THIN LAYER
CHROMATOGRAPHIC ATLAS
OF
AYURVEDIC PHARMACOPOEIAL
DRUGS

PART - I
VOLUME - III

First Edition

Government of India
Ministry of AYUSH

Published by
PHARMACOPOEIA COMMISSION FOR INDIAN MEDICINE & HOMOEOPATHY
GHAZIABAD
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Ministry of AYUSH, Government of India

On behalf of : Government of India
Ministry of AYUSH,
AYUSH Bhawan, B Block,
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Published by : Pharmacopoeia Commission for Indian Medicine & Homoeopathy
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Ghaziabad-201002 (U.P.) India

Cover Page Photographs:
1. Ficus hispida L. Plant
2. TLC profile of Fruit extract viewed under 366 nm
3. TLC profile of Fruit extract after derivatization and viewed under white light
FOREWORD

The Ayurvedic Pharmacopoeia Committee (APC) such as the authority, under the Ministry of AYUSH has brought out several single and compound monographs under Part-I and Part-II volumes respectively as legal document done with Ayurvedic Pharmacopoeia of India (API). These are aimed to provide easy-to-follow quality standards on identity, purity and strength of each of the Ayurvedic drug. With the passage of the time, due to technological advancement, new testing methods and techniques have been evolved and adopted to achieve these objectives. Of them, the Thin Layer Chromatography (TLC) is most reliable technique for monitoring the identity and purity of drugs and at the same time for detecting adulteration and substitution.

2. The first ever publication of its kind titled “Thin Layer Chromatographic Atlas of Ayurvedic Pharmacopoeial Drugs Part I, Volume I” was published in the year 2009. This volume was welcomed by the drug analysts and quality control personnel and drug manufacturers across the country. In the series of that the Second publication, covering ninety-nine single Ayurvedic Pharmacopoeial Drugs of API Part-I Volume-III is being published by the Ministry of AYUSH to meet its commitment for ensuring quality standard of Ayurvedic drugs.

3. I place my high appreciation on record the composite efforts of the scientist of the Central Council for Research in Ayurvedic Sciences (CCRAS), members of the Ayurvedic Pharmacopoeia Committee and Pharmacopoeia Commission for Indian Medicine & Homeopathy (PCIM&H) in bringing out this publication. The highly appreciable contribution of Prof. S. S. Handa, Chairman, Scientific Body, PCIM&H, Late Dr. P. D. Sethi, Prof. V. K. Kapoor, Dr. M. M. Padhi (Deputy Director General, CCRAS), Dr. Rajeev Kr. Sharma (Director PCIM&H) and his team is specifically acknowledged.

4. I am sure that the present volume will prove very useful to all the stakeholders such as; Ayurvedic drug industries, drug testing laboratories, academicians and research institutions for the purpose of authentication of plant drug identification as well as analysis.

(Ajit M. Sharan)

NEW DELHI
1st March, 2016
PREFACE

The Indian traditional medicine is one of the most important rich heritage of using of plants as medicine. The first ever use as medicine is well recorded in Vedic compendium i.e. Rigveda. A sizable number of plant drugs are found in Atharvaveda, which became the basis of the development of the Science of life as evident in ancient scriptures of Ayurveda; Charak Samhita and Susruta Samhita. In both the works, thousands of drugs of plant origin with their properties, action and uses are ascribed.

Following the tradition, in medieval period more number of plants including plants found in original works is seen with the addition of new therapeutic uses for the wellness of all living beings in India. In India the tradition has continued and good number of works have been published. The government of India realized the importance of Ayurveda, and Pharmacopoeial monographs on single and compound formulations were published in volumes in different years since 1978.

In the current scenario, the importance of the plant based drugs has been realized throughout the world. So as to the Ayurvedic drugs of plant origin in India, quality standard has been emphasized by the Government of India in accordance with WHO guidelines. The Ayurvedic Pharmacopoeia Committee of India as an integral part of Government of India, Ministry of AYUSH is working hard and publishing quality standards of the single drug. In series of that, new methods and techniques are adopted to achieve these objectives for detecting adulteration and substitution, the most reliable and simplest technique; Thin Layer Chromatography (TLC) has been adopted.

In the year 2009 the “Thin Layer Chromatographic Atlas of Ayurvedic Pharmacopoeial Drugs of API Part-I, Vol.-I” was published and now second publication in this series covering ninety-nine single Ayurvedic Pharmacopoeial Drugs of API Part-I, Vol. III is being published by the Ministry of AYUSH to meet its commitment for ensuring quality of Ayurvedic drugs.

It is hoped that this current volume will find place as guidance to the Ayurvedic drugs manufacturers in India to develop quality standard Ayurvedic products from medicinal plants of Ayurvedic classics for the beneficial of the consumers. Apart from that, this will also be useful to the researchers interested in Ayurvedic plant based drugs.
Pharmacopoeia Commission for Indian Medicine & Homoeopathy

Pharmacopoeia Commission for Indian Medicine & Homoeopathy (PCIM&H) is an autonomous organization under Ministry of AYUSH, Govt. of India with a primary mandate to develop pharmacopoeial standards for drugs/formulations used under Ayurveda, Siddha, Unani and Homoeopathic systems of medicine. It serves as an umbrella organization for Ayurvedic Pharmacopoeia Committee (APC), Siddha Pharmacopoeia Committee (SPC), Unani Pharmacopoeia Committee (UPC) and Homoeopathic Pharmacopoeia Committee (HPC). Pharmacopoeial Laboratory for Indian Medicine (PLIM) and Homoeopathic Pharmacopoeia Laboratory (HPL) are its permanent supporting structures.

The Commission was initially established as Pharmacopoeia Commission for Indian Medicine (PCIM) in the year 2010. In pursuance to the decision of Central Government, Homoeopathy was incorporated and the Commission was renamed as Pharmacopoeia Commission for Indian Medicine & Homoeopathy (PCIM&H) on 25th June 2014. Commission has a three-tier structure of Governance comprising of the General Body, Standing Finance Committee and Scientific Body. The Secretary, Ministry of AYUSH, Govt. of India is ex-officio Chairman of the Commission.

Objectives

1. Publication and revision of the Ayurvedic, Siddha, Unani and Homoeopathic Pharmacopoeia of India at suitable intervals and of such addenda or supplementary compendia during the intervening periods as may be deemed necessary; releasing the publications for public use from a date when they are to become official.

2. Publication and revision of the Ayurvedic, Siddha and Unani Formularies of India, Homoeopathic pharmacopoeia as well as Homoeopathic Pharmaceutical Codex at regular intervals with a view to make it an authentic source of information on rational combination and use of medicines including their methods of preparation, therapeutic indications, adverse reactions, contra-indications, drug-drug interactions and similar issues concerning Indian medicines for safe use in humans and animals. Identification of Ayurvedic, Siddha and Unani formulations and Homoeopathic pharmacopoeia as well as Homoeopathic Pharmaceutical Codex with a view to develop their quality standards and to ensure quality and safety of ASU & H medicine.

3. To nurture and promote awareness of quality in Ayurvedic, Siddha and Unani drugs/formulations, Homoeopathic pharmacopoeia as well as Homoeopathic Pharmaceutical Codex and drug research on ASU products and publish regularly or at suitable intervals other related scientific information as authorized under the rules and procedures of the Commission.

4. Exchange information and interact with expert committees of the World Health Organization and other international bodies with a view to harmonize and develop the Ayurvedic, Siddha, Unani and Homoeopathic Pharmacopoeial standards to make those internationally acceptable.

5. Arranging studies either under its own auspices or through collaboration with other institutions to develop standards and quality specifications for identity, purity and strength of raw materials and compound formulations and to develop Standard Operating Procedures for the process of manufacture included or to be included in the Ayurvedic, Siddha, Unani and Homeopathic Pharmacopoeia/formulary and its addenda or supplementary compendia or other authorized publications.

6. Maintain National repository of authentic reference raw materials used in the manufacture of Ayurveda, Siddha, Unani and Homeopathic medicines for the purpose of reference and supply of reference standards to the stake holders at a price.
7. To assign responsibilities described for Pharmacopoeial Laboratory for Indian Medicine and Homoeopathic Pharmacopoeia Laboratory under the Drugs & Cosmetics Act.

8. Generate and maintain repository of chemical reference marker compounds of the plants or other ingredients used in standardizing Ayurveda, Siddha, Unani and Homeopathy medicines and supply them as reference standards to the stake holders on price.

9. Furtherance of the provision of Chapter IVA of Drugs and Cosmetic Act, 1940 in case ASU drugs & 4A of Schedule II of Drugs & Cosmetics Act in case of Homoeopathy medicine and rules there under related to Ayurvedic, Siddha and Unani drugs and Homoeopathy medicine respectively.

10. Acting as a coordinating centre for analytical laboratories, industry and academia by encouraging exchange of scientific and technical information and staff and by undertaking sponsored funded research as well as consultancy projects.

11. Organizing national/international symposia, seminars, meetings and conferences in selected areas from time to time and to provide updated regular training to the regulatory authorities and stake holders.

**The General Body**

The General Body is the apex body and is responsible for overall governance of the Commission.

**Composition:**

i) Secretary, Ministry of AYUSH
   - Sh. Nilanjan Sanyal until 31\textsuperscript{st} August, 2015;
   - Sh. Ajit M. Sharan from 1\textsuperscript{st} Sept., 2015
   
ii) Joint Secretary, Ministry of AYUSH
    - Sh. Raj Pratap Singh until 1\textsuperscript{st} Dec., 2014
    - Sh. Anurag Srivastav until 1\textsuperscript{st} Nov., 2015
    - Sh. Jitendra Sharma from 2\textsuperscript{nd} Nov., 2015

iii) Chairman, Scientific Body, PCIM&H
    - Prof. S. S. Handa
    
iv) Secretary and Director General, ICMR
    - Dr. Soumya Swaminathan

v) Chairman, CII or his nominee
   - Sh. Sumit Mazumder

vi) Chairman, FICCI or his nominee
    - Mr. Harshavardhan Neotia

vii) Drugs Controller General (India)
    - Dr. G. N. Singh

viii) Central Drug Controller (AYUSH)

ix) Adviser (Ayurveda), Ministry of AYUSH
    - Dr. Manoj Nesari

x) Adviser (Unani), Ministry of AYUSH
    - Prof. Rais-Ur-Rahman

xi) Adviser (Homoeopathy), Ministry of AYUSH
    - Dr. N. Radha
Eminent ASU&H experts (one from each system)
1. Dr. Vaidya Balendu Prakash (Ayurveda Expert)
   Turner Road, Dehradun, Uttarakhand
2. Dr. V. Arunachalam (Siddha Expert)
   Dean, Santhigiri Health Care & Research Organization,
   Santhigiri Ashramam, Santhigiri P.O,
   Thiruvanathapuram-695589, Kerala
3. Dr. Mohd. Khalid Siddique (Unani Expert)
   Former DG, CCRUM,
   Jamia Hamdard Enclave, New Delhi
4. Dr. S. P. Singh (Homoeopathy Expert)
   Former Adviser (Homoeopathy), S R B, 68-C Shipra Riviera.
   Indirapuram, Ghaziabad-201014

One representative each of ASU&H Drug Manufacturers
1. Mr. Pramod Sharma (Ayurveda Industry)
   Managing Director,
   Shree Baidyanath Ayurvedic Bhawan (P) Ltd.
   Patna 800001. Bihar
2. Dr. M. K. Thyagarajan (Siddha Industry)
   IMPCOPS, Adayar, Chennai-600020
3. Dr. Ajmal K. P. (Unani Industry)
   Hermas Herbal Unani Pharmaceuticals, Chennamangallur,
   (PO) Mukkam, Calicut-673602
4. Dr. P. N. Verma (Homoeopathy Industry)
   Scientific Advisor, Dr. Willmar Schwabe India Pvt. Ltd,
   Noida-201307

The Standing Finance Committee
All matters with respect to financial approvals are dealt by Standing Finance Committee. Standing Finance Committee is responsible for screening/appraising/evaluating the projects/works etc. of the Commission and recommend for the approval of these projects /works by the General Body.

Composition:

i) Joint Secretary (AYUSH)  
   Sh. Raj Pratap Singh until 1st Dec., 2014  
   Sh. Anurag Srivastava until 1st Nov., 2015  
   Sh. Jitendra Sharma from 2nd Nov., 2015  
   Chairman

ii) Chairman, Scientific Body  
    Prof. S.S. Handa  
    Vice-Chairman

iii) Financial Adviser, M/o Health &Family Welfare  
    Smt. Vijaya Srivastava
    Member

iv) Central Drug Controller (AYUSH)
    Member

v) Director, PCIM&H  
   Dr. Rajeev Kr. Sharma  
   Member Secretary
**The Scientific Body**

The Scientific Body is responsible for designing/preparing and according technical approval for all the scientific & technical works/projects and execution of these works/projects through different Pharmacopoeia Committees / other agencies, publication of validated Pharmacopoeia after obtaining the approval of the General Body.

