluene: Ethyl Acetate: Formic acid (15:3:0.1 v/v/v) as mobile phase. Plates were derivatized with Anisaldehyde-Sulphuric acid reagent. Densitometric Analysis was performed at 520 nm. Compact bands for β -sitosterol and Lupeol were obtained at R_f ~0.54 and 0.64 respectively. The method was linear over concentration range 150-350 ng/spot and 300-700 ng/spot with correlation coefficient 0.9989 and 0.9991 for β -sitosterol and Lupeol, respectively.

Major Chemical Constituents: The herb has been reported to contain chemical constituents such as β -sitosterol, Lupeol, linoleic acid and oleic acid as main constituents along with other fatty acids, polysaccharides, histidine and phenyl alanine. Lupeol and β -sitosterol both have been reported to have antipyretic, hepatoprotective, antioxidant, anticancer and macrofilaricidal activities.

Therapeutic Usages: Vatavyadhi (rheumatism), Kamla (jaundice), Mutrakrichha (urinary infections), Vatarakta (gout). Premeha (diabetes), Athisara (dysentery) etc.

Pharmacological Studies: The plant is known to possess antitumor, hypoglycemic, antipyretic, and Anti-nociceptive, aphrodisiac, antibacterial, free radical scavenging and lipid peroxidation, hepatoprotective and haematopoietic activity.

Contraindications: Known allergy to the plants of the Acanthaceae family.

Adverse Effects: There are no known side effects with this herb. The acute and chronic toxicity profiles were studied with methanolic extract (MHA) of seeds of *Hygrophila auriculata* in rats. In acute toxicity studies MHA did not produce any toxic manifestations up to the dose of 2000 mg/kg/p.o body weight.

Precautions: Avoid Kokilaksha or use only under medical supervision during pregnancy and breastfeeding.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: 3-6 gm of the drug in powder form.

Formulations: Sanjiban Modak, Grani Ballav, Manmathavra Ras

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Kuksima

Botanical Name: *Blumea lacera* (Burm.f.) DC.

Family: Asteraceae

Synonyms:

Bangla	: কুকসিমা (Kuksima)
Hindi	: Jangli Muli
Sanskrit	: Kukkuradru, Kukundara
Urdu/Unani/Tibb	: Kakarondaa
English	: Lettuce-Leaf Blumea, Blumea

Geographical Distribution: *Blumea lacera* is well-known Bangladeshi medicinal plants belong to the family Asteraceae. *Blumea lacera* is familiar as Kukursunga in different area of Bangladesh. It is also commonly found in India, Australia, China, Malaya and tropical Africa.

Plant Descriptions

General Description: Kuksima is an erect herb which grows as a weed in uncultivated lands all over Bangladesh. *Blumea lacera* is a member of Asteraceae, which is a very large and widespread family of flowering plants. The family has 32,913 accepted species names in 1911 genera, 13 subfamilies. In an Indian system of traditional medicines, i.e., Ayurveda and *B. lacera* DC. is used as bitter, astringent, acrid, thermogenic, ophthalmic, digestive and anthelmintic.



Figure 27. *Blumea lacera* (Burm.f.) DC.

Macroscopic Description: This is an annual herb. Stems: Glandular or hairy, simple or branched, erect and about 30–60 cm in height. Leaves: Oblanceolate to obovate, at the margins (rarely) lobulated or toothed, 2–6 cm in width, 5–12 cm in length and smaller at the top. Flowers: Flowering heads are borne on axillary cymes, flowers are about 8mm across and bright yellow in color, they are collected in terminal and spike-like panicles. Involucre bracts hairy and narrow. Achenes not ribbed, glabrous and quadrangled.

Microscopic Description: Microscopical evaluation basically targeted on diagnostic characters. In *Blumea lacera* characteristic arrangement of xylem in radial row in the stem, presence of uniseriate, multicellular covering trichomes and biseriate multicellular club shaped glandular trichomes which turn pinkish when stained with phloroglucinol+ HCl. Oil glands and ring of stone cells present in the stem of both plants. Thin section of root of both plants showing blue color when treated with weak iodine solution. Stomata are very common in epidermis of leaf in both species and it is diacytic type. Other diagnostic characters which are analyzed are resinous cells in root, spindle shaped fibres in root, pericycle made up of 1-2 layer of parenchyma in the stem.

Part Used: Whole plant, Leaves and root

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kashaya (Astringent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Teekna (Pungent)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphapitta samaka

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 8.4 %w/w
Acid insoluble ash	: Not more than 1.1%w/w
Alcohol soluble extractive	: Not less than 13.2 %w/w
Water soluble extractive	: Not less than 9.1 %w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.

Pesticides residues : According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifosmethyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Major Chemical Constituents: Phytochemical studies of the plant have reported the isolation of a total of 17 compounds belonging to natural product classes such as flavonoids, terpene glycosides, phenol glycosides, essential oils, coniferyl alcohol derivatives and terpenoid ketones. The leaves on steam distillation yield 0.5% essential oil from which camphor is isolated. The oil contains cineol 66, d-fenchone 10 and citral about 6%. Campesterol has been isolated from aerial parts and 5-hydroxy-3, 6, 7; 3', 4'- pentamethoxy flavone, 5, 3', 4' trihydroxy flavone and an unidentified flavone have been isolated from leaves.

Therapeutic Usages: Fever, urinary retention, headache, wounds, abdominal disorders, worm infestation, jaundice, hemorrhoids, cough, bronchitis, leucorrhea, pain, burning sensation and diarrhea.

Pharmacological Studies: Analgesic, hypothermic, anti-leukemic, antiviral, cytotoxic activities against breast cancer cells, antidiarrheal, antimicrobial, anxiolytic, anti-atherothrombosis activities.

Contraindications: Known allergy to the plants of the Asteraceae family.

Adverse Effects: There are no known side effects with this herb. Acute toxicological study result presented the LD₅₀ value is more than 2000 mg/kg body weight (LD₅₀ > 2000mg/kg body weight.) Therefore ED₅₀ or dose for pharmacological activity can be easily calculated.

Precautions: Avoid Kuksima or use only under medical supervision during pregnancy and breastfeeding.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Decoction 10 ml and 3 -6 g. of the drug in powder form.

Formulations: Blumea Powder, Blumea Tablet

References:

1. Uddin AR, Tiralongo SJ, Darren JGI, Evelin T. A New Cytotoxic Steroidal Glycoalkaloid from the Methanol Extract of *Blumea lacera* Leaves. *J Pharm Pharm Sci.*; 2015;18(4):616 – 633.
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3. Khair A, Ibrahim M, Ahsan Q, Homa Z, Kuddus MR, Rashid RB, Rashid MA. Pharmacological Activities of *Blumea lacera* (Burm. f) DC: A Medicinal Plant of Bangladesh. *British Journal of Pharmaceutical Research.* 2014; 4(13):1677-1687.
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5. Khatri S, Phougat N, Chaudhary R, Singh B, Chhillar AK. Chemical composition, antioxidant, antibacterial and cytotoxicity analysis of *Blumea lacera* (Burm. f.) DC. *Int J Pharm Pharm Sci* 2016;8(8):313-319.

Kukurchithe

Botanical Name: *Litsea glutinosa* (Lour.) C. B. Rob.

Family: Lauraceae

Synonyms:

Bangla	: কুকুরচিঁতা (Kukurchita)
Hindi	: Maida lakadi
Sanskrit	: Gandhaparna
Urdu/Unani/Tibb	: Maida Lakdi
English	: Common tallow laurifolia/ Indian laurel

Geographical Distribution: It is native to India, South China to Malaysia, Philippines, Australia and the western Pacific islands. It has been observed throughout Asia, including several regions of China, India, Bhutan, Myanmar, Nepal, Thailand and Vietnam. It was once abundant in Bangladesh but it is now very rare and vulnerable to extinction due to unsustainable collection of bark for commercial purpose.

Plant Descriptions:

General Description: *Litsea glutinosa* is a rainforest tree in the laurel family, Lauraceae. It is well known as Kukurchita in Bangladesh and Village children frequently use these fruits as the bullet of toy gun. The whole tree is filled with wild smell. The tree grows here and there in Bangladesh. Flowering occurs between March and June and fruits appear in September-October.



Figure 28. *Litsea glutinosa* (Lour.) C. B. Rob.

Macroscopic Description: *Litsea glutinosa* is an evergreen, or deciduous, tree that reaches a height of 3-15 m. It is a polymorphic species with leaves that are alternate and elliptical to oblong-elliptical, 3.5-10 × 1.5-11 cm, velvety (particularly when young) or glabrous. Umbels contain many small yellowish flowers, the males having 8-20 stamens. Fruits are round and about 8 mm or less in diameter. The tree is able to reproduce vegetatively, accounting for over half of the stems produced, mostly from root-suckers. Leaves are slightly hairy, ovate, dark green in color. If crushed sticky leaves emit a kind of aroma. Small yellowish flowers bloom in clusters on the axil of leaves. Flower has many stamens; it looks like the earring of women.

Part Used: Bark

Organoleptic Properties:

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter), Kashaya (Astringent)
Guna (Attribute)	: Laghu (Light), Snigdha (Slimy)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Vata samaka

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 9 %w/w
Acid insoluble ash	: Not more than 1%w/w
Alcohol soluble extractive	: Not less than 4 %w/w
Water soluble extractive	: Not less than 20 %w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more

than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Major Chemical Constituents: Phytochemical profiling of the bark of *L. glutinosa* showed the presence of a number of secondary metabolites including steroids and terpenoids, alkaloids, lactones, sesquiterpenes, flavonoids, lignans, and essential oils and significant bioactivities.

Therapeutic Usages: Diarrhoea, dysentery, influenza, stomach aches, diarrhea, diabetes, vomiting, bone pain.

Pharmacological Studies: Anticancer, anti-inflammatory, antimicrobial, antioxidant, antidiabetic, anti-HIV, insecticidal, analgesic activity and antibacterial activity etc.

Contraindications: Known allergy to the plants of the Lauraceae family.

Adverse Effects: There is no known side effect with this herb.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: 1-3 gm of the drug in powder form.

Formulations: Ashti sandanak lepa

References:

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Makal

Botanical Name: *Citrullus colocynthis* (L.) Schrader

Family: Cucurbitaceae

Synonyms:

Bangla	: মাকাল (Makhal)
Hindi	: Indrayana
Sanskrit	: Satakratulata, Indravalli
Urdu/Unani/Tibb	: Hanzal, Indrayan
English	: Colocynth, Bitter Apple

Geographical Distribution: *Citrullus colocynthis* (Linn.) Schrad, commonly known as Colocynth, a member of Cucurbitaceae is native to Mediterranean region and Asia. Geographically it is distributed in deserts of North Africa, South Europe and whole of Asia, extended up to Egypt. In India, this drought tolerant plant species is usually dispersed among all hot arid areas. It is the most commonly utilized plant in Indian traditional medicinal framework and easily propagated by vegetative and generative modes of reproduction in summers.

Plant Descriptions:

General Description: *Citrullus colocynthis* is from the Cucurbitaceae family. Its family has a wide genetic diversity. It grows well in desert regions, especially in alkaline soils, and shows high resistance to water stress and salinity. Similar to watermelon, *Citrullus colocynthis* is a perennial plant with leafy and stiff-haired stems.

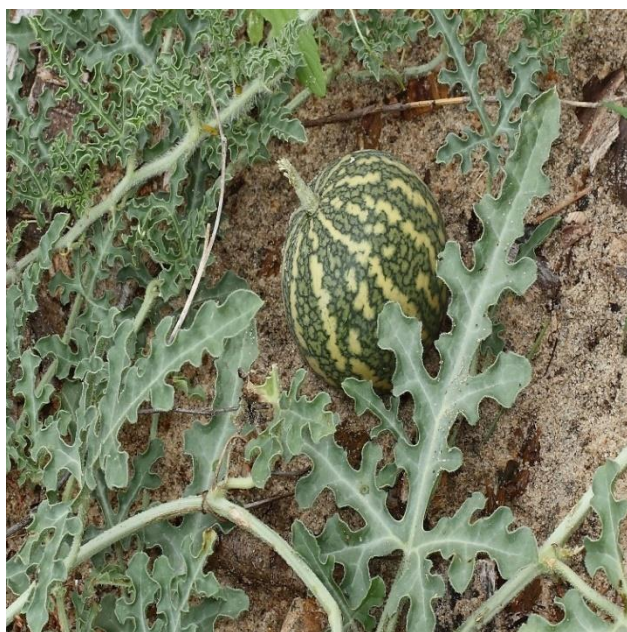


Figure 29. *Citrullus colocynthis* (Linn.) Schrader

Macroscopic Description: Leaves very variable, 3.6-6.3 cm long, 2.5-5.0 cm wide, pinnately lobed in outline, generally 3 lobed, sometimes 3-7 lobed, middle lobe largest, each lobe deeply pinnatifid; petiole 1.3-2.5 cm long, entire leaf densely hirsute; taste, very bitter.

Microscopic Description: Leaf- Petiole - shows ridged outline; epidermis single layered consisting of oval to rounded cells, covered with thick cuticle; hairs uniseriate, 2-4 celled, present on both surfaces; cortex consisting of 3-7 layers, round collenchymatous cells, followed by a single layered endodermis; pith consisting of thin-walled, isodiametric, parenchymatous cells; vascular bundles generally eight, arranged in discontinuous ring, bicollateral, each bundle surrounded by semilunar patches of sclerenchymatous cells towards endodermis.

Midrib - shows single layered epidermis, covered with cuticle on both surface; hair present on both surfaces, uniseriate, consisting of 2-3 cells, apical cells being pointed or blunt; cortex consisting of 2-3 layers of collenchymatous cells on dorsal side, followed by thin-walled, parenchymatous cells; vascular bundles present, two well developed, one smaller and other larger, conjoint, bicollateral, composed of xylem and phloem.

Lamina -shows single layered epidermis covered with cuticle, hairs similar to those of midrib and present on both surfaces, but more abundant on lower surface; palisade single layered, spongy parenchyma generally 5-8 layered, composed of thin walled, almost isodiametric cells, filled with chlorophyll contents and traversed by a number of veins, vein islet number 29-38 per sq. mm; palisade ratio 2.75-3.75; stomata anomocytic present on both surfaces, stomatal index on upper surface 12.5-28.5 and on lower surface 25.0 -31.2.

Powder - Course, olive green; shows entire or broken pieces of hairs; epidermal cells polygonal, moderately thick-walled, 27.5-49.5 μ long and 19-27 μ wide; spongy parenchyma cells, anomocytic type of stomata and xylem vessels. blunt; cortex consisting of 2-3 layers of collenchymatous cells on dorsal side, followed by thin-walled, parenchymatous cells; vascular bundles present, two well developed, one smaller and other larger, conjoint, bicollateral, composed of xylem and phloem.

Lamina -shows single layered epidermis covered with cuticle, hairs similar to those of midrib and present on both surfaces, but more abundant on lower surface; palisade single layered, spongy parenchyma generally 5-8 layered, composed of thin walled, almost isodiametric cells, filled with chlorophyll contents and traversed by a number of veins, vein islet number 29-38 per sq. mm; palisade ratio 2.75-3.75; stomata anomocytic present on both surfaces, stomatal index on upper surface 12.5-28.5 and on lower surface 25.0 -31.2.

Powder - Course, olive green; shows entire or broken pieces of hairs; epidermal cells polygonal, moderately thick-walled, 27.5-49.5 μ long and 19-27 μ wide; spongy parenchyma cells, anomocytic type of stomata and xylem vessels.

Part Used: The root, leaf, pulp and seed are used.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu, Sara
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphahara, Pittahara, Recana

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 18 %w/w
Acid insoluble ash	: Not more than 6%w/w
Alcohol soluble extractive	: Not less than 7 %w/w
Water soluble extractive	: Not less than 18 %w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Thin Layer Chromatography: TLC of alcoholic extract of the drug on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) five fluorescent zones at Rf. 0.46, 0.61, 0.75, 0.94 (all green) and 0.97 (red). On spraying with 5% Methanolic- Sulphuric acid reagent and on heating the plate for ten minutes at 105°C four spots appear at Rf. 0.61 (green), 0.75 (green), 0.83 (grey) and 0.94 (grey).

Major Chemical Constituents: *Citrullus colocynthis* are mostly contain glycosides, which can produce dihydroelatericin B (cucurbitacin L), elatericin B (cucurbitacin I) and elaterin (cucurbitacin E) through enzymatic hydrolysis. In addition, these compounds encompass Caffeic acid derivatives, chlorogenic acid and cucurbitacin E-, J-, L-glucosides. Another compound extracted from *Citrullus colocynthis* is quercetin. Also, the presence of phenolic acids, flavonoids, fatty acids, tocopherols, and alkaloids in the *Citrullus colocynthis* was identified.

Therapeutic Usages: Ascites, ulcers, urinary discharges, joint pain, asthma, throat diseases, constipation, tuberculosis glands of the neck, bronchitis, anemia, tumors, enlargement of spleen, elephantiasis, jaundice and dyspepsia.

Pharmacological Studies: Antioxidant, antidiabetic, antimicrobial, anticancer, anti-inflammatory, analgesic, gastrointestinal, reproductive, hypolipidemic and anti-obesity effect.

Contraindications: The plant is relative safe in external use. Internally it is poisonous and need to purify before oral use. It is contraindicated in Diabetes, Kidney disease, diarrhea and prior to surgery.

Adverse Effects: The drug is severely poisonous. It has a strongly irritating (and painful) effect on mucous membranes due to its cucurbitacin glycoside content. Overdoses usually associated with vomiting, bloody diarrhea, colic, and kidney irritation, follow the intake of toxic dosages (0.6 to 1 g), and then increased diuresis which progressed to anuria. Lethal dosages (starting at 2 gm) lead to convulsions, paralysis and, if untreated, to death through circulatory collapse. The treatment for poisonings should proceed symptomatically following gastric lavage.

Precautions: It could be concluded that the extract of fruit pulp of *Citrullus colocynthis* may cause teratogenic effects if given during the early stage of pregnancy.

Dosage Forms: For external use only

Formulations: Naranyan Churna, Manjisthasav, Kiratadi Taila

References:

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Mashani

Botanical Name: *Teramnus labialis* (L. f.) Spreng

Family: Fabaceae

Synonyms:

Bangla	: মাষানি (Mashani)
Hindi	: Mashvan, Banvdad
Sanskrit	: Mahasaha, Suryasani, Kamboj
English	: Vogel-Tephrosia

Geographical Distribution: The plant is sometimes gathered from the wild for local use as a medicine and source of edible seeds. It has been trialled as a pasture and agroforestry crop, but is only grown commercially in Cuba. Widely spread in the tropics, found though moister Africa, Asia from India through to New Guinea and west Pacific; Caribbean, C, America. It is the rare plant in Bangladesh.

Plant Descriptions

General Description: *Teramnus labialis* is a herb, commonly known as *mashaparni* (Sanskrit) and a well-known medicinal plant in the Ayurvedic system of medicine. *Teramnus labialis* is an extremely variable, prostrate or trailing, evergreen herbaceous plant, sometimes becoming woody at the base. It grows best in areas where annual daytime temperatures are within the range 17 - 27°C, but can tolerate 10 - 36°C. It has been reported to be useful in treating rheumatism, tuberculosis, nerve disorders, paralysis and catarrhs.



Figure 30. *Teramnus labialis* (L. f.) Spreng

Macroscopic Description:

Root - Tap root with lateral roots occurs in cylindrical, branched pieces, 3-5 cm long, and upto 1cm in diameter, light brown to dark brown, with longitudinal and transverse cracks; lateral roots thin, smooth, and moderately woody; fracture, laminated and short.

Stem - Cut pieces 5-8 cm long, upto 0.8 cm in dia, somewhat twisted and branched, or cylindrical, slender, rough due to cracks and longitudinal ridges and furrows, brownishgrey; fracture, short and fibrous.

Leaf - Trifoliate, leaflet ovate-oblong, 6-12 cm long, base round or acute, light brownish-yellow.

Flower - Lax axillary racemes, 5-15 cm long, flowers red, pink, purple or white, slender, more or less hairy rachis.

Fruit - Pod upto 5 cm long, straight or sometimes slightly recurved, brownish-black to dark brown, having 6-8 or 12 seeds.

Seed - Oblong, cylindrical, slightly rounded at the ends; 2-3 mm long upto 2 mm in diameter; dark brown.

Microscopic Description:

Root - Poorly developed cork, 4-10 layered, consisting of tangentially elongated cells with brown walls, exfoliating strips of crushed cork cells occasionally present; secondary cortex consisting of 3-8 rows of tangentially elongated, thin-walled cells; secondary phloem appearing dome-shaped, composed of sieve tubes, companion cells, parenchyma, fibres, and crystal fibres, the whole being traversed by phloem rays that funnel out beyond phloem; phloem parenchyma thin-walled, polygonal; phloem fibres numerous, lignified, thick-walled, septate, occur mostly in groups, among phloem parenchyma; crystal fibres present containing a prismatic crystal of calcium oxalate; cambium not distinct; secondary xylem consisting of vessels, fibres and crystal fibres all traversed by xylem rays; vessels solitary or in groups of 2-3 with pitted thickenings; tracheids present, fibres septate with thick-walls and pointed; xylem parenchyma nonlignified, thick-walled elongated cells; crystal fibres, elongated, thick-walled, divided by transverse partitions into chambers, each chamber containing a prismatic crystal of calcium oxalate; xylem rays, 1 to 6 cells wide, thin-walled radially elongated; prismatic crystals of calcium oxalate, and starch grains present in secondary cortex, phloem fibres, phloem parenchyma and medullary rays; starch grains, numerous, mostly simple, rarely compound, oval to rounded with central hilum measuring 3-14 μ in diameter

Stem-Shows 6-11 layers, thin-walled, rectangular, exfoliated cork cells; secondary cortex consisting of thin-walled, oval to rectangular, parenchymatous cells having numerous groups of cortical fibres, arranged in radial rows; pericycle composed of isolated strands of fibres, occasionally with stone cells between them; secondary phloem composed of usual elements along with secretory cells; secondary xylem composed of usual elements; xylem fibres long, lignified;

vessels simple pitted; ray 1 or 2 cells wide, pith composed of oval to polygonal, thin-walled, parenchymatous cells containing secretory cells.

Leaf

Midrib - single layered epidermis covered by thick cuticle, and having a few unicellular hairs on both surfaces; this is followed by 4 or 5 layered, thick-walled polygonal, collenchymatous cells on both lower and upper surfaces; 2 or 3 layers of oval to polygonal, thin-walled parenchymatous cells present on both surfaces; 'U' shaped vascular bundles having usual elements.

Lamina - single layered epidermis covered by thick striated cuticle and having a few unicellular hairs on both surfaces; single layered palisade cell; 1 or 2 layers of thinwalled, polygonal parenchymatous cells containing chlorophyll on lower surface, a few small vascular bundles having usual elements scattered in central regions; stomata paracytic on both surfaces; stomatal index 28-34 on lower surfaces and 18-24 on upper surfaces; palisade ratio not more than 5; vein-islet number 6-8; veinlet termination number not more than 4.

Fruit - Single layered, thick-walled, radially elongated, epidermal cells, followed by one row of thick-walled, rounded to rectangular, stone cells of various sizes having narrow, lumen and centric striations, 3 or 4 layers of thin-walled radially elongated, parenchymatous cells and several layers of thick-walled, lignified sclerenchymatous cells of mesocarp.

Seed-Testa containing thick-walled, tangentially elongated, lignified, sclerenchymatous cells, followed by 2 layers of thin-walled, palisade-like cells, palisade internally supported by a single layered bearer cells; cotyledons consist of oval to polygonal, thin walled parenchymatous cells.

Powder-Light yellowish-cream; shows fragments of cork, parenchyma, tracheids, unicellular hairs, thick-walled, elongated, polygonal cells of testa, simple pitted vessel, septate, thick-walled and pointed fibres; prismatic crystals of calcium oxalate, simple, oval to rounded starch grains measuring 3 -14 μ in diameter

Powder-Light yellowish-cream; shows fragments of cork, parenchyma, tracheids, unicellular hairs, thick-walled, elongated, polygonal cells of testa, simple pitted vessel, septate, thick-walled and pointed fibres; prismatic crystals of calcium oxalate, simple, oval to rounded starch grains measuring 3 -14 μ in diameter

Part Used: The roots, seeds, leaves and ashes of the plant are extensively used

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	:Balya, Grahi, Vrsya, Vatapittasamaka, Kaphavardhaka, Sukrala

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 7 %w/w
Acid insoluble ash	: Not more than 0.5%w/w
Alcohol soluble extractive	: Not less than 3 %w/w
Water soluble extractive	: Not less than 7 %w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9 : 1) shows under UV (366 nm) seven fluorescent zones at Rf. 0.05, 0.10, 0.15 (all blue), 0.26 (light blue), 0.49, 0.74 (both blue) and 0.85 (light blue). On exposure to Iodine vapour four spots appear at Rf. 0.05, 0.10, 0.33 and 0.69 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110° C four spots appear at Rf. 0.05, 0.10, 0.33 (all violet) and 0.96 (dark violet).

Major Chemical Constituents: Phytochemical investigation on the seeds of *T. labialis* yielded a water-soluble gallactomannan. The major bioactive phytoconstituents are fraxidin and gallactomannan. The essential amino acids lysine, leucine, isoleucine, arginine, valine and histidine are present in relatively large quantities and concentrations of minerals such as potassium, magnesium, calcium, and, phosphorus is also high.

Therapeutic Usages: Atisara, Pravahika, Vatapitta Jvara, Sukralpita, Raktapitta, Raktavikara, Daha and Sotha.

Pharmacological Studies: Antioxidant, antiinflammatory, antihyperglycemic, hypolipidemic activity.

Contraindications: Known allergy to the plants of the Fabaceae family. It may be shown contraindication in patients who are taking domperidone, bromocriptin or hormonal products.

Adverse Effects: There are no known side effects with this herb. No mortality and the sign of toxicity were observed at the dose of 2000 mg/kg in case of albino rats. Weight may be gained with long term use.

Precautions: Avoid Mashani or use only under medical supervision during pregnancy. It is highly indicated in breastfeeding.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: 5-10 g. of the drug in powder form.

Formulations: Chyawanprash, Asoka Ghrta, Maddam Narayana Taila, Brhat Mahamas Taila.

References:

1. Anonymous, Masaparni (Whole Plant). The Ayurvedic Pharmacopoeia of India, Part- I, Volume III, page 118
2. Sridhar C, Krishnaraju AV, Subbaraju GV. Anti-inflammatory constituents of *teramnus labialis*. Indian J Pharm Sci, 2006; 68 (1):111-114
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Muganee

Botanical Name: *Phaseolus trilobus* Linn.

Family: Fabaceae

Synonyms:

Bangla	: মুগানি (Muganee)
Hindi	: Janglee Mung
Sanskrit	: Suryaparni, Saha
Urdu/Unani/Tibb	: Jangli-math, Mukni, Mugwan
English	: Three-lobed Kidney Bean, Wild Kidney Bean.

Geographical Distribution: *Phaseolus trilobus* is native to Asia found in Bhutan, India, Indonesia, Bangladesh, Myanmar, Pakistan, Sri Lanka, Taiwan and Vietnam. It is naturalized in Africa, Australia, Madagascar, Mauritius and South America. It is found throughout India, in forests at low altitudes and in open rich soil and on Himalayas up to 7000 ft.

