

**THE AYURVEDIC PHARMACOPEIA
OF
BANGLADESH**

**Part I: Volume III
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 HOMOEOPATHY AND TRADITIONAL MEDICINE
MOHAKHALI, DHAKA**

2019

Published by : Line Director, Alternative Medical Care (AMC)
Directorate General of Health Services (DGHS)
Health Service Division (HSD)
Mohakhali, Dhaka-1212

Ownership : Line Director, Alternative Medical Care (AMC)
Directorate General of Health Services (DGHS)
Mohakhali, Dhaka-1212

Composed by : LIFE Center, House 93, Road 1, Mohammadia Housing Society
Mohammadpur, Dhaka-1207
Cell: 0088-01711450350
Emai: lifecenterbd@gmail.com

**Design, Planning
& Edited by** : Dr. A.H.M Kamruzzaman
Deputy Program Manager (Ayurvedic)
Alternative Medical Care (AMC)
Directorate General of Health Services (DGHS)
Mohakhali, Dhaka-1212

First Published : June 2019

Printed by : LIFE Center, House 93, Road 1, Mohammadia Housing Society
Mohammadpur, Dhaka-1207
Cell: 0088-01711450350
Emai: lifecenterbd@gmail

On behalf of : **Government of the People's Republic of Bangladesh**
Directorate General of Health Services (DGHS)
Mohakahali, Dhaka-1212

ISBN :

**Editorial Committee for Pharmacopoeia
(UNANI, AYURVEDIC & HOMEOPATHIC)**

1.	Prof. (Dr.) Sanya Tahmina Jhora	Additional Director General, (Planning & Development) Directorate General of Health Services, Mohakhali, Dhaka.	Convener
2.	Dr. Mohammad Azizur Rahman Siddiqui	Line Director, Alternative Medical Care (AMC), DGHS, Mohakhali, Dhaka.	Member Secretary
3.	Professor Abdur Rahman	Deen, Faculty of Pharmacy University of Dhaka	Member
4.	Professor Sitesh Bacher	Chairman, Pharmacy Department University of Dhaka	Member
5.		Program manager, Alternative Medical Care (AMC) DGHS, Mohakhali, Dhaka	Member
6.	Dr. Md. Abdul Mozid	Principal cum Superintendent Govt. Homeopathic Medical College & Hospital, Mirpur-14, Dhaka-1221	Member
7.	Dr. Swapan Kumar Datta	Principal cum Superintendent (Additional) Govt. Homeopathic Medical College & Hospital, Mirpur-14, Dhaka-1221	Member
8.	Md. Asraf Hosen	Assistant Director on the behalf of Director, Directorate General of Drug Administration, Mohakhali, Dhaka.	Member
9.	Dr. A H M Kamruzzaman	Deputy Program Manager (Ayurvedic) Alternative Medical Care (AMC), DGHS, Mohakhali, Dhaka.	Member
10	Dr. Abu Bakar Siddique	Deputy Program Manager (Unani) Alternative Medical Care (AMC), DGHS, Mohakhali, Dhaka.	Member
11	Dr. Md.Kamrul Kayes	Deputy Program Manager (Homeopathic) Alternative Medical Care (AMC), DGHS, Mohakhali, Dhaka.	Member

AYURVEDIC PHARMACOPEIA EXPERT COMMITTEE

1. Professor Dr. Md. Ruhul Furkan Siddique Team leader
Pharmacopoeia preparatory committee
And Professor, Department of Public Health and Informatics,
Jahangirnagar University.
2. **Dr. Md. Nazmul Huda** Co-Team Leader
Lecturer, Govt. Unani & Ayurvedic Medical College & Hospital,
Mirpur 13, Dhaka, Bangladesh
3. **Dr. Shurub Hossain** Member
Lecturer, Govt. Unani & Ayurvedic Medical College & Hospital,
Mirpur 13, Dhaka, Bangladesh

Functions:

1. To prepare an Ayurvedic Pharmacopeia of single drugs and compound drugs.
2. Ayurvedic Pharmacopeia subcommittee will be carried out scientific works to generate data on monographs of single drugs in which lay down standards for compound formulations.
3. To 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. To prepare an Ayurvedic Pharmacopeia the subcommittee had carried out scientific works to generate data on various monographs of single drugs. Plant origin of Monograph is now being brought out. The Ayurvedic Pharmacopeia of Bangladesh Part II comprise of 50 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.

Index

Contents		Page no.	
Index		III-IV	
Legal Notice		V	
General Definitions		VI-VIII	
Abbreviations and Acronyms		IX	
Preface		X-XI	
Introduction		1-3	
MONOGRAPHS OF SINGLE DRUGS			
Sl. No.	Bangla Name	Scientific Name	Page no.
01	Aaphim	<i>Papaver somniferum</i> Linn.	4-6
02	Akarkara	<i>Anacyclus pyrethrum</i> DC	7-9
03	Amrakeshi	<i>Mangifera indica</i> L.	10-13
04	Aswattha	<i>Ficus religiosa</i> L.	14-16
05	Ativish	<i>Aconitum heterophyllum</i> Wall. Ex. Royle	17-19
06	Bach	<i>Acorus calamus</i> L.	20-22
07	Bakuchi	<i>Psoralea corylifolia</i> L.	23-25
08	Bamanhati	<i>Bauhinia acuminata</i> L.	26-28
09	Bannil	<i>Tephrosia purpurea</i> Pres.	29-32
10	Bat	<i>Ficus benghalensis</i> L.	33-36
11	Boro Elach	<i>Amomum subulatum</i> Roxb.	37-40
12	Chita	<i>Plumbago zeylanica</i> L.	41-43
13	Choi	<i>Piper chaba</i> Hunter	44-46
14	Chakule	<i>Uraria picta</i> Desb.	47-50
15	Chakunda	<i>Cassia tora</i> L.	51-53
16	Chalmogra	<i>Hydnocarpus wightiana</i> Blume	54-56
17	Chobchini	<i>Smilax china</i> L.	57-59
18	Chatim	<i>Alstonia scholaris</i> R.Br.	60-62
19	Danti	<i>Baliospermum montanum</i> Muell-Arg	63-65
20	Devadaru	<i>Cedrus deodara</i> (Roxb) loud	66-68
21	Goniari	<i>Premna serratifolia</i> L.	69-71
22	Guggul	<i>Commiphora mukul</i> (Hook Ex. Stocks) Engl.	72-74
23	Hing	<i>Ferula asafetida</i> Regel	75-77
24	Jaggadumur	<i>Ficus racemosa</i> L.	78-80
25	Jamani	<i>Trachyspermum ammi</i> L.	81-83
26	Jatamansi	<i>Nardostachys jatamansi</i> DC.	84-86
27	Kababchini	<i>Piper cubeba</i> L.	87-89
28	Karpur	<i>Cinnamomum camphora</i> (L.) Presl.	90-92
29	Katki	<i>Picrorhiza kurroa</i> Benth.	93-95
30	Kur	<i>Saussurea lappa</i> C.B. CL	96-98
31	Kushmanda	<i>Benincasa hispida</i> (Thunb.) Congn.	99-101
32	Kush	<i>Desmostachya bipinnata</i> Stapf.	102-104
33	Lodha	<i>Symplocos racemosa</i> Roxb.	105-108
34	Lajjabati	<i>Mimosa pudica</i> L.	109-112
35	Meshsringi	<i>Gymnema sylvestre</i> R.BR.	113-116
36	Mehedi	<i>Lawsonia inermis</i> L.	117-120
37	Mundi	<i>Sphaeranthus indicus</i> L.	121-124
38	Patha	<i>Cissampelos pareira</i> L.	125-127
39	Parul	<i>Stereospermum suaveolens</i> (Roxb.) DC.	128-131
40	Rheuchini	<i>Rheum emodi</i> Wall	132-135
41	Rakhal Shasa	<i>Citrullus colocynthis</i> Schrad.	136-139
42	Shefali	<i>Nyctanthes arbor-tristis</i> L.	140-144
43	Somlatha	<i>Sarcostemma acidum</i> Voigt	145-148

44	Somraji	<i>Centratherum anthelminticum</i> (L.) Kuntze	149-151
45	Swarnalata	<i>Cuscuta reflexa</i> Roxb.	152-154
46	Shyonak	<i>Oroxylum indicum</i> L.	155-158
47	Talishpatra	<i>Abies webbiana</i> Lindle	159-161
48	Talamuli	<i>Curculigo orchioides</i> Gaertn	162-164
49	Teori	<i>Operculina turpethum</i> L.	165-167
50	Tetul	<i>Tamarindus indica</i> L.	168-170
APPENDIX-1			171-178
Principal Forms of Ayurvedic (egetable) Medication and Methods of their Preparation and Uses in Brief			
APPENDIX II			179-193
Tests and Determinations			
APPENDIX III			194-196
Heavy Metal Test			
APPENDIX IV			197-199
Microvial Limit Test			
APPENDIX V			200-202
Pesticide Residue			
REFERENCES			203-214

Legal Notice

The Ayurvedic Pharmacopeia of Bangladesh (A.P.B.), Part I, Vol.III, is the book of standards for single drugs included therein and the standards prescribed in the A.P.B., Part I, Vol.III, would be official. If considered these standards can be amended and the Chairman of the Ayurvedic Pharmacopeia Committee authorised to issue such amendments. Whenever such amendments are issued the A.P.B., Part I, Vol.III, 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 Bangala, 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 defined 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 %(%), 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 acts on mentioned ailments.

Pharmacological Study: 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.	:
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	: M
mm.	: Millim
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

Bangladesh, due to its unique variety of geographical and climatic factors, has had a rich and varied flora of the medicinal plants since the Vedic period. A major portion of our people are even used the plants as home remedies in the rural and remotest parts of the country since long but they do not know the scientific therapeutic value of the drugs according to the role of human body system and dosages as well as correct identification of the crude herbal drugs. Ayurveda had never been static, its practitioners had been innovative and dynamic in the therapeutic practice and carried on clinical trials out of the local flora and discovered newer medicine with same therapeutic values. The modern world has slowly started the appreciating value of herbal medicines and understanding the basic comprehensive philosophy of Ayurveda. Not only that, they have already been included traditional herbal medicine in their health programme and used for treatment of their patients randomly because its effectiveness, negligible adverse side effects, easily availability, inexpensiveness and environment friendly. There are three source of medicine in Ayurveda like herb/plant, animal and mineral etc. More than 90% of ingredients used in Ayurvedic medicine are plant based and about 10% are from mineral and animal origins. 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. According to the demand of medical practitioner and science a standard general classification of Ayurvedic drugs, fixed recognized rules for the determination of dosage and preparation of Ayurvedic Pharmacopeia is essential as far best which will be regulated by the Government of Bangladesh. The demand for Ayurvedic and plant based medicine is growing up rapidly within the country and abroad. The Government of Bangladesh, Ministry of Health & Family Welfare appreciated the need to prescribe quality standards for Ayurvedic drugs and the drugs act was amended in 1982. A huge number of Ayurvedic practitioners practicing through the country by poly herbal Ayurvedic drugs manufactured by Ayurvedic pharmaceutical industries. But for developing standards of quality, purity and strength of Ayurvedic medicine, no Pharmacopeial laboratory for Ayurvedic medicine yet has been established in Bangladesh. Considering the necessity of legal document of standard quality of drugs Director, Homeo and Traditional Medicine had been taken work plan to preparation the Ayurvedic Pharmacopeia 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 (DGHS) consisting of experts on Unani or Ayurvedic or Homeopathic and other sciences including experts of pharmacognosy, chemistry and pharmacy. DGHS 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 was prepared and which consists of 50 medical plants. Ayurvedic Pharmacopoeia of Bangladesh Volume II also consists of 50 monographs of single medicinal plants was published in June 2016 under HNPSDP. In that continuation, the Ayurvedic Pharmacopoeia of Bangladesh Volume III is going to be published by June 2019 under 4th sector HPNSP which also consists of 50 monographs of single medicinal plants.

Aaphim

Botanical Name: *Papaver somniferum* Linn.

Family: Papaveraceae

Synonyms:

Bangla: আফিম (Aaphim)

Hindi: Apheem, Postadaanaa, Khaskhas, Khasabija

Sanskrit: Khasatilah, Khakhasa

Urdu/Unani/Tibb: Apheem, Khashkashsafaid

English: Opium, Poppy, White poppy

Geographical Distribution: *Papaver somniferum* is originally a native of the warmer parts of western Asia from where it was taken to Greece. From Asia Minor the Arabs traders took it to the Far Eastern countries, including India and China. *Papaver somniferum* is sometimes found apparently wild in Britain. It is now extensively cultivated in most of the States of Europe not on account of the opium as in India, Turkey, and Iran, but on account of the capsules and of the oil obtained from the seeds.

Plant Descriptions:

General Description *Papaver somniferum* is an erect, green herb that reaches up to 60-120 cm in height. Its leaves are many, amplexicaule, lobed, dentate or serrate, linear-oblong or ovate-oblong. The flowers are large and are differently colored (white, pink, bright red). There are about hundred different poppy plant species available. Flower ovary is globose. Capsules, fruits are flat-topped, globose or sub-globose, large and glabrous. Seeds are grey-brown or white. Flowering is during the winter and fruiting in summer season.



Fig. *Papaver somniferum* Linn.

Macroscopic Description: The seeds of *Papaver somniferum* are dried, white, grey or grayish black in colour, sub-reniform and about 1.25 mm long. The surface is covered with polygonal reticulations about nine in length and five in width of seed, the hilum and micropyle are situated in a depression near one end. The embryo is curved and embedded in endosperm. Sweetish or oily in taste and unpleasant odour.

Microscopic Description: Sectional view of seed coat showed a single layer of epidermis which contains somewhat elongated, thick walled parenchymatous cells with thick cuticle on outer side. Below which the region is composed of polygonal to oval, thin walled parenchymatous cells. The epidermis of cotyledons is usually consisted of rectangular to oval, slightly thick walled parenchymatous cells which possess yellowish brown contents. Rest of the part is made up of thin walled, hexagonal to polygonal parenchymatous cells, containing starch grains. The starch grains are oval to round in shape. The sectional view of radical showed the epidermis composed of squarish parenchymatous cells. Aleurone grains are present in cortical region which consisted of many layers of thin walled, polygonal to oval parenchymatous cells.

Powder: Light brown, coarse, not free flowing, clot or ball forming, under microscope exhibits large fatty oil droplets, characteristic penta to hexagonal testa cells, endosperm and reticulate layer cells; cells containing characteristic crystal and fibres also present.

Part Used: Fruits, seeds and latex.

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Suksma (Minuteness), Vyavayi
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Balya (strengthening), Grahi (absorbent), Vrishya (aphrodisiac), Nidrajanan (sedative), Swashar (good for respiratory disorder), Bedanashamak (pain killer).

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 8% w/w
Acid insoluble ash	: Not more than 1.5% w/w
Alcohol soluble extractive	: Not less than 7% 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 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, *Salmonellae* 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 hexane extract on silica gel 60 F 254 plate using toluene: Acetone (93:07) shows five spots at R_f 0.25, 0.39, 0.50, 0.76 and 0.83 on spraying with vanillin sulphuric acid reagent and heating the plate for 15 minutes at 110^oc.

Major Chemical Constituents: It contains many isoquinine alkaloids. The most important phytochemicals are morphine, noscapine and codeine. Other alkaloids are thebaine, narceine, papaverine, codamine and rhoeadine.

Therapeutic Use: Epilepsy, diarrhoea, sperm problems, insomnia, pain reliever.

Pharmacological Study: Analgesics, antitussive, anti-diarrheal, antiallodynic, antioxidant, antimutagenic, anticarcinogenic, antimicrobial, antiparasitic, anti-inflammatory, effect on nervous system, and other effects.

Contraindications: Should not be used during pregnancy or lactation, bleeding disorders, children, kidney disease, depression like mental disorder and known allergy to the plants of the Papaveraceae family.

Adverse Effects: Its overdose causes- drowsiness, sleep, respiratory arrest, depression and even death etc.

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

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

Posology: 25 to 125 mg as per the strength of the patient.

Formulations: Ahiphenasav, Karpur Ras, Jouban Satadal, Kamini Vidravan Ras.

Akarkara

Botanical Name: *Anacyclus pyrethrum* DC

Family: Asteraceae

Synonyms:

Bangla: আকরকরা (Akarkara)

Hindi: Akalkara

Sanskrit: Akallaka, Akallaka, Akarakarabha

Urdu/Unani/Tibb: Aqaraqarha

English: Pellitory, Pellitory of Spain, Pyrethre, Pyrethrum

Geographical Distribution: It is found in North Africa, Arabia, Syria, Algeria, elsewhere in the mediterranean region and varieties of this drug are seen in some place of India such as Jammu and Kashmir, West Bengal.

Plant Descriptions:

General Description: Akarkara is a perennial herb with numerous spreading, prostrate or ascending branched stems. The stems are hollow, thickened and grow along the ground before turning upward. The plant grows to about 45 cm high. The stems are hairy in the upper portions, glabrous below. The leaves are smooth, alternate and pinnate with deeply cut segments. Each stem bears a flower. Flower heads are terminal, large, 2.5-3.5 cm wide with a wide disc. The disk flowers are yellow and ray flowers white, tinged with purple beneath. The fruit has transparent wings. Roots are tough, cylindrical, 7-15 cm in length, tapering slightly at both ends, with a few hairy rootlets and occasionally topped by bristly remains of leaves, external surface rough brown, shrivelled, bark upto 3 mm thick.

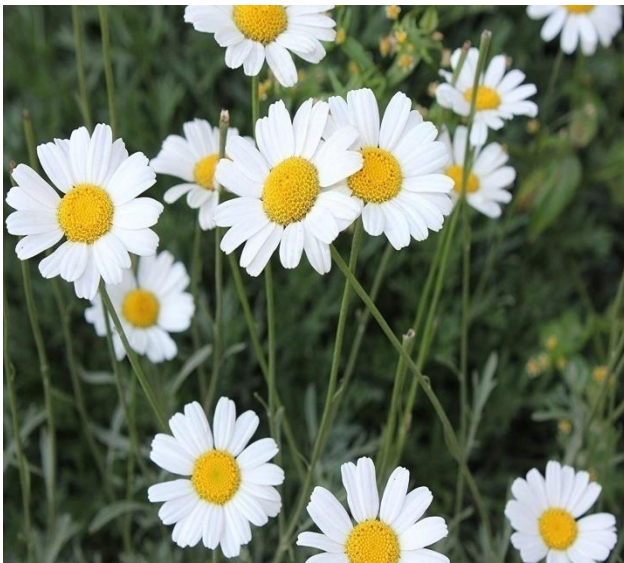


Fig. *Anacyclus pyrethrum* DC.

Macroscopic Description: Roots tough, cylindrical, 7-15 cm in length, tapering slightly at both ends, with a few hairy rootlets and occasionally topped by bristly remains of leaves, external surface rough, brown, shrivelled, bark upto 3 mm thick, not easily separable, odour, slightly aromatic, taste, characteristically astringent and pungent, on chewing gives tingling sensation to tongue and lips and causes excessive flow of saliva.

Microscopic Description: Root-Mature root shows cork consisting of tabular cells, many of which developed as sclerenchyma; a few innercork cells contain rosette crystals of calcium oxalate; secondary cortex consisting of isodiametric or tangentially, elongated, thin-walled, parenchymatous cells; a few sclerenchymatous cells also found scattered in secondary cortex; secondary phloem consisting of usual elements, cambium 2-5 layered, secondary xylem very wide consisting of xylem vessels, tracheids and xylem parenchyma; vessels pitted, more or less in groups distributed throughout xylem, more and wider vessels found towards periphery, xylem fibres thick-walled, 1.37-28.8 μm width, 53.2-231 μm length having narrow lumen, medullary rays numerous, running straight, bi to tri and multiseriate, uniseriate rays very rare, starting from primary xylem and reaching upto secondary cortex; ray cells thick-walled, radially elongated, inulin present in cells of secondary cortex, secondary phloem and medullary rays; oleo-resinous schizogenous glands found scattered in secondary cortex, secondary phloem and medullary rays; calcium oxalate crystals in rosette form present in secondary cortex, secondary phloem, secondary xylem and medullary ray cells.

Powder-Ash coloured; shows vessels having scalariform thickening, rosette crystals of calcium oxalate and fragments of sclerenchyma; also gives positive tests for inulin.

Part Used: Flowers, leaves, roots.

Organoleptic Properties

Rasa (Taste)	:Katu (Pungent)
Guna (Attribute)	:Tikshna (Sharp), Ruksha (Dry)
Virya (Potency)	:Usna(Hot)
Vipaka (Metabolism)	:Katu (Pungent)
Karma (Action)	:Deepana, Kaphahara, Svedana, Vajikarak, Vatahara

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 10% w/w
Acid insoluble ash	: Not more than 2% w/w
Alcohol soluble extractive	: Not less than 8% w/w
Water soluble extractive	: Not less than 22% 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 *enterobacteriaceae*, *Salmonellae 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.

Major Chemical Constituents: The phytochemical screening of roots, leaves and flowers revealed presence of alkaloids, reducing compounds and catechic tannins. The roots are rich in alkaloids while the aerial parts are rich in tannins and flavonoids. Root contains a brown acrid resin, a trace of tannic acid, inulin, gum, various salts, and lignin. The roots of the plant are aphrodisiac due to presence of bio-active compound N-alkylamides.

Therapeutic Use: Sinusitis, oedema, dyspepsia, cough, bronchial asthma, sciatica, hemiplegia, toothache, dental cavities, looseness of teeth, pyorrhea, sore throat, rheumatic pain, facial paralysis, epilepsy, neurasthenia, insanity and flaccidity of tongue.

Pharmacological Study: Abortifacient, anesthetic, anti-inflammatory, antimutagenic, cyclooxygenase inhibitor, hypoglycemic, neurotonic, lacrimator, expectorant, diaphoretic, antipyretic, molluscicide, rubefacient, sialagogue, stimulant and tonic.

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

Adverse Effects: Large oral doses may cause gastric discomfort like tenesmus, vomiting, bleeding; increase in heart rate and unconsciousness etc.

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

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

Posology: 0.5-1 gm of the drug in powder form.

Formulations: Jouban Satadal, Kamini Vidravan Ras, Kumariasav

Amrakeshi

Botanical Name: *Mangifera indica* L.

Family: Anacardiaceae

Synonyms:

Bangla: আমকেশী (Amrakeshi)

Hindi: Aam

Sanskrit: Ambrah

Urdu/Unani/Tibb: Amra

English: Mango

Geographical Distribution: It is native tropical Asia and has been cultivated in the Indian subcontinent for over 4000 years and is now found naturalized in most tropical countries.

Plant Descriptions:

General Description: *Mangifera indica* is a large evergreen tree in the anacardiaceae family that grows to a height of 10-45 m, dome shaped with dense foliage, typically heavy branched from a stout trunk. The leaves are spirally arranged on branches, linear-oblong, lanceolate-elliptical, pointed at both ends, the leaf blades mostly about 25-cm long and 8-cm wide, sometimes much larger, reddish and thinly flaccid when first formed and release an aromatic odour when crushed. The inflorescence occurs in panicles consisting of about 3000 tiny whitish-red or yellowish-green flowers. The fruit is a well known large drupe, but shows a great variation in shape and size. It contains a thick yellow pulp, single seed and thick yellowish-red skin when ripe. The seed is solitary, ovoid or oblong, encased in a hard, compressed fibrous endocarp.



Fig. *Mangifera indica* L.

Macroscopic Description:

Mangifera indica tree is simple, belonging to the family Anacardiaceae. The shape of the leaves are lanceolate to elliptic 6-16in long and alternate. It is dark green, glabrous, entire and acute apex. Petiole is 1-4in long and swollen at base. Inflorescences usually have primary, secondary, and tertiary pubescent, cymose branches pale green to pink or red and bear hundreds of flowers. Fruits are drupe, round to ovate to oblong and long. Fruits can weigh from less than 50 g to over 2 kg.

Microscopic Description:

Root – Shows 5 or 6 layers of thin-walled, tabular, regularly arranged cork cells; cork cambium single layered; secondary cortex composed of 4 to 6 layers of oval, tangentially arranged, thin-walled, parenchymatous cells, a few fibres present singly or in groups; secondary phloem composed of sieve elements, parenchyma and fibres traversed by phloem rays; sieve elements somewhat collapsed towards periphery but intact in inner phloem region; phloem parenchyma composed of rounded to somewhat oval cells, larger towards periphery; fibres thick-walled, lignified with narrow lumen and tapering ends; phloem rays 1 to 5 cells wide, their cells being oval or rectangular in the portion nearer the wood but broader towards their distal ends; secondary xylem composed of vessels, tracheids, fibres, crystal fibres and parenchyma traversed by xylem rays; vessel very few, mostly confined to inner and outer part of xylem; fibres similar to those of phloem fibres and arranged in close set concentric bands; in isolated preparation vessels are cylindrical, pitted with transverse to oblique perforation; tracheids possess bordered pits; xylem parenchyma mostly rectangular with simple pits; xylem ray cells isodiametric showing simple pits; starch grains simple, round to oval, measuring 6 to 17µm in diameter, distributed throughout parenchymatous cells of secondary cortex, phloem and xylem; prismatic crystals of calcium oxalate present in crystal fibres, as well as in many parenchymatous cells of secondary cortex, phloem and ray cells. Stem shows single layered epidermis covered with cuticle, a few epidermal cells elongate outwards forming papilla; cortex 8 to 10 cells wide, consisting of oval to circular, thin walled, parenchymatous cells; groups of pericyclic fibres present in the form of discontinuous ring; phloem consisting of usual elements except phloem fibres; phloem rays 2 to 4 cells wide; xylem consisting of usual elements; vessels mostly simple pitted; fibres simple with blunt tips; xylem rays 1 to 4 cells wide and 2 to 8 cells in height; pith wide, consisting of thin-walled, round to oval parenchymatous cells.

Leaf-

Midrib – single layered epidermis on either surfaces covered with striated cuticle having a few unicellular or bicellular, hooked or straight and pointed tipped hairs present on both surfaces but more on lower surface; collenchyma 2 or 3 layered, followed by 2 layers of parenchyma cells; single row of pericyclic fibers present on both sides; vascular bundle located centrally.

Lamina – shows single layered epidermis on either surfaces, a few unicellular or bicellular, hooked or straight, pointed tipped hairs present on lower surface; mesophyll differentiated into single layered palisade and spongy parenchyma; spongy parenchyma cells oval to rounded having small intercellular spaces; numerous paracytic stomata present on lower surface; stomatal index 27 to 36 on lower

surface; palisade ratio 4 or 5; vein-islet number 29 to 32 per sq. mm.; vascular bundle present centrally.

Powder – Greenish-yellow; shows simple pitted vessels; fragments of fibres, tracheids, parenchyma cells; pieces of hairs; palisade cells; a few prismatic crystals of calcium oxalate; epidermal cells wavy walled in surface view showing paracytic stomata and starch grains simple, round to oval, measuring 6 to 17 μ m in dia.

Part Used: Roots

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Amla (Sour), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Sara (Unstable)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Dipana, Sangrahi, Tridosahara, Vatahara, Vrsya, Sothahara, Sandhaniya, Jivanu Nasaka, Balavardhaka

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 4% w/w
Alcohol soluble extractive	: Not less than 7% w/w
Water soluble extractive	: Not less than 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>Salmonellae 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.

Major Chemical Constituents: The different chemical constituents of the plant, especially the polyphenolics, flavonoids, triterpenoids. Mangiferin a xanthone glycoside major bio-active constituent, isomangiferin, tannins & gallic acid derivatives. The bark is reported to contain protocatechic acid, catechin, mangiferin, alanine, glycine, γ -aminobutyric acid, kinic acid, shikimic acid and the tetracyclic triterpenoids cycloart-24-en-3 β ,26-diol, 3-ketodammir-24 (*E*)-en-20S,26-diol, C-24 epimers of cycloart-25 en 3 β ,24,27-triol and cycloartan-3 β ,24,27-triol.

Therapeutic Use: Diarrhea, vomiting, burning sensation, fever, cough, bloody dysentery, insanity, gout, bleeding piles, excessive thirst, diseases of eyes and fracture.

Pharmacological Study: Antidiabetic, anti-oxidant, anti-viral, cardiogenic, hypotensive, anti-inflammatory, antibacterial, anti fungal, anthelmintic, anti parasitic, anti tumor, anti HIV, anti bone resorption, antispasmodic, antipyretic, antidiarrhoeal, antiallergic, immunomodulation, hypolipidemic, anti microbial, hepatoprotective, gastroprotective.

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

Adverse Effects: Over-dosages can be twitching pain, nausea & vomiting, diarrhea.

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

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

Posology: 20-50 gm powder for decoction.

Formulations: Pushyanug Churna, Patrangasav, Nyagrodhadi Churna, Khargabaty

Ashwattha

Botanical Name: *Ficus religiosa* L.

Family: Moraceae

Synonyms:

Bangla: অশ্বথ (Ashwattha)

Hindi: Pipala, Pipal, pipli, pipar, Peepul

Sanskrit: Ashwatha, Ashvatha, Pippala

Urdu/Unani/Tibb: Apheem, Khashkhashafaid

English: Pipal tree, Peepal tree, Sacred fig, Sacred Ficus

Geographical Distribution: *Ficus religiosa* is distributed throughout Bangladesh; also found in India, China, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand.

Plant Descriptions:

General Description: *Ficus religiosa* is a large dry season-deciduous or semi-evergreen tree up to 30 metres (98 ft) tall and with a trunk diam of up to 3 metres (9.8 ft). The leaves are cordate in shape with a distinctive extended drip tip; they are 10–17 s (3.9–6.7 in) long and 8–12 centimetres (3.1–4.7 in) broad, with a 6–10 s (2.4–3.9 in) petiole. The fruits are small figs 1–1.5 s (0.39–0.59 in) in diam, green ripening to purple.



Fig. *Ficus religiosa* L.

Macroscopic Description: Bark occurs in flat or slightly curved pieces, varying from 1.0-2.5 cm or more in thickness, outer surface brown or ash coloured, surface uneven due to exfoliation of cork, inner surface smooth and somewhat brownish, fracture, fibrous, taste, astringent.

Microscopic Description: Transverse section of bark shows compressed rectangular to cubical, thick-walled cork cells and dead elements of secondary cortex, consisting of masses of stone cells, cork cambium distinct with 3-4 rows of newly formed secondary cortex, mostly composed of stone cells towards periphery, stone cells found scattered in large groups, rarely isolated,

most of parenchymatous cells of secondary cortex contain numerous starch grains and few prismatic crystals of calcium oxalate, secondary phloem a wide zone, consisting of sieve elements, phloem fibres in singles or in groups of 2 to many and non-lignified, numerous crystal fibres also present, in outer region sieve elements mostly collapsed while in inner region intact, phloem parenchyma mostly thick-walled, stone cells present in single or in small groups similar to those in secondary cortex, a number of ray-cells and phloem parenchyma filled with brown pigments, prismatic crystals of calcium oxalate and starch grains present in a number of parenchymatous cells, medullary rays uni to multiseriate, wider towards outer periphery composed of thick-walled cells with simple pits, in tangential section ray cells circular to oval in shape, cambium when present, consists of 2-4 layers of thin-walled rectangular cells

Part Used: Bark, tender leaf, fruits and latex.

Organoleptic Properties

Rasa (Taste)	: Kasaya (Astringent)
Guna (Attribute)	: Guru (Heavy), Ruksha (Dry)
Virya (Potency)	: Sheeta (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Varnya, Kaphapittavinashi, Sangrahi, Bhagnasandhanakara, Mutrala.

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 0.3% w/w
Alcohol soluble extractive	: Not less than 8% 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>Salmonellae 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.

Major Chemical Constituents: Fruits contain a considerable amount of flavonoids namely kaempferol, quercetin, and myricetin and other phenolic components. Asparagine and tyrosine are the most abundant amino acids of the fruit pulp. The seeds contain phytosterolin, β -sitosterol, and its glycoside, albuminoids, carbohydrate, fatty matter, coloring matter, caoutchoue 0.7– 5.1%. Phytosterols like, lanosterol, β -sitosteryl Dglucoside, bergapten, bergaptol and stigmasterol found in the bark.

Therapeutic Use: Diarrhoea, dysentery, asthma, cough, gastric problems, vomiting, constipation, wounds, skin disease, gonorrhoea, burns.

Pharmacological Study: Antimicrobial, anti-parasitic, anti-parkinson's, anticonvulsant, anti-amnesic, anticholinergic, antidiabetic, anti-inflammatory, analgesic, cytotoxic, anti-ulcer, wound healing, antioxidant, anti- asthmatic, reproductive, hepatoprotective, nephroprotective and dermatoprotective.

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

Adverse Effects: No known any adverse effects 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 in a well-closed container, protected from light and moisture.

Posology: 3 to 5 gm powder or 50-100 ml decoction.

Formulations: Mehavinash, Chandanasava, Sarivadyasava, Kamdev Grita

Ativish

Botanical Name: *Aconitum heterophyllum* Wall. Ex. Royle

Family: Ranunculaceae

Synonyms:

Bangla: অতিবিষ (Ativish)

Hindi: Atis

Sanskrit: Aruna, Ghunapriya, Visa

Urdu/Unani/Tibb: Atees

English: Atis Root

Geographical Distribution: Ativisha grows in sub-alpine and alpine zones of Himalayas from Indus to Kumaon at an altitude of 2000 to 5000 metres.

Plant Descriptions:

General Description: *Aconitum heterophyllum* is a herbaceous perennial plant with an erect stem that can be branched or unbranched and is usually 15 – 90 cm tall, occasionally reaching 200 cm. Aerial parts are annual but the roots are biennial about 2.0 to 7.5 cm. long and 0.4 to 1.6 cm. or more thick at its upper extremity, gradually decreasing in thickness towards tapering end, externally yellowish to greyish white, external surface wrinkled marked with scars of fallen rootlet and with a rosette of scaly rudimentary leaves on top. The stem is clasping and erect. The branches are absent or rarely one or two in number. Leaves are glabrous, sessile, and variable in shape and size. Flowers are large, hooded, white–violet in colour and occur in slender racemes or lax leafy panicles. Corolla is hairy. Carpels are five in number, containing 10–18 follicles. *Aconitum heterophyllum* is classified into white, yellow, red, and black varieties. The white tuber variety, with rapid growth and high yield, is considered to be the best.



Fig. *Aconitum heterophyllum* Wall. Ex. Royle

Macroscopic Description: Roots, ovoid-conical, tapering downwards to a point, 2.0-7.5 cm long, 0.4-1.6 cm or more thick at its upper extremity, gradually decreasing in thickness towards tapering end, externally light ash-grey, white or grey-brown, while internally starch white, external surface wrinkled marked with scars of fallen rootlet and with a rosette of scaly rudimentary leaves on top: fracture, short, starchy, showing uniform white surface, marked towards centre by 4-7 concentrically arranged yellowish-brown dots, corresponding to end of fibrovascular bundles traversing root longitudinally taste, bitter with no tingling sensation.

Microscopic Description: Transverse section of mature root shows, single layered epidermis consisting of light brown tabular cells rupturing on formation of cork, cork consists of 5-10 rows of tangentially elongated, thin-walled cells, cork cambium single layered consisting of tangentially elongated, thin-walled cells, cortex much wider consisting of tangentially elongated or rounded, thin-walled parenchymatous cells with intercellular spaces, cells fully packed with both simple as well as compound starch grains, compound starch grains composed of 2-4 components of spherical body, endodermis distinct composed of barrel shaped cells, elements of vascular bundles poorly developed, vascular bundles, arranged in a ring, inter-fascicular cambium present in form of a ring composed of few layered thin-walled cells, central core consisting of thin-walled parenchymatous cells, possessing starch grains similar to those found in cortical cells.

Powder-Ash coloured to light brown, under microscope shows abundant simple and compound starch grains and parenchymatous cells.

Part Used: Stem and Roots.

Organoleptic Properties

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

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 6% w/w
Water soluble extractive	: Not less than 24% 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 *enterobacteriaceae*, *Salmonellae 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.

Major Chemical Constituents: Roots contain intensely bitter alkaloid atisine, acotinic acid, tannic acid, and pectinous substances. It has abundant starch, fat, and a mixture of oleic, palmitic, stearic glycerides.

Therapeutic Use: Diarrhea, dysentery, cough, dyspepsia, chronic enteritis, and as a febrifuge and bitter tonic in combating debility after malaria.

Pharmacological Study: Alexipharmic, anodyne, anti-atrabilius, anti-flatulent, anti-periodic, anti-phlegmatic, carminative, anti-oxidative, anti-inflammatory, and expectorant properties.

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

Adverse Effects: Large oral doses may cause hypotension, dryness in the body, increase in heart rate and unconsciousness etc.

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

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

Posology: 0.5-1 gm of the drug in powder form.

Formulations: Bal Chturbhadrika, Atisar Jog, Ashwagandadi Kwath, Bilwadi Kwath

Bach

Botanical Name: *Acorus calamus* L.

Family: Araceae.

Synonyms

Bengali: বচ (Bacha)

Hindi: Bach, Gora-bach

Sanskrit: Uragandha, Ugra, sadgrantha

Urdu/Unani: Waja-e-Turki

English: The Sweet Flag

Geographical Descriptions: Calamus is found all over the world. It probably originated in India and North America. It has been long known for its medicinal value, it is wild or cultivated throughout Himalayas at an altitude ascending up to 6000 feet.

Plant Description: The plant grows from 60 to 100 cm tall. The stem is triangular and sprouts from a horizontal, round root-stock, which has the thickness of a thumb. The upper shoot forms a grooved flower sheath. The leaves are oblong, sword-shaped and arranged in two rows. The leaves have no stems. The rhizome has an intensely aromatic fragrance and a tangy, pungent and bitter taste. The leaves often undulate on the margins. Four types of Calamus are used in herbal medicine: type I-*Acorus calamus* L. var. *americanus*, a diploid American var.; type II-var. *vulgaris* L. (var. *calamus*), a European triploid; type III and type IV-var. *augustatus* Bess. And var. *versus* L., subtropical tetraploids.



Fig. *Acorus calamus* L.

Macroscopic Description: Drug occurs in simple or rarely with thumb-like branches at nodes; sub cylindrical to slightly flattened, somewhat tortuous or rarely straight, cut pieces of 1-5 cm long, and 0.5-1.5 cm thick; upper side marked with alternately arranged, large, broadly, triangular, transverse leaf scars which almost encircle the rhizome; at nodes leaf sheath mostly having an appearance present; lower side shows elevated tubercular spots of root scars; light-brown with reddish-tinge to pinkish externally, buff colored initially; fracture, short; odor, aromatic; taste, pungent and bitter.

Microscopic Description: Rhizome - Shows single layered epidermis; cortex composed of spherical to oblong, thin-walled cells of various sizes, cells towards periphery, smaller, somewhat collenchymatous, more or less closely arranged cells towards inner side, rounded and form a network of chains of single row of cells, enclosing large air spaces, fibro-vascular bundles and secretory cells having light yellowish-brown contents, present in this region; endodermis distinct; stele composed of round, parenchymatous cells enclosing large air spaces similar to those of cortex and several concentric vascular bundles arranged in a ring towards endodermis, a few vascular bundles scattered in ground tissues; starch grains simple, spherical, measuring 3-6 μ in diam, present in cortex and ground tissue.

Part Used: Rhizome, flower and fruits.