**Composition:**

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<th>i)</th>
<th>Eminent Scientist or an ASU&amp;H Expert with significant experience in Pharmacopoeial work</th>
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<td>Dr. K. Ravi (Joint Adviser)</td>
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<th>xviii)</th>
<th>Professional expert drawn one each from ASU&amp;H industry</th>
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<td>Members</td>
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1. Dr. K. Anil Kumar, Managing Director, Kerala Ayurveda Pharmacy Ltd. (KPL), Athani-683585, Aluva, Kerala

2. Dr. S. Jahir Hussain, Sidha Physician, QC Section, TAMPCOL, Alathur, Dist. Kanchipuram

3. Sh. Kafeel Ahmed, Manager, Tibbiya College Dawakhana, Aligarh Muslim University, Aligarh
4. Dr. Nishant Tripathi, General Manager, M. Bhattacharya & Co. Pvt. Ltd.
   73, N. S. Road, Kolkata-700 001

xix) One expert each from ASU&H Academia and Regulatory Bodies

1. Dr. G. S. Badesha, Director (Ayurveda), Govt. of Chattisgarh, Raipur, Chattisgarh.
2. Dr. N. Kabilan, Associate Professor, The Tamil Nadu Dr. M. G. R Medical University, Anna salai, Guindy, Chennai-600 032
3. Prof. Yashmin Shamsi
   Faculty of Unani Medicine, Jamia Hamdard University, Delhi
4. Dr. S. K. Nanda, Director, National Institute of Homoeopathy, Kolkata-700106

xx) Director, PCIM&H
    Dr. Rajeev Kr. Sharma

Member Secretary

Execution of Pharmacopoeial Work

Pharmacopoeia Committees

The Scientific and technical work of the Commission is being executed through Ayurvedic, Siddha, Unani & Homoeopathic Pharmacopoeia committees under the supervision of the Scientific Body. The function of Pharmacopoeia committees is to prepare official formularies, Pharmacopoeias of single drugs and compound formulations, Pharmacopoeial codex and other technical documents related to standards for drugs. The present composition of ASU&H Pharmacopoeia committees is as below:

I. Ayurvedic Pharmacopoeia Committee

1. Prof. V. K. Joshi
   B-6, New Medical Enclave, Nariya, Banaras Hindu University,
   Varanasi-221005
   Chairman

2. Adviser (Ay.): Dr. Manoj Nesari
   Ministry of AYUSH, AYUSH Bhawan, B Block, GPO Complex, INA, New Delhi- 110023

3. Director
   Pharmacopoeial Laboratory for Indian Medicine
   Kamla Nehru Nagar, Ghaziabad- 201002

4. Director General: Prof. K. S. Dhiman
   Central Council for Research in Ayurvedic Sciences (CCRAS)
   61-65, Institutional Area, Opp. ‘D’ Block, Janakpuri, New Delhi- 110058
   Member Secretary

5. Prof. V. K. Kapoor
   1473, Pushpak Complex, Sector-49 B, Chandigarh- 160047
   Member

6. Dr. Roopak Kumar
   Vice-President, Multani Pharmaceuticals Ltd., Analytical Division, Village:-
   Makkanupur, Roorkee, Dist.- Haridwar- 237891
   Member

7. Prof. Karan Vashisth
   Former Head, University Institute of Pharmaceutical Science (UIPS), Chandigarh-160014
   Member

8. Ms. S. Satakopan
   7/4 Padmam Flats, 7th street Nanganallur, Chennai-600061
   Member
9. Dr. Malati Chauhan
   IPGT&RA, Gujarat Ayurved University,
   Jamnagar, Gujarat

10. Dr. J. L. N. Sastry
    Head, Dabur Research & Development Center (DRDC),
    Dabur India Limited 22, Site IV, Sahibabad (UP)

11. Dr. K. N. Dwiwedi
    Head, Deptt. of Dravyaguna, I.M.S., Banaras Hindu University,
    Varanasi- 221005

12. Dr. S. K. Dixit
    B-3/402, Shivala,
    Varanasi-221005

13. Dr. S. S. Savrikar
    Prof. & HOD Rasashastra & Bhaishajya Kalpana
    Govt. Ayurvedic College & Hospital
    Solapur Road, Madhuban, Osmanabad, Maharashtra- 413501

14. Dr. C. K. Katiyar
    CEO Technical, Emami HCD,
    Emami Towers, 5th Floor, 687, Anandapur,
    E.M. Bypass, Kolkata-700107

15. Dr. P. M. Variar
    Arya Vaidya Sala, Kottakkal,
    Malappuram, Kerala-676503

16. Dr. Aditya Kaushik
    Head-Medical Regulatory Affairs
    Glaxo SmithKline Consumer Healthcare Ltd.,
    Sector 32, Gurgaon-122001, Haryana

17. Dr. Shailesh Nadkarni
    Shree Dhootapapeshwar Ltd.
    135, Nanubai, Desai Road, Khetwadi, Mumbai- 400004

II. Siddha Pharmacopoeia Committee

1. Dr. G. Veluchamy
   24, Chokkanathar Street, Karthikeyan Nagar,
   Maduravoyal, Chennai-600095

2. Deputy Adviser (Siddha): Dr. K. Ravi (Joint Adviser)
   Ministry of AYUSH, AYUSH Bhawan,
   B Block, GPO Complex, INA, New Delhi- 110023

3. Director
   Pharmacopoeial Laboratory for Indian Medicine
   Kamla Nehru Nagar, Ghaziabad- 201002

4. Director General: Prof. R. S. Ramaswamy
   Central Council for Research in Siddha (CCRS)
   SSCRI, Anna Hospital Campus, Arumbakkam,
   Chennai-600106

5. Dr. Sharada Vasanth
    Former Research Officer (Chem.),
    SSCRI, Chennai-600106

6. Dr. K. Balakrishna
    Former Research Officer (Chem.),
    SSCRI, Chennai-600106
7. Prof. V. Gopal
   Principal, Govt. College of Pharmacy,
   Mother Teresa PG Research Institute of Health Sciences,
   Puducherry-605006

8. Dr. Sasikala Ethiraju
   Research Officer (Pharmacognosy),
   SCRL, Chennai-600106

9. Dr. P. Jayaraman
   Former Prof. of Botany,
   Presidency College, Chennai

10. Dr. (Prof.) I. Sornamariammal
    Former Joint Director of Indian Medicine,
    Chennai

11. Dr. P. Kumar
    Drug License Issuing Authority for ISM, Anna Hospital Campus,
    Arumbakkam, Chennai

12. Prof. Jayprakash Narayanan
    Former Vice-Principal,
    Old NO. 55, New No. 70,
    Panchaliamman Koil Street, Arumbakkam, Chennai-600106

13. Dr. Kumaravel
    No. 25, II Street Ram Nagar,
    North Extension Vijayanagar, Velacherry,
    Chennai

14. Dr. V. Kalidass
    Proprietor, Raja Siddha Marunthagam,
    1/3, Dhermathupatty, Madurai- 625008

15. Dr. K. Vasanthira
    Prof. of Pharmacology,
    Stanley Medical College, Chennai

16. Dr. G. Thiyagarajan
    Former Joint Director of ISM,
    19/5, Arunachalapuram Street, Sandopalayam,
    Aminjikarai, Chennai

17. Dr. T. Anandan
    75, O Block, Ganapathy Colony,
    Anna Nagar (E), Chennai

III. **Unani Pharmacopoeia Committee**

1. Dr. G. N. Qazi,
   Vice-Chancellor, Jamia Hamdard University,
   Mehrauli Road, New Delhi- 110062

2. Adviser (Unani): Prof. Rais-Ur-Rahman
   Ministry of AYUSH, AYUSH Bhawan,
   B Block, GPO Complex, INA, New Delhi- 110023

3. Director
   Pharmacopoeial Laboratory for Indian Medicine,
   Kamla Nehru Nagar, Ghaziabad- 201002

4. Director General: Prof. Rais-Ur-Rahman
   Central Council for Research in Unani Medicine (CCRUM)
   61-65, Institutional Area, Opp. ‘D’ Block, Janakpuri,
   New Delhi- 110058
5. Dr. Rahul Singh  
   Head, CQA Healthcare Products, Emami Group of Companies,  
   Emami Towers, 5th Floor, 687, Anandapur,  
   E.M. Bypass, Kolkata-700107  
5. Dr. Arshad Khuroo,  
   Plot GP-5, Sector-18,  
   Udyog Vihar Industrial Area, Gurgaon-122001  
7. Prof. Maninder Kaur  
   UIPS, Punjab University, Chandigarh  
8. Dr. Deepak M.  
   Sr. Manager, Natural Remedies,  
   Plot No. 5B, Veersanda Indl. Area,  
   19th K.M. Stone, Hosur Road, Bangalore- 560100  
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INTRODUCTION

The Ayurvedic system of medicine is prevalent in India since the vedic period and as early as the dawn of human civilization. Though Ayurveda has undergone many changes in the course of its long history, it still remains the mainstay of medical relief to a large section of population of the nation. Due to urbanization and dwindling of forests, vaidya by and large is no longer self-contained unit collecting and preparing his own medicines as before. He has now to depend on the newly developed agencies like one collecting and supplying the crude drugs and the other undertaking mass production of medicines in the Ayurvedic pharmaceutical units run on commercial scale.

In view of the new trend in Ayurvedic pharmaceutical field, Government of India considered it expedient to utilize the existing Drugs and Cosmetics Act 1940, to also control to a limited measure the Ayurvedic, Siddha and Unani drugs by amending the Act.

The act was accordingly amended in 1964, to ensure only a limited control over the production and sale of these medicines namely: -

i) The manufacture should be carried under prescribed hygienic conditions, under supervision of a person having a prescribed qualification;

ii) The raw materials used in the preparation of drugs should be genuine and properly identified and

iii) The formula or the true list of all the ingredients, contained in the drugs, should be displayed on the label of every container.

The Ayurvedic Pharmacopoeia Committee, (APC) constituted under the erstwhile Department of AYUSH (vide letter No. 5-5/CCRAS-2006/Tech/APC/Hqrs. dated 12th March, 2009) Ministry of Health and Family Welfare, Govt. of India initiated the exercise on present volume of the Atlas. This Pharmacopoeia Committee included Prof. S. S. Handa (Chairman), Dr. S. K. Sharma (Vice Chairman), Dr. G. S. Lavekar (Member Secretary until February 2010) and Dr. Ramesh Babu Devalla (Member Secretary) and other eminent experts in respective fields. The work was further carried out under auspices of PCIM&H and duly approved by its Governing Body.

Ministry of AYUSH, Government of India has already an on-going programme of developing quality standards and standardization of Ayurvedic Single Drugs and Compound Formulations used in Ayurvedic practice. The Ayurvedic Pharmacopoeia Committee, duly constituted by the Ministry of AYUSH under the Commission, brings out periodically Ayurvedic Pharmacopoeia of India consisting of Part-I and Part-II. Part-I gives the quality standards of single drugs while the Part-II deals with the standards of classical Ayurvedic compound formulations. Eight volumes of API, Part-I and three volumes of API, Part-II have been published. For the preparation of Pharmacopoeia, it becomes imperative that the drugs of natural origin which are to be used in Ayurvedic practice as single drugs or are to be used in the manufacture of compound formulations, the identity of the plant or its part used as a drug is to be authenticated. Besides, establishing the botanical identity through macroscopic and microscopic profiles, a Thin-layer Chromatographic profile (TLC) of each of the drug provides an unambiguous identity. For this purpose, the APC has chartered a programme of preparing an Atlas on Thin-layer Chromatographic (TLC-Atlas) as a supplement to each volume of Ayurvedic Pharmacopoeia of India, Part-I. In addition to monitoring the identity of the drug, detection of adulterants is also taken care of. The Atlas which would embody the photographic profiles of TLC pattern of each of the drug will provide a ready reference for the comparison of the commercially marketed drug with the authentic one. The Atlas would serve the same purpose as a catalogue of spectra does for organic drug molecules.

The present compilation is in the series of already published Thin Layer Chromatographic Atlas of Ayurvedic Pharmacopoeial Drugs, Part-I, Vol.-I. This publication deals with 99 crude drugs of the 100
included in Vol-III of API, Part-I. The profile of each drug is titled with the official name (as given in the API Part I, Vol-III) followed by binomial nomenclature with family and part of the plant with photograph. Major chemical constituents, solvent system used as mobile phase are given and visualization under UV and after derivatization has been depicted in the photographs. Type of the TLC plates used and method of sample preparation are included in Annexures.