Plant Descriptions:

General Description: *Phaseolus trilobus* is a genus of annual or perennial herbs or twiners popularly called as African gram or jungle mat bean belongs to family Fabaceae, is a medicinal plant widely used in Indian traditional system of medicine for curing jaundice, diarrhoea, haemorrhoids, dyspepsia found throughout the tropics and warm temperate regions of the world. There are five species occur in India, three of them are cultivated throughout the world mainly for their edible pods. The plant occurs in grassland, on road verges, irrigated land, drain edges and banks of irrigation channels.



Figure 31. *Phaseolus trilobus* Linn.

Macroscopic Description:

Root - Occurs in 2.5 to 15.0 cm long, 0.1 or 0.2 cm thick; cylindrical pieces, external surface brownish-grey, rough due to secondary roots; fracture, fibrous.

Stem - Occurs in 12.0 to 55.0 cm long, 0.1 or 0.2 cm thick pieces, more or less cylindrical, grooved, slender, glabrous, pale green; fracture, fibrous

Leaf - Leaves alternate, pinnately trifoliate, petioled; leaflets palmately 3-lobed; 1.3 to 2.5 cm long; mid lobe large, obovate spathulate, lateral lobe oblique and small, margin ciliate, apiculate, pale green in colour.

Flower - Sessile or very shortly pedicelled; small, yellow with conspicuous persistent bracts and bracteole; calyx, gamosepalous, campanulate, 1 or 2 mm long, pale yellow, five toothed; corolla papilionaceous.

Fruit - A pod; 2.5 to 6 or 7 cm long, 3 mm thick; greyish-black; linear or rarely oblong, torose, subcylindrical, smooth glabrous, recurved or reflexed, 6 to 12 seeded.

Seed - Grey, smooth, with 2 punctate, shortly linear hilum and without strophiole.

Microscopic Description:

Root-Shows a wavy outline, having single layered epidermis, consisting of thick walled, parenchymatous cells, covered by thick cuticle; secondary cortex composed of 3 to 6 layered, thin-walled, oval to polygonal, parenchymatous cells; pericycle fibres are present in a discontinuous ring; vascular bundles arranged in a ring; secondary phloem composed of thin-walled cells with brownish contents; secondary xylem consisting of usual elements; radially arranged, lignified, vessels with pitted or reticulate thickening, followed by pith consisting of thin-walled, oval to polygonal, parenchymatous cells.

Stem - Shows a more or less wavy outline; epidermis single layered consisting of thin walled, parenchymatous cells; secondary cortex consisting of 2 to 5 layers collenchymatous and 1 or 2 layers of parenchymatous thin walled cells; pericycle present in form of a discontinuous ring; vascular bundles arranged in a ring; secondary phloem consisting of compactly arranged, thick-walled cells, having usual elements traversed by phloem rays; secondary xylem composed of usual elements; lignified vessels radially arranged, showing pitted and spiral thickenings; crystal fibres absent; xylem fibres moderately thick walled with narrow lumen and blunt tips, central region occupied by pith consisting of thin-walled, circular, parenchymatous cells.

Leaf-

Midrib - shows single layered epidermis having a few unicellular, pointed hairs on both surfaces, 6 or 7 layers, polygonal collenchyma cells on upper and 5 or 6 layers, thick walled, collenchyma on lower surface; a single layered thick-walled, lignified polygonal, sclerenchymatous cells present on either side of 'C' shaped vascular bundle having usual elements.

Lamina - isobilateral, shows single layered, elongated, balloon-shaped, thin-walled, epidermis cells on both surfaces, a few unicellular hairs similar as in midrib present on both surfaces; stomata

paracytic, present on both surfaces; palisade 2 or 3 layered on upper epidermis, 1 or 2 layered on lower epidermis; palisade ratio 6 or 7 on lower surface, 7 or 8 on upper surface; vein islet number 34 to 45; veinlet termination number 20 to 33; stomatal index, 30 to 36 per sq. mm on lower surfaces, 20 to 27 per sq. mm on upper surface.

Seed - Shows testa consisting of 2 or 3 layered, thick-walled, elongated, lignified stone cells having striations and narrow lumen; cotyledon composed of oval to polygonal, thin walled, parenchymatous cells.

Powder - Light greyish-green; shows fragments of parenchyma, unicellular pointed broken hairs; lignified, simple pitted, reticulate or spiral vessels; paracytic stomata, epidermal cells in surface view with wavy outline.

Part Used: Whole plant and Fruits.

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Pittahara, Sukrala, Caksusya, Kaphahara, Rasayana, Visaghna, Sukrad, Osahara, Garbhasthapan

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 11.5 %w/w
Acid insoluble ash	: Not more than 1.5 %w/w
Alcohol soluble extractive	: Not less than 3 %w/w
Water soluble extractive	: Not less than 11%w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonellaspp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of cis,

trans and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of alcoholic extract on Silica Gel 'G' using n-Butanol: Acetic acid: Water (4:1:5) shows under UV (366 nm) five fluorescent zones at Rf. 0.35, 0.42, 0.58, 0.70 and 0.82 (all blue). On exposure to Iodine vapour six spots appear at Rf. 0.30, 0.42, 0.50, 0.58, 0.70 and 0.82 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and on heating the plate for ten minutes at 105° C five spots appear at Rf. 0.30, 0.42, 0.58, 0.70 and 0.82 (all yellow).

Major Chemical Constituents: Different secondary metabolites have been reported from various parts of *Phaseolus trilobus* as dalbergioidin, fats, fixed oil, flavonoids, glycosides, isovitexin, kaempferol, kievitone, phaseollidin, quercitin, saponins, sterols, tannins, terpenoids and vitexin. The fruit of this plant is found to contain proteins, minerals and vitamin K and C. The bean contains methionine, tryptophan and tyrosine. The seed protein contained lysine, valine, leucine and phenylalanine.

Therapeutic Usages: Jvara, Kasa, Krmi, Ksaya, Kustha, Pradara, Vatarakta, Daha, Pitta Daha, Musika Visa, Ksata sotha, Madya and Trsna.

Pharmacological Studies: Hepatoprotective, antidiabetic, anti-inflammatory, sedative, antiemetic, antimicrobial, antitussive and is effective in oxidative stress induced cholestatic hepatic injury, arthritis and oedema.

Contraindications: Known allergy to the plants of the Fabaceae family. It may be shown contraindication in patients who are taking antidiabetics products.

Adverse Effects: There are no known side effects with this herb. It is best to avoid during constipation.

Precautions: Avoid *Phaseolus trilobus* or use only under medical supervision during pregnancy.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: 3-5 gm of the drug in powder form. Decoction 50 -100 ml.

Formulations: Asoka Ghrta, Bala Taila, Brahmmi Rasayana.

References:

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Nagdhona

Botanical Name: *Artemisia maritima* Linn.

Family: Asteraceae

Synonyms:

Bangla	: নাগদোনা (Nagdhona)
Hindi	: Kirmani
Sanskrit	: Chauhara, Nagadamani
Urdu/Unani/Tibb	: Afsanteen-ul- bahr
English	: Worm seed, Sea wormwood, Old women

Geographical Distribution: *Artemisia maritima* is a large, diverse and economically important genus of the family asteraceae. It has more than 500 species. *Artemisia* is a wind pollinated cosmopolitan genus, mainly distributed in temperate areas of mid to high latitudes of the northern hemisphere, colonizing in arid and semiarid environmental landscape, with only a few representatives in the southern hemisphere. Central Asia is its centre of diversification while the Mediterranean region and North West America are two secondary speciation areas. A few species are also reported in Africa and Europe. It is also available in India. A few species are found in chattagram region of Bangladesh.

Plant Descriptions:

General Description: *Artemisia* species are mostly herbs, and sometimes shrubs, usually with strong aroma. *Artemisia maritima* is a strongly aromatic, herbaceous perennial plant growing from a short, usually branching, woody rootstock. The plant produces a mat of non-flowering rosettes. The plant is harvested from the wild for local use as a medicine.



Figure 32. *Artemisia maritima* Linn.

Macroscopic Description: *Artemisia maritima* is an annual herbaceous plant, very fragrant, and a tall erect stalk which is more than 2 m tall in optimal growing conditions. Plant bodies are often densely hairy. Leaves are pinnatifid to pinnatisect with variable dimensions. Capitulum inflorescence is generally in the form of a paniculate- raceme arrangement. Herbaceous involucre bracts are present. Receptacles are convex or flat and naked or covered by hairs. Ray florets are pistillate. Corolla color is yellow or green and rarely brown. Disk florets are bisexual. Cypselas are obovoid to oblong and mostly brown

Microscopic Description: The stem of *Artemisia maritima* has a circular shape. The epidermis is monolayer, the medulla occupies about 2/3 of the radius of the stem, the medulla is central and relatively broad, and the vascular tissue is formed of vascular bundles arranged in a circle surrounding the medulla. The root of *Artemisia maritima* has a circular shape. The epidermis is monolayer with many epidermal hairs. The pericycle delimits the end of the vascular bundle, while the vascular bundle is inside the pericycle. Within the center, the medulla occupies 1/3 of the radius of the root.

Artemisia maritima powder has brown green color, aromatic pleasant odor with bitter taste, and a smooth texture.

Part Used: Whole plant

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Teeksna (Hot)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphavata shamaka

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 8.3 %w/w
Acid insoluble ash	: Not more than 0.9 %w/w
Alcohol soluble extractive	: Not less than 6.2 %w/w
Water soluble extractive	: Not less than 3.8%w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: The essential oil was applied on TLC aluminium plate (Merck) precoated with silica gel 60F₂₅₄ plates of 0.2 mm thickness using the Linomat IV (CAMAG, Muttenz, Switzerland) applicator as 6 mm bands. The plate was developed in the mobile phase of Toluene : Ethyl acetate (10:0.5, v/v) up to 8 cm height from the application point in the presaturated CAMAG TLC twin trough chamber. The TLC profile showed 5 spots at 0.31 (Blue), 0.38 (Blue), 0.57 (Bluish purple), 0.69 (Purple) and 0.85 (Purple).

Major Chemical Constituents: It contains trace amounts of thymol and carvacrol, as well as phenolic compounds with potent antioxidant and free radical scavenging activity, betaine, choline, tannis, pigments, essential oil, and santonin. Seed contains 2 % essential oil. Essential oil is also known as Artemisia oil or Armoise oil. Seed also contains two crystalline substances i.e. 1.5 to 2.0 % santonin are artemisin. Leaves contain alkaloid, saponin, flavonide and polyphenols and artemisinin. Essential oil: yellowish colour and penetrating, disagreeable odour, cineol 80 % dipentene (limonene/geraniol – mentadien – 1.8), terpinen, pinen, α and β – terpineol, tujone derivatives i.e. (z) thujone 0.2 % and (E) thujone 0.5 %: however the tujone content varies widely, chamazulene 18 %, nuciferol butanoate 8 %, nuciferol propionate 5 %, caryophyllene oxide 4.0 %, tujilic alcohol 5 – 7 %, sesquiter phenol, alkaloid phenol carbonic acid: the caffeic acid, flavonoids.

Therapeutic Usages: Vrushya (aphrodisiac), Deepana (improve digestion), Tridoshashamana, tridosha (balance all the three doshas) and Krimihara (useful in worm infestation, infected wounds).

Pharmacological Studies: Antihypertensive, anti-inflammatory, antioxidant, immunosuppressive antiarthritic, antispasmodic, antimalarial activity and antiparasitic activity.

Contraindications: Do not employ in patients with ulcers, intestinal diseases, heart disease, liver complaints or in persons with impaired kidney functions as the possibility of intoxication is augmented.

Adverse Effects: Large dose of the herb Nagdhona can be toxic to human. Hence care should be taken during the administration of this herb. Headache, diarrhea, loss of consciousness, irregular heart beat and mild tremors of limbs can be observed in case of overdose.

Precautions: Artemisia is unsafe in pregnancy. It can stimulate uterine contractions and increase the chances of bleeding and spotting. It may also have effects on hormones or alter the pregnancy hormones, which may lead miscarriage. There is a little information available regarding the safety of Nagdhona during breastfeeding. It might pass into milk and cause heartburn in infants.

Dosage Forms: Crude drug, capsules, tablets and oil. Store in a well-closed container, protected from light and moisture.

Posology: 3-6 gm. of the drug in powder form. Decoction 50 -100 ml.

Formulations: Artemisia Powder, Artemisia Tablet

References:

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Natakaranja

Botanical Name: *Pongamia pinnata* Linn.

Family: Leguminosae

Synonyms:

Bangla	: নটকরঞ্জ (Natakaranja)
Hindi	: Karanj
Sanskrit	: Karanjaka, Naktamala
Urdu/Unani/Tibb	: Karanj
English	: Karum Tree' or 'Poonga Oil Tree'

Geographical Distribution: It is an important nonedible minor oilseed tree that grows in the semiarid regions. It is probably originated from India and grows naturally in India, Bangladesh, Pakistan, Malaysia, Thailand, Vietnam, Australia, Florida, and Sri Lanka and also in northeastern Australia, Fiji, Japan, and the Philippines. In India, billions of karanja trees exist where karanja trees are cultivated commercially and seed is collected from December to April. However, in Bangladesh it is not cultivated commercially yet.



Figure 33. *Pongamia pinnata* Linn.

Plant Descriptions:

General Description: The name 'Pongamia' has derived from the Tamil name, 'pinnata' that refers to the 'Pinnate leaves'. The tree is a member of the 'leguminosae' family. In Hindi and Bengali, the people named it as 'Karanj' or 'Papar' or 'Kanji'. The fresh bark of *Pongamia pinnata* is sweet and mucilaginous to taste, soon become bitter and acrid. It is an Indo-Malaysian species, a medium-sized evergreen tree, common on alluvial and coastal situations from India to

Fiji, from sea level to 1200 m. In the months of March and April, the 'Pongam Tree' stands as painted in crimson color for a week or so as the buds develop into wilted, new leaves and just after the leaves begin to grow mature, the tree attains a gorgeous glowing lime-green colour. The 'Pongam Tree' is being cultivated in a large number of gardens and along the countless roads in India and is becoming the one of the most admired city trees

Macroscopic Description: Drug occurs in pieces of varying sizes; reddish-brown externally and yellowishwhite, internally; external surface rough, due to peeling off, of outer thin skin and presence of numerous irregularly scattered and transversely arranged rows of lenticels; fracture, fibrous; taste, very bitter.

Microscopic Description: Root Bark-Shows cork consisting of 5-15 or more rows of rectangular, tangentially elongated, thin-walled, cells; secondary cortex wide composed of polygonal, tangentially elongated cells, most of the cells containing both simple and compound starch grains having 2-5 components round to oval in shape, 3-11 μ in diameter, a few cells contain yellowish-brown contents and prismatic crystals of calcium oxalate; stone cells found scattered in this region in singles and groups, single cells of varying shape and size; secondary phloem very wide, composed of tangentially arranged fibres alternating with sieve tubes and phloem parenchyma, traversed by phloem rays; most of phloem parenchyma cells contain starch grains and crystals, similar to those present in secondary cortex; phloem rays many, mostly straight, 1-2 seriate, consisting of thin-walled, radially elongated cells towards inner region and tangentially elongated towards periphery; most of ray cells contain starch grain, similar to those present in secondary cortex.

Powder-Creamish-yellow; shows thin-walled, parenchymatous cells, cork cells, phloem fibres, stone cells and simple and compound starch grains measuring 3-11 μ in diameter.

Part Used: Flower, seed, leaf and root.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter), Kasay (Astringent)
Guna (Attribute)	: Tiksna (Sharp)
Virya (Potency)	: Ushana (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphahara, Pittahara, Vatahara

Purity and Safety Test

Foreign matter	: Not more than 1 %w/w
Total ash	: Not more than 11 %w/w
Acid insoluble ash	: Not more than 2%w/w
Alcohol soluble extractive	: Not less than 3.5 %w/w
Water soluble extractive	: Not less than 17 %w/w

Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of alcoholic extract of the drug on Silica Gel 'G' plate using Toluene: Ethylacetate (9:1) shows under U.V. (366 nm) eleven fluorescent zones at Rf. 0.04 (blue), 0.08 (greenish blue), 0.13 (Sky blue), 0.18 (blue) 0.25 (sky blue), 0.31 (sky blue), 0.37 (greenish yellow), 0.42 (sky blue), 0.47 (greenish yellow), 0.51 (light blue), 0.80 (light blue). On exposure to Iodine vapour nine spots appear at Rf. 0.09, 0.18, 0.31, 0.37, 0.47, 0.47, 0.51, 0.80 and 0.98 (all yellow).

Major Chemical Constituents: Seeds contain six compounds (two sterols, three sterol derivatives and one disaccharide) together with the eight fatty acids (three saturated and five unsaturated). The metabolites, β -sitosteryl acetate and galactoside, stigma sterol, galactoside and sucrose are being reported for the first time. The saturated and unsaturated fatty acids (two monoenoic, one dienoic and two trienoic) are present in exactly the same amount. Oleic acid occurred in highest amount (42.44%), stearic (29.64%) and palmitic (18.58%) acids are the next in the quantity. Karangin, pongamol, pongagalabrone, and pongapin, pinnatin and kanjone have been isolated from seeds.

Therapeutic Usages: Krmiroga, Kandu, Prameha, Kustha, Dustavrana, Yoniroga.

Pharmacological Studies: Antioxidant, antimicrobial, anti-parasite, anti-inflammatory, anti-convulsant, anti-diabetic, anti-hyperammonemic, cytotoxicity, anthelmintic, and insecticidal activities.

Contraindications: Known allergy to the plants of the Leguminosae family.

Adverse Effects: The herb is safe for human use at this dose but should be administered cautiously in impaired liver functions.

Precautions: Use only under medical supervision during pregnancy and breastfeeding.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: 1-3 gm of the drug for decoction.

Formulations: Jwarkeshari Rasayan, Sri Gopal Taila, Bisnu Taila

References:

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Papaya

Botanical Name: *Carica papaya* Linn.

Family: Caricaceae

Synonyms:

Bangla	: পেঁপে (Papeya)
Hindi	: Papita
Sanskrit	: Nalaparni, Eranda Karkati
Urdu/Unani/Tibb	: Aranda Kharbuza
English	: Papaya

Geographical Distribution: *Carica papaya* is a plant belonging to family Caricaceae. It is originated from Southern Mexico, Central America and the northern part of South America. It is cultivated for its fruits, throughout the world's tropical and subtropical regions which include 57 countries like India, Bangladesh, Sri Lanka, Brazil, Indonesia, Mexico and Nigeria. Among these countries India is the largest producer of papaya. Its seeds were distributed to the Caribbean and south-east Asia during Spanish exploration in the 16th Century, from where it spread rapidly to India, the Pacific and Africa. In Bangladesh, it is cultivated all over the country.

Plant Descriptions:

General Description: Papaya is a berry type fruit with parietal placentation, it is well known for its food and nutritional values. It is also called as “fruit of a common man”, known as popular fruit. The plants are usually short-lived, but can produce fruits for more than 20 years.



Figure 34. *Carica papaya* Linn.

Macroscopic Description: Physical examination of the untreated sample of *Carica papaya* L. leaves was carried out under diffused sunlight and artificial source similar to day light. Morphological examination revealed that the leaves of papaya are usually larger and arranged spirally having long stem (1-3.5 ft) and their blades are split into 7-11 main lobes are usually veins are deeply palmated and serration are shallow. The stem have a green to dark green colour while leaves are green with yellow ribs and veins. The petiole develops last in leaf is solid and cylindrical but hollow. According to pinnate or palmate type of venation the incision found to be palmatipartite. Organoleptic property of leaf powder is green to dark green in colour, with smooth surface.

Microscopic Description: Transverse section of the leaf shows a well defined upper and lower epidermis surrounded by well defined 5-7 layers of collenchyma and scellerenchyma. The epidermis is composed of very large round cells with wavy and refractive walls. The inner walls of the cells are strongly but unevenly thickened. The endodermis is composed of parenchymatous cells with moderately thickened walls and are found usually attached to the portions of the parenchyma the cells of which are small, thin walled and polygonal. The pith is found to be absent as the stalk is hollow from inside. A middle portion is covered with xylem and phloem surrounded by parenchymatous cell that in turn surrounded by scellerenchyma cells. The observed characteristics of the leaves were found to be in complete agreement with previous finding.

The drug powder is irritating with characteristic odour and bitter in taste.

Part Used: Fruit, Leaf, Latex, Seed

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	:Laghu (Light for digestion), Ruksa (Dry), Tikshna (Pungent)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	:Katu (Pungent)
Karma (Action)	:Kaphavatahara (pacifies Kapha and Vata doshas), Hridya (benefits the heart)

Purity and Safety Test

Foreign matter	: Not more than 2 %w/w
Total ash	: Not more than 16.72 %w/w
Acid insoluble ash	: Not more than 3.25%w/w
Alcohol soluble extractive	: Not less than 13.43 %w/w
Water soluble extractive	: Not less than 10.58 %w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for

	crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: The solvent system used was n Hexane: Acetone (8.5:1.5), 10mg/ml of leaf sample of different extracts was procured from hot extraction method and stock solution of 100 µg/ml of βcarotene (Sigma Aldrich, New Delhi) using chloroform as a solvent was prepared. Test solution and standard solution was applied on a precoated silica gel 60 F254 TLC plate and run in the previously saturated solvent system. The R_f value (number of spots) are 0.10, 0.16, 0.24, 0.30, 0.36 and 0.71.

Major Chemical Constituents: Fruit-protein, fat, fibre, carbohydrates, minerals, calcium, phosphorus, iron, vitamin C, thiamine, riboflavin, niacin, and carotene, amino acid, citric acids and malic acid (green fruits), volatile compounds: linalol, benzylisothiocyanate, *cis* and *trans* 2, 6-dimethyl-3,6 epoxy-7 octen-2-ol. Alkaloid, α; carpine, benzyl-β-D glucoside, 2-phenylethyl-β-D-glucoside, 4-hydroxyl - phenyl-2 ethyl-β-D glucoside and four isomeric malonated benzyl-β-D glucosides. Seed - Fatty acids, crude proteins, crude fibre, papaya oil, carpine, benzylisothiocyanate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane, β sitosterol, caricin and an enzyme myrosin. Root - Arposide and an enzyme myrosin.

Therapeutic Usages: Kasa (cough), Shwasa (asthma, respiratory disorders involving difficulty in breathing), Yakrutodara (hepatomegaly), Pleehodara (splenomegaly, enlarged spleen), Mandagni (low digestion strength), Shotha (oedema, swelling, inflammatory conditions) and Visha (toxic conditions).

Pharmacological Studies: Anticancer, antibacterial, hepatoprotection, antiinflammatory and antioxidant, anthelmintic, antiprotozoan, antifungal, antiviral, antiinflammatory, free-radical scavenging, antisickling, neuroprotective, diuretic, abortifacient, hypoglycemic and hypolipidemic, antihypertensive, wound healing, antitumor and antifertility activities.

Contraindications: Papaya is contraindicated in patients with known hypersensitivity to any of its components (eg, papain). It is contraindicated in hypothyroidism and clotting disorders.

Adverse Effects: Papaya may cause severe allergic reactions in sensitive people. Topically, papaya latex can be a severe irritant and vesicant. Papaya juice and papaya seeds are unlikely to cause adverse effects when taken orally; however, papaya leaves at high doses may cause gastric irritation.

Precautions: Pregnant women should not consume raw papaya as the milk present in the raw papaya may cause abortion. In the folklore practice, raw papaya is used to cause abortion.

Dosage Forms: Crude drug, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Leaf infusion 40-80 ml, Seed powder: 0.5-1 gm, Latex: 3-6 gm

Formulations: Papaya Leaves Powder, Papaya Leaves Tablet

References:

1. Anitha B, Raghu N, Gopenath TS, Karthikeyan M, Gnanasekaran A, Chandrashekrappa GK and Basalingappa KM. Medicinal Uses of Carica Papaya. J Nat Ayurvedic Med, 2018;2(6): 000144.
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Padma

Botanical Name: *Nelumbo nucifera* Gaertn.

Family: Nymphaeaceae

Synonyms:

Bangla	: পদ্ম/শাপলা (Padma Phool, Saplapool)
Hindi	: Kamal, Kanwal
Sanskrit	: Abja, Aravinda, Padma
Urdu/Unani/Tibb	: Kamal
English	: Lotus

Geographical Distribution: *Nelumbo nucifera* is commonly found growing in ponds, tanks and jheels; it is often cultivated for its elegant, sweet scented flowers which is called as the “National flower of Bangladesh”. *Nelumbo nucifera* (Asian lotus) is the only species that occurs throughout Asia, which may be detailed as Bangladesh, Bhutan, China, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Nepal, Pakistan, Philippine, Sri Lanka, Thailand, Vietnam, South West Asia and Australia.

Plant Descriptions:

General Description: It is a large aquatic herb with stout creeping yellowish white colored rhizomes. In Sanskrit the *nelumbo nucifera* is called ‘Kamala.’ It is two types one with white flowers commonly called ‘Sveta kamala’ and the other with pink or reddish pink flowers called ‘Rakta Kamal’. Every part of the plant has distinct name and almost all parts are used medicinally, the whole plant with flowers is known as ‘Padmini’, the rhizome is known as ‘Kamalakand’, the tender leaves are known as ‘Sambartika’, the peduncle as ‘mrinal’ or ‘Visa’, the stamens as ‘Kirijalaka’ the torus as ‘Padmakosa’ the seeds as ‘Karnika’ or ‘Padmaksya’ and the honey formed in the flowers by the bees feeding upon padma is known as ‘Padma- Madhu’.



Figure 35. *Nelumbo nucifera* Gaertn.

Macroscopic Description: Drug occurs as entire or pieces of flowers, comprising of calyx, corolla, androecium, gynoecium and thalamus; entire flower 10-15 cm in diameter, yellowish-brown; sepals leaf-like, crimped, 3-5 cm long, 1.3-2 cm wide, dark brown, broken pieces also occur; petals numerous, crimped, elliptic, obtuse, membranous, finely veined, 2-4 cm long, 1.2-2 cm wide yellowish-brown; anther, erect, linear 1.4-2 cm long, extended into clavate appendages; gynoecium apocarpous; carpels many, free, embedded in a creamy, top shaped fleshy thalamus (torus) 3-5 cm long and 2.5-3 cm wide; fruit an etaerio of achenes, becoming loose in their sockets when ripe; seed hard, black, starchy and large.

Microscopic Description: Flower: Petal - shows single layered epidermis on both surfaces, consisting of rectangular cells covered with striated cuticle; ground tissue consisting of polygonal, parenchymatous cells with wide air-sacs.

Stamen: Filament - filament appears circular in outline, consisting of single layered epidermis covered with striated cuticle; followed by ground tissue of oval, angular, parenchymatous cell; vascular bundle single, present in centre consisting of usual elements of xylem and phloem tissues.

Anther - shows four chambered anther, two on either sides, connected by parenchymatous cells containing vascular bundle; anther consists of a single layer of epidermis, composed of thin-walled, rectangular, parenchymatous cells followed by single layer of endothecium consisting of thin-walled, columnar, parenchymatous cells; spore sac contains yellow, spherical pollen grains with smooth exine and intine walls, measuring 50-61 μ in diameter.

Powder - Dusty brown; shows fragments of vessels with spiral thickening, spherical, yellow pollen grains, measuring 50-61 μ in diameter having smooth exine and intine.