Organoleptic Properties

Rasa (Taste)	: Katu, Tikta
Guna (Attribute)	: Laghu, Tiksna
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Dipana, Krmihara, Kanthya, Kaphahara, Medhya, Vatahara, Mala Mutravisodhana, Vamak.

Purity and Safety test

Total ash	: Not more than 7% w/w
Acid insoluble	: Not more than 1% w/w
Water soluble	: Not less than 16% w/w

Thin Layer Chromatography : TLC of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate (9:1) shows two spots at R_f 0.14 (violet) and 0.73 (violet) on spraying with Vanillin-Sulphuric acid reagent and heating the plate for ten minutes at 105°c.

Microbial contamination : In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*,

Salmonellae 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 will not be more than 10, 0.5 and 0.3 μ gm/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, 0.1, 0.5, 0.5 and 0.1 μ gm/kg respectively.

Major Chemical Constituents: β -Asarone (isoasarone) is usually the major constituent. α - Asarone, elemicine, cis-isoelemicine, *cis* and *trans* isoeugenol and their methyl ethers, camphene, P-cymene, β -gurjunene, α selinene, β -cadinene, camphor, terpinen-4-ol, α -terpineol and α -calacorene, acorone, acorenone, acoragermacrone, 2-deca 4,7-dienol, shyobunones, isohyobunones, calamusenone, linalool and pre-isocalamendiol are also present.

Therapeutic Use: Diarrhea, dysentery, bronchitis, cough, fever, dyspepsia, epilepsy, intestinal worms, diarrhea, teething, colic, asthma, loss of appetite, catarrh, and hysteria etc.

Pharmacological Study: Anti-inflammatory activity, anticonvulsant, analgesic, anticellular, immunosuppressive, anti-diabetic, romatic, stimulant, bitter tonic, emetic, expectorant, emmenagogue, aphrodisiac, laxative, diuretic, antispasmodic, carminative, and anthelmintic properties and many more.

Adverse Effects: May possess immunosuppressive, moderately hypotensive and respiratory depressant properties, no serious health hazards or side effects are known with the administration of designated therapeutic dose. But, extract of *Acorus calamus* (upto a dose of 600 mg/kg BW) lacked any potential toxicity, as it neither caused any lethality nor changed the general behavior in both acute and chronic toxicity studies in rats.

Precautions: Long-term use of this drug should be avoided. Malignant tumors appeared in rats that received Indian Calmus oils over an extended period.

Contraindications: Alpha-asarone potentiates pentobarbital, accounts for some, but not all, neurodepressive activity. Beta-asarone is reportedly hallucinogenic. It may cause hypotension and respiratory depression.

Dosage form: Powder or churna.

Posology: 60-120 mg in powder form, 1-2 gm of the drug in powder form for inducing vomiting.

Formulations: Hingustaka Churna, Chandraprava Bati, Khadiradi Bat.

Bakuchi

Botanical Name: *Psoralea corylifolia* L.

Family: Leguminosae

Synonyms

Bengali: বাকুচি (Bakuchi, Somraji, Hakucha Veeja)

Hindi: Babchi, Bavachi, Bakuchi

Sanskrit: Avalguja, Somaraji

Urdu/Unani: Babchi

English: The Sweet Flag

Geographical Descriptions: *Psoralea corylifolia* is native to India and Sri Lanka, and was occasionally cultivated in Arabia for its supposed medicinal properties. Grows throughout the sandy loamy plains of central and east India.

Plant Description: *Psoralea corylifolia* grows 50–90 cm tall and is an annual plant. It has pale-purple flowers in short, condensed, axillary spikes. Its corolla is pale purple. Flowers one-seeded fruits. The most distinctive feature is the occurrence of minute brown glands which are immersed in surface tissue on all parts of the plant which give it a distinctive and pleasant fragrance. The black variety is commonly used today (as opposed to the white variety also mentioned in Susruta).



Fig. *Psoralea corylifolia* L.

Macroscopic Description: Fruits, dark chocolate to almost black with pericarp adhering to the seed-coat, 3-4.5 mm long, 2-3 mm broad, ovoid-oblong or bean shaped, somewhat compressed, glabrous rounded or mucronate, closely pitted, seeds campylotropous, nonendospermous, oily and free from starch, odourless, but when chewed smell of a pungent essential oil felt, taste, bitter, unpleasant and acrid.

Microscopic Description: Transverse section of fruit shows pericarp with prominent ridges and depressions, consisting of collapsed parenchyma and large secretory glands containing oleo-resinous matter testa, an outer layer of palisade epidermis, layer of bearer cells which are much thickened in the inner tangential and basal radial walls and 2-3 layers of parenchyma, cotyledons of polyhedral parenchyma and three layers of palisade cells on the adaxial side.

Part Used: Seeds, seed oil, roots, and leaves.

Organoleptic Properties

Rasa (Taste)	: Katu, Tikta
Guna (Attribute)	: Ruksa
Virya (Potency)	: Sita
Vipaka (Metabolism)	: Katu
Karma (Action)	: Grahi, slesmssrapittanut, Vranapaha, Hrdaya.

Purity and Safety test

Total ash	: Not more than 8% w/w
Acid insoluble	: Not more than 2% w/w
Water soluble	: Not less than 13% w/w

Thin Layer Chromatography

: The ethanol extracts produce three fraction having R_f 0.76, 0.69 and 0.39 under ethyl acetate: methanol (3:7) solvent system. While aqueous extracts produce two fraction having R_f 0.65 and 0.42 under ethyl acetate: acetone (4:6) solvent system. TLC profiling of ethanol and aqueous extracts gives an impressive result that directing towards the presence of number of phytochemical. The TLC method is best choice for the identification of secondary metabolite present in plants. Here the different R_f values indicate the presence of different nature of phytoconstituents in single extracts. Different R_f values of the compound also reflects an idea about their polarity. This information will help in selection of appropriate solvent system for further separation of compound from these plant extracts.

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*,

Salmonellae 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 will not be more than 10, 0.5 and 0.3 μ gm/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, 0.1, 0.5, 0.5 and 0.1 mic.gm/kg respectively.

Major Chemical Constituents: The major active constituents of *Psoralea corylifolia* are corylifols a-c (prenylflavonoids) that are present in the seeds, other active compound such as psoralen, isopsoralen and neobavaisflavones are found in the dried ripe fruits. Daidzein (4:7 dihydroxyisoflavon) and genistein (4'5'7 trihydroxyisoflavon) are presence in natural plants of *P. corylifolia* as well as in-vitro cultures. Other active constituents have since been identified, including neoba-vaishflavone, borachin, bavaisflavooz, bavachalcone, bavachromene psoralidin, corylifolinin, barachini psoralenoside, isopsoralenoside and coumarins.

Therapeutic Use: Alopecia, inflammation, leukoderma, leprosy, psoriasis, and eczema.

Pharmacological study: Antimicrobial activity, antipregnancy and estrogenic activity, antitumor activity, antioxidant activity, immunomodulatory activity, and anti-inflammatory activity.

Adverse effects and Precautions: No drug-herb interactions are known but caution should be observed with external applications. Bakuchi should not be used with patients undergoing PUVA therapy due to the increased risk of photosensitive reactions.

Contraindication: Use with caution in pregnancy. It has a controversial history due to occasionally causing inflammatory skin eruptions when used externally in conjunction with UV therapy for psoriasis and vitiligo. The furanocoumarins, containing psoralens, promote pigmentation but are also considered to carry a high risk when used with great exposure to UV light. Traditional use is considered safe used at a low dose for internal consumption with moderate exposure to sunlight.

Dosage form: Powder or churna and Taila.

Posology: 3-6 gm of the drug in powder form. Taila to be applied externally.

Formulations: Somaraji Taila.

Bamanahati

Botanical Name: *Bauhinia acuminata* L.

Family: Fabaceae/Leguminosae

Synonyms

Bengali: বামনহাটি/কাঞ্চন (Kanchana)

Hindi: Sivamalli, Kachanar, Kanchanar, Kachnar

Sanskrit: Kancanaraka

Urdu/Unani: Kachnaar

English: Mountain Ebony/ Dwarf white bauhinia

Geographical Descriptions: Many species are widely planted in the tropics as ornamental, particularly in northern India, Vietnam, southeastern China, Brunei, Java and Bangladesh. It is commonly cultivated in South East Asia and Sri Lanka.

Plant Description: The genus *Bauhinia*, is one of the largest genera in sub-family caesalpiniaceae represent more than 300 species. *Bauhinia* has been extensively planted as a garden, park and roadside ornamental tree in many warm temperate and sub-tropical region. The term *Bauhinia* is derived from the new Latin word “*Bauhin*” named after the Bauhin brothers, Swiss-French botanists Jean Bauhin and Gaspard Bauhin. *Bauhinia acuminata* L. is seedless and would not present such a litter problem. It is the most spectacular and most wanted *Bauhinia* spp; bearing six-inch, orchid-like flowers of rich reddish rose purple during the winter but is very tender to freezing temperatures.



Fig. Bauhinia acuminata L.

Macroscopic Description: Bark, dark brown, sometimes with silvery patches, rough, compact, exfoliating in woody strips and scales, outer surface with small transverse and longitudinal cracks, internal surface white, taste, astringent. Leaves are lobbed, shaped like an ox or cow hoof; long and broad with the apical cleft. Flowers are fragrant with five white petals, ten yellow tipped stamens and a green stigma. Fruit is a pod 7.5 to 15 cm long and 1.5 to 1.8 cm broad.

Microscopic Description: Imposed of thin-walled, slightly compressed, yellow brown cells followed by a number of layers of brown colored cells, inner cork composed of transversely elongated orange brown cells, cork interrupted at certain places due to formation of rhytidoma, some secondary cortex composed of 15 or more rows or transversely elongated to circular, thin-walled, parenchymatous cells, some secondary cortex cells contain orange brown contents: groups of stone cells found scattered in this region occasionally arranged in 1-7 or more tangential rows, pericyclic fibres, thick-walled with narrow lumen, scattered in secondary cortex in singles or in groups, secondary phloem consists of sieve tubes, companion cells, phloem parenchyma and fibres traversed by funnel shaped medullary rays, phloem fibres arranged in radial rows throughout phloem region, prismatic and rhomboidal crystals or calcium, oxalate abundantly found in phloem and secondary cortex regions, very rarely found in cork cells, cluster crystals also present in secondary cortex and secondary phloem, crystal fibres also found in secondary phloem.

Part Used: Flowers, root, bark.

Organoleptic Properties

Rasa (Taste)	: Kasaya
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Sita
Vipaka (Metabolism)	: Katu
Karma (Action)	: Dipana, Grahi, Tridosahara, Gandavrddhihara

Purity and Safety test

Total ash	: Not more than 11% w/w
Acid insoluble	: Not more than 0. % w/w
Water soluble	: Not less than 06% w/w

Thin Layer Chromatography

: The ethanolic extract of powdered of fruits of Bauhinia acuminata was subjected to thin layer chromatography studies, to find the presence of number of compounds which support by the chemical test. R_f value and colour of TLC spots, in solvent system of Ethyl acetate: Benzene and few drops of Formic acid (1.5:8:5: Few drops). TLC finger printing of ethanol extract of leaves of Bauhinia acuminata.

Extract	Solvent System	No. of Spots	Colour of Spots	R_f value
Ethanolic extract	Ethyl acetate: Benzene: Formic acid (1.5:8:5: Few drops)	5	Green Green Brown Brown Yellow	0.08 0.12 0.20 0.26 0.28

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 mic. gm/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, 0.1, 0.5, 0.5 and 0.1 mic.gm/kg respectively.

Major Chemical Constituents: Rich phytochemicals such as flavonoids, tannin, kaempferol, terpenoids, saponins, reducing sugars steroids, cardiac glycosides and quercetin.

Therapeutic Use: Insect bites, snake bite, scorpion sting, constipation, oedema, fever, inflammation, rheumatism. It roots, leaves, flowers and seeds use for laxative and purgative. The plant also use as febrifuge, vermifuge, anticonvulsant and against chicken pox, guinea worm and black quarter.

Pharmacological Study: Anticancer, antioxidant, hypolipidemic, antimicrobial, anti-inflammatory, nephroprotective, hepatoprotective, antiulcer, immunomodulating, molluscicidal and wound healing effects.

Adverse Effects and Contraindication: The aqueous and ethanolic extracts of the stem and root of *B. variegata/ acuminata* Linn is to be safe up to 2000 mg/kg body weight.

Dosage Form: Powder or churna and Guggulu and Kwath.

Posology: 20-30 gm of the drug for decoction.

Formulations: Kancanara Guggulu

Bannil

Botanical Name: *Tephrosia purpurea* Pres.

Family: Fabaceae

Synonyms

Bengali: বননীল/স্বরপুঞ্জ (Bannil)

Hindi: Dhamasia, Sarphanka

Sanskrit: Sharapunkha, Pleehashatru

Urdu/Unani: Sarphoka

English: Wild Indigo, Common Tephrosia, Purple tephrosia

Geographical Descriptions: Occurs naturally in grassy fields, waste places and thickets, on ridges, and along roadsides. Dry, rocky or clay soil in coastal sites, on lava fields, open areas at elevations from 5-610 m in Hawaii. It is available in bushy of Bangladesh, India and Sri Lanka as well as Asia. The genus *Tephrosia*, some pantropical taxa with about four hundred species distributed throughout the world. Twenty-four species of *Tephrosia* were recorded in India.

Plant Description: *Tephrosia purpurea* or purple tephrosia is an erect or spreading annual or short-lived perennial herb, sometimes bushy, usually growing from 40-80 cm tall, rarely up to 1.5 m. The plant has a range of traditional medicinal uses, being harvested from the wild and used locally. It is also cultivated as a green manure crop. *Tephrosia purpurea* commonly known in Sanskrit as Sharapunkha, a highly branched, sub erect and herbaceous perennial herb. Herb is found in tropical regions and bears white to purplish flowers. According to Ayurveda, the name of “Sarwa wranvishapaka” means, property to heal all types of wounds.



Fig. *Tephrosia purpurea* Pres.

Macroscopic Description: Tephrosia purpurea or Purple tephrosia is a suberect, much-branched, polymorphic, perennial herb, 30-60 cm in height. Leaves are imparipinnate, 5-15 cm long whereas leaflets are 9-21, glabrous above and obscurely silky beneath, narrow, oblanceolate. Flowers bear in leaf-opposed racemes, blue or purple. Pods: linear, slightly curved, and glabrescent. Seeds: 5-10, smooth, greenish-grey.

Microscopic Description: The leaf is dorsiventral with prominent midrib and uniformly thick lamina. The midrib is elliptical in sectional view, equally projecting on the adaxial and abaxial sides. It is 200 μ m thick. The adaxial and abaxial epidermal layers are thin with small rectangular or squareshaped cells. The vascular bundle is single with broad arc of xylem mass and abaxial band of phloem. On the lower part of the vascular bundle is a broad bowl shaped fibre sheath. On the adaxial part are a thick mass of fibres and a short pillar of parenchyma extension. Around the vascular bundle occur large, thin walled compact angular parenchyma. The palisade zone extends upto adaxial pillar of sclerenchyma. The xylem elements are thick walled, angular and are clustered.

Lamina-The lamina is 110 μ m thick. It has thin, epidermal cells which are rectangular or spindle shaped. Epidermal trichomes are frequently seen on both epidermal layers. The mesophyll tissue is differentiated into wide zone of palisade cells and narrow zone of spongy parenchyma cells.

Palisade zone 50 μ m in height with two or three cylindrical, loosely arranged cells. The spongy parenchyma has four or five layers of lobed parenchymatous tissues. The lateral vein does not project above the surface of the lamina. It has a medianly placed cluster of xylem and a small group of phloem. The vascular bundle is surrounded by a thin sheath of parenchyma cells. On the adaxial and abaxial parts of the vascular bundle thick masses of fibres are seen.

Part Used: Whole plant, seeds, root-bark and root

Organoleptic Properties

Rasa (Taste)	: Tikta, Kashaya
Guna (Attribute)	: Laghu, Ruksa, Teekshna
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Vata and Kapha Shamaka

Purity and Safety Test

Total ash	: Not more than 5.64% w/w
Acid insoluble	: Not more than 1.18% w/w
Water soluble	: Not less than 15.26% w/w

Thin Layer Chromatography

: The ethanolic extract showed a positive Shinoda test indicating the presence of flavonoids. Co-chromatography with the standard flavonoidal compounds, i.e. rutin and quercetin, on the thin layer chromatographic plates (TLC) showed the spots at the same R_f as the standard compounds, further

clarifying the presence of flavonoidal compounds in the extract. The solvent system used for TLC was methanol: water: formic acid (40:57:3) and R_f observed for quercetin and rutin was 0.07 and 0.17, respectively. TLC aluminum plates pre-coated with silica gel RP-18F254 S were used.

Microbial Contamination

: The test for *Salmonella* spp. in Rhizoma Rhei products should be negative. The maximum acceptable limits of other microorganisms are as follows. For preparation of decoction: aerobic bacteria-not more than 10⁷/g; fungi-not more than 10⁵/g; *Escherichia coli*-not more than 10²/g. Preparations for internal use: aerobic bacteria-not more than 10⁵/g or ml; fungi-not more than 10⁴/g or ml; *enterobacteria* and certain Gram-negative bacteria-not more than 10³/g or ml; *Escherichia coli*-0/g or ml.

Heavy Metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels will not be more than 10, 0.5 and 0.3 µ gm/kg, respectively.

Pesticides Residues

: To be established in accordance with national requirements. Normally, the maximum residue limit of aldrin and dieldrin in Rhizoma rhei is not more than 0.05 mg/kg.

Major Chemical Constituents: Beta-Sitosterol, lupeol, retin, delphinidin chloride, cyaniding chloride, isolonchocarpin, lanceolatins A and B, pongamol, karangin, kangone, 5,7-dimethoxy-8, flavanone, 2-methoxy-3-9-dihydroxycoumestone, flevichapparins B and C, methyl karanjic acid and purpurin.

Therapeutic Use: Inflammations, skin diseases, scrofula, elephantiasis, dyspepsia, stomachalgia, flatulence, haemorrhoea, chronic fever, boils pimples, haemorrhoids, asthma, bronchitis, anaemia, hepatosplenomegaly, verminosis, strangury, odontalgia and gingivitis.

Pharmacological Study: Anti-inflammatoy, analgesic, hepatoprotective, immunomodulatory, anti-diabetic, antileishmanial, anti-helicobacter pylori, antiulcer activity, wound healing potential, anti-carcinogenic and anti- lipidperoxidative activities.

Adverse Effects: They are mildly toxic to humans and other mammals, but extremely toxic to many insects (hence their use as an insecticide) and aquatic life, including fish. This higher toxicity in fish and insects is because the lipophilic rotenonoid is easily taken up through the gills or trachea, but not as easily through the skin or the gastrointestinal tract. LD₅₀ of the ethanolic extract of aerial parts of

TP has been found 5.12 g/kg. Deliberate ingestion of rotenone, however, can be fatal. The compound decomposes when exposed to sunlight and usually has an activity of six days in the environment.

Contraindication: The acute toxicity study conducted for aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected 1/8th and 1/4th of 2000 mg/kg i.e. 250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage form: Powder, Decoction and Taila.

Posology: Powder 3-6 gm per day and Juice 10-20 ml.

Formulations: Yakrit phalantak churna

Bat

Botanical Name: *Ficus benghalensis* L.

Family: Moraceae

Synonyms

Bengali: বট (Bat)

Hindi: Bar

Sanskrit: Nyagrodha/Avaroha

Urdu/Unani: Bad, Bargud

English: Banyan tree

Geographical Descriptions: *Ficus benghalensis* is a very ancient herb known to Bangladesh, which is found in northern districts. It is common in the low country dry regions of Sri Lanka up to an altitude of about 2000 feet. Also occurs in the sub-Himalayan forests and South India and naturalized elsewhere.

Plant Description: *Ficus benghalensis* is an evergreen tree with a wide, spreading crown; it can grow 20-30 metres or taller. The plant usually begins life as an epiphyte, growing in the branch of another tree; as it grows older it sends down aerial roots which, when they reach the ground quickly form roots and become much thicker and more vigorous. They supply nutrients to the fig, allowing it to grow faster than the host tree. The aerial roots gradually encircle the host tree, preventing its main trunk from expanding, whilst at the same time the foliage smothers the foliage of the host. Eventually the host dies, leaving the fig to carry on growing without competition. It can become a very large, spreading tree in time, with some specimens several hundred metres across and producing aerial roots from the spreading branches that eventually become new trunks and allow the crown to spread even further.



Fig. *Ficus benghalensis* L.

Macroscopic Description: The mature stem bark is grey and thin, closely adhered ashy white, light bluish-green or grey patches. Bark is flat or slightly curve and externally rough due to presence of horizontal furrows and lenticels. Fracture is short in outer two thirds of bark while inner portion shows a fibrous fracture taste, astringent.

Microscopic Description: Transverse section of mature bark shows compressed cork tissue and dead elements of secondary cortex consisting of mostly stone cells and thin-walled, compressed elements of cortex cork cells rectangular, thick-walled and containing brownish content, secondary cortex wide, forming more than half of thickness of bark, composed of large groups of stone cells and parenchymatous cells, stone cells vary in shape, parenchymatous cells thin-walled and somewhat cubical to oval few in number and occur between groups of stone cells, some of cells contain prismatic crystals of calcium oxalate, starch grains and tannin, secondary phloem composed of a few sieve elements parenchyma, fibres, stone cells and latex tube alternating with medullary rays, sieve elements compressed in outer region of bark while intact in inner region, few thick-walled phloem parenchyma occurring in between patches of phloem fibres and stone cells, stone cells similar to those present in secondary cortex, some phloem cells contain prismatic calcium oxalate crystals also, present in fibres forming crystal fibres, medullary rays 2-5 seriate, composed of thick-walled, circular to oval cells few cells also converted into stone cells and some have pitted walls, also containing plenty of starch grains, mostly rounded, rarely oval or semi-lunar in shape, simple as well as compound type, compound starch grains consist of 2-3 components, cambium composed of a few layers of small, rectangular, thin-walled cells.

Part used: Bark, tender leaves and latex.

Organoleptic properties

Rasa (Taste)	: Kasaya
Guna (Attribute)	: Guru, Rooksha
Virya (Potency)	: Sheeta
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphpitta Shamaka

Purity and safety test

Total ash	: Not more than 8% w/w
Acid insoluble	: Not more than 3% w/w
Water soluble	: Not less than 8% w/w

TLC profile with marker constituents

: Results obtained on distances travelled by solvent front and extracts on performing the thin layer chromatography were analyzed and the R_f values were noted. The larger the R_f value, the lower the polarity of natural products or phytochemical. The number of spots and the R_f values clearly indicate that each latex solvent extract with different

solvent systems has many phyto constituents present in them except than S3 (Formic acid: Toluene = 5:5) which has mostly given only single spot with methanol and ethanol extract in *F. benghalensis*. Complete data about the TLC profiling of plants bark and leaves solvent extracts are given below.

Name of the Extract	Methanol	Ethanol	Acetone	Ethyl acetate
S1 = B: C (7:3) S1 = B: C (7:3) S1 = B: C (7:3) S1=B:C (7:3)	0.15, 0.43, 0.64 0.15,0.43,0.64	0.20,0.49,0.66	0.20,0.50,0.66	0.20, 0.52, 0.56
S2 = B: C: EA (4:2:1) S2= B:C:EA (4:2:1)	0.56, 0.756	0.18, 0.62, 0.88 0.18,0.62, 0.88	0.60, 0.88	0.62, 0.88, 0.95 0.62,0.88,0.95
S3= FA:T5:5	0.56, 0.756	.60, 0.78, 0.95 0.60,0.78,0.95	0.78	0.70,0.79,0.92
S4= FA: T:M 2.5:2.5:1	0.708 0.958, 0.68, 0.75, 0.95 , 0.68,0.75,0.95	0.70,0.91	0.68,0.89	0.68,0.89
S5= T:B5:5	0.2,0.5,0.65	0.27,0.37,0.67,, 0.95	0.22,0.57,0.7	0.55,0.62,0.7,0.85, 0.95

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 μ gm/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, 0.1, 0.5, 0.5 and 0.1 μ gm/kg respectively.

Major Chemical Constituents: Three ketones: 20-tetratriacontene-2-one, 6-heptatriacontene-10-one, pentatriacontan-5-one, and two other compounds, beta-sitosterol-alpha-D-glucose and meso-inositol have been isolated from the stem bark of *Ficus benghalensis*.

Therapeutic Use: Biliousness, ulcers, erysipelas, vomiting, daha, prameha, raktapitta, trisna, visarpa, vrana, yonidosa, fever, inflammation, leprosy, gonorrhoea, remedy for toothache, diabetes, cooling and tonic.

Pharmacological Study: Antihyperglycemic, antidiabetic, antihyperlipidemic, hypocholesterolemic, anti-inflammatory, analgesic, antibacterial, antifungal, larvicidal, anti-diarrhoeal, antimutagenic, antioxidant, cytotoxic, hepatoprotective, anti-arthritis, antiallergic and immunostimulatory.

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

Contraindication: It is best to avoid during constipation.

Precautions: Precaution should be exercised while using the latex of the plant as it is toxic in nature. The leaves and bark of the tree are however, safe to consume and seldom have been reported to cause any side-effects.

Dosage Form: Powder, decoction and milky latex.

Posology: Powder 1-3gm, Decoction 50-80 ml and latex 5-8 drops per day.

Formulations: Sharno Sindur, Usirasava, Dasamularishta

Boro Elach

Botanical Name: *Amomum subulatum* Roxb.

Family: Zingiberaceae

Synonyms

Bengali: বড় এলাচ (Boro Elach)

Hindi: Bari ilaichi

Sanskrit: Sthula-elaa, Bhadraa, Bhadrailaa, Bahulaa, Prithivikaa, Triputaa, Truti.

Urdu/Unani: Heel Kalaan, Qaaqule Kubaar, Bari elaichi, Purbi elaichi

English: Greater or Nepal Cardamom.

Geographical Descriptions: Several species of the genus *Amomum* are distributed all over the mountainous area from the Himalayas to Southern China. Furthermore, some African cardamoms (genus *Aframomum*, in Madagascar, Somalia and Cameroon; another member of this genus is the pungent West African spice grains of paradise) have a similar taste and appear sporadically on the Western market. *Amomum subulatum* is native to the Eastern Himalayas; the main production regions are Eastern Nepal, India (mostly in the tiny union state Sikkim) and Bhutan. More than 50% of the world's harvests are produced in India

Plant Description: The botanical species name *subulatum* derives from Latin *subula* awl, referring probably to the awl-shaped and pointed leaves. Black cardamom is an evergreen plant that grows up to 5 ft tall. Leaves are found on the upper portion of the stem. The old stems die down after a few years. The rhizomes are a dull red colour. Flower buds appear in spring from the base of the rhizome.



Fig. *Amomum subulatum* Roxb.

Macroscopic Description: Amomum subulatum is a perennial with a thick, tuberous rhizome and numerous long roots. There are up to 30 erect, glabrous, green stems that are 2 to 3 m high. The leaves are in 2 rows with a leaf membrane at the end of a soft-haired sheath. The leaf surface is lanceolate, clearly acuminate and up to 60 cm long. The leaves are entire-margined, downy above, and silky-haired beneath and punctuated by numerous small oil cells. The seeds are about 4 mm diam and dark-reddish-brown.

Microscopic Description: Amomum subulatum seed showed a very thin membranous aril composed of several layers of collapsed cells containing oil globules and prismatic crystals of calcium oxalate. Testa consists of single layered epidermis of rectangular cells followed by 1-2 layers of collapsed, thin-walled parenchymatous cells, beneath which a single layered large rectangular cells containing oil globules were present, which were internally surrounded by several layers of flattened, thin-walled, parenchymatous cells. Perisperm was surrounded externally by thick-walled, sclerenchymatous, radially elongated dark brown beaker cells. Perisperm enclosed the endosperm and embryo, both composed of polygonal, thin-walled, parenchymatous cells.

Part Used: Seed, rhizome

Organoleptic Properties

Rasa (Taste)	: Katu, Tikta
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphvata samaka, Pitta vardhaka

Purity and safety test

Total ash	: Not more than 11% w/w
Acid insoluble	: Not more than 0.2% w/w
Water soluble	: Not less than 0.6% w/w

Thin Layer Chromatography

: Silica gel (60-120 mesh) was used as absorbent for column chromatography. The column was taken and packed with glass wool at the bottom of the column. The slurry was prepared using silica gel and hexane. It was poured slowly from the top of the column in a little quantity allowing for the uniform packing. 2/3rd of the column was packed by using above procedure. The remaining completely dried silica gel slurry containing the diethyl ether extract of the drug was poured in the silica column (mesh size 60-120, 50×12 cm) and then eluted successively with different solvents, in the increasing order of polarity like n-hexane, petroleum ether (40-60°C), Benzene:

acetone (9:1), Benzene : acetone (8:2), Benzene : acetone (7.5:2.5), Benzene : acetone (5:5), Benzene : acetone (4.5:5.5) and ethanol. The fractions were collected and marked. The marked fractions were subjected to thin layer chromatography to check homogeneity of various fractions. The fractions having same R_f values were combined together and concentrated.¹⁴ Crystallize the selected concentrate with ethyl acetate and yielded the compound. A new compound was isolated first time from ether extract of *Ammomum subulatum* leaves such as yellow prism crystals with 0.1% yield, showed violet color on TLC plate under UV chamber had following properties-

R_f value: 0.4 [Chloroform: methanol (10:1 v/v)],
Empirical formula: $C_{16}H_{14}O_4$, m.pt: 208-209°C UV:
 λ_{max} (DMSO): 210 nm [Ethanol: water (5:5 v/v)].

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 mic. gm/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, 0.1, 0.5, 0.5 and 0.1 μ gm/kg respectively.

Major Chemical Constituents: The seeds contain 3% of an essential oil, which is dominated by 1, 8-cineol (typically 70%). Smaller and variable amounts of α -terpinyl acetate, limonene, terpinene, terpineol and sabinene have also been reported. The pericarp contains small amount (0.2%) of essential oil, with a much reduced 1, 8-cineol fraction compared to the seed oil. On the other hands, it obtains a few % of sesquiterpenoids (spathulenol, germ-acrene D, β -selinene). The brown colour of the pericarp is attributed to 0.1% antho-cyanines (cyanidin-3-glucosid, cyanidin-3, and 5-diglucosid); similar compounds make for the red colour of some onion cultivars.

Therapeutic Use: Dyspnea, cough, thirst, vomiting, diseases of the mouth, nausea, itching, indigestion, abdominal pains and rectal diseases, congestion of the lungs, pulmonary tuberculosis, and inflammation of the eyelids and antidote for both snake and scorpion venom.

Pharmacological Study: Analgesic, anti-microbial, anti-oxidant, anti-ulcer, cardio-adaptive, anti-diabetic activity.

Adverse Effects: Very few adverse effects have been reported with cardamom. Primarily, the seeds may cause allergic contact dermatitis. The cardamom seeds may trigger gallstone colic (spasmodic pain) and is not recommended for self-medication in patients with gallstones. Although not well studied, cardamom may increase the risk of bleeding.

Contraindication: Pregnancy and lactation

Dosage Form: Powder or churna, decoction, tincture and oil.

Posology: There is no proven safe or effective dose of cardamom. Traditionally, the typical dose of cardamom is 1.5 gm of the ground seeds per day. As a digestive, a tea prepared from 1 teaspoon of freshly crushed cardamom seeds infused in 1 cup boiled water for 10-15 minutes may use and use in children is not recommended.

Formulations: Kalomegasava, Sarivaddarista, Eladdarista

Chita

Botanical Name: *Plumbago zeylanica* L.

Family: Plumbaginaceae

Synonyms:

Bangla: চিতা (Chita)

Hindi: Chita, Chitarak, Chitawar, Chiti, Chitra

Sanskrit: Chitra, Chitrapali, Chitraka, Chitranga

Urdu/Unani/Tibb: Sheetraj Hindi, Cheetah, Chitalakri

English: Ceylon leadwort

Geographical Distribution: It is found throughout India; much cultivated in wild in the W. peninsula and probably in Bengal, Malaypeninsula, Ceylon –tropics of the old world.

Plant Descriptions: *Plumbago zeylanica* is a herbaceous plant with glabrous stemsthat are climbing, prostrate, or erect. The leaves are petiolate or sessile and have ovate, lance-elliptic, or spatulate too blanceolate blades that measure 5-9×2.5-4 cm in length. Bases are attenuate while apexes are acute, acuminate, orobtuse. Inflorescences are 3–15 cm in length and have glandular, viscid rachises. Bracts are lanceolate and 3-7×1-2 mm long. The heterostylous flowers have white corollas 17–33 mm in diam and tubes 12.5–28 mm in length. Capsules are 7.5–8 mm long and contain are reddish brown to dark brown seeds.



Fig. *Plumbago zeylanica* L.

Macroscopic Description: Root is dark brown in color. The root surface is rough and firm due to scaling off of longitudinal striation. Inner side of root is creamy white, soft and collapsed and non-collapsed phloem zone distinctly visible.

Microscopic Description: Transverse section of root shows starch grains simple, compound, round, oval, elliptical, 2-20 μ in diam, vessels with simple pits up to 190 μ in length, vessels with bordered pits up to 110 μ in length, stone cells 25 μ , sclereids with lignified 180 μ in length, prismatic crystals of calcium oxalate, outer most tissue of cork consisting of 5-7 row, parenchyma containing starch grains and some cells with yellow contents, fibres scattered singly or in groups of 2-6, phloem an arrow zone of polygonal, thin-walled cells, consisting of usual elements and phloem fibres, similar to cortical zone, phloem fibres usually in groups of 2-5 or more but occasionally occurring singly, lignified starch grains, fibres with pointed end up to 520 μ in length.

Part Used: Root

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Tikshana (Sharp)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Deepana, Pachana, Sothahara, Kaphavatahar, Arsahar, Sulahar

Purity and Safety Test

Foreign matter	: Not more than 3% 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 12% 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>Salmonellae 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, 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: Roots and aerial parts principally contain plumbagin, a yellow naphthaquinone. Roots contain chitranone, zeylanone, maritnone, dihydrosteronemaritnone, 2-methyl naphthaquin, a quinine, plumbazelanone and methylene di-plumbagin. Aerial parts contain plumbazelanone, a binaphthaquinone, chitanone and terpenoids, lupeol, α - and β -amyrinand γ -taraxesterol. The plant also contains a dihydroquinone, alkaloids, glycosides, tannin, saponins and steroids. Roots also contain 3-chloroplumbagin, 3,3'-biplumbagin, zeylinone, isozeylinone, elliptinone and droserone.

Therapeutic Use: Inflammation, leprosy, scabies, ringworm, dermatitis, ulcers, hemorrhoids, hookworm, gonorrhoea, syphilis, rheumatic pain, sprains, scabies, skin diseases, and wounds healing.

Pharmacological Study: Anti-inflammatory, anti-oxidant, anti-microbial, cardi tonic, hepatoprotective, neuroprotective, anti-hyperglycemic, anti-allergic, anti-arthritis, anti-diarrhoeal, anti-haemorrhagic, aphrodisiac, carminative, diuretic, expectorant.

Contraindications: Pregnancy, lactation, young children, patients suffering from liver or kidney diseases.

Adverse Effects: Large doses may cause abortion, diarrhea, paralysis of muscular tissue, painful micturition, and respiratory failure.

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

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

Posology: Root powder 1-2 gm.

Formulations: Louhasav, Sarkararista, Kankayan Gurika, Loudhrasav

Choi

Botanical Name: *Piper chaba* Hunter

Family: Piperaceae

Synonyms:

Bangla: চৈ (Choi)

Hindi: Chavya

Sanskrit: Chavya, chavila

Urdu/Unani/Tibb: Peepal Chab, Kababah

English: Java long pepper root, wild pepper

Geographical Distribution: It is native to South and Southeast Asia throughout India, West Bengal, Tripura, Bangladesh and other warmer regions of Asia including Malaysia, Sinagapore and Sri Lanka.

Plant Descriptions: *Piper chaba* is a creeper plant that spreads on the ground. It may also grow around large trees. The leaves are oval-shaped and about 2 to 3 inches long. The flowers are monoceous and blossom during the monsoon. The fruit looks similar to other varieties of long pepper, with an elongated shape that can grow up to 3 inches long. The fruit is red when ripe, which turns dark brown or black when dry.



Fig. *Piper chaba* Hunter

Macroscopic Description: Drug consists of dried cut pieces of stem of variable length and usually 0.5-2.0 cm in width, cylindrical and somewhat twisted, greyish-brown, surface smooth with a few longitudinal wrinkles, nodes and internodes distinct, fracture, short; odour, peppery; taste, acrid.

Microscopic Description: Stem-Shows a thin cork consisting of 3-4 layers of rectangular, brownish cells; cork cambium not distinct; secondary cortex a wide zone, consisting of round, oval to rectangular, thin-walled, parenchymatous cells with prominent intercellular spaces; plenty of simple starch granules present; endodermis single layered; stelar region composed of five wedge-shaped vascular bundles alternating with wide medullary rays; phloem lies towards outer side and composed of sieve elements, parenchyma and phloem fibres occurring singly or in groups; xylem lies towards centre and composed of vessels, tracheid, fibres and xylem parenchyma; isolated vessels barrel-shaped with pitted and reticulate thickenings; fibres needle and spindle-shaped, medullary rays multi-seriate, cells thin walled, filled with simple, round to oval, starch grains, measuring 3-14 μ in diam.

Powder-Greyish-brown; shows fragments of vessels, fibres and simple, round to oval starch grains, measuring 3-14 μ in diam.

Part Used: Fruit, root

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphavatasamaka, dipana, pachana, kasagna, swasagna, arshogna, krimigna

Purity and Safety Test

Foreign matter	: Not more than 2% 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 3% 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 <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>Salmonellae 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.

Major Chemical Constituents: Piper chaba contains isoflavanons such as 5, 8-dihydroxy-6, 7-dimethyl isoflavan-4-one and 5, 6-dihydroxy-7, 8-dimethyl isoflavan-4-one have been isolated from the stem. Kusunokinin and pellitorine are present in the stem bark. Oil contains gibbilibods A-D (74.2%) with remaining major constituent having terpenes camphene (13.6%) and alpha pinene (6.5%). Piperine, piperonaline, guineensine, and the isobutylamide of 11-(3,4-methylenedioxyphenyl) undeca-2, 4, 10-trienoic acid are found from the extract.

Therapeutic Use: Anorexia, cholera, dysentery, diarrhea, stomach complaints, arthritis and rheumatism, sprains, stiffness, cold, flu, flatulence, nausea, catarrh, and cough.

Pharmacological Study: Antioxidant, anti-diarrhoeal, antibacterial, anti-hypertensive, carminative, diuretic, stimulant, expectorant, analgesic, antihyperlipidemic, antiandrogenic, immunoregulatory, antidepressant, gastro-protective, anti-flatulent, anti-fungal, anti-tussive activity.

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

Adverse Effects: Over-dosage may lead to gastric irritation.

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

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

Posology: Powder 1-2 gm.

Formulations: Prasarani Sandhan, Rasnasav, Pippaladyarista, Dasamularista

Chakule

Botanical Name: *Uraria picta* Desb.