Since authentic library of Phyto-chemical Reference Standards (PRS) was not available at that time for thin layer chromatographic identification tests, authenticated samples of crude plant drugs were selected and authenticated for use as basis for comparison of samples being tested for identity. A solution of the standard specimen is referred to as the Reference Specimen Solution (R) and the solution of the test sample is designated as test solution. The Thin Layer Chromatogram of the Test Solution (T) should exhibit similar pattern and bands when compared with Reference Thin Layer Chromatogram.

Ayurvedic Pharmacopoeia of India, Part-I, Vol-III is a legal document of standards for the quality of single drugs included therein (under the Drugs and Cosmetic Act, 1940) and comprises of 100 monographs on single drugs of plant origin. Thin Layer Chromatographic Atlas is a companion volume of API, Part-I, Vol-III, comprising of TLC fingerprint of 99 drugs of the 100 drugs included in the pharmacopoeia. It may be pointed out that the details given here are solely to help analytical personnel in the laboratory, as additional visual aid to confirm their identity and this publication has no mandatory status. Stakeholders are welcome to give their suggestions on this publication so that these suggestions are evaluated and followed in the forthcoming volumes of the “TLC Atlas of Ayurvedic Pharmacopoeial Drugs”.

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ABBREVIATIONS FOR TECHNICAL TERMS

- ⁰C -
- centimetre(s) - cm
- Family - Fam.
- High Performance Thin Layer Chromatography - HPTLC
- microlitre(s) - μl
- millilitre(s) - ml
- millimetre(s) - mm
- nanometre(s) - nm
- Thin Layer Chromatography - TLC
- Ultra-violet - UV

INDO-ROMANIC EQUIVALENTS OF DEVANĀGARĪ ALPHABETS

<table>
<thead>
<tr>
<th>Devanāgarī</th>
<th>Roman</th>
<th>Indro-Romanic</th>
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## Ayurvedic Pharmacopoeial Drugs

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ādhakī (Root)</td>
<td>Cajanus cajan (L.) Millsp.</td>
</tr>
<tr>
<td>2</td>
<td>Agnimantha (Root)</td>
<td>Clerodendrum phlomidis L. f.</td>
</tr>
<tr>
<td>3</td>
<td>Ambaśṭhakī (Root)</td>
<td>Hibiscus sabdariffa L.</td>
</tr>
<tr>
<td>4</td>
<td>Āmra (Seed)</td>
<td>Mangifera indica L.</td>
</tr>
<tr>
<td>5</td>
<td>Āmra (Stem Bark)</td>
<td>Mangifera indica L.</td>
</tr>
<tr>
<td>6</td>
<td>Āmṛāta (Stem)</td>
<td>Spondias pinnata (L.f.) Kurz</td>
</tr>
<tr>
<td>7</td>
<td>Apāṁārga (Root)</td>
<td>Achyranthes aspera L.</td>
</tr>
<tr>
<td>8</td>
<td>Aralū (Stem Bark)</td>
<td>Ailanthus excelsa Roxb.</td>
</tr>
<tr>
<td>9</td>
<td>Arka (Stem Bark)</td>
<td>Calotropis procera (Ait.) R.Br.</td>
</tr>
<tr>
<td>10</td>
<td>Asana (Stem Bark)</td>
<td>Pterocarpus marsupium Roxb.</td>
</tr>
<tr>
<td>11</td>
<td>Asthisāṃḥṛt (Stem)</td>
<td>Cissus quadrangularis L.</td>
</tr>
<tr>
<td>12</td>
<td>Ātmaguptā (Seed)</td>
<td>Mucuna prurita Hook.</td>
</tr>
<tr>
<td>13</td>
<td>Bhāraṅgī (Root)</td>
<td>Clerodendrum serratum (L.) Moon</td>
</tr>
<tr>
<td>14</td>
<td>Bījapūra (Fresh Fruit)</td>
<td>Citrus medica L.</td>
</tr>
<tr>
<td>16</td>
<td>Bimbī (Whole Plant)</td>
<td>Cocccinia indica Wight &amp; Arn.</td>
</tr>
<tr>
<td>17</td>
<td>Cāṅgerī (Whole Plant)</td>
<td>Oxalis corniculata L.</td>
</tr>
<tr>
<td>18</td>
<td>Cirabilva (Fruit)</td>
<td>Holoptelea integrifolia Planch.</td>
</tr>
<tr>
<td>19</td>
<td>Dantī (Root)</td>
<td>Baliospermum montanum (Willd.) Muell. Arg.</td>
</tr>
<tr>
<td>20</td>
<td>Dhattūra (Seed)</td>
<td>Datura metel L.</td>
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<tr>
<td>21</td>
<td>Drāksā (Fruit)</td>
<td>Vitis vinifera L.</td>
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<tr>
<td>22</td>
<td>Dūrvā (Root)</td>
<td>Cynodon dactylon (L.) Pers.</td>
</tr>
<tr>
<td>23</td>
<td>Eraṅḍa (Fresh Leaf)</td>
<td>Ricinus communis L.</td>
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<td>24</td>
<td>Eraṅḍa (Seed)</td>
<td>Ricinus communis L.</td>
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<tr>
<td>25</td>
<td>Gambhāṛī (Stem)</td>
<td>Gmelina arborea Roxb.</td>
</tr>
<tr>
<td>26</td>
<td>Granthiparṇī (Root)</td>
<td>Leonotis nepetifolia (L.) R.Br.</td>
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<tr>
<td>27</td>
<td>Haṃṣapadī (Whole Plant)</td>
<td>Adiantum lunulatum Burm.f.</td>
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<td>28</td>
<td>Hapuṣā (Fruit)</td>
<td>Juniperus communis L.</td>
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<td>29</td>
<td>Indravāṛuṇī (Fruit)</td>
<td>Citrullus colocynthis (L.) Schrad.</td>
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<tr>
<td>30</td>
<td>Indrayava (Seed)</td>
<td>Holarrhena antidysenterica Wall.</td>
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<tr>
<td>31</td>
<td>Īśvarī (Root)</td>
<td>Aristolochia indica L.</td>
</tr>
<tr>
<td>32</td>
<td>Jāṭī (Leaf)</td>
<td>Jasminum officinale L.</td>
</tr>
<tr>
<td>33</td>
<td>Kadalī (Rhizome)</td>
<td>Musa paradisiaca L.</td>
</tr>
<tr>
<td>34</td>
<td>Kākajāṅghā (Root)</td>
<td>Peristrophe bicalyculata (Retz.) Nees</td>
</tr>
<tr>
<td>35</td>
<td>Kākanāsikā (Seed)</td>
<td>Martynia annua L.</td>
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<tr>
<td>36</td>
<td>Kākolī (Tuberous Root)</td>
<td>Lilium polyphyllum D. Don.</td>
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<tr>
<td>37</td>
<td>Kamala (Rhizome)</td>
<td>Nelumbo nucifera Gaertn.</td>
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<tr>
<td>38</td>
<td>Karamarda (Root)</td>
<td>Carissa carandas L.</td>
</tr>
<tr>
<td>No.</td>
<td>Name (Parts)</td>
<td>Scientific Name</td>
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<tr>
<td>39</td>
<td>Karavīra (Root)</td>
<td>Nerium indicum Mill.</td>
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<tr>
<td>40</td>
<td>Kāśa (Root Stem)</td>
<td>Saccharum spontaneum L.</td>
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<tr>
<td>41</td>
<td>Kaṭphala (Fruit)</td>
<td>Myrica esculenta Buch. - Ham. ex D.Don</td>
</tr>
<tr>
<td>42</td>
<td>Kaṭphala (Stem Bark)</td>
<td>Myrica esculenta Buch. - Ham. ex D.Don</td>
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<tr>
<td>43</td>
<td>Kola (Fruit Pulp)</td>
<td>Ziziphus jujuba Mill.</td>
</tr>
<tr>
<td>44</td>
<td>Kola (Stem Bark)</td>
<td>Ziziphus jujuba Mill.</td>
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<tr>
<td>45</td>
<td>Koṣṭakē (Whole Plant)</td>
<td>Luffa acutangula (L.) Roxb.</td>
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<tr>
<td>46</td>
<td>Kumudā (Flower)</td>
<td>Nymphaea alba L.</td>
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<tr>
<td>47</td>
<td>Kuṣa (Root Stem)</td>
<td>Desmostachya bipinnata (L.) Stapf.</td>
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<tr>
<td>48</td>
<td>Lāṅgalē (Tuberous Root)</td>
<td>Gloriosa superba L.</td>
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<tr>
<td>49</td>
<td>Laśuna (Bulb)</td>
<td>Allium sativum L.</td>
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<tr>
<td>50</td>
<td>Mahābalā (Root)</td>
<td>Sida rhombifolia L.</td>
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<tr>
<td>51</td>
<td>Mañjīṣṭhā (Stem)</td>
<td>Rubia cordifolia L.</td>
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<tr>
<td>52</td>
<td>Marica (Fruit)</td>
<td>Piper nigrum L.</td>
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<td>Māṣaparṇī (Whole Plant)</td>
<td>Terammus labialis (L.f.) Spreng.</td>
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<td>54</td>
<td>Masūra (Seed)</td>
<td>Lens culinaris Medik.</td>
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<td>Mudga (Seed)</td>
<td>Phaseolus radiatus L.</td>
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<td>Mīlaka (Seed)</td>
<td>Raphanus sativus L.</td>
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<td>57</td>
<td>Munḍīṭikā (Leaf)</td>
<td>Sphaeranthus indicus L.</td>
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<td>58</td>
<td>Musta (Rhizome)</td>
<td>Cyperus rotundus L.</td>
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<tr>
<td>59</td>
<td>Nāgavallī (Leaf)</td>
<td>Piper betle L.</td>
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<tr>
<td>60</td>
<td>Nārikela (Endosperm)</td>
<td>Cocos nucifera L.</td>
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<tr>
<td>61</td>
<td>Nicula (Fruit)</td>
<td>Barringtonia acutangula (L.) Gaertn.</td>
</tr>
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<td>62</td>
<td>Nīlī (Whole Plant)</td>
<td>Indigofera tinctoria L.</td>
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<tr>
<td>63</td>
<td>Nirguṇṭī (Leaf)</td>
<td>Vitex negundo L.</td>
</tr>
<tr>
<td>64</td>
<td>Padmaka (Heart Wood)</td>
<td>Prunus cerasoides Buch. - Ham. ex D.Don</td>
</tr>
<tr>
<td>65</td>
<td>Pāṭalā (Root)</td>
<td>Stereospermum suaveolens (Roxb.) DC.</td>
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<tr>
<td>66</td>
<td>Phalgu (Fruit)</td>
<td>Ficus hispida L.</td>
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<tr>
<td>67</td>
<td>Phalgu (Root)</td>
<td>Ficus hispida L.</td>
</tr>
<tr>
<td>68</td>
<td>Prapunnāḍa (Seed)</td>
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<td>Pterocarpus santalinus L.f.</td>
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<td>Rakra punarnavā (Root)</td>
<td>Boerhaavia diffusa L.</td>
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<td>Pluchea lanceolata (DC.) C. B. Clarke</td>
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<td>73</td>
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<td>Barleria prionitis L.</td>
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<td>Streblus asper Lour.</td>
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<td>Šālmali (Stem Bark)</td>
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<td>Sarala (Heart Wood)</td>
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<td>87</td>
<td>Śiṃšapā (Heart Wood)</td>
<td>Dalbergia sissoo Roxb. ex DC.</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Scientific Name</td>
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<td>-----</td>
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<td>Dalbergia sissoo Roxb. ex DC.</td>
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<td>Sthauṇeya (Leaf)</td>
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<td>Sūraṇa (Corm)</td>
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<td>Śveta Candana (Heart Wood)</td>
<td>Santalum album L.</td>
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<td>Śyonāka (Root)</td>
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<td>Borassus flabellifēr L.</td>
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<td>Trivṛt (Root)</td>
<td>Operculina turpethum (L.) Silva Manso</td>
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<td>Tuminī (Fresh Fruit)</td>
<td>Lagenaria siceraria (Molina) Standl.</td>
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<td>97</td>
<td>Udumbara (Fruit)</td>
<td>Ficus glomerata Roxb.</td>
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<td>Uśīra (Root)</td>
<td>Vetiveria zizanioides (L.) Nash</td>
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<td>99</td>
<td>Utpala (Flower)</td>
<td>Nymphaea stellata Willd.</td>
</tr>
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</table>

ANNEXURES
INDEX
**Botanical name**: *Cajanus cajan* (L.) Millsp. (Fam. - Fabaceae), root

**Crude drug sample**: ARRI, Itanagar - CCRAS (October, 2007) (R)

**Chemical constituents**: 5,7,2‘-Trihydroxyisoflavon-7-O-β-D-glucoside, 5,7,4‘-Trihydroxyisoflavone (genistein) and cajanone

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate (7.5 : 2.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1**: *Cajanus cajan* (L.) Millsp.