Part Used: The whole plant and flower

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter), Kasay (Astringent)
Guna (Attribute)	: Sita (Cold), Laghu (Light)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Kaphahara, Pittahara, Varsya

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 12 % w/w
Acid insoluble ash	: Not more than 3% w/w
Alcohol soluble extractive	: Not less than 6 % w/w
Water soluble extractive	: Not less than 14 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not

	more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: Coumarins, saponins, flavonoids and alkaloids have been sought in this extract. The developing solvent used was CHCl₃ / AcOEt / n-C₆H₁₄ (5: 6: 2.5; v/v/v). Antimony chloride (SbCl₃) shows steroid-type saponins in yellow (R_f = 0.13; 0.41; 0.48) and triterpenes spots in pink-violet (R_f = 0.02; 0.08; 0.16).

Major Chemical Constituents: The major secondary metabolites present in the *Nelumbo* are alkaloids such as dauricine, lotusine, nuci-ferine, pronuciferine, liensinine, isoliensinine, roemerine, neferine and arnepavine, Procyanidin are isolated from the seedpod of *N. nucifera*. Seeds also contain gallic acid (11), D (-)-30 - bromo-O-methyl-arnepavine (12), D-1, 2, 3, 4-tetrahydro-6-methoxy-1-(p-methoxy benzyl)-2-methyl-7-isoquinolinol (13), saponins and carbohydrates. Normally, lotus especially seeds are rich in protein, amino acids, unsaturated fatty acids and minerals. *Nelumbo* seeds have also been found to contain a variety of minerals such as chromium (0.0042%), sodium (1.00%), potassium (28.5%), calcium (22.10%), magnesium (9.20%), copper (0.0463%), zinc (0.0840%), and manganese (0.356%) and iron (0.1990%). Other relevant nutritional elements include total ash (4.50%), moisture (10.50%), crude carbohydrate (1.93%), crude fibre (10.60%), fat (72.17%), and protein (2.70%).

Therapeutic Usages: Raktapitta (haematemesis), Visarpa (erysepalis), Trsna (thirst), Daha (burning) and Visavikara.

Pharmacological Studies: Antioxidant, anti-inflammatory, antimicrobial, antiarrhythmic, antipyretic, anti-ischaemic, anti-diabetic, hypoglycaemic, antidiarrhoeal, immunomodulatory and other activities.

Contraindications: Known allergy to the plants of the Nymphaeaceae family.

Adverse Effects: Lotus is likely safe when eaten as food. However, there is not enough known about lotus to know if it is safe when used as a medicine. It can cause allergic reactions such as skinitching in some people. It may cause constipation.

Precautions: Lotus might lower blood sugar levels in some people. Watch for signs of low blood sugar (hypoglycemia) and monitor blood sugar carefully if have diabetes and use lotus as a medicine.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: 12 -24 gm of the drug for decoction.

Formulations: Ushrasav, Pusparaj Prasarani Taila

References:

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Pakur

Botanical Name: *Ficus lacor* Buch. Ham.

Family: Moraceae

Synonyms:

Bangla	: পাকুড় (Pakur)
Hindi	: Pakad
Sanskrit	: Parkari
Urdu/Unani/Tibb	: Pakhad
English	: Elephant fig

Geographical Distribution: *Ficus lacor* is widely distributed around the world in both tropical and subtropical regions. It is distributed worldwide in South East Asia, Burma, Indochina, Australia, India, Myanmar, Bhutan, Bangladesh and Nepal.

Plant Descriptions

General Description: The genus, *Ficus*, is composed of over 800 species and is one of around forty genera of the Moraceae family of mulberry. *Ficus lacor* Buch. Ham. is a huge deciduous, fast-growing closely foliaceous tree approximately 20 meter in height with a finely shaped crown. It is a small deciduous or nearly evergreen tree, which grow good on moderately deep soils with an adequate moisture supply. Although it has tolerance to frost, its seedling is very susceptible to damage by browsing and fire. There is only one type of fig, containing both seed and gall flower. A seed is generally collected between March and May. *Ficus lacor* Buch. Ham. is commonly propagated by cutting.



Figure 36. *Ficus lacor* Buch. Ham.

Macroscopic Description: *Ficus lacor* is a huge deciduous or nearly evergreen tree, swiftly growing closely foliaceous approximately 20 meter in height with a finely shaped crown and with some aerial roots as shown in fig. Bark: Rough, quilled pieces, flat to curved, 0.4-0.7 cm thick; outer surface ash or whitish-grey; numerous transversely arranged lenticels; ranging from 0.1 cm to 1.3 cm long, lip-shaped and exfoliating; inner surface rough, fibrous, longitudinally striated, reddish-brown; fracture, fibrous. Leaves: Alternate, elliptic-oblong, 11-17 cm by 4-7 cm, abruptly narrowed to a point, three-veined at base; leaf stalks 3-8 cm long, joined at apex; branchlets usually densely hairy. Fruit type and maturity: One type of fig usually red or purple when ripe.

Microscopic Description: Shows 5-8 layered cork consisting of thin-walled, rectangular cells, a few external layers exfoliating; secondary cortex very wide consisting of compactly arranged, rectangular, thick-walled, pitted cells, patches of circular to elongated, lignified, elliptical stone cells with radiating canals, a few with concentric striations; a few prismatic crystals of calcium oxalate and reddish-brown contents found scattered throughout the secondary cortex; secondary phloem very wide consisting of mostly stratified layers of collapsed cells forming ceratenchyma, groups of fibres, phloem parenchyma, laticiferous cells, traversed by 2-5 seriate phloem rays; phloem fibres lignified with wide lumen and pointed tips; thin-walled, rectangular, a few phloem parenchyma containing prismatic crystals of calcium oxalate.

Powder - Reddish-brown; shows thick-walled parenchyma with simple pits; stone cells in groups and singles, prismatic crystals of calcium oxalate, elongated phloem fibres with wide lumen and pointed tips.

Part Used: Fruit, leaves and latex

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Kasaya (Astringent)
Guna (Attribute)	: Ruksha (Dry)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Sramahara, Kaphahara, Medohara, Pittahara, Stambhana, Dahahara, Sangrahi, Bhagnasadhaka, Yonidosahara

Purity and Safety Test

Foreign matter	: Not more than 1 % w/w
Total ash	: Not more than 10 % w/w
Acid insoluble ash	: Not more than 1.5 % w/w
Alcohol soluble extractive	: Not less than 5 % w/w
Water soluble extractive	: Not less than 6 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total

yeast and mould count, total *Enterobacteriaceae* are not more than 10^4 cfug⁻¹, 10^3 cfug⁻¹ and 10^4 cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total *Enterobacteriaceae*, *Salmonella spp*, *S.aureus*, *Pseudomonas aeruginosa* and *Coliforms* will be absent.

Heavy metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.

Pesticides residues

: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: Presence of alkaloids in various extracts was investigated by using the Ethyl acetate: methanol: water (100: 13.5: 10) mobile phase and glycosides in various extracts was investigated by using toluene: ethyl acetate (70: 30) mobile phase. The development was done by using 0.5% anisaldehyde reagent as the developing agent and observation of spots was done either in normal or UV light. The TLC of alkaloids shows different spots having R_f value, that is, 0.45, 0.58, and 0.62 and the TLC of glycosides shows R_f values, that is, 0.42 and 50.

Major Chemical Constituents: The qualitative evaluation of different extracts indicated the presence of carbohydrates, phenolic, triterpenoids, protein and free amino acids (three amino acid viz. ornithine, alanine, tyrosine) compounds. *Ficus lacor* leaves have been accounted for the presence of numerous compounds counting β -sitosterol, lupeol, α -amyrin, β -amyrin, stigmasterol, and campesterol. The further chemicals namely such as scutellarein glucoside, scutellarein, infectorin, sorbifolin, bergaptol, and bergapten were identified from the whole plant. It also contains fibre and antioxidants i.e. Vitamin-C and β -carotene.

Therapeutic Usages: Sotha, Raktapitta, Visarpa, Vrana, Yoniroga and Atisara.

Pharmacological Studies: Antibacterial, antioxidant, anti-inflammatory, antidiarrheal, antitumor, anticancer, antispasmodic, anti-arthritic, antifilarial and nutritive.

Contraindications: Known allergy to the plants of the Moraceae family. It is contraindicated in Behavioral changes and convulsion.

Adverse Effects: Pakur is likely safe when used within recommended therapeutic dose. Latex may cause allergic reactions such as skinitching in some people. It may also cause constipation.

Precautions: Precaution should be taken during pregnancy and lactation.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills.

Posology: 50 gm of the drug in powder form for decoction.

Formulations: Pakur Kwath

References:

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Phalsa

Botanical Name: *Grewia asiatica* Linn.

Family: Tiliaceae

Synonyms:

Bangla	: ফলসা (Phalsa)
Hindi	: Phalsa, Falsa
Sanskrit	: Parushaka
Urdu/Unani/Tibb	: Phalasah
English	: Phalsa fruit

Geographical Distribution: *Grewia* genus comprises approximately 150 species of small trees and shrubs, distributed in subtropical and tropical regions of World. It is commonly distributed in India, Sri Lanka, Bangladesh, Nepal, Myanmar, Thailand, Pakistan, Cambodia and other tropical countries.

Plant Descriptions

General Description: Phalsa is a deciduous straggling shrub or small tree growing 2-10 metres tall and exists in two forms, i.e. tall and dwarf types of phalsa. The plant grows in both tropical and subtropical climates but will tolerate other climates, except at high altitude; however, it does best in regions having distinct summer and winter seasons. The temperature range for growth is reported to be 10 - 44°C with the optimum between 23-34°C. Phalsa begins to bear fruit after only 2 years, but does not produce marketable fruit until the 3rd year



Figure 37. *Grewia asiatica* Linn.

Macroscopic Description: *Grewia asiatica* is a 4 to 5 m tall shrub. The leaves are approximately 5–18 cm long and broad. The flowers are arranged in cymes of several together, the individual flowers are yellowish in color with five large (12 mm) sepals and five smaller (4–5 mm) petals. The flower has a diameter of about 2 cm. Leaves may be ovate, suborbicular, acute, subacuminate or cuspidate, sharply and often coarsely, double serrate, subglabrous above, hoary-tomentose beneath and rounded or only slightly cordate at the base.

Fruits: grow in bunches from leaf axilla, ripen in summer and act as nature's boon against scorching summer heat. Round pea like fruit is green when unripe and tastes sour. When ripe, it is a fleshy fibrous drupe, grayish to reddish purple in colour.

Microscopic Description: *Grewia asiatica* shows presence of prismatic and rosette crystals, Parenchymal cells, crystal fibre, spiral vessels, epidermal cells, starch grains, aleurone grains, stellate hairs, which serve as an important microscopic diagnostic characters.

Powder of *Grewia asiatica* leaves when observed under 10x magnification revealed the presence of rectangular shaped epidermal cells with thin, cuticle wall and starch grains, elongated unicellular to multicellular stellate covering trichome, polygonal and cuboidal calcium oxalate crystals, unicellular covering trichome, multicellular head and unicellular stalk of a glandular trichome.

Part Used: Fruit, leaves and Root

Organoleptic Properties

Guna (Attribute)	: Laghu (light), Snigdha (Oily)
Rasa (Taste)	: Madhura (Sweet)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Vatapitta shamaka, Jarahara, Virechana,

Purity and Safety Test

Foreign matter	: Not more than 1 % w/w
Total ash	: Not more than 3 % w/w
Acid insoluble ash	: Not more than 1.4 % w/w
Alcohol soluble extractive	: Not less than 56.80 % w/w
Water soluble extractive	: Not less than 56.29 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella</i> spp, <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Major Chemical Constituents: Plant parts are found to have all the essential mineral elements, carbohydrates, proteins, fatty acids and other active metabolites like flavonoids, tannins, phenols, alkaloids, steroids and triterpenoids, lignans, lactones, flavones, anthocyanins etc. *Grewia asiatica* contains anthocyanin type cyanidin 3- glucoside, vitamin C, minerals and dietary fibers.

Therapeutic Usages: Daha, Arsha, Jwara and Kshaya. Traditionally the unripe fruits are said to remove vata, kapha and biliousness.

Pharmacological Studies: Antimicrobial, anticancer, antimalarial, antiplatelet and antiemetic activities; fruit possess anticancer, antioxidant, radioprotective and antihyperglycemic properties; while stem bark possesses analgesic, antipyretic, and anti-inflammatory activities.

Contraindications: Known allergy to the plants of the Tiliaceae family. It is contraindicated in patients who are taking hypoglycemic, sedative, antidepressant drug.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic dose. Its LD₅₀ is higher than 3000 mg/kg.

Precautions: Precaution should be taken during pregnancy and lactation.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Decoction 10-20 ml

Formulations: Drakhadi Kashayam.

References:

1. Zia-Ul-Haq M, Stanković MS, Rizwan K, Feo VD. *Grewia asiatica* L., a food plant with multiple uses. *Molecules* (Basel, Switzerland), 2013; 18(3): 2663–2682.
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3. Tripathi S, Chaurey M, Balasubramaniam A, Balakrishnan N. *Grewia asiatica* Linn. As a Phytomedicine: A Review. *Research J. Pharm. And Tech.* 2010; 3(1):1-3.
4. Paul S. Pharmacological actions and potential uses of *Grewia asiatica*: A review. *International Journal of Applied Research* 2015;1(9):222-228
5. Shukla R, Sharma DC, Baig MH, Bano S, Roy S, Provazník I, Kamal MA. Antioxidant, Antimicrobial Activity and Medicinal Properties of *Grewia asiatica* L. *Med Chem.* 2016;12(3):211-6.

Pilu

Botanical Name: *Salvadora persica* Linn.

Family: Salvadoraceae

Synonyms:

Bangla	: পিলুগাছ (Peelugachh)
Hindi	: Pilu
Sanskrit	: Gudaphala
Urdu/Unani/Tibb	: Peelu
English	: Salt bush

Geographical Distribution: The genus *Salvadora* belongs to family 'Salvadoraceae'. It comprises three genera (i.e. *Azima*, *Dobera* and *Salvadora*) and 10 species distributed mainly in the tropical and subtropical region of Africa and Asia. In Indian subcontinent this family is represented by only one genus with two species viz. *S. persica* and *S. oleoides*. Recently, a new species *Salvadora alii* has been described from Sindh and Pakistan. It is native to Algeria, Egypt, India, Nigeria, Pakistan, Saudi Arabia, Sri Lanka, Bangladesh, Uganda and Zimbabwe. In India it is distributed in arid and semi-arid regions of Rajasthan and Gujarat.

Plant Descriptions

General Description: *Salvadora persica* Linn. commonly known as miswak (tooth brush), belongs to the family Salvadoraceae. It is an upright evergreen small tree or shrub, seldom more than 1 ft in diameter reaching a maximum height of 3 m. The use of miswak is a pre-Islamic custom, which was adhered to by the ancient Arabs to get their teeth white and shiny. The beneficial effects of miswak in respect of oral hygiene and dental health are partially due to its mechanical action and partially due to pharmacologic action. It is used for centuries as a natural toothbrush; its fibrous branches have been promoted by the World Health Organization for oral hygiene. The plant has been used for the preparation of a number of medicinally important products such as abrasives, antiseptics, astringent, detergents, enzyme inhibitors and fluorides.

Macroscopic Description: Fruits are 3 to 5 mm in diameter, ellipsoid-ovoid, occasionally with a small pedicel attached; surface greenish or greenish-brown to dark brown in colour, with irregular wrinkles, sometimes shrunken; pericarp thin, easily separable, exhibiting creamish to dull brown seed, odour characteristic and taste bitter.

Microscopic Description: The epidermis is single layered consisting of thick walled, radially elongated cells covered externally with cuticle, the mesocarp differentiated into three zones, the outer and inner zone exhibiting thin walled parenchyma cells while a continuous zone of sclerenchymatous tissue with vascular bundles embedded in it is present in the middle region; testa shows single layered epidermis of thin walled cells followed by parenchymatous cells of the embryo containing aleurone grains and occasional oil globules.

Powder - Powder shows fragments of parenchymatous cells with aleurone grains and oil globules; scalariform, reticulate as well as border-pitted vascular elements; thick walled epidermal cells in surface view and sclereids.



Figure 38. *Salvadora persica* Linn.

Part Used: Leaves, roots, stem bark, seed and oil

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (light), Snigdha (Oily), Tiksna (Hot)
Virya (Potency)	: Ushan (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Sothahara, Bhedana, Depana, Kaphahara, Rasayana, Vatahara, Virecana, Vidahi

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 15 % w/w
Acid insoluble ash	: Not more than 4 % w/w
Alcohol soluble extractive	: Not less than 12 % w/w
Water soluble extractive	: Not less than 40 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for

	crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of alcoholic extract on precoated Silica gel 'G' plate (Merck), using n-Butanol; Acetic acid; water (4:1:5), in visible light shows three spots at Rf.0.23, 0.80 (both light green) and 0.46 (light yellow); under UV (366 nm) two white spots appear at Rf.0.37 and 0.46; under UV (254nm) three spots appear at Rf.0.37 (white), 0.46 and 0.80 (both pink), on exposure to Iodine vapours four yellow spots appear at Rf.0.10, 0.37, 0.46 and 0.80, on spraying with vanillin sulphuric acid and heating the plate at 110°C for 10 minutes, six spots appear at Rf. 0.10, 0.23 (both violet), 0.37, 0.40, 0.46 and 0.80 (all orange).

Major Chemical Constituents: *Salvadora persica* is known to contain several biologically active chemical constituents such as volatile oils, flavonoids, alkaloids, steroids, terpenoids, saponins, and carbohydrate. The leaves, roots and stem bark contain an alkaloid trimethylamine. The seed is rich in oil and contains lauric, myristic and palmitic acids. The root contains elemental gamma monoclinic sulphur, benzyl glucosinolate, salvadoreurea (a urea derivative), m-anisic acid and sitosterol. Benzyl isothiocyanate which is isolated from the root, exhibits antiviral activity against Herpes simplex virus-1 which affects oral region.

Therapeutic Usages: Asmari, Arsa, Anaha, Gulma, Jvara, Mutrakrcchra, Sarpavisa, Udararoga and Bastivikara.

Pharmacological Studies: Antiulcer, antifungal, anti-parasitic, antiviral and antibacterial properties. It also possess anticonvulsant activity, antifertility activity, antimycotic activity, analgesic effect and cytotoxic activity.

Contraindications: Known allergy to the plants of the Salvadoraceae family. Oral intake is not suitable for pitta type person or high pitta disorders.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic dose but in rare case it may cause diarrhea.

Precautions: Precaution should be taken during pregnancy and lactation.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 3-6 gm

Formulations: Pilu Taila

References:

1. Anonymous, Piluh (Fruit)). The Ayurvedic Pharmacopoeia of India, Part- I, Volume V, page 158
2. Kumar S, Rani C, Mangal M. A Critical review on *Salvadora persica*: An important medicinal plant of arid zone. International Journal of phytomedicine, 2012; 4; 292-303
3. Khatak M, Khatak S, Siddqui AA, Vasudeva N, Aggarwal A, Aggarwal P. *Salvadora persica*. Pharmacognosy reviews, 2010; 4(8), 209–214.
4. Haque MM, Alsareii SA. A review of the therapeutic effects of using miswak (*Salvadora Persica*) on oral health. Saudi Med J. 2015 May;36(5):530-43.
5. Aumeeruddy MZ, Zengin G, Mahomoodally MF. A review of the traditional and modern uses of *Salvadora persica* L. (Miswak): Toothbrush tree of Prophet Muhammad, Journal of Ethnopharmacology, 2018; 213: 409-444

Raisarisa

Botanical Name: *Brassica juncea* (L.) Czern.

Family: Cruciferae

Synonyms:

Bangla	: সরিষা (Sarisha)
Hindi	: Rai/Sarson
Sanskrit	: Rajika
Urdu/Unani/Tibb	: Rai, roghan sarson, sarson
English	: Mustard/Wild turnip

Geographical Distribution: The genus *Brassica* contains over 150 species that are cultivated worldwide as oil seed crops and/or vegetables. Its primary center of origin is central Asia (northwest India), with secondary centers in central and western China, eastern India, Burma, and through Iran to the Near East. The principle growing countries are Bangladesh, Central Africa, China, India, Japan, Nepal, and Pakistan, as well as southern Russia north of the Caspian Sea. It is considered also as a principle weed in Canada, a common weed in Argentina and Australia, and a weed in Fiji, Mexico, and the United States.

Plant Descriptions

General Description: *Brassica juncea* also known as Indian mustard, Chinese mustard, oriental mustard, leaf mustard, or mustard green, is a species of mustard family of Brassicaceae (Cruciferae) plants. *Brassica* is one of the most ancient spices. It has 3 varieties namely black, brown and white. Brown mustard is largely cultivated. Brown mustard plant produces tiny yellow colored flowers, which almost cover the plant. The black mustard plant normally grows to a height of 10 feet. White mustard is the mildest among all the varieties of mustard. Mustard Seed has a fresh aroma and slightly biting flavor but when the seeds are dried they do give any fragrance. The leaves, the seeds, and the stem of this mustard variety are edible. Charaka has categorized the white variety as *asthanopaga* – adjunct to decoction enemas and the black variety as *kandughna* – antipruritic.

Macroscopic Description: Mustard plants can reach 150 cm in height. The young stems and leaves are bristle, the stems are erect, the lower leaves are smaller, the edges are notched or toothed, the upper leaves are narrow-lanceolate, and the edges are not sparsely toothed or entire. Mustard usually blooms from March to May and bears fruit from May to June. Mustard has a short growing period, about 30 days from sowing to harvest. The suitable growth temperature is 15–22°C



Figure 39. *Brassica juncea* (L.) Czern.

Microscopic Description: The leaves are broadly ovate, coarsely dentate, the lowest ones lyrate and slightly hispid whereas, the upper ones are lanceolate, all stalked, dark green in colour. The flowers are in corymbose racemes, stalked, bright yellow. The fruits, siliqua are 2.5-5 cm long, oblong-linear. The seeds are brownish-red, tiny. The seeds are reddish brown with a smooth texture and approximately 0.9-1 mm in diameter; they have a bitter taste and characteristic pungent smell when crushed. The testa is dark reddish-brown to yellow and minutely pitted. The cells of the outer epidermis of the testa contained mucilage. The embryo is oily and yellow in color, containing two cotyledons folded against their midribs to enclose the radicals.

Part Used: Seed and seed oil

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Snigdha (Oily)
Virya (Potency)	: Ushan (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Vatahara, Kaphahara, Pittabhardhaka

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 4.5 % w/w
Acid insoluble ash	: Not more than 3.6 % w/w
Alcohol soluble extractive	: Not less than 9.43 % w/w
Water soluble extractive	: Not less than 5.2 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not

	more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: The seed extract was checked by TLC on analytical plates over silica gel 60 F₂₅₄. The qualitative analysis for different class of phytoconstituents was carried out by spotting the bands of extract using capillaries and using the mobile phase n-butanol: n-propanol: water: glacial acetic acid (3:1:1:1) using different spray reagents. A total of seven distinct bands were observed under different spraying conditions with R_f 0.19, 0.26, 0.28, 0.4, 0.43, 0.5 and 0.57.

Major Chemical Constituents: The major pungent chemical constituent of such commercialized oils is Allyl isothiocyanate which is formed from its precursor during the processing of the seeds. This isothiocyanate is now considered to be the most important cancer chemo-preventive phytochemical with other potential health benefits and antimicrobial agent against a variety of organisms. *Brassica juncea* is known to produce several other classes of bioactive phyto-chemicals including glycosides, flavonoids, phenolic compounds, sterols and triterpene alcohols, proteins and carbohydrates. During more recent years it has also been cultured to produce a greater variety of benefits, including selenium, chromium, iron, and zinc food supplements.

Therapeutic Usages: Kustha, Kandu, Kantharoga, Graharoga, Krimi, Ama, Pleeha and Sotha.

Pharmacological Studies: Antioxidant, antidiabetic, hyperglycemic, anxiolytic, antimicrobial, anticancer, antimutagenic, antiinflammatory, neuroprotective.

Contraindications: Known allergy to the plants of the Cruciferae family. It contraindicated in pitta disorders.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic. It may cause burning sensation, burning urination, bleeding disorders and gastritis in pitta dominant patient. Peogon meat fried in mustard oil acts as poison.

Precautions: Precaution should be taken during pregnancy and lactation and in children.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Seed powder 2 – 4 gm

Formulations: Maharasona Pinda, Brihat Dasamul Taila, Somraji Taila

References:

1. Kumar V, Thakur A, Barothia N, Chatterjee S. Therapeutic potentials of Brassica juncea: An overview. TANG; 2011; 1: 1-17.
2. Mishra A, Pragyandip D, Murthy PN, Siddique HH, Kushwaha P. Classical review on Rajika (Brassica juncea). Res Rev J Bot Sci. 2012; 1:18-23.
3. Yan T, Fangming D. Phytochemistry and biological activity of mustard (Brassica juncea): a review. Cyta-Journal of Food; 2020; 18(1):704–718
4. Harita P. Pharmacognosy and Phytochemical Analysis of Brassica juncea Seeds. Pharmacognosy Research.2014; 6: 47-54.
5. Kumar V, Kaur N, Wadhwa P. A Review Over the effect of Heavy Metabolism of Brassica juncea (L.) and Myristica fragrans. Asian Journal of Pharmaceutical Research. 2021; 11(2):97-203.

Ritha

Botanical Name: *Sapindus mukorossi* Gaertn.

Family: Sapindaceae

Synonyms:

Bangla	: रिठा (Ritha)
Hindi	: Reetha
Sanskrit	: Kumba beeja, Reetakaranja
Urdu/Unani/Tibb	: Pheenil, Reetha
English	: Soapnut, Washnut

Geographical Distribution: *Sapindus mukorossi* well known as soapnut, belong to family Sapindaceae. Also known as soapnut tree (Reetha), it is one of the most important trees of tropical and subtropical regions of Asia. It is native to Southern India, Southern China, Pakistan, Bangladesh, Hawaii, Caribben, Central America and Mexico.

Plant Descriptions

General Description: *Sapindus*, the genus belong to the family Sapindaceae, commonly known as Soap berry family by the presence of saponins, which are well known for their detergent properties. It is popular ingredient of ayurvedic preparation such as shampoo. The species is widely grown in upper reaches of the Indo-Gangetic plains, Shivaliks and sub-Himalayan tracts at altitudes from 200 to 1500 meter. The genus *Sapindus* includes two major species *S. mukorossi* and *S. emarginatus* in north and south India. It flowers during summer. The fruits appear in July – August and ripen by November – December. *Sapindus mukorossi* is one of the most important sources for saponins.



Figure 40. *Sapindus mukorossi* Gaertn.

Macroscopic Description:

Leaves: Leaves are 30-50 cm long, alternate, paripinnate; common petiole very narrowly bordered, glabrous; leaflets 5-10 pairs, opposite or alternate, 5-18 by 2.5-5 cm, lanceolate, acuminate, entire, glabrous, often slightly falcate or oblique; petioles 2-5 m long. Inflorescence: a compound terminal panicle, 30 cm or more in length, with pubescent branches.

Fruit: The fruit is a small leathery-skinned drupe 1-2 cm (0.39-0.79 in) in diameter, yellow ripening blackish, containing one to three seeds.

Bark: Bark is dark to pale yellow in colour, fairly smooth and having many vertical lines of lenticles and fine fissure exfoliating in irregular wood scales.

Microscopic Description:

Shape and size of epidermal cells: Single layered Adaxial epidermis with height: width ratio -1:2, covered by a thick cuticle; Abaxial epidermis: single layer with height: width ratio 1:1, covered by a thin cuticle.