Family: Fabaceae

Synonyms:

Bangla: চাকুলে (Chakule)

Hindi: Pithavan, Dabra

Sanskrit: Citraparni, Kalasi, Dhavani, Prthakparni, Shrigalavinna

Urdu/Unani/Tibb: Chakule

English: Indian Uraria

Geographical Distribution: *Uraria picta* is not a very common species, but occurs throughout tropical India, extending up to 300 m altitude in Tarai region of the Himalayas.

Plant Descriptions:

General Description: *Uraria picta* is an erect, under shrub, 60–75 cm tall, with several branches. Leaves are generally three to five in number, up to nine-foliolate. Leaflets are imparipinnate, linear-oblong, obtuse, mucronate at apex, white clouded above and pubescent below. Purple flowers occur in dense, cylindrical racemes with bracts; calyx teeth are lanceolate and the corolla is papilionaceous. Pod (fruit) has three to six joints.



Fig. *Uraria picta* Desb.

Macroscopic Description:

Root—Occur in pieces of varying size, thickness of 1 to 2 cm, gradually tapering, tough, woody, cylindrical; externally light yellow to buff, internally pale yellow; surface bearing fine longitudinal striations; fracture, splintery or fibrous; taste, slightly acrid.

Stem—About 8.0 to 16.0 cm long, 0.2 to 0.4 cm in diam, in cut pieces; cylindrical, branched, pubescent, external surface light yellow to brown; transversely cut and smoothed surface shows buff-white colour, mature stem longitudinally wrinkled, leaf scar present at nodes; fracture, fibrous.

Leaf—Very variable, imparipinnate, upto 20 cm or more long, upto 2 cm wide; leaflets on the upper part of the stem 5 to 7, rigidly sub-coriaceous, linear-oblong, acute, blotched with white; glabrous above, finely reticulately veined and minutely pubescent beneath, base rounded; leaflets on the lower part of the stem 1 to 3, sub-orbicular or oblong.

Microscopic Description:

Root—Shows 5 or 6 layers of thin-walled, tabular, regularly arranged cork cells; cork cambium single layered; secondary cortex composed of 4 to 6 layers of oval, tangentially arranged, thin-walled, parenchymatous cells, a few fibres present singly or in groups; secondary phloem composed of sieve elements, parenchyma and fibres traversed by phloem rays; sieve elements somewhat collapsed towards periphery but intact in inner phloem region; phloem parenchyma composed of rounded to somewhat oval cells, larger towards periphery; fibres thick-walled, lignified with narrow lumen and tapering ends; phloem rays 1 to 5 cells wide, their cells being oval or rectangular in the portion nearer the wood but broader towards their distal ends; secondary xylem composed of vessels, tracheids, fibres, crystal fibres and parenchyma traversed by xylem rays; vessel very few, mostly confined to inner and outer part of xylem; fibres similar to those of phloem fibres and arranged in close set concentric bands; in isolated preparation vessels are cylindrical, pitted with transverse to oblique perforation; tracheids possess bordered pits; xylem parenchyma mostly rectangular with simple pits; xylem ray cells isodiametric showing simple pits; starch grains simple, round to oval, measuring 6 to 17 μ m in diam distributed throughout parenchymatous cells of secondary cortex, phloem and xylem; prismatic crystals of calcium oxalate present in crystal fibres, as well as in many parenchymatous cells of secondary cortex, phloem and ray cells. Stern shows single layered epidermis covered with cuticle, a few epidermal cells elongate outwards forming papillae; cortex 8 to 10 cells wide, consisting of oval to circular, thin walled, parenchymatous cells; groups of pericyclic fibres present in the form of discontinuous ring; phloem consisting of usual elements except phloem fibres; phloem rays 2 to 4 cells wide; xylem consisting of usual elements; vessels mostly simple pitted; fibres simple with blunt tips; xylem rays 1 to 4 cells wide and 2 to 8 cells in height; pith wide, consisting of thin-walled, round to oval parenchymatous cells.

Leaf-

Midrib—single layered epidermis on either surfaces covered with striated cuticle having a few unicellular or bicellular, hooked or straight and pointed tipped hairs present on both surfaces but more

on lower surface; collenchyma 2 or 3 layered, followed by 2 layers of parenchyma cells; single row of pericyclic fibers present on both sides; vascular bundle located centrally.

Lamina – shows single layered epidermis on either surfaces, a few unicellular or bicellular, hooked or straight, pointed tipped hairs present on lower surface; mesophyll differentiated into single layered palisade and spongy parenchyma; spongy parenchyma cells oval to rounded having small intercellular spaces; numerous paracytic stomata present on lower surface; stomatal index 27 to 36 on lower surface; palisade ratio 4 or 5; vein-islet number 29 to 32 per sq. mm.; vascular bundle present centrally.

Powder–Greenish-yellow; shows simple pitted vessels; fragments of fibres, tracheids, parenchyma cells; pieces of hairs; palisade cells; a few prismatic crystals of calcium oxalate; epidermal cells wavy walled in surface view showing paracytic stomata and starch grains simple, round to oval.

Part Used: Roots

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Amla (Sour), Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Sara (Unstable)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Dipana, Sangrahi, Tridosahara, Vatahara, Vrsya, Sothahara, Sandhaniya, Jivanu Nasaka, Balavardhaka

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 4% w/w
Alcohol soluble extractive	: Not less than 7% w/w
Water soluble extractive	: Not less than 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>Salmonellae 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.

Major Chemical Constituents: Two isoflavanones 5, 7-dihydroxy-2'-methoxy-3', 4'-methylenedioxyisoflavanone, and 4', 5'-dihydroxy-2', 3'-dimethoxy-7-(5-hydroxychromen-7yl)-isoflavanone along with 6 compounds including isoflavanones, triterpenes and steroids.

Therapeutic Use: Diarrhea, vomiting, burning sensation, fever, cough, bloody dysentery, insanity, gout, bleeding piles, excessive thirst, diseases of eyes and fracture.

Pharmacological Study: Anti-oxidative, anti-microbial, anti-diarrhoeal, anti-catarrhal, anti-inflammatory, analgesics, hepatoprotective, anti-cholinergic and expectorant.

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

Adverse Effects: Large oral doses may cause diarrhea, nausea and vomiting and abdominal pain.

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

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

Posology: 20-50 gm powder for decoction.

Formulations: Barunadya Louha, Dhanyakadi Kwath, Dosomularista, Amritarista.

Chakunda

Botanical Name: *Cassia tora* L.

Family: Fabaceae/Leguminosae

Synonyms:

Bangla: চাকুন্দে (Chakunda)

Hindi: Pavand, Chakunda

Sanskrit: Edagaja, Dadrughna, Chakramarda

Urdu/Unani/Tibb: Panwar

English: Fetid Cassia

Geographical Distribution: *Cassia tora* is found in many parts of the world. It grows abundantly in parts of Afghanistan, Bangladesh, India, China, Pakistan, Myanmar, Nepal and Bhutan. It is also grown and cultivated areas in the Himalayas at the elevation of 1400 m in Nepal. It is distributed throughout India, Sri Lanka, West China and the tropics.

Plant Descriptions: An herbaceous foetid annual weed, almost an under shrub, upto 30-90 cm in height. Seed Hard, 1cm long, 3-4 mm thick, oblong or rhombohedral, both ends appear as if cut off obliquely, greenish-brown to brownish-black, smooth and shiny. Leaves pinnately compound, rachis grooved with a conical gland between each of the two lowest pairs of leaflets, leaflets three pairs, obovate-oblong, membranous, base somewhat oblique main nerves 8-10 pairs. Flowers yellow, in subsessile pair in the axils of the leaves, the upper ones crowded, stamens seven, perfect and three staminodes. Fruit subtetrasutures very broad.



Fig. *Cassia tora* L.

Macroscopic Description: Seed hard, 1 cm long, 3-4 mm thick, oblong or rhombohedral, both ends appear as if cut off obliquely, greenish-brown to brownish-black, smooth and shiny; odourless; taste, bitter.

Microscopic Description: Seed shows seed coat consisting of longitudinally elongated cells, covered with thick, smooth cuticle, followed by palisade layer composed of closely packed, radially arranged, non-lignified, thickened columnar cells, and by a single layer of dumb-bell shaped, thick-walled, parenchymatous cells; a wide zone of thick-walled, parenchymatous cells forming inner layer of testa present, differentiated into outer 8-10 layers of tangentially elongated, parenchymatous cells and a single layer of broad cells which are squarish in shape; a few vascular bundles scattered in this zone; embryo consists of radicle, plumule and two cotyledons; epidermis of cotyledon consists of a single layer, externally covered with cuticle, followed by two layers of palisade-like cells of mesophyll; mesophyll of ventral side composed of rectangular to polygonal cells filled with round to oval starch grain, measuring 8-12 μ in diam.

Powder-Light brown; shows fragments of testa, parenchymatous cells, very small, numerom: simple, round to oval, starch grains measuring 8-12 μ in diam., and a few rosette crystals of calcium oxalate upto 49 μ in diam.

Part Used: Seeds, leaves, root

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Ushna (Heating)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Rechana, Kapha-Vatahar, Krimighna, Kushthaghna, Lekhana, Vishaghna, Tvak Varnaprasadakaram, Tvachya

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 7% 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>Salmonellae 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.

Major Chemical Constituents: Roots contains 1, 3, 5-trihydroxy-6-7-dimethoxy-2-methylanthroquinone and beta-sitosterol. Seeds: Naphtho-alpha-pyrone-toralactone, chrysophanol, physcion, emodin, rubrofusarin, cchrysophonic acid-9-anthrone. Leaves: Emodin, tricontan-1-0l, stigmasterol, b-sitosterol-b-D-glucoside, freindlen, palmitic, stearic, succinic and d-tartaric acids uridine, quercitrin and isoquercitrin.

Therapeutic Usages: Leprosy, ringworm, flatulence, colic, dyspepsia, constipation, coughs, bronchitis, cardiac disorders and skin diseases.

Pharmacological Study: Laxative, antiperiodic, anthelmintic, anti-inflammatory, antimicrobial, antioxidant, estrogenic, hypolipidemic, hepatoprotective, antishigellosis, antinociceptive, ophthalmic, cardiogenic, expectorant.

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

Adverse Effects: Over-dosage may lead to diarrhea and others gastric problems.

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

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

Posology: Seeds powder 1-3 gm and leaf juice 5-10 ml.

Formulations: Nimbadi Churna, Brihat Morichyadi Taila, Dadru Dalam

Chalmogra

Botanical Name: *Hydnocarpus wightiana* Blume

Family: Achariaceae

Synonyms:

Bangla: চালমুগরা (Chalmogra)

Hindi: Chalmogra, Chalmoogra, JangaliBadam

Sanskrit: Tuvaraka, Turveraka, Kushtavairi

Urdu/Unani/Tibb: Chaalmagraa

English: Soorty oil tree

Geographical Distribution: The plants are found in the maintains of Western Ghats from Maharashtra to Kerala and is also found in the hilly regions of Assam and Tripura. It is also cultivated in Uganda, Nigeria, Srilanka and few other South East Asian countries.

Plant Descriptions: *Hydnocarpus wightiana* is an evergreen deciduos tree with can grow upto 16m or more in height. Bark is rough, brown and wood whitish but generally becomes brownish-grey due to fungal sapstain and turns streaked. Leaves are oblong, ovate or elliptic, somewhat serrate and 10-16 cm long. Flowers of this herb are small, solitary fascicles and greenish white. Fruits are globose, mammilate, tomentose and 5.1-10.2 cm diam. It bears the fruits between the months of August and September. Seeds are striate, sub avoid, obtusely angular and 2.0-2.5 cm long.



Fig. *Hydnocarpus wightiana* Blume

Macroscopic Description:

Fruits: The fruits are globose or ovoid, some 10 cm in diam with a thick woody rind. Internally, they contain 10-16 black seeds embedded in the fruit pulp. The seeds account for some 20% of the fruit weight. Seeds obtusely angular, embedded in scant white pulp, and firmly adherent to the thin black testa. When the pulp is peeled off, the outer surface of the testa is seen to be rough and striated by shallow longitudinal grooves. Inside the shell is copious oily albumen, containing two large, plain heart shaped and leafy cotyledons. The albumen when fresh is white but turns to dark brown color in the dry seeds.

Seeds: Seeds are ovoid, irregular and angular, dorsiventral, slightly flattened, massive, lump-like, of various shapes, 2.54-3.175 cm long, 2.54 cm wide, and 0.4-0.5 cm in thickness toward the apex, skin is smooth, gray, and brittle; kernel oily and dark brown; hilum lies at a small circular elevation located at the base and micropyle adjacent to it. It has characteristic nauseous odor, acrid taste and oily on touch

Microscopic Description: Seed shows oval in outline, showed outer thin testa, centrally located, and linearly arranged thin cotyledon encircled by endosperm.

Part Used: Fruit, seeds, seed oil

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter), Kashaya(Astringent)
Guna (Attribute)	: Snigdha (Unctuous), Tikshna (Sharp)
Virya (Potency)	: Ushna (Heating)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kapha-Vatahar

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 7% 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>Salmonellae 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.

Major Chemical Constituents: Hypnocarpic acid, chalmoorgic acid, It also oleic acid and palmitic acid.

Therapeutic Usages: Abdominal distension, piles, sciatica, fever, itching, worm infestation, leprosy, oedema, urticarial, skin diseases, intestinal obstructions etc.

Pharmacological Study: Hypolipidemic, anti-inflammatory antineoplastic activity, cytotoxic activity.

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

Adverse Effects: Over-dosage may lead to diarrhea and others gastric problems.

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

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

Posology: Powder 1-3 gm, seed oil 3-30 drops in divided doses per day.

Formulations: Brihat Somraji Taila.

Chobchini

Botanical Name: *Smilax china* L.

Family: Smilacaceae

Synonyms:

Bangla: চোবচিনি (Chobchini)

Hindi: Chobchini

Sanskrit: Madusnuhi

Urdu/Unani/Tibb: Chobchini

English: China root

Geographical Distribution: *Smilax china* is a plant species in the genus *Smilax*. It is native to China, Japan, Korea, Philippines, Thailand, Vietnam, Myanmar, and Assam.

Plant Descriptions: *Smilax china* is a woody vine armed with small thorns all over the stem. Rhizomes are long, thick and grey colored. Leaves are simple, alternate, elliptically oblong to subrounded, 5 to 8 cm long, 2.5 to 4 cm wide; those toward the end of the branches are much smaller and veined. Petioles are about 7 millims long, with adnate spiculate stipules which frequently are extended into tendrils. In florescence arises from the upper leaf axils, 3 to 5 cm long. Flowers are white to yellowish-green, their pedicels subtended by bracteoles, umbellate.



Fig. *Smilax china* L.

Macroscopic Description: Tubers about 6 to 12 cm long, 2 to 4 cm wide, rough, irregular, cylindrical, curved, slightly tapering with brownish or blackish scars; externally brownish-yellow in colour, and internally brown in colour; fracture, hard; odour not characteristic; taste, slightly bitter.

Microscopic Description: Cortex shows several layers of thin-walled, polygonal, elongated mucilaginous parenchymatous cells, a few cells containing raphides of calcium oxalate; endodermis not distinguished; ground tissue having several vascular bundles consisting of usual elements; fibres long and aseptate; numerous simple and compound starch grains, measuring 16 to 38 μ in diam. with 2 to more than 9 components mostly spherical to ovoid, having hilum in centre.

Powder: Shows light brown, fragments of mucilaginous parenchymatous cells of cortex fibres and vessels with reticulate thickening; a few scattered needles of calcium oxalate from raphides; numerous simple and compound starch grains measuring 16 to 38 μ in diam with 2 to more than 9 components, mostly spherical to ovoid having hilum in centre.

Part Used: Rhizome

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Tikta (Bitter)
Karma (Action)	: Tridoshashamak

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 0.6% w/w
Acid insoluble ash	: Not more than 0.006% w/w
Alcohol soluble extractive	: Not less than 0.8% 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>Salmonellae 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.

Major Chemical Constituents: Chopchini contains fats, saponins, glycosides, gums, starch, flavonoids, tannins, terpenes, alkaloids etc. The major constituents are kaemperol-7-O-beta-D-glucopyranoside, engeletin, isoengeletin, kaempferol, dihydrokaempferol, dihydrokaempferol-5-O-P-D-glucopyranoside, rutin, kaempferol- 5-O-beta-D-glucopyranoside, 3, 5, 4'-trihydroxystibene, vanillic acid, 3, 5-dimethoxy 4-O-beta-D-glu-copyranosylcinnamic acid, beta-sitosterol, and beta-daucosterol.

Therapeutic Use: Dyspepsia, flatulence, colic, constipation, helminthiasis, skin diseases, leprosy, psoriasis, fever, epilepsy, insanity, neuralgia, syphilis, strangury, seminal weakness and general debility.

Pharmacological Study: Antimicrobial, antimutagenic, antioxidant, anti-inflammatory, anti-cancer, anti-diabetic and neuroprotective effects.

Contraindications: Should not be used during pregnancy or lactation, obese person, and known allergy to the plants of the Smilacaceae family.

Adverse Effects: Over-dosage may lead to diarrhoea.

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

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

Posology: Powder 3-6 gm, decoction 30-40 ml.

Formulations: Meharaj, Mehabajra Rasayan, Saribaryarista.

Chatim

Botanical Name: *Alstonia scholaris* R.Br.

Family: Apocynaceae

Synonyms:

Bangla: ছাতিম (Chatim)

Hindi: Chatium, Chhatin

Sanskrit: Saptaparna

Urdu/Unani/Tibb: Kashim

English: Devil's Tree

Geographical Distribution: The species is found in the sub-Himalayan tract from Yamuna eastwards, ascending up to 1000 m. It occurs in tropical, subtropical, and moist deciduous forests in India, and is widely cultivated as avenue tree throughout India.

Plant Descriptions: Chatim is a medium-sized evergreen tree, usually 12–18 m high, sometimes up to 27 m high, with close-set canopy. Bark is rough, greyish white, yellowish inside, and exudes bitter latex when injured. Leaves are four to seven in a whorl, and are thick, oblong, with a blunt tip. They are dark green on the top, and pale and covered with brownish pubescence on the dorsal surface. Flowers are fragrant, greenish-white or greyish-yellow in umbrella-shaped cymes. Follicles (fruits) are narrowly cylindrical, 30 cm×3 cm, fascicled, with seeds possessing brown hair. Flowering and fruiting occur from March to July, extending to August in subtropical climate.



Fig. *Alstonia scholaris* R.Br.

Macroscopic Description: Bark occurs in channelled or occasionally quilled pieces, 3-4mm thick from branches and cut or broken irregularly into curved or flat pieces, about 7 mm thick from stem, externally younger bark dark grey to brown, older bark very rough, uneven and much fissured transversely and longitudinally, both marked with numerous rounded or transversely elongated, grey to whitish brown lenticels, internally brownish-buff to dark greyish-brown, somewhat striated and indented, fracture, short and smooth, fractured surface shows a narrow, inner portion traversed by numerous, fine, medullary rays and a varying spongy outer portion.

Microscopic Description: Transverse section of bark shows a multi-layered, thick and thin-walled cork, abroad zone of secondary cortex composed of thin-walled, parenchymatous cells, including many rounded latex cavities, scattered throughout tissue, containing numerous rhombic to polygonal calcium oxalate crystals, numerous stone cells forming a non continuous layer of 4-8 cells, irregular, rounded to linear, fibre-like, blunt at both ends, internal to secondary cortex a secondary phloem cells containing many sieve tubes, corkcells brick shaped to almost square in transverse and longitudinal sections and polygonal in surface view, cork cambium forms a region of two rows of cells identical to corkcells, situated in between cork and secondary cortex, secondary phloem cells smaller in dimension than cortical cells consisting of phloem parenchyma, many sieve tubes and companion cells, fibres absent.

Part Used: Stem bark, leaves, latex, and flowers

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Snigdha (Unctuousness)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Anulomana, Dipana, Jwar-har, Kushaghna, Rakta-shodhaka, Tridosh-nashak

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 3% w/w
Alcohol soluble extractive	: Not less than 4% 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 *enterobacteriaceae*, *Salmonellae 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.

Major Chemical Constituents: Principal constituents of leaf, barks of stems and roots are indole alkaloids, picrinine, nareline, akuammicine, scholarine, strictamine, tetrahydroalstonine, detamine, echitenine, echitamine etc.

Therapeutic Usages: Fever, malarial fever, diarrhoea, dysentery, indigestion, gastritis, skin diseases, ulcers, asthma, bronchitis, rheumatism, cardiopathy, agalactia and debility.

Pharmacological Study: Antidiabetic, antibacterial, antianxiety, anti-inflammatory, antiulcer, anticancer, antimicrobial, antidiarrhoeal, antioxidant, wound healing activities etc.

Contraindications: Should not be used during pregnancy or lactation, obese person, and known allergy to the plants of the Apocynaceae family.

Adverse Effects: In higher concentration it creates a marked toxicity to the brain.

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

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

Posology: Powder 3-6 gm, bark decoction 20-80 ml.

Formulations: Amritarista, Jwarkeshari Rasayan, Barty Taila.

Danti

Botanical Name: *Baliospermum montanum* Muell-Arg

Family: Euphorbiaceae

Synonyms:

Bengali: দন্তী (Danti)

Hindi: Danti, Hakum, Hakun

Sanskrit: Danti, Hastidanti

Urdu/Unani: Danti

English: Red physic Nut

Geographical Descriptions: *Baliospermum montanum* occurs in Bangladesh, Pakistan, India, Bhutan the Andaman Islands, Burma (Myanmar), Indo-China, southern China, Thailand, Peninsular Malaysia, Sumatra, Java and Sumbawa.

Plant Description: A perennial and woody undershrub grows up to 1.5 ms in height. Leaves simple, sinuate-toothed, upper ones small, lower ones are large, flowers are numerous, in axillary racemes with male flowers above and female below. Fruits capsule, 12 mm long, obovoid, seeds ellipsoid and smooth.



Fig. *Baliospermum montanum* Muell-Arg

Macroscopic Description: Root pieces almost cylindrical, straight or ribbed with secondary and tertiary roots, 0.2-1 cm thick and upto 10 cm or more in length, tapering at one end, tough, externally brown; surface, rough due to longitudinal striations, transverse cracks and scars of rootlets; internally cream-coloured; transversely smoothed root shows thin, brown bark and yellowish-white central core; taste, bitter.

Microscopic Description: Shows 5-18 layered cork, consisting of brown coloured, suberised or lignified brick-shaped cells, a few cells containing tannin and red colouring matter; secondary cortex

consists of 2-7 layers of oval to elliptical, tangentially elongated cells, a few cortical fibres are also present in this region; secondary phloem consists of usual elements, traversed by uni to biseriate phloem rays; secondary xylem consists of usual elements; vessels and tracheids, bordered pits, a few having reticulate thickening; fibres slightly thick-walled, narrow lumen and blunt tips; xylem rays 1 or 2 cells wide; rosette crystals of calcium oxalate and starch grains, present only in secondary cortex and phloem; starch grains solitary and in groups, simple, round to oval measuring 6-17 μ in diam.

Powder-Brown; shows fragments of cork more or less rectangular, thick-walled in surface view; rosette crystals of calcium oxalate; numerous phloem fibres with narrow lumen and blunt tips, border pitted- and reticulate vessels, tracheid and tannin cells, round to oval simple starch grains measuring 6-17 μ in diam, and in groups occasionally.

Part used: Roots, leaves and seeds

Organoleptic properties:

Rasa (Taste)	: Katu (Pungent)
Guna (Attribute)	: Guru, Tikshna (Heavy, sharp)
Virya (Potency)	: Ushna(Hot)
Vipaka (Metabolism)	: Katu(Pungent)
Karma (Action)	: Sodhaka, Depana, Kaphahara, Raktadosahara, Vidahara, Rocaka, Vikasi Vrana

Purity and Safety Test

Foreign matter	: Not more than 2% w/w
Total ash	: Not more than 10% w/w
Acid insoluble ash	: Not more than 3% w/w
Alcohol soluble extractive	: Not less than 1.5% w/w
Water soluble extractive	: Not less than 3% w/w
Thin Layer Chromatography:	: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethyl acetate (9 :1) shows under U.V. (366 nm) a fluorescent zone at R_f 0.65 (blue). On exposure to Iodine vapor two spots appear at R_f 0.51 and 0.65 (both yellow). On spraying with 50% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C twospots appear at R_f 0.51 and 0.65 (both grey).
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, <i>Salmonellae 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> 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: Beta- sitosterol and triterpenoids, resinous glycosides, phorbol esters.

Therapeutic usages: Skin diseases, constipation, anaemia, jaundice, digestive disorders, tumour, wound, oedema, asthma cough, bronchitis etc

Pharmacological study: Anti-cancer, anti-microbial, hepato-protective activity, anti-helminthic, immunomodulatory activity

Contraindications: It is not recommended for pregnancy and lactation.

Adverse effects: Over-dosages can be twitching pain, nausea & vomiting, diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages form: Powder and oil

Posology: 1-3 gm of the drug in powder form. Seeds powder: 125-250 mg, seeds oil-3-5 drops

Formulations: Chandraprabha Bati, Kshudabati Bati, Abhayarista, Dantadyarista

Devadaru

Botanical Name: *Cedrus deodara* (Roxb) Loud

Family: Pinaceae

Synonyms:

Bengali: দেবদারু (Devadaru)

Hindi: Devdar

Sanskrit: Devdaru, Devdrum

Urdu/Unani: Deodar, Burada Deodar

English: Deodar trees, Himalayan Cedar

Geographical Descriptions: *Cedrus deodara* is a species of cedar native to the Bangladesh, western Himalayas in Eastern Afghanistan, Northern Pakistan and India (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and, Arunachal Pradesh states and the Darjeeling Region of West Bengal), Southwestern Tibet and Western Nepal.

Plant Description: *Cedrus deodara* is a large evergreen, dioecious tree, to 65 m tall and more than 4 m DBH, crowns become rounded or broad and flat with horizontal or slightly ascending or descending branches, which are not whorled but arise irregularly from the stem. The bark is greyish brown, dark, almost black, with vertical and diagonal cracks dividing it into irregular oblong scales. Leaves solitary, acicular, stiff, sharp-pointed, 25-37 mm long, silvery or silvery-blue, on the normal long shoots spirally arranged, and on the short arrested shoots in pseudo whorls. Male flowers solitary and erect or catkins, pale green to yellowish green with purplish tinge, oblong, ovoid, and 2.5 to 4.6 cm long by 1 to 1.5 cm in diam. On opening they elongate rapidly to 5-7.5 cm in length and become yellow with pollen. The female flowers are solitary and erect at the end of arrested branchlets; flowers, at the time of pollination, are oblong, ovoid, 1.2 to 2.0 cm long and 0.6 cm in diam, pale glaucous green. The scales occur in a spiral of 8x5; at the time of pollination they stand perpendicular to the axis, exposing ovules and close after pollination. Cones solitary or in pairs, erect, ovoid or ellipsoidal, 7.5-12 cm long and 5-8.7 cm in diam with numerous fan-shaped scales arranged in spiral of 8x5 on persistent woody central axis, rounded at the apex, bluish when young, reddish-brown when ripe. On each scale rests a pair of winged seeds. Seed triangular, winged, 2.5 to 3.7 cm long; wings with rounded corners, 2-2.5 cm broad.



Fig. *Cedrus deodara* (Roxb) Loud

Macroscopic Description: Wood moderately hard, light yellowish-brown to brown; wood splits readily longitudinally; annual rings well marked; medullary rays appear as whitish lines; resin canals, if present, arranged in long tangential rows, showing up as dark, narrow line on the radial surface of the wood pieces; odour, aromatic; taste, not distinct.

Microscopic Description: Mature wood almost entirely of narrow, quadrangular or rarely five or six sided tracheids, having very thick-wall with pits and a narrow lumen; xylem rays very fine, numerous and run straight throughout the region, uniseriate and 2 to 16 cells high in tangential section; vessels absent.

Powder- Brownish-yellow in colour and oily, shows entire or fragments of tracheids and xylem ray cells.

Part used: Heart wood, bark, leaves

Organoleptic properties:

Rasa (Taste)	: Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Snigdha
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphahara, Vatahara, Dustavranasodhaka

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 2% w/w
Acid insoluble ash	: Not more than 1% w/w
Alcohol soluble extractive	: Not less than 7% w/w
Water soluble extractive	: Not less than 1.5% w/w

Thin Layer Chromatography: : TLC of alcoholic extract on Silica gel 'G' using Toluene: Ethylacetate (9:1) shows under U.V. (366 nm) six fluorescent zones at R_f. 0.11. 0.18. 0.32. 0.46, 0.65 and 0.75 (all blue). On exposure to Iodine vapour seven spots appear at R_f. 0.14. 0.42. 0.51, 0.67, 0.78, 0.84 and 0.92 (all yellow). On spraying with Methanolic-Sulphuric acid reagent and on heating the plate for ten minutes at 105°C eight spots appear at R_f. 0.10 (violet), 0.18 (violet), 0.52 (grey), 0.64 (violet), 0.71 (violet). 0.78 (violet). 0.89 (violet), 0.92 (green).

Microbial contamination : In accordance with National guideline and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total enterobacteriaceae are not more than 10⁴ cfug⁻¹, 10³ cfug⁻¹ and 10⁴ cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total enterobacteriaceae, *Salmonellae 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.

Major chemical constituents: Terpenoids, flavonoids and glycosides.

Therapeutic usages: Fever, flatulence, pulmonary disorders, urinary disorders, rheumatism, diarrhea, dysentery, piles, insomnia, diabetes and skin diseases etc.

Pharmacological study: Antifertility, anti-inflammatory, antiseptic, antispasmodic, antiviral, antibacterial, astringent, carminative, diaphoretic, diuretic, insecticide

Contraindications: It is not recommended for pregnancy & lactation.

Adverse effects: Over-dosages can be twitching pain, nausea & vomiting, diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages form: Powder and oil

Posology: 3-6 gm of the drug in powder form, oil 2-40 drops

Formulations: Punarnovastak Kwath, Devdaribadi Kwath, Kankarista, Kumariasav

Goniari

Botanical Name: *Premna serratifolia* Linn.

Family: Verbenaceae

Synonyms:

Bangla: গনিয়ারী (Goniari)

Hindi: Arni, Piran, Pirun, Urni

Sanskrit: Agnimantha, Gandhapushpa, Jayanti

Urdu/Unani/Tibb: Arani

English: Headache tree

Geographical Distribution: It is a natural inhabitant of lower and outer sub-tropical, Himalayan tracts extending from Chenab in north-west India to Bhutan in the east and extending to an elevation of 1400 m. It is also found in dry forests tracts of South-West Bengal, Odisha and coastal Peninsular India.

Plant Descriptions:

General description: It is a small tree. The branches are spiny; bark is thin, pale and exfoliating; wood is light brown and scented. Leaves are ovate or ovate-oblong, long-acuminate, base rounded, cordate or tapering, entire or irregularly dentate; blade 7-15 cm long; petiole 2.5 cm long. Flowers are arranged in terminal, corymbose, trichotomous panicles and are greenish in colour. Calyx comprised of 4 or 5 sepals, with rounded and nearly equal teeth. Corolla lobes are equal or bilabiate, upper lip retuse or emarginate, lower lip of 3 equal lobes and throat closed with white hairs. Fruit is a globose drupe, green when young, dark at maturity, 3.5-4.5 mm in diam.



Fig. *Premna serratifolia* L.

Macroscopic Description: Roots light brown or yellowish brown, woody, 6-8 cm long and 4-5mm in diam, brown from outside and yellow from within, having a short fracture. Roots contain yellow pigment tannin. Roots are light brown, woody, branched and cylindrical. Outer surface is exfoliated at some places and shows longitudinal striations and wrinkles. Roots possess bland taste and are slightly aromatic, woody, branched and tortuous to cylindrical in shape. Surface gets exfoliated easily and shows prominent longitudinal striations and wrinkles.

Microscopic Description: The transverse section shows cork, consisting of 8-10 rows of tangentially elongated and radially arranged suberised cells. Cork is followed by cortex made up of 10-15 layers of thin walled parenchymatous cells, closely arranged with little intercellular spaces. Cortex shows two to three discontinuous layers of stone cell that are thick walled, lignified and lodged with prisms of calcium oxalate. A few cortical cells contain yellowish brown pigment. Phloem shows thin walled cells and in between the phloem cells stone cells with prisms of calcium oxalate crystals are present. The xylem vessels are of varying size, lignified, found isolated or in the group of 2-3. Medullary rays are 2-3 seriate and the cells are pitted and lignified. Starch is present in the medullary ray cells.

Powder: Powdered root is light brown, with slightly aromatic and bland taste. Starch is abundant, simple, and spherical and cup shaped. Stone cells are rectangular to oblong and lodged/ loaded with 3-8 prisms of calcium oxalate which are found scattered also. The vessels and fibers of the xylem are lignified and found in the groups of interlocking cells. The xylem vessels have bordered pitted thickenings.

Part Used: Root bark, leaf

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Katu (Pungent), Kasaya (Astringent), Madhura (Sweet)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry)
Virya (Potency)	: Usna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Sothahara, Bedhanasthapana, Kapha-vatashamaka

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 1% w/w
Alcohol soluble extractive	: Not less than 2% 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 *enterobacteriaceae*, *Salmonellae 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.

Major Chemical Constituents: Premnacorymboside A, scutellarioside II, quercetin - 3-rutinoside, leonurioside A were isolated from the stem bark. Alkaloid contents like premnine, ganikarine, premnazole are reported in root from different researchers. 1β , 3α , 8β -trihydroxy-pimara-15-ene; 6α , 11, 12, 16-tetrahydroxy-7-oxo-abieta-8, 1, 13-triene; 2α , 19-dihydroxypimar-7,15-diene are present in root bark.

Therapeutic Usages: Neuralgia, inflammations, cardiac disorders, cough, asthma, bronchitis, leprosy, skin disorders, dyspepsia, flatulence, constipation, fever, diabetes and anorexia.

Pharmacological Study: Anti-inflammatory, analgesic, antiarthritic, antimicrobial, antiobesity, antihepatotoxic, antifertility, anti-asthmatic, antioxidant, antidiarrheal, hypoglycemic and immunomodulatory activity.

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

Adverse Effects: Over-dosage may lead to gastric irritation.

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

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

Posology: Churna 1-3 gm, Juice 10-20 ml, Kwath 50-100 ml.

Formulations: Brihat Bat Gajankush, Dasamul Kwath, Dosomularista

Guggul

Botanical Name: *Commiphora mukul* (Hook Ex. Stocks) Engl.

Family: Burseraceae

Synonyms:

Bangla: গুগগুল (Guggul)

Hindi: Guggul, Gogil, Gugal, Mukul

Sanskrit: Guggul, Devadhoop, Kaushik, Pur, Mahishaksha,

Urdu/Unani/Tibb: Bikh dab

English: Indian Bdellium, Gum Guggul

Geographical Distribution: The Guggul plant may be found from northern Africa to central Asia, but is most common in Northern India. It is also found in the tracts of Western India and found extensively in Rajasthan, Gujrat, and Maharashtra. It is propagated by seeds and root cuttings.

Plant Descriptions: It is a shrub or small tree, reaching a maximum height of 4 m (13 ft), with thin papery bark. The branches are thorny. The leaves are simple or trifoliate, the leaflets ovate, 1–5 cm (0.39–1.97 in) long, 0.5–2.5 cm (0.20–0.98 in) broad, and irregularly toothed. It is gynodioecious, with some plants bearing bisexual and male flowers, and others with female flowers. The individual flowers are red to pink, with four small petals. The small round fruit are red when ripe. Pale yellow to brown aromatic gumresin obtained from the bark of the plant. Agglomerated tears of resin are somewhat transparent, with waxy surface and brittle innature. Gum-resin is thick, scented, burnt on fire, liquifies in sun heat. When dissolved in water, it turns milky white.



Fig. *Commiphora mukul* (Hook Ex. Stocks) Engl.

Macroscopic Description: Drug occurs in vermicular pieces of pale yellow or brown coloured mass, makes milky emulsion in hot water and readily burns, when fresh viscid and golden coloured, odour; aromatic, taste is bitter and astringent.

Part Used: Gum resin

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Tikshna (Sharp), Vishad (Non-slimy)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Balya, Rasayana, Varnya, Vatabalasajit, Medohara

Purity and Safety Test

Foreign matter	: Not more than 4% w/w
Total ash	: Not more than 5% w/w
Acid insoluble ash	: Not more than 1% w/w
Alcohol soluble extractive	: Not less than 27% w/w
Water soluble extractive	: Not less than 53% w/w
Volatile 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>Salmonellae 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.

Major Chemical Constituents: Guggulu contains diterpenoids, triterpenoids, steroids, longchain aliphatic tetrols, aliphatic esters, ferulates, lignans, carbohydrates, and a variety of inorganic ions besides minor amounts of sesamin and other unidentified constituents.

Therapeutic Usages: Obesity, osteoarthritis, rheumatoid arthritis, gout, facial paralysis, sciatica, constipation, haemorrhoids, liver disorders, inflammation, cyst, cervical lymphadenitis, coronary thrombosis, anaemia, diabetes, urinary calculus, increased frequency and turbidity of urine, and skin diseases.

Pharmacological Study: Anti-oxidant, hypocholesterolemic, thyroid-stimulant, anti-arthritis, anti-inflammatory, anti-microbial, hepatoprotective, cardio-protective, antispasmodic, anti-suppurative, anthelmintic etc.

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

Adverse Effects: Improper use may lead to abdominal pain, diarrhea and rashes and excess use of guggul may cause impotency, cataract, weight loss, syncope and dryness of body.

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

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

Posology: 125mg-1 gm.

Formulations: Brihat Jogaraj Guggul, Kanchanar Guggul, Navakarsic Guggul

Hing

Botanical Name: *Ferula asafoetida* Regel

Family: Umbelliferae

Synonyms

Bengali: হিং (Hing)

Hindi: Hing, Hingda

Sanskrit: Ramaha, Sahasravedhi

Urdu/Unani: Hitleet, Hing

English: Asfoetida

Geographical Descriptions: Asafoetida is native to central Asia, eastern Iran to Afghanistan, and today it is grown chiefly in Iran and Afghanistan, from where it is exported to the rest of the world. In India it has been grown widely in Kashmir and in some parts of Punjab.

Plant Description: *Ferula asafoetida* is herbaceous plant of the umbelliferae family. It is oleo gum resin obtained from the rhizome and root of plant. Also known as devil's dung, stinking gum, food of the gods, and giant fennel, hing has a varied and surprising diversity of uses. Along the Tex-Mex border hing was used for wolf bait. The odor attracts wolves. In Jamaica, hing is used to protect the fontanel of newborn babies from spirits. Once common in Europe during Roman times, hing is relatively unknown to the modern western palate. Its latin name, asafoetida, literally means fetid-resin and attests to its unique smell and derivation process from root sap.



Fig. *Ferula asafoetida* Regel

Macroscopic Description: Rounded, flattened or masses of agglutinated tears, greyish-white to dull yellow, mostly 12-25 mm in diam, freshly exposed surface, yellowish and translucent or milky white, opaque, slowly becoming pink, red, finally reddish brown, odor, strong, characteristic and persistent, taste, bitter and acrid.

Part used: Rhizome and root of plant.

Organoleptic Properties

Rasa (Taste)	: Katu
Guna (Attribute)	: Tikсна
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Anulomana, Dipana, Hrđya, Krmighna, Pacana, Rucya, Vatakaphaprasamana

Purity and Safety test

Total ash	: Not more than 15% w/w
Acid insoluble	: Not more than 3% w/w
Water soluble	: Not less than 50% w/w

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 μ gm/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, 0.1, 0.5, 0.5 and 0.1 μ gm/kg respectively.