**Figure 2**: TLC fingerprint of *Cajanus cajan* (L.) Millsp., root
AGNIMANTHA

Botanical name: *Clerodendrum phlomidis* L.f. (Fam. - Verbenaceae), root

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Prectolinarigenin, scutellarin, aspigenin, hospidulin, clerosterol, clerodin, lerodendrin A, cerolic acid, ceryl alcohol and raffinose

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n-Hexane : Toluene : Ethyl acetate* (1.5 : 6 : 2.5)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Clerodendrum phlomidis* L.f.

---

**Figure 2:** TLC fingerprint of *Clerodendrum phlomidis* L.f., root

I: 254 nm, II: 366 nm and III: after derivatization, under white light
AMBAŞŤHAKİ

Botanical name : *Hibiscus sabdariffa* L. (Fam. - Malvaceae), root
Crude drug sample : NRIASHRD, Gwalior - CCRAS (May, 2011) (R)
Chemical constituents : Hibiscetin, cyanidin and cyanin glucosides
Sample Preparation and TLC : As annexure - I, (type I)
Solvent system : *Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.2)*
Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant](image1.png) ![Root](image2.png)

Figure 1: *Hibiscus sabdariffa* L.

![TLC Fingerprint](image3.png)

Figure 2: TLC fingerprint of *Hibiscus sabdariffa* L., root
<table>
<thead>
<tr>
<th><strong>Botanical name</strong></th>
<th><em>Mangifera indica</em> L. (Fam. - Anacardiaceae), seed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crude drug sample</strong></td>
<td>NRIBAS, Pune - CCRAS (August, 2007) (R)</td>
</tr>
<tr>
<td><strong>Chemical constituents</strong></td>
<td>Stearic acid, palmitic acid, oleic acid, linoleic acid and linolenic acid</td>
</tr>
<tr>
<td><strong>Sample Preparation and TLC</strong></td>
<td>As annexure - I, (type II)</td>
</tr>
<tr>
<td><strong>Solvent system</strong></td>
<td><em>Toluene : Ethyl acetate : Formic acid</em> (8 : 2 : 0.3)</td>
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<tr>
<td><strong>Visualization</strong></td>
<td>Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent</td>
</tr>
</tbody>
</table>

![Plant and Seed](image)

Figure 1: *Mangifera indica* L.

![TLC Fingerprint](image)

Figure 2: TLC fingerprint of *Mangifera indica* L., seed
Botanical name: *Mangifera indica* L. (Fam. - Anacardiaceae), stem bark

Crude drug sample: NRIBAS, Pune - CCRAS (June, 2007) (R)

Chemical constituents: Mangiferin, tannins - gallic acid, m-digallic acid, gallotannin - butina and fisetin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate : Formic acid (5.0 : 4.5 : 0.5)*

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Mangifera indica* L.

![Plant](image1) ![Stem bark](image2)

Figure 2: TLC fingerprint of *Mangifera indica* L., stem bark

I: 254 nm, II: 366 nm and III: after derivatization, under white light
Botanical name: *Spondias pinnata* (L.f.) Kurz (Fam. - Anacardiaceae), stem
Crude drug sample: ARIMCHC, Thiruvananthapuram - CCRAS (July, 2007) (R)
Chemical constituents: β-amyrin and oleanolic acid
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Toluene : Ethyl acetate : Glacial acetic acid (7 : 2 : 0.2)
Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

**Figure 1:** *Spondias pinnata* (L.f.) Kurz

**Figure 2:** TLC fingerprint of *Spondias pinnata* (L.f.) Kurz, stem

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**APĀMĀRGA**

**Botanical name** : *Achyranthes aspera* L. (Fam. - Amaranthaceae), root

**Crude drug sample** : RRIHF, Tarikhet - CCRAS (September, 2007) (R)

**Chemical constituents** : Ecdysone, ecdysterone, inokosterone, oleanoic acid and glycosides

**Sample Preparation and TLC** : As annexure - I, (type I)

**Solvent system** : *Toluene : Ethyl acetate : Glacial acetic acid (8.5 : 1 : 0.5)*

**Visualization** : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Achyranthes aspera* L.

**Figure 2:** TLC fingerprint of *Achyranthes aspera* L., root

---

I: 254 nm, II: 366 nm and III: after derivatization, under white light
ARALU

Botanical name : *Ailanthus excelsa* Roxb. (Fam. - Simaroubaceae), stem bark

Crude drug sample : NRIASHRD, Gwalior - CCRAS (September, 2007) (R)

Chemical constituents : Quassinoids - glaucarubin, excelsin, ailanthinone, glaucarubol and sterols

Sample Preparation and TLC : As annexure - I, (type I)

Solvent system : Chloroform : Methanol (9.5 : 0.5)

Visualization : Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Ailanthus excelsa* Roxb.

---

Figure 2: TLC fingerprint of *Ailanthus excelsa* Roxb., stem bark

I: 366 nm and II: after derivatization, under white light
ARKA

Botanical name: *Calotropis procera* (Ait.) R.Br. (Fam. - Asclepiadaceae), stem bark

Crude drug sample: NVARI, Jhansi - CCRAS (December, 2007) (R)

Chemical constituents: Calotropeols (α and β), β-amyrin and giganteol

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Formic acid (7.5 : 1.5 : 1)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde-sulphuric acid reagent

---

Figure 1: *Calotropis procera* (Ait.) R.Br.

---

Figure 2: TLC fingerprint of *Calotropis procera* (Ait.) R.Br., stem bark
ASANA

Botanical name  :  *Pterocarpus marsupium* Roxb. (Fam. - Fabaceae), stem bark
Crude drug sample  :  NRIBAS, Pune - CCRAS (January, 2008) (R)
Chemical constituents  :  Tannins - kinotannic acid, catechol, proto-catechinic acid, gallic acid; flavonoids and sesquiterpenes
Sample Preparation and TLC  :  As annexure - I, (type I)
Solvent system  :  Chloroform : Methanol (9.5 : 0.5)
Visualization  :  Under 254 nm; 366 nm; after derivatization with iodine vapour

Figure 1: *Pterocarpus marsupium* Roxb.

Figure 2: TLC fingerprint of *Pterocarpus marsupium* Roxb., stem bark

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**ASTHISAMHRT**

**Botanical name**: *Cissus quadrangularis* L. (Fam. - Vitaceae), stem

**Crude drug sample**: NVARI, Jhansi - CCRAS (August 2007) (R)

**Chemical constituents**: Terpenes - δ-amyrin, δ-amyrone, onocer-7-ene-3α,21β-diol and onocer-7-ene-3β,21α-diol

**Sample Preparation and TLC**

**Solvent system**: Toluene : Ethyl acetate (8 : 2)

**Visualization**: Under 366 nm; after derivatization with anisaldehyde-sulphuric acid reagent

---

**Figure 1**: *Cissus quadrangularis* L.

**Figure 2**: TLC fingerprint of *Cissus quadrangularis* L., stem

I: 366 nm and II: after derivatization, under white light
Botanical name: *Mucuna prurita* Hook. (Fam. - Fabaceae), seed

Crude drug sample: NVARI, Jhansi - CCRAS (December, 2007) (R)

Chemical constituents: L-3,4-Dihydroxyphenylalanine (L-dopa)

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n*-Hexane : Ethyl acetate : Glacial acetic acid (8 : 1.5 : 0.5)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

**Figure 1:** *Mucuna prurita* Hook.

**Figure 2:** TLC fingerprint of *Mucuna prurita* Hook., seed
BHĀRAŊĪ

Botanical name: Clerodendrum serratum (L.) Moon (Fam. - Verbenaceae), root
Crude drug sample: PLIM, Ghaziabad (September, 2009) (R)
Chemical constituents: D-Mannitol, γ-sitosterol, oleanolic acid, queretarolic acid and serratagenic acid
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Ethyl acetate : Formic acid (9 : 1)
Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: Clerodendrum serratum (L.) Moon

Figure 2: TLC fingerprint of Clerodendrum serratum (L.) Moon, root

I: 366 nm and II: after derivatization, under white light
BĪJAPŪRA

Botanical name : *Citrus medica* L. (Fam. - Rutaceae), fresh fruit

Crude drug sample : NEIARI, Guwahati - CCRAS (September, 2010) (R)

Chemical constituents : Coumarins, flavonoids, carotenes, terpenes and linalool and essential oil

Sample Preparation and TLC : As annexure - I, (type I)

Solvent system : Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.3)

Visualization : Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Citrus medica* L.

**Figure 2:** TLC fingerprint of *Citrus medica* L., fresh fruit

I: 366 nm and II: after derivatization, under white light
BILVA

Botanical name: *Aegle marmelos* (L.) Corr. (Fam. - Rutaceae), root
Crude drug sample: NRIBAS, Pune - CCRAS (July, 2007) (R)
Chemical constituents: Coumarins, marmin, skimmianine, phenolic alkaloids, aegeline, flavonoids and lupeol
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Toluene : Ethyl acetate (7.5 : 2.5)
Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Aegle marmelos* (L.) Corr.

Figure 2: TLC fingerprint of *Aegle marmelos* (L.) Corr., root
**BIMBĪ**

**Botanical name**: *Coccinia indica* Wight & Arn. (*Fam.* - Cucurbitaceae), whole plant

**Crude drug sample**: AMHRI, Nagpur - CCRAS (August, 2007) (R)

**Chemical constituents**: Triterpene alcohols - cycloartanol, α- & β- amyrin, flavonoids - quercitin and sterols - β-sitosterol

**Sample Preparation and TLC**

**Solvent system**: *Chloroform : Methanol* (9 : 1)

**Visualization**: Under 254 nm; 366 nm; after derivatization with 5% methanolic-sulphuric acid reagent

---

**Figure 1**: *Coccinia indica* Wight & Arn.

**Figure 2**: TLC fingerprint of *Coccinia indica* Wight & Arn., whole plant
Botanical name: Oxalis corniculata L. (Fam. - Oxalidaceae), whole plant
Crude drug sample: NRIASHRD, Gwalior - CCRAS (January, 2008) (R)
Chemical constituents: Flavonoids - vitexin, isovitexin-2'-O-β-D-glucopyranoside and transphytol
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Chloroform : Methanol (9.5 : 0.5)
Visualization: Under 254 nm; 366 nm; after derivatization with iodine vapours

Figure 1: Oxalis corniculata L.

Figure 2: TLC fingerprint of Oxalis corniculata L., whole plant
**CIRABILVA**

**Botanical name**: *Holoptelea integrifolia* Planch. (Fam. - Ulmaceae), fruit

**Crude drug sample**: RRIHF, Tarikhet - CCRAS (July, 2007) (R)

**Chemical constituents**: Lysine, glutamic acid and histidine

**Sample Preparation and TLC**

**Solvent system**: *Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.1)*

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1**: *Holoptelea integrifolia* Planch.

**Figure 2**: TLC fingerprint of *Holoptelea integrifolia* Planch., fruit
DANTĪ

Botanical name: Baliospermum montanum (Willd.) Muell. Arg. (Fam. - Euphorbiaceae), root

Crude drug sample: ARIMCHC, Thiruvananthapuram - CCRAS (August, 2007) (R)

Chemical constituents: Diterpene esters, baliospermin and phenolic esters

Sample Preparation and TLC:

Solvent system: Toluene : Ethyl acetate (9 : 1)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: Baliospermum montanum (Willd.) Muell. Arg.

Figure 2: TLC fingerprint of Baliospermum montanum (Willd.) Muell. Arg., root
DHATTŪRA

Botanical name: *Datura metel* L. (Fam. - Solanaceae), seed
Crude drug sample: RRIHF, Tarikhet - CCRAS (July, 2007) (R)
Chemical constituents: Scopolamine and atropine
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Toluene : Chloroform : Methanol (2 : 6 : 2)
Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Datura metel* L.