Stomatal feature: Ranunculaceous (anomocytic) type of stomata, Homal and Hypostomatic (Only one type of stomata and present only on the abaxial surface) typically bean shaped, slightly projecting out from the neighbouring epidermal cells.

Cuticle: Usually smooth, without striations, thin on the abaxial surface, strongly thickened on adaxial surface.

Pattern of anticlinal epidermal wall: Usually straight, without any sinuous or papillose pattern

Part Used: Fruit, shell, shell powder, root and bark

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Tiksna (Strong)
Virya (Potency)	: Ushan (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Tridohsanasaka

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 10.3 % w/w
Acid insoluble ash	: Not more than 0.39 % w/w
Alcohol soluble extractive	: Not less than 2.5 % w/w
Water soluble extractive	: Not less than 8.6 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count,

	total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Major Chemical Constituents: The major constituents of *Sapindus mukorossi* fruit are saponins (10 %-11.5 %), sugars (10%) and mucilage. Saponins are secondary plant metabolites with divergent biological activities. *Sapindus* saponins are a mixture of six sapindosides (sapindosides A, B, C, D and mukorozi saponins (E₁ and Y₁), with sapindoside B as one of the major constituents. Different types of triterpene, saponins of oleanane, dammarane and tirucullane type were isolated from the galls, fruits and roots of *Sapindus mukorossi*.

Therapeutic Usages: Graharoga, Kustha, Kandu, Visha and Visphota.

Pharmacological Studies: Antibacterial, spermicidal, anti-trichomonas, insecticidal, anxiolytic, hepatoprotective, fungicidal, anti-inflammatory, antiplatelet aggregation, tyrosinase inhibition and free radical scavenging activities.

Contraindications: Known allergy to the plants of the Sapindaceae family. It is contraindicated in bleeding disorders.

Adverse Effects: It is abortifacient and spermicidal.

Precautions: Precaution should not take during pregnancy.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 1- 3 gm divided dose per day

References:

1. Singh S, Ali M. *Sapindus mukorossi*: A review article The Pharma Innovation Journal; 2019; 8(12): 88-96
2. Upadhyay A, Singh DK. Pharmacological effects of *Sapindus mukorossi*. *Revista do Instituto de Medicina Tropical de São Paulo*, 2012; 54(5), 273-280.
3. Krishnaveni A, Rani TS. Pharmacognostical and Preliminary Phytochemical Studies of *Sapindus trifoliatus* Vahl. *Ethnobotanical Leaflets*, 2008; 12: 820-826.
4. Ediriweera ERHSS, Premakeerthi WMSA, Perera AMHY. A Literary Review on *Sapindus trifoliatus* (Gaspenela) and Its Medicinal Values. *International Journal of Ayurveda and Pharma Research*. 9(2): 51-55.
5. Arulmozhi DK, Veeranjanyulu A, Bodhankar SL, Arora SK. Pharmacological investigations of *Sapindus trifoliatus* in various in vitro and in vivo models of inflammation. 2005; 37(2): 96-102.

Rudrakhha

Botanical Name: *Elaeocarpus ganitrus* Roxb.

Family: Elaeocarpaceae

Synonyms:

Bangla	: रुद्राक्ष (Rudrakhha)
Hindi	: Rudraksha
Sanskrit	: Rudraksha, Nameru
English	: Woodenbegar, Bead Tree

Geographical Distribution: *Elaeocarpus ganitrus* is a medium sized tree grows in many countries including India, Bangladesh, Bhutan, Maldives, Nepal, Pakistan, Indonesia, New Guinea to Australia, Guam, Hawaii and Srilanka. It is cultivated as an ornamental tree in various parts of India.

Plant Descriptions

General Description: *Elaeocarpus ganitrus* is a large evergreen grows up to 50-200 feet height big leaved tree. It is popular for its attractive fruit stones. Its beads are covered by an outer shell of blue color on fully ripening, hence also called blueberry beads. In ancient Indian medicine, the fruits were employed to ward off evil spirits and omens which can be considered to be at least partly manifestations of microbial infection.

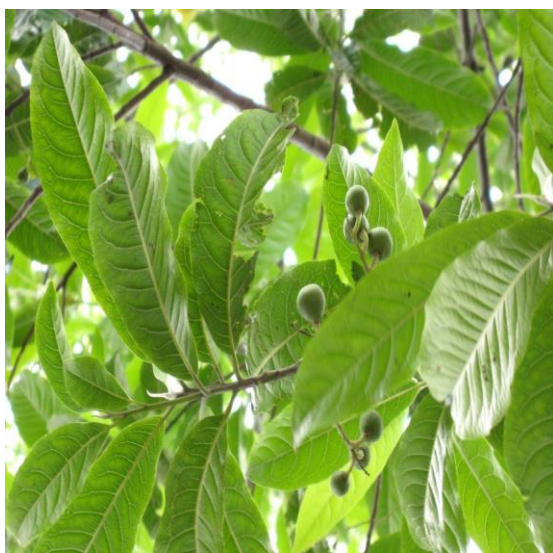


Figure 41. *Elaeocarpus ganitrus* Roxb.

Macroscopic Description: Leaves are 5-6 inch length, 2 inch broad, Simple, glabrous, oblong-lanceolate, sub-entire or irregularly crenate, acute or acuminate. Flowers are white or yellow colored, in dense racemes and mostly from axils of fallen leaves, fringed petals, anthers are linear, appear in April-may. Fruits are round or oval, small, violet or blue colored and acidic in taste. Endocarp- Stony endocarp is hard, globular, strongly tubercule, marked with 5 to longitudinal ridges, rarely 1 to 4, reddish brown in color.

Microscopic Description: The transverse section of leaf was divided into three regions of epidermis, mesophyll and vascular bundle. The epidermis was found in both upper and lower surface. It was found to be single layered, compactly arranged parenchyma cells covered externally with a cuticle. Mesophyll: Mesophyll was found to be present in between the two epidermal layers (Upper & Lower). It comprised of palisade cells which were made up of two layers of elongated, compactly arranged chlorenchyma cells, found only in the lamina region. Spongy parenchyma was also found which consisted of a few layers of loosely arranged oval chlorenchyma cells. A few vascular strands, prisms of calcium oxalate were also found in the mesophyll. Midrib: The epidermal layers were found to be continuous over the midrib region. 2-3 layers of collenchyma cells were found below the upper epidermis and above the lower epidermis. Bulk of the midrib region is made up of oval parenchyma cells which are arranged without intercellular spaces. A few prisms of calcium oxalate were also found scattered in the cells of the midrib. 3-9 vascular bundles are found in the centre of the midrib region. The vascular bundles are described as conjoint, collateral and closed. A patch of pericyclic fibres were found above and below each vascular bundle. Stomata: The stomata were found to be large no. in leaf. They were present in lower epidermis. The type of stomata is paracytic because stomata comprise two guard cells covered by two subsidiary cells; the long axes are parallel to that of stomata.

Powder microscopy: In the powdered preparation, square shaped calcium oxalate crystals were present. Xylem vessels were found to be lignified, pitted walls and some of these having spiral arrangements. Ground tissues were found to be thin walled & polygonally arranged. Xylem and phloem parenchymatic cells, spongy parenchyma, unicellular trichomes were observed. Starch grains present were circular to oval in shape.

Part Used: Seed

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet)
Guna (Attribute)	: Guru (Heavy), Snigdha (Oily), Tikсна (Hot)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Pacifies Vata & Pitta

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 4.6 % w/w
Acid insoluble ash	: Not more than 1.7% w/w
Alcohol soluble extractive	: Not less than 5.1 % w/w
Water soluble extractive	: Not less than 9.23 % w/w

Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of alcoholic extract on precoated Silica gel 'G' plate (Merck), using a huge number of solvent systems were checked to achieve a good resolution. Finally, the solvents hexane: ethyl acetate: acetic acid was used. Thin layer chromatographic studies of the hexane extract of *Elaeocarpus Ganitrus*. Solvent system I Hexane: Acetic acid (9:1), 3 spots were visible R_f values 0.24, 0.37 and 0.58. In solvent system II Hexane: Ethyl acetate: Acetic acid (5:4:1), 1 spot detected R_f value 0.87. In solvent system III Hexane: Ethyl acetate: Acetic acid (4:4:2), 1 spot detected R_f value 0.84. In solvent system IV Hexane: Ethyl acetate: Acetic acid (3:6:1), 2 spots were visible R_f values 0.08 and 0.92. In solvent system V Hexane: Ethyl acetate: Acetic acid (2:7:1), 3 spots were obtained having R_f of 0.09, 0.81 and 0.94.

Major Chemical Constituents: Active constituents present in Rudraksha are elaeocarpidine, elaeocarpine, rudrakine, flavonoids quercetin. Extracts shows presence of phytosterols, fat, alkaloids, flavonoids, carbohydrates, ethanol, proteins and tannins, gallic acid and ellagic acid. It contains 50.03% C, 0.95% N, 17.89% H, and 30.53% O₂. Extraction with ethanol ether shows presence of alkaloids, flavonoids, carbohydrates, proteins, tannins. Extraction with water shows presence of carbohydrates, proteins, tannins.

Therapeutic Usages: Cerebral sedative, expectorant, liver tonic and febrifuge and is useful in epileptic fits, melancholia, manic conditions, mental disorders convulsions, insomania, cephalagia, hypertension and bronchitis etc.

Pharmacological Studies: Anti-inflammatory, analgesic, sedative, antidepressant, antiasthmatic, hypoglycemic, antihypertensive, smooth muscle relaxant, hydrocholeretic, antiulcerogenic and

anticonvulsant. In addition, the Rudraksha extracts also known to exhibit very high antimicrobial and nephroprotective activity.

Contraindications: Known allergy to the plants of the Elaeocarpaceae family. It is contraindicated in concomitant use of antidepressant and hypnotic drug.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic dose but high dose it may cause sedation. In the acute oral toxicity study, EGA showed no mortality till the 5 gm/kg dose in mice.

Precautions: Precaution should be taken during pregnancy and lactation.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 1-3 gm twice a day with appropriate adjuvant

Formulations: Durlava Ras, Bamanamrita Ras

References:

1. Gaurav AD. Effect of extract of rudraksha (elaecarpus ganitrus) on parkinson's disease and depression. World Journal of Pharmaceutical Research.; 2018; 7(12):937-947.
2. Singh B, Chopra A, Ishar MP, Sharma A, Raj T. Pharmacognostic and antifungal investigations of Elaeocarpus ganitrus (Rudraksha). Indian journal of pharmaceutical sciences, 2010; 72(2), 261–265.
3. Kumar G, Karthik L, Rao B. A Review on Medicinal Properties of Elaeocarpus ganitrus Roxb.ex G. Don. (Elaeocarpaceae). Research Journal of Pharmacy and Technology. 2014; 7:1184-1186.
4. Tewari D, Kumar P, Sharma P. Pharmacognostical Evaluation of Elaeocarpus sphaericus (Rudraksha) Leaves. International Journal of Pharmacognosy and Phytochemical Research. 2013; 5. 147-150.
5. Tripathy S, Mida A, Ranjan SS. Phytochemical screening and thin layer chromatographic studies of elaeocarpus ganitrus seed the magical electromagnetic bead (rudraksha). International Journal of Pharmacy and Biological; 2016; 6(3):16-24
6. Rao GHJ, Lakshmi P. Sapindus trifoliatus: A Review. International Journal of Pharmacy & Technology, 2012; 4(3):2201-2214.

Sara

Botanical Name: *Saccharum munja* Roxb.

Family: Poaceae

Synonyms:

Bangla	: শর (Sara)
Hindi	: Sarkand, Munja
Sanskrit	: Bhadra, Munja
Urdu/Unani/Tibb	: Munja, Sarkanda
English	: Thatch-Grass

Geographical Distribution: The common name of the plant is Kana or sarkanda or Moonja and is distributed from north and North West India to Pakistan, Bangladesh and Afghanistan. It is mostly found in arid areas and along river banks in Bangladesh.

Plant Descriptions:

General Description: *Saccharum munja* belongs to the family Poaceae. It is commonly famous as Munj in Hindi and used in religious ceremonies. This grass also forms the raw material for manufacture of a variety of handicrafts, furniture and huts. It is perennial and reed like grass which colonized easily without any maintenance and no inputs are required. More importantly, in drought condition this plant is tough and beautiful. It grows up to 7ft in height. The flowering season of this tropical grass is from October to December in Bangladesh.

Macroscopic Description: Roots are adventitious porous, numerous, arising from a common root stock, cylindrical, 5-30 cm long, 0.1-0.5 cm in diameter, pale straw colored with attached rootlets, bark papery; fracture splintery. It has no specific odor and taste.



Figure 42. *Saccharum munja* Roxb.

Microscopic Description: Root stock shows single layered epidermis, consisting of slightly oval, thin-walled cells, a few elongated, pointed, aseptate, long unicellular hairs arise from epidermis; cortex composed of 2-3 layered, elongated, thick-walled, palisade-like cells and 3-4 layers of thin-walled, oval to polygonal parenchymatous cells; endoderm is consisting of thin-walled, single layered cells, followed by 6-9 layered, thick-walled, lignified, polygonal, continuous ring of sclerenchymatous cells; pericycle single layered, composed of very small, thin-walled cells beneath endoderm is; ground tissues wide, composed of thin-walled, oval to polygonal, elongated parenchymatous cells having numerous, round to oval starch grains measuring 8-24 μ in diameter, scattered 'U' shaped vascular bundle with sheath, also seen in this region.

Powder - Dark brown; shows fragments of thin-walled, tabular, somewhat rectangular, epidermal cells in surface view, oval to polygonal: thin-walled parenchymatous and thick-walled polygonal sclerenchymatous cells, pointed unicellular hairs, vessels with reticulate thickening, small round to oval starch grains, measuring 8-24 μ in diameter

Part Used: Root, stem, upper leaves

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter)
Guna (Attribute)	: Sara
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Pittahara, Vrsya, Srmahara

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 7 % w/w
Acid insoluble ash	: Not more than 4 % w/w
Alcohol soluble extractive	: Not less than 3 % w/w
Water soluble extractive	: Not less than 4 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.

Pesticides residues : According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) one fluorescent zone at Rf. 0.83 (green). On exposure to Iodine vapour three spots appear at Rf. 0.30, 0.83 and 0.90 (all yellow). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 105°C six spots appear at Rf. 0.13, 0.23, 0.30 (all dull yellow), 0.69, 0.83 and 0.90 (all grey).

Major Chemical Constituents: The plant stem, flowers and adjacent soil found to have nutrients such as sodium, potassium, calcium, magnesium, iron, chlorides, bicarbonates, sulphates and phosphates which are responsible for its medicinal importance. It contains valuable phytoconstituents such as Quinones, Terpenes, Alkaloids, Saponins, Tanins, Carbohydrates, Proteins, Coumarins, Phenolic compounds, Steroids and Glycosides.

Therapeutic Usages: Raktapitta, Mutarakrcchra, Aemari, Daha, Raktadosa, sotha and Ksaya.

Pharmacological Studies: Antiinflammatory, antifungal, antimicrobial activity, galactagogue and diuretic, purgative, and aphrodisiac activity. It stimulates lactation in nursing mothers and spermatogenesis in men.

Contraindications: Individual intolerance, allergic reaction and hypersensitivity.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic dose but high dose can cause an allergic reaction.

Pregnancy and lactation: It is safe in pregnancy and lactation

Precautions: No known yet. But caution may be taken in diarrhea.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 3 - 6 gm and decoction 50 -100 ml.

Formulations: Trina Panchamula Kwath

References:

1. Anonymous, Kasa (Root Stock). The Ayurvedic Pharmacopoeia of India, PART- I, Volume III, page 88
2. Pandey VC, Singh K, Singh RP, Singh B. Naturally growing *Saccharum munja* L. on the fly ash lagoons: A potential ecological engineer for the revegetation and stabilization. *Ecological Engineering*, 2012; 40; 95–99
3. Sandeep R, Navneet N, Gaurav S, Manisha A, Suraj B, Sandeep G, Shwali S, Singh P, Kapoor R. Medicinal Aspects of *Sacchrum munja*. *Research J. Pharm. and Tech.* 2010;3(3):636-639.
4. M. Sathya and R. Kokilavani. Effect of *Saccharum spontaneum* Linn. on Lysosomal enzymes of Urolithiatic rats. *Journal of Applied Pharmaceutical Science*. 2012; (9):122-126.
5. Graham DB, Josef NS, Kushner NS, Kristin S. The reproductive biology of *Saccharum spontaneum* L.: implications for management of this invasive weed in Panama. *NeoBiota*, 20;61-79.

Saibal

Botanical Name: *Ceratophyllum demersum* Linn.

Family: Ceratophyllaceae

Synonyms:

Bangla	: শৈবাল (Saibal)
Hindi	: Sevar
Sanskrit	: Shaivala, Jalaja
Urdu/Unani/Tibb	: Shinblan
English	: Coon tail, Hornwort

Geographical Distribution: *Ceratophyllum demersum* can be found in ponds, lakes, ditches, and quiet streams with moderate to high nutrient levels. Plant occurs all through world in aquatic circumstance e.g. tanks, Ponds, riverbeds, seacoasts. The plant is distributed in large areas of the world in Europe, Asia, and Northern Africa.

Plant Descriptions:

General Description: It is a submerged perennial macrophyte which normally grows with the base of its stem buried in sandy or silty substrates. It does not form roots. It grows in waters that are clear or turbid, still or flowing, and warm or ice-covered. *C. demersum* growth with its peak at summer may be attributed to the environmental conditions that should be changed to be more appropriate, while the environmental conditions are not suitable to growth of macrophytes at winter. *Ceratophyllum demersum* L. (CD) is eight inches to three feet in length and Leaves close around one inch long which are spread in water & shaping net-like, between together, over the water surface, step by step a thick inclusion on the water surface.



Figure 43. *Ceratophyllum demersum* Linn.

Macroscopic Description:

Leaf: The 1.6- 4 cm long leaves are branched into 2 (sometimes 4) straightened or linear segments with minor teeth along one edge. The leaves are regularly fairly hardened or crunchy. They are arranged in whorls of 5 to 13 leaves with the whorls getting thick towards the stem tip.

Stem: Prolong, 30cm- 60 cm long, unreservedly fanning and either delicate solidly extend or string like and versatile; hubs 1cm- 3 cm separated however becoming crowded near the tips.

Root: Roots are missing, replaced by finely isolated basal stem branches named 'rhizoid shoots' Floats openly underneath the surface, or is in some cases anchored to the base by altered leaves, particularly in streaming water.

Flower: Greenish, Tiny, little to one mm long, unisexual, separated & sessile in leaf bases, every subtended in 9- 12 calyx-like bracts, male & female blossom by occur independently on the similar plant.; female blossom brief ovary surmounted by a solitary straightforward style and single; The male blossoms happen two by two on inverse sides of the stem, with 12 to 15 sessile elongated anthers each ending in 2 sharp focuses. Blooming happens from June to September.

Fruit: The little (4-7mm), Black ellipsoid achenes, hard, one-seeded, egg shaped fruit has 3 long spines, one spine at the fruit tip and 2 at the base.

Seed-The fruit goes about as seed

Microscopic Description:

Xylem and phloem occur in *Ceratophyllum* stems; roots are lacking in the genus. In larger stems, a central core of elongate cells contains scattered sieve tube elements with simple sieve plates; the sieve tubes are associated with companion cells. Sieve tubes are not organized into phloem strands. The central core of main and branch stems contain elongate cells, some of which lack starch and tannins. These cells lack any evidence of the annular or helical thickenings of secondary wall material characteristic of primary xylem in other vascular plants, and therefore xylem cannot be claimed for *Ceratophyllum*.

Part Used: Whole plant

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (light), Snigdha (Oily)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Tridosha shamaka

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 7 % w/w
Acid insoluble ash	: Not more than 4 % w/w
Alcohol soluble extractive	: Not less than 3 % w/w

Water soluble extractive	: Not less than 4 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established national guideline.

Major Chemical Constituents: The plant CD extracts comprise of various types of phytochemicals for example, flavonoids, alkaloids, glycosides, tannins & cardiac glycoside. CD incorporates magnesium, calcium dry matter, nitrogen free extract, crude protein, crude fibre, crude Fat & ash.

Therapeutic Usages: Raktapitta, Shosha, Santapa, Vrana, Daha and Trishna.

Pharmacological Studies: Antidiarrhoeal, antioxidant, antimicrobial potential, anti-inflammatory, antineoplastic potential, antipyretic action, and antiulcer action.

Contraindications: Individual intolerance, allergic reaction and hypersensitivity.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic dose but high dose can cause an allergic reaction.

Pregnancy and lactation: Precaution should be taken during pregnancy and lactation.

Precautions: No known yet.

Dosage Forms: Crude drug, decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Swarasa 10-20 ml.

Formulations: Himsagar Taila

References:

1. Al-Kenzawi MAH, Hassan FM, Al-Mayah AAA. The Distribution of *Ceratophyllum demersum* L. in Relation to Environmental Factors in Restored Al-Mashb marsh, Hor Al-Hammar, Southern Iraq. *Marsh Bulletin*, 2012;7(2) 137-149.
2. Abu T. A Review: Aquatic Macrophyte *Ceratophyllum demersum* L. (Ceratophyllaceae): Plant Profile, Phytochemistry and Medicinal Properties. *International Journal of Science and Research*; 2017; 6(7):394 –399
3. Mishra S, Srivastava S, Tripathi RD, Kumar R, Seth CS, Gupta DK. Lead detoxification by coontail (*Ceratophyllum demersum* L.) involves induction of phytochelatins and antioxidant system in response to its accumulation. *Chemosphere*. 2006 Nov;65(6):1027-39.
4. Hreeb KK. Effect of different water temperatures on growth of aquatic plants *Salvinia natans* and *Ceratophyllum demersum*. *Journal of Coastal Life Medicine* 2017; 5(1): 13-15

Shiyal Kata

Botanical Name: *Argemone mexicana* Linn.

Family: Papaveraceae

Synonyms:

Bangla	: শিয়াল কাটা (Shiyal kata)
Hindi	: Satyanasi, Kataila
Sanskrit	: Katu parni, Svarna Kshiri
Urdu/Unani/Tibb	: Baramdaandi
English	: Mexican poppy,

Geographical Distribution: *Argemone mexicana* Linn. belongs to the Papaveraceae family under genus *Argemone*, which is commonly known as Mexican or prickly poppy. It is native to tropical America, but has widely spread too many tropical and sub-tropical regions. It is frequently found as a weed in cultivated and abandoned fields. The species is found in Asia, Africa, North America, Central America, the Caribbean, South America, Europe, and Oceania. This plant is common everywhere by roadsides and fields in Bangladesh as well.

Plant Descriptions:

General Description: *Argemone mexicana* Linn. is a widespread annual, hermaphroditic weed primarily associated with agricultural crops and wastelands. It is a major weed of a number of crops in the tropics and warm temperate regions and is persistent as it produces a seed bank. It is a shrub, mostly pollinated by insects, with terminal bright yellow flowers. In South Africa the seeds of *A. mexicana* have been declared as 'noxious' as its seeds or bits of seeds may represent a hazard to human or animal health when consumed.



Figure 44. *Argemone mexicana* Linn.

Macroscopic Description: The plant is an erect prickly annual herb of about 1-meter-high; leaves are usually 5 to 11 cm long, and more or less blotched with green and white, glaucous broad at the base, half-clasping the stem prominently sinuate-lobed, and spiny. The flowers become 4 to 5 cm in diameter, and are terminal, yellow, and scentless. The capsule is spiny, obovate or elliptic-oblong, and about 3 cm in length. The seeds are spherical, shining, black and pitted.

Microscopic Description: Stamens are polyandrous, indefinite with complete, introse and yellow anthers. Gynoecium has 4-6 carpels, syncarpous with unilocular superior ovary and parietal placentation. Roots are long and subcylindrical. *Argemone mexicana* contains light yellow coloured fat oil which is obtained by pressurizing the seeds. Argemone oil is raw tasted and slightly has nauseous odour which can be easily saponified. The powdered aerial part sample was treated (mounted) with appropriate chemical reagents on microscope slides and observed under the microscope to ascertain the presence or absence of chemical substances as follows: phloroglucinol plus conc. hydrochloric acid for lignin, ferric chloride solution for tannins, sudan iv solution for oil, N/50 iodine solution for starch, million's reagent for proteins and chloral hydrate plus hydrochloric acid for calcium oxalate.

Part Used: Root, Seed, Latex, Seed oil

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (light), Rooksha (Dryness)
Virya (Potency)	: Sita (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Balance Kapha and pitta, Rechani, Shodhani, Utkleshakarini

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 16.7 % w/w
Acid insoluble ash	: Not more than 2.9 % w/w
Alcohol soluble extractive	: Not less than 17.2 % w/w
Water soluble extractive	: Not less than 34.3 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

Major Chemical Constituents: Most of the isolated compounds belong to the class of alkaloids; besides, terpenoids, flavonoids, phenolics, long-chain aliphatic compounds, and few aromatic compounds are found. Alkaloids include berberine, protopine, protopine hydrochloride, sanguinarine, and dihydrosanguinarine. The seed contains oil 35%, protein 24%, saturated fatty acid 14.2%–14.5% and unsaturated fatty 84.2%–84.8%. The oil consists mainly of linoleic acid (54%–61%) and oleic acid (21%–33%).

Therapeutic Usages: Krimi, Visa, Raktajit, Raktapitta, Mutrakricha, Ashmari, Daha, Jwara, Kamla, Kandu and Anaha.

Pharmacological Studies: Antibacterial, antifungal, fungitoxic, vasoconstrictor and vasorelaxant effects, anti-stress and antiallergic, antihelmintic and antiprotozoal activities.

Contraindications: It is contraindicated in Colitis, IBS, Diarrhoea, dysentery and hypersensitivity.

Adverse Effects: It is usually safe within recommended therapeutic dose but high dose can cause purgation, dehydration and abdominal pain.

Pregnancy and lactation: It is not suitable during pregnancy, lactation and in children.

Precautions: These seeds are found some times adulterated with Black mustard. Argemone oil in edible mustard oil is reported frequently responsible for outbreaks and epidemic dropsy.

Dosage Forms: Crude drug, decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 1-3 gm, Swaras 5 -10 ml, Latex 5 -10 drops and Seed oil 10 -30 drops.

Formulations: Kasisadi Tail

References:

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Shewra

Botanical Name: *Streblus asper* Lour.

Family: Moraceae

Synonyms:

Bangla	: শেওড়া (Shewra)
Hindi	: Sahora, Sihoda
Sanskrit	: Sokhota, Pitaphalaka
Urdu/Unani/Tibb	: Sehoda
English	: Sand Paper Mulberry

Geographical Distribution: *Streblus asper* Lour. belongs to the family Moraceae is a small tree which is indigenous to tropical countries such as India, Bangladesh, Sri-Lanka, Malaysia, the Philippines and Thailand.

Plant Descriptions:

General Description: *Streblus asper* known as Demon tree is an important medicinal plant. It is known by various names, e.g. Berrikka, Rudi, Sheora, Koi, Siamese rough bush and Tooth brush tree. *Streblus asper* is an unarmed shrub or a small tree about 10-meter-high with pubescent or tomentose branchlets. The tender twigs of the tree are used as tooth brush as they show selective bactericidal activity towards bacteria responsible for tooth cavities. Brushing with twigs also helps in pyorrhea.