Major Chemical Constituents: Asafoetida shows it to consist of carbohydrates 67.8% per 100 gms, moisture 16.0%, protein 4.0%, fat 1.1%, minerals 7.0% and fiber 4.1%. Its mineral and vitamin contents include substantial calcium besides phosphorus, iron, carotene, riboflavin and niacin. Its calorific value is 297, contains 40-64% resinous material composed of ferulic acid, umbel-liferone, asaresinotannols, farnesiferols A, B, and C etc., about 25% gum composed of glucose, galactose, l-arabinose, rhamnose, and glucuronic acid and volatile oil (3-17%) consisting of disulfides as its major

components, notably 2-butyl propenyl disulfide (E- and Z-isomers), with monoterpenes (α - and β -pinene, etc.), free ferulic acid, valeric acid, and traces of vanillin (LAF).

Therapeutic usages: Asthma, whooping cough, flatulence, constipation, chronic liver and spleen diseases and epilepsy.

Pharmacological study: Anticholesterolemic, anticoagulant, antifertility, antifungal, antihepatotoxic, anti-inflammatory, antioxidant, antiparasitic, smooth muscle relaxant activity, anti-diabetic, antiulcerogenic, anticarcinogenic activity, anthelmintic activity and antispasmodic activity.

Adverse effects: No health hazards or side effects are known in conjunction with the proper administration of designated therapeutic dosages. The intake of larger dosages can lead to swelling of the lips, digestive complaints (belching, flatulence, and diarrhea), discomfort and headache. Convulsions are possible in susceptible individuals. Swelling of the genital organs has been observed following external administration on the abdomen.

Contraindication: The acute toxicity study conducted for aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected $1/8^{\text{th}}$ and $1/4^{\text{th}}$ of 2000 mg/kg i.e. 250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage form: Powder, decoction.

Posology: Powder 125-500 mg of the drug.

Formulations: Hingastaka churna

Jaggadumur

Botanical Name: *Ficus racemosa* L.

Family: Moraceae

Synonyms:

Bengali: যজ্জডুমুর (Jaggadumur)

Hindi: Dumar

Sanskrit: Audumbara

Urdu/Unani: Dumar

English: cluster fig, country fig, cratcock, gular fig, redwood fig

Geographical Descriptions: *Ficus racemosa* is not epiphytic but is found throughout greater part of India in moist localities, along the banks of streams, sides of ravines and also on rocky slopes, sometimes almost gregariously. It is also found in Bangladesh, Burma, China, Indonesia, Malaysia, and Australia.

Plant Description: Deciduous trees, to 30 m high; bole buttressed; bark 8-10 mm thick, surface reddish-brown or yellowish-brown smooth, coarsely flaky, fibrous; blaze creamy pink; latex milky; young shoots and twigs finely white hairy, soon glabrous; branchlets 1.5-3 mm thick, puberulous. Leaves simple, alternate, stipules 12-18 mm long, lanceolate, linear-lanceolate, pubescent, often persistent on young shoots; petiole 10-50 mm long, slender, grooved above, becoming brown scurfy; lamina 6-15x3.5-6 cm, ovate, obovate, elliptic-oblong, elliptic-lanceolate, elliptic-ovate or oblong-ovate, base acute, obtuse or cuneate, apex narrowed, blunt or acute, margin entire, membranous, glabrous, blistered appearance on drying; 3-ribbed from base, 4-8 pairs, slender, pinnate, prominent beneath, intercostae reticulate, obscure. Flowers unisexual; inflorescence a syconia, on short leafless branches or warty tubercles of trunk or on larger branches, subglobose to pyriform, smooth, often lenticellate-verrucose; peduncle 3-12 mm long, stout, orifice plane or slightly sunken, closed by 5-6 apical bracts; internal bristles none; basal bracts 3, 1-2 m long, ovate-triangular, obtuse, persistent; flowers of unisexual.



Fig. *Ficus Racemosa* L.

Macroscopic Description: Bark greyish-green, surface soft and uneven, 0.5-1.8 cm thick, on rubbing white papery flakes come out from outer surface, inner surface light brown, fracture fibrous, taste, mucilaginous without any characteristic odour.

Microscopic Description: Transverse section of bark shows cork, 3-6 layers of thin-walled cells filled with brownish content, cork cambium single layered, secondary cortex 6-12 layered, composed of thin-walled rectangular cells arranged regularly, a number of secondary cortex cells contain starch grains and some contain rhomboidal crystals of calcium oxalate, most of the cells filled with chloroplast giving green appearance, cortex a fairly wide zone composed of circular to oblong, thin-walled cells, containing orange-brown content, most of the cells filled with simple and compound starch grains, a number of cells also contain cubical and rhomboidal crystals of calcium oxalate, some cortical cells get lignified with pitted walls found scattered singly or in large groups throughout cortical region, secondary phloem a very wide zone composed of parenchyma with patches of sieve tubes, companion cells by medullary rays, phloem parenchyma circular to oval and thin-walled, phloem fibres much elongated, lignified, very heavily thickened and possess a very narrow lumen: medullary rays uni to pentaseriate widen towards peripheral region, a number of ray cells also get lignified and show pitted wall as described above, laticiferous cells also found in phloem region similar to parenchyma but filled with small granular masses, starch grains and rhomboidal crystals of calcium oxalate also found in most of phloem parenchyma and ray cells, cambium, when present, 2-3 layered, of tangentially elongated thin-walled cells.

Part used: Bark, fruits & latex

Organoleptic properties:

Rasa (Taste)	: Kashaya (Astringent)
Guna (Attribute)	: Guru (Heavy), Rooksha (Dryness)
Virya (Potency)	: Sheeta (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Pitta-Kaphahara, Kaphapittasamaka, Medohara, Mutrasangrahaniya, Vranasodhaka, Vranaropaka, Raktastambhana.

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% w/w
Alcohol soluble extractive	: Not less than 7% 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 enterobacteriaceae are not more than 10^4 cfug ⁻¹ , 10^3

cfug⁻¹ and 10⁴ cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total *enterobacteriaceae*, *Salmonellae 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 <i>cis</i> , <i>trans</i> 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 leaves of this plant are rich in flavonoids, triterpenoids, alkaloids, and tannins. The other major of stem bark are glycosides (leucocyanidin-3-O-β-D-glucopyranoside, leucopelargonidin-3-O-β-D-glucopyranoside, leucopelargonidin-3-O-β-D-glucopyranoside, leucopelargonidin-3-O-α-L-rhamnopyranoside); sterols (β-sitosterol, stigmasterol, α-amyrin acetate, lupeol, and lupeol acetate); and tannins (ellagic acid). The trunk bark is rich in various types of sterols like β-sitosterol, lupenol, and stigmasterol. Glucan acetate is the major component of fruits. The other components are glucan acetate, tiglic acid, taraxasterol, lupeol acetate, friedelin, and hydrocarbons. The latex contains various types of steroids such as euphol, isoeuphorbol, β-sitosterol, 4-deoxyphorbol, cycloartenol, and cycloeuphordenol.

Therapeutic Use: Cooling, galactagogue, gynaecological disorders, leucorrhoea, blood disorders, burning sensation, fatigue, urinary discharges, leprosy, menorrhagia, epistaxis and intestinal worms, bronchitis, diseases of kidney and spleen.

Pharmacological Study: Antidiabetic, antioxidant, antidiarrheal, anti-inflammatory, antipyretic, antifungal, antibacterial, hypolipidemic, and antifilarial, and hepatoprotective.

Contraindications: It is not recommended for pregnancy and lactation.

Adverse effects: Over-dosages can be twitching pain, nausea, vomiting, and diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages Form: Powder and decoction

Posology: 3-6 gm of the drug in powder form. 20-30 gm of the drug for decoction.

Formulations: Bahu Mutrantak Ras, Ushirasav

Jamani

Botanical Name: *Trachyspermum ammi* L.

Family: Apiaceae

Synonyms:

Bengali: যমানী (Jamani)

Hindi: Ajwain

Sanskrit: Yamini

Urdu/Unani: Sat-ajavayan

English: Carom seeds, Bishop's weed

Geographical Descriptions: *Trachyspermum ammi* commonly known as 'Ajwain' is distributed throughout Bangladesh, India, Pakistan, Afghanistan and Iran.

Plant Description: Ajwain's small, oval-shaped, seed-like fruits are pale brown schizocarps, which resemble the seeds of other plants in the Apiaceae family such as caraway, cumin and fennel. They have a bitter and pungent taste, with a flavor similar to anise and oregano. They smell almost exactly like thyme because they also contain thymol, but they are more aromatic and less subtle in taste, as well as being somewhat bitter and pungent. Even a small number of fruits tends to dominate the flavor of a dish.



Fig. *Trachyspermum ammi* L.

Macroscopic Description: It is widely grown in arid and semi-arid regions where soils contain high levels of salts. Ajwain is a profusely branched annual herb, 60-90 cm tall. Stem is striated; inflorescence compound umbel with 16 umbellets, each containing up to 16 flowers; flowers actinomorphic, white, male and bisexual; corolla 5, petals bilobed; stamens 5, alternating with the petals; ovary inferior; stigma knob-like; fruit aromatic, ovoid, cordate, cremocarp with a persistent

stylopodium; leaves pinnate, with a terminal and 7 pairs of lateral leaflets. Fruit, consists of two mericarps, grayish brown, ovoid, compressed, about 2 mm long and 1.7 mm wide, 5 ridges and 6 vittae in each mericarp, usually separate, 5 primary ridges

Microscopic Description: Transverse section of fruit shows two hexagonal structures attached with each other by carpophores, epicarps consists of a single layer of tangentially elongated tabular cells, mesocarp consists of moderately thick-walled, rectangular to polygonal tangentially elongated cells having some vittae, carpophores and vascular bundles present as groups of thick-walled radially elongated cells, integument, barrel shaped of tangentially elongated cells, endosperm consists of thin walled cells filled with embryo, oil globules, small and circular, composed of polygonal thin walled cells. The powder microscopy shows the presence of oil globules and groups of endosperm cells.

Powder- Oily, greyish-brown, under microscope, presence of Oil globules and groups of endosperm cells, characterised.

Part Used: Fruits (Seed)

Organoleptic properties:

Rasa (Taste)	: Katu, Tikta (Pungent, Bitter)
Guna (Attribute)	: Laghu, Rooksha, Teekshna (Light, Dry, Sharp)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Dipana, Lekhana, Pacana, Partidusaka, Slesmaghna, Sulghna, Uttejaka, Vatanulomana, Vedansamaka, Visaghna

Purity and Safety Test

Foreign matter	: Not more than 5% w/w
Total ash	: Not more than 9% w/w
Acid insoluble ash	: Not more than 0.2% w/w
Alcohol soluble extractive	: Not less than 2% 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>Salmonellae 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.

Major Chemical Constituents: Fiber (11.9%), carbohydrates (38.6%), tannins, glycosides, moisture (8.9%), protein (15.4%), fat (18.1%), saponins, flavone and mineral matter (7.1%) containing calcium, phosphorous, iron and nicotinic acid. Ajwain fruits yield 2% to 4% brownish essential oil, with thymol as the major constituent (35% to 60%). The nonthymol fraction (thymene) contains para-cymene, γ -terpinene, α - and β -pinenes, dipentene, α -terpinene, and carvacrol. Minute amounts of camphene, myrcene, and α -3-carene also have been found in the plant. Alcoholic extracts contain a highly hygroscopic saponin. From the fruits, a yellow, crystalline flavone and a steroid-like substance has been isolated and it also contains 6-O- β -glucopyranosyloxythymol, glucoside and yields 25% oleoresin containing 12% volatile oil (thymol, γ -terpinene, para-cymene, and α - and β -pinene). The principal oil constituents of *Trachyspermum ammi* are carvone (46%), limonene (38%), and dillapiole (9%).

Therapeutic Use: Dyspepsia, rheumatism, distension of abdomen due to obstruction to passage of urine and stool, hookworms, tastelessness, infantile diarrhoea, emesis, toothache, abdominal lump, dysuria, splenomegaly, headache, skin disease, pain in the abdomen, dry piles, gastro-entritis with piercing pain.

Pharmacological Study: Antifungal, antioxidant, antimicrobial, antinociceptive, cytotoxic, hypolipidemic, antihypertensive, antispasmodic, broncho-dilating actions, antilithiasis, diuretic, abortifacient, antitussive, nematocidal, anthelmintic and antifilarial.

Contraindications: Stomach ulcer, internal bleeding, ulcerative colitis, mouth ulcer.

Adverse effects: Over-dosages can be twitching pain, nausea & vomiting, diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages Form: Power and oil

Posology: 25 to 125 mg, oil-1-3 drops

Formulations: Jamani Ark, Narayan Ras, Shringadi Kwath, Jirakadyarista

Jatamansi

Botanical Name: *Nardostachys jatamansi* DC.

Family: Caprifoliaceae/Valerianaceae

Synonyms:

Bengali: জটামাংসী (Jatamansi)

Hindi: Jatamansi, Balchara

Sanskrit: Jatamansi, Bhytajata, Tapaswani

Urdu/Unani: Sumbul-ut-Teeb

English: Musk-root, Indian spikenard & Indian nard

Geographical Descriptions: *Nardostachys jatamansi* is a flowering plant of the honey suckle family that grows in the eastern Himalayas, primarily in a belt throughout Nepal, Sikkim and Bhutan.

Plant Description: It is a perennial herb about 10-60 cm in height having long stout, rhizomes root. The leaves are elongated and spatulated while few leaves are sessile, oblong or sub ovate. Its roots are thick and have too many hairs.



Fig. *Nardostachys jatamansi* DC.

Macroscopic Description: Dried rhizome dark brown, 2.5-7.5 cm long, cylindrical, covered with reddish-brown fibres forming a network, which are skeletons of sheathing leaf bases, fracture, brittle, internal colour reddish-brown, colour, strongly aromatic, taste, bitter.

Microscopic Description: Transverse section of rhizome shows cork consisting of 2-5 layers of cells filled with oil globules, cortex characterised by the presence of schizogenous canals, phloem in form of patches of small cells, cambium ring distinct and continuous, xylem consists of vessels, scattered individually or in rows of two or three vessels, with scalariform thickening, older rhizomes show one or more stellate shaped rings of interxylary and medullary cork, completely or incompletely separating the rhizome into four to nine vascular strands by joining outer cork, each separated strand

encircled by a few layers of cork cell. Transverse section of rhizome shows cork consisting of 2-5 layers of cells filled with oilglobules, cortex characterised by the presence of schizogenous canals, phloem in form of patches of small cells, cambium ring distinct and continuous, xylem consists of vessels, scattered individually or in rows of two or three vessels, with scalariform thickening, older rhizomes show one or more stellate shaped rings of interxylary and medullary cork, completely or incompletely separating the rhizome into four to nine vascular strands by joining outer cork, each separated strand encircled by a few layers of cork cell consisting of an outer cortex zone followed by two or more functional vascular bundles, tissues in between the strands usually non-functional except for the cork cells which act as storage organ for oil globule.

Part used: Roots/Rhizome

Organoleptic properties:

Rasa (Taste)	: Tikta (bitter), Kashaya (astringent), Madhura (sweet)
Guna (Attribute)	: Laghu (light), Snigdha (Oily)
Virya (Potency)	: Sheeta (Cool)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Balance tridosha

Purity and Safety Test

Foreign matter	: Not more than 5% w/w
Total ash	: Not more than 9% w/w
Acid insoluble ash	: Not more than 5% w/w
Alcohol soluble extractive	: Not less than 2% 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>Salmonellae 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: Alpha-patchoulene, angelicin, beta-eudesmol, beta-patchoulene, beta-sitosterol, calarene, calarenol, elemol, jatamansin, jatamansinol, jatamansone, n-hexacosane, n-hexacosanol, n-hexacosanyl arachidate, n-hexacosanyl isovalerate, nardol, nardostechone, norsechelanone, orosolol, patchouli alcohol, seychellane, seychellene, valeranal, valeranone. Volatile essential oil, resins, sugar, starch, bitter extractive matter, gum, ketone, sesquiterpin ketone, spirojatamoletc. Other sesquiterpenes include nardin, nardal, jatamnsic acid, b- maline and patchouli alcohol. Various other sesquiterpenes known are nardostachone, dihydrojatamansin, jatamansic acid, jatamansinone, orosolol, oroselone, seselin, nardostachyin, nardosinone, spirojatamol, jatamol A and B, calarenol, seychellene, seychellane, coumarin: xanthogalin. An alkaloid named actinidine has also been reported. Nardal has been found as an active component

Therapeutic Use: Stress and mood disorders, depression, anxiety, panic disorders, insomnia, obsessive compulsive disorders, epilepsy, hysteria, convulsion, headache, memory loss etc

Pharmacological Study: Hepatoprotective, antidepressant, anticonvulsant, cardio protective, antifungal and antibacterial, antiparkinson and hypolipidemic activity.

Contraindications: It is not recommended for pregnancy and lactation.

Adverse Effects: Patients with known hypersensitivity reactions should avoid use.

Precautions: Essential oils are mainly for aromatherapy and extremely concentrated and should never be used internally unless they are properly diluted. Because they are oils, they only dilute properly in other oils such as ghee (purified butter). No more than 1 to 2 drops should be consumed at a given time.

Dosages Form: Powder and Oil.

Posology: Power 1-3 gm along with honey, ghee or water.

Formulations: Jatamansi Ark, Nidrakar Bati, Pittantak Ras, Dasamularista

Kababchini

Botanical Name: *Piper cubeba* L.

Family: Piperaceae

Synonyms:

Bangla: কাবাবচিনি (Kababchini)

Hindi: Kabab-chini, Sitalchini

Sanskrit: Kankolaka, Kankola

Urdu/Unani/Tibb: Kabab chini

English: Java pepper

Geographical Distribution: The plant is native of Indonesia. It is mostly grown in Java and Sumatra, hence some time known as “Java pepper” but also from some African countries. It is cultivated in some of the West Indian islands.

Plant Descriptions: *Piper cubeba*, a climbing shrub with cylindrical, smooth zigzag, striate stem somewhat thickened at the node. Fruit wrinkled, rounded, 5-7 mm in diam, light brown to dark brown, about 7 mm long stalk attached, pericarp red to slightly brown, testa fused with pericarp, fruit hard and stony albumen white and oily, odour aromatic and characteristic, taste pungent and slightly bitter. The fruit is almost globular (diam 3-6 mm) with a slender stalk like portion (length, upto 7 mm.) attached to its base, hence the cubeb is also known as tailed pepper. The pericarp is dusky red to slightly brown, rarely grayish in colour.



Fig. *Piper cubeba* L.

Macroscopic Description:

Leaves: Alternate, on short stout petiole, blade about 6 inches long, lanceolate or oval oblong, tapering to the acute apex, usually somewhat unequal at the base, quite entire, slightly wavy, glabrous on both surfaces, somewhat coriaceous, deep green rather paler and prominent vein beneath.

Flowers: Unisexual, dioecious, minute, sessile, each with a bract at the base, densely crowded in small, cylindrical, stalked, solid spike coming opposite the leaves; the male spikes slender, tapering, shortly stalked, about an inch long, the female shorter, blunt, thick and fleshy, on longer stalks.

Fruits: Globular smooth, about ¼ inch long, with a blunt apiculous and tapering below into a stalk-like base, which a little longer than round extremity, projecting horizontally from the axis and together forming a lax raceme (many of the ovaries becoming abortive) about 2 inches long.

Microscopic Description: The pericarp consists of an epidermis beneath which is an interrupted row of small thick wall cells. Within this, the parenchyma is composed of cells containing starch and oil, in the latter, bundles of needle shaped crystals of Cubebin may be observed, lastly the inner most layer of pericarp is formed by several rows of tangentially extended cells containing essential oil. The nut is yellow and brittle. The seed when present is seen to contain crystals of Cubebin. Transverse section of the fruit show an outer layer of epidermis, externally covered with thick cuticle, a row of 2-5 small, crushed, brown and thick walled cells below, mesocarp composed of large thin-walled parenchymatous cells, oil cell and vascular bundle, endocarp of multilayered sclerified heavily lignified with narrow lumen, testa and tegmen composed of elongated cells, tegmen cells, hyaline and kernel cells grayish in colour.

Part Used: Dried immature full-grown fruits.

Organoleptic Properties

Rasa (Taste)	: Katu (Pungent), Tikta (Bitter)
Guna (Attribute)	: Laghu (Light), Ruksha (Dry), Teekshana (Sharp)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kapha-vatashamaka

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 1% w/w
Alcohol soluble extractive	: Not less than 14% 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 *enterobacteriaceae*, *Salmonellae 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.

Major Chemical Constituents: The dried fruits contain up to 10% essential oil composed of monoterpenes (sabinene 50%, careen, alpha-thujene, 1,4-cineol) and sesquiterpenes (copaene, alpha and beta-cubene, delta-cadinene, caryophyllene, germacrene, cubebol). The monoterpenes dominate by mass, but the sesquiterpenes are important for the characteristics flavor.

Therapeutic Use: Stomatitis, gastric ulcer, jaundice, dysentery, renal calculi, cystitis, rheumatism, gonorrhoea and other uro-genital disorders.

Pharmacological Study: Diuretic, lithotriptic, deobstruent, demulcent, anti septic, hepatoprotective, anti-inflammatory, mouth refresher, stimulant, antiasthmatic, carminative, sedative, gastrotonic etc.

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

Adverse Effects: Over-dosage may lead to hyperacidity and regurgitation.

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

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

Posology: 1-3gm daily in divided doses.

Formulations: Driti Bati, Mehabajra Rasayan, Avyadi Churna, Bahu Murantak Ras

Karpur

Botanical Name: *Cinnamomum camphora* (L.) Presl.

Family: Lauraceae

Synonyms:

Bangla: कर्पूर (Karpur)

Hindi: Karpura, Karpur

Sanskrit: Kapur, Karpur

Urdu/Unani/Tibb: Kafoor

English: Kamphor tree

Geographical Distribution: *Cinnamomum camphora* is a native to warm temperature of East Asia. It can grow on rocky hills, roadsides, along the stream banks in agricultural areas etc. It is also growing in ever-green forest.

Plant Descriptions:

General Description: It is a small, glabrous tree, up to 40 m tall with a diam of up to 3 m. The bark is yellow or brown with vertical fissures. Leaves alternate, simple, with 3 to several distinct nerves and penninerved with stout dormant buds enclosed in large, silky orbicular concave, imbricating caducous scales and a strong smell of camphor when crushed. Flowers bisexual, in lax axillary, terminal panicles on the ends of the twigs, creamy white in colour, hermaphroditic, actinomorphic; ovary 1, locular; ovule 1, pendulous or basal; stamens definite, free; anthers opening by valves or slits; embryo minute. The fruit is a round, one-seeded, fleshy drupe, 7-8 mm wide, purple-black at maturity.



Fig.: *Cinnamomum camphora* (L.) Presl.

Macroscopic Description: Heartwood yellowish-brown to red-brown, not distinctly demarcated from the paler sapwood. Grain straight to moderately interlock. Texture moderately fine and even; planed

surfaces greasy to the touch; a persistent camphor-like odour present in most species. Growth rings usually present but indistinct; vessels hardly visible to the naked eye or only visible with a hand lens; parenchyma and rays usually not distinct to the naked eye; ripple marks absent.

Microscopic Description: Growth rings indistinct to vague, marked by thick-walled and flattened latewood fibres, occasionally also by discontinuous marginal parenchyma bands. Vessels diffuse, 20-50/mm², solitary and in radial multiples of 2-3, rarely in small clusters, angular to round or oval, average tangential diam 80-170 µm; perforations predominantly simple, but sporadic scalariform plates with few bars occurring in all species; intervessel pits alternate, non-vestured, round to polygonal, 8-12µm; vessel-ray and vessel-parenchyma pits with reduced borders to simple, horizontally elongated (gash-like); helical thickenings and deposits absent; tyloses usually present. Fibres 1130-1580µm long, all non-septate or partly septate, thin-walled to thick-walled, depending on the species, with simple to minutely bordered pits mainly confined to the radial walls. Parenchyma sparse to abundant, vasicentric to weakly aliform; apotracheal parenchyma diffuse and additionally in marginal bands of 1-2 cells wide, in 3-6 celled strands. Rays 6-7/mm, 2-3 cells wide, up to 0.7 mm high, heterocellular with 1 rows of square to upright marginal cells. Crystals absent in most species, but minute crystals of various shapes present in ray cells in some species. Silica bodies absent. Secretory (oil or mucilage) cells associated with ray and axial parenchyma.

Part Used: Gum, leaves, wood.

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Katu (Pungent), Madhur (Sweet)
Guna (Attribute)	: Laghu (Light), Ruksa(Dry)
Virya (Potency)	: Sheeta (Cold)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Tridosahara, Caksusya, Hrdaya, Lekhana, Medya, Pacana, Vedanasthapanana, Vrsya.

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 0.3% w/w
Alcohol soluble extractive	: Not less than 8% 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>Salmonellae 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.

Major Chemical Constituents: The oil's high eugenol content also makes it valuable as a source of this chemical for subsequent conversion into isoeugenol, another flavouring agent. Major oil constituents are camphor, linalool, borneol, camphene, dipentene, terpineol, safrole and cineole.

Therapeutic Use: Bodyache, arthritis, fevers, skin diseases, nervous weakness, cold and cough, convulsions, mouth related disorders, indigestion, abdominal distension, bad breath, pyorrhea, microbial infections, muscular cramps, sinusitis etc.

Pharmacological Study: Antispasmodic, stimulant, anti-neuralgic, decongestant, sedative, anti-inflammatory, anesthetic, antiseptic, disinfectant, and insecticide effects.

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

Adverse Effects: Over-dosage may lead to seizures, confusion, restlessness, nausea, vomiting etc.

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

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

Posology: 125-375 mg, in divided dose per day.

Formulations: Karpur Ras, Sri Maha Laxmi Bilash, Chandrodoya Makardwaja, Karpurasav

Katki

Botanical Name: *Picrorhiza kurroa* Benth.

Family: Scrophulariaceae

Synonyms:

Bangla: কটকী (Katki)

Hindi: Kutki

Sanskrit: Tiktarohini, Kauka, Rohini

Urdu/Unani/Tibb: Kutki

English: Hellebore

Geographical Distribution: *Picrorhiza kurroa* is globally distributed in the Himalayan range across Pakistan, India and Nepal. Within India, it is found in the alpine Himalayas of Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and Sikkim between an altitude range of 3300-4300 m.

Plant Descriptions: The *Picrorhiza* species is a small perennial herb. Stem is small, weak, creeping, erect at flowering, leafy, and slightly hairy. Roots are about 5–10 cm long. Rhizomes are jointed and zigzag, greyish-brown, cylindrical, irregularly curved with branching and rooting at the jointed nodes. Leaves are 5–10 cm long, almost radical, sharply serrate, turning black on drying. Flowers are very small, white or pale blue purple, in dense terminal spikes.



Fig. *Picrorhiza kurroa* Benth.

Macroscopic Description: Rhizome is 2.5-8 cm long and 4-8 mm thick, sub cylindrical, straight or slightly curved. It is externally greyish-brown, rough surface due to longitudinal wrinkles, circular scars of roots and bud scales attached. The tip ends of rhizome in a growing bud are surrounded by tufted crown of leaves. Fracture is short; odour is pleasant and bitter in taste. Root is thin, cylindrical, 5-10 cm long, 0.05-0.1 cm in diam, straight or slightly curved with a few longitudinal wrinkles and dotted scars, mostly attached with rhizomes, dusty grey, fracture, short, inner surface black with whitish xylem; odour, pleasant; taste, bitter.

Microscopic Description: Transverse section of the rhizomes showed outermost thin brown colored cork, lacunose black colored bark, a circle of vasculature formed by 5 to 7 ovate vascular bundles.

Young roots generally have single layered epidermis, some epidermal cells are elongate forming unicellular hairs, hypodermis single layered, cortex is 8-14 layered, oval to polygonal, thick walled, parenchymatous cells, primary stele tetrarch to heptarch, enclosed by single layered pericycle, thick-walled cells of endodermis, mature root shows 4-15 layers of cork, 1-2 layers of cork cambium, secondary phloem poorly developed, secondary xylem consisting of vessels, tracheids, parenchyma and fibers, vessels have varying shape and size, some cylindrical with tail like, tapering ends, some drum shaped with perforation on end walls or lateral walls, tracheids are cylindrical with tapering pointed ends, fibers aseptate, thick-walled, lignified with tapering blunt with pointed ends.

Powder is dusty grey; shows groups of fragments of cork cells, thick-walled, parenchyma, pitted vessels and aseptate fibres, simple round to oval, starch grains, measuring 25-104 μ in diam.

Part Used: Rhizome and roots.

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Katu (Pungent)
Guna (Attribute)	: Laghu (Light)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Hridya, Pitta-har, Dipani, Bhedini, Jwar-har.

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 1% w/w
Alcohol soluble extractive	: Not less than 10% 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>Salmonellae 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.

Major Chemical Constituents: Kutkin is the active principal of *Picrorhiza kurroa* and is comprised of kutkoside and the iridoidglycoside picrosides I, II, and III. Other identified active constituents are apocynin, drosin, and ninecucurbitacin glycosides.

Therapeutic Usages: Liver disorders, fever, asthma, jaundice, gastrointestinal and urinary disorders, leukoderma, snake bite, scorpionsting.

Pharmacological Study: Antihepatotoxic, hypolipidemic, anti-inflammatory, antispasmodic, antitumor, antiviral, purgative, immunomodulatory, antioxidant, anti-phosphodiesterase, neurotogenic, antidiabetic, antiasthmatic, cardioprotective and leishmanicidal activities.

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

Adverse Effects: Over-dosage may lead to vomiting, nausea, and rashes if not taken with proper care.

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

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

Posology: 1-3 gm (in adult) and 0.5 gm-1 gm (in kids) depending on age and health, twice a day with water, after meals.

Formulations: Arogya Vardhani, Amritastak Kwath, Kalomegasav, Saribadyarista

Botanical Name: *Saussurea lappa* C.B.CL.

Family: Asteraceae (compositae)

Synonyms:

Bangla: कूड़ (Kur)

Hindi: Kutha

Sanskrit: Amaya, Pakala

Urdu/Unani/Tibb: Qust

English: Costus

Geographical Distribution: *Saussurea lappa* is indigenous to India, Pakistan and China, where it grows in the Himalaya region at 2500-3500 m altitude.

Plant Descriptions: *Saussurea lappa* is an upright, robust, tall, perennial herb growing to a height of 1–2 m having the stem erect. Root is stout of about 60 cm having a strong, characteristic odour. The transverse section clearly shows periderm in which phloem and xylem are distinctly shown. Stem is also stout and fibrous. The leaves are lobate, stalked and are about 1 m long. Flowers are dark bluish purple to black coloured arranged in axillary and in terminal clusters. The flower heads are stalkless, hard and round in shape about 3–5 cm in diam. Fruit is about 3 mm long, curved, cupped and compressed.



Fig. *Saussurea lappa* C.B.CL.

Macroscopic Description: Drug greyish to dull brown, thick stout, subiform to cylindrical, 7-15 cm. Long, 1.0-5.5 cm broad, thicker roots with collapsed centre, occasionally ridged, wrinkles longitudinal and anastomosed.; rootlets rarely present; cut surface shows two regions, outer periderm ring thin, inner porous woody portion lighter in colour showing fine radial striations and often the central portion collapsed; fracture, short, horny; odour, strong, characteristically aromatic, taste, slightly bitter.

Microscopic Description: Transverse section of thin root shows thin periderm, followed by a broad zone of phloem still a broader zone of xylem traversed by wide medullary rays; cork. 3-5 layered wide, secondary cortical cells polygonal, mostly elongated, secondary phloem consists of mostly storage parenchyma, small groups of sieve tubes and companion cells and often phloem fibres, bast fibres thick-walled, lignified, up to 350 μ m in length, with many simple pits associated with fibre, tracheids and parenchyma; wood fibres smaller than bast fibres; with wider lumen and obtusely tapering ends, medullary rays multiseriate and wider in phloem region; resin canals found throughout as large cavities; some roots possess a central cylinder of sclerenchyma while others have parenchymatous centre with scattered xylem elements; in older roots, wood parenchyma collapses and takes a spongy appearance in the centre of root; inulin present in storage parenchyma.

Powder: Deep brown or rusty; under microscope irregular bits of yellow, brown or orange-red fragments of resins and oils associated with thin-walled parenchymatous cells, broken bits of xylem vessels with scalariform, reticulate thickening and horizontal end walls.

Part Used: Roots.

Organoleptic Properties

Rasa (Taste)	: Tikta (Bitter), Katu (Pungent)
Guna (Attribute)	: Laghu (Light), Ruksa (Dry), Tikshna (Sharp)
Virya (Potency)	: Ushna (Hot)
Vipaka (Metabolism)	: Katu (Pungent)
Karma (Action)	: Kaphahara, Vatahara, Raktashodhaka, Varnya.

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 12% 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>Salmonellae 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.

Major Chemical Constituents: Roots contain odorous principle composed of two liquids resins, alkaloids, a solid resin, salt of valeric acid, an astringent and ash that contains manganese. The oil of the root was found to have following approximate composition: Camphene 0.04%, phellandrene 0.4%, terpene alcohol 0.2%, A-costene 6.0%, B-costene 6.0%, aplotaxene 20.0%, costol 7.0%, dihydrocostuslactone 15.0%, costus lactone 10.0%, costic acid 14%. Active principal of the root are (a) an essential oil of a strong aromatic penetrating and fragrance odour 1.5%. (b) Aglycoside and (c) an alkaloid Saussurine 0.05%. Kuthroots contain resinoids (6%), and essential oil (1.5%), alkaloid (0.05%) inulin (18%), saussurea lactone (20-25%), a fixed oil and minor constituents like tannin and sugars.

Therapeutic Use: Chronic skin diseases, asthma, dysentery, rheumatism, cold, cough, toothache, stomachache, typhoid fever and rheumatism etc.

Pharmacological Study: Angiogenesis effect, anti-arthritic, anti-convulsant, anti-cancer, anti-inflammatory, anti-ulcer, anti-viral, antifungal, hepatoprotective and hypoglycemic effects etc.

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

Adverse Effects: Over-dosage may lead to damage of kidney.

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

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

Posology: 1-2gm daily in divided doses.

Formulations: Saribadi Bati, Kankayan Gurika, Saribadyarista, Manjisthasav

Kushmanda

Botanical Name: *Benincasa hispida* (Thunb.) Congn.

Family: Cucurbitaceae

Synonyms:

Bangla: চালকুমড়া (Chalkumra)

Hindi: Kushmand, Petha

Sanskrit: Puspaphalam, Brihatphalam

Urdu/Unani/Tibb: Petha

English: White guard melon

Geographical Distribution: It is commonly cultivated in all over the Bangladesh for producing fruits used as vegetable and edible fruits.

Plant Descriptions: Annual branched trailing gourd climbing by means of tendrils, leaves large deiform to rounded, 10-25 cm diam deeply cordate, 5-7 lobbed, shortly hispid beneath, margin sinuate flowers yellow, unisexual, male peduncle 7.5-10 cm long, female peduncle shorter, fruits fleshy, broadly cylindrical and 30-40 cm long, hairy when young waxy bloom when mature, seeds numerous and collapsed, yellowish white.



Fig. *Benincasa hispida* (Thunb.) Congn.

Macroscopic Description: Dried cut pieces of the fruit are irregular in shape, with thick, smooth, glossy, curved, pericarp; pale whitish brown pithy pulp of the mesocarp. Taste is slightly sweet; odour characteristic. Drug occurs in deformed, compressed, cut pieces of various sizes; epicarp cream coloured with light yellowish to brownish mesocarp; taste, slightly acidic.

Microscopic Description: Mature fruit showed cuticularised epicarp consisting of single layered, squarest or slightly tangentially elongated cells of epidermis, outer tangential walls of epidermis thickened and cuticularised. A few epidermal cells divide peripherally and become 2 or 3 layered. Mesocarp has a heterogeneous structure consisting of multilayered hypodermis composed of tangentially elongated, thin walled, parenchymatous cells. Immediately within this is a zone of thick walled, multilayered, lignified sclerides and stone cells with the outer one to three layers thicker than the inner 2 to 6 or more layers. Beneath this zone, thin walled tangentially elongated, parenchymatous cells are present, their size gradually increases from those at periphery to those inside of mesocarp, the latter becoming circular has conspicuous intercellular spaces; vascular bundles are poorly developed, bicollateral, found scattered throughout the mesocarp.

Part Used: Fruits and seeds.

Organoleptic Properties

Rasa (Taste)	: Madhur (Sweet)
Guna (Attribute)	: Laghu (Light), Snigdha (Unctuous)
Viryā (Potency)	: Sheeta (Cold)
Vipaka (Metabolism)	: Madhur (Sweet)
Karma (Action)	: Medhya, Balya, Dahaprasamana, Trishnanigrahana, Nidrajanana, Ksayahara, Krmighna, Mutrajanana, Vrishya, Bastishodhak, Sonitasthapana, Brihana, Rasayana

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 1% w/w
Alcohol soluble extractive	: Not less than 10% w/w
Water soluble extractive	: Not less than 24% 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>Salmonellae 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.

Major Chemical Constituents: The major constituents are volatile oils, flavonoids, glycosides, saccharides, proteins, carotenes, vitamins, minerals, β -sitosterin and uronic acid.

Therapeutic Use: Epilepsy, anxiety, lung cancer, cough, asthma, urine retention and internal hemorrhage.

Pharmacological Study: Anticonvulsant, anxiolytic, gastroprotective, antinociceptive, antipyretic, antihistaminic, anti-inflammatory, analgesic, antioxidant, antidiarrhoeal, anorectic, angiogenic, anthelmintic etc.

Contraindications: Should not be used during pregnancy or lactation, obese person, and known allergy to the plants of the Cucurbitaceae family.

Adverse Effects: Over-dosage may lead to digestive problems.

Precautions: Do not use in cold, asthma and bronchitis.

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

Posology: Fruits used as vegetables, seed powder 3-6 gm, seed oil 5ml.

Formulations: Kushabaleha, Kanda Amlaki, Basakusmanda Khanda, Srigopal taila.

Kush

Botanical Name: *Desmostachya bipinnata* Stapf.

Family: Poaceae

Synonyms:

Bangla: कुश (Kush)

Hindi: Kush

Sanskrit: Barhi, Kush, Durbha

Urdu/Unani/Tibb: Bikh dab

English: Halfa grass

Geographical Distribution: This species is globally distributed from North Africa, Middle East to India and South East Asia. Within India, it is found throughout the plains and flourishes well in dry and hot situations forming big tussocks in sandy desert areas. It is also found in low lying or water-logged soils.

Plant Descriptions: Kush is a harsh rhizomous perennial grass. Culms are stout, up to 1.2m high. Leaf blades are up to 65 cm long; 3.8-10.5 mm wide when unrolled. Lower leaf-sheaths are leathery, often densely flabellate towards the base of the culm. Inflorescence is up to 60 cm long. Spikes are clustered or spaced, 14 cm long. Spikelets are 3-17 flowered, narrowly ovate to linear-oblong, 3-10 mm long. Lower glume 0.7-1.5 mm long, upper glume 1.1-2.0 mm long. Lemmas are straw-coloured or suffused with purple, 1.8-2.7 mm long.