Figure 2: TLC fingerprint of *Datura metel* L., seed
DRAKSHA

Botanical name: *Vitis vinifera* L. (Fam. - Vitaceae), fruit

Crude drug sample: NADRI, Bangalore - CCRAS (January, 2008) (R)

Chemical constituents: Monoglucosides, delphinidin, cyanidins, flavonoids and β-sitosterol

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate (8 : 2)*

Visualization: Under 366 nm; after derivatization with iodine vapours

---

**Figure 1: Vitis vinifera** L.

**Figure 2: TLC fingerprint of Vitis vinifera** L., fruit

I: 366 nm and II: after derivatization, under white light
**DUURVA**

**Botanical name**: *Cynodon dactylon* (L.) Pers. (Fam. - Poaceae), root

**Crude drug sample**: RRIF, Tarikhet - CCRAS (July, 2007) (R)

**Chemical constituents**: Sterols - β-sitosterol and stigmasterol acetate

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Formic acid (7 : 3 : 0.1)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Plant**

**Root**

**Figure 1**: *Cynodon dactylon* (L.) Pers.

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**Figure 2**: TLC fingerprint of *Cynodon dactylon* (L.) Pers., root

**I**: 254 nm, **II**: 366 nm and **III**: after derivatization, under white light

---

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**ERANÇA**

**Botanical name** : *Ricinus communis* L. (Fam. - Euphorbiaceae), fresh leaf  
**Crude drug sample** : CCRAS Headquarters, New Delhi (September, 2010) (R)  
**Chemical constituents** : Ricinine, n-demethylricinine, 3-O-β-D-rutinosides, kaempferol, quercetin and ferulic acid  
**Sample Preparation and TLC** : As annexure - I, (type I)  
**Solvent system** : *Chloroform : Methanol* (9.5 : 0.5)  
**Visualization** : Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

**Figure 1:** *Ricinus communis* L.

**Figure 2:** TLC fingerprint of *Ricinus communis* L., fresh leaf

I: 366 nm and II: after derivatization, under white light
**ERAṆḌA**

**Botanical name**: *Ricinus communis* L. (Fam. - Euphorbiaceae), seed

**Crude drug sample**: RRIHF, Tarikhet - CCRAS (August, 2007) (R)

**Chemical constituents**: Fixed oil - triglycerides, triricinolein, ricinoleic acid

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: *n*-Hexane : Ethyl acetate : Toluene (2.5 : 1.5 : 6)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1**: *Ricinus communis* L.

**Figure 2**: TLC fingerprint of *Ricinus communis* L., seed

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**GAMBHĀRĪ**

**Botanical name**: *Gmelina arborea* Roxb. (Fam. - Verbenaceae), stem

**Crude drug sample**: NVARI, Jhansi - CCRAS (August, 2007) (R)

**Chemical constituents**: Gmelinol

**Sample Preparation and TLC**

**Solvent system**: Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

![Plant](image1.png)

![Stem](image2.png)

Figure 1: *Gmelina arborea* Roxb.

![TLC fingerprint](image3.png)

Figure 2: TLC fingerprint of *Gmelina arborea* Roxb., stem
GRANTHIPARṆĪ

Botanical name: *Leonotis nepetifolia* (L.) R.Br. (Fam. - Lamiaceae), root

Crude drug sample: NADRI, Bangalore - CCRAS (January, 2011) (R)

Chemical constituents: Premarrubin and marrubin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Chloroform : Methanol* (3 : 5 : 2)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Leonotis nepetifolia* (L.) R.Br.

Figure 2: TLC fingerprint of *Leonotis nepetifolia* (L.) R.Br., root

I: 366 nm and II: after derivatization, under white light
<table>
<thead>
<tr>
<th>Botanical name</th>
<th>Adiantum lunulatum Burm.f. (Fam. - Polypodiaceae), whole plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude drug sample</td>
<td>ARRI, Itanagar - CCRAS (August, 2010) (R)</td>
</tr>
<tr>
<td>Chemical constituents</td>
<td>Terpenoids - fern-9,11-en-6-α-ol, fern-9,11-ene, fern-9,11-en-25-oic acid, filicenol-B, adiantone; flavonoids and steroids</td>
</tr>
<tr>
<td>Sample Preparation and TLC</td>
<td>As annexure - I, (type I)</td>
</tr>
<tr>
<td>Solvent system</td>
<td>Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.3)</td>
</tr>
<tr>
<td>Visualization</td>
<td>Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent</td>
</tr>
</tbody>
</table>

**Figure 1:** Adiantum lunulatum Burm.f.

**Figure 2:** TLC fingerprint of Adiantum lunulatum Burm.f., whole plant
HAPUŞA

Botanical name: *Juniperus communis* L. (Fam. - Cupressaceae), fruit

Crude drug sample: PLIM, Ghaziabad (October, 2010) (R)

Chemical constituents: α-pinene, β-myrene, geranial, α-caryophyllene, trans-calamenene

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.3)*

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Juniperus communis* L.

Figure 2: TLC fingerprint of test solution of *Juniperus communis* L., fruit
INDRAVĀRṆĪ

Botanical name: *Citrullus colocynthis* (L.) Schrad. (Fam. - Cucurbitaceae), fruit

Crude drug sample: CCRAS Headquarters, New Delhi (September, 2008) (R)

Chemical constituents: Resins - resinous glycosides (colocynthin and colocynthitin); colocynthinic acid and cucurbitacins - cucurbitacin E and I

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate : Glacial acetic acid* (8 : 2 : 0.2)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Plant**

**Fruit**

Figure 1: *Citrullus colocynthis* (L.) Schrad.

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**I**: 366 nm and **II**: after derivatization, under white light

Figure 2: TLC fingerprint of *Citrullus colocynthis* (L.) Schrad., fruit
INDRAYAVA

Botanical name : *Holarrhena antidysenterica* Wall. (Fam. - Apocynaceae), seed

Crude drug sample : RRIHF, Tarikhet - CCRAS (July, 2007) (R)

Chemical constituents : Steroidal alkaloids - antidysentericine, kurchiline, kurchphyllamine, kurchiphyllyline, holarrhesmine, kurchessine and hollarrhidine

Sample Preparation and TLC : As annexure - I, (type I)

Solvent system : *Toluene : Chloroform : Methanol (2 : 6 : 2)*

Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Holarrhena antidysenterica* Wall.

Figure 2: TLC fingerprint of *Holarrhena antidysenterica* Wall., seed
**Botanical name**: *Aristolochia indica* L. (Fam. - Aristolochiaceae), root

**Crude drug sample**: AVS, Kottakkal (September, 2011) (R)

**Chemical constituents**: Aristlochic acid-I, aristolochic acid-D, aristolochic acid-D methyl ether lactam, aristolic acid and p-coumaric acid

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.2)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1**: *Aristolochia indica* L.

**Figure 2**: TLC fingerprint of *Aristolochia indica* L., root

1: 254 nm, II: 366 nm and III: after derivatization, under white light
**JÄTĪ**

**Botanical name**: *Jasminum officinale* L. (Fam. - Oleaceae), leaf

**Crude drug sample**: NADRI, Banglore (January, 2011) (R)

**Chemical constituents**: Oleuropein, ligstroside, demethyloleuropein, methoxyoleuropein (R & S) and ursolic acid

**Sample Preparation and TLC**

: As annexure - I, (type I)

**Solvent system**: *Toluene : Ethyl acetate : Formic acid* (7 : 3 : 0.1)

**Visualization**: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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Figure 1: *Jasminum officinale* L.

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Figure 2: TLC fingerprint of *Jasminum officinale* L., leaf

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I: 366 nm and II: after derivatization, under white light
KADALĪ

Botanical name: *Musa paradisiaca* L. (Fam. - Musaceae), rhizome

Crude drug sample: ARRI, Itanagar - CCRAS (September, 2007) (R)

Chemical constituents: Carbohydrates, catecholamines - norepinephrine, serotonin, dopamine; tryptophan and indole derivative

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate (7.5 : 2.5)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Musa paradisiaca* L.

Figure 2: TLC fingerprint of *Musa paradisiaca* L., rhizome

**I**: 366 nm and **II**: after derivatization, under white light
KĀKAJĀNGHĀ

Botanical name:  Peristrophe bicalyculata (Retz.) Nees (Fam. - Acanthaceae), root
Crude drug sample:  NVARI, Jhansi - CCRAS (August, 2008) (R)
Chemical constituents:  Volatile oils - β-caryophyllene, α-zingiberene, germacrene D and globulol
Sample Preparation and TLC:  As annexure - I, (type I)
Solvent system:  Toluene : Ethyl acetate : Formic acid (9.3 : 0.7 : 0.3)
Visualization:  Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant](image1.png)  ![Root](image2.png)

Figure 1: Peristrophe bicalyculata (Retz.) Nees

![TLC fingerprint of Peristrophe bicalyculata (Retz.) Nees, root](image3.png)

I: 254 nm, II: 366 nm and III: after derivatization, under white light
Figure 2: TLC fingerprint of Peristrophe bicalyculata (Retz.) Nees, root
KĀKANĀSIKĀ

Botanical name: *Martynia annua* L. (Fam. - Martyniaceae), seed

Crude drug sample: NRIASHRD, Gwalior - CCRAS (February, 2008) (R)

Chemical constituents: Fixed oils - arachidic, linoleic, oleic, palmitic and stearic acids

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate (9.3 : 0.7)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1:** *Martynia annua* L.

**Figure 2:** TLC fingerprint of *Martynia annua* L., seed

I: 366 nm, II: after derivatization, under white light
**KĀKOLĪ**

**Botanical name**  : *Lilium polyphyllum* D.Don (Fam. Liliaceae), tuberous root  
**Crude drug sample**  : CCRAS Headquarters, New Delhi (September, 2011) (R)  
**Chemical constituents**  : Sugars  
**Sample Preparation and TLC**  : As annexure - I, (type I)  
**Solvent system**  : *Toluene : Ethyl acetate : Formic acid (9 : 1 : 0.2)*  
**Visualization**  : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant](image1.jpg)  
![Tuberous root](image2.jpg)

**Figure 1:** *Lilium polyphyllum* D.Don

![TLC Fingerprint](image3.jpg)

**Figure 2:** TLC fingerprint of *Lilium polyphyllum* D.Don, tuberous root

**I:** 254 nm, **II:** 366 nm and **III:** after derivatization, under white light
KAMALA

Botanical name: *Nelumbo nucifera* Gaertn. (Fam. - Nelumbonaceae), rhizome

Crude drug sample: PLIM, Ghaziabad (September, 2009) (R)

Chemical constituents: Nelumbine, nuciferine, dehydronuciferine, β-sitosterol, asparagine, nelumboside, lotusine, neferine, palmitic acid and nicotinic acid

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n-Hexane : Toluene : Ethyl acetate* (0.5 : 7 : 2.5)

Visualization: Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

![Plant](image1.png)

![Rhizome](image2.png)

Figure 1: *Nelumbo nucifera* Gaertn.

![TLC Fingerprint](image3.png)

**Figure 2: TLC fingerprint of Nelumbo nucifera* Gaertn., rhizome**

I: 254 nm, II: 366 nm and III: after derivatization, under white light
KARAMARDA

Botanical name: *Carissa carandas* L. (Fam. - Apocynaceae), root

Crude drug sample: NRIASHRD, Gwalior - CCRAS (February, 2008) (R)

Chemical constituents: Steroids - carissone, carindone, carinol; cardiac glycosides - odoroside H and digitoxigenin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Formic acid (8 : 2 : 0.5)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Carissa carandas* L.

Figure 2: TLC fingerprint of *Carissa carandas* L., root
KARAVĪRA

Botanical name: *Nerium indicum* Mill. (Fam. - Apocynaceae), root

Crude drug sample: NADRI, Bangalore - CCRAS (July, 2007) (R)

Chemical constituents: Glycosides, plumericin, neroside and lupeol acetate

Sample Preparation and TLC

Solvent system: *Ethyl acetate: Formic acid : Glacial acetic acid : Water* (10 : 1 : 1 : 0.5)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1:** *Nerium indicum* Mill.

**Figure 2:** TLC fingerprint of *Nerium indicum* Mill., root

I: 254 nm, II: 366 nm and III: after derivatization, under white light
Botanical name: *Saccharum spontaneum* L. (Fam. - Poaceae), root stock

Crude drug sample: ARRI, Itanagar - CCRAS (August, 2010) (R)

Chemical constituents: Starch and polyphenolic compounds

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Chloroform : Ethyl acetate : Formic acid* (5 : 2.5 : 2.5 : 0.3)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Saccharum spontaneum* L.