Powder - Light-grey; shows, phloem fibres, thick and thin-walled stone cells and a large number of oblique, rectangular, prismatic crystals of calcium oxalate.



Figure 45. *Streblus asper* Lour.

Macroscopic Description: Mature stem bark occurs in channelled pieces; thickness varies from 0.3-1 cm; outer surface light grey to silvery brown with faint ridges and a number of lenticels making the surface quite rough; inner surface smooth and brownish in colour; fracture, tough, brittle on the outer portion and fibrous in the inner portion; no taste and odour.

Microscopic Description: Shows a cork consisting of 4-10 layers of thin-walled, rectangular and tangentially arranged cells; cork cambium single layered; secondary cortex Consists of 3-4 layers of thin-walled, somewhat rectangular or circular to polygonal cells; a number of stone cells present either in singles or in groups in tangential bands; stone cells of two types, one having thick-walled and narrow lumen while the other having comparatively thinner wall and wider lumen; they vary in shape, being rectangular, oval, circular to conical, each with simple pits on their walls and radiating canals; secondary phloem consists of sieve elements, parenchyma, phloem fibres and stone cells, traversed by phloem rays; phloem parenchyma thin-walled, circular to oval in shape, phloem fibres moderately thick-walled and lignified with wide lumen, occurring in singles or in groups and radially arranged; stone cells similar to those present in cortical region, occur throughout the phloem; phloem rays thin-walled, rectangular and radially elongated in transverse section, a few ray cells also converted into stone cells; prismatic crystals of calcium oxalate occur throughout the tissues of bark.

Part Used: Root, Bark and leaves

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Rooksa (Dryness)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Sothahara, Medohara, Vata-slesmahara

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 15 % w/w
Acid insoluble ash	: Not more than 2 % w/w
Alcohol soluble extractive	: Not less than 3 % w/w
Water soluble extractive	: Not less than 12 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella</i> spp, <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9: 1) shows under UV (366 nm) six fluorescent zones at Rf. 0.11, 0.18 (both light blue), 0.28 (pink), 0.36 (blue), 0.41 (pink) and 0.93 (blue). On exposure to Iodine vapour eight spots appear at Rf. 0.11, 0.28, 0.41, 0.52, 0.60, 0.76, 0.86 and 0.93 (all yellow). On spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 110°C seven spots appear at Rf. 0.11, 0.28 (both light brown), 0.36, 0.41, 0.52, 0.76 (all light violet) and 0.93 (dark brown).

Major Chemical Constituents: *Streblus asper* is a rich source of cardiac glycosides namely kamloside, asperoside, strebloside, indroside, canno- dimemoside, strophalloside, strophanolloside, 16-O-acetyl- glucogitomethoside, glucogitodimethoside, glucokamloside, sarmethoside and glucostrebloside. The other glycosides reported from the roots include b-sitosterol-3-O-b-d-arabino-furanosyl-O-a-l-rhamnopyranosyl-O-b-d-glucopyranoside. From the stem bark of this plant, a-amyrin acetate, lupeol acetate, b-sitosterol, a-amyrin, lupeol and diol, streblo- side and mansonin have been isolated.

Therapeutic Usages: Raktapitta (bleeding disorder), Arsha (piles), Shlipada (filaria), Apachi (scrofula glandular swellings), Prameha (urinary problems), Kushtha (skin disease), and Gandamala (cervical lymphadenitis).

Pharmacological Studies: Antifilarial, anticancer, antimicrobial, antiallergic, insecticidal, antiparasitic and antimalarial activities.

Contraindications: It is contraindicated in individual intolerance, allergic reaction, hypersensitivity, arrhythmia, peptic ulcer disease and oedema.

Adverse Effects: It is recommended as safe and non-toxic within recommended therapeutic dose but high dose can cause constipation and stomach irritation. It contains cardiac glycosides. Study show higher dose increases heart rate and cause slight oedema of heart muscles in dose dependent manner.

Pregnancy and lactation: It is better to avoid during pregnancy and lactation

Precautions: It is hot in nature, so should be used with caution in summer and by hot temperament individuals and menstruating women.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 1-3 gm and decoction 10 -20 ml.

Formulations: Manjisthasav, Sukrasanjibani Modak

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Suranjan

Botanical Name: *Colchicum luteum* Baker.

Family: Colchicaceae (Liliaceae)

Synonyms:

Bangla	: সুরাঞ্জন (Suranjan)
Hindi	: Hirantutiya, Surinjin, Barbari
Sanskrit	: Hiranyatutha, Tuthanjana
Urdu/Unani/Tibb	: SuranjanTalkh
English	: Golden collyrium

Geographical Distribution: It is widely distributed in China, India, Pakistan, Turkestan and Afghanistan. *Colchicum luteum* grows in India from Kashmir to Chamba. It is generally found in areas of the Himalayan region extending up to the HindKush Mountains.

Plant Descriptions

General Description: *Colchicum luteum* Baker belongs to the family Colchicaceae (Liliaceae), a type of lily plant with yellow flowers. It is found growing on grassy slopes in the temperate Himalayas. There are two varieties of Suranjan available in the market, Sweet (Suranjan Shirin), and Bitter (Suranjan Talkh). The bitter variety contains alkaloid Colchicine in fairly large amount whereas Sweet variety contains traces of this alkaloid in physiologically inactive form. Suranjan Talkh is differentiated from Suranjan Shireen by its bitter taste, smaller size, and darker color.



Figure 46. *Colchicum luteum* Baker.

Macroscopic Description: It is a small perennial herb attaining a height of 2-10 inches. The leaves are alternate or less often opposite or whorled, broad linear shape with a dimension of 12-18cm x 0.8-2cm. The flowers are nearly always bisexual and actinomorphic. Corms are light brown in color and opaque with a bitter taste.

Microscopic Description: In the transverse section, it appears reniform (kidney shaped) being depressed in the region of the groove. The epidermis consists of rectangular cells, some of which contain a few starch grains. Below the epidermal layer is a thin-walled hypoderm composed of similar cells but devoid of contents. The ground tissue is composed of thin-walled parenchyma densely loaded with starch. Some of the cells near the periphery on the grooved side are more or less crushed laterally forming 2-4 fine streaks. There are numerous scattered vascular bundles mostly located in the central region of the corm near the basal bud. The bundles near the periphery are poorly developed and more scattered. The vascular bundles are collateral with occasional bicollateral bundles. The xylem consists of annular or spiral elements. The starch grains in the parenchymatous ground tissue are simple, ovoid, spherical or polyhedral. They vary in size from 2 – 21 microns and possess a 2 – 6 angled stellate hilum.

Part Used: Root, corm or rhizome

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Rooksa (Dryness)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphavata shamaka

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 2.92 % w/w
Acid insoluble ash	: Not more than 0.783 % w/w
Alcohol soluble extractive	: Not less than 0.719 % w/w
Water soluble extractive	: Not less than 6.318 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonellaspp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.

Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: Thin layer chromatography of petroleum ether extract of the drug was carried out on aluminium plates precoated with Silica gel-G (Layer thickness 0.20-0.25 mm) for all extracts in various phases later sprayed by different spraying reagents. The R_f value are found as 0.26, 0.53 and 0.90.

Major Chemical Constituents: Chemical analysis reveals the presence of Colchamine, 3-desmethylamine, 3-dimethyl-β-lunicolchamine, 3-desmethylcolchamine, β-lunicolchicine, N-desacetyl-N-formylolchicine, Luteidine, New alkaloid L-5 and L6, Lutiene and Collutine N-oxide.

Therapeutic Usages: Pradaha (inflammation), Sotha (Swelling), Sandhivata (joint pain), Batrakta (gout), Gridharshi (sciatica), Sandhipradaha (Osteoarthritis), Amavata (rheumatoid arthritis), Ajirna (indigestion), and Healing of wounds.

Pharmacological Studies: Antioxidant, anti-inflammatory, analgesic, antigranuloma, antifungal and anti-gout activities.

Contraindications: It is contraindicated in debility, cardiac, kidney, or gastrointestinal problems.

Adverse Effects: If consumed in increased dosage it may causes intoxication along with nausea, vomiting, diarrhea, alopecia, aplastic anemia, diarrhea, enterosis, leukopenia, myopathy, nausea, skin alterations, vomiting, violent purging, serious inflammation of the stomach, and bowels, and death.

Pregnancy and lactation: Do not take in pregnancy. It may cause fetal abnormalities.

Precautions: Suranjan is included in list of poisonous plants. It must be used with caution. It is toxic plant due to the presence of several alkaloids (mainly colchicine, demecolcine, and colchicoside), which are present in all plant parts. It must not be used for a longer period of times. Prolonged use may cause agranulocytosis (deficiency of granulocytes in the blood, causing increased vulnerability to infection), aplastic anemia (deficiency of all types of blood cell caused by failure of bone marrow development), and peripheral nerve inflammation (damage to or disease affecting nerves).

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 125 -750 mg, Extract 60 -120 mg and decoction 10 -20 ml.

Formulations: Negendra Bati, Tribhrityadi Bati

References:

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Taklebu

Botanical Name: *Citrus medica* Linn.

Family: Rutaceae

Synonyms:

Bangla	: টক লেবু (Taklebu)
Hindi	: Bijoura
Sanskrit	: Matulunga
Urdu/Unani/Tibb	: Turanj
English	: Wild Lemon, Citron

Geographical Distribution: Citrons are only grown commercially in locations where warm temperatures can be guaranteed. Currently, citrons are grown for religious uses are produced in Israel along the Mediterranean coast, Italy, and Morocco, with minor production in Greece. Citrons are grown extensively in China, Southeast Asia, and Korea, mostly for medicinal purposes and a little for ornamental use. In Bangladesh it grows allover the country.

Plant Descriptions:

General Description: The species name *medica* indicates that Linnaeus thought that the origin of citron was in Medea/Persia (modern-day Iran), and does not, as is sometimes mistakenly thought, refer to the medicinal value of the fruit. *Citrus medica* Linn is a slow-growing shrub or small tree reaching up to 15 ft (4.5 m) in height with stiff branches and twigs and spines in the leaf axils. The flower buds are large and white or purplish. The citron tree is probably the most cold-sensitive tree. Temperatures lower than 10°C can cause significant injury to the tree and can destroy the current flower or fruit load.



Figure 47. *Citrus medica* Linn.

Macroscopic Description: Leaves are 3-6 inch long, elliptic-ovate or ovate-lanceolate with sort, wingless or nearly wingless petioles. Flowers are 5-10 in a raceme, small or middle-sized; petals are generally more or less pink. Fruit-hesperidium, 5-10 cm long, ovoid, oblong or globose, nipple-shaped at the end with thick, rough or irregular or warted rind; dark green when unripe and yellow when ripe; pulp, pale yellow; taste, acidic and sweetish.

Microscopic Description:

Petiole-Transverse section of petiole showed thin single layer of epidermis with cuticle. Below the layer of epidermis many (12-16) layers of chlorenchymatous cells were situated. Upper 3 to 4 layers of chlorenchyma were arranged compactly which contain chloroplast while cells of lower layers were larger and pentagonal in shape with more intercellular space. Radially intermittently arranged 5 to 7 layer of lignified sclerenchymatous pericyclic fibres, situated between endodermis and vascular bundles covered the vascular bundles. Between two groups of this pericyclic fibre tissue cortex cells containing chloroplast were extended. These tissues provide strength to the vascular bundles. Vascular bundles were conjoint, collateral, discontinued ring situated at the centre. Xylem, radially arranged vessels, was composed by xylem fibres and xylem parenchyma. Central part was occupied with thin-walled polygonal pitted paranchymatous cells with intercellular space in between them. The lysigenous cavities were found in the upper lamina portion.

Midrib and lamina-Diagrammatic section through mid rib showed upper epidermis, lower epidermis and centrally located vascular bundle. Detailed Transverse section revealed epidermis, hypodermis with prismatic crystals, chloronchymatous cells which were continuous with palisade layer of lamina, chlorenchyma, fibrous ring of pericyclefibres, conjoint vascular bundles and pith centrally. Around the vascular bundle, the phloem tissues were surrounded (from the outside) with an incomplete ring of thick-walled fibres (sclerenchyma). This ring was composed of 1-5 layers of compact, donut-shaped fiber cells with very thick, apparently highly lignified, secondary walls.

The fibrous ring was wider (with more layers) in the center, especially on the lower side of the midrib, tapering towards the sides leaving a large gap (devoid of these fibers) on both sides of the vascular bundle. Several smaller gaps were also observed on both the lower and upper sides of the fibrous ring, and these gaps, in addition to the larger gaps on the sides, were occupied with much thinner-walled cells similar to those of the ground parenchyma. Central part occupied with thin-walled polygonal pitted paranchymatous cells with intercellular space in between them. The T.S. of lamina of leaf showed the presence of single layered epidermal cells; mesophyll differentiated into upper elongated compactly arranged palisade cells and lower oval to round shaped spongy parenchyma of 5 to 6 layers with intercellular spaces. The lysigenous cavities were found in the upper lamina portion and also in the ground tissue. Stomata were parasitic and present on lower surfaces only. Vascular bundles were conjoint,

collateral, discontinued ring situated at the centre. Xylem radially arranged vessels, were composed of xylem fibres and xylem parenchyma. Phloem was present lower side of xylem consists phloem fibres and sieve elements.

Powder microscopy. The powder microscopy of *C. medica* showed epidermal peeling, isolated vascular strands, trichome, parenchyma cells, paracytic stomata and the guard cells containing prismatic crystal. Isolated xylem elements were seen united in a bundle. The bundle consists of vessels, fibres and parenchyma cells. Separated parenchyma cells of the mesophyll tissue, crystal fibres, simple fibre, oil globules and fragment of annular vessels were seen scattered in the powder.

Part Used: Root, fruit and leaves

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Amla (Sour)
Guna (Attribute)	: Laghu (Light), Snighda (Oily)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Amla (Sour)
Karma (Action)	: Dipana, Hrdya, Kaphahara, Medhya, Pittahara, Vatahara,

Purity and Safety Test

Foreign matter	: Not more than 2 % w/w
Total ash	: Not more than 5 % w/w
Acid insoluble ash	: Not more than 0.2 % w/w
Alcohol soluble extractive	: Not less than 20 % w/w
Water soluble extractive	: Not less than 40 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more

than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of alcoholic extract on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows under U.V. (3661 nm) seven fluorescent zones at Rf. 0.03 (light sky blue), 0.08 (yellowish green), 0.11(light sky blue), 0.19(light sky blue), 0.39 (light sky blue), 0.56 (dark sky blue) and 0.66 (light sky blue). On exposure to Iodine vapour ten spots appear at Rf. 0.03, 0.04, 0.08, 0.11, 0.16, 0.38, 0.43, 0.53, 0.72 and 0.93 (all yellow).

Major Chemical Constituents: Citrus fruits are recognized as an important component of the human diet, providing a variety of constituents important to human nutrition, including vitamin C, folic acid, potassium, flavonoids, pectin, and dietary fibres. Citrus also contains significant amounts of highly oxygenated triterpenoid compounds (limonoids), particularly in underutilized by-products of citrus juice production. The peel of Citrus fruit is a rich source of flavanones and many polymethoxylated flavones, which are very rare in other plants.

Therapeutic Usages: Raktapitta, Svasa, Kasa, Aruci, Trsna, Udara Roga, Vibandha, Madatyaya, Hikka and Agnimandya.

Pharmacological Studies: Analgesic, anticancer, hypoglycaemic, hypocholesterolemic, hypolipidemic, antimicrobial, anthelmintic and estrogenic activities.

Contraindications: It is contraindicated in high pitta condition such bleeding disorders (heavy periods), nasal bleeding, burning sensation and gastritis.

Adverse Effects: Lemon is safe in food amounts and may be safe in higher medicinal amounts. The side effects of higher amounts of lemon are not known. Applying lemon to the skin may increase the chance of sunburn, especially in light-skinned people.

Pregnancy and lactation: It is safe during pregnancy and lactation

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 1-3 gm and decoction 10 -20 ml.

Formulations: Kangkayon Gutika

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Tishi

Botanical Name: *Linum usitatissimum* Linn.

Family: Linaceae

Synonyms:

Bangla	: তিশি (Tishi)
Hindi	: Alsi
Sanskrit	: Uma, Ksuma
Urdu/Unani/Tibb	: Alsi, Katan
English	: Linseed

Geographical Distribution: Flax was grown in 47 countries in 2004 with the seed production of 1.903 million metric tones. Canada has the highest area and production of flax in the world followed by China, USA, India and EU. In Bangladesh it is cultivated as seasonal crops and maximum value is added by the northern district of Bangladesh.

Plant Descriptions

General Description: *Linum usitatissimum* Linn. is one of the world's oldest cultivated crops with evidence dating back thousands of years. It belongs to the genus *Linum* and family Linaceae. It is a cool temperate annual herbaceous plant with shallow root system, continues to be widely grown for oil, fiber, and food. Flaxseed is a premium food delivering high performance and is one of the richest sources of ω -3 fatty acids (α -linolenic acid) known to man.



Figure 48. *Linum usitatissimum* Linn.

Macroscopic Description: Seed small, brown, glossy with minutely pitted surface, about 4-6 mm long and 2-2.5 mm in maximum width, elongated-ovoid, flattened, rounded at one end and obliquely pointed at the other, near which on one edge, a light depression enclosing hilum and micropyle, embryo consisting of two yellowish-white, flattened planoconvex cotyledons and a radicle, nearly fills the seed and completely surrounded by a thin, whitish endosperm, both endosperm and embryo oily, testa mucilaginous when soaked in water, odour, characteristic, taste, oily when chewed.

Microscopic Description: Transverse section of seed shows testa consists of isodiametric cells with mucilaginous outer walls, collenchymatous cells of middle layer of seed coat cylindrical, single layered, yellowish brown, longitudinally elongated, about 120-190 μ long and 14-17 μ wide, thick, lignified and with pitted walls, single layer of flattened polygonal pigment cells with reddish-brown contents, aleurone grains in the cotyledons, upto 20 μ in diameter, each with globoid and crystalloid, abundant globule of fixed oil and occasional starch grains present.

Part Used: Seed and seed oil

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter)
Guna (Attribute)	: Guru (Heavy), Snighda (Oily)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Vataghna, Acaksusya, Kaphapitta prokapani (increase kapha and pitta), Sukraghni (reduce sperm/semen)

Purity and Safety Test

Foreign matter	: Not more than 1 % w/w
Total ash	: Not more than 5 % w/w
Acid insoluble ash	: Not more than 2 % w/w
Alcohol soluble extractive	: Not less than 30 % w/w
Water soluble extractive	: Not less than 15 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10 ⁴ cfug ⁻¹ , 10 ³ cfug ⁻¹ and 10 ⁴ cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.

Pesticides residues : According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of *cis*, *trans* and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: 'G' (20x20cm) coated with silica gel thickness 1mm type (60F₂₅₄) method was used. The separation solution (ethyl acetate: ethyl alcohol) was used with ratio (1:19) shows under U.V. (3661 nm). The lignan compound has R_f: 0.45 when used the liquid-liquid system to separate the lignan from flaxseed. The ethyl acetate and water system has weak polarity and the lignan dissolved in water and when evaporated water yellowish powder had get.

Major Chemical Constituents: Flaxseed accumulates many biologically active compounds and elements including linolenic acid, linoleic acid, lignans, cyclic peptides, polysaccharides, alkaloids, cyanogenic glycosides, and cadmium. Most biological and clinical studies of flaxseed have focused on extracts containing α -linolenic acid or lignan.

Therapeutic Use: Krmiroga, Kustha, Prameha and Siroroga. Traditionally it considered a confident drug in the treatment of several diseases like atherosclerosis, Backache, Constipation, Piles, Fistula, Cough, Pleurisy, Pneumonia, Gonorrhea, Gout, High Cholesterol and Obesity.

Pharmacological Studies: Antiarrhythmic effects, anticoagulant and antiplatelet effects, anti-diabetic functions, anti-cancerous action, cardio protective effect, nephro-protective effect, hormonal effects, anti-ulcer effect and laxative effect.

Contraindications: It is contraindicated in Bowel obstruction, cancer (breast, ovarian, uterine), and endometriosis, narrowing of the esophagus (esophageal stricture), hormone sensitive conditions, elevated triglycerides, intestinal inflammation, acute, and uterine fibroids.

Adverse Effects: Flaxseed is safe within recommended therapeutic dosage, but in high dose Nausea, bloating, gas, abdominal pain, heartburn, or diarrhea may occur.

Pregnancy and lactation: Avoid use of flaxseed during pregnancy or while breastfeeding.

Precaution: Caution should be taken in allergy, diabetes and bleeding disorders.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 3-6 gm.

Formulations: Linseed Powder, Linseed Tablet

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Turmuḡ

Botanical Name: *Citrullus lanatus* (Thunb.) Matsum. & Nakai.

Family: Curcubitaceae

Synonyms:

Bangla	: তরমুজ (Turmuḡ)
Hindi	: Tarbuj
Sanskrit	: Kalinga
Urdu/Unani/Tibb	: Tarbuz
English	: Water melon

Geographical Distribution: Water melon is cultivated and distributed in all warmer countries of the world on the sandy river beds for its fruits. China is the largest producer of watermelon with 52.3 million tons of the total world production. Other major producing countries are Turkey, Iran, Brazil, Uzbekistan, Alzeria, USA, Russia, Egypt and Mexico. In Bangladesh, watermelon production is not uniformly distributed in all of the regions due to the prevailing climatic and edaphic factors and most are produced in the southern parts of the country.

Plant Descriptions

General Description: *Citrullus lanatus* belongs to the Cucurbitaceae family, which is cultivated in 6.2% of the world area devoted to vegetable crops. In the Ayurvedic system of medicine, the seeds are known as chayapula Krishna beeja/Rakta beeja. Water melon is an annual plant, producing stems up to 4 metres long, occasionally to 10 metres. These stems climb with the help of tendrils or, more frequently, trailing along the ground.

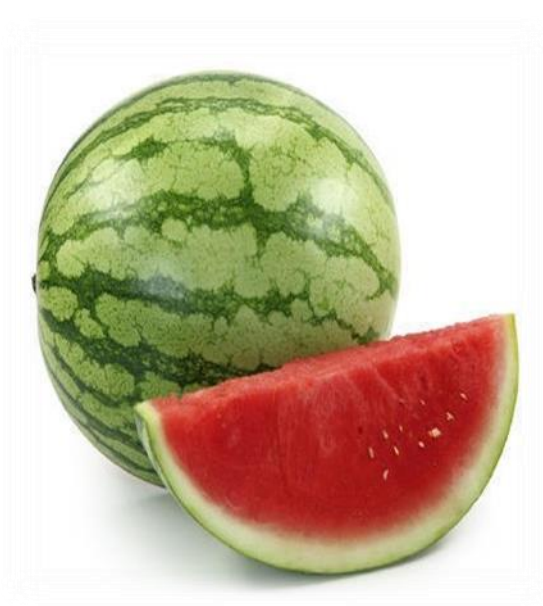


Figure 49. *Citrullus lanatus* (Thunb.) Matsum. & Nakai.

Macroscopic Description: Water melon is climbing annual large climber, leaves are deeply divided or moderately lobed, and glabrous, hairy, tendrils, bifid, stout, and pubescent. Flowers are large, yellow, and monocious. Male flowers; calyx tube campanulate, lobes 5, stamens 3, short, anthers scarcely covering 1 celled, 2 celled cells conduplicate, connective not produced. Female flowers; calyx and corolla as in the male, ovary ovoid, style short, stigmas 3, reniform, ovules many, horizontal, placenta. Fruit subglobose or ellipsoid, smooth greenish, flesh juicy, red or yellowish white. Seeds usually margined.

Microscopic Description: Transverse section of the seed, below the radicle region (upper region) shows outer integument (seed coat), cotyledons and 2 small vascular bundles on either side with xylem and phloem. Transverse section of the middle region of the seed shows outer integument, cotyledons, endosperm and a small embryo. Endosperm region is made up of many layered, thin walled polygonal parenchymatous cells. Transverse section of the basal region of the seed shows outer integument and cotyledon region. L.S. of the seed shows radicle, seed shows outer integument and cotyledon region. T.S. of the basal region of the seed coat shows, outer integument (outer testa) made up of single outer epidermal layer consisting of elongated palisade cells with brown thickening in the centre. Epidermis is followed by 5 to 8 layered, compactly arranged polygonal stone cells with heavily lignified walls with pits inside the lumen, stone cell region is followed by single layer of elongated stone cell layer with large lumen with pits and 2 to 3 layers of crushed parenchymatous layer.

Part Used: Root, fruit and seed

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet)
Guna (Attribute)	: Laghu (Light)
Virya (Potency)	: Sita (cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Pittahara

Purity and Safety Test

Foreign matter	: Not more than 1 % w/w
Total ash	: Not more than 3.29 % w/w
Acid insoluble ash	: Not more than 0.11 % w/w
Alcohol soluble extractive	: Not less than 10.85 % w/w
Water soluble extractive	: Not less than 19.62 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic

	count, total <i>Enterobacteriaceae</i> , <i>Salmonella spp</i> , <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of <i>cis</i> , <i>trans</i> and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC studies of the above four extracts were carried out in various solvent systems at 30°C, using silica gel G as adsorbent. The R_f values are recorded in Chloroform (Chloroform Methanol 40:5) 0.21, 0.37, 0.57, 0.64, 0.8, 0.9 and in Alcohol (Chloroform, Acetone 60:40) 0.1, 0.2, 0.49, 0.53, 0.6, 0.73, 0.78, 0.9, 0.95.

Major Chemical Constituents: The plant is rich in alkaloids, flavanoids, tannins, amino acids, carbohydrates, cardioglycosides, terpenoids, steroids, carotenoids, oils and fats. it is very rich in vitamins A 3%, different vitamins from vitamin B complex like Thiamine (Vit. B1), Riboflavin (Vit. B2), Niacin (Vit. B3), Pantothenic acid (B5), vitamin B6 and Folate (Vit. B9) which ranges between 1-3%, Vitamin C 14%. The mineral composition is Calcium 1%, Iron 2%, Magnesium 3%, Phosphorus 2%, Potassium 2% and Zinc 1%.

Therapeutic Usages: High blood pressure, scanty urination, burning micturition and gonorrhoea.

Pharmacological Studies: Antibacterial, antifungal antimicrobial, antiulcer, antioxidant, anti-inflammatory, gastroprotective, analgesic, laxative, anti-giardial, hepatoprotective and against prosthetic hyperplasia and atherosclerosis.

Contraindications: It is contraindicated in diabetes, GDM and hypotension.

Adverse Effects: Water melon can cause side effect if taken in excess. It increases kapha dosa. So it may cause weak digestion, abdominal gas and abdominal pain.

Pregnancy and lactation: It has tocolytic properties. So, avoid to use during normal termination of pregnancy.

Precaution: Caution should be taken in allergy, diabetes and bleeding disorders.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills.

Posology: Powder 3-6 gm.

Formulations: Water melon Decoction, Water melon Capsule

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Ushir

Botanical Name: *Vetiveria zizanioides* (L.) Nash.

Family: Poaceae

Synonyms:

Bangla	: উশির/বেনামূল (Ushir/Benamul)
Hindi	: Khasa, Bena
Sanskrit	: Virana, Sevyā
Urdu/Unani/Tibb	: Khas
English	: Cuscut Grass

Geographical Distribution: *Vetiveria zizanioides* has been known to Indian subcontinent since ancient times. It is well known plant from South India and widely distributed in India, Burma, Ceylon, Bangladesh and spread from Southwest Asia to tropical Africa. It is found throughout the plains and lower hills particularly on the river banks and in rich marshy soil.