Fig. *Desmostachya bipinnata* Stapf.

Macroscopic Description: Drug occurs in 6-20 cm long, 0.3-0.5 cm thick cut pieces, almost cylindrical; internodes smooth, stout, mostly covered with shining sheath, having distinct nodes; brownish-yellow; a few thin, fibrous, ash coloured roots arise at nodes; fracture, short.

Microscopic Description: Root stock shows single layered epidermis, covered with striated cuticle; hypodermis composed of 3-5 layered, circular to polygonal, sclerenchymatous cells; cortex consisting of 5-9 layered, circular parenchymatous cells with small intercellular spaces; a few collateral vascular bundles found scattered in this zone, followed by 5-8 layered, discontinuous sclerenchymatous ring; ground tissue composed of continuous mass of slightly thick-walled, non-lignified, parenchymatous cells; numerous, collateral, vascular bundles found scattered in this zone and each covered by sclerenchymatous sheath; xylem vessels simple pitted; starch grains simple round to oval, with centric hilum, measuring 8-14 μ india., and compound having two components, found scattered in hypodermis, cortex and ground tissues.

Powder-Yellowish-brown; shows fragments of circular to polygonal sclerenchymatous cells with distinct lumen and striations; long, pointed fibres; simple pitted xylem vessels; starch grains simple round to oval with centric hilum measuring 8-14 μ in diam.

Part Used: Root

Organoleptic Properties

Rasa (Taste)	: Madhura (Sweet), Kasaya (Astringent)
Guna (Attribute)	: Laghu (Light), Snigdha (Slimy)
Virya (Potency)	: Sheeta (Cold)
Vipaka (Metabolism)	: Madhura (Sweet)
Karma (Action)	: Mutrala, Kapha-pitta shamaka

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 7% w/w
Alcohol soluble extractive	: Not less than 3% 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>Salmonellae 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.

Major Chemical Constituents: Desmostachya bipinnata contains different chemical constituents like alkaloids, carbohydrates, saponins, tannins, phytosterols and phenolic compounds, lignin, flavonoids, protein and free amino acids and several essential oils.

Therapeutic Use: Diuretic, urinary calculi, dysuria and other disease of bladder, galactogogue, dysentery, diarrhea, thirst, menorrhagia and skin diseases.

Pharmacological Study: Antiulcerogenic, antioxidant, anti-histaminic, anti-obesity, diuretic and laxative, anti-diarrheal, anti urolithiatic, analgesic, anti-inflammatory, hepatoprotective.

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

Adverse Effects: Over-dosage may lead to gastric irritation.

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

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

Posology: Decoction 50-70 ml.

Formulations: Trinapanchamul Kwath, Kushabaleha

Lodha

Botanical Name: *Symplocos racemosa* Roxb.

Family: Symplocaceae

Synonyms

Bengali: লোধ (Lodha)

Hindi: Lodha

Sanskrit: Rodhra

Urdu/Unani: Lodh, Lodhpathani

English: Symplocos bark

Geographical Descriptions: *Symplocos racemosa* is a genus of flowering plants; distributed in tropical and subtropical Asia, Malaysia, and America. It is a small evergreen tree, found in the plains and lower hills throughout North and East India, ascending in the Himalayas up to an elevation of 1400 m, Bengal, Assam and Chhota Nagpur. In Pakistan only two species are found, namely *S. racemosa* and *S. cochinchinensis*. *S. cochinchinensis* var. *laurina* known as kabli-vetti or Lodh tree is widely distributed in tropical and subtropical areas in Asia, Oceania and America. In Bangladesh small quantities are found in Chattagram hill tracks.

Plant Description: There are 300-500 species of the Symplococaceae family are found all over the world, where only 68 species are found in India. There are two major varieties of Lodhra. They are Savara Lodhra and Pattika Lodhra. The second variety is described with synonyms like Krimka, Jirna, Brihat parna, Laksha, Prasadana, Tivita, Marjana, and Pattika. Thakurji reported Savara Lodhra as *Symplocos racemoserox* and Pattika Lodhra as *Symplocos crataegoids*. Another species of *Symplocos* is *Symplocos laurina*, *Symplocos paniculata*, *Symplocos sumuntia* are also used under the name Lodhra.

Macroscopic Description: Mature stem bark occurs in channeled or curved pieces, few fiat pieces also occur in thickness up to 1cm, fissures and cracks make the outer surface uneven and rough. The external appearance is grayish brown to grey, pale to whitish-brown internally, fracture short and granular in cortical region and somewhat fibrous in inner region. Taste is astringent and feebly bitter. It is an Evergreen tree, tall and bark often marked with white patches. Leaves are crowded in nature with elliptic-oblong or elliptic-lanceolate. They are narrow at base, acute or acuminate at apex, glandular-serrate, crenate or subentire, glabrous on both side curves, polished and shining above the nerve pair. Flowers are about 8-18 cm long axillary racemes, white, fragrant. Fruit a drupe with ellipsoid to ovoid or oblong with 1-1.5x0.6 cm. Seeds are oblong and hard.

Microscopic Description: Transverse section of mature bark with a wide cork of thin-walled and cells are rectangular. Cork cambium is 1-3 layered. A number of stone cells towards inner sides, a number of stone cells scattered into the region having highly thickened walls with distinct pits. Mainly it contains crystals of calcium oxalate and starch grains. Secondary phloem parenchyma, phloem fibres and stone cells are present with medullary rays.

Powder: Greyish-brown, under microscope shows fragments of cork, stone cells, fibres, prismatic and cluster crystals of calcium oxalate and starch grains.



Fig. *Symplocos racemosa* Roxb.

Part Used: Stem bark and flowers.

Organoleptic Properties

Rasa (Taste)	: Kasaya
Guna (Attribute)	: Laghu
Virya (Potency)	: Sita
Vipaka (Metabolism)	: Katu
Karma (Action)	: Caksusya, Grahi, Kaphapittanut

Purity and Safety test

Total ash	: Not more than 12 % w/w
Acid insoluble	: Not more than 1 % w/w
Water soluble	: Not less than 15 % w/w

Thin Layer Chromatography

: 5 gm of drug of each sample were shade dried and coarsely powdered and defatted with hexane. The plant materials were packed in a Soxhlet apparatus and extracted successively with chloroform and ethanol for 5 hrs separately. The extracts were filtered by using Whatmann No.1 filter paper. The extracts were concentrated on water bath and made up to 10 ml volumetric flask. Different compositions of the mobile phase for TLC analysis were tested in order to obtain high resolution and reproducible

peaks. The corresponding R_f values of various spots for chloroform and alcohol extract is given in below table.

R_f values of chloroform and alcohol extracts

Types of lights with wavelength	Chloroform extracts [Mobile phase: Toluene: Ethyl acetate (8:2)]		Alcohol extracts [Mobile Phase: Toluene: Ethyl acetate: Formic acid (7 :3:0.1)]	
	<i>S. racemosa</i>	<i>S. crataegoides</i>	<i>S. racemosa</i>	<i>S. crataegoides</i>
UV-254 nm	0.77 Green	0.92 Green	0.32 Green	0.89 Green
	0.63 Green	0.17 Green		0.32 Green
	0.17 Green			
	0.62 Blue	0.79 Red	0.92 Fluorescent Blue	0.92 Fluorescent Blue
	0.40 Blue	0.64 Fluorescent blue	0.83 Blue	0.83 Blue
	0.20 Blue	0.43 Red	0.77 Blue	0.77 Fluorescent Blue
UV-366 nm	0.15 Fluorescent blue	0.37 Blue	0.31 Blue	0.31 Blue
	0.11 Fluorescent blue	0.25 Blue		
		0.20 Blue		
		0.11 Blue		
		0.63 Grey	0.78 Grey	0.90 Grey
Visible Light (after derivatisation vanillin-sulphuric acid reagent)	0.46 Grey	0.65 Violet		
	0.37 Grey	0.50 Grey		
		0.45 Grey		
		0.37 Violet		
		0.13 Grey		

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E. coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 μ gm/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, 0.1, 0.5, 0.5 and 0.1 mic.gm/kg respectively.

Major Chemical Constituents: *S. racemose* is pure source of phytochemicals which include flavonoids, phenols, tannins, saponins and glycosides. It contains several flavonoid glucosides like symplocoside, symposide, leucopelargonidine-3 glucoside, ellagic acid, rhamnetin 3-digalactoside, triterpenoids like 19 α -hydroxy acetic acid³, 28-O-bis- β -glucopyranosides, betulin, lino-leic acid, β -sitosterol and α -amyrin and alkaloids like oturine, loturidine, colloturine and harmine are seen as chief bio actives from the plant.

Therapeutic Use: Snake bite, scorpion sting, diarrhea, dysentery, for spongy gum, bleeding, leprosy, dropsy and also used in abortion, miscarriages, for ulcers of vagina, uterine disorders.

Pharmacological Study: Anti-cancer, hepatoprotective, anti-oxidant, antibacterial, anti-androgenic effect, anti-inflammatory, analgesic, wound healing activity, Lipoxxygenase and urease inhibitory activity and anti-diabetic effects.

Adverse Effects and Contraindication: The acute toxicity study conducted for aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and 1/8th and 1/4 thof 2000 mg/kg i.e.250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage Form: Powder, decoction.

Posology: 3-5 gm of the drug in powder form. 20-30 gm of the drug in decoction form.

Formulations: Lodhrasava, Pusyanuga Churna

Lajjabati

Botanical Name: *Mimosa pudica* L.

Family: Fabaceae

Synonyms

Bengali: লজ্জাবতি (Lajjabati)

Hindi: Laajavanti

Sanskrit: Lajjaalu

Urdu/Unani: Chhuimui, Sharmili, Laajwanti.

English: Sensitive-plant, Humble Plant.

Geographical Descriptions: *Mimosa pudica* is native to South America, North America and Central America. It can also be found in Asia in countries such as Singapore, Bangladesh, Thailand, India, Nepal, Indonesia, Malaysia, Philippines, Vietnam, Cambodia, Laos, Japan, Sri Lanka, Guam and well across the southern part of the United States. The plant is a wide spread weed in tropical regions and has naturalized elsewhere in warm areas, commonly distributed in open-spaces, especially road side, cultivated land, and waste area. It is commonly grown as a curiosity in greenhouses.

Plant Description: *Mimosa pudica* is a creeping annual or perennial herb. It has been identified as lajjalu in Ayurveda and has been found to have antiasthmatic, aphrodisiac, analgesic, and antidepressant properties. Two well-known movements are observed in *Mimosa pudica*: one is the very rapid movement of the leaves when it is stimulated by touch, heating, etc., and the other is the very slow, periodical movement of the leaves called nyctinastic movement which is controlled by a biological clock. The leaves of the sensitive plant *Mimosa pudica* can adapt their closing response to electrical and mechanical stimulation so that they reopen to repeated stimulation. The more intense the stimuli and the longer the intertribal interval, the longer it takes to adapt. Leaves adapted to the effects of mechanical stimulation can still respond by closing to electrical stimulation and vice versa.



Fig. *Mimosa pudica* L.

Macroscopic Description: Root-Cylindrical, tapering rependant, with secondary and tertiary branches, varying in length up to 2-cm thick, surface more or less rough or longitudinally wrinkled; grayish-brown to brown, cut surface of pieces pale yellow, fracture hard, woody, bark-fibrous; odor, distinct; taste, slightly astringent. Stem-Cylindrical, up to 2.5 cm in diam; sparsely prickly, covered with long, weak bristles longitudinally grooved, external surface light brown, internal surface grey, bark fibrous; easily separable from wood. Leaf-Digitately compound with one or two pairs of sessile, hairy pinnae, alternate, petiolate, stipulate, linear lanceolate; leaflets 10–20 pairs, 0.6–1.2 cm long, 0.3–0.4 cm broad, sessile, obliquely narrow or linear oblong; obliquely rounded at base, acute, nearly glabrous; yellowish green. Flower-Pink, in globose head, peduncles prickly; calyx very small; corolla pink, lobes 4, ovate oblong; stamens 4, much exerted; ovary sessile; ovules numerous. Fruit-Lomentum, simple, dry, 1–1.6 cm long, 0.4–0.5 cm broad, with indehisced segments and persistent sutures having two to five seeds with yellowish spreading bristle at sutures, 0.3 cm long, glabrous, and straw colored. Seed-Compressed, oval-elliptic, brown to gray, 0–0.3 cm long, 2.5 mm broad, having a central ring on each surface.

Microscopic Description: Root-Mature root shows cork 5–12 layered, tangentially elongated cells, a few outer layer crushed or exfoliated; secondary cortex consisting of 6–10 layered, tangentially elongated thin-walled cells; secondary phloem composed of sieve elements, fibers, crystal fibers, and phloem parenchyma traversed by phloem rays, phloem fibers, single or in groups, arranged in tangential bands; crystal fibers thick walled, 3–25 chambered, each with single or two to four prismatic crystals of calcium oxalate; phloem rays uni-to-multi-seriate, two to three seriate more common; secondary xylem consists of usual elements traversed by xylem rays; vessels scattered throughout secondary xylem having bordered pits and reticulate thickenings; crystal fibers containing one or rarely two to four prismatic crystals of calcium-oxalate in each chambers; parenchyma, thick walled, scattered throughout secondary xylem; xylem rays uni-to-bi-seriate; rarely multi-seriate, wider toward secondary phloem and narrow toward center; starch grains, prismatic crystals of calcium oxalate and tannin present in secondary cortex, phloem and xylem rays, and parenchyma; starch grains both simple and compound having two to three components, rounded to oval measuring 6–20 μ m and 16–28 μ m in diam, respectively.

Stem-Mature stem shows four to eight layered, exfoliated cork of tangentially elongated cell filled with reddish brown contents; secondary cortex wide, consisting of large, moderately thick walled, tangentially elongated to oval, parenchymatous cells, filled with reddish brown contents, a few cells contain prismatic crystals of calcium oxalate, a number of lignified, fibers single or in groups, scattered throughout; secondary phloem consisting of usual elements, two to five transversely arranged strips of fibers occur alternating with narrow strips of sieve elements and parenchyma, crystal fibers elongated, thick-walled, containing single crystal of calcium oxalate in each chamber; phloem rays thick walled radially elongated; secondary xylem composed of usual elements traversed by xylem rays, vessels, drum shaped with spiral thickenings, tracheids pitted with pointed ends, fibers of two types, shorter wide lumen and longer with narrow lumen; xylem rays radially elongated, thick

walled, 1–6 cells wide and 3-30 cells high; pith consisting of polygonal, parenchymatous cells with intracellular spaces.

Leaf- Petiole shows single layered epidermis, covered with thin cuticle; cortex four to seven layered of thin walled, parenchymatous cells; pericycle arranged in a ring; four central vascular bundles present with two smaller vascular bundles arranged laterally, one in each wing.

Midrib- Shows a single-layered epidermis, covered with thin cuticle, upper epidermis followed by a single-layered palisade, spongy parenchyma single-layered, pericycle same as in petiole; vascular bundle single.

Seed-Shows single-layered radially elongated cells; followed by five- to six-layered angular cells filled with dark brown contents; endosperm consists of angular or elongated cells, a few containing prismatic crystals of calcium oxalate; cotyledons consist of thin-walled cells, a few cells containing rosette crystals of calcium oxalate; embryo straight with short and thick radical.

Powder- Reddish brown, shows reticulate, pitted vessels, prismatic and rosette crystals of calcium oxalate, fibers, crystal fibers, yellow or brown parenchymatous cells, palisade cells, nonglandular, branched, shaggy hair, single and compound starch grains, measuring 6–25 μ m in diam with two to three components.

Part Used: Whole plant, leaves, and roots.

Organoleptic Properties

Rasa (Taste)	: Tikta, Kasaya
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Sita
Vipaka (Metabolism)	: Katu
Karma (Action)	: Grahi, Kaphahara, Pittahara

Purity and Safety test

Total ash	: Not more than 10 % w/w
Acid insoluble	: Not more than 5 % w/w
Water soluble	: Not less than 9 % w/w

Thin Layer Chromatography

: TLC of alcoholic extract of the drug on Silica Gel 'G' plate using n-Butanol: Acetic acid: Water: (4:1:5) Under U.V. (366 nm) four fluorescent zones appear at R_f 0.35, 0.62, 0.69 (all blue) and 0.81 (bluish-pink). On exposure to Iodine vapour two spots appear at R_f 0.35 and 0.94 (both yellow) On spraying with Dragendorff reagent followed by 5% Methanolic Sulphuric acid reagent one spot appears at R_f 0.35 (orange).

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total

yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 μ gm/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, 0.1, 0.5, 0.5 and 0.1 μ gm/kg respectively.

Major Chemical Constituents: Bioactive components such as terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins, and coumarins. Roots of the plant are indicative of the presence flavonoids, phytosterol, alkaloids, amino acids, tannins, glycoside, and fatty acids.

Therapeutic Use: Hemorrhagic diseases, diarrhea, gynecological disorders, leprosy, dysentery, vaginal and uterine complaints, inflammations, burning sensation, asthma, leucoderma, and fatigue and blood diseases.

Pharmacological Study: Wound healing activity, anti oxidant, antimicrobial, analgesic and anti-inflammatory, antidiarrhoeal, antifertility, antihyperglycemic, antihelminthes, anti-hepatotoxic, antimalarial and activity.

Adverse effects and Contraindication: As per pharmacological studies it is assumed that it may increase the glucose level and causes diuresis. So, caution should be taken in diabetes, kidney diseases and concomitant use of anticonvulsant drugs. The acute toxicity study conducted for aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected 1/8th and 1/4th of 2000 mg/kg i.e. 250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage Form: Powder, decoction.

Posology: Root juice: 10–20 ml and decoction 50–100 ml. Whole plant: 10–20 gm for decoction.

Formulations: Kutajavaleha, Pusanuga Churna.

Meshshringi

Botanical Name: *Gymnema sylvestre* R.BR.

Family: Asclepiadaceae.

Synonyms

Bengali: মেসশ্ৰিঙ্গি (Meshshringi)

Hindi: Gudmaar, Medhaa Singee

Sanskrit: Madhunasini, Ajasrangi

Urdu/Unani: Gurmaar Buuti

English: Periploca of the wood

Geographical Descriptions: *Gymnema sylvestre*, which originated in Indian, has a natural occurrence in the tropical forests of Central India, Western Ghats, and Southern India and in the southern part of China, tropical Africa, Malaysia, Sri Lanka and Chattagram and Sylhet of Bangladesh. The plant grows best in areas with a high to average rainfall.

Plant Description: *Gymnema* derives from the Greek words "gymnos" and "nēma" meaning "naked" and "thread" respectively; the species epitheton *sylvestre* means "of the forest" in Latin.

The Hindi name Gurmar, Sanskrit Madhunashini, Urdu Gurmar, Malayalam Chakkarakolli and Telugu Podapatri, literally mean "sugar destroyer". Meshasringa translates as "ram's horn", a name given to the plant due to the shape of its fruits. *G. sylvestre* is a slow growing, perennial, woody climber, grows upto 600 m height. The plant is a large, more or less pubescent, woody climber. The leaves are opposite, usually elliptic or ovate (1.25 – 2.0-inchx0.5-1.25 inch). Flowers are small, yellow, in axillary and lateral umbel in cymes; Follicles are terete and lanceolate upto 3 inches in length.



Fig. *Gymnema sylvestre* R.BR.

Macroscopic Description: Leaf simple, opposite, elliptical or ovate, petiolate, petiole 6 to 12 mm long and pubescent; lamina 3 to 6 cm long and 1 to 3 cm broad; acute or shortly acuminate; more or less pubescent on both sides, base rounded or cordate, venation reticulate; odour, unpleasant; taste, bitter and acrid. Tap root branched, rough, longitudinally fissured, corky, and soft and nodulose pieces, 2 to 7 cm long and 0.2 to 1.0 cm in thickness; external surface dark brown and cut surface showing a core cream in colour; fracture, splintery; odour, unpleasant; taste, bitter and acrid.

Microscopic Description: Petiole-Nearly semi circular in outline having a deep furrow, shows a single layered epidermis covered with thick cuticle; multicellular uniseriate trichomes present; cortex composed of 3 or 4 layers of collenchyma and 3 or 4 layers of thin walled parenchymatous cells with intercellular spaces; vascular bundle bicollateral, conjoint and 3 in number, one central larger and crescent shaped and 2 lateral and smaller in size; a few rosette crystals of calcium oxalate present in cortical region.

Midrib-Epidermis and trichome as in petiole; epidermis followed by 2 or 3 layers of collenchyma adjacent to the lower surface; vascular bundle crescent shaped, bicollateral, conjoint and situated in centre; rest of the tissue between collenchyma and vascular bundles consisting of polygonal thin-walled parenchymatous cells with intercellular spaces, a few having rosette crystals of calcium oxalate.

Lamina-Shows dorsiventral structure; epidermis and trichome as in petiole and midrib; trichome cylindrical, consists of 3 to 6 cells nearly similar in width and variable in length, terminal cells blunt, most of them curved inwards from the leaf surface; palisade 1 or 2 layers; spongy parenchyma irregular, arranged with distinct intercellular spaces, rosette crystals of calcium oxalate present in this region; stomata paracytic, present only on lower surface; palisade ratio 7 or 8; stomatal index 20 to 25, vein islet number 7 to 10 per sq. mm.

Root-Shows 5 to 20 rows of tangentially elongated and radially arranged cork cells; secondary cortex a wide zone consisting of oval to polygonal cells somewhat irregular in shape and moderately thick walled, filled with rosette crystals of calcium oxalate and a few simple or compound starch grains; secondary phloem composed of sieve tubes, companion cells and phloem parenchyma, with mostly large and a few small rosette crystals and starch grains; medullary rays prominent, uni or multi seriate, generally tetra seriate, extending from primary xylem to secondary phloem; groups of oval to elongated, thick walled, lignified sclereids with clear striations and narrow lumen present in cortex and phloem region; secondary xylem consists of usual lignified elements; vessels simple pitted, single or 2 to 7 in radial groups and dispersed throughout the xylem region; fibres long with tapering ends and wide lumen; primary xylem present diarch.

Powder-Light green; under microscope shows epidermal cells having nearly straight wall, and paracytic stomata in surface view; rosette crystals of calcium oxalate; broken pieces of trichomes and spiral vessels.

Part Used: Leaves and roots

Organoleptic properties

Rasa (Taste)	: Tikta, Kasaya
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Caksuya, Dipana, Kaphahara, Vatahara, Visaghna, Sramasana

Purity and Safety test

Total ash	: Not more than 12 % w/w
Acid insoluble	: Not more than 2 % w/w
Water soluble	: Not less than 28 % w/w

Thin Layer Chromatography

: TLC of the alcoholic extract of leaf on Silica Gel 'G' plate using n-Hexane: Toluene: Ethylacetate (5:10:2) as mobile phase shows four fluorescent zones under U.V. (366 nm) at R_f. 0.24, 0.37 (both Red), 0.50 (blue) and 0.60 (Red). On spraying with AnisaldehydeSulphuric acid reagent and heating the plate at 110o for ten minutes seven spots appear at R_f. 0.29 (green), 0.37, 0.47 (both violet), 0.55 (pink), 0.60 (green), 0.66 (violet) and 0.93 (pink). TLC of the alcoholic extract of root on Silica Gel 'G' plate using Toluene: Ethylacetate: Methanol (10:10:4) as mobile phase shows on spraying with Anisaldehyde-Sulphuric acid reagent and heating the plate at 110°C for ten minutes eight spots at R_f. 0.17 (brown), 0.25 (violet), 0.48 (grey), 0.57 (pink), 0.68, 0.80, 0.87 (violet) and 0.95 (pink).

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will not more than 10⁴ cfug⁻¹, 10³ cfug⁻¹, and 10⁴ cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total *enterobacteriaceae*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 $\mu\text{g}/\text{kg}$, 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, 0.1, 0.5, 0.5 and 0.1 $\mu\text{g}/\text{kg}$ respectively.

Major Chemical Constituents: Gymnemic acids, a group of triterpenoid saponins belonging to oleanane and dammarene classes. Oleanane saponins are gymnemic acids and gymnema saponins, while dammarene saponins are gymnemasides. Other plant constituents are flavones, anthraquinones, hentriacontane, pentatriacontane, α and β chlorophylls, phytin, resins, d-quercitol, tartaric acid, formic acid, butyric acid, lupeol, β -amyrin related glycosides and stigmasterol. The plant extract also tests positive for alkaloids. The structure of gurmarin, another anti-sweet agent found in gymnema, has been elucidated as a polypeptide comprising 35 amino acid residues.

Therapeutic usages: Diabetes, dyslipidemia, amenorrhoea, asthma, bronchitis, cardiopathy, conjunctivitis, constipation, cough, dyspepsia, haemorrhoids, hepatosplenomegaly, inflammations, intermittent fever, jaundice and leucoderma.

Pharmacological study: Anti-diabetic, anti-inflammatory, anticancer, antioxidant.

Adverse effects: No adverse reactions in a long-term study of insulin-dependent diabetic patients. However, consider the possibility of hypoglycemia. In an acute toxicity study in mice, no gross behavioral, neurologic, or autonomic effects are observed. The acute LD_{50} is 3990 mg/kg. The safety ratio ($\text{LD}_{50}/\text{ED}_{50}$) is 11 and 16 in normal and diabetic rats, respectively.

Contraindication: Gymnema might decrease blood sugar. Insulin is also used to decrease blood sugar. Taking gymnema along with insulin and other oral hypoglycemic drugs might cause blood sugar to be too low. Blood sugar should be monitored closely.

Dosage form: Powder or churna, decoction, tincture.

Posology: Adult dose: In liquid form (extract), 25 to 75 ml per week is recommended. Tablet form; in 8 to 12 gm per day of leaf equivalent is recommended.

Formulations: Mrtasanji Vani Sura, Gurmar Bati

Mehedi

Botanical Name: *Lawsonia inermis* L.

Family: Lythraceae.

Synonyms

Bengali: মেহেদি (Mehedi)

Hindi: Mehendi

Sanskrit: Nil Madayantika

Urdu/Unani: Mehendi, Hina

English: Henna

Geographical Descriptions: This plant is multi branched, deciduous shrub or small tree is shrub cultivated for its various uses and purposes. It is native to Arabia and Persia and found in Egypt, India, the Middle East, Kurdistan and Iran. Past study reported the availability of mehedi as a plantation shrub in the rural homesteads of Bangladesh, having some religious and ceremonial uses, and described it is a sacred and the most cared for species in the Muslim community of the country. Although it's cultivation has been restricted to the homestead level and specific to the Muslim community, recently mehadi has been cultured commercially in some areas of central of Bangladesh.

Plant Description: Mehadi consists of dried leaves of *Lawsonia inermis* Linn. is a small, elegant bush with fragrant flowers cultivated and naturalised all over the country. The species attains an average height of 3–4 m, and is an evergreen with opposite, oval-lanceolate, entire and glabrous leaves, preferring hot climates for growth.



Fig. *Lawsonia inermis* L.

Macroscopic Description: Flower and Fruit: The flowers are in small impressive groups of 4 panicles and yellowy-white to brick-red. The calyx is top-shaped, later bowl-shaped without

appendages. The petals are thick, much wrinkled, and yellowish-white to brick. The stamens are arranged in pairs. The fruit is an indehiscent or a fibrously torn berry. The seeds are small and angular, and the seed skin is spongy at the tip. Leaves, Stem and Root: Henna is a deciduous, 2 to 6 m high shrub with partly thorny, short shoots and opposite paired narrowly acuminate lanceolate leaves.

Microscopic Description: Petiole-shows concavo-convex outline; epidermis consisting of single layered cells covered by thick, striated cuticle; below epidermis 2 to 4 layered collenchyma and 3 to 4 layered parenchyma having intercellular spaces; pericycle 2 to 4 layered, stele bicollateral; cambium a thin strip present between xylem and phloem; phloem consisting of usual elements; xylem mostly composed of tracheids and vessels. Midrib -shows upper and lower epidermis covered externally by thick and striated cuticle; epidermis followed by 2 to 4 layers of collenchymatous cells, circular in shape with angular thickening; beneath which are 3 or 4 layers of parenchymatous cells, isodiametric with intercellular spaces; stele crescent-shaped, consisting of usual elements traversed by medullary rays; phloem fibres seen in the phloem region; a few parenchymatous cells contain rosette and prismatic crystals of calcium oxalate. Lamina - shows upper and lower epidermis composed of tangentially elongated cells covered externally by a thick striated cuticle; some large epidermal cells form mucilage sacs projecting into adjacent palisade zone; anomocytic stomata distributed on both surfaces; mesophyll composed of 1 to 3 layers of palisade tissue and 2 to 4 layers of spongy parenchyma; palisade cells filled with chloroplasts, spongy parenchyma oval to circular in shape, oil globules present in palisade and spongy parenchyma; rosette and prismatic crystals of calcium oxalate also present in spongy parenchyma; mesophyll traversed by vascular strands composed of xylem surrounded by phloem with a patch of sclerenchymatous fibres on abaxial side; average stomatal index 10 to 15 and 15 to 18 in upper and lower surface the respectively; palisade ratio 5 to 8 on both surfaces; vein islet number 30 to 45.

Powder-Dark brown; shows fragments of thin-walled, parenchyma cells, wavy thinwalled epidermal cells in surface view, anomocytic stomata, rosette and prismatic crystals of calcium oxalate, a few oil globules, and vessels showing spiral thickenings.

Part used: Leaves, fruit, bark

Organoleptic properties

Rasa (Taste)	: Tikta, Kasaya
Guna (Attribute)	: Laghu, Ruksha
Virya (Potency)	: Sita
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphasamaka, Pittasamaka

Purity and safety test

Total ash	: Not more than 11 % w/w
Acid insoluble	: Not more than 3 % w/w
Water soluble	: Not less than 25 % w/w

Thin Layer Chromatography

: TLC of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethyl acetate (9:1) shows in the visible light three spots at R_f 0.35, 0.60 and 0.63 (all grey). Under U.V. (366 nm) seven spots appear at R_f 0.18, 0.26, 0.35, (all violet), 0.39, 0.61, 0.68 (all reddish violet) and 0.73 (violet). On spraying with 5% Methanolic Sulphuric acid reagent and heating the plate at 105°C for ten minutes five grey colour spots appear at R_f 0.09, 0.41, 0.61, 0.70 and 0.95.

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will not more than 10⁴ cfug⁻¹, 10³ cfug⁻¹, and 10⁴ cfug⁻¹ respectively for crude plant materials. The load of total viable aerobic count, total *enterobacteriaceae*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 µgm/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, 0.1, 0.5, 0.5 and 0.1 µgm/kg respectively.

Major Chemical Constituents: Lawsone (C₁₀H₆O₃) is the colouring component present in leaves of henna and gets fixed well by wool, silk and tenaciously by the skin. Researchers isolated four compounds by thin layer chromatography. Out of these three fractions were identified as gallic acid, lawsone (2-hydroxy- 1,4-naphthoquinone), and 1,4-naphthoquinone. Beside these lacoumarin, this is a coumarin, from *L. inarmis* leaves. Two xanthenes i.e. 1, 3-dihydroxy-6, 7-dimethoxyxanthone and 1-hydroxy-3,6-diacetoxy-7-methoxyxanthone, apigenin-4'-glucoside, apigenin-7-glucoside, luteolin-7-glucoside, and luteolin-3'-glucoside were also isolated.

Therapeutic Use: Wound, leprosy, skin diseases dysuria, jaundice, bleeding disorders, amenorrhea, dysmenorrhea, diarrhea, dysentery, coughs, bronchitis, headache, rheumatism, anemia, fever, and acute psychosis.

Pharmacological Study: Analgesic, hypoglycemic, antimalarial, hepatoprotective, nootropic, immunostimulant, anti-inflammatory, antibacterial, antimicrobial, antifungal, antiviral, antiparasitic, antitrypanosomal, antidermatophytic, antioxidant, anthelmintic, antifertility, tuberculostatic and anticancer.

Adverse Effects: Health risks or side effects following the proper administration of designated therapeutic dosages are not recorded. Stomach complaints are possible due to the tannin content.

Contraindication: Contraindicated during pregnancy and lactation and who are willing to get pregnant.

Dosage Form: Henna is used rarely for internal use in ground form or as an infusion. Henna is applied externally as an ingredient in hair and skin lotions.

Posology: For internal use, 3 gm of powder leaves to be taken daily, for amebiasis and ulcers.

Formulations: Madayanyadi Churna

Mundi

Botanical Name: *Sphaeranthus indicus* L.

Family: Asteraceae

Synonyms:

Bengali: মুন্ডি (Mundi)

Hindi: Mundi, Gorakhmundi

Sanskrit: Mundi, Sravani, Bhumikadamba

Urdu/Unani: Mundi

English: East Indian globe thistle

Geographical Descriptions: *Sphaeranthus indicus* is a medicinal plant widely used in Indian traditional system of medicine for curing various ailments. It grows in rice fields, dry waste places and cultivated lands in tropical parts of India. It is distributed throughout Bangladesh, India, Sri Lanka, Africa and Australia from sea level to an altitude of 50 feet in hills.

Plant Description: Munditaka consists of dried whole plant of *Sphaeranthus indicus* Linn. It is a multi-branched aromatic herb 1-2 feet in height, found abundantly in damp places throughout the country. It is an important medicinal plant used for the treatment of styptic gastric disorders, skin diseases, anthelmintic, glandular swelling, nervous depression, analgesic, antibiotics, antifungal, laxative and diuretic properties.



Fig. *Sphaeranthus indicus* L.

Macroscopic Description: The herb *Sphaeranthus indicus* Linn is much branched, strongly scented, and annual erect with branched tapering roots tap roots. Stems are cylindrical with toothed wings. Leaves are sessile, decurrent, 2–7 cm long, 1–1.5 cm wide, obovate-oblong, rounded or subacute, glandular-hairy, spinous-serrate or dentate, narrowed at the base and greenish-brown in color. Flowers are borne in terminal, solitary, globose, clusters of heads. Heads of flowers are purple, bracts are short

slender and acuminate. In each head, the outer flowers are females, few or many, fertile, the central flowers bisexual, fertile or sterile, involucre narrow, bracts paleaceous, spatulate, acute, ciliate; receptacle small, naked. Corolla of female flowers are purple, slender, tubular, minutely two to three toothed; corolla of hermaphrodite flowers are purplish white, tubular or funnel-shaped, four to five toothed, anther-base sagittate, auricles acute or tailed, style-armed, filiform, sometimes connate. Fruits are oblong and have compressed achenes in which pappus are absent. Odor of herb is slightly aromatic but disappears on long storage.

Microscopic Description: Root - Epidermis single layered, rectangular; secondary cortex composed of oval to tangentially elongated, thin-walled, parenchymatous cells having aerenchyma; secondary phloem composed of thin-walled, oval to polygonal cells, a large number of groups of lignified phloem fibres found scattered in this zone; central portion occupied by lignified, secondary xylem having usual elements; vessels simple pitted; starch grains simple, round to oval with concentric striations and distinct hilum. Measuring 13 to 27 μ in diam, present in secondary cortex. Stem - Epidermis single layered covered with thick cuticle; cortex consisting of 4 to 6 layers of oval to polygonal, thin-walled, parenchymatous cells; endodermis single layers of barrel-shaped cells; pericyclic fibres, lignified arranged in discontinuous ring; secondary phloem narrow, having usual elements; groups of cellulosic fibres found scattered in this zone; secondary xylem composed of usual elements; vessels with spiral thickening or simple pitted; pith very wide composed of oval to polygonal, thin-walled, parenchymatous cells. Leaf-Midrib-epidermis single layered, followed by 4 to 6 layered collenchyma and 3 or 4 layered parenchyma cells present on both surfaces; trichomes both non-glandular and glandular, present on both surfaces, glandular trichomes 2 or 3 cells high, uni or biseriate stalk, having a multicellular head; non-glandular trichomes uniseriate with 2 to 5 cells, vascular bundle 3 or 4, situated centrally having usual elements. Lamina - epidermis single layered having numerous non-glandular and glandular trichomes similar to those present in midrib; mesophyll composed of oval to polygonal thin walled parenchymatous cells and not differentiated into palisade and spongy parenchyma cells, anisocytic stomata present on both surfaces; stomatal index 32 to 38 on lower surfaces, 20 to 29 on upper surfaces; stomatal number 47 to 54 per sq. mm on lower surfaces, 15 to 22 per sq. mm on upper surfaces; vein islet number 20 to 26.

Powder-Greyish-yellow; shows fragments of thin-walled, oval to polygonal aerenchyma cells; thin-walled, sinuous, elongated epidermal cells; small pieces of glandular trichomes; a few anisocytic stomata; vessels with spiral and pitted thickening; fibres short, thick walled, lignified with wide lumen and blunt tips having simple pits; oval to round, elliptic, simple starch grains with centric hilum and striations, measuring 13 to 27 μ in diam.

Part Used: Whole plant, seeds, flowers and roots.

Organoleptic Properties

Rasa (Taste)	: Madhura, Katu, Tikta, Kasaya
Guna (Attribute)	: Laghu
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Medhya, Rasayana, Rucya, Svarya, Vatahara, Visaghna, Kaphapittanuta

Purity and safety test

Total ash	: Not more than 23 % w/w
Acid insoluble	: Not more than 9 % w/w
Water soluble	: Not less than 6 % w/w

Thin Layer Chromatography

: TLC of alcoholic extract of the drug on Silica gel 'G' using Toluene. Ethylacetate (9:1) shows under U.V. (366 nm) two fluorescent spots at R_f 0.54 and 0.76 both green. On exposure to Iodine vapour one spot appears at R_f 0.44 (brown). On spraying with 5% Methanolic-Sulphuric acid reagent and heating the plate for 10 minutes at 105°C five spots appear at R_f 0.20 (violet), 0.25 (blue), 0.44, 0.54 and 0.59 (all violet).

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E. coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 µgm/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, 0.1, 0.5, 0.5 and 0.1 µgm/kg respectively.

Major Chemical Constituents: A sesquiterpene lactone, 7-hydroxyeudesm-4-en-6, 12-olide, and a sesquiterpene acid, 2-hydroxycostic acid, along with the known compounds, β-eudesmol and ilicic acid, have been isolated from the acetone extract of *Sphaeranthus indicus*. Three 7-hydroxyeudesmanolides and two sesquiterpenoids, cryptomeridiol and 4-epicryptomeridiol, have been isolated from this plant. Eudesmanoids such as 11α,13-dihydro-3α,7α-dihydroxy-4,5-epoxy-6β,7-eudesmanolide, 11α,13-dihydro-7α-acetoxy-3β-hydroxy-6β,7-eudesm-4-enolide and 3-keto-β-eudesmol have been isolated from *Sphaeranthus indicus* Linn.

Therapeutic Use: Insanity, tuberculous glands, indigestion, bronchitis, spleen diseases, elephantiasis, anaemia, pain in the uterus and vagina, piles, biliousness, epileptic convulsions, asthma, leukoderma, dysentery, vomiting, urinary discharges, pain in the rectum, looseness of the breasts, hemicrania.

Pharmacological Study: Hypotensive, anxiolytic, neuroleptic, hypolipidemic, immunomodulatory, antioxidant, anti-inflammatory, bronchodilatory, antihyperglycemic and hepatoprotective activities.

Adverse effects and Contraindication: *Sphaeranthus indicus* Linn extract is safe and well tolerated in both oral and topical dosage strengths.