Figure 2: TLC fingerprint of *Saccharum spontaneum* L., root stock

I: 366 nm and II: after derivatization, under white light
KAṬPHALA

Botanical name : *Myrica esculenta* Buch.-Ham. ex D. Don (Fam. - Myricaceae), fruit

Crude drug sample : ARRI, Itanagar - CCRAS (August, 2010) (R)

Chemical constituents : Myristin, myricitrin and glycoside

Sample Preparation and TLC : As annexure - I, (type I)

Solvent system : *Toluene : Ethyl acetate : Glacial acetic acid* (9.5 : 0.5 : 0.1)

Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1:** *Myrica esculenta* Buch.-Ham. ex D. Don

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**Figure 2:** TLC fingerprint of *Myrica esculenta* Buch.-Ham. ex D. Don, fruit

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I: 254 nm, II: 366 nm and III: after derivatization, under white light

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**KAṬPHAĻA**

**Botanical name**: *Myrica esculenta* Buch.-Ham. ex D. Don (Fam. - Myricaceae), stem bark

**Crude drug sample**: RRIHF, Tarikhet - CCRAS (August, 2007) (R)

**Chemical constituents**: Glycosides - myricitrin, D-glucopyranoside; sitosterol and tannins - epigallocatechin-3-O-gallate

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: *Toluene : Ethyl acetate : Formic acid (8 : 2 : 0.5)*

**Visualization**: Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

---

**Figure 1**: *Myrica esculenta* Buch.- Ham. ex D. Don

**Figure 2**: TLC fingerprint of *Myrica esculenta* Buch.- Ham. ex D. Don, stem bark

**I**: 254 nm, **II**: 366 nm and **III**: after derivatization, under white light
**KOLA**

**Botanical name**: *Ziziphus jujuba* Mill. (Fam. - Rhamnaceae), fruit pulp

**Crude drug sample**: PLIM, Ghaziabad (September, 2009) (R)

**Chemical constituents**: Triterpines - Oleanolic acid

**Sample Preparation and TLC**

**Solvent system**: Toluene : Ethyl acetate : Glacial acetic acid (8 : 2 : 0.3)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1**: *Ziziphus jujuba* Mill.

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**Figure 2**: TLC fingerprint of *Ziziphus jujuba* Mill., fruit pulp

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**I**: 254 nm, **II**: 366 nm and **III**: after derivatization, under white light

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0.5

0
KOLA

Botanical name : Ziziphus jujuba Mill. (Fam. - Rhamnaceae), stem bark
Crude drug sample : NADRI, Bangalore - CCRAS (July, 2007) (R)
Chemical constituents : Mauritine-A, mucronine-D, amphibine-H, nummularine (A & B), sativanine (A & B), frangulanine, and mucronine
Sample Preparation and TLC : As annexure - I, (type I)
Solvent system : Acetonitrile : Toluene : Glacial acetic acid (5 : 4 : 1)
Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant](image1)

![Stem bark](image2)

Figure 1: Ziziphus jujuba Mill.

![TLC fingerprint](image3)

I: 254 nm, II: 366 nm and III: after derivatization, under white light

Figure 2: TLC fingerprint of Ziziphus jujuba Mill., stem bark
KOŞÅTAKİ

Botanical name : *Luffa acutangula* (L.) Roxb. (Fam. - Cucurbitaceae), whole plant
Crude drug sample : NEIARI, Guwahati - CCRAS (July, 2010) (R)
Chemical constituents : Luffaculin, luffangulin, trypsin inhibitors (LA-1, LA-2), curcurbitacins (B & E) and oleanolic acid
Sample Preparation and TLC : As annexure - I, (type I)
Solvent system : *Chloroform : Ethyl acetate : Formic acid* (3 : 7 : 0.3)
Visualization : Under 366 nm; after derivatization with anisaldehyde -sulphuric acid reagent

![Plant](image1.png)
![Whole plant](image2.png)

Figure 1: *Luffa acutangula* (L.) Roxb.

![TLC fingerprint](image3.png)

Figure 2: TLC fingerprint of *Luffa acutangula* (L.) Roxb., whole plant

I: 366 nm and II: after derivatization, under white light
KUMUDA

Botanical name: *Nymphaea alba* L. (Fam. - Nymphaeaceae), flower

Crude drug sample: NEIARI, Guwahati - CCRAS (August, 2010) (R)

Chemical constituents: Tannic & gallic acids, starch, mucilage, resin, sugar and tartaric acid

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate : Formic acid* (5 : 5 : 0.4)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Nymphaea alba* L.

Figure 2: TLC fingerprint of *Nymphaea alba* L., flower

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**KUŚA**

**Botanical name**: *Desmostachya bipinnata* (L.) Stapf. (Fam. - Poaceae), root stock

**Crude drug sample**: CSMRIASDD, Chennai - CCRAS (March, 2009) (R)

**Chemical constituents**: Coumarins - scopoletine, umbeliferone; flavanoid glycosides - trycin, trycin-7-glucoside; sugars and amino acids

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Acetic acid (5 : 5 : 0.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with iodine vapours

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**Figure 1**: *Desmostachya bipinnata* (L.) Stapf.

**Figure 2**: TLC fingerprint of *Desmostachya bipinnata* (L.) Stapf., root stock
Botanical name: *Gloriosa superba* L. (Fam. - Liliaceae), tuberous root

Crude drug sample: NEIARI, Guwahati - CCRAS, (August, 2010) (R)

Chemical constituents: Colchicine

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Glacial acetic acid (8 : 2 : 0.2)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Gloriosa superba* L.

Figure 2: TLC fingerprint of *Gloriosa superba* L., tuberous root
LAȘUNA

Botanical name: *Allium sativum* L. (Fam. - Liliaceae), bulb

Crude drug sample: RRIHF, Tarikhet - CCRAS (September, 2007) (R)

Chemical constituents: Volatile oil, allyl disulphide, diallyl disulphide, allin, allicin, mucilage and albumin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Glacial acetic acid (7 : 3 : 0.2)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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![Plant](image1.png)  ![Bulb](image2.png)

Figure 1: *Allium sativum* L.

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![TLC fingerprint](image3.png)

Figure 2: TLC fingerprint of *Allium sativum* L., bulb

* I: 254 nm, II: 366 nm and III: after derivatization, under white light
MAHĀBALĀ

Botanical name : *Sida rhombifolia* L. (Fam. - Malvaceae), root
Crude drug sample : PLIM, Ghaziabad (September, 2009) (R)
Chemical constituents : Alkaloids - vasicinone, vasicine and β-phenylethylamine
Sample Preparation and TLC : As annexure - I, (type I)
Solvent system : Toluene : Chloroform : Methanol (2 : 7 : 1)
Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Sida rhombifolia* L.

Figure 2: TLC fingerprint of *Sida rhombifolia* L., root
Botanical name: *Rubia cordifolia* L. (Fam. - Rubiaceae), stem

Crude drug sample: CCRAS Headquarters, New Delhi (December, 2008) (R)

Chemical constituents: Anthraquinones - rubiadin, alizarin and purpurin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Glacial acetic acid (7.5 : 2.5 : 0.06)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

### MAṆJIṢṬHĀ

**Plant**

**Stem**

Figure 1: *Rubia cordifolia* L.

Figure 2: TLC fingerprint of *Rubia cordifolia* L., stem

I: 366 nm and II: after derivatization, under white light
MARICA

Botanical name : *Piper nigrum* L. (Fam. - Piperaceae), fruit

Crude drug sample : NADRI, Bangalore - CCRAS (August, 2007) (R)

Chemical constituents : Alkaloids - piperine, pipercide, piperonal, piperoleine A and B; phellandrene; caryophyllene and sabenene

Sample Preparation and TLC : As annexure - I, (type I)

Solvent system : *Toluene : Ethyl acetate : Glacial acetic acid* (6 : 4 : 0.1)

Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Piper nigrum* L.

**Figure 2:** TLC fingerprint of *Piper nigrum* L., fruit

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**Botanical name**: *Teramnus labialis* (L.f.) Spreng. (*Fam. - Fabaceae*), whole plant

**Crude drug sample**: AVS, Kottakal (September, 2011) (R)

**Chemical constituents**: Vitexin, bergenin, daidzin and 3-O-methyl-D- *chiro*-inositol

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: *Toluene : Ethyl acetate : Formic acid* (8 : 2 : 0.2)

**Visualization**: Under 366 nm; after derivatization with anisaldehyde-sulphuric acid reagent

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**Figure 1**: *Teramnus labialis* (L.f.) Spreng.

**Figure 2**: TLC fingerprint of *Teramnus labialis* (L.f.) Spreng., whole plant

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1: 366 nm and II: after derivatization, under white light
MASÜRA

Botanical name: *Lens culinaris* Medik. (Fam. - Fabaceae), seed
Crude drug sample: NADRI, Bangalore - CCRAS (August, 2007) (R)
Chemical constituents: Phenolic acids - p-coumarin, ferulic acid, kaempferol; triglycosides; triterpene alcohols; vitamin-B and proteins
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: *Toluene : Ethyl acetate : Glacial acetic acid* (6 : 4 : 0.1)
Visualization: Under 366 nm; after derivatization with ninhydrin - reagent

Figure 1: *Lens culinaris* Medik.

Figure 2: TLC fingerprint of *Lens culinaris* Medik., seed
MUDGA

Botanical name: Phaseolus radiatus L. (Fam. - Fabaceae), seed
Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)
Chemical constituents: Genstein, kievitone, hydroxydaidzein, isoferreirin, eugenol, demethylvesitol and pectin

Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: n-Butanol : Glacial acetic acid : Water (4 : 1 : 5) (Upper layer)
Visualization: Under 366 nm; after derivatization with ninhydrin-reagent

Figure 1: Phaseolus radiatus L.

Figure 2: TLC fingerprint of Phaseolus radiatus L., seed
MÜLAKA

Botanical name: *Raphanus sativus* L. (Fam. - Brassicaceae), seed

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Anthocyanin - cyanidin-3-glucoside; glucosinolate, isothiocyanate

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n-Hexane : Ethyl acetate : Formic acid (8 : 1.5 : 0.5*)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant and Seed](image)

**Figure 1:** *Raphanus sativus* L.

![TLC Fingerprint](image)

**Figure 2:** TLC fingerprint of *Raphanus sativus* L., seed

I: 254 nm, II: 366 nm and III: after derivatization, under white light
MUṆḌĪTIKĀ

Botanical name: *Sphaeranthus indicus* L. (Fam. - Asteraceae), leaf

Crude drug sample: CSMRIASDD, Chennai - CCRAS (February, 2009) (R)

Chemical constituents: Isoflavone glycoside - 5,4’-dimethoxy-3’-prenyl-biochanin-7-O-β-D-galactoside

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate : Glacial acetic acid* (5 : 5 : 0.5)

Visualization: Under 254 nm; 366 nm; after derivatization with iodine vapours

![Plant](image1)

![Leaf](image2)

Figure 1: *Sphaeranthus indicus* L.

![TLC Fingerprint](image3)

Figure 2: TLC fingerprint of *Sphaeranthus indicus* L., leaf

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**MUSTÊ**

**Botanical name**: *Cyperus rotundus* L. (Fam. - Cyperaceae), rhizome

**Crude drug sample**: NRIASHRD, Gwalior - CCRAS (Sept, 2007) (R)

**Chemical constituents**: A tricyclic sesquiterpene - cyperene; a bicyclic sesquiterpene - cyperene-2; essential oils - copadiene, cyperenol and cyperolone

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: *Toluene : Ethyl acetate : Glacial acetic acid* (8.5 : 1 : 0.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1**: *Cyperus rotundus* L.

**Figure 2**: TLC fingerprint of *Cyperus rotundus* L., rhizome

I: 254 nm, II: 366 nm and III: after derivatization, under white light
NÄGAVALLĪ

Botanical name : *Piper betle* L. (Fam. - *Piperaceae*), leaf

Crude drug sample : NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents : Eugenol, eugenyl acetate and β-sitosterol

Sample Preparation and TLC

Solvent system : *Toluene : Ethyl acetate : Formic acid* (7.5 : 1.5 : 1)

Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Sample Preparation and TLC

Solvent system : *Toluene : Ethyl acetate : Formic acid* (7.5 : 1.5 : 1)

Visualization : Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Piper betle* L.

Figure 2: TLC fingerprint of *Piper betle* L., leaf

**I**

I: 254 nm, II: 366 nm and III: after derivatization, under white light

Figure 2: TLC fingerprint of *Piper betle* L., leaf
NĀRIKELA

Botanical name: *Cocos nucifera* L. (Fam. - Arecaceae), endosperm

Crude drug sample: NADRI, Bangalore - CCRAS (Aug, 2007) (R)

Chemical constituents: Fixed oil - lauric, miristic, palmitic, stireic acid and caprillic acid

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n-Hexane : Ethyl acetate (8 : 2)*

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Cocos nucifera* L.

**Figure 2:** TLC fingerprint of *Cocos nucifera* L., endosperm

I: 254 nm, II: 366 nm and III: after derivatization, under white light
NICULA

Botanical name: *Barringtonia acutangula* (L.) Gaertn. (Fam. - Lecythidaceae), fruit

Crude drug sample: PLIM, Ghaziabad (September, 2009) (R)

Chemical constituents: Barringtonenic acid and barragegenic C

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n-Hexane : Toluene : Ethyl acetate* (1.5 : 6 : 2.5)

Visualization: Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

Figure 1: *Barringtonia acutangula* (L.) Gaertn.