Plant Descriptions

General Description: *Vetiveria zizanioides* belongs to the family Poaceae, subfamily of Panicoideae also commonly known as Khas-Khas or khus grass; is native to India and Bangladesh. The vetiver grass has a gregarious habit and grows in bunches. It is a densely tufted grass, with long, thin and rigid leaves and can grow up to 1.5 meters high. The plant is different from the other grass forms, in that instead of having mat-like root systems, the plant grows in large clumps from a branched 'spongy' rootstock with erect culms.



Figure 50. *Vetiveria zizanioides* (L.) Nash.

Macroscopic Description: Clusters of wiry roots upto 2 mm in diameter, minute, longitudinally grooved; colour varies from cream, grey or light yellow to brown; fracture, short and splintery; odour, strong aromatic; taste, slightly bitter.

Microscopic Description: Root shows an epidermis consisting of tangentially elongated cells having brownish content, followed by a layer of hypodermis, consisting of thin-walled cells, similar to epidermis; cortex consisting of 2-3 layers of thick-walled, lignified sclerenchymatous cells towards periphery and aerenchymatous cells towards centre; endoderm is, single layered of barrel-shaped cells with highly thickened inner walls; pericycle many layered with thick-walled, sclerenchymatous cells enclosing radial vascular bundles arranged in a ring; simple, round to oval, starch grains measuring 8-12 μ in diameter present in aerenchyma, pericycle and pith cells.

Part Used: Root

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Snighda (Oily)
Virya (Potency)	: Sita (cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Pacana, Pittaghna, Stambhana, Vataghna, Dabaklanti-hara, Kaphapittahrt

Purity and Safety Test

Foreign matter	: Not more than 1 % w/w
Total ash	: Not more than 9 % w/w
Acid insoluble ash	: Not more than 6 % w/w
Alcohol soluble extractive	: Not less than 4 % w/w
Water soluble extractive	: Not less than 5 % w/w
Microbial contamination	: In accordance with National guideline and WHO guideline the maximum permissible microbial load of <i>E.coli</i> , total yeast and mould count, total <i>Enterobacteriaceae</i> are not more than 10^4 cfug ⁻¹ , 10^3 cfug ⁻¹ and 10^4 cfug ⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total <i>Enterobacteriaceae</i> , <i>Salmonella</i> spp, <i>S.aureus</i> , <i>Pseudomonas aeruginosa</i> and <i>Coliforms</i> will be absent.
Heavy metals	: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels are not more than 10, 0.5, 5 and 0.3mg/kg, respectively.
Pesticides residues	: According to WHO guideline, normally the maximum permissible residue limit of aldrin and dieldrin (sum of), azinphosmethyl, bromopropylate, chlordane (sum of cis,

trans and oxythlordane), chlorfenvinphos, chlorpyrifos-methyl, diazinon, endrin and hexachlorobenzene are not more than 0.05, 1.0, 3.0, 0.05, 0.5, 0.1, 0.5, 0.5 and 0.1 mg/kg respectively and to be established National guideline.

TLC profile with marker constituents: TLC of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4:1:5) shows under U.V. (366 nm) two fluorescent zones at Rf. 0.49 and 0.72 (both blue). On exposure to Iodine vapour three spots appear at Rf. 0.28, 0.75 and 0.94 (all yellow). On spraying with 5% Methanolic Sulphuric acid reagent and heating the plate at 105°C for ten minutes four spots appear at Rf. 0.19, 0.33, 0.73 and 0.94 (all grey).

Major Chemical Constituents: The chemical constituents present in the plant are Vetiverol, Vetivone, Khusimone, Khusimol, Vetivene, Khositone, Terpenes, Benzoic acid, Triptene-4-ol, β -Humulene, Epizizianal, vetivenyl vetivenate, iso khusimol, β -vetivone, vetivazulene. In the roots, the main component was valencene (30.36%), while in the shoots and leaves, they were 9-octadecenamide (33.50%), 2,6,10,15,19,23-hexamethyl-2,6,10,14,18,22-tetracosahexaene (27.46%), and 1,2-benzendicarboxylic acid, diisooctyl ester (18.29%).

Therapeutic Usages: Jvara, Trsna, Mutrakrcchra and Vrana. Traditionally it is used in headache, rheumatism, sprain, urinary tract infection and malarial fever.

Pharmacological Studies: Carminative, stomachic, haematinic, expectorant, antispasmodic, antiasthmatic, antigout, anthelmenthic, antimicrobial and diuretic properties.

Contraindications: Not known

Adverse Effects: It is considered safe within recommended therapeutic dosage.

Pregnancy and lactation: It should not use during pregnancy and lactation. It might cause miscarriage.

Dosage Forms: Crude drug, Decoction, capsules, tablets and pills. Store in a well-closed container, protected from light and moisture.

Posology: Powder 3-6 gm for infusion.

Formulations: Ushrasav, Somnath Ras, Pranda Gudika, Phalakalyan Grita

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APPENDIX I

PRINCIPAL FORMS OF AYURVEDIC (VEGETABLE) MEDICATION AND METHODS OF THEIR PREPARATION AND USES IN BRIEF

“Ayurvedic Materia Medica includes not only crude drugs property, but also a large number of preparations made from them: e.g., as given in this Appendix.”

“As different parts of plants contain different properties, only those parts which contain efficient properties are used in the below-mentioned forms of preparation. Whole plants are used in the case of herbs which are very small and possess one uniform Rasa in all their parts. Each variety of preparation has its own value in therapeutics. The Churns are rather bulky preparations and on account of their complex nature take more time to act. It is, therefore, desirable that only those drugs whose principles are easily soluble or separable should be chosen in the preparation of Churna. Sugar, common salt, rock salt, etc. are generally mixed with these powders in order to make them more active and palatable. Water, milk, honey and ghee are some of the common vehicles. In some cases, the juices of fruits like the lemon or pomegranate are used, as the organic acids, which they contain, facilitate the actions of the Churna. Before using the powders of the whole drugs, it is therefore necessary to ascertain which drugs are water-soluble and which are not. In modern Pharmacopeia, alcohol, ether and the like are used as solvents to help the easy solution of the constituents, which are insoluble in water. (Tinctures are instances of such processes). This is because modern Pharmacologists are in favour of availing themselves of the important constituents only and not all the parts of the drugs. Ayurvedic scientist, on the other hand, has attached more importance to the clinical findings and has based the pharmacological value of the whole drugs on the results of experience. In the place of tinctures, they have used decoctions and infusions. They have again used extract occasionally, evidently for the purpose of portability and adaptability and also for the facility of concentration, which they afford. Similarly methods of maceration, percolation and precipitation have been used to separate the soluble from the insoluble constituents of the drugs. Satvas are instances of such preparations. Whole drugs were used by the Ayurvedists of the olden times for reasons not only pharmacological and economical but also social i.e. relating to the tastes, habits, customs and social conditions, obtaining then in the country. It must be admitted that strides of civilization have always something to do with the turn of mind of particular generations; yet we cannot ignore the fact that the system had grown in Indian Subcontinent on account of both extraneous circumstances and intrinsic virtues. So far as the scientific methods are concerned, it may be said that the Pancha-bhautika character of dravyas prominently occupied the minds of the Ayurvedists, and not the analytic and synthetic methods of the West, as the latter, though practical could not satisfy the basic theories of the Orientals. "It is the character of the Western intelligence to analyze, separate and combine," but this process is sometimes too elaborate and the results obtained are sometimes time-serving. There is also a tendency to artificialise, which makes the subject more and more complex. The motto of the West is

to find out drugs or remedies, which have a specific property capable of a sure and rapid action. These tendencies, though useful in serving one purpose, are not free from the faults of commission and omission.” (Dr. H. V. Savnur’s A Handbook of Ayurvedic Materia Medica, etc. (1950).

1. **Arka** is a distilled essences or liquors, made by soaking drugs in water for 24 to 48 hours and then extracting their essence by distillations; the essence or liquors thus obtained are Arkas. Araks are usually equivalent to aquae or ‘waters’ of the British Pharmacopeia, and they are prepared in the same way. They are used in fevers, dyspepsia and externally as cooling lotions.

2. **Arista** is a weak alcoholic preparation prepared by making a decoction of the drugs and then allowing them to undergo fermentation by the help of raw sugar or honeys. Fermentation is allowed to go on for a period of 7-10 days in hot weather, for 15 to 30 days in cold weather.

3. **Asavas and Aristas** are medicated spirituous liquors. They are prepared with honey and treacle and various medicinal substances, such as roots, leaves, barks, etc., of plants cut into pieces and steeped in water and laid aside in air-tight earthen jars for vinous fermentation for at least one month. The proportion of the different ingredients is generally as follows: Water 32 Kg., treacle or jaggery 12.5 kg, and honey 6.25 Kg., medicinal substances 1.25 Kg., in powder or decoction. When raw vegetable juices are used for fermentation, the resulting fluid or liquid is called Asava. In other words, Asavas are weak alcoholic preparations prepared by infusing the drugs, in cold water and allowing undergoing fermentation with the help of raw sugar or jaggery or honey. “The above difference in Arishtas and Asavas is not true in all cases. Some Asavas are prepared by decoction and some Arishtas from infusion. When the decoction of drugs only is used for fermentation, the fermented product is called Arishta. These preparations combine the virtues or properties of spirituous drinks and those of the drugs used in preparing them. Many of these are stomachic, stimulants, tonics, astringents, alternatives, febrifuges, etc.

4. **Avalehas** are lehas, linctuses or confections or thickened extracts: These are equivalent to confections, electuaries or conserves of the B.P. To prepare them, decoction, after being strained, again boiled down to a thick soft consistency with sugar or honey. If sugar is to be used in this preparation, its quantity should be four times that of the drugs, and in the case of jaggery, it should be double that of the drugs. If water or milk is to be added, the quantity to be added should be four times that of the drugs used. These extracts or confections, when properly made, should sink in water, do not readily dissolve in water, can be drawn out into threads or wires, and, if made thicker, will receive impressions of coins on their surface. They should show a good colour and emit sweet smell. Extracts are generally administered with the addition of milk, sugarcane juice, sugar or any other infusions or decoctions or powders, in 48 gm. desirable under the circumstances. Avalehas are used for digestive troubles, respiratory affections and for general tonic effect on the body.

5. **Bati /Vatikas/Tablets/Pills** are usually prepared by reducing a decoction of vegetable substances to a thick consistency and then adding some powders, or drugs or articles such as, water, treacle, raw

sugar, honey, gum, guggul, as the case may be, for making a pill mass. Water or honey is usually the only anupans for administering pills where none else are mentioned.

6. **Bhasmas or Bhasms** is called alkaline ashes and are prepared from vegetable and mineral substances. Vegetable ashes in the case of Vegetable, the drugs containing more or less alkalies are at first made into a coarse powder or pieces, and then burnt till they are completely reduced to ashes. Mineral ashes: In preparing these, metals are first subjected to a process of purification. The purified mass is then oxidized. The oxidized product is then subjected to a process of roasting. Finally, the roasted mass is reduced to a fine powder, when it is fit for use. Ashes are also prepared from various animal products, such as, Bones, horns, pearls, cowries, etc.

7. **Bhavana** is a process in which powders are soaked in various fluids, such as the expressed juice of herbs, decoctions etc., and then dried. For this purpose the quantity of juice added to the powder should be sufficient to cover it. The mixture is then allowed to dry in a shaded place. This process is repeated twice, thrice, seven or as many times, as is necessary.

8. **Churna** is powder mixtures prepared by pounding dry vegetable, mineral or animal substances in a mortar with a pestle and passing the powder through cloth or linen, or fine sieve. "If jaggery is to be mixed with the powder, it should be equal to the Churna and in the case of sugar; it should be double the Churna. Usually powders are taken with milk or hot water etc., and are often used four times in quantity. Sometimes with ghee, oil, honey or sugar, their proportion is just sufficient to mix the dose, or even double the Churna in quantity. Where no directions are given, hot water is the only 'Anupan' or vehicle. Churna prepared without the aid of machinery are considered more effective. Powders are particularly useful in later stages of severe maladies after the well-known Bhasmas and Rasayan are used and the morbid process has been brought to the minimum. These are required to be given in bulk, and their action, though quick, is only temporary. These are the least toxic and dangerous, and their efficacy depends on timing their administration in relation to the disease and the hour of the day, meals, etc.

9. **Dravas or Dravakas** or distilled mineral acids, several formulae are given in different works for their preparation. A number of mineral substances or salts are heated in a retort and the distilled fluid collected in a glass receiver. The acids are tested and regarded as well-made by their property of dissolving a cowrie or shell thrown into them. There are two varieties of Dravaka, called Swalpa-Dravaka and Shanka-Dravaka.

10. **Phantas** is infusion prepared in hot water by steeping (for 12 hours) in an earthen vessel, pounded drugs 1 part, in 4 or 8 parts of fresh boiled water, till it becomes cold. The fluid decanted from this vessel after the stated period is called "phanta". It should be used in the same way as decoction. The dose is 96 ml in a day.

11. **Gudikas or Gulikas** (Pills) are large pills or boluses. The method of preparation is just the same as in the case of 'Vatikas' or 'Vataka'. These are intended to be swallowed whole by chewing or without. These including Guggulu, are very much milder than the Bhasmas and Rasayan, with a very

few exceptions. These are, as a general rule, less durable and deteriorate on exposure to the atmosphere, and hence require to be kept well protected. These are useful to the run-down and weak patients suffering from chronic complaints and sensitive to any medicament hot in nature. Similarly these are required to be continued for days together, as action on the systematic tissues is very slow and mild in nature. But they have one very great advantage, viz., they can be administered to children and the aged, and during pregnancy, where Bhasmas and Rasayanas cannot be tolerated.

12. **Himams** is cold infusions prepared by steeping for one whole night 1 part of powdered drugs in 6 parts of cold water. The dose and the method of preparation are the same as in the case of 'phanta'.

13. **Kalkas** (pounded mass) is paste prepared by grinding dry or fresh whole vegetable substances, moistened with water, if necessary, on a flat stone or slab with a miler into thin paste, ball, or a vicious lump. When honey, ghee or oil is to be added to the mass, it should be double the quantity of the drug. But in the event of the addition of sugar or jaggery, the proportion should be equal, and when liquids are to be added, they should be four times the mass.

14. **Kalpa** is, when it is very hard to procure genuine and fresh medicinal herbs, some Ayurvedic pharmacy in order to overcome this practical difficulty, have prepared different Kalpas from genuine and fresh herbs, which keep well for a long time wutgiyt any deteruiratuib as to their therapeutic value; they are said to have been manufactured under expert supervision with scientific technique, and are guaranteed against adulteration or impurity. The great advantage of these Kalpas is the small dosage in which these can be therapeutically administered.

15. **Kanjee or Kanjika** is a sour liquid produced from the acetous fermentation of powdered paddy and other grains. Two (2) kg of powdered paddy (grown in rainy season) are steeped in 8 kg, ' of water and laid aside in a covered earthen pot for 15 days and upwards, so that it may undergo acetous fermentation. The resulting fluid is' called Kanjika or Dhanya1mla, that is, the acid produced from paddy. Kanjika is a clear transparent fluid with an acid taste and vinous smell. It is cooling, refrigerant, and useful as a drink in fever, burning of the body, etc. Other grains besides paddy are some- times used for acetous fermentation. If mustard or the seeds of Raphanus sativus are used instead of baddy, the resulting fluid is called Sintaki. If the husked grains of barley are boiled and steeped in water, the resulting acid liquor is called Sauvira.

16. **Khandapaka** means Confections. These are made by adding to syrup, medicines in fine powder and gently stirring them over a slow fire till intimately mixed and reduced to proper consistence, i.e., that of an extract. Honey is usually subsequently added to confections.

17. **Ksharas (Alkalis)** is wholly or completely burnt and medicinal plants or herbs, or specified parts of their ashes allowed dissolving or mixing in water allowed to stand, and which after filtration, is evaporated. The residue thus left is a white fine powder, which is called Kshar, is a very useful preparation, effectively acting on the complaints of liver and spleen. As a rule, Ksharas are very active, costic and corrosive, and hence should be used with discretion and caution. These are stimulating to digestive secretion, anti-fermentative, and useful in cases of ascites and abdominal

tumors. An overdose or indiscriminate use leads to decay and falling of teeth, stomatitis and destruction of body tissues. In cases of pregnant women tuberculous patients, the aged and Young children, ksharas should be prescribed very judiciously.

18. **Kshirapaka** is decoction in milk. One part of medicine or drug is boiled in 8 parts of milk and thirty-two of water, till the water is evaporated and the milk alone remains; the decoction is then strained.

19. **Kwaths or decoctions** is generally prepared by boiling 1 part of vegetable substances or drugs, (roots, woods, barks and leaves of fresh plants), previously pounded into coarse powder or cut or sliced into small pieces, and then boiled over a slow fire with 8 or 16 parts of water, till the whole is reduced to one-fourth, or 1/8, or 1/16 of the total water is left. The decoction is then strained through cloth. When decoctions are prepared with dry substances, 8 parts of water are used. Decoctions are administered with (anupans) vehicles like salt, honey, sugar, treacle, alkalies, (alkaline ashes) ghee, oil or some medicinal powders, as the case may require. The principal drug should be taken or mixed with the decoction. Every day, the decoction should be prepared fresh, in several doses for the whole day, for administration; it should under no circumstances be kept overnight. Always prepare fresh decoction. Decoctions are of different, strengths, as under:

- Paachan is a decoction in which the solution is reduced to one-half of the total quantity. It digests the Aamadasha.
- Deepan is a decoction in which the solution is reduced to one-tenth. It stimulates excretion.
- Shodhana is that type of decoction in which the solution is reduced to one-twelfth of the total quantity. It eliminates excretion.
- Shamana is a decoction in which the solution is reduced to one-eighth. It modifies the severity of the disease.
- Tarpana is a decoction in which the solution is boiled till it reaches the boiling-point. It nourishes the Dhatus.
- Kledana is a decoction in which the solution is reduced to one-fourth. It causes disquietude-distress to the heart.
- Vishoshee is also a decoction in which the solution is reduced to one-sixteenth. It causes thirst.

General instructions regarding the preparation of decoctions:

A decoction should not be allowed to evaporate after the proper strength is reached, nor should it be boiled again after being once taken off the fire and placed on the ground. A decoction should be rejected when (a) it assumes a dark, blue or red color; (b) it becomes thick, slimy or weak; (c) it is over-boiled; & (d) it emits a raw or rotten fleshy smell. The odour of the decoction should be of the nature of the drugs used, and its appearance pure or lustrous. (A Hand Book of Ayurvedic Materia Medica, (1950). "Famous Ayurvedic Ltd., concerns are preparing decoction s in concentrated liquor form, wherein all the properties of

the crude decoction have been fully preserved. These liquid decoction, although free from alcohol remain well-preserved for a long time. Though rather slow in action, these have penetrating properties and are very useful in chronic cases.

20. **Malama (Ointments)** is semisolid or soft preparations acting chiefly as local anodynes and sedatives, for local application for various lesions, containing active drugs mixed with ghee, bees-wax, cocoanut or coconut oil, vaseline etc., either alone or in combination form, the bases of all ointments. Strict precaution should be taken to protect the eyes from these ointments as they cause irritation. Similarly contamination of the ointment with dirty and soiled fingers should be avoided during application. The lesion where one particular ointment is intended to be applied should first be cleaned with soap or antiseptic lotion and the part dried with clean and sterilized linen. Ointment just sufficient for one application should be taken separately and carefully applied to the part. Strict cleanliness is in itself the first essential measure towards recovery.

21. **Manda** is prepared 14 parts of water and one part of the cereal, □ usually rice or 'Laj' (Khai), Manda when ready, is completely free from the grain (rice).

22. **Mantha** is also a variety of cold infusion: all emulsion prepared in an earthen vessel; of one part of drugs in fine powder with four parts of cold water. The dose is 96 gm. in a day.

23. **Modaka** is boluses, larger than gutika, prepared by adding powders of medicinal substances to cold syrup and stirring them together till uniformly mixed. No boiling is required in this preparation. Syrups should be made with sugar and water, or with sugar and decoction of the prescribed drugs.

24. **Muramba** (Confections) is liquid preparations of drugs or fruits made by soaking them in syrup or honey.

25. **Nasya** is a preparations used in the treatment of cold, headaches or nervous diseases.

26. **Paya or Yoosha** or decoction is prepared in 14 parts of water, and 1 part of the cereal, and the preparation is allowed to boil till the consistency gets thicker than that of 'Manda'. Peya is a little mixed with the grain. Yoosha is a bit thicker than Peya.

27. **Putapaka** means roasting, or roasted mass within a closed cover. In this process, vegetable drugs are reduced to a paste which is wrapped up in the leaves of either *Eugenia jambolana* or *Ficus bengalensis*, or *Gmelina arborea*, firmly tied with thread, string or fibres of some sort, preferably vegetable, covered with a layer of clay from half to one inch in thickness and roasted in or over a fire made of dried cow-dung-cakes. When the layer of clay assumes a brick-red colour on the surface, roasting is known to be complete, the ball should be withdrawn from the fire and broken-open, and the juice of the roasted drug expressed. This juice is administered, with the addition of honey, sugar or such other adjuncts, as may be directed. Sometimes the roasted drug itself is given in the form of a powder or pills. Thus, 'Putapakas' contain some more principles of the drugs than 'Svarasas', owing to the action of fire. The dose is 1 to 4 tolas, and is generally recommended to be taken with milk.

28. **Rasayana** is a major mercurial preparation which forms in Ayurved the chief part of the most important preparations. Every Rasayan contains mercury and sulphur in combination called "Kajjali",

(or mercury in different forms, e.g., metallic, sulphide, subsulphide, black sulphate, oxide,. etc.). But, a few are exceptions, as they contain no mercury, and yet they have got action similar to mercury-containing Rasayan. Rasayan should be stored in glass bottles to keep them active and free from atmospheric contamination. Some Rasayan are also known as Matras, Both the constituents are first purified by an elaborate process, and also are required to be imbibed with the properties of fresh juices of different indigenous plants, whereby the preparations become more potent. Different Bhasmas, which form the constituents of Rasayan, are first carefully prepared fully in accordance with the formulae and process of Ayurvedic Science. These preparations retain the therapeutic properties and potency for any length of time. A skilful and experienced practitioner may find various different marvelous results when used through different Anupama or Vehicles. Rasayan promote different secretory organs and endocrine glands, and build up all body tissues, and for fulfilling these objects, Rasayan require to be thoroughly triturated. Titration is a process by itself, which allows effective combination of different constituents of a particular preparation and divides it into finest particles, thus increasing its assimilative power and therapeutic effect. Kupistha Rasayan or (Sindura Kalpa Rasayan) differ from simple Rasayan, only in one respect, viz., that they are required in addition to trituration to be heated with other suitable minerals in hard glass, in a red hot furnace, from 24 to 72 hours. These being stronger than simple Rasayan are more effective and useful in prolonging the life of the patient in the last stage, even when injections fail to have the desired effect! But, being very active and powerful they demand a judicious and timely usage in medical practice. These are meant for momentary application and are contra-indicated for a prolonged usage. They should be always prescribed in combination with adjuncts and correctors, and greatest precaution should be taken to ascertain that they are genuine and prepared scientifically and correctly, so that mercury is well combined with other ingredients. Otherwise there is a great risk of mercurial poisoning.

29. **Satvas or Satwa** denote the fresh herb is crushed into a coarse mass and allowed to remain in a basin of water for about 12 hours. The whole thing is churned vigorously and strained through muslin. The strained fluid is allowed to stand for some hours, during which time, the active ingredients settle at the bottom. The upper column of the clear water is siphoned off and the sediment is dried into a fine powder, which contains all the properties of the respective medicinal herb in an altered form and taste. All such essences are cool in action and very handy for administration.

30. **Sitakashaya** is cold infusion prepared by steeping one part of the powdered drug in 6 of cold water for the night and straining the fluid in the morning.

31. **Sneha** is prepared with either water or some such fluid as decoction, expressed juice, milk, and butter-milk etc. the proportions being as under:

Kalka (Pasty mass)	Medicated oil or ghee	Fluid
1	4	16 water
1	6	24 Decoction

1	8	32 Meat juice
1	8	32 Milk, Curds etc.

N. B. In the case of the last two, additional water to the extent of four times the (Sneha) may be added, if necessary.

When more than one variety of fluids are required, then up to four such sorts the usual proportion of four parts of fluid to one of Sneha should be taken, and the varieties should be boiled separately. But when the number of fluids required exceeds four, each of the fluids should be equal in quantity to the Sneha, and all should be mixed and boiled together. When the Sneha is intended to be prepared in decoction only, the pounded mass, left after the decoction is strained, may also be added to the mixture before it is boiled. But when it is expressly desired that the remains (kalka) of decoction are not wanted, they should be discarded.

32. **Swarasas** are fresh expressed juices (succus) prepared by pounding green fresh medicinal plants in a mortar and expressed and strained through a clean cloth or linen. One should see beforehand that the plant is not infested with worms and/or injured by inclemency's of weather. The Svarasas contain only those principles, which are dissolved in the sap. (When fresh drugs are not available, and in the cases of plants like "Guduchi", whose juice- cannot be extracted, water should be added to the pounded drug in the proportion of 2:1, and kept for a day and night; the mixture should then be strained and the solution used).

APPENDIX-1I

TESTS AND DETERMINATIONS

Microscopic Identification

Microscopic identification of the botanical ingredients is a standard for statutory purposes in several solid and semisolid compound formulations. Microscopic identification tests are confined to those formulations where the botanical ingredients are not more than ten, and where they are added 'in situ' in powder form as 'Praksepa Dravyas'. Such comminuted ingredients lend themselves for microscopic identification, as they are not drastically changed in cell structure or contents while processing, and appear intact in microscopic slide preparations, after proper treatment. Appropriate processing for separation and isolation of botanical debris from a formulation without loss of debris, by hand picking, shifting, washing, sedimentation, density separation or by floatation etc., are the preliminary steps. This is followed by clearing the debris in chemical reagents, reacting it with suitable reagents and stains and finally mounting a little part on a slide in a medium of suitable refractive index (see later part) that helps to show the unit structures in good relief. Identification of the discrete, but disoriented units from the botanical ingredients in a formulation will not be possible without proper isolation, and should not be attempted. Monographs where the test is prescribed give both a relevant method of isolation and diagnostic features specific to the expected ingredients in that formulation. Only a brief method and a few of the characteristics for each ingredient are given, but an analyst may use other methods of isolation and choose more characteristics to draw a correct conclusion. Although monographs prescribe standards only for the 'Praksepa Dravyas', characteristics from other ingredients that are processed into extracts or decoctions prior to their addition to a formulation may also be seen in a slide preparation, giving rise to recognisable unique characteristics. In addition, cell or tissue structures common to several ingredients added to a formulation, and therefore not specific to any one of them, would also be present. Caution should therefore be exercised so that such features are not construed as parts from adulterants or substitutes or foreign parts. Proper study of the individual ingredients using authentic material and reference to their monographs in the Ayurvedic Pharmacopeia for Single Drugs would help avoid errors of this nature. Skill in the recognition of discrete and disoriented tissue components and the knowledge required to ascribe them to their correct source should be acquired by the analyst.