Dosage Form: Powder, decoction and topical paste.

Posology: For internal use, 1-3 gm of powder leaves to be taken daily.

Formulations: Ratnagiri Rasa, Mundi Arka, Vatagajankusa Rasa, Mundi kavatha

Patha

Botanical Name: *Cissampelos pareira* L.

Family: Menisoermaceae

Synonyms:

Bengali: পাঠা (Patha)

Hindi: Akanadi, Patha

Sanskrit: Patha, Ambashtaki

Urdu/Unani: Patha

English: Velvet leaf

Geographical Descriptions: A climbing under shrub with triangular leaves and greenish inflorescence. It is commonly found throughout tropical and subtropical Bangladesh, India, Pakistan, Nepal, Bhutan and Afghanistan. Stem of the plant is used in Ayurveda. The herb is widely found in Bangladesh, India, Sri Lanka and other countries in the Asian subcontinent.

Plant Description: Perennial climbing shrubs with small greenish-yellow flowers; leaves peltate or orbicular-reniform, ovate-subreni form, with truncate cordate base; inedible, dark, grape-sized berries; Flowers unisexual; male flowers with 4–5 sepals, ovate to obovate, hairy outside, greenish or yellowish, corolla cup-shaped, filaments of stamens completely fused; female flowers with 1 sepal, ovary superior, hairy, 1-celled, style thick with spreading, 3-lobed stigma; Fruit a short-hairy, orange to red drupe; Seed horses hoe-shaped; embryo elongate, narrow, embedded in endosperm, cotyledons flattened.



Fig. *Cissampelos pareira* L.

Macroscopic Description: Roots, cylindrical, often tortuous, 1-1.5 cm in diam, light brown to yellowish in colour, surface rough and at places rugged due to transverse wrinkles, cracks and fissures, fracture short and splintery, odour, faint aromatic, taste, bitter

Microscopic Description: Transverse section of root shows, 6-10 layers of thin-walled, rectangular cork cells secondary cortex, 1-3 layered of oval to tangentially elongated cells, discontinuous ring consisting of 2-3 rows of stone cells and group of phloem fibres, stone cells variable in shape with simple pits, vascular strands as radiating strips usually 8-12 of xylem and phloem some reaching up to the centre, phloem consists of small strands of sieve elements and parenchyma just below the ring of stone cells, xylem consists of vessels, tracheids, fibres and xylem parenchyma, vessels and tracheids show simple pits on the walls, xylem parenchyma usually thick-walled and lignified but due to delignification patches of thin-walled parenchyma appear in the xylem region., medullary rays 1-3 seriate appear to be very wide at a number of places due to addition of delignified xylem parenchymatous cells, ray cells thin-walled, a few lignified and thick-walled while some show reticulate thickening, plenty of starch grains present in some of ray cells.

Part used: Roots, stem, leaves

Organoleptic properties:

Rasa (Taste)	: Katu, Tikta
Guna (Attribute)	: Laghu, Tiksna
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Bhagnasandhanakrt, Grahi, Raktasodhaka, Visaghna, Tridosasamana, Stanyasodhana

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 1% w/w
Alcohol soluble extractive	: Not less than 11% w/w
Water soluble extractive	: Not less than 13% w/w

Thin Layer Chromatography

: TLC of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethyl acetate (9:1) shows under U.V. (366 nm) a fluorescent zone at R_f 0.65 (blue). On exposure to Iodine vapor two spots appear at R_f 0.51 and 0.65 (both yellow). On spraying with 50% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C two spots appear at R_f 0.51 and 0.65 (both grey).

Microbial contamination

: In accordance with National guideline and WHO guideline the maximum permissible microbial load of *E.coli*, 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*, *Salmonellae 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.

Major Chemical Constituents: Alkaloids, saponin and quaternary ammonium bases, flavonol and sterol.

Therapeutic Use: Fever, cough, leprosy, sensation, asthma, bronchitis, cystitis, dysuria and lactation disorders, skin disorders, scabies, non-healing ulcers, leprosy, migraine, leucorrhoea and gonorrhoea.

Pharmacological Study: Anti-inflammatory, analgesic, antipyretic, antibacterial, antifertility, anti-diarrheal, anti-diabetic, anti-venom, anti-urolithic, anti-oxidant, anti-ulcer, anti-parasitic, anti-microbial, anti-malarial, anti-dengue, anti-diuretic, anti-cancer, immunomodulators, cardiovascular, neuroprotective, memory enhancing, hepato-protective, muscle-relaxant activity.

Contraindications: It is not recommended for pregnancy and lactation.

Adverse effects: Over-dosages can be twitching pain, nausea & vomiting, diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages form: Powder & decoction

Posology: 3-6 g of the drug in powder form. Decoction-15 to 60 ml

Formulations: Nimbadi Kwath, Usirasav, Chandanasav

Parul

Botanical Name: *Stereospermum suaveolens* (Roxb.) DC.

Family: Bignoniaceae

Synonyms

Bengali: পাৰুল (Parul/ Atkopali)

Hindi: Pad, Padal, Padaria, Padijala

Sanskrit: Abhipriya, Alivallabha, Ambuvasani

Urdu/Unani: Padal

English: Adakapari, Bignonia chelonoides

Geographical Descriptions: *Stereospermum suaveolens* (Roxb.) DC. is a very familiar herb in this sub-continent, especially native to Bangladesh, India and Myanmar. In Bangladesh, it is found in forests of Chittagong, Chittagong hill tracts, and the northern districts.

Plant Description: The length and thickness of the *Stereospermum suaveolens* (Roxb.) DC plant is about 6-9 cm and 1-1.5 cm respectively. Its shape is cylindrical, externally brown to creamy, rough due to vertical fissures, cracks, ridges and transverse fine lenticles, internally dark brown, lamellation of stratification due to presence of concentric bands of fibres. 'Patala' is an ingredient of the reputed dasamula (ten roots) and is used in many important ayurvedic formulations. Saligramanighantu recognizes three types of patala viz. bhumipatala, ksudrapatala and vallipatala. Bhavaprakasa, however has mentioned two types of patala i.e white flowered patala and copper-red flowered or tamrapatala.



Fig. *Stereospermum suaveolens* (Roxb.) DC..

Macroscopic Description: Root occurs in about 6-9 cm long, 1-1.5 cm thick cut pieces, cylindrical, externally brown to creamy, rough due to vertical fissures, cracks, ridges and transverse fine lenticels, internally dark brown, lamellation or stratification due to presence of concentric bands of fibres; fracture tough and fibrous; odour, not distinct; taste, bitter.

Microscopic Description: Root cork consists of 25-35 layers of rectangular cells with 3-5 stratified layers, lignifications being more prominent where the stratification starts, arranged with 1-3 tangential rows of narrow cells alternating with 3-5 tangential rows of wider cells; cork cambium composed of 1-2 layers of tangentially elongated cells; secondary cortex arranged more or less radially, becomes polyhedral to iso-diamic in inner region, a few cells getting converted into stone cells which are regular in shape and show projection; secondary phloem wide, forms ceratenchyma between two obliquely running rays; some rays and phloem cells get converted into irregular, polygonal shaped stone cells, measuring 10-150 μ in width, phloem parenchyma being intact; medullary rays multiseriate, being 3-4 cells wide, and 8-11-15 cells high; fibres tapering, pointed or slightly blunt, with a small peg-like projection at both ends; sieve tube gets collapsed in outer region forming strips of ceratenchyma; a few small microsphenoidal crystals of calcium oxalate present in phloem parenchyma and rays; secondary xylem wide having usual elements; vessels simple, pitted, lignified; fibres large, pointed, aseptate; rays multiseriate, 2-3 cells wide. Powder is dark brown that is shown fragments of rectangular cork and phloem parenchyma cells; groups of single, thick-walled, cubical to rectangular; a number of microsphenoidal crystals of calcium oxalate, intact and scattered outside.

Part Used: Stem bark, leaves and root.

Organoleptic Properties

Rasa (Taste)	: Tikta, Kasaya
Guna (Attribute)	: Laghu, Rooksha
Virya (Potency)	: Anusna
Vipaka (Metabolism)	: Katu
Karma (Action)	: It is tridosahara i.e balances the three doshas

Purity and safety test

Total ash	: Not more than 8 % w/w
Acid insoluble	: Not more than 6 % w/w
Water soluble	: Not less than 20 % w/w

Thin Layer Chromatography

: T.L.C. of the alcoholic extract on Silica gel 'G' plate using n-Butanol: Acetic acid: Water (4: 1 :5) shows in visible light three spots at R_f 0.62, 0.85 and 0.92 (all light yellow). Under UV (366 nm) five fluorescent zones are visible at R_f 0.47, 0.53 (both light blue), 0.62 (bluish pink), 0.74 (blue) and 0.85 (light green). On exposure to Iodine vapour seven spots appear at R_f 0.14, 0.28, 0.47, 0.53, 0.74, 0.85

and 0.92 (all yellow). On spraying with 5% Methanolic Phosphomolybdic acid reagent and heating the plate for ten minutes at 110°C four spots appear at R_f 0.47, 0.74, 0.85 and 0.92 (all bluish grey).

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E.coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 µgm/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, 0.1, 0.5, 0.5 and 0.1 µgm/kg respectively.

Major Chemical Constituents: P-coumaric acid, triacontanol, 3-cetyl alcohol, oleic, palmitic, stearic acid, lapachol, dehydroalpha-lapachone and dehydrotectol in root heartwood; β-sitosterol and n-triacontal in root bark.

Therapeutic Use: Anorexia, difficulty in breathing, anasarca, piles, vomiting, hiccough, thirst, bleeding diseases, diarrhea, and blood diseases etc

Pharmacological Study: Anti-inflammatory, anticancer, hepatoprotective, antihyperglycemic and antioxidant activities.

Adverse Effects: For acute toxicity, an LD₅₀ dose of 2000 mg/kg and above is categorized as unclassified.

Precautions: Precaution should be taken in concomitant use of hypoglycemic, anti-diuretic drugs. Electrolyte imbalance patients should not take the *S. suaveolens*.

Dosage Form: Powder or decoction. Package in well closed and light resistant containers.

Posology: Powder: 5-10 gm per day and decoction 25-50 ml per day orally.

Formulations: Amritarisha, Dasamularishta, Dasamula Kath.

Rheuchini

Botanical Name: *Rheum emodi* Wall

Family: Polygonaceae

Synonyms:

Bengali: রেউচিনি (Rheuchini)

Hindi: Dolu. Revandchini

Sanskrit: Gandhini, Revatchini, Pita, Amlaparni

Urdu/Unani: Rewand chini

English: Indian rhubarb

Geographical Descriptions: *Rheum emodi* is a stout herb, endemic to the Himalayan region distributed in the temperate and subtropical region of India, Bangladesh and Srilanka. It grows in the alpine zone on rocky soils, moraines and cervices. *Rheum officinale* and *R. palmatum* are cultivated in China (Gansu, Sichuan, and Qinghai provinces), the Democratic People's Republic of Korea and the Republic of Korea. There are several commercial grades (rhizome with or without rootlets, peeled or unpeeled, in transverse or longitudinal cuts).

Plant Description: It grows at 2500– 4000 m in the Himalayas. The root should be 3 years old prior to harvesting. Originally imported from China and Tibet as *Rheum palmatum* and *officinale*, the Indian species is *Rheum australe*. Suitable for short-term use only as it can cause habituation of the bowel.



Fig. *Rheum emodi* Wall

Macroscopic Description: *Rheum emodi* is a leafy perennial herb, 1.5-3.0 m in height. Roots are very stout and radical leaves long-petioled, very large, often 60 cm in diam, orbicular or broadly ovate obtuse, base cordate 5-7 nerved, papillose beneath, subscaberulous above; petiole 30-45 cm, very stout, scaberulous. Panicle is 0.6-0.9 m, papilloselypuberulous, fastigiately branched and leafy with erect strict branches; flowers small 3 mm diam, dark purple or pale red, in axillary panicles. Fruit ovoid-oblong, 13 mm long, purple, base cordate, apex notched, wings narrower than the disk. Roots and rhizomes are the main parts used as drug and are collected in October to November. Root of Indian Rhubarb is darker, inferior in aroma, coarser and untrimmed, is not decorticated. Fresh rhizome is 6 to 12 inches long, and the freshly fractured surface is dull orange to yellowish brown

Microscopic Description: The transverse section of the rhizome shows wavy medullary rays, 2-4 cells in width; the xylem consists of a matrix of wood parenchyma and resembles the phloem and cortex regions in that the cells possess starch, tannin, or large cluster crystals of calcium oxalate. Large, reticulately thickened vessels occur singly or in small groups. Embedded in the parenchyma near the cambium line and mostly in the pith are a number of compound ("stellate") fibrovascular bundles, each of which consists of a small circle of open collateral bundles separated from each other by yellowish brown medullary rays containing anthraquinone derivatives. The bundles differ from the ordinary open collateral bundle in showing phloem inside and xylem outside the cambium. In *R. officinale* the compound bundles ("stellate spots") are scattered through the pith, whereas in *R. palmatum* they are mostly arranged in a ring, the remainder being scattered on either side of the ring. Powdered plant material Powdered Rhizoma Rhei is dusky yellowish orange to moderate yellowish brown, and coloured red in the presence of alkali. Under the microscope, it shows numerous starch grains, spherical, single or 2-4 compound, 2-25 µm in diam; fragments of non-lignified, reticulate and spiral tracheae, vessels, parenchyma cells containing starch grains or tannin masses; large rosette aggregates of calcium oxalate, 30-60 µm, frequently over 100 µm, and occasionally attaining a diam of 190 µm; and medullary-ray cells containing an amorphous yellow substance, insoluble in alcohol.

Part Used: Underground stem and roots.

Organoleptic Properties

Rasa (Taste)	: Katu, Tikta
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphapityasamaka

Purity and safety test

Total ash	: Not more than 12% w/w
Acid insoluble	: Not more than 2% w/w
Water soluble	: Not less than 30% w/w

Thin Layer Chromatography

: Both of the extracts i.e methanolic and aqueous were checked by thin layer chromatography. For methanolic extract solvent system were selected was chloroform: methanol (80:20) and for aqueous extract methanol: water: formic acid (18:9:1). After performing TLC of both the extracts, R_f values were calculated for the spots which were seen under U V illumination. The R_f values were:

Plant extract	Solvent system	R_f values
Aqueous extract	Methanol:H ₂ O:Formic acid(18:9:1)	0.38,0.58
Methanolic extract	chloroform: methanol (80:20)	0.65, 0.712, 0.75

Microbial Contamination

: The test for *Salmonella* spp. in *Rhizoma Rhei* products should be negative. The maximum acceptable limits of other microorganisms are as follows. For preparation of decoction: aerobic bacteria not more than 10⁷/g; fungi not more than 10⁵/g; *Escherichia coli* not more than 10²/g. Preparations for internal use: aerobic bacteria not more than 10⁵/g or ml; fungi not more than 10⁴/g or ml; enterobacteria and certain gram-negative bacteria not more than 10³/g or ml; *Escherichia coli* 0/g or ml.

Heavy Metals

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

Pesticides Residues

: To be established in accordance with national requirements. Normally, the maximum residue limit of aldrin and dieldrin in *Rhizoma Rhei* is not more than 0.05 mg/kg.

Major Chemical Constituents: *Rheum emodi* possess a number of phytoconstituents and these are: anthraquinones, anthrones, stilbenes, oxanthrone ethers and esters, flavonoids, lignans, phenols, carbohydrate and oxalic acid. The most common constituents of *Rheum emodi* are anthraquinone and stilbene. Anthraquinones include rhein, chrysophanol, aloe-emodin, emodin, physcion (emodinmonomethyl ether), and chrysophanein and emodin glycoside. Stilbene includes picetannol, resveratrol and their glycosides. Different derivatives of oxanthrone include oxanthrone ether (revandchinone-4), oxanthrone esters (revandchinone-1 and revandchinone-2), and revandchinone-3. Other complex compounds have also been reported, including torachryson 8-O-b-

D-glucoside, sulfated anthraquinone glycoside sulfemodin 8-O-b-D-glucoside b-asarone and rhein 11-O-b-D-glucoside. Tannins are also present in rhubarb which includes hydrolysable tannins, containing ester or glycosidic bonds composed of gallic acid, glucose and other monosaccharides and condensed tannins, derived primarily from the flavone derivatives catechin and leucocyanidin.

Therapeutic usages: Constipation, indigestion, diarrhea, cough, asthma, haemoptysis, headache, migraine, paralysis, bruises, muscular pain, skin problems and menstrual disorder, retention of urine, swelling and inflammation, sciatica freckle and other skin marks.

Pharmacological study: Anticancer, antioxidant, anti-inflammatory, antimicrobial, antifungal, antidyslipidemic, antiplatelet, antidiabetic, antiulcer, hepatoprotective, immunoenhancing and nephroprotective activities.

Adverse effects and Contraindication: The aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected 1/8th and 1/4th of 2000 mg/kg i.e.250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Contraindication: It is contraindicated in pregnancy and breast-feeding as emodin is excreted through the breast milk and vata-type of diarrhoea with weakness, gout due to oxalic acid content. Use with caution in intestinal inflammation; never use in intestinal obstruction with abdominal pain of unknown origin. Rhubarb should not be administered to patients with intestinal obstruction and stenosis, atony, severe dehydration states with water and electrolyte depletion, or chronic constipation, inflammatory intestinal diseases, such as appendicitis, Crohn disease, ulcerative colitis, or irritable bowel syndrome, or in children less than 10 years of age. As with other stimulant laxatives, rhubarb is contraindicated in patients with cramps, colic, haemorrhoids, nephritis, or any undiagnosed abdominal symptoms such as pain, nausea, or vomiting.

Dosage form: Powder, decoction.

Posology: 0.5 gm is astringent and constipating, 1gm is laxative, more than 3 gm is purgative and it is also haemostatic when used at up to 9 gm per day in a decoction. Use of Rhizoma Rhubarb for children under 10 years of age is contraindicated.

Formulations: Kankayan Bati, Panchamoola Taila

Rakhal Shasa

Botanical Name: *Citrullus colocynthis* Schrad.

Family: Cucurbitaceae

Synonyms:

Bengali: মাখাল/রাখাল শ্বাস (Rakhal Shasa)

Hindi: Dolu. Indrayana

Sanskrit: Indravarunika, Indravalli

Urdu/Unani: Hanzal, Indrayan

English: Colocynth, Bitter Apple

Geographical Descriptions: Bitter apple is indigenous to Turkey and southern Mediterranean countries. It grows in warmer and tropical regions. The plant grows up to the 1500 m above the sea level, the sandy loam, sub desert soil and sandy sea coasts. It is found in India, Pakistan, Sri Lanka, Egypt, Syria and the Arabian Gulf.

Plant Description: The Ayurvedic name of bitter apple is indravaruni. It is botanically identified as *Citrullus colocynthis* Linn. belongs to Cucurbitaceae family. The drug is perennial climber and is documented to possess beneficial effects as purgative, vermifuge, blood purifier, eradicates tumor in stomach, ascites, menstrual disorders etc. It tends to control kapha and pitta doshas. Characteristically its fruit is very poisonous.



Fig. *Citrullus colocynthis* Schrad.

Macroscopic Description: Flower and Fruit-The flowers are yellow and appear singly in the leaf axils. The fruit is about the size of an apple. It is yellow, smooth, dry and very bitter. When ripe, the fruit contains white spongy flesh within the coriaceous peel, with numerous ovate, white or brownish seeds. The seeds are 0.75 cm long and 0.5 cm wide, ovate, compressed, without an edge, oily and somewhat shiny.

Leaves Stem and Root-Bitter apple is an annual similar to a watermelon plant. The stems are leafy and rough-haired. The leaves are alternate on long petioles. They are triangular, divided, variously indented, obtuse and pubescent. The upper surface is delicate green, the lower surface rough and pale.

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. Root-Mature root shows wavy outline consisting of 6-10 layers of rectangular, thick walled, tangentially elongated cork cells, a few filled with dark brown contents; secondary cortex consists of 10-15 layers of elliptical, tangentially elongated, thin walled, parenchymatous cells; secondary phloem a narrow-zone, composed of sieve elements, parenchyma and medullary rays; xylem forms bulk of root, consisting of vessels, fibres, parenchyma and medullary rays; vessels mostly solitary or in groups of two to four having reticulate and spiral thickenings; fibres aseptate, thick-walled, pitted, elongated with pointed ends, lying around vessels; medullary rays poorly developed and uniseriate; starch grains oval to round in shape 2.5-7.5 μ in diam mostly simple or rarely compound having 2-3 components, found scattered throughout but more abundantly in phloem parenchyma. Powder - Coarse, 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: Dried pulp and root.

Organoleptic Properties

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

Purity and Safety test

Total ash : Not more than 18 % w/w

Acid insoluble : Not more than 6 % w/w

Water soluble : Not less than 18 % w/w

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 R_f. 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 R_f. 0.61 (green), 0.75 (green), 0.83 (grey) and 0.94 (grey).

Microbial Contamination

: The test for *Salmonella* spp. in *Rhizoma Rhei* products should be negative. The maximum acceptable limits of other microorganisms are as follows. For preparation of decoction: aerobic bacteria not more than 10⁷/g; fungi not more than 10⁵/g; *Escherichia coli* not more than 10²/g. Preparations for internal use: aerobic bacteria—not more than 10⁵/g or ml; fungi not more than 10⁴/g or ml; enterobacteria and certain Gram-negative bacteria—not more than 10³/g or ml; *Escherichia coli* 0/g or ml.

Heavy Metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels will not be more than 10, 0.5 and 0.3 mic. gm/kg, respectively.

Pesticides Residues

: To be established in accordance with national requirements. Normally, the maximum residue limit of aldrin and dieldrin in *Rhizoma Rhei* is not more than 0.05mg/kg. For other pesticides, see WHO guidelines on quality control methods for medicinal plants and guidelines for predicting dietary intake of pesticide residues.

Major Chemical Constituents: Its pulp contains certain chemical agents like colocyntin, certain fixed or stable oils, resins that are not soluble in ether, sticky substances that is, gums, pectin, certain minerals like Ca and Mg. Traces of magnesium phosphate have also be seen. Lignin is also present. Their active ingredients are phytosterol glycoside, elaterin, albuminoids. It also contains bitter

substance colocynthin and colocynthenin. Seeds contain phytosterolin. Two phytosterols and hydrocarbons, polysaccharides and glycosides are present. It also contains anti tumeruos agents like cucurbitacin B and cucurbitacin E.

Therapeutic Use: Insanity, jaundice, indralupta, variscose vein, piles, ascites and enlarged abdomen of children.

Pharmacological Study: Antioxidant, antidiabetic, antimicrobial, anticancer, anti-inflammatory, analgesic, gastrointestinal, reproductive etc.

Adverse Effects: The drug is severely poisonous. It has a strongly irritating (and painful) effect on mucous membranes due to its cucurbitacin glycoside content, out of which cucurbitacins are released in watery environments. Vomiting, bloody diarrhea, colic, and kidney irritation follow the intake of toxic dosages (0.6 to 1 gm), and then increased diuresis that progresses 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.

Contraindication: Strongly contraindicated in enteritis, diarrhea, liver impairment, children, weak person and kidney diseases. *C. colocynthis* is abortifacient; thus, it is contraindicated during pregnancy.

Dosage Form: Powder and Taila.

Posology: Fruit powder: 125-500 mg, Root powder: 1-3 gm and Fruit juice: 10-20 ml.

Formulations: Abhayarista, Rodhrasava, Mritasanjivani Sura

Shefali/Sheuli

Botanical Name: *Nyctanthes arbor-tristis* L.

Family: Oleaceae

Synonyms

Bengali: শিউলি/শেফালি (Shefali, Sheuli)

Hindi: Harsingar

Sanskrit: Parijatha, Sephalika

Urdu/Unani:

English: Night jasmine

Geographical Descriptions: *Nyctanthes arbor-tristis* is native to India, distributed widely in sub-Himalayan regions and Southward to Godavari. It is also widely distributed in all over Bangladesh, Indo-Pak subcontinent and South-East Asia, tropical and sub-tropical South East Asia. It grows in Indo-Malayan region and distributed across Terai tracts as well as Burma and Ceylon. It tolerates moderate shade and is often found as undergrowth in dry deciduous forests. It is also found in Thailand.

Plant Description: *Nyctanthes arbor-tristis* ‘a night flowering sad tree’ of family Oleaceae is well known in Bangladesh, India and its neighboring countries as one of the most versatile medicinal plants having a wide spectrum of biological activities and is widely cultivated in tropical and subtropical regions all over the world. It is a terrestrial woody perennial having life span of 5-20 years. It is usually a shrub or a small tree having brilliant, highly fragrant flowers, which bloom at night and fall off before sunrise, giving the ground underneath a pleasing blend of white and red. Thus, during the day the plant loses all its brightness and hence is called "Tree of sadness" (*arbor-tristis*). It is also known as Harsinghar, Coral Jasmine, Parijat, queen of the night and night flowering jasmine. Folk people of Tripura predict the weather and rainfall variation through flowering phenology of night flowering jasmine which help them to plan agroforestry activities and disaster prevention.



Fig. *Nyctanthes arbor-tristis* L.

Macroscopic Description: *Nyctanthes arbor-tristis* Linn is a large shrub growing up to 10 m tall, with quadrangular branches and flaky grey rough bark. The leaves are rough, hairy, decussately opposite, simple, 6–12 cm long, 2-6.5 cm broad with an entire margin. The flowers are arranged at the tips of branches terminally or in the axils of leaves and are often seen in clusters of 2-7 together. These are fragrant, sessile, with companulate calyx and a 5-8 lobed white corolla with an orange-red center. Two stamens are inserted near the top of the corolla tube and stigma is obscurely bifid. The petals are snowy white with dewdrops sitting on them and are used for worship. Fruits are flat, compressed, brown, heart shaped to round capsules with 2 sections each containing a single seed. Seeds are exalbuminous, testa are thick, outer layer of large transparent cells is heavily vascularized. Cotyledons are flat and radicle is inferior.

Microscopic Description: The transverse section of leaf passing through the midrib convexly projects on lower side, and slightly grooved with a shallow central elevation on upper side. U-shaped meristele was found, the arms of which reach almost up to the palisade tissue of lamina, which lies in the midrib, leaving wide parenchymatous cortex at lower side and lignified pitted parenchymatous zone in the centre of an arc of xylem. Simple and compound starch grains and occasionally few lignified fibres were present in the pericyclic region. Few layers of collenchyma were laid under both the epidermis, the upper layer located adjacent at the opening of U-shaped xylem. The lower epidermis of midrib bears large number of multiseriate papillose projections. It bears simple covering unicellular trichomes of various sizes containing cystolith at the base. Glandular trichomes with unicellular stalk and bicellular head filled with dark brown content were also present. The cells of upper epidermis of lamina were thick walled somewhat straight and devoid of stomata. The lamina adjacent to the midrib showed two rows of epidermis. The cells of lower epidermis are smaller in size

than that of upper one with sinuous walls at places, cuticle striated and transverse by numerous anomocytic stomata. Both the epidermii are papillose and bear, short and long unicellular trichomes with pointed apex, and multi-cellular spherical head or bicellular head, sessile glandular trichomes with four celled head are also present. Underneath the upper epidermis lie two rows of palisade cells, followed by 7-9 rows of spongy parenchyma traversed by vascular strands and encircled by parenchymatous cells.

Powder Microscopy: Powder microscopy of *Nyctanthes arbor-tristis* showed the fragments of upper epidermis with straight or slightly wavy cells and devoid of stomata. Walls of upper epidermis are found with straight or slightly wavy cells and devoid of stomata. Unlike this, walls of lower epidermis are distinctly sinuous and contain many anomocytic stomata, adjacent epidermal cells of which are with distinctly striated cuticle, simple, covering, warty, thick walled trichomes of various sizes, embedded with cystolith at the base; glandular trichomes are with unicellular stalk, bicellular head and sessile trichomes with 4 celled head. Fragments of lamina showing epidermis and rows of palisade cells, Fragments of lamina showing epidermis and rows of palisade cells.

Part Used: Leaves and bark.

Organoleptic Properties

Rasa (Taste)	: Tikta
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphavata shamaka

Purity and Safety test

Total ash	: Not more than 14.4% w/w
Acid insoluble	: Not more than 4.7% w/w
Water soluble	: Not less than 10.5% w/w

Thin Layer Chromatography

: Preparation of sample solution: An accurately weighed 0.1gm of dried leaves powder was extracted in 10 ml of methanol, warmed at 70°C temperature for 30 minutes and kept overnight in sealed mouth for total extraction. Then it was filtered using whatmann no. 1 in a dry 50 ml volumetric flask and the volume was made up to the mark with methanol to get a sample of 2000 ppm.

Preparation of standard solution of Nyctanthoside: 5mg of nyctanthoside was dissolved in methanol and solution was transferred to a 50 ml volumetric flask quantitatively and diluted up to the mark with methanol to obtain 100 ppm solution.

Plant extract contain the same nyctanthoside (R_f 0.55) as in track. Further the sample track) and standard track were scanned at 254 nm and the scanned picture showed the same R_f value 0.55 for nyctanthoside in both the track. Finally, this nyctanthoside band in both the track which came at 0.55 R_f were scanned at their maximum 310 nm. The spectral pattern for nyctanthoside in extract matched with the standard track. Thus the presence of nyctanthoside was confirmed by overlaying the UV spectra.

Microbial Contamination

: The test for *Salmonella spp.* in Rhizoma Rhei products should be negative. The maximum acceptable limits of other microorganisms are as follows. For preparation of decoction: aerobic bacteria not more than 107/g; fungi not more than 105/g; *Escherichia coli* not more than 102/g. Preparations for internal use: aerobic bacteria not more than 105/g or ml; fungi not more than 104/g or ml; enterobacteria and certain Gram-negative bacteria not more than 103/g or ml; *Escherichia coli* 0/g or ml.

Heavy Metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels will not be more than 10, 0.5 and 0.3 $\mu\text{g}/\text{kg}$, respectively.

Pesticides Residues

: To be established in accordance with national requirements. Normally, the maximum residue limit of aldrin and dieldrin in Rhizoma Rhei is not more than 0.05mg/kg.

Major Chemical Constituents: Phytosterols, phenolics, tannins, flavonoids, glycosides and saponins. The secondary metabolites such as glycosides and alkaloids are the largest groups of chemicals produced by this plant. The glycosides are iridoid glycosides and phenylpropanoid glycosides. Iridoid glucosides, arbortristoside A, B, D and E have been isolated from the seeds. Iridoid glycosides in the leaves are 6, 7-di-O-benzoyl nyctanthoside, 6-O-trans-cinnamoyl, β -hydroxyloganin and 7-O-trans-cinnamoyl-6 β -hydroxyloganin and desrhamnosylverbascoside, which possess anti-inflammatory and anti-pyretic activities.

Therapeutic Use: Fever, enlargement of the spleen, malaria, blood dysentery, cough gastritis, infection of scalp, piles and skin diseases.

Pharmacological study: Hair tonic, hepatoprotective, anti-leishmaniasis, anti-viral, antifungal, anti-pyretic, anti-histaminic, anti-malarial, anti-bacterial, anti-inflammatory and anti-oxidant activities.

Adverse Effects: Any sign of toxicity or abnormality at the doses of 50–3000 mg/kg. No abnormal behavior or body weight changes were observed for a period of 7 days. The LD₅₀ is more than 3000 mg/kg. Mild sedation and CNS depression may occur at large dose.

Contraindication: Concomitant use of anxiolytic, CNS depressant like phenobarbitone and diuretic agents.

Dosage Form: Powder and Juice.

Posology: Powder 1–3 gm, Juice 10-20 ml.

Formulations: Bala taila, Aswhagandarista and Amritarista.

Somalatha

Botanical Name: *Sarcostemma acidum* Voigt

Family: Asclepiadaceae

Synonyms

Bengali: সোমলতা (Somalatha)

Hindi: Somlata

Sanskrit: Somavalli, Somalataa

Urdu/Unani:

English: Moon Plant

Geographical Descriptions: The plant is found in India, Pakistan, Bangladesh and Europe. In India, it is mainly found in Bihar, West Bengal and many places of South India in dry rocky places at an altitude of 1350 m. It was also distributed widely over tropical and subtropical areas of Africa, America and Asia.

Plant Description: *Sarcostemma acidum* Roxb. Voigt is a xerophytic plant of the family Asclepiadaceae. Plant is locally known as Khair, Soma and Somavalli. It is a traditional medicinal plant categorized as a member of soma plants used to prepare Somras. This plant is almost leafless, straggling, jointed shrub with many branches. Plant grows in open sun light on rockysandy soil in arid and semi-arid areas with low rainfall. The condition of shade and high moisture is preferable. As per geographical indications, flowering of the plant occurs during summer and fruiting in October. It was propagated through seed.



Fig. *Sarcostemma acidum* Voigt

Macroscopic Description: It is a perennial leafless, jointed trailing shrub, fleshy glabrous, twining branches having milk white latex, leaves reduced to scales, opposite, color-green, shape-cylindrical, length 2 to 4 m, diam of stem 0.5 to 1 cm; Root-depth only 5 to 8 inch with 3 to 5 sub root branches, color-brownish; Flower sactinomorph, color-white or pale greenish white, odorfragnant, in umbels

on branch extremities, diam 0.8 to 1cm. sepals (5), petals (5) attached with androceium (stamens 5), gynoecium (ovary 2), androecium and gynoecium are attached with the help of stigma.

Microscopic Description: Stem-Transverse section of *Sarcostemma acidum* showed three parts 1. Outer layer 2. Cortex 3. Vascular bundles. Outer most layer of stem (Epidermis) was seen as a thick single cell layer. Collenchymal cells in 2 to 3 layers were found underneath the epidermis, it similar to parenchymal cells. Thin walled polyhedral parenchymal cells were arranged in 5 to 6 layers without intracellular space. A single layer of endodermis cells were seen separating cortex and vascular bundles. Vascular bundles were seen in ring shape and cambium cells layers (2 to 3) were arranged separating phloem and xylem tissues. Starch grains were also present near phloem tissues. Medullary rays and pith were found to make central part of stem. Root-Transverse section of *Sarcostemma acidum* showed three parts 1. Outer most layer 2. Cortex 3. Vascular bundles. Outer most layer 'cork' was thick walled and rectangular shape parenchymal cells layers (5 to 6) were seen underneath the cork which made cortex of root. Phloic fibers and ploem were arranged under parenchyma. Cambium layers were seen separating phloem and xylem. Xylem was scattered in between conjunctive tissues and covered large part of vascular bundles. Absence of pith and presence of secondary growth in root were also seen. Bark Anomocytic or Ranunculaceous type stomata were found in longitudinal section of bark. Two guard cells and five subsidiary cell were clearly seen.

Part Used: Whole plant.

Organoleptic Properties

Rasa (Taste)	: Kashaya
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphvata shamaka (Reduces vitiated kapha and vata doshas.)

Purity and Safety test

Total ash	: Not more than 12.12% w/w
Acid insoluble	: Not more than 4.5% w/w
Water soluble	: Not less than 12.4% w/w

Thin Layer Chromatography

: Extraction process: The powdered drug was homogenized with methanol: water (4:1) for 30 minutes and filtered, the filtrate was acidified (dilute sulphuric acid) and extracted exhaustively with chloroform then got two layer (acidic & chloroform) after 10 minutes the chloroform layer was separated with separating funnel and examined under thin layer chromatography.

Solvent system: Firstly, TLC was performed in pure solvents based on trial and error method. Then different combinations of solvent systems were tried for best separation of constituents. By optimization of the solvent system, chloroform: methanol (9:1) was found the best system for the resolution of various components.

Observation and interpretation of chromatogram: The spots produced were observed in daylight, under short and long wavelength of ultraviolet light. RF values of spots were 0.48, 0.60 and 0.77 respectively.

Microbial Contamination

: The test for *Salmonella spp.* in Rhizoma Rhei products should be negative. The maximum acceptable limits of other microorganisms are as follows. For preparation of decoction: aerobic bacteria not more than 10⁷/g; fungi not more than 10⁵/g; *Escherichia coli* not more than 10²/g. Preparations for internal use: aerobic bacteria not more than 10⁵/g or ml; fungi not more than 10⁴/g or ml; *enterobacteria* and certain Gram-negative bacteria not more than 10³/g or ml; *Escherichia coli* 0/g or ml.

Heavy Metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels will not be more than 10, 0.5 and 0.3 mic. gm/kg, respectively.

Pesticides Residues

: To be established in accordance with national requirements. Normally, the maximum residue limit of aldrin and dieldrin in Rhizoma Rhei is not more than 0.05mg/kg.

Major Chemical Constituents: Plant contains many important phytochemicals such as malic acid, succinic acid, reducing sugars, α and β -amyrins, lupeol and lupeol-acetate, and β -sitosterol. It has four lignans, sacidumlignans A–D, and two degraded lignan derivatives, sacidumols A and B, pinoresinol, 9 α -hydroxypinoresinol, perforatic acid, and peucenine-7-O-methyl ether, isolated from the ethanolic extract of the whole plant of *S. acidum*. Among these, sacidumlignan A showed moderate antimicrobial activity against two Gram-positive bacteria in vitro.

Therapeutic Use: Snake bite, rabies, emesis, mental diseases, sinusitis, rhinitis and leprocy. Latex is applied on wounds and cuts. Stem is effective in bronchodialator, vasodilator, anti-asthmatic, rheumatism, gout and obesity. The plant stem is used to cure bone fracture.

Pharmacological Study: Antimicrobial, anti-inflammatory, antifertility, anti-ulcer, anxiolytic, antipsychotic, and central nervous system inhibitory

Adverse Effects: There is no potent oral toxicity. There may be a little bit chance of reducing sperm motility and density in male.

Contraindication: Act as agood antifertility agent by reducing sperm motility and density and 80%. So contraindicated in pregnancy or who are trying to conceive. and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected 1/8th and 1/4th of 2000 mg/kg i.e.250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage Form: Powder and Kath.

Posology: Fruit powder 125-500 mg, Root powder 1-3 gm and Fruit juice 10-20 ml.

Formulations: Somras

Somaraaj

Botanical Name: *Centratherum anthelminticum* (L.) Kuntze

Family: Asteraceae

Synonyms

Bengali: সোমরাজ (Somaraaj)

Hindi: Karjiri, Somaraaji

Sanskrit: Aranya-Jiraka, Vanajiraka, Kaalijiri, Karjiri. Somaraaji

Urdu/Unani: Kamoonbarri

English: Purple Flea-bane, Achenes

Geographical Descriptions: It is found throughout India up to an altitude of about 500 m. More common in waste places near habitations.

Plant Description: *Centratherum anthelminticum* is an annual, erect and leafy plant. It is commonly known as kalijiri. *Vernonia anthelmintica* and *Conyza anthelmintica* are the scientific synonyms of this plant. Locally, the plant is known as black/bitter cumin, or kalijiri in India. The plant is an erect, pubescent, annual herb which can grow up to 90 cm in height. Kalijiri is often confused with black caraway or black cumin seeds (Kala Jeera). According to Ayurveda texts, Kala jeera is also called krisna jeerak which belongs to seeds of *carum bulbocastanum* plant. However, they both have similar benefits in some extent, but both are different seeds of different plants and have a significant difference in health benefits. In skin diseases kalijira is more beneficial than kala jeera.