Figure 2: TLC fingerprint of *Barringtonia acutangula* (L.) Gaertn., fruit
Botanical name: *Indigofera tinctoria* L. (Fam. - Fabaceae), whole plant

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Glycosides - indican and indirubin

Sample Preparation and TLC:

Solvent system: *Toluene : Ethyl acetate : Glacial acetic acid* (8.5 : 1.0 : 0.5)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1:** *Indigofera tinctoria* L.

**Figure 2:** TLC fingerprint of *Indigofera tinctoria* L., whole plant

**I:** 254 nm, **II:** 366 nm and **III:** after derivatization, under white light
NIRGUNĐĪ

Botanical name: *Vitex negundo* L. (Fam. - Verbenaceae), leaf
Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)
Chemical constituents: Negundoside and nishindaside
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Toluene : Ethyl acetate : Formic acid (7.5 : 1.5 : 1)
Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Vitex negundo* L.

Figure 2: TLC fingerprint of *Vitex negundo* L., leaf
PADMAKA

Botanical name: *Prunus cerasoides* Buch.-Ham. ex D.Don (Fam. Rosaceae), heartwood

Crude drug sample: RRIHF, Tarikhet - CCRAS (August, 2007) (R)

Chemical constituents: Dihydrotectochrysin, dihydrowogonin, pinocembrin, chrysin, naringenin, kaempferol, aromadendrin and quercetin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Chloroform : Methanol (2 : 5 : 3)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant](image1.jpg) ![Heartwood](image2.jpg)

Figure 1: *Prunus cerasoides* Buch.-Ham. ex D.Don

![TLC_fingerprint](image3.jpg)

**I:** 254 nm, **II:** 366 nm and **III:** after derivatization, under white light

Figure 2: TLC fingerprint of *Prunus cerasoides* Buch.-Ham. ex D.Don, heartwood
Botanical name: *Stereospermum suaveolens* (Roxb.) DC. (Fam. Bignoniaceae), root

Crude drug sample: NRIBAS, Pune - CCRAS (March, 2011) (R)

Chemical constituents: Bitter substances, sterols, glycosides and glycol - alkaloids

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.1)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Stereospermum suaveolens* (Roxb.) DC.

Figure 2: TLC fingerprint of *Stereospermum suaveolens* (Roxb.) DC., root
**PHALGU**

**Botanical name**: *Ficus hispida* L. (Fam. Moraceae), fruit

**Crude drug sample**: NRIBAS, Pune - CCRAS (July, 2007) (R)

**Chemical constituents**: Sterol - β-sitosterol; terpenes - β-amyrin and hispidine; carbohydrates - glucose, fructose and sucrose

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate (7.5 : 2.5)

**Visualization**: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1**: *Ficus hispida* L.

**Figure 2**: TLC fingerprint of *Ficus hispida* L., fruit

**I**: 366 nm and **II**: after derivatization, under white light

---

66
PHALGU

Botanical name: *Ficus hispida* L. (Fam. Moraceae), root
Crude drug sample: ARRI, Itanagar - CCRAS (January, 2008) (R)
Chemical constituents: Alkaloids
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: *n-Hexane : Toluene : Ethyl acetate* (3 : 5 : 2)
Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Ficus hispida* L.

Figure 2: TLC fingerprint of *Ficus hispida* L., root
**Botanical name** : *Cassia tora* L. (Fam. – Caesalpiniaeae), seed

**Crude drug sample** : NVARI, Jhansi - CCRAS (October, 2007) (R)

**Chemical constituents** : Fatty acids - palmitic, stearic, lignoceric, oleic, linoleic; anthroquinones - rhein, aloe-emodin, emodin; glycosides - rubrofusarin triglucoside and nor-rubrofusarin gentiobioside

**Sample Preparation and TLC** : As annexure - I, (type I)

**Solvent system** : Toluene : Ethyl Acetate : Glacial acetic acid (7 : 3 : 0.1)

**Visualization** : Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Cassia tora* L.

**Figure 2:** TLC fingerprint of *Cassia tora* L., seed
RAKTACANDANA

Botanical name: *Pterocarpus santalinus* L.f. (Fam. - Fabaceae), heartwood
Crude drug sample: PLIM, Ghaziabad - CCRAS (R)
Chemical constituents: Santalin A, santalin B and pterocarpol
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: *Toluene : Ethyl acetate : Glacial acetic acid (6 : 4 : 0.5)*
Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

![Plant](image1.png)

![Heartwood](image2.png)

Figure 1: *Pterocarpus santalinus* L.f.

![TLC Fingerprint](image3.png)

**I:** 254 nm, **II:** 366 nm and **III:** after derivatization, under white light

Figure 2: TLC fingerprint of *Pterocarpus santalinus* L.f., heartwood
RAKTA PUNARNAVĀ

Botanical name: *Boerhaavia diffusa* L. (Fam. - Nyctaginaceae), root

Crude drug sample: NVARI, Jhansi - CCRAS (February, 2008) (R)

Chemical constituents: Alkaloids – punarnavine and punarnavoside

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Glacial acetic acid (6 : 4 : 0.1)

Visualization: Under 254 nm; 366 nm; after derivatization with iodine vapours

---

**Figure 1:** *Boerhaavia diffusa* L.

**Figure 2:** TLC fingerprint of *Boerhaavia diffusa* L., root

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**Botanical name**: *Amaranthus tricolor* L. (Fam. - Amaranthaceae), whole plant

**Crude drug sample**: AMHRI, Nagpur - CCRAS (September, 2007) (R)

**Chemical constituents**: Amaranthin, isoamaranthin, betaine, vitamins, amino acids and sterols

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Formic acid (8 : 2 : 0.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1**: *Amaranthus tricolor* L.

**Figure 2**: TLC fingerprint of *Amaranthus tricolor* L., whole plant
Botanical name: *Pluchea lanceolata* (DC.) C. B. Clarke (Fam. - Asteraceae), leaf

Crude drug sample: NRIASHRD, Gwalior - CCRAS (December, 2007) (R)

Chemical constituents: Flavonoids - quercetin, quercitrin, iso-rhamnitin and glycosides - pluchioside

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl Acetate : Formic Acid* (8 : 2 : 0.5)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Pluchea lanceolata* (DC.) C. B. Clarke

**Figure 2:** TLC fingerprint of *Pluchea lanceolata* (DC.) C. B. Clarke, leaf
SAHACARA

Botanical name: *Barleria prionitis* L. (Fam. - Acanthaceae), whole plant

Crude drug sample: NRIASHRD, Gwalior - CCRAS (February, 2008) (R)

Chemical constituents: α-amyrin, β-sitosterol, Iridoids - acetylbarlerin and barlerin

Sample Preparation and TLC: As annexure - I, (type I)


Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

**Figure 1:** *Barleria prionitis* L.

**Figure 2:** TLC fingerprint of *Barleria prionitis* L., whole plant
SAHADEVİ

Botanical name: *Vernonia cinerea* (L.) Less. (Fam. - Asteraceae), whole plant

Crude drug sample: NRIBAS, Pune - CCRAS (January 2008) (R)

Chemical constituents: Sterols - lupeol, stigmasterol, luteolin-7-O-glucoside, lupeolacetate, α-amyrin and β-amyrin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate* (9.5 : 0.5)

Visualization: Under 366 nm; after derivatization with anisaldehyde-sulphuric acid reagent

![Plant](image1)  ![Whole plant](image2)

Figure 1: *Vernonia cinerea* (L.) Less.

![TLC fingerprint](image3)

I: 366 nm and II: after derivatization, under white light

Figure 2: TLC fingerprint of *Vernonia cinerea* (L.) Less., whole plant
**SAILEYA**

**Botanical name**: *Parmelia perlata* (Huds.) Ach. (Fam. - Parmeliaceae), lichen

**Crude drug sample**: CCRAS Headquarters, New Delhi (September 2011) (R)

**Chemical constituents**: Lichen acids - atranorin and lecanoric acid

**Sample Preparation and TLC**

**Solvent system**: Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.2)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1**: *Parmelia perlata* (Huds.) Ach.

**Figure 2**: TLC fingerprint of *Parmelia perlata* (Huds.) Ach., lichen

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**ŚĀKA**

**Botanical name:** *Tectona grandis* L.f. (Fam. - Verbenaceae), heartwood

**Crude drug sample:** NVARI, Jhansi - CCRAS (February, 2008) (R)

**Chemical constituents:** Anthraquinone – tectoquinone

**Sample Preparation and TLC:** As annexure - I, (type I)

**Solvent system:** *Chloroform : Methanol : Glacial acetic acid* (8 : 2 : 0.1)

**Visualization:** Under 254 nm; 366 nm; after derivatization with iodine vapours

---

*Plant*

*Heartwood*

Figure 1: *Tectona grandis* L.f.

---

![TLC fingerprint](image)

**Figure 2:** TLC fingerprint of *Tectona grandis* L.f., heartwood

**I:** 254 nm, **II:** 366 nm and **III:** after derivatization, under white light
**Sākhoṭaka**

**Botanical name**: *Streblus asper* Lour. (Fam. Moraceae), stem bark

**Crude drug sample**: NEIARI, Guwahati - CCRAS, (July, 2010) (R)

**Chemical constituents**: α-amyrin acetate, lupeol acetate, β-sitosterol, α-amyrin, lupeol, strebloside and mansonin

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.4)

**Visualization**: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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Figure 1: *Streblus asper* Lour.

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**Plant**

**Stem bark**

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Figure 2: TLC fingerprint of *Streblus asper* Lour., stem bark
Botanical name: *Desmodium gangeticum* (L.) DC. (Fam. - Fabaceae), root

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2008) (R)

Chemical constituents: Gangetinin and desmodin

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Glacial acetic acid (7.5 : 2.5 : 0.06)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Desmodium gangeticum* (L.) DC.

**Figure 2:** TLC fingerprint of *Desmodium gangeticum* (L.) DC., root

---

I: 254 nm, II: 366 nm and III: after derivatization, under white light
Botanical name: *Oryza sativa* L. (Fam. - Poaceae), fruit

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Aliphatic acids - palmitic acid, behenic acid, lignoceric acid; ceryl alcohol, melisyl alcohol

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *n*-Hexane : Ethyl acetate : Formic acid (8 : 2 : 0.2)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Oryza sativa* L.

I: 366 nm and II: after derivatization, under white light

Figure 2: TLC fingerprint of *Oryza sativa* L., fruit
Botanical name: *Bombax ceiba* L. (Fam. - Bombacaceae), stem bark

Crude drug sample: NRIASHRD, Gwalior - CCRAS (Oct, 2007) (R)

Chemical constituents: Sterols - β-sitosterol and lupeol

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate (7.5 : 2.5)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

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**Figure 1:** *Bombax ceiba* L.

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**Figure 2:** TLC fingerprint of *Bombax ceiba* L., stem bark

I: 366 nm and II: after derivatization, under white light
Botanical name: *Crotalaria juncea* L. (Fam. - Fabaceae), seed

Crude drug sample: NRIASHRD, Gwalior - CCRAS (Oct, 2007) (R)

Chemical constituents: Glycoside - apigenin-7-glucuronide and alkaloid - junceine

Sample Preparation and TLC: As annexure - I, (type II)

Solvent system: *Toluene : Ethyl acetate : Formic acid* (5 : 5 : 0.2)

Visualization: Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1:** *Crotalaria juncea* L.

**Figure 2:** TLC fingerprint of *Crotalaria juncea* L., seed
**Botanical name**: *Saccharum bengalense* Retz. (Fam. - Poaceae), root

**Crude drug sample**: NRIASHRD, Gwalior (October, 2011) (R)

**Chemical constituents**: Sugars

**Sample Preparation and TLC**

**Solvent system**: Toluene : Ethyl acetate : Formic acid (7 : 3 : 0.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

---

**Figure 1**: *Saccharum bengalense* Retz.

---

**Figure 2**: TLC fingerprint of *Saccharum bengalense* Retz., root
SARALA

Botanical name: *Pinus roxburghii* Sarg. (Fam. - Pinaceae), heartwood

Crude drug sample: RRIHF, Tarikhet - CCRAS (January, 2011) (R)

Chemical constituents: Turpentine oil - pinene, careen, terpine and longifolene

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Formic acid (7 : 2.5 : 0.5)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Pinus roxburghii* Sarg.