Stains and reagents for micro chemical reactions: The Ayurvedic Pharmacopeia volumes on single drugs already include micro chemical reactions for ergastic substances and may be consulted in addition to the following for use on isolated debris:

Acetic acid: Dilute 6 ml of glacial acetic acid with 100 ml of distilled water; used for identification of cystoliths, which dissolve with effervescence.

Aniline chloride solution: Dissolve 2 g in a mixture of 65 ml of 30 per cent ethyl alcohol and 15 ml distilled water and add 2 ml of conc. Hydrochloric acid. Lignified tissues are stained bright yellow.

Bismarck brown: Dissolve 1 g in 100 ml of 95 per cent of ethyl alcohol; used as a general stain for macerated material (with Schultze's).

Bremer's reagent: Dissolve 1 g of sodium tungstate and 2 g of sodium acetate in sufficient quantity of water to make 10 ml yellowish to brown precipitates; indicate the presence of tannin.

Chlorinated soda solution (Bleaching solution): Dissolve 75 g of sodium carbonate in 125 ml of distilled water; triturate 50 g of chlorinated lime (bleaching powder) in a mortar with 75 ml of distilled water, adding it little by little. Mix the two liquids and shake occasionally for three or four hours. Filter and store, protected from light. Used for lighting highly coloured material, by warming in it and washing the tissues thoroughly.

Canada balsam (as a Mountant): Heat Canada balsam on a water bath until volatile matter is removed and the residue sets to a hard mass on cooling. Dissolve residue in xylene to form a thin syrupy liquid. Used for making permanent mounts of reference slides of selected debris.

Chloral hydrate solution: Dissolve 50 g of chloral hydrate in 20 ml of distilled water. A valuable clarifying agent for rendering tissues transparent and clear, by freeing them from most of the ergastic substances, but leaving calcium oxalate crystals unaffected.

Chloral iodine: Saturate chloral hydrate solution with iodine, leaving a few crystals undissolved; useful for detecting minute grains of starch otherwise undetectable.

Chlorzinciodine (Iodinated zinc chloride solution): Dissolve 20 g of zinc chloride and 6.5 g of potassium iodide in 10 ml of distilled water. Add 0.5 g of iodine and shake for about fifteen minutes before filtering. Dilute if needed prior to use. Renders cellulosic walls bluish violet and lignified walls yellowish brown to brown.

Chromic acid solution: 10 g of dissolved in 90 ml of dilute sulphuric acid: macerating agent similar to Schultze's.

Corallin soda: Dissolve 5 g of corallin in 100 ml of 90 per cent ethyl alcohol. Dissolve 25 g of sodium carbonate in 100 ml distilled water; keep the solutions separate and mix when required, by adding 1 ml of the corallin solution to 20 ml of the aqueous sodium carbonate solution. Prepare fresh each time, as the mixture will not keep for long. Used for staining sieve plates and callus bright pink and imparts a reddish tinge to starch grains and lignified tissues.

Ammoniacal solution of Copper oxide (Cuoxam): Triturate 0.5 g of copper carbonate in a mortar with 10 ml of distilled water and gradually add 10 ml of strong solution of ammonia (sp. gr. 0.880) with continued stirring; used for dissolving cellulosic materials.

Eosin: 1 per cent solution in 90 per cent ethyl alcohol; stains cellulose and aleurone grains red.

Ferric chloride solution: A per cent solution ferric chloride in distilled water. Tannin containing tissues coloured bluish or greenish black.

Glycerin: Pure or diluted as required with one or two volumes of distilled water. Used as a general mountant.

Haematoxylin, Delafield's: Prepare a saturated solution of ammonia alum. To 100 ml of this add a solution of 1 g of Haematoxylin in 6 ml of ethyl alcohol (97 per cent). Leave the mixed solution exposed to air and light in an unstopped bottle for three or four days. Filter and add to the filtrate 25 ml of glycerin and 25 ml of methyl alcohol. Allow the solution to stand exposed to light, till it acquires a dark colour (about two months). Refilter and store as a stock solution. Dilute it 3 or 4 times volumes with distilled water. Stains cellulosic fibers blue; used only on water washed material.

Iodine water: Mix 1 volume of decinormal iodine with 4 volumes of distilled water. Stains starch blue, and reveals crystalloids and globoids when present in aleurone grains.

Iodine and potassium iodide solution: Dissolve 1 g of potassium iodide in 200 ml of distilled water and 2 g of iodine; stains lignified walls yellow and cellulosic walls blue.

Lactophenol (Amman's Fluid): Phenol 20 g, lactic acid 20 g, glycerin 40 g, distilled water 20 ml dissolve; reveals starch grains in polarised light with a well marked cross at hilum, and also minute crystal of calcium oxalate as brightly polarising points of light.

Methylene blue: A solution in 25 ml of ethyl alcohol (95 per cent). A general stain for nucleus and bacteria.

Millon's reagent: Dissolve 1 volume of mercury in 9 volumes of fuming nitric acid (sp. Gr. 1.52), keeping the mixture well cooled during reaction. Add equal volume distilled water when cool. Stains proteins red.

Naphthol solution: Dissolve 10 g of Naphthol in 100 ml of ethyl alcohol; a specific stain for detection of inulin; cells containing inulin turn deep reddish violet.

Phloroglucinol: 1 g of phloroglucinol dissolved in 100 ml of 90 per cent ethyl alcohol; mount debris in a few drops, allow to react for a minute, draw off excess of reagent with a filter paper strip, and add a drop of conc. hydrochloric acid to the slide; lignified tissues acquire a deep purplish red colour; very effective on water washed material but not in chloral hydrate washed debris.

Picric acid solution (trinitrophenol solution): A saturated aqueous solution made by dissolving 1 g of picric acid in 95 ml of distilled water; stains animal and insect tissues, a light to deep yellow; in a solution with ethylalcohol, aleurone grains and fungal hyphae are stained yellow.

Potash, Caustic: A 5 per cent aqueous solution; used to separate tenacious tissues of epidermis and also laticiferous elements and vittae, both of which are stained brown.

Ruthenium red: Dissolve 0.008 g of ruthenium red in 10 ml of a 10 per cent solution of lead acetate; (to be freshly prepared) used for identification of most kinds of mucilage containing tissues, which turn pink. A 0.0008 g ruthenium red dissolved in 10 ml of distilled water and used immediately stains cuticular tissues in debris to a light pink.

Safranin: A 1 per cent solution in ethyl alcohol 50 per cent; used to stain lignified cell walls deep red, even after clearing with chloral hydrate.

Schultze's Maceration fluid: Add isolated debris to 50 per cent conc. nitric acid in a test tube and warm over water bath: add a few crystals of potassium chlorate while warming, till tissues soften; cool, wash with water thoroughly and tease out for mounting hard tissues; isolated cell structures are clearly revealed, but the structures are not useful for measurement of dimensions.

Sudan Red III: Dissolve 0.01 g of sudan red III in 5 ml of ethyl alcohol (90 per cent) and 5 ml of pure glycerin; suberised walls of cork cells, and fatty material in cells are stained bright red.

Sulphovanadic acid (Mandelin's reagent): Triturate 1 gm of ammonium vandate with 100 ml conc. sulphuric acid. Allow the deposit to subside and use the clear liquid. This is to be prepared fresh; useful for identification of alkaloids, particularly strychnine which turns violet in the cells containing it.

Refractive indices of certain mountants

Water 1.333

Lactophenol 1.444

Chloral Hydrate solution 1.44 to 1.48

Olive oil 1.46 to 1.47

Glycerol 1.473

Castor oil 1.48

Clove oil 1.53

Cresol 1.53

Cassia oil 1.6

Xylol 1.49

Alcohol 1.36

Chloroform 1.44

Microscopical methods of examining crude vegetable drugs

Methods of preparing specimens of crude materials of vegetable drugs for microscopical studies vary, depending on the morphological groups of drugs to be examined and also on the natures of the material i.e., entire, cut or powdered.

LEAVES, HERBS AND FLOWERS

For examining leaves, herbs and flowers (entire or cut) under microscope, following methods are employed for clarification:

A. Entire and cut materials

(i) Entire materials: When examining entire leaves, herbs and flowers, take pieces of leaf (margin and vein of leaves only), herbs (only leaf) and flowers (only calyx and corolla) in test tube. Add a solution of caustic alkali or nitric acid to the test tube and boil for 1-2 minutes, pour the contents into a porcelain dish, drain off the liquid, wash the material with water and leave for sometimes.

Remove the pieces of the material from the water with a spatula and put on the slide, add a few drops of the solution of glycerol or chloral hydrate. Crush the material with scalpel and cover with cover slip before examining.

(ii) Cut materials—For examining cut leaves, herbs and flowers, take several pieces in a test tube and employ the same methods as described for entire materials. Other methods employed for clarification of the material (leaf and stem) are described below:-

(a) Leaf—Boil pieces of leaves in a test tube with chloral hydrate for several minutes until completely clarified and then examine them in chloral hydrate solution. After clarification, leaf pieces are divided into two parts with the help of a scalpel or needle, and carefully turn one part. The leaf can be examined from both the dorsal and ventral surfaces.

(b) Stem—To examine stem material (without leaf) boil pieces in a solution of caustic alkali or in nitric acid. Remove the epidermis with a scalpel or a needle for examining the surface. For examining pressed specimen of stem, take separate tissue and press them with a scalpel on the slide.

B. Powder: For examining characters of the powder take sufficient amount of powder in Chloral-hydrate solution on a slide and cover it with a cover slip, warm over a low flame for a short time.

II. FRUITS AND SEEDS

A. Entire materials

For microscopical examination of fruit and seed take the specimens or outer coat of seed or fruit and examine as described below:

(i) Outer Coat—For examining the outer coat boil 3 or 4 seeds or fruits in caustic alkali solution in a test tube for 1-2 minutes (outer coat specimens with intensive pigmentation are boiled for longer period). After boiling, place the pieces on slide, remove the layers of the coat and examine them after mounting in glycerol solution.

(ii) Section—If fruits or seeds are too hard to cut then boil them for 15-30 minutes or more depending on their hardness or keep them in moistening chamber or absorb in water and chloroform solution or soften them with stem and then cut the specimen for examining purpose. For cutting small, flat seeds (which are difficult to hold) place them in a pith or potato slit for section cutting. Small, round or smooth seeds cannot be cut into section in the pith, then in such cases, they may be embedded in paraffin wax blocks for section cutting. For this, a block of paraffin ($0.6 \times 0.5 \times 1.5$ cms. in size) is made and the seed is embedded in the block by making a cavity or a pit in the block with a hot teasing needle. Cut the section with a sharp razor (through the object) together with the paraffin, place them on to the slide, remove paraffin with a needle or wash it with xylene and examine the section in chloral-hydrate solution.

B. Powder: For examining the structure of the cells of the seed coat and the cells of the embryo take a small amount of powder of the material on a slide in glycerol and cover it with a cover slip and examine.

1. Starch–For examining the presence of starch in the seed, take two specimens, one in iodine solution and the other in water. With iodine solution starch turns blue. Shape and the structure of starch grains can be seen in water and their size is measured. When examining objects containing starch, prepare specimen by slightly warming in chloral-hydrate solution.

2. Fixed Oil–For examining the presence of fixed oil, prepare a specimen in a solution of Sudan III droplets of fixed oil are coloured orange pink. When examining objects containing small amount of fixed oil, prepare a specimen by slightly warming in chloral-hydrate solution, and when examining objects containing large amount of fixed oil, then the powder is de-fatted and clarified as follows: Place 0.5 g. of the powder in a porcelain dish, add 5-10 ml. of dilute nitric acid and boil for 1 minute, then strain off the liquid through a cloth, wash the residue with hot water and return it to the porcelain dish with a spatula, boil it with 5-10 ml of caustic alkali solution for 1 minute and again strain it through the cloth and wash with water. Examine the residue in a glycerol solution, after the treatment the structure of the layers of the coat and their cells can be seen very distinctly.

3. Mucilage–Prepare a specimen in Ruthenium Red and examine it under a low power microscope or under dissecting microscope. Mucilage appears as pinkish-red or yellow coloured masses.

III. BARKS

A. Entire material: Prepare transverse or longitudinal section of bark. To soften bark break it into pieces of about 1-2 cm long and 0.5-1 cm wide and boil with in a test tube for 1-3 minutes. Soft pieces are then straightened with a scalpel so as to have a exact transverse or longitudinal direction. Cut the section with razor; moisten the surface of the bark with glycerol solution. Remove the sections with a brush and place them on the slide. Thin pieces of the bark are cut by placing them in the pith (potato or carrot). The sections are treated with various reagents before examining.

1. Lignified elements–For testing lignin add several drops of phloroglucinol and a drop of concentrated hydrochloric acid to the section on a slide then draw off the liquid, immerse the section in chloral hydrate solution and cover with a cover slip (the specimen should not be heated); the lignified elements are coloured crimson. Phloroglucinol can be substituted by saffranine, and the lignified elements are coloured pink. The excessive stain can be washed out with acidified alcohol.

2. Starch–Starch is detected by treating with iodine solution.

3. Tannin–Tannin is detected by treating with ferric ammonium sulphate solution (blue-black or green black colour shows the presence of Tannin) or with potassium-bichromate solution (brown colour indicates the presence of Tannin).

4. Anthraquinone derivatives–Anthraquinone derivatives are detected by treating with alkali solution (blood-red colour shows the presence of anthraquinone derivatives).

B. Cut materials: Prepare small pieces or scraping of bark and boil them for 3-5 minutes in a solution of caustic alkali or potassium hydroxide or in nitric acid solution and then mount in glycerin for examination on a slide covered with a cover slip.

C. Powder: Prepare specimen for examination by placing a little amount of powder on a slide, add 1-2 drops of phloroglucinol and a drop of concentrated hydrochloric acid, cover it with a cover slip, draw off the liquid from one side of the slide with filter paper, and then apply 1-2 drops of chloral-hydrate solution from the other side of the slide, lignified elements are stained crimson-red. Specimen may also be prepared with caustic alkali or ferric ammonium sulphate for this purpose.

IV. ROOTS AND RHIZOMES

A. Entire materials: For anatomical examination of entire roots and rhizomes cut transverse and longitudinal sections. For this, soften small pieces of roots without heating in glycerol solution for 1-3 days, depending on their hardness. The softened roots are straightened with the help of a scalpel in the right direction and then cut a section with the razor. First, cut thicker entire slices and then make thin, smaller sections. Stain the entire slices with phloroglucinol and concentrated hydrochloric acid or with safranin examine the specimen under a dissecting microscope. For microchemical test the small and thin sections are examined under microscope, as follows:

1. Starch—Starch is detected with iodine solution. For this, prepare specimen with water to measure the granule of starch with an ocular micrometer.

2. Inulin—Inulin is detected with Molish's reagent. For this place a little powder on a slide and apply 1-2 drops of naphthol and a drop of concentrated sulphuric acid, if inulin is present, the powder will appear reddish-violet coloured. Starch also gives this test, so the test for inulin can be done in the absence of starch.

3. Lignified elements—Lignified elements (fibrovascular bundles, mechanical tissue etc.) are detected with phloroglucinol and concentrated hydrochloric acid or safranin solution as mentioned above for barks.

4. Fixed oil—For fixed oil detection use Sudan IV, as mentioned above for fruits and seeds.

If required for tannin, anthraquinone derivatives test as mentioned above.

B. Cut material

Make small pieces or scrapings of roots or rhizomes and boil them for 3-5 minutes in caustic alkali or in nitric acid and then make pressed specimen and immerse them in glycerol. Microchemical tests can be performed with scrapings for various chemicals as mentioned above.

C. Powder

Prepare several specimens of the powder on slides in chloral hydrate solution and perform the above mentioned standard tests for detection of starch, fixed oil, inulin, lignified elements, anthraquinone derivatives, tannins, mucilage, etc.

Types of Stomata: There are several types of stomata, distinguished by the form and arrangement of the surrounding cells. The following descriptions apply to mature stomata.

Anomocytic (irregular-celled)—Previously known as ranunculaceous. The stoma is surrounded by a varying number of cells in no way differing from those of the epidermis generally.

Anisocytic (unequal-celled)—Previously known as cruciferous or solanaceous. The stoma is usually surrounded by three subsidiary cells, of which one is markedly smaller than the others.

Diacytic (cross-celled) -previously known as caryophyllaceous. The stoma is accompanied by two subsidiary cells whose common wall is at right angles to the guard cells.

Paracytic (parallel-celled)—Previously known as rubiaceus. The stoma has one each side one or more subsidiary cells parallel to the long axis of the pore and guard cells.

Determination of stomatal index

The stomatal index is the percentage of the number of stomata formed by the total number of epidermal cells, including the stomata, each stoma being counted as one cell. Place leaf fragments of about 5 × 5 mm in size in a test tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragment to a microscopic slide and prepare the mount, the lower epidermis uppermost, in chloral hydrate solution and put a small drop of glycerol-ethanol solution on one side of the cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper a cross (x) for each epidermal cell and a circle (o) for each stoma. Calculate the result as follows:

$$S \times 100$$

$$\text{Stomatal index} = \frac{\quad}{\quad}$$

$$E + S$$

Where

S = the number of stomata in a given area of leaf; and

E = the number of epidermal cells (including trichomes) in the same area of leaf.

For each sample of leaf make not fewer than ten determinations and calculate the average index.

Determination of palisade ratio: Palisade ratio is the average number of palisade cells under one epidermal cell. Place leaf fragments of about 5 × 5 mm in size in a test-tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer a fragment to a microscopical slide and prepare the mount of the upper epidermis in chloral hydrate solution and put a small drop of glycerol solution on one side of the cover-glass to prevent the preparation from drying. Examine with a 40x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Trace four adjacent epidermal cells on paper; focus gently downward to bring the palisade into view and trace sufficient palisade cells to cover the area of the outlines of the four epidermal cells. Count the palisade cells under the four epidermal cells. Where a cell is intersected, include it in the count only when more than half of it is within the area of the epidermal cells. Calculate the average number of palisade cells beneath one epidermal cell, dividing the count by 4; this is the “Palisade ratio”.

Determination of vein-islet number: The mesophyll of a leaf is divided into small portions of photosynthetic tissue by anastomosis of the veins and veinlets; such small portions or areas are termed

“Vein-Islets”. The number of vein-islets per square millimeter is termed the “Vein-Islet number”. This value has been shown to be constant for any given species and, for fullgrown leaves, to be unaffected by the age of the plant or the size of the leaves. The vein-islet number has proved useful for the critical distinction of certain nearly related species. The determination is carried out as follows:

For whole or cut leaves—Take pieces of leaf lamina with an area of not less than 4 square millimeters from the central portion of the lamina and excluding the midrib and the margin of the leaf. Clear the pieces of lamina by heating in a test tube containing chloral hydrate solution on a boiling water-bath for 30 to 60 minutes or until clear and prepare a mount in glycerol-solution or, if desired, stain with safranin solution and prepare the mount in Canada Balsam. Place the stage micrometer on the microscope stage and examine with 4x objective and a 6x eye piece. Draw a line representing 2 mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on the line representing an area of 4 square millimeters. Move the paper so that the square is seen in the centre of the field of the eyepiece. Place the slide with the cleared leaf piece on the microscope stage and draw in the veins and veinlets included within the square, completing the outlines of those vein-islets which overlap two adjacent sides of the square. Count the number of vein-islets within the square including those overlapping on two adjacent sides and excluding those intersected by the other two sides. The result obtained is the number of vein-islets in 4 square millimeters. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millimeter.

For leaf fragments having an area less than 4 square millimeters—Take fragments of leaf lamina each with an area of not less than 1 square millimeter, excluding the midrib and the margin of the leaf. Clear and prepare amount as stated above. Use a 10x objective and a 6x eyepiece and draw a line representing 1 mm on a sheet of paper by means of a microscopical drawing apparatus and construct a square on this line representing an area of 1 square millimetre. Carry out the rest of the procedure as stated above. The result obtained is the number of vein-islets in 1 square millimetre. For each sample of leaf make no less than 12 determinations and calculate the average number.

Determination of stomatal number: Place leaf fragments of about 5x5 mm in size in a test tube containing about 5 ml of chloral hydrate solution and heat in a boiling water-bath for about 15 minutes or until the fragments become transparent. Transfer fragments to a microscopic slide and prepare the mount the lower epidermis uppermost, in chloral hydrate solution and put a small drop of glycerol-ethanol solution on one side of the cover glass to prevent the preparation from drying. Examine with a 40 x objective and a 6x eye piece, to which a microscopical drawing apparatus is attached. Mark on the drawing paper a cross (x) for each stomata and calculate the average number of stomata per square millimeter for each surface of the leaf.

DETERMINATION OF QUANTITATIVE DATA

Net content: The content of the final or retail pack shall not be less than 98 percent of the declared net content.

Foreign matter: The sample shall be free from visible signs of mold growth, sliminess, stones, rodent excreta, insects or any other noxious foreign matter when examined as given below.

Take a representative portion from a large container, or remove the entire contents of the packing if 100 g or less, and spread in a thin layer in a suitable dish or tray. Examine in daylight with unaided eye. Transfer suspected particles, if any, to a petri dish, and examine with 10x lens in daylight.

Determination of total ash: Incinerate about 2 to 3 g accurately weighed, of the ground drug in a tared platinum or silica dish at a temperature not exceeding 4500 until free from carbon, cool and weigh. If a carbon free ash cannot be obtained in this way, exhaust the charred mass with hot water, collect the residue on an ashless filter paper, incinerate the residue and filter paper, add the filtrate, evaporate to dryness, and ignite at a temperature not exceeding 4500.

Determination of acid insoluble ash: To the crucible containing total ash, add 25 ml of dilute hydrochloric acid. Collect the insoluble matter on an ashless filter paper (Whatman 41) and wash with hot water until the filtrate is neutral. Transfer the filter paper containing the insoluble matter to the original crucible, dry on a hot-plate and ignite to constant weight. Allow the residue to cool in a suitable desiccator for 30 minutes and weigh without delay. Calculate the content of acid-insoluble ash with reference to the air-dried drug.

Determination of water soluble ash: Boil the ash for 5 minutes with 25 ml of water; collect insoluble matter in a Gooch crucible or on an ashless filter paper, wash with hot water, and ignite for 15 minutes at a temperature not exceeding 4500. Subtract the weight of the insoluble matter from the weight of the ash; the difference in weight represents the water soluble ash. Calculate the percentage of water-soluble ash with reference to the air-dried drug.

Determination of sulphated ash: Heat a silica or platinum crucible to redness for 10 minutes; allow cooling in a desiccator and weighing. Put 1 to 2 g of the substance, accurately weighed, into the crucible, ignite gently at first, until the substance is thoroughly charred. Cool, moisten the residue with 1 ml of sulphuric acid, heat gently until white fumes are no longer evolved and ignite at 800 ± 250 until all black particles have disappeared. Conduct the ignition in a place protected from air currents. Allow the crucible to cool, add a few drops of sulphuric acid and heat. Ignite as before, allow cooling and weighing. Repeat the operation until two successive weighing do not differ by more than 0.5 mg.

Determination of alcohol soluble extractive: Macerate 5 g of the air dried drug, coarsely powdered, with 100 ml of alcohol the specified strength in a closed flask for twenty-four hours, shaking frequently during six hours and allow to stand for eighteen hours. Filter rapidly, taking precautions against loss of solvent, evaporate 25 ml of the filtrate to dryness in a tared flat bottomed shallow dish, and dry at 1050, to constant weight and weigh. Calculate the percentage of alcohol-soluble extractive with reference to the air-dried drug.

Determination of water soluble extractive: Proceed as directed for the determination of alcohol-soluble extractive, using chloroform-water instead of ethanol.

Determination of ether soluble extractive (fixed oil content): Transfer a suitably weighed quantity (depending on the fixed oil content) of the air-dried, crushed drug to an extraction thimble, extract with solvent ether (or petroleum ether, b.p. 400 to 600) in a continuous extraction apparatus (Soxhlet extractor) for 6 hours. Filter the extract quantitatively into a tared evaporating dish and evaporate off the solvent on a water bath. Dry the residue at 105° to constant weight. Calculate the percentage of ether-soluble extractive with reference to the air-dried drug.

Determination of moisture content (loss on drying): Procedure set forth here determines the amount of volatile matter (i.e., water drying off from the drug). For substances appearing to contain water as the only volatile constituent, the procedure given below, is appropriately used. Place about 10 g of drug (without preliminary drying) after accurately weighing (accurately weighed to within 0.01 g) it in a tared evaporating dish. For example, for unground or unpowdered drug, prepare about 10 g of the sample by cutting shredding so that the parts are about 3 mm in thickness. Seeds and fruits, smaller than 3 mm should be cracked. Avoid the use of high speed mills in preparing the samples, and exercise care that no appreciable amount of moisture is lost during preparation and that the portion taken is representative of the official sample. After placing the above said amount of the drug in the tared evaporating dish, dry at 105° for 5 hours, and weigh. Continue the drying and weighing at one hour interval until difference between two successive weighing corresponds to not more than 0.25 per cent. Constant weight is reached when two consecutive weighing after drying for 30 minutes and cooling for 30 minutes in a desiccator, show not more than 0.01 g difference.

Determination of water insoluble matter: Take 10 gm of sample, add 200 ml hot distilled H₂O and bring to boiling. Allow to cool to room temperature. Filter through a tared gooch crucible having a bed of asbestos or sintered glass filter. Wash the residue with hot water till the filtrate is sugar-free (perform Molisch test). Dry the gooch crucible or sintered glass filter at 135 ± 2° C and weigh. Express as % insoluble matter.

Determination of volatile oil in drugs: The determination of volatile oil in a drug is made by distilling the drug with a mixture of water and glycerin, collecting the distillate in a graduated tube in which the aqueous portion of the distillate is automatically separated and returned to the distilling flask, and measuring the volume of the oil. The content of the volatile oil is expressed as a percentage v/w. The apparatus consists of the following parts. The cleverger's apparatus described below is recommended but any similar apparatus may be used provided that it permits complete distillation of the volatile oil. All glass parts of the apparatus should be made of good quality resistance glass.

The apparatus is cleaned before each distillation by washing successively with acetone and water, then inverting it, filling it with chromic sulphuric acid mixture, after closing the open end at G, and allowing to stand, and finally rinsing with water.

Methods of determination: A suitable quantity of the coarsely powdered drug together with 75 ml of glycerin and 175 ml of water in the one litre distilling flask, and a few pieces of porous earthen ware and one filter paper 15 cm cut into small strips, 7 to 12 mm wide, are also put in the distilling flask,

which is then connected to the still head. Before attaching the condenser, water is run into the graduated receiver, keeping the tap T open until the water overflows, at P. Any air bubbles in the rubber tubing a—b are carefully removed by pressing the tube. The tap is then closed and the condenser attached. The contents of the flask are now heated and stirred by frequent agitation until ebullition commences. The distillation is continued at a rate, which keeps the lower end of the condenser cool. The flask is rotated occasionally to wash down any material that adheres to its sides. At the end of the specified time (3 to 4 hours) heating is discontinued, the apparatus is allowed to cool for 10 minutes and the tap T is opened and the tube L1 lowered slowly; as soon as the layer of the oil completely enters into the graduated part of the receiver the tap is closed and the volume is read. The tube L1 is then raised till the level of water in it is above the level of B, when the tap T is slowly opened to return the oil to the bulb. The distillation is again continued for another hour and the volume of oil is again read, after cooling the apparatus as before. If necessary, the distillation is again continued until successive readings of the volatile oil do not differ. The measured yield of volatile oil is taken to be the content of volatile oil in the drug. The dimensions of the apparatus may be suitably modified in case of necessity.