Fig. *Centratherum anthelminticum* (L.) Kuntze

Macroscopic Description: Fruits are oblong cylindrical with flatten hairy apex and cap like base; 4.5-6 mm in length and about 1 mm in diam. Fruits consists 10 ridges and abundant small cream silky hairs on outer surface. Externally fruits are brownish-black with extremely bitter taste and characteristic odour.

Microscopic Description: Transverse section of fruit shows a well differentiated pericarp, testa and endosperm. Pericarp consists of an external single layer of epicarp, a large parenchymatous mesocarp and single layer of endocarp. Epicarp consists of single layer of parenchymatous cells with abundant unicellular pointed trichomes mainly on ridges and sessile glandular trichomes with reddish orange secretion. Mesocarp consists of transparent compactly pack parenchyma embedded with vascular bundles below each ridge, yellow colored bunch of collenchymatous cells and wavy band of thick walled sclereids. Endocarp consists of single layer of thick walled cells. Testa is represented by two layers, outer integument with beaker shaped cells and inner integument with thin wall transparent parenchymatous cells. Endosperm forms the bulk of the testa and lies within. Compactly pack polygonal endosperm cells contain abundant oil secretion, also presence of aleurone grains.

Powder Microscopy: The fine powder was mounted in glycerin as well as stained (phlorogucinol + Concentrated HCL). Observation of microscope showed presence of unicellular pointed trichomes, sessile glandular trichomes, yellow collenchymatous cells, lignified fibres, abundant oil globules, brown testa cells, compact polygonal transparent endosperm cells, xylem vessels and so on.

Part Used: Seeds and fruits

Organoleptic Properties

Rasa (Taste)	: Katu, Tikta
Guna (Attribute)	: Laghu, Rooksha
Virya (Potency)	: Anusna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Tridoshahara

Purity and Safety test

Total ash	: Not more than 4.8% w/w
Acid insoluble	: Not more than 4% w/w
Water soluble	: Not less than 4.9% w/w

Thin Layer Chromatography : TLC studies of the petroleum ether (40-60°C), chloroform and ethanol extracts were carried out in various solvents at 30°C using Silica gel G as adsorbant. Rf value of Petroleum ether, Chloroform and ethanol are 6.189, 5.900 and 5.686 respectively.

Microbial Contamination : In accordance with national and WHO guideline the maximum permissible microbial load of *E. coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 µgm/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, 0.1, 0.5, 0.5 and 0.1 µgm/kg respectively.

Major Chemical Constituents: *Centratherum anthelminticum* has been investigated for its bioactive compounds and more than 120 compounds were identified, ranging from fatty acid, sterols, sesquiterpene lactones, carbohydrates and flavonoids.

Therapeutic Use: Cough diarrhea, tonic, alterative, helminth, skin diseases, ulcers, leucoderma and fevers.

Pharmacological Study: Anti-inflammation/anti-pyretic, anti-helminthic, anti-viral, insecticidal, anti-microbial, anti-filarial, anti-cancer, anti-diabetic, diuretic, melanogenesis and wound healing activities.

Adverse Effects: In adults, if dosage is less than 1 gm per day taken in divided dose, then it does not cause any side effects, but when its dosage increases, its emetic action also increases, which result in nausea, vomiting, dizziness and stomach cramp (rare, but occur with dosage more than 3 gm twice daily).

Contraindication: It is contraindicated in diabetics, hepatorenal disturbances and pregnancy. According to Ayurveda, it has strong katu rasa and usna virya which is not suitable for pregnancy. But it is likely to be safe during lactation.

Dosage form: Powder, oil or decoction.

Posology: Powder: Infants and children: 10 mg/kg b.w/day but total dose should not exceed 1 gm/day. In adult: 500 mg to 2 gm twice daily. Lactation: 250-500 mg twice daily. Maximum possible dose 4 gm in divided dose.

Formulations: Somraj oil

Swarnalata

Botanical Name: *Cuscuta reflexa* Roxb.

Family: Convolvulaceae

Synonyms

Bengali: স্বর্ণলতা (Swarnalata)

Hindi: Amarbel

Sanskrit: Swarnalateea, Amaravali

Urdu/Unani:

English: Beggar weed, Lady's lace

Geographical Descriptions: *Cuscuta* is found in the temperate and tropical regions of the world with huge species diversity in tropical and subtropical regions. It is usually found in all over Bangladesh. It is found up to an altitude of 2348 m. It is also found in India, Afghanistan, Malaysia, Nepal and Thailand. It grows on thorny, non-thorny and other shrubs, sometimes completely covering bushes and trees. *Cuscuta reflexa* spread from one host to another, and on special branching organs called houstonia.

Plant Description: *Cuscuta reflexa* is an extensive climber parasite. It occurs throughout the plains of Bangladesh and India. It has no chlorophyll and cannot make its own food by photosynthesis. Some research studies say that the plant has very low levels of chlorophyll and can slightly photosynthesize. But other species of *Cuscuta* are entirely dependent on the host plants for nutrition. The stem is thread like filaments it begins to grow and attach themselves to nearby host plants. The nature plants live its entire life without attachment to the ground. It has long history of ethnomedicinal use. *Cuscuta* is a genus of about 100–170 species.



Fig. *Cuscuta reflexa* Roxb.

Macroscopic Description: *Cuscuta reflexa* is a parasitic climber with slender stems and branches. Stems are very long, rather stout, closely twining, branched, glabrous, pale greenish yellow, sometimes dotted with red. Flowers solitary or in umbellate clusters of 2- 4 or in short racemes; pedicels short, glabrous, usually curved (rarely 0), bracts 1.5 mm. long, ovate-oblong, obtuse fleshy. Calyx divided

almost to the base, lobes 3 mm. long, slightly unequal, broadly ovate, obtuse, glabrous and fleshy. Corolla white; tube 6-8 by 4 mm. almost cylindrical; lobes 2.5-3 mm. long, deltoid, acute, reflexed; scales almost at the base of the corolla-tube, large, oblong, sub quadrate or somewhat obovate, fimbriate and incurved at the apex. Stamens in the throat of the corolla-tube; filaments scarcely any; anthers about ½ exerted beyond the top of the corolla-tube. Ovary ovoid; style simple, very short and thick; stigmas 2, distinct, large thick and fleshy, 1.5 mm. long, ovoid. Capsules 6-8 mm. diam, depressed globose, glabrous, circumscissile near the base. Seeds 2-4, large, black, and glabrous.

Part Used: Whole plant.

Organoleptic Properties

Rasa (Taste)	: Kasya, Tikta
Guna (Attribute)	: Picchila
Virya (Potency)	: Sita
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphapittasamaka

Purity and Safety test

Total ash	: Not more than 15% w/w
Acid insoluble	: Not more than 3% w/w
Water soluble	: Not less than 50% w/w

Microbial Contamination

: In accordance with national and WHO guideline the maximum permissible microbial load of *E. coli*, total yeast and mould count, total *enterobacteriaceae* will 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*, *Salmonellae 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 will not be more than 10, 0.5 and 0.3 µgm/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, 0.1, 0.5, 0.5 and 0.1 µgm/kg respectively.

Major Chemical Constituents: Cuscutin, quercetin, amarbelin, amino acids, cuscutaline, scoparone, melanettin, hyperoside, aromadendrin, taxifolin, astragalin, myricetin, kaempferol, apigenin 7-O-glucoside, luteolin, quercetin, 6,7-dimethoxy-2H-1 benzopyran-2-one, 3-(3,4-dihydroxyphenyl)-2-propen-1-ethanoate, 6,7,8-trimethoxy-2H-benzopyran-2-one, 3-(4-O- β -D-glucopyranoside-3,5-dimethoxyphenyl)-2-propen-1-ol β -sitosterol, α -amyirin, β -amyirin, β -amyirin acetate, α -amyirin acetate, oleanolic acetate, oleanolic acid, lupeol, 3 β -hydroxyolean-12-enetriecanoate and heptadecanoate, coumarin, 3,4-O-dicaffeoylquinic acid, 3-O-caffeoylquinic acid, D-mannitol, myricetin 3-O- α -rhamnoside. Dulcitol, laurotetanine (alkaloid) it creates convulsion, if used in a large quantity then cause death. Dulcitol, sitosterol, carotenoids, flavonoids, violaxanthin, lutein, lycopene, carotene, α -cryptoxanthin, choline kinase, benzofuran 2, 3, dihydro, 2-methoxy-4-vinylphenol and 2-propenoic acid, 3-(4-hydroxyphenyl)-methyl ester.

Therapeutic Use: Constipation, flatulence, liver complaints, bilious affections, hair growth promoter, tonic, diaphoretic and demulcent.

Pharmacological Study: Antihypertensive, antidiabetic, antioxidant, hair growth promoting, antimicrobial, spasmolytic, antitumor, anti-arthritic, nephroprotective, antiviral, anti-inflammatory, antipyretic etc.

Adverse Effects: Health risks or side effects following the proper administration of designated therapeutic dosages are not recorded. It is conceivable that the drug triggers intestinal colic in cases of over dosage.

Contraindication: The acute toxicity study conducted for aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected 1/8th and 1/4th of 2000 mg/kg i.e. 250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage Form: Decoction.

Posology: 10–20 ml Juice

Formulations: Akashvalli Arka

Shyonak/Shona

Botanical Name: *Oroxylum indicum* L.

Family: Bignonaceae

Synonyms

Bengali: শ্যোনাক (Shyonak)

Hindi: Sonapatha

Sanskrit: Tuntuka, Prithu shimba

Urdu/Unani:

English: Broken bone tree, Midnight horror

Geographical Descriptions: *Oroxylum indicum* is native to the Indian subcontinent, in the Himalayan foothills with a part extending to Bhutan and southern China, in Indo-China and the Malaysia ecozone. It is diversely available in the forest of National Park in Assam, India, reported from Sri Lanka (Ceylon). It is available in Bangladesh especially in chittagram hilltracks.

Plant Description: *Oroxylum indicum* also known as “Sona” or ‘Sonapatha’ is an important herb in Ayurvedic medicine and indigenous medical system for over thousands of years. Sona means gold. Its inner layer of the bark is golden yellow in color. It is a tree which can attain a height of 12 m (40 feet). The large leaf stalks wither and fall off the tree and collect near the base of the trunk, appearing to look like a pile of broken limb bones. The tree is a night-bloomer and flowers are adapted to natural pollination by bats. They form enormous seed pods that hang down from bare branches. Those long fruits curve downward and resemble the wings of a large bird or dangling sickles or swords in the night.



Fig. *Oroxylum indicum* L.

Macroscopic Description: A small tree, 8-15 m tall, branched at top; bark lightbrown, soft with green juice and often with numerous corky lenticels. Leaves are 3-7 cm long, 2-3 pinnate with opposite pinnae, rachis very stout, cylindrical, leaflets 2-4 pairs, 6-12 cm long and 4-10 cm broad, ovate or elliptic, acuminate, glabrous, base rounded or sometimes cordate; petioles of the lateral leaflets 6-15 mm long. Flowers numerous, foetid, in large erect racemes, 0.3-0.6-m long or even more pedicels 6-30 mm long. Calyx 4 cm long, leathery, oblong-campanulate and glabrous. Corolla usually lurid-purple, reaching 10 cm long, fleshy lobes about 4 cm long with crisped margins. Stamens 5, slightly exerted beyond the corolla tube, one of them little shorter than the 4, filaments cottony at the base. Capsules 0.3-0.6-m-long and 5-9 cm broad, straight, tapering to both ends, flat; hardly 8 mm thick, acute, valves semi-woody. The seeds are round with papery wings. Seeds are flat and are 3 inch in length and 2 inch in width. The flowers are born in rainy season and fruit appears in December to March.

Microscopic Description: The transverse section of the stem bark shows outer most 10-15 layered cork cells. The cork is 171-190 μm thick and are arranged in radial rows, suberized, some cells become lignified and appear as stone cells. Cork followed by 2-4 layered cork cambium which is 19.0-28.5 μm thick. Phelloderm region vary narrow, 15-25 cells broad. The phelloderm is 285 μm -380 μm thick. Number of stone cells and fibres were embedded in this region. Stone cells are much smaller in size as compared to phloem region. Rest of the section is made of secondary phloem. The phloem is divided into two parts, outer and inner region. In outer phloem plenty of stone cells are present in large groups and some fibres. While in inner phloem the condition is vice versa that is more fibre groups are presents and stones cells are very less in number. Ceratenchyma is also observed in inner phloem region. Most of the parenchymatous cells are filled with brownish-black content. Medullary rays are multiseriate and heterogenous and the cells of medullary rays are much smaller compared to the other phloem parenchymatous cells. Acicular crystals are embedded in medullary rays cells and parenchymatous cells of phloem. Starch grains, very minutes up to 5 μm in diam. are present in the secondary phloem region.

Powder: The powder was yellowish-green in colour, without any characteristic odour, astringent in taste. Under microscopic observation the powder shows fragments of cork cells in surface and tangential view. In surface view the cells are hexagonal and polygonal in shape. Stone cells and abundant sclereids, isolated or fairly in large groups, thick walled, pitted showing a considerable variation in size and shape. Few are elongated (fibre sclereids). Paranchymatous cells filled with black-brown content, patches of parenchymatous cells. Fragments of fibres in groups, isolated bast fibre, thick walled with uneven lumen with tapering ends, septate and non-septate fibre with varying shapes and sizes. The abundant acicular crystals were found scattered as such and embedded in medullary ray cells. Very minute starch grains were scattered into the powder. Parenchymatous cells were attached to the medullary rays

Part Used: Root, bark and fruit.

Organoleptic Properties

Rasa (Taste)	: Madhura, Tikta, Kashaya
Guna (Attribute)	: Laghu, Ruksa
Virya (Potency)	: Usna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphavatahara

Purity and safety test

Total ash	: Not more than 18% w/w
Acid insoluble	: Not more than 2.5% w/w
Water soluble	: Not less than 5.11% w/w

Thin Layer Chromatography

: TLC of the methanol extract was done using Chloroform: Methanol: Formic acid (8.8:0.5:0.2) as mobile phase and the R_f value were recorded. TLC fingerprints of methanolic extract of stem bark of *Oroxylum indicum* are of 0.04, 0.21, 0.46. And Under UV 366 R_f values are 0.53, 0.70, 0.83, 0.90, 0.98, 0.03, 0.09 whereas Under Visible Light after Spray with Vanillin–sulphuric acid R_f values are 0.25, 0.30, 0.33, 0.38, 0.65, 0.72 and 0.98.

Microbial Contamination

: The test for *Salmonella spp.* in Rhizoma Rhei products should be negative. The maximum acceptable limits of other microorganisms are as follows. For preparation of decoction: aerobic bacteria not more than 107/g; fungi not more than 105/g; *Escherichia coli* not more than 102/g. Preparations for internal use: aerobic bacteria not more than 105/g or ml; fungi not more than 104/g or ml; enterobacteria and certain Gram-negative bacteria not more than 103/g or ml; *Escherichia coli* 0/g or ml.

Heavy Metals

: In the final dosage form of the plant material the lead, mercury, arsenic and cadmium levels will not be more than 10, 0.5 and 0.3 $\mu\text{g}/\text{kg}$, respectively.

Pesticides Residues

: To be established in accordance with national requirements. Normally, the maximum residue limit of aldrin and dieldrin in Rhizoma Rhei is not more than 0.05 mg/kg.

Major Chemical Constituents: The containing flavones and their glycosides baicalein and scutellarein. Leaves also contain an anthraquinone, aloemodin. Bark of the root is reported with chrysin, baicalein and oroxylin-A. Bark also gave dihydrobaicalein. Heartwood yielded beta-sitosterol and an isoflavone, prunetin. The bark also contains traces of an alkaloid, tannic acid, sitosterol and galactose. Its root and stem contains three flavones named oroxylin A (5,7-dihydroxy-6-methoxyflavone), baicalein (5, 6, 7-trihydroxyflavone) and chrysin (5,7-dihydroxyflavone). It also contains pterocarpan and rhodioside with p-hydroxyphenylethanols and cyclohexanols. Four flavonoids, chrysin, baicalein, baicalein-7-h Oglucoside, baicalein-7-O-diglucoside (Oroxylin B) and one unknown flavonoid have also been isolated from the seeds of *Oroxylum indicum*. Seeds also contain shiny oil.

Therapeutic Use: Fevers, bronchitis, intestinal worms, vomiting, dysentery, leucoderma, asthma, inflammation, diarrhea, diaphoretic, and rheumatism. The seeds are purgative and taken orally to treat throat infections and hypertension.

Pharmacological Study: Anti-arthritic, antispasmodic, antibacterial, anti-inflammatory, immunostimulant, antidiabetic, hepatoprotective, antiarthritic, antioxidant, antimicrobial, antihelminthic, antileishmanial, antiviral, CNS depressant.

Adverse Effects: No known side effects have been seen. It is found to be safe to use in lactation and in children. The acute toxicity study conducted for aqueous and ethanolic extracts indicates that they are safe upto 2000 mg/kg body weight and was selected 1/8th and 1/4th of 2000 mg/kg i.e.250 mg/kg and 500 mg/kg respectively as per fixed dose procedure.

Dosage Form: Swarasa, Katha, Powder and Taila.

Posology: Katha 40-80 ml kwath, 3-6 gm powder per day.

Formulations: Dasamula kwath, Dasamularista, Dasamula Taila, Chyavanprash

Talishpatra

Botanical Name: *Abies webbiana* Lindle

Family: Pinaceae

Synonyms:

Bengali: তালিশপত্র (Talishpatra)

Hindi: Talishpatra, Taleehpatra

Sanskrit: Patradhyam

Urdu/Unani: Zarnab

English: Himalayan Siver Fir

Geographical Descriptions: Talispatra is a coniferous medicinal tree found in Himalaya of India & Bhutan. It is known as Talispatra in Ayurveda, Talispatri in Siddha, and Talisapattar in Unani.

Plant Description: *Abies webbiana* is a tall, evergreen fir tree with thick, spreading, horizontal branches. It reaches height of 60 ms. It is a coniferous tree found in Himalayas at high altitude of 2800-10000 feet. It is most common at higher range of Himalaya. The dark-brown cones appear in October-November. The wood of the tree is used in constructional work. *Abieswebbiana* leaves are single, spirally, arranged all-round the branchlets, flat, narrow, linear, one to three inches long, with narrow short terete petiole. The flowers are monoecious, either male or female, but both sexes can be found on the same plant. The pollination of flower is done by Wind. It prefers moist soil, and grow well in heavy clay soils. It can be grown in shade or sun.



Fig. *Abies webbiana* Lindle

Macroscopic Description: Leaves flat, 1 to 5.5 cm long, about 2 mm broad; shining, midrib in the upper surface channelled down the middle but raised beneath; with two faint white lines on either side of the midrib beneath, petiole very short, greyish-brown; odour, terebinthine like; taste, astringent.

Microscopic Description: Mature leaf shows single layered epidermis on either side covered with thick cuticle; upper epidermis followed by single layered sclerenchymatous hypodermis, lower epidermis shows papillate projections at some places followed by 1 or 2 layers sclerenchymatous

hypodermis; palisade 2 layered; spongy parenchyma 4-6 layered; vascular bundle single, situated centrally, consisting of xylem and phloem, enclosed by a single layered endodermis; xylem on upper side and phloem on lower side; cambium inconspicuous; secretory cavities two in numbers, located on either side of vascular bundle, stomata sunken type, present only on the lower surface.

Powder-Greenish-brown; shows sclerenchymatous cells, palisade, spongy parenchyma and a few epidermal cells.

Part Used: Leaves

Organoleptic Properties:

Rasa (Taste)	: Tikta, Madhura, Katu
Guna (Attribute)	: Laghu, Tikshna
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Dipana, Hrdya, Vata-kapha har.

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 14% w/w
Water soluble extractive	: Not less than 15% 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>Salmonellae 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

Thin Layer Chromatography

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 of alcoholic extract on Silica Gel 'G' using Toluene: Ethylacetate (9:1) shows in visible light five spots at R_f 0.09, 0.41, 0.59, 0.67 (all green) and 0.92 (light green). Under U.V. (366 nm) eight fluorescent zones visible at R_f 0.05 (orange), 0.09 (blackish) 0.14 (orange), 0.43 (red), 0.54 (blue), 0.62 (blackish red), 0.67 and 0.92 (both red). On exposure to iodine vapour eleven spots appear at R_f 0.04, 0.08, 0.12, 0.17, 0.39, 0.50, 0.57, 0.65, 0.73, 0.85 and 0.92 (all yellow). On spraying with Vanillin Sulphuric acid reagent and heating the plate at 105°C for ten minutes eleven spots appear at R_f 0.04, 0.08, 0.12, 0.17, 0.39, 0.50, 0.57, 0.65, 0.73, 0.85 and 0.92 (all violet).

Major Chemical Constituents: Essential oil and alkaloid.

Therapeutic Use: Chronic obstructive pulmonary diseases, cough, tumor, hypochlorhydria, amoebiasis, hiccup, vomiting, helminthiasis, and mouth disorders.

Pharmacological Study: Aromatic, anticatarrhal, antitussive, antispasmodic, antirheumatic, antiseptic, appetizer, aphrodisiac, antiinflammatory, antipyretic/antifebrile/febrifuge, carminative, decongestant, expectorant, blood purifiers.

Contraindications: It is not recommended for pregnancy and lactation.

Adverse Effects: Over-dosages can be twitching pain, nausea, vomiting, and diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages form: Powder and decoction

Posology: 2-3 gm of the drug in powder form and 5-10 drops daily.

Formulations: Talishadi churna, Dhatri Louha, Kankasav, Brihat Basabaleha

Talmuli

Botanical Name: *Curculigo orchioides* Gaertn

Family: Amaryllidaceae

Synonyms:

Bengali: তালমুলী (Talamuli)

Hindi: Syahmusali, Kalimusli

Sanskrit: Bhumitila

Urdu/Unani: Musali Siyah, Kali Musali

English: Golden Eye Grass, Ginseng, Black musali

Geographical Descriptions: Talamuli grows as Forest herb since generations; it is in use as folk medicine. In many parts of India, due to its over exploitation, Talamuli is becoming rare in occurrence.

Plant Description: Talamuli is a herbaceous tuberous perennial with a short or elongate root stock bearing several fleshy lateral roots; Leaves sessile or petiolate 15-45x1.3-2.5 cm, linear or linear lanceolate, tips sometimes rooting, scape very short, clavate; Flowers in racemes, distichous, yellow, lowest in the racemes 2 sexual, perianth segments elliptic, oblong, hairy on the back; Fruits capsules, derived from inferior tricarpellary syncarpous ovary, 1-4 seeded; Seeds black, oblong, deeply grooved in wavy lines.



Fig. *Curculigo orchioides* Gaertn

Macroscopic Description: Drug occurs in transversely cut pieces of 2.5-5 cm long, cylindrical, straight to slightly curved, cut surface 1.0-4.5 cm in dim; external surface blackish-brown, cut surface cream coloured; surface with numerous shallow wrinkles and transverse cracks; with a few rootlets and root scars; nodes and internodes prominent; taste, mucilaginous and slightly bitter.

Microscopic Description: Shows a narrow strip of cork, consisting of 5-7 rows of light brown cubical to rectangular cells; secondary cortex consists of thin-walled, parenchymatous cells, densely filled with starch grains and acicular crystals of calcium oxalate, either isolated or in bundles, in a few

cells; a few small, round to tangentially elongated, lysigenous cavities also found scattered in this region; a few vascular bundles found embedded in cortical region with phloem towards outer side, and consisting of a few xylem elements; ground tissue consists of parenchymatous cells, some of which contain acicular crystals of calcium oxalate; numerous fibro-vascular bundles found scattered throughout the region, mostly towards peripheral region having phloem, almost encircled by xylem vessels having annular and spiral thickenings; starch grains simple, rounded to oval and also compound of 2-4 components, measuring 4-21 μ in diam, present in cortical and central region, a number of deep red, resin canals found throughout the region, mucilage in the form of colourless mass found in a few cortical parenchymatous cells.

Powder-Greyish; vessels with annular and spiral thickenings; simple, round to oval, starch grains measuring 4-21 μ in diam, and compound starch grains having 2 to 4 components and a few acicular crystals of calcium oxalate; mucilage in the form of colourless mass found in a few cortical parenchymatous cells

Part Used: Rootstock/rhizome, leaf, root or whole plant

Organoleptic Properties:

Rasa (Taste)	: Madhura, Tikta
Guna (Attribute)	: Guru, Shnigdha, Picchila
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Madhura
Karma (Action)	: Sramahara, Dahahara, Pittahara, Vrsya, Brhmana, Rasayana, Pustiprada, Balaprada

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 2% w/w
Alcohol soluble extractive	: Not less than 3% 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 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, <i>Salmonellae 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*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) four fluorescent zones at R_f. 0.39, 0.77, 0.90 and 0.97 (all yellow). On exposure to Iodine vapour twelve spots appear at R_f. 0.06, 0.13, 0.17, 0.25, 0.39, 0.50, 0.62, 0.70, 0.77, 0.88, 0.90 and 0.97 (all yellow). On spraying with Dragendorff reagent followed by sodium nitrite three spots appear at R_f. 0.39, 0.70 and 0.88 (all light purple).

Major chemical constituents: Tannin, resin, saponin and alkaloid.

Therapeutic usages: Pruritus, skin diseases, asthma, bronchitis, jaundice, diarrhea, cuts and wounds, colic, vomiting, erectile impotence, spermatorrhoea, general weakness, burning, fatigue, piles and menorrhagia.

Pharmacological study: Aphrodisiac, immunostimulant, hepatoprotective, antioxidant, anti-cancer, antidiabetic, Spermatogenic, Antiasthmatic, anticonvulsant, antibacterial, antitumor, cardiovascular and central nervous system activity.

Contraindications: It is not recommended for pregnancy and lactation.

Adverse effects: Over-dosages can be twitching pain, nausea, vomiting, and diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages form: Powder.

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

Formulations: Uddyam, Siba Modak, Sanjibonimodak, Sanjiboni Rasayan

Teori

Botanical Name: *Operculina turpethum* L.

Family: Convolvulaceae

Synonyms:

Bengali: তেউরী (Teori)

Hindi: Nishothra

Sanskrit: Syama, Tribhandi

Urdu/Unani: Turbud, Nishoth

English: Terpeth Root, Indian Jalap

Geographical Descriptions: It is commonly found on the roadsides across Bangladesh, India.

Plant Description: A large twining herb with milky juice; root long, branched, fleshy; stems winged. Leaves 4-10 by 1.5-7 cm, ovate, cordate. Flowers white, 4-5 cm long, funnel-shaped, in few flowered bunches. Sepals about 2 cm long, but when plant is in fruit, they become much larger and brittle and enclose the fruits.

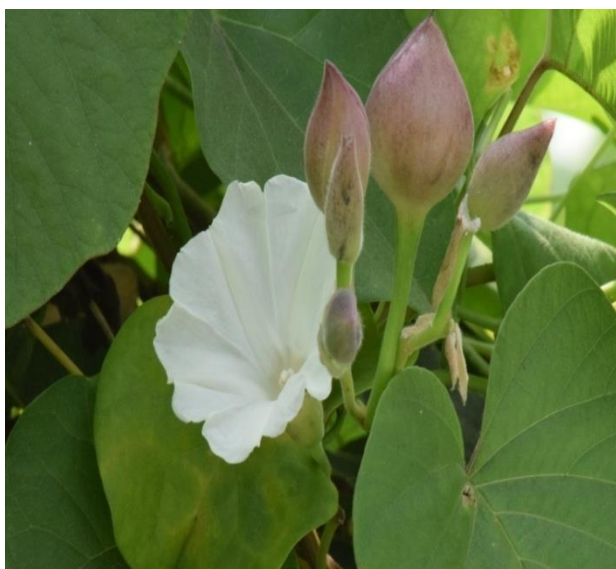


Fig. *Operculina turpethum* L.

Macroscopic Description: Roots occur in pieces, 1.5-15 cm long, 1-5 cm diam, usually unbranched, cylindrical, elongated, bearing thin rootlets; thicker pieces, occasionally split and show central wood portion; surface dull grey, reddish-grey to light brown, showing deep furrows or longitudinal wrinkles giving a rope-like or columnar appearance; transversely cut surface shows thick, whitish bark and light yellow centre; fracture in bark, short; in wood, fibrous; odour, indistinct; taste, slightly acrid and nauseating when kept in mouth for some time.

Microscopic Description: Mature root shows thin cork, consisting of 3-5 rows of brown cells; secondary cortex 4-6 layered, composed of tangential elongated, thin-walled cells; some of the cortical cells become thick-walled appearing as isolated, oval to subrectangulars clerenchymatous cells having wide lumen; secretory cavities surrounded by subsidiary cells and resin canals found scattered in secondary cortex; secondary phloem, a wide zone, consisting of sieve elements and

phloem parenchyma; vascular bundles arranged in a continuous and a discontinuous ring, traversed by uni and biseriate medullary rays; numerous resin cells also seen in phloem in longitudinal rows; xylem shows 3-5 radiating arms; small patches of intraxylary phloem often formed; xylem vessels in singles or 2-3 in groups, having simple pits on their walls; calcium oxalate crystals as prisms and rosettes found scattered in cortex, phloem parenchyma, xylem parenchyma and medullary ray cells; starch grains, both simple and compound, simple ones elliptical to spherical with central cleft hilum, compound grains consisting of 2-4 components, size vary from 5-44 μ in diam, found scattered in cortex, phloem parenchyma, xylem parenchyma and medullary ray cells.

Powder-Greyish to light brown; shows parenchymatous cells, cellulosic fibres with pointed tips, vessels with simple pits, simple and compound starch grains elliptical to spherical with central cleft, measuring 5-44 μ in diam, having 2-4 components, rosette and prismatic crystals of calcium oxalate.

Part Used: Seeds, root bark, root, stem, and leaves.

Organoleptic Properties:

Rasa (Taste)	: Tikta, Katu
Guna (Attribute)	: Laghu, Ruksa, Tiksna
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Katu
Karma (Action)	: Kaphapittahara, Pittahara, Virechana, Sukhavirecanaka, Jvarahara

Purity and Safety Test

Foreign matter	: Not more than 2% 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 10% w/w
Water soluble extractive	: Not less than 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>Salmonellae 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*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 R_f 0.08, 0.21 (both light blue) and 0.58 (blue). On exposure to Iodine vapour seven spots appear at R_f 0.21, 0.41, 0.49, 0.58, 0.71, 0.90 and 0.97 (all yellow). On spraying with VanillinSulphuric acid reagent and heating the plate for ten minutes at 110°C seven spots appear at R_f 0.21, 0.41, 0.49 (all light violet), 0.58, 0.70, 0.90 and 0.97 (all violet).

Major Chemical Constituents: Phenol, flavonoid, phytosterol, terpenoid, cardiac glycosides, resin, glucoside, turpethinic acid, volatile oil, scopoleptin, triterpene and sitosterol.

Therapeutic Use: Fevers, edema, ascites, anorexia, constipation, hepatosplenomegaly, hemorrhoids, cervical lymphadenitis, fistulas, constipation, chronic gout, fever, bronchitis, ulcers, hemorrhoids, tumors, obesity, jaundice, herpes, induce lacrimation, and other skin disorders.

Pharmacological Study: Antibacterial, anti-inflammatory, analgesic, hepatoprotective, anti-arthritis, ulcer protective, antidiarrheal, antidiabetic, and cytotoxic properties.

Contraindications: It is not recommended for pregnancy & lactation.

Adverse effects: Over-dosages can be twitching pain, nausea and vomiting, diarrhea.

Precautions: It should not be used in pregnancy, in children below 12 years of age, in elderly, in physically or mentally weaker persons, and in persons suffering from diarrhoea, bleeding per rectum, rectal prolapse, or fecal incontinence. Trivrit may act as an abortifacient when used in pregnant ladies.

Dosages form: Powder.

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

Formulations: Abhyarista, Ashwagandharista, Meharaj, Saribadyarista,

Tetul

Botanical Name: *Tamaricus indicus* L.

Family: Fabaceae.

Synonyms:

Bengali: তেতুল (Tetul)

Hindi: Imli

Sanskrit: Amlika, Tintidika

Urdu/Unani: Imli

English: Tamarind, Tamarind Tree

Geographical Descriptions: *Tamaricus indicus* has been cultivated in Bangladesh, India for centuries and was taken by the Spanish conquistadores to the West Indies and Mexico in the 17th century. It is now widely grown in the tropics as an ornamental to provide shade as well as for the fruit. The name tamarindus comes from the Arabic Tamar-Hindi, meaning 'date of India', and refers to the date-like pulp inside the pods. According to folklore the sailors used to eat tamarind fruit as a complement to their otherwise starchy diet, in the belief that eating it would prevent scurvy.

Plant Description: A large tree up to 30 m high, with spreading branches. The bark is brownish grey, peeling off in flakes. Leaves are even-pinnate, consisting of 10-18 pairs of small leaflets, rather close together. Petioles and rachis up to 12 cm long; leaflets oblong, up to 30 by 10 mm; opposite, pink or reddish when young, membranous, glabrous, with an obtuse apex and unequal base. The inflorescence is a terminal raceme, yellowish orange to pale green, consisting of a narrow turbinate calyx tube with four imbricate segments. There are three unequal petals, the upper cordate about 1 cm long, and two lateral petals, narrowed towards the base. There are three fertile stamens, the base conical; ovary linear, about 7 mm long, pubescent, on a stalk adnate to the calyx tube. Pods are oblong, slightly curved, up to 15 cm long and reddish brown. The seed is glossy, dark brown, embedded in a thick, sticky aromatic and acid brown pulp.



Fig. *Tamaricus indicus* L.

Macroscopic Description: Fruit pulp occurs as a reddish-brown, moist, sticky mass, in which yellowish brown fibres are readily seen; odour, pleasant; taste, sweetish and acidic.

Microscopic Description: Fruit pulp consists of thin-walled, elongated to polygonal, parenchymatous cells of considerable size, traversed by a number of long fibro-vascular bundles and having a very few small starch granules, and numerous prismatic crystals of calcium oxalate.

Part Used: Fruits, fruit pulp, seeds, leaves, flowers and bark.

Organoleptic properties:

Rasa (Taste)	: Madhura, Amla, Kasaya
Guna (Attribute)	: Guru, Ruksha, Sara
Virya (Potency)	: Ushna
Vipaka (Metabolism)	: Alma
Karma (Action)	: Kaphavatanut, Dipana, Bastisuddhikara, Bhedi, Vistambhi, Dipana, Hrdya

Purity and Safety Test

Foreign matter	: Not more than 1% w/w
Total ash	: Not more than 4% w/w
Acid insoluble ash	: Not more than 0.5% w/w
Alcohol soluble extractive	: Not less than 46% w/w
Water soluble extractive	: Not less than 59% 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>Salmonellae 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

Thin Layer Chromatography

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 of the alcoholic extract on Silica gel 'G' plate using Toluene: Ethyl acetate (9 :1) shows under U.V. (366 nm) a fluorescent zone at R_f 0.65 (blue). On exposure to Iodine vapor two spots appear at R_f 0.51 and 0.65 (both yellow). On spraying with 50% Methanolic-Sulphuric acid reagent and heating the plate for ten minutes at 110°C two spots appear at R_f 0.51 and 0.65 (both grey).

Major Chemical Constituents: Inorganic acids, Sugars, Saponin and bitter principle- tamarindinca

Therapeutic Use: Dysentery, cough, fractures, chicken pox, eye diseases, ear problem, piles, oedema, ringworm, heart diseases etc.

Pharmacological Study: Antioxidant, antiinflammatory, anti-bacterial, antifungal, antiviral, immunomodulatory, hypo-lipidaemic, and hypo-glycaemic activity.

Contraindications: It is not recommended for pregnancy and lactation.

Adverse effects: Over-dosages can be twitching pain, nausea, vomiting, and diarrhea.

Precautions: Should not use in high dose or longer period of times.

Dosages form: Mahasankha Bati

APPENDIX I

PRINCIPAL FORMS OF AYURVEDIC (VEGETABLE) MEDICATION AND METHODS OF THEIR PREPARATION AND USES IN BRIEF

“Ayurvedic Vegetable 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 tuberculous pregnant women, 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 Aamadosha.
- 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 decoctions 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 secretary 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-II

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 gm in a mixture of 65 ml of 30% 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 gm in 100 ml of 95% of ethyl alcohol; used as a general stain for macerated material (with Schultze's).

Bremer's reagent: Dissolve 1 gm of sodium tungstate and 2 gm 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 gm of sodium carbonate in 125 ml of distilled water; triturate 50 gm 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 gm 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 gm of zinc chloride and 6.5 gm of potassium iodide in 10 ml of distilled water. Add 0.5 gm 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 gm of dissolved in 90 ml of dilute sulphuric acid: macerating agent similar to Schultze's.

Corallin soda: Dissolve 5 gm of corallin in 100 ml of 90% ethyl alcohol. Dissolve 25 gm 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 gm 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% solution in 90% 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 gm of Haematoxylin in 6 ml of ethyl alcohol (97%). 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 gm 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 gm, lactic acid 20 gm, glycerin 40 gm, 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%). 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% 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% 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 gm of ruthenium red in 10 ml of a 10% solution of lead acetate; (to be freshly prepared) used for identification of most kinds of mucilage containing tissues, which turn pink. A 0.0008 gm ruthenium red dissolved in 10 ml of distilled water and used immediately stains cuticular tissues in debris to a light pink.

Safranin: A 1% solution in ethyl alcohol 50%; used to stain lignified cell walls deep red, even after clearing with choral hydrate.

Schultze's Maceration fluid: Add isolated debris to 50% 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 gm of sudan red III in 5 ml of ethyl alcohol (90%) 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 gm 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 microm.

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 scrapping 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 rubiaceous. 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:

$$\text{Stomatal index} = \frac{S \times 100}{E + S}$$

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 millim 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 millims 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 microm 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 millims. 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 millims. For each sample of leaf make not fewer than three determinations and calculate the average number of vein-islets per square millim.

For leaf fragments having an area less than 4 square millims–Take fragments of leaf lamina each with an area of not less than 1 square millim, excluding the midrib and the margin of the leaf. Clear and prepare amount as stated above. Use a 10 x 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 veinislets 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 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 stomata and calculate the average number of stomata per square millim 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 % 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 gm 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 1-2 gm 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 8000 ± 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 gm 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 1050 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 gm of drug (without preliminary drying) after accurately weighing (accurately weighed to within 0.01 gm) it in a tared evaporating dish. For example, for unground or unpowdered drug, prepare about 10 gm 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%. 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 gm 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° 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 clevenger'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 or 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 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: 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 diam 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 diam, 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% homogenate of the plant tissue in 80% 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% 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% 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% 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% 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 with in 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°C, 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% of cottonseed oil in other oils.

Test for clove oil, alkali soluble matter: Place 80 ml of a 5% 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 diam that not less than 15cm in length has a capacity of 10 ml. 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-III

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% 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% ammonium dihydrogen phosphate and 0.2% 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 gm 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% 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% 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 1 per 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 1 per 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 400. 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 400 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 diam 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 diam, 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 diam. 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, defoliant 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:

$$ADI \times M$$

MDD x 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:

$$ADI \times M \times E$$

MDD x 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

REFERENCES

1. A K Meena, M M Rao, C M Krishna, Komal Preet, K N Sunil Kumar, M M Padhi, Ramesh Babu. (2010). Evaluation of Pharmacognostic and Physicochemical Params of *Picrorrhiza kurroa* Royle ex Benth. *International Journal of Ayurvedic Medicine*, 1(1):41-46.
2. Abbasi, M.A., Ahmad, V.U., Zubair M., Fatima, N., Farooq, U., Hussain, S., Lodhi, M.A., Choudhary, M.I., (2004). Phosphodiesterase and Thymidine phosphorylase inhibiting Salirepin derivatives from *Symplocos racemosa*. *Planta Medica* 70(12),1189-94.
3. Abdullah Tauheed, Hamiduddin, Ali A. (2017) *Aqarqarha* (*Anacyclus pyrethrum* DC.) a potent drug in Unani medicine: A review on its historical and phyto-pharmacological perspective. *J. Pharm. Sci. Innov.* 6(1):22-28
4. Ahmad H., Sehgal S., Mishra A., and Gupta R., (2012). *Mimosa pudica* L. (Laajvanti): An overview; *Pharmacogn Rev.* Jul-Dec; 6(12): 115–124.
5. Ahmed Malik et al. (2016). *Rheum emodi* as valuable medicinal plant. *Journal of General Medicine and Pharmacy*, 5. 35-44.
6. Ahmad wani S, Shah K. W. and Ashfaq A. M. (2012). Preliminary phytochemical investigation and thin layer chromatography of *Rheum emodi*; *International Research Journal of Pharmacy*, 3 (4), p-176-177.
7. Ahmad.S. & Rageeb.M., Usman.M. & Akthar.R. and Imran. M. (2016). Assessment of Pharmacognostical Characters of Leaves of *Tephrosia purpurea* Linn. *Journal of Pharmacy Research*, 10(1), 25-28.
8. Alam K, Pathak D, Ansari SH. (2011). Evaluation of anti-inflammatory activity of *Amomum subulatum* fruit extract. *Int. J. Pharmaceu. Sci. Drug. Res*; 3(1): 35-37.
9. Ali Esmail Al-Snafi, 2013, The Pharmacological Importance of *Bauhinia variegata*. A Review; *International Journal of Pharma Sciences and Research (IJPSR)*, Vol 4 No 12 Dec, page 160-164.
10. Ali Esmail Al-Snafi. The Pharmacological Importance of *Benincasahispida*. A review, Ali Esmail Al-Snafi. (2013) *International Journal of Pharma Sciences and Research (IJPSR)*, 4(12): 165-170.
11. Ali, M. *Textbook of Pharmacognosy*, CBS Publishers, Delhi, India, 1994.
12. Amalraj A and Gopi S (2017). Biological activities and medicinal properties of *Asafoetida*: A review, *Journal of Traditional and Complementary Medicine* 7, Page 347–359.
13. Amara, U., Mashwani, Z.R., Khan, A., Laraib, S., Wali, R., Sarwar, U., Ain, Q.T., Shakeel, S., Rahimullahand Sohail (2017). Conservation Status and Therapeutic Potential of *Saussurealappa*: An Overview. *American Journal of Plant Sciences*, 8, 602-614
14. Ambasta SP (1986), *The useful plants of India*. Publication and Information Directorate, Council for Scientific and Industrial Research, New Delhi, 602

15. Ambavade S.D., Mhetre N.A., Tate V.D. and Bodhankar S.L. (2006). Pharmacological evaluation of the extracts of *Sphaeranthus indicus* flowers on anxiolytic activity in mice: *Indian J Pharmacol*, 38, (4):254-259.
16. Amit K & Vandana, (2013). Medicinal Properties of *Acorus calamus*, *Journal of Drug Delivery & Therapeutics*; 3(3), 143-144.
17. Ani, V., (2008). Studies on phytochemicals and biological properties of bitter cumin *Centrathrum anthelminticum* (L.) Kuntze. Ph.D. Thesis, University of Mysore, India.
18. Anonymus, 1999. *Rhizoma Rhei*, WHO monographs on selected medicinal plants, World Health Organization Geneva, Vol. 1, page 231.
19. Anonymous (2016). *Tephrosia purpurea*. Birla Institute of Scientific Research. Plant id 0123.
20. Anonymous, 2001. *Citrullus colocynthis* Schrad. The Ayurvedic Pharmacopoeia of India, New Delhi: Department of ISM and H, Ministry of Health and Family Welfare, Government of India. PART- I, Volume II, page 52-56.
21. Anonymous, *Ferula foetida* Regel., The Ayurvedic Pharmacopoeia of India, New Delhi: Department of ISM and H, Ministry of Health and Family Welfare, Government of India; 2001. PART- I, Volume I, page 64.
22. Anonymous, *Lawsonia inermis* Linn. The Ayurvedic Pharmacopoeia of India, PART- I, Volume IV, page 66
23. Anonymous, *Mimosa pudica* Linn., The Ayurvedic Pharmacopoeia of India, New Delhi: Department of ISM and H, Ministry of Health and Family Welfare, Government of India; 2001. PART- I, Volume II, page 105.
24. Anonymous, *Sphaeranthus indicus* Linn, The Ayurvedic Pharmacopoeia of India New Delhi: Department of ISM and H, Ministry of Health and Family Welfare, Government of India; 2001. PART- I, Volume IV, page 78.
25. Anonymous, *Symplocos racemosa* Roxb., The Ayurvedic Pharmacopoeia of India, New Delhi: Department of ISM and H, Ministry of Health and Family Welfare, Government of India; 2001. PART- I, Volume I, page 112.
26. Anonymous, The Ayurvedic Pharmacopoeia of India, Part- I, Volume I
27. Anonymous, The Ayurvedic Pharmacopoeia of India, Part- I, Volume II
28. Anonymous, The Ayurvedic Pharmacopoeia of India, Part- I, Volume III
29. Anonymous, The Ayurvedic Pharmacopoeia of India, Part- I, Volume VI
30. Anonymous, The Ayurvedic Pharmacopoeia of India, Part- I, Volume V
31. Anonymous. The Ayurvedic Pharmacopoeia of India Government of India, Ministry of Health and Family Welfare, Department of Indian Systems of Medicine and Homeopathy, Vol. 1, Part 1-7, 1st edition, 2001.

32. Berrig C, Koechilin R, Ternutzer A. (1993). A preliminary profile with particular emphasis on horticulture and animal husbandry. Study group on institutions. Human actions and resources management, Institute of geography, University of Zurich, Switzerland: 47-51.
33. Bhatia, Daksh and K Gupta, M & Gupta, Ankur & Singh, Mamta and Kaithwas, Gaurav. (2008). Pharmacognostical studies on seeds of *Centratherum anthelminticum* Kuntze. *Natural Product Radiance*. 7. 326-329.
34. Bhattacharjee, S., Chiranjib Bonoushadi, Ananda Publishers Private Ltd., Calcutta, India, 1977.
35. Bilal A. Zargara, Mubashir H. Masoodia, Bahar Ahmedb, Showkat A. Ganiec (2011). Phytoconstituents and therapeutic uses of *Rheum emodi* wall. ex Meissn, Elsevier, *Food chemistry* 128, 585-589.
36. Bisht, A & Zaman, K & Singh, M & Gupta, R & Singh, V. (2011). Pharmacognostical studies on *Oroxylum indicum* (Linn.) Vent. stem bark. *Indian Journal of Natural Products and Resources*. 2. 472-478.
37. Biswas, K and Ghosh, A. Bharatiya Bonoushadi, Cacutta University, Calcutta, India, 1973.
38. BrijendraSingh et al Pharmacognostic and Physicochemical Studies on *Plumbagozeylanica* Linn. Root. *Drug Invention Today* 2010, 2(4),217-219
39. Buddhadev S. G. and Buddhadev S. S (2016). Ayurvedic Medicinal Plant *Lawsonia Inermis* Linn.: A Complete Review, *Pharma Science Monitor* 7(2), Apr-Jun, 240-248.
40. C.P. Khare, 2007; *Acorus calamus* Linn. *Indian Medicinal Plants, an Illustrated Dictionary*, page 298.
41. C.P. Khare, 2007; *Cuscuta reflexa*. *Indian Medicinal Plants, an Illustrated Dictionary*, page 189.
42. C.P. Khare, 2007; *Lawsonia inermis* Linn. *Indian Medicinal Plants, an Illustrated Dictionary*, page 366.
43. C.P. Khare, 2007; *Mimosa pudica* Linn. *Indian Medicinal Plants, an Illustrated Dictionary*, page 416.
44. Chaevallier, Andrew. *The Encyclopedia of Medicinal Plants*, 1st st edition, DK Publishing Inc., New York, USA, 1996.
45. Chattarjee, Asma, Chandra, Prakash & Satyesh; 1997. *The treatise on Indian medicinal plants*. National Institute of Science Communication, New Delhi; 5: 46- 47.
46. Chopra, RN, Chopra IC and Verma, BS. *Supplement to Glossary of Indian Medicinal Plants*, reprint edition, CSIR, New Delhi, India, 1992.
47. Chowdhury, Shaheed et al. (2009). Small-Scale Mehedi (*Lawsonia inermis* L.) Farming in the Central Bangladesh: A Promising NTFP-Based Rural Livelihood outside the Forests. *Small-scale Forestry*. 9. 93-105. 10.1007/s11842-009-9104-4.

48. Council of Europe, European Pharmacopeia, 8th Edition, European Union, 2014.
49. Das, D.K. 1987. Edible fruits of Bangladesh forests. Bull. No. 3 Plant Taxonomy Series, BFRI, 16 pp.
50. Dash V B. *Materia Medica of Ayurveda: Based on Madanapala's Nighantu*, New Delhi, India B. Jain Publishers (P) Ltd, reprint edition, 2006.
51. David heacn, *Asa foetida*, PDR for herbal medicine, Herbal Monograph, 4th edition, page 47, ISBN: 1-56363-361-2
52. Deka. D. C., Kumar. V., Prasad. C., Kumar. K., Gogoi. B J., Singh L, and Srivastava. R B. (2013) *Oroxylum indicum*– a medicinal plant of North East India: An overview of its nutritional, remedial, and prophylactic properties, *Journal of Applied Pharmaceutical Science* Vol. 3 (Suppl 1), pp. S104-S112, May.
53. Dev, Suresh Kumar. (2017). Phytochemical and Pharmacological aspects of *Sarcostemma acidum* (Roxb.) Voigt. *Journal of Pharmacy Research*. 11. 1429-1431.
54. Dev. L. R., Anurag. M. and Rajiv. G. (2010). *Oroxylum indicum*: A Review, *Phcog.Net*, May, Vol 2, Issue 9.
55. Devmurari, V. P., 2010. Antibacterial evaluation and phytochemical screening of *Symplocos racemosa* Roxb. *International Journal of PharmTech Research* 2 (2), 1359-63.
56. Dhuley JN. 1999. Anti-oxidant effects of cinnamon (*Cinnamomum verum*) bark and greater cardamom (*Amomum subulatum*) seeds in rats fed high fat diet. *Indian J ExpBiol*; 37(3):238-242.
57. Dongray A., Irrchariya. D. R, Chanchal. D and Chaudhary. S 2016; Phytochemical and Pharmacological Properties of *Bauhinia acuminata*; *World Journal of Pharmaceutical Research*; Vol 05, Issue 01, page 531-546.
58. Dr Al-Snafi A. E. 2016. Chemical constituents and pharmacological effects of *Citrullus colocynthis* - A review; *IOSR Journal of Pharmacy*, Volume 6, Issue 3 (March 2016), PP. 57-67.
59. Dr. Nidhi Garg¹, Dr. Akhil Jain. Therapeutic and Medicinal Uses of *Karpura*-A Review. *International Journal of Science and Research (IJSR)*, Volume 6 Issue 4, April 2017, pp-1174-1181.
60. Dr. Ruchi Srivastava, Dr. G.P. Kimothi, Aakarkarabh - An Important Medicinal Herb:info Ayurveda, Volume 12, No.1January - March 2016
61. Dr. Ruchi Srivastava, Dr. G.P. Kimothi, Aakarkarabh - An Important Medicinal Herb:info Ayurveda, Volume 12, No.1January - March 2016
62. Dr. Salim S. 2014. *INDRAVARUNI – Citrullus colocynthis* Linn – Ayurvedic Herb:<https://liveayurvedalife.com/indravaruni-citrullus-colocynthis-linn-ayurvedic-herb/>

63. Elgayyar M, Draughon FA, Golden DA. 2001. Antimicrobial activity of essential oils from plants against selected pathogenic and saprophytic microorganisms. *J Food Prot*; 64(7):1019-1024.
64. Evans, C.T., D.B. Ledesma, T.Z. Schulz, E.R. Simpson and C.R. Mendelson, 1986. Isolation and characterization of a complementary DNA specific for human aromatase-system cytochrome P-450 mRNA. *Proc. Nat. Acad. Sci.*, 83: 6387-6391.
65. Farah A, Siddiqui A, Aslam M, Javed K, Jafri MA. 2005. Anti-ulcerogenic activity of *Elettaria cardamomum* Maton. and *Amomum subulatum* Roxb. Seeds. *Ind. J. Trad. Know*; 4(3): 298-302.
66. Galani, V. J., Patel, B. G., & Rana, D. G. (2010). *Sphaeranthus indicus* Linn: A phytopharmacological review. *International journal of Ayurveda research*, 1(4), 247–253. doi:10.4103/0974-7788.76790
67. Gandhi, D.M. & Kapadia, N.S. & Shah, S.K. & Verma, P.D. & Shah, K.N. & Shah, Mamta. (2012). Pharmacognostical study and development of quality control params for *Sarcostemma brevistigma* Wight & Arn. *Journal of Natural Remedies*. 12. 77-86.
68. Ghani, A. *Medicinal Plants of Bangladesh with Chemical Constituents and Uses*, Asiatic Society of Bangladesh, Dhaka, 2nd edition 1998.
69. Gopala K, Subarayan & Vadivel, Ealumalai & Dhanalakshmi, K. (2009). Phytochemical and Pharmacognostical Studies of *Tephrosia purpurea* Linn. Aerial and Roots parts. *Journal of herbal medicine and toxicology*. 3. 73-78.
70. Gopala Krishna C, Divya M, Ramya, Rohita K. and Phani kumar K. (2013). Pharmacological evaluation of *Symplocos Racemosa* bark extracts on experimentally induced ulceritis in rat model. *SDKPK Elixir Pharmacy*. 55. 12964-12966.
71. Govindarajan N., Reddy Cheekala U.M., Arcot S., Sundaramoorthy S., Shanmugam M., Duraisamy R., Cheemalapati V.N. and Raju I. (2016). Comparative Powder Microscopic and HPTLC Studies on Stem bark of *Symplocos racemosa* Roxb. and *Symplocos crataegoides* Ham.; *Pharmacognosy Journal*, Vol 8, Issue 4, Jul-Aug.
72. Gulab S. Thakur, Rohit Sharma, Bhagwan S. Sanodiya, Mukeshwar Pandey, GBKS Prasad and Prakash S. Bisen. 2012; *Gymnema sylvestre*: An Alternative Therapeutic Agent for Management of Diabetes, *Journal of Applied Pharmaceutical Science*, India. Vol. 2 (12), pp. 001-006, December.
73. Hazra, Kalyan. (2012). Pharmacognostic and biomarker based Thin Layer Chromatographic profile of leaves of *Nyctanthes arbor-tristis* L. *Journal of Pharmacy Research*. 5(7):3567-3571.
74. Heacn D 2000, *PDR for herbal medicine*, 4th edition, published by Medical Economics Company, Inc. at Montvale, NJ 07645-1742. Page 254
75. Hegnauer, R., 1973. *Symplocaceae*. *Chemotaxonomie der Pflanzen*, VI. Birkhauser Verlag, Basel-Stuttgart pp. 478-81.

76. Hmad Malik et al. (2016). Rheum emodi as valuable medicinal plant. International Journal of General Medicine and Pharmacy. 5. 35-44.
77. http://gernot-katzers-spice-pages.com/engl/Amom_sub.html
78. http://gernot-katzers-spice-pages.com/engl/Pipe_cub.html
79. <https://www.bimbima.com/ayurveda/>
80. https://www.bimbima.com/ayurveda/medicinal-use-of-akarkara-spilanthes-acmella/1383/#general_information
81. ([http://www.indianmedicinalplants.info/d2/Aconitum-heterophyllum\(Ativisa%20\).html](http://www.indianmedicinalplants.info/d2/Aconitum-heterophyllum(Ativisa%20).html))
82. (<https://www.dabur.com/in/en-us/about/science-of-ayurveda/herbal-medicinal-plants/ateech-plant>)
83. Hussain, S., Gaffney, F., Ahmed, N., Slevin, M., Choudhary, M. I., Ahmad, V. U., Quasmi, Z., Abbasi, M., 2009. An investigation of the kinetic and anti-angiogenic properties of plant glycoside inhibitors of thymidine phosphorylase. Journal of Asian Natural Products Research 11(2), 159-67.
84. Huxley. A. 1992; *Ficus benghalensis L.* The New RHS Dictionary of Gardening.; MacMillan Press
85. Jadav HR, Ruknuddin G, Harisha CR. Kumar PP. Preliminary Pharmacognostical profile of Tuvaraka. (Hydnocarpus laurifolia (Dennst) Sleumer.) seeds. Med J DY Patil Univ 2016; 9:219-23.
86. Jadhav, Mamata & Menon, Sasikumar & Shailajan, Sunita. (2015). Anti-androgenic effect of *Symplocos racemosa* Roxb. against letrozole induced polycystic ovary using rat model. Journal of Coastal Life Medicine. 1. 10.12980/JCLM.1.2013C79.
87. Jain.A. Nahata.A. and Kumar Singhai. A. (2013). Effect of *Tephrosia purpurea* (L.) Pers. Leaves on Gentamicin-Induced Nephrotoxicity in Rats. Sci Pharm. Oct-Dec; 81(4): 1071–1087. Published online 2013 Jul 22. doi: 10.3797/scipharm.1302-09.
88. Jit Narayan Sah, Vinay Kumar Varshney. Chemical constituents of *Picrorhiza* genus: a Review. American Journal of Essential Oils and Natural Products 2013; 1 (2): 22-37
89. Johnson T, Krishnakumar K. and Dineshkumar B. (2018). Phyto-Pharmacological Review of *Symlocos Racemosa* Bark; J. Bio.Innov7 (4), pp: 611-617,
90. Joseph B., George J., and Mohan J., 2013. Pharmacology and Traditional Uses of *Mimosa pudica*; International Journal of Pharmaceutical Sciences and Drug Research; 5(2): 41-44
91. K. Madhuri & K. Elango & S. Ponnusankar. *Saussurealappa* (Kuth root): review of its traditional uses, phytochemistry and pharmacology. Orient Pharm Exp Med (2012) 12:1–9
92. K.K. Bhutani, A.N. Jadhav, V. Kalia, Effect of *Symplocos racemosa* Roxb. on gonadotropin release in immature female rats and ovarian histology, J. Ethnopharmacol. 94 (2004) 197-200.

93. Kahare C.P (2007). *Centratherrum anthelminticu*, Indian Medicinal Plant, An Illustrated Dictionar, Page 137.
94. Kanhaiya Agrawal. Review of drugs under Laghupanchmula, Journal of Pharmacognosy and Phytochemistry 2018; 7(3): 3363-3369
95. Kapoor LD. Handbook of Ayurvedic Medicinal Plants. Boca Raton Fla. CRC Press, USA, 1990.
96. Kareparamban JA, Nikam PH, Jadhav AP and Kadam VJ (2012). *Ferula foetida* “Hing”: A Review, Research Journal of Pharmaceutical, Biological and Chemical Sciences, April – June, RJPBCS Volume 3, Issue 2, Page No. 775.
97. Khan. F.A. & Akter.S., Akter.M. & Billah.M.M and Shakil.A. J (2017). Sedative, Analgesic and Cytotoxic activities of *Nyctanthes arbor-tristis* L. IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS). Volume 12, Issue 5 Ver. IV (Sep. – Oct.), PP 01-07
98. Shivani S. & Ansari S.H., Zahiruddin S & Parveen. R and Ahmad S. (2015). Quality Standards of Leaves of *Nyctanthes arbor-tristis* Linn. International Journal of Drug Development and Research, Volume 7(3): 004-009 (2015)-004.
99. Kirtikar KR, Basu BD 1988. Indian Medicinal Plants. Dehradun: International Book Distributors: pp. 1848-1849.
100. Kitikar. K.R. 1975; Indian Medicinal Plants, Second Edition, vol.III, page 2312, edit, E. BLATTER Jayyed. Press, Delhi-6.
101. Kolammal, M 1978, Pharmacognosy of Ayurvedic Drugs, Pharmacognosy Unit, Ayurveda College, Trivandrum, vol. 2, pp. 36-37.
102. Koti, B.C. and A. Purnima, 2008. Diuretic activity of extracts of *Centratherrum anthelminticum*. Int. J. Green Pharmacy, 2: 228-231.
103. Kritikar KR, Basu BD, Indian Medicinal Plants, Bishen Sing Mahendra Pal Sing. Dehradun.1975; 2nded: Vol II, pp 1511-1513.
104. KulsoomZahara et al. A review of therapeutic potential of *Saussurealappa*-An endangered plant from Himalaya. Asian Pac J Trop Med 2014; 7(Suppl 1): S60-S69
105. Kumar D. B., Dhirawat.R. and Kumawat.M. (2014). Pharmacognostical Study of a Medicinal Plant of India – *Sarcostemma acidum*, International Journal of Pharmacognosy and Phytochemical Research 14-15; 6(4); 690-697.
106. Kumar Uikey S, Yadav A.S, Ajit K. Sharma, Atul K. Rai, Raghuwanshi D.K. , and Badkhane Y, 2010; The Botany, Chemistry, Pharmacological and Therapeutic Application of *Psoralea corylifolia* L. – A Review, International Journal of Phytomedicine 2 (2010) 100-107
107. Kumar V, Shahid S, Shamim U, Ansari A and Iqbal M. 2018, *Gymnema sylvestre* for Diabetics, India, Journal of Herbs, Spices & Medicinal Plants, Vol. 14(1–2).

108. Kumar, G.S., Jayaveera, K.N., Ashok, C.K., Sanjay, P.U., Swamy, B.M.V., Kumar, D.V., 2007. Antimicrobial effects of Indian medicinal plants against acne-inducing bacteria. *Tropical Journal of Pharmaceutical Research* 717-23.
109. Kurian. T. and Ittiyavirah Dr. S. P. (2018). Psychopharmacological Studies of Methanolic Extract of *Sarcostemma acidum* (Roxb) Voigt, *World Journal of Pharmaceutical Research*, Vol 7, Issue 9.
110. Lalchand & Rekha, Sahu & Rakshpal, Gupta & Rout, Om & D Scholar, M. (2018). *Cuscuta reflexa* (Dodder Plant): A Critical Review on the Medicinal Plant used in Ayurveda. *International Journal of Research in Ayurveda and Pharmacy*. 8. 10.7897/2277-4343.086288.
111. Lata Singh. K, K. Singh. D and Kumar Singh. V, 2016, Multidimensional Uses of Medicinal Plant *Kachnar* (*Bauhinia variegata* Linn.), *American Journal of Phytomedicine and Clinical Therapeutics*, *AJPCT*, 4:2: 058-072
112. Lodhi, M. A., Abbasi, M. A., Choudhary, M. I., Ahmad, V. U., 2007. Kinetic studies on triacontanyl palmitate: a urease inhibitor. *Natural Product Research* 21(8), 721-25
113. M. Prathapa Reddy, T. R. Shantha, V. Rama Rao, N. (2018) Shiddamallayya and Amit Kumar Dixit. Pharmacognostical Standardization on the Roots of *Agnimantha Premna serratifolia* Linn. *IJP*, 5(7): 426-430.
114. Mahendra P and Bisht S (2012). *Ferula asafoetida*: Traditional uses and pharmacological activity, *Pharmacogn Rev.* Jul-Dec; 6(12): 141–146.
115. Manisha A. and Reni K. 2013, Isolation and Characterization of a Novel Chemical Entity from Ether Extract of *Ammomum subulatum* Leaves; *International Journal of Research in Pharmacy and Science*, *IJRPS*, 3(1), 52-56.
116. Manvar. M. (2012). Pharmacognostical and Phytochemical Investigations on *Vernonia anthelmintica* Willd. *Inventi: Planta Activa*. 4. 1-3.
117. Masihuddin, Jafri MA, Siddiqui A, Chaudhary S, Traditional uses, phytochemistry and pharmacological activities of *Papaver somniferum* with special reference of Unani medicine: an updated review, *Journal of Drug Delivery and Therapeutics*. 2018; 8(5-s):110-1164 DOI: <http://dx.doi.org/10.22270/jddt.v8i5-s.2069>
118. Md. Shahidul Islam (2012). Phytochemical and Biological Investigation of *Nyctanthes arbor-tristis* (Leaves). A Dissertation, The Department of Pharmacy, East West University: [http://dspace.ewubd.edu/bitstream/handle/123456789/65/Md. %20Shahidul%20 Islam.pdf?sequence=1&isAllowed=y](http://dspace.ewubd.edu/bitstream/handle/123456789/65/Md.%20Shahidul%20Islam.pdf?sequence=1&isAllowed=y).
119. Mehta, B.K., D. Mehta and A. Itoriya, 2010. Isolation and structure determination of acetylated triterpenoid saponins from the seeds of *Centrathium anthelminticum*. *Nat. Prod. Res. Part A*. 24: 120-130.
120. Mehta, B.K., D. Mehta and M. Verma, 2005. Novel steroids from the seeds of *Centrathium anthelminticum*. *Nat. Prod. Res.: Formerly Nat. Prod. Lett.*, 19: 435-442.
121. Mohammad A. Rashid et al, 2018. *Stereospermum suaveolens* (Roxb.) DC. Shows Potential in vivo and in vitro Bioactivities; *Dhaka Univ. J. Pharm. Sci.* 17(2): 257-263, (December)

122. Mukherjee Pulok K. Quality Control of Herbal Drugs. Business Horizons Publication. New Delhi. 2002.
123. Nadkarni KM. Indian Materia Medica. Dhoora Papeeshwar Prakashan Ltd., Panval, Vol. 1, 3rd edition, 1954.
124. Nishat Farah¹, Saurabh Srivastava, Pradeep Singh, Garima Mishra. Phytopharmacological Review of *Cassia tora* Linn. (Fabaceae). Asian Journal of Plant Science and Research, 2011, 1 (1): 67-76
125. Nishyeeswar K, Hemadri K. Dravyaguna Vijnana, Chaukhamba Sanskrit Pratishthan, Delhi, India, 1st edition, 2010.
126. Pandey, Sandeep & Shukla, Arti & Pandey, Supriya & Pandey, Ankita. (2017). Morphology, chemical composition and therapeutic potential of *Somlata* (*Sarcostemma acidum* Wight. & Arn.). Pharma Science Monitor. 8. 54-60.
127. Pankaj et. al. 2012; Phytopharmacological study and Ethnobotany of plant *Ficus benghalensis* Linn. The Journal of Phytopharmacology, 1(2):51-62
128. Patel, D. K., Patel, K., Gadewar, M., Tripathi, R., 2012. A review on medicinal importance, pharmacological activity and bioanalytical aspects of beta-carboline alkaloid ‘‘Harmine’’. Asian Pacific Journal of Tropical Biomedicine 660-4.
129. Patel, V.P., M. Hirpara and M.P. Suthar, 2012. In vitro screening for antibacterial activity of various extract of *Centratherrum anthelminticum* seeds. Asian J. of Pharm. Sci. Tech., (In Press).
130. Paydar M, Moharam A. B., Wong Y.L., Looi C.Y., Wong W.F., Nyamathulla. F., Pandey V., Kamalidehghan. B. and Arya A. (2013). *Centratherrum anthelminticum* (L.) Kuntze a Potential Medicinal Plant with Pleiotropic Pharmacological and Biological Activities, International Journal of Pharmacology, Volume 9 (3): 211-226.
131. PDR for herbal medicine, 4th edition, page 138
132. PDR for herbal medicine, 4th edition, page 149
133. PDR for herbal medicine, 4th edition, page 391
134. Phalsteen Sultan, Shahid Rasool* and Qazi Parvaiz Hassan. *Picrorhizakurroa* Royle ex Benth. A plant of diverse pharmacological potential. Annals of Phytomedicine 6(1): 63-67, 2017
135. Pole S, 2013. *Psoralea corylifolia*, Ayurvedic Medicine, The principles of traditional practices, edit Singing Dragon, an Jessica Kingsley Publishers, Philadelphia, PA 19106, USA
136. Pole S, 2013. *Rheum palmatum*, Ayurvedic Medicine, The principles of traditional practices, edit Singing Dragon, an Jessica Kingsley Publishers, Philadelphia, PA 19106, USA, page 250.
137. Prasanth Reddy V, Sudheshna G., Afsar S.K., Saran S.S., Kumar, S.N., Ram C. R. & K Ravindra Reddy, Dr. (2012). Evaluation of anti-ulcer activity of *Citrullus colocynthis* fruit against pylorus ligation induced ulcers in male wistar rats. International Journal of Pharmacy and Pharmaceutical Sciences. 4. 446-451.

138. Pravin B., Deshmukh, Vijay P and Kishanchnad K. 2013. Review on *Citrullus colocynthis*, International Journal of Research in Pharmacy and Chemistry. IJRPC, 3(1).
139. Prerna Sarup, Suman Bala, and Sunil Kamboj, "Pharmacology and Phytochemistry of Oleo-Gum Resin of *Commiphora wightii* (Guggulu)," *Scientifica*, vol. 2015, Article ID 138039, 14 pages, 2015. <https://doi.org/10.1155/2015/138039>
140. Priyanka Pandey et al, 2013; Physico-chemical and preliminary phytochemical screening of *Psoralea corylifolia*, Scholars Research Library, Archives of Applied Science Research, 5 (2):261-265.
141. Prof Dr Ali Esmail Al-Snafi. Pharmacology of *Ficus religiosa*- A review. IOSR Journal Of Pharmacy, Volume 7, Issue 3 Version.1 (March 2017), PP. 49-60
142. Rajkumar V, Guha G, Kumar R A. 2011. Antioxidant and Anti-Cancer Potentials of *Rheum emodi* Rhizome Extract. Evidenced-Based Complementary and Alternative Medicine June; 1-9.
143. Ramachandran S (2013). Review on *Sphaeranthus indicus* Linn. (Kotṭaikkarantai). Phcog Rev [serial online] [cited 2019 Apr 16]; 7:157-69.
144. Rani et al. 2015, screening of phytochemicals, TLC profiling total flavonoid and phenolics content, anti-oxidant activity and anti-microbial activity of *Ficus benghalensis* Linn and *Ficus religiosa* Linn latex; J Pharm Pharm Sci, Vol 7, Issue 9, 480-485
145. Rani, Champa & Chawla, Sunaina & Mangal, Manisha & K. Mangal, A & Kajla, Subhash & Dhawan, Ashok. (2011). *Nyctanthes arbor-tristis* Linn. (Night jasmine): A sacred ornamental plant with immense medicinal potential. Indian Journal of Traditional knowledge. . 3: 427-435. Indian Journal of Traditional knowledge. 3. 427-435.
146. Rehman H., Begum W., Anjum F., and Tabasum H. 2014. *Rheum emodi* (Rhubarb): A Fascinating Herb; Journal of Pharmacognosy and Phytochemistry; 3 (2): 89-94
147. Samuel V.J., Mahesh A.R. and Murugan.V. (2019). Phytochemical and pharmacological aspects of *Tephrosia* genus: A brief review. Journal of Applied Pharmaceutical Science Vol. 9(03), pp 117-125, March.
148. Sandeep Pandey et al. Chemical composition and medicinal uses of *Anacyclus pyrethrum*, Pharma Science Monitor 9(1), Jan-Mar 2018, 551-560
149. Saneja A, Sharma C, Aneja K.R and Pahwa R, 2010; *Gymnema Sylvestre* (Gurmar): A Review, Der Pharmacia Lettre: 2 (1) 275-284
150. Saraf, M N., Doshi, N S., Jadhav, S R., Soni, K., Kumar, P Suresh. (2007). Mechanism of spasmolytic activity of a fraction of *Sarcostemma brevistigma* Wight, Indian Journal of Experimental Biology, Vol.45, pp 419-424.
151. Sastry J.L.N., Dravyaguna Vijnana, Chaukhambha Orientalia, Varanasi, India, Vol. II, reprint edition, 2014.
152. Selvaraj, Gurudeeban & Kaliyamurthi, Satyavani & Ramanathan. (2010). Bitter Apple (*Citrullus colocynthis*): An Overview of Chemical Composition and Biomedical Potentials. Asian Journal of Plant Science. 9. 394-401. 10.3923/ajps.2010.394.401.

153. Shah KA, Patel MB, Patel RJ, Parmar PK. *Mangifera indica* (mango). *Pharmacogn Rev.* 2010;4(7):42–48. doi:10.4103/0973-7847.65325
- 154. Sharma DK, Hall IH. Hypolipidemic, anti-inflammatory, and antineoplastic activity and cytotoxicity of flavonolignans isolated from *Hydnocarpus wightiana* seeds. *J Nat Prod.* 1991 Sep-Oct;54(5):1298-30.**
155. Sharma R K, Goel A and Bhatia A. K (2016). *Lawsonia inermis* Linn: A Plant with with cosmetic and medical benefits, *Int J Appl Sci Biotechnol*, Vol 4(1): 15-20.
156. Sharma, P.C., Yelna, M.B., Dennis, T.J., 2002. Database on Medicinal Plants used in Ayurveda, Central Council for Research in Ayurveda and Siddha, Vol. V, New Delhi, pp.164-70.
157. Sharma, Rajesh & Mehan, Dr. Sidharth & Kalra, Sanjeev & Khanna, Deepa. (2013). *Tephrosia Purpurea*-A magical Herb with Blessings in human biological system. 12-22.
158. Sharma, S. K., Sharma, S. M., Saini, V. P., Mohapatra, S., 2013. Evaluation of analgesic and anti inflammatory activity of *Symplocos racemosa*. *International Research Journal of Pharmacy* 4(2), 136-39.
159. Shivanand T Biradar, Harisha C R, GalibR, Prajapati P K. Pharmacognostical Evaluation of *Benincasa Hispida* (thunb.) Cogn. (Kushmanda) Fruit. *J. Res. Trad. Medicine | Mar - Apr 2016 | Volume 2 | Issue 2*, pp-34-38
160. Shukla. S. Archana.(2017) Review Literature on *Ahiphen*. *IJAAR*, 3(5):908-913
161. Shukla SH, Mistry HA, Patel VG and Jogi BV. Pharmacognostical, preliminary phytochemical studies and analgesic activity of *Amomum subulatum* Roxb. *An International Journal of Pharmaceutical Sciences.* 1(1): 90-102.
162. Singh and Jawaid: *Cinnamomum camphora*(Kapur): Review. *Pharmacognosy Journal | March-April 2012 | Vol 4 | Issue 28*, pp-1-5
163. Singh J. Dr. (2016). *Kali Jeeri (Kalijiri) - Centratherum anthelminticum*. *Ayur Times.* June 21: <https://www.ayurtimes.com/kali-jeeri-kalijiri-centratherum-anthelminticum/>
164. Singh, S., N.A. Ansari, M.C. Srivastava, M.K. Sharma and S.N. Singh, (1985). Anthelmintic activity of *Vernonia anthelmintica*. *Indian Drugs*, 22: 508-511.
165. Sm, Dhivya & Kalaichelvi, K & Sharmila, S. (2017). Pharmacognostical Studies on *Sarcostemma brevistigma*, Wight. and Arn. – An Ethnomedicinal Plant. *International Journal of Pharmacognosy and Phytochemical Research.* 9. 10.25258/phyto.v9i5.8144.
166. Studies on chemical constituents of rhizomes of *Smilax china*. *China journal of Chinese materiamedica* 33(21):2497-9
167. Sunita Verma. An overview: A sacred tree *Ficus religiosa* (Peepal). *World Journal of Pharmacy and Pharmaceutical Sciences*, Vol 5, Issue 8, 2016, Volume 5, Issue 8, 427-433
168. Surendra Kr. Sharma¹*and Naresh Kumar¹, Pharmacognostical evaluation of the rhizomes of *Picrorhizakurroa Royle* Ex Benth. *Journal of Pharmacy Research* 2012,5(2),1116 -1118.

169. Thomson Healthcare. 2007. Bitter apple, PDR for herbal medicine, published by Medical Economics Company, Inc. at Montvale, NJ 07645-1742, 4th edition, page 83
170. Tropical Plants Database, Ken Fern. Tropical.theferns.info. 2019-06-10. <tropical.theferns.info/viewtropical.php?id=Tephrosia+purpurea>
171. Usmani et al. / Journal of Applied Pharmaceutical Science 6 (03); 2016: 144-150 https://www.bimbima.com/ayurveda/medicinal-use-of-akarkara-spilanthes-acmella/1383/#general_information
172. Usmani et al. / Journal of Applied Pharmaceutical Science 6 (03); 2016: 144-150
173. Vasant Lad D (2006). *Ferula asafetida*, AYURVEDIC MEDICINE: The Principles of Traditional Practice, 2nd Edited Singing Dragon (2013), an imprint of Jessica Kingsley Publishers 116 Pentonville Road London N1 9JB, UK.
174. Vashist, H., Jindal, A., 2012. Antimicrobial activities of medicinal plants- A review. International Journal of Research in Pharmaceutical and Biomedical Sciences 3(1), 222-30.
175. Velaskar S, etal (2016). Efficacy and Safety of Two Doses of *Sphaeranthus indicus* Extract in the Management of Plaque Psoriasis: A Randomized, Double Blind, and Placebo Controlled Phase II Trial.: American Journal of Dermatology and Venereology 2016, 5(1): 6-15 DOI: 10.5923/j.ajdv.20160501.03
176. Venkidesh, R., Pal, D., Kumar, C.K., Saravanakumar, A., Mandal, S.C., 2012. Studies on antidiabetic potential of *Symplocos racemosa* Roxb. bark extract in streptozotocin induced diabetic rats. International Journal of Phytopharmacy Research 3(1), 1-5.
177. Vijayabaskaran, M., Yuvaraja, K.R., Babu, G., Perumal P., Jayakar B., 2010. Isolation and characterization of phenolic glycoside from the bark of *Symplocos racemosa* Roxb. EJournal of Chemistry 7(S1), S255-S260.
178. Vijikumar S., Ramanathan K. and Parimala Devi B. 2011. *Cuscuta reflexa* ROXB.: A Wonderful Miracle Plant in Ethnomedicine; Indian Journal Of Natural Sciences; VolII, Issue 9, December.
179. Wakchaure D., Jain D., Singhai A.K. and Somani R (2011). Hepatoprotective activity of *Symplocos racemosa* bark on carbon tetrachloride -induced hepatic damage in rats; Journal of Ayurveda & Integrative Medicine, July-September, Vol 2, Issue 3, p 137
180. Whistler. W.2000; *Ficus benghalensis* L.; Tropical Ornamentals; A Guide, Timber Press Inc. Oregon.
181. World Health Organization, WHO Monographs on Selected Medicinal Plants, Vol. I-IV, World Health Organization, Geneva 1999.
182. Yende S.R, Harle U.N, Rajgure D.T, Tuse T.A. and N.S. Vyawahare, 2008; Pharmacological profile of *Acorus calamus*: An Overview, Pharmacognosy Reviews [Phcog Rev.]- Supplement, Vol 2, Issue 4, Jul-Dec, Page 22-26.

-0-