Special Processes Used in Alkaloidal Assays

Continuous extraction of drug: Where continuous extraction of a drug of any other substance is recommended in the monograph, the process consists of percolating it with suitable solvent at a temperature approximately that of the boiling point of the solvent. Any apparatus that permits the uniform percolation of the drug and the continuous flow of the vapour of the solvent around the percolator may be used. The type commonly known as the Soxhlet apparatus (see fig. 2) is suitable for this purpose.

Tests for complete extraction of alkaloids: Complete extraction is indicated by the following tests:

When extracting with an aqueous or alcoholic liquid-After extracting at least three times with the liquid, add to a few drops of the next portion, after acidifying with 2 N hydrochloric acid if necessary, 0.05 ml of potassium mercuri-iodide solution or for solanaceous alkaloids 0.05 ml of potassium iodobismuthate solution; no precipitate or turbidity, is produced.

When extracting with an immiscible solvent-After extracting at least three times with the solvent, add to 1 to 2 ml of the next portion 1 to 2 ml of 0.1 N hydrochloric acid, remove the organic solvent by evaporation, transfer the aqueous residue to a test tube, and add 0.05 ml of potassium mercuri-iodide solution for solanaceous alkaloids 0.05 ml of potassium iodobismuthate solution or for emetine, 0.05 ml of iodine solution; not more than a very faint opalescence is produced.

Thin-Layer Chromatography (TLC): Thin-layer chromatography is a technique in which a solute undergoes distribution between two phases, stationary phase acting through adsorption and a mobile phase in the form of a liquid. The adsorbent is a relatively thin, uniform layer of dry finely powdered material applied to a glass, plastic or metal sheet or plate. Precoated plates are most commonly used. Separation may also be achieved on the basis of partition or a combination of partition and adsorption,

depending on the particular type of support, its preparation and its use with different solvent. Identification can be effected by observation of spots of identical R_f value and about equal magnitude obtained, respectively, with an unknown and a reference sample chromatographed on the same plate. A visual comparison of the size and intensity of the spots usually serves for semi-quantitative estimation.

Apparatus

- (a) Flat glass plates of appropriate dimensions which allow the application at specified points of the necessary quantities of the solution being examined and appropriate reference solutions and which allow accommodation of the specified migration path-length. The plates are prepared as described below; alternatively, commercially prepared plates may be used.
- (b) An aligning tray or a flat surface on which the plates can be aligned and rested when the coating substance is applied.
- (c) The adsorbent or coating substance consisting of finely divided adsorbent materials, normally 5 μm to 40 μm in diameter is suitable for chromatography. It can be applied directly to the plate or can be bonded to the plate by means of plaster of paris (Hydrated Calcium Sulphate) or with any other suitable binders. The adsorbent may contain fluorescing material to help in visualising spots that absorb ultra-violet light.
- (d) A spreader which, when moved over the glass plate, will apply a uniform layer of adsorbent of desired thickness over the entire surface of the plate.
- (e) A storage rack to support the plates during drying and transportation.
- (f) A developing chamber that can accommodate one or more plates and can be properly closed and sealed. The chamber is fitted with a plate support rack that supports the plates, back to back, with lid of the chamber in place.
- (g) Graduated micro-pipettes capable of delivering microlitre quantities say 10 μl and less.
- (h) A reagent sprayer that will emit a fine spray and will not itself be attacked by the reagent.
- (i) An ultra-violet light, suitable for observation at short (254 nm) and long (365 nm) ultra-violet wavelengths.

Preparation of Plates: Unless otherwise specified in the monograph, the plates are prepared in the following manner. Prepare a suspension of the coating substance in accordance with the instructions of the supplier and, using the spreading device designed for the purpose, spread a uniform layer of the suspension, 0.20 to 0.30 mm thick, on a flat glass plate 20 cm long. Allow the coated plates to dry in air, heat at 1000 to 1050 for at least 1 hour (except in the case of plates prepared with cellulose when heating for 10 minutes is normally sufficient) and allow to cool, protected from moisture. Store the plates protected from moisture and use within 3 days of preparation. At the time of use, dry the plates again, if necessary, as prescribed in the monographs. Now a days pre coated plates of silica gel on glass/aluminium/ plastic sheets are also available.

Methods: Unless unsaturated conditions are prescribed, prepare the tank by lining the walls with sheets of filter paper; pour into the tank, saturating the filter paper in the process, sufficient of the mobile phase to form a layer of solvent 5 to 10 mm deep, close the tank and allow to stand for 1 hour at room temperature. Remove a narrow strip of the coating substance, about 5 mm wide, from the vertical sides of the plate. Apply the solutions being examined in the form of circular spots about 2 to 6 mm in diameter, or in the form of bands (10 to 20 mm x 2 to 6 mm unless otherwise specified) on a line parallel with, and 20 mm from, one end of the plate, and not nearer than 20 mm to the sides; the spots should be 15 mm apart. If necessary, the solutions may be applied in portions, drying between applications. Mark the sides of the plate 15 cm, or the distance specified in the monograph, from the starting line. Allow the solvent to evaporate and place the plate in the tank, ensuring that it is as nearly vertical as possible and that the spots or bands are above the level of the mobile phase. Close the tank and allow to stand at room temperature, until the mobile phase has ascended to the marked line. Remove the plate and dry and visualise as directed in the monograph; where a spraying technique is prescribed it is essential that the reagent be evenly applied as a fine spray. For two-dimensional chromatography dry the plate after the first development and carry out the second development in a direction perpendicular to the first. When the method prescribed in the monograph specifies 'protected from light' or 'in subdued light' it is intended that the entire procedure is carried out under these conditions.

Visualisation The phrases ultra-violet light (254 nm) and ultra-violet light (365 nm) indicate that the plate should be examined under an ultra-violet light having a maximum output at about 254 or at about 365 nm, as the case may be. The term secondary spot means any spot other than the principal spot. Similarly, a secondary band is any band other than the principal band.

Rf Value: Measure and record the distance of each spot from the point of its application and calculate the Rf value by dividing the distance travelled by the spots by the distance travelled by the front of the mobile phase.

Starch estimation (Mont Gomery, 1957) [Spectrophotometric method]: Prepare 10 per cent homogenate of the plant tissue in 80 per cent ethanol. Centrifuge at 2000 rpm for 15 minutes. To the residue thus obtained, add 4 ml of distilled water, heat on a water bath for 15 minutes and macerate with the help of glass rod. To each of the samples, add 3 ml of 52 per cent perchloric acid and centrifuge at 2000 rpm for 15 minutes. The supernatant thus obtained is made upto known volume (generally upto 10 ml or depending on the expected concentration of starch). Take 0.1 ml aliquot, add 0.1 ml of 80 per cent phenol and 5 ml conc. sulphuric acid, cool and then read the absorbance at 490 nm.

Sugar estimation (Mont Gomery, 1957) [Spectrophotometric Method]: Prepare 10 per cent homogenate of the plant tissue in 80 per cent ethanol. Centrifuge at 2000 rpm for 15 minutes. The supernatant obtained is made upto known volume (generally upto 10 ml or depending on the expected

concentration of sugar). Take 0.1 ml aliquot, add 0.1 ml of 80 per cent phenol and 5 ml conc. sulphuric acid, cool and then read the absorbance at 490 nm.

Fatty oil estimation: To estimate fatty oils, extract accurately weighed air-dried powdered plant material with petroleum ether (40-600) in a Soxhlet apparatus. Dry the extract over anhydrous sodium sulphate and remove the solvent under vacuum at 400. Weigh the residue and calculate the percentage with reference to the weight of plant material used.

Test for argemone oil (Mustard oil): Take 2-3 drops of the oil in a dry test tube and mix successively with one drop of liquid phenol and 2-4 ml of conc. Sulphuric acid and shake. A deep red colour develops within 10-20 seconds if argemone oil is present as adulterant.

Test for the presence of cottonseed oil (Halphen test): Take about 5ml of the oil in a test tube and add equal amount of Sulphur solution (1% solution of Sulphur in carbon disulphide and then add an equal volume of amyl alcohol). Mix thoroughly by shaking and heating gently in a water bath (70-80°) for a few minutes with occasional shaking until the carbon disulphide has boiled off and the sample stops foaming. Place the tube in an oil bath or a saturated brine bath maintained at 110 to 115°, and hold for 1 to 2 hours. A red colour at the end of this period indicates the presence of cottonseed oil. This test is sensitive to the extent of 0.5 percent of cottonseed oil in other oils.

Test for clove oil, alkali soluble matter: Place 80 ml of a 5 per cent w/v solution of potassium hydroxide in a 150-ml flask with a long neck, which is graduated in tenths of an ml and is of such diameter that not less than 15cm in length has a capacity of 10ml. The flask before use is cleaned with Sulphuric acid and well rinsed with water. Add 10ml of the oil, cleared by filtration if necessary, and shake thoroughly at five-minute intervals for half an hour, at ambient temperature. Raise the undissolved portion of the oil into the graduated part of the neck of the flask by gradual addition of more of the potassium hydroxide solution; allow standing for not less than twenty-four hours, and read off the volume of the undissolved portion of the oil. The undissolved portion of the oil measures not less than 1.0 ml and not more than 1.5 ml.

APPENDIX-1II

HEAVY METAL TESTS

Determination of lead (Pb) (Graphite Oven Method):

Determination conditions: Reference condition: dry temperature: 100-1200, maintain 20 seconds; ash temperature: 400-7500, maintain 20-25 seconds; atomic temperature: 1700-21000, maintain 4-5 seconds; measurement wavelength: 283.3 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of lead standard stock solution: Measure accurately a quantity of lead single-element standard solution to prepare standard stock solution with 2 per cent nitric acid solution, which containing 1 µg per ml, stored at 0-50.

Preparation of calibration curve: Measure accurately a quantity of lead standard stock solutions respectively, diluted with 2 per cent nitric acid solution to the concentration of 0, 5, 20, 40, 60, 80 ng per ml, respectively. Measure respectively accurately 1 ml the above solution, add respectively 1 ml of 1 per cent ammonium dihydrogen phosphate and 0.2 per cent magnesium nitrate mix well, pipette accurately 20 µl to inject into the atomic generator of graphite oven and determine their absorbance, then draw the calibration curve with absorbance as vertical axis and concentration as horizontal ordinate.

Preparation of test solution

Method: Weigh accurately 0.5 g of the coarse powder of the substance being examined, transfer into a casparian flask, add 5-10 ml of the mixture of nitric acid and perchloric acid (4 : 1), add a small hopper on the flask-top, macerate overnight, heat to slake on the electric hot plate, keep somewhat-boiling, if brownish-black, add again a quantity of the above mixture, continuously heat till the solution becomes clean and transparent, then raise temperature, heat continuously to thick smoke, till white smoke disperse, the slaked solution becomes colourless and transparent or a little yellow, cool, transfer it into a 50 ml volumetric flask, wash the container with 2 per cent nitric acid solution add the washing solution into the same volumetric flask and dilute with the same solvent to the volume, shake well. Prepare synchronously the reagent blank solution according to the above procedure.

Determination: Measure accurately 1 ml of the test solution and its corresponding reagent blank solution respectively, add 1 ml of solution containing 1per cent ammonium dihydrogen phosphate and 0.2 per cent magnesium nitrate, shake well, pipette accurately 10-20 µl to determine their absorbance according to the above method of "Preparation of calibration curve". Calculate the content of lead (Pd) in the test solution from the calibration curve.

Determination of Cadmium (Cd) (Graphite Oven Method)

Determination conditions: Reference condition: dry temperature: 100-1200, maintain 20 seconds; ash temperature: 300-5000, maintain 20-25 seconds; atomic temperature: 1500-19000, maintain 4-5 seconds; measurement wavelength: 228.8 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of Cd standard stock solution: Measure accurately a quantity of Cd single-element standard solution to prepare standard stock solution Cd with 2 per cent nitric acid, which containing 0.4 µg per ml Cd, stored at 0-50.

Preparation of calibration curve: Measure accurately a quantity of cadmium standard stock solutions, diluted to the concentration of 1.6, 3.2, 4.8, 6.4 and 8.0 ng per ml with 2 per cent nitric acid, respectively. Pipette accurately 10 µl the above solutions respectively, inject them into the graphite oven, determine their absorbance, and then draw the calibration curve with absorbance as vertical axis and concentration as horizontal ordinate.

Preparation of test solution: Reference to “Preparation of test solution” of Pb in the above.

Determination: Pipette accurately 10-20 µl of the test solution and its corresponding reagent blank solution respectively; determine their absorbance according to the above method of “Preparation of calibration curve. If interference occurs, weigh accurately respectively 1 ml of the standard solution, blank solution and test solution, add 1 ml of a solution containing 1per cent ammonium dihydrogen phosphate and 0.2 per cent magnesium nitrate, shake well, determine their absorbance according to the method above, calculate the content of Cd in the test solution from the calibration curve.

Determination of Arsenic (As) (Hydride Method)

Determination conditions: Apparatus: suitable hydride generator device, reducing agent: a solution containing 1per cent sodium borohydride and 0.3 per cent sodium hydroxide; carrier liquid: 1 per cent hydrochloric acid; carrier gas: nitrogen; measurement wavelength: 193.7 nm; background calibration: deuterium lamp (D lamp) or Zeeman Effect.

Preparation of As standard stock solution: Measure accurately a quantity of As single-element standard solution to prepare standard stock solution with 2 per cent nitric acid solution, which contains 1.0 µg per ml As, stored at 0-50.

Preparation of calibration curve: Measure accurately proper quantity of arsenic standard stock solutions, diluted with 2 per cent nitric acid to the concentration of 2, 4, 8, 12 and 16 ng per ml respectively. Accurately transfer 10 ml of each into 25 ml volumetric flask respectively, add 1 ml of 25 per cent potassium iodide solution (prepared prior to use), shake well, add 1 ml of ascorbic acid solution (prepared prior to use), shake well, dilute with hydrochloric acid solution (20-100) to the volume, shake well, close the stopper and immerse the flask in a water bath at 800 for 3 minutes. Cool, transfer proper quantities of each solution respectively into the hydride generator device, determine the absorbance, then plot the calibration curve with peak area (absorbance) as vertical axis and concentration as horizontal ordinate.

Determination: Pipette accurately 10 ml of the test solution and its corresponding reagent blank solution respectively, proceed as described under “Preparation of calibration curve” beginning at the words “add 1 ml of 25 per cent potassium iodide solution”. Calculate the content of As in the test solution from the calibration curve.

Determination of Mercury (Hg) (Cold Absorption Method)

Determination conditions: Apparatus: suitable hydride generator device; reducing agent: a solution containing 0.5 per cent sodium borohydride and 0.1 per cent sodium hydroxide; carrier liquid: 1 per cent hydrochloric acid; carrier gas: nitrogen; measurement wavelength: 253.6 nm; background calibration: deuterium lamp (D lamp) or Zeeman effect.

Preparation of mercury standard stock solution: Measure accurately a proper quantity of mercury singleelement standard solution to prepare standard stock solution with 2 per cent nitric acid solution, which containing 1.0 µg per ml Hg, stored at 0-50.

Preparation of calibration curve: Measure accurately 0, 0.1, 0.3, 0.5, 0.7 and 0.9 ml of mercury standard stock solution, transfer into a 50 ml volumetric flask respectively, add 40 ml 4 per cent sulphuric acid solution and 0.5 ml of 5 per cent potassium permanganate solution, shake well, drop 5 per cent hydroxylamine hydrochloride solution until the violet red just disappears, dilute with 4 per cent sulfuric acid solution to the volume, shake well. A quantity of each solution is injected to the hydride generator device, determine the absorbance, then plot the calibration curve with peak area (absorbance) as vertical axis and concentration as horizontal ordinate.

Preparation of test solution

Method: Transfer 1 g of the coarse powder of the substance being examined, accurately weighed, into a casparian flask, add 5-10 ml of the mixture solution of nitric acid and perchloric acid (4 : 1), mix well, fix a small hopper on the flask-top, immerse overnight, heat to slake on the electric hot plate at 120-1400 for 4-8 hours until slaking completely, cool, add a quantity of 4 per cent sulfuric acid solution and 0.5 ml of 5 per cent potassium permanganate solution, shake well, drop 5 per cent hydroxylamine hydrochloride solution until the violet red colour just disappears, dilute with 4 per cent sulphuric acid solutions to 25 ml, shake well, centrifugate if necessary, the supernatant is used as the test solution. Prepare synchronally the reagent blank solute based on the same procedure.

Determination: Pipette accurately a quantity of the test solution and its corresponding reagent blank solution, respectively, proceed as described under "Preparation of calibration curve" beginning at the words "add 1 ml of 25 per cent potassium iodide solution". Calculate the content of mercury (Hg) in the test solution from the calibration curve.

APPENDIX 1V

MICROBIAL LIMIT TESTS

The following tests are designed for the estimation of the number of viable aerobic micro-organisms present and for detecting the presence of designated microbial species in pharmaceutical substances. The term 'growth' is used to designate the presence and presumed proliferation of viable micro-organisms.

Preliminary Testing: The methods given herein are invalid unless it is demonstrated that the test specimens to which they are applied do not, of themselves, inhibit the multiplication under the test conditions of micro-organisms that can be present. Therefore, prior to doing the tests, inoculate diluted specimens of the substance being examined with separate viable cultures of *Escherichia coli*, *Salmonella* species, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. This is done by adding 1 ml of not less than 10⁻³ dilutions of a 24 h broth culture of the micro-organisms to the first dilution (in buffer solution pH 7.2, fluid soyabean-casein digest medium or fluid lactose medium) of the test material and following the test procedure. If the organisms fail to grow in the relevant medium the procedure should be modified by (a) increasing the volume of diluent with the quantity of test material remaining the same, or (b) incorporating a sufficient quantity of a suitable inactivating agent in the diluents, or (c) combining the aforementioned modifications so as to permit growth of the organisms in the media. If inhibitory substances are present in the sample, 0.5 per cent of soya lecithin and 4 per cent of polysorbate 20 may be added to the culture medium. Alternatively, repeat the test as described in the previous paragraph, using fluid casein digest-soya lecithin-polysorbate 20 medium to demonstrate neutralization of preservatives or other antimicrobial agents in the test material. Where inhibitory substances are contained in the product and the latter is soluble, the Membrane filtration method described under Total Aerobic Microbial Count may be used. If in spite of incorporation of suitable inactivating agents and a substantial increase in the volume of diluent it is still not possible to recover the viable cultures described above and where the article is not suitable for applying the membrane filtration method it can be assumed that the failure to isolate the inoculated organism may be due to the bactericidal activity of the product. This may indicate that the article is not likely to be contaminated with the given species of micro-organisms. However, monitoring should be continued to establish the spectrum of inhibition and bactericidal activity of the article.

Media: Culture media may be prepared as given below or dehydrated culture media may be used provided that, when reconstituted as directed by the manufacturer, they have similar ingredients and / or yield media comparable to those obtained from the formulae given below. Where agar is specified in a formula, use agar that has a moisture content of not more than 15 per cent. Where water is called for in a formula, use purified water. Unless otherwise indicated, the media should be sterilized by heating in an autoclave at 1150 for 30 minutes. In preparing media by the formulas given below, dissolve the soluble solids in the water, using heat if necessary, to effect complete solution and add

solutions of hydrochloric acid or sodium hydroxide in quantities sufficient to yield the required pH in the medium when it is ready for use. Determine the pH at 25.0 ± 0.2 .

Total Aerobic Microbial Count: Pretreat the sample of the product being examined as described below.

Water soluble products: Dissolve 10 g or dilute 10 ml of the preparation being examined, unless otherwise specified, in buffered sodium chloride-peptone solution pH 7.0 or any other suitable medium shown to have no antimicrobial activity under the conditions of test and adjust the volume to 100 ml with the same medium. If necessary, adjust the pH to about 7.

Products insoluble in water (non fatty): Suspend 10 g or 10 ml of the preparation being examined, unless otherwise specified, in buffered sodium chloride-peptone solution pH 7.0 or any other suitable medium shown not to have antimicrobial activity under the conditions of the test and dilute to 100 ml with the same medium. If necessary, divide the preparation being examined and homogenize the suspension mechanically. A suitable surface-active agent such as 0.1 per cent w/v of polysorbate 80 may be added to assist the suspension of poorly wettable substances. If necessary, adjust the pH of the suspension to about 7.

Fatty products: Homogenise 10 g or 10 ml of the preparation being examined, unless otherwise specified, with 5g of polysorbate 20 or polysorbate 80. If necessary, heat to not more than 40°C. Mix carefully while maintaining the temperature in the water-bath or in an oven. Add 85 ml of buffered sodium chloride-peptone solution pH 7.0 or any other suitable medium shown to have no antimicrobial activity under the conditions of the test, heated to not more than 40°C if necessary. Maintain this temperature for the shortest time necessary for formation of an emulsion and in any case for not more than 30 minutes. If necessary, adjust the pH to about 7.

Examination of the sample: Determine the total aerobic microbial count in the substance being examined by any of the following methods.

Membrane filtration: Use membrane filters 50 mm in diameter and having a nominal pore size not greater than 0.45 µm the effectiveness of which in retaining bacteria has been established for the type of preparation being examined. Transfer 10 ml or a quantity of each dilution containing 1 g of the preparation being examined to each of two membrane filters and filter immediately. If necessary, dilute the pretreated preparation so that a colony count of 10 to 100 may be expected. Wash each membrane by filtering through it three or more successive quantities, each of about 100 ml, of a suitable liquid such as buffered sodium chloride-peptone solution pH 7.0. For fatty substances add to the liquid polysorbate 20 or polysorbate 80. Transfer one of the membrane filters, intended for the enumeration of bacteria, to the surface of a plate of casein soyabean digest agar and the other, intended for the enumeration of fungi, to the surface of a plate of Sabouraud dextrose agar with antibiotics. Incubate the plates for 5 days, unless a more reliable count is obtained in shorter time, at 300 to 350 in the test for bacteria and 200 to 250 in the test for fungi. Count the number of colonies

that are formed. Calculate the number of micro-organisms per g or per ml of the preparation being examined, if necessary counting bacteria and fungi separately.

Plate count for bacteria: Using Petri dishes 9 to 10 cm in diameter, add to each dish a mixture of 1 ml of the pretreated preparation and about 15 ml of liquefied casein soyabean digest agar at not more than 450. Alternatively, spread the pretreated preparation on the surface of the solidified medium in a Petri dish of the same diameter. If necessary, dilute the pretreated preparation as described above so that a colony count of not more than 300 may be expected. Prepare at least two such Petri dishes using the same dilution and incubate at 300 to 350 for 5 days, unless a more reliable count is obtained in a shorter time. Count the number of colonies that are formed. Calculate the results using plates with the greatest number of colonies but taking 300 colonies per plate as the maximum consistent with good evaluation.

Plate count for fungi: Proceed as described in the test for bacteria but use Sabouraud dextrose agar with antibiotics in place of casein soyabean digest agar and incubate the plates at 200 to 250 for 5 days, unless a more reliable count is obtained in a shorter time. Calculate the results using plates with not more than 100 colonies.

APPENDIX V

PESTICIDE RESIDUE

Definition: For the purposes of the Pharmacopeia, a pesticide is any substance or mixture of substances intended for preventing, destroying or controlling any pest, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of vegetable drugs. The item includes substances intended for use as growth-regulators, defoliants or desiccants and any substance applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Limits: Unless otherwise indicated in the monograph, the drug to be examined at least complies with the limits indicated in Table -1, The limits applying to pesticides that are not listed in the table and whose presence is suspected for any reason comply with the limits set by European Community directives 76/895 and 90/642, including their annexes and successive updates. Limits for pesticides that are not listed in Table.-1 nor in EC directives are calculated using the following expression:

$$\text{ADI} \times \text{M}$$

$$\text{MDD} \times 100$$

ADI = Acceptable Daily Intake, as published by FAO-WHO, in milligrams per kilogram of body mass,

M = body mass in kilograms (60 kg),

MDD = daily dose of the drug, in kilograms.

If the drug is intended for the preparation of extracts, tinctures or other pharmaceutical forms whose preparation method modifies the content of pesticides in the finished product, the limits are calculated using the following expression:

$$\text{ADI} \times \text{M} \times \text{E}$$

$$\text{MDD} \times 100$$

E = Extraction factor of the method of preparation, determined experimentally.

Higher limits can also be authorised, in exceptional cases, especially when a plant requires a particular cultivation method or has a metabolism or a structure that gives rise to a higher than normal content of pesticides. The competent authority may grant total or partial exemption from the test when the complete history (nature and quantity of the pesticides used, date of each treatment during cultivation and after the harvest) of the treatment of the batch is known and can be checked precisely.

Sampling

Method: For containers up to 1 kg, take one sample from the total content, thoroughly mixed, sufficient for the tests. For containers between 1 kg and 5 kg, take three samples, equal in volume, from the upper, middle and lower parts of the container, each being sufficient to carry out the tests. Thoroughly mix the samples and take from the mixture an amount sufficient to carry out the tests. For containers of more than 5 kg, take three samples, each of at least 250 g from the upper, middle and

lower parts of the container. Thoroughly mix the samples and take from the mixture an amount sufficient to carry out the tests.

Size of sampling: If the number (n) of containers is three or fewer, take samples from each container as indicated above under Method. If the number of containers is more than three, take n+1 samples for containers as indicated under Method, rounding up to the nearest unit if necessary. The samples are to be analysed immediately to avoid possible degradation of the residues. If this is not possible, the samples are stored in air-tight containers suitable for food contact, at a temperature below 00, protected from light.

Reagents: All reagents and solvents are free from any contaminants, especially pesticides, which might interfere with the analysis. It is often necessary to use special quality solvents or, if this is not possible, solvents that have recently been re-distilled in an apparatus made entirely of glass. In any case, suitable blank tests must be carried out.

Apparatus: Clean the apparatus and especially glassware to ensure that they are free from pesticides, for example, soak for at least 16 h in a solution of phosphate-free detergent, rinse with large quantities of distilled water and wash with acetone and hexane or heptane.

Substance Limit (mg/kg)

Alachlor 0.02

Aldrin and Dieldrin (sum of) 0.05

Azinphos-methyl 1.0

Bromopropylate 3.0

Chlordane (sum of cis-, trans – and Oxythlordane) 0.05

Chlorfenvinphos 0.5

Chlorpyrifos 0.2

Chlorpyrifos-methyl 0.1

Cypermethrin (and isomers) 1.0

DDT (sum of p,p-‘DDT, o,p-‘DDT, p,p-‘DDE and p,p-‘TDE 1.0

Deltamethrin 0.5

Diazinon 0.5

Dichlorvos 1.0

Dithiocarbamates (as CS₂) 2.0

Endosulfan (sum of isomers and Endosulfan sulphate) 3.0

Endrin 0.05

Ethion 2.0

Fenitrothion 0.5

Fenvalerate 1.5

Fonofos 0.05

Heptachlor (sum of Heptachlor and Heptachlorepoxyde) 0.05

Hexachlorobenzene 0.1
Hexachlorocyclohexane isomers (other than) 0.3
Lindane (-Hexachlorocyclohexane) 0.6
Malathion 1.0
Methidathion 0.2
Parathion 0.5
Parathion-methyl 0.2
Permethrin 1.0
Phosalone 0.1
Piperonyl butoxide 3.0
Pirimiphos-methyl 4.0
Pyrethrins (sum of) 3.0
Quintozene (sum of quintozene, pentachloroaniline and methyl
pentachlorophenyl sulphide) 1.0

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