Figure 2: TLC fingerprint of *Pinus roxburghii* Sarg., heartwood

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**SARALA**

**Botanical name**: Pinus roxburghii Sarg. (Fam. - Pinaceae), root

**Crude drug sample**: RRIHF, Tarikhet - CCRAS (January, 2011) (R)

**Chemical constituents**: \(\alpha\) & \(\beta\) - pinene, \(\delta\)-carene, sesquiterpenes; abiotic, isopimamic acid and hexacosylferulate

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Methanol : Glacial acetic acid (6 : 4 : 1 : 0.2)

**Visualization**: Under 254 nm; 366 nm; after derivatization with iodine vapours

---

**Figure 1**: Pinus roxburghii Sarg.

**Figure 2**: TLC fingerprint of Pinus roxburghii Sarg., root

I: 254 nm, II: 366 nm and III: after derivatization, under white light
SARŚAPA

Botanical name: Brassica campestris L. (Fam. - Brassicaceae), seed
Crude drug sample: NVARI, Jhansi - CCRAS (January, 2007) (R)
Chemical constituents: Flavonoid - rutin
Sample Preparation and TLC: As annexure - I, (type I)
Solvent system: Toluene : Ethyl acetate : Acetic acid (6 : 4 : 0.1)
Visualization: Under 366 nm; after derivatization with iodine vapours

Figure 1: Brassica campestris L.

Figure 2: TLC fingerprint of Brassica campestris L., seed

I: 254 nm, II: 366 nm and III: after derivatization, under white light
BATAPATRIKĀ

Botanical name: *Rosa centifolia* L. (Fam. - Rosaceae), flower

Crude drug sample: Aayatra Ayurvedic Sadan, Dehradun (December, 2011) (R)

Chemical constituents: Essential oil - citronellol, geraniol, nerol, linalool; phenylethyl alcohol, farnesol, stearoptene, α-pinene, β-pinene and limonene

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Formic acid (4 : 4 : 2)

Visualization: Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

![Plant](Image1) ![Flower](Image2)

Figure 1: *Rosa centifolia* L.

![TLC Fingerprint](Image3)

**I**: 254 nm, **II**: 366 nm and **III**: after derivatization, under white light

Figure 2: TLC fingerprint of *Rosa centifolia* L., flower
Botanical name: *Dalbergia sissoo* Roxb. ex DC. (Fam.- Fabaceae), heartwood

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Dalbergin, dalbergenone, latifolin, myristic, palmitic, stearic, arachidic, linoleic, oleic acid, lignin and holocellulose

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.5)

Visualization: Under 254 nm; 366 nm; after derivatization with iodine vapours

---

Figure 1: *Dalbergia sissoo* Roxb. ex DC.

I: 254 nm, II: 366 nm and III: after derivatization, under white light

Figure 2: TLC fingerprint of *Dalbergia sissoo* Roxb. ex DC., heartwood
Botanical name: *Dalbergia sissoo* Roxb. ex DC. (Fam. - Fabaceae), stem bark

Crude drug sample: NRIBAS, Pune - CCRAS (July, 2007) (R)

Chemical constituents: Flavonoids - dalbergenone, dalbergin, methyldalbergin and 4-phenyl-chromene-dalbergichromene

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: Toluene : Ethyl acetate (7.5 : 2.5)

Visualization: Under 254 nm; 366 nm

---

Figure 1: *Dalbergia sissoo* Roxb. ex DC.

Figure 2: TLC fingerprint of *Dalbergia sissoo* Roxb. ex DC., stem bark

I: 254 nm and II: 366 nm
**SIRISA**

**Botanical name**: *Albizia lebbeck* (L.) Benth. (Fam. - Mimosaceae), stem bark

**Crude drug sample**: NRIBAS, Pune - CCRAS (August, 2007) (R)

**Chemical constituents**: Catechin - leucocyanidin; saponins - acacic acid and albegenin

**Sample Preparation and TLC**

**Solvent system**: Toluene : Ethyl acetate : Methanol : Glacial acetic acid (6 : 4 : 1 : 0.2)

**Visualization**: Under 254 nm; 366 nm; after derivatization with iodine vapours

---

**Figure 1**: *Albizia lebbeck* (L.) Benth.

**Figure 2**: TLC fingerprint of *Albizia lebbeck* (L.) Benth., stem bark

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**STHAUNEYA**

**Botanical name**: *Taxus baccata* L. (Fam. - Taxaceae), leaf

**Crude drug sample**: RRIHF, Tarikhet - CCRAS (August, 2007) (R)

**Chemical constituents**: Alkaloids - taxine, taxinine, ephidrine; glycosides - taxicatin, taxiphyllin, ecdysterone and resins

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: *Toluene : Ethyl acetate* (7 : 3)

**Visualization**: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Taxus baccata* L.

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Figure 2: TLC fingerprint of *Taxus baccata* L., leaf

I: 254 nm, II: 366 nm and III: after derivatization, under white light
**SŪRĀṆĀ**

**Botanical name** : *Amorphophallus campanulatus* Blume ex Decne. (Fam. - Araceae), corm

**Crude drug sample** : NVARI, Jhansi - CCRAS (August, 2007) (R)

**Chemical constituents** : Butyric acid, stigmasterol, carbohydrates and albuminoids

**Sample Preparation and TLC** : As annexure - I, (type I)

**Solvent system** : *Toluene : Ethyl acetate : Formic acid* (8.5 : 1 : 0.5)

**Visualization** : Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

---

**Figure 1**: *Amorphophallus campanulatus* Blume ex Decne.

**Figure 2**: TLC fingerprint of *Amorphophallus campanulatus* Blume ex Decne., corm

- **I**: 254 nm, **II**: 366 nm and **III**: after derivatization, under white light
**ŚVETA CANDANA**

**Botanical name**: *Santalum album* L. (Fam. - Santalaceae), heartwood

**Crude drug sample**: CCRAS Headquarters, New Delhi (June, 2008), (R)

**Chemical constituents**: Terpenes - santalol (α & β), santalenes (α & β), santenol and santalic acids (α & β)

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate (8 : 2)

**Visualization**: Under 254 nm; 366 nm; after derivatization with iodine vapours

---

Figure 1: *Santalum album* L.

Figure 2: TLC fingerprint of *Santalum album* L., heartwood
Botanical name: *Oroxylum indicum* (L.) Kurz (Fam. Bignoniaceae), root

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Ellagic acid

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate : Formic acid (5 : 5 : 0.5)*

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

Figure 1: *Oroxylum indicum* (L.) Kurz

Figure 2: TLC fingerprint of *Oroxylum indicum* (L.) Kurz, root
Botanical name: *Borassus flabellifer* L. (Fam. Arecaceae), inflorescence

Crude drug sample: NVARI, Jhansi - CCRAS (August, 2007) (R)

Chemical constituents: Kernels contain galactomannan (polysaccharide)

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Chloroform : Ethyl acetate : Formic acid* (5 : 2.5 : 2.5 : 0.3)

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1: Borassus flabellifer** L.

**Figure 2: TLC fingerprint of Borassus flabellifer** L., inflorescence
**Botanical name**: *Operculina turpethum* (L.) Silva Manso, (Fam. Convolvulaceae), root

**Crude drug sample**: NVARI, Jhansi - CCRAS (September, 2010) (R)

**Chemical constituents**: Turpethin, coumarin, scoipoletin, luteolin, gentisic, protocatechuic, vanillic, melilotic, ferulic acid

**Sample Preparation and TLC**: As annexure - I, (type I)

**Solvent system**: Toluene : Ethyl acetate : Formic acid (4.5 : 5 : 0.5)

**Visualization**: Under 254 nm; 366 nm; after derivatization with vanillin - sulphuric acid reagent

---

**Figure 1**: *Operculina turpethum* (L.) Silva Manso

**Figure 2**: TLC fingerprint of *Operculina turpethum* (L.) Silva Manso, root

I: 254 nm, II: 366 nm and III: after derivatization, under white light
TUMBINİ

Botanical name : *Lagenaria siceraria* (Molina) Standl. (Fam. - Cucurbitaceae), fresh fruit

Crude drug sample : ARRI, Itanagar - CCRAS (August, 2010) (R)

Chemical constituents : Cystine, glutamic acid, leucines, phenylalanine, proline, serine, threonine, tryosine, alanine, arginine, aspartic acid

Sample Preparation and TLC : As annexure - I, (type I)

Solvent system : *Toluene : Chloroform : Methanol* (5 : 4 : 1)

Visualization : Under 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Lagenaria siceraria* (Molina) Standl.

---

Figure 2: TLC fingerprint of *Lagenaria siceraria* (Molina) Standl., fresh fruit

I: 366 nm and II: after derivatization, under white light
UDUMBARA

Botanical name: *Ficus glomerata* Roxb. (Fam. Moraceae), fruit

Crude drug sample: ARRI, Itanagar - CCRAS (Oct, 2007) (R)

Chemical constituents: Sterol - β-sitosterol; terpenoids - lupeol acetate, gluanol and hentriacontane

Sample Preparation and TLC: As annexure - I, (type I)

Solvent system: *Toluene : Ethyl acetate (9 : 1)*

Visualization: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

Figure 1: *Ficus glomerata* Roxb.

Figure 2: TLC fingerprint of *Ficus glomerata* Roxb., fruit
**Botanical name**
: *Vetiveria zizanioides* (L.) Nash (Fam. - Poaceae), root

**Crude drug sample**
: NRIASHRD, Gwalior-CCRAS (December, 2007) (R)

**Chemical constituents**
: Sesquiterpene alcohol - epikhusinol, khusol, khusenol, khusimol and khusenic acid (zizanoic acid)

**Sample Preparation and TLC**
: As annexure - I, (type I)

**Solvent system**
: Toluene : Ethyl acetate : Glacial acetic acid (8.5 : 1 : 0.5)

**Visualization**
: Under 254 nm; 366 nm; after derivatization with anisaldehyde - sulphuric acid reagent

---

**Figure 1: Vetiveria zizanioides (L.) Nash**

**Figure 2: TLC fingerprint of Vetiveria zizanioides (L.) Nash, root**

I: 254 nm, II: 366 nm and III: after derivatization, under white light
UTPALA

Botanical name : *Nymphaea stellata* Willd. (Fam. - Nymphaeaceae), flower

Crude drug sample : CSMRIASDD, Chennai - CCRAS (March, 2009) (R)

Chemical constituents : Astragalin, corilagin, gallic acid, kaempferol, quercetin-3-methyl ether, quercetin and 2, 3, 4, 6-tetra-o-galloyl dextroglucose

Sample Preparation and TLC : As annexure – I, (type I)

Solvent system : *Toluene : Ethyl acetate : Acetic acid (5 : 5 : 0.5)*

Visualization : Under 366 nm

![Plant](image1.png)

![Flower](image2.png)

Figure 1: *Nymphaea stellata* Willd.

![TLC fingerprint](image3.png)

Figure 2: TLC fingerprint of *Nymphaea stellata* Willd., flower
ANNEXURES
### Sample preparation & Chromatographic Conditions

<table>
<thead>
<tr>
<th>Preparation of Sample (type I)</th>
<th>Preparation of Sample (type II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take 10 grams of coarsely powdered drug in 250 ml stoppered conical flask and extract with 100 ml alcohol for 24 hours by maceration with occasional shaking. Filter the extract and make up the volume to 100 ml in a volumetric flask.</td>
<td>Take 10 grams of coarsely powdered drug in 250 ml stoppered conical flask and extract with 100 ml dichloromethane for 24 hours by maceration with occasional shaking. Filter the extract and make up the volume to 100 ml in a volumetric flask.</td>
</tr>
</tbody>
</table>

**Thin Layer Chromatography**
- HPTLC system equipped with an automatic TLC sample applicator fitted with 100 µL syringe, TLC visualizer (254 nm, 366 nm and white light)

**Stationary phase**
- TLC precoated plate with silica gel 60F$_{254}$ of 0.2 mm thickness

**Volume of reference (R) and test (T) solution applied**
- 7 µl each

**Development chamber**
- Twin trough chamber (10 x 10 cm) with stainless steel lid

**Distance travelled by solvent system**
- 8 cm (band to solvent front)
Annexure - II

General Procedure

(i) Plate Material & Washing of Plate

Pre-coated Silica gel 60F254 TLC plates (0.2 mm) of 10 x 10 cm size are used and washed before the application of the spots as follows:

1. Mark the direction of development with a pencil at the upper edge of the plate and develop the plate with 20 ml methanol per trough in 10 x 10 twin-trough chamber (TTC) to the upper edge.
2. Dry the plate at 120° for 20 minutes in a clean drying oven.
3. Equilibrate plate with lab atmosphere (temperature, relative humidity) in a suitable container providing protection from dust and fumes.
   Plates are handled either on both side edges or on the top edge.

(ii) Tank Saturation - Before placing the plate into the development chamber, add 10 ml of mobile phase into the chamber and cover it with stainless steel lid. Keep it for 20 minutes in order to saturate the tank with the vapours of mobile phase.

(iii) Sample Application

Samples are applied as 8-10 mm bands (spray-on technique) using a suitable instrument, keeping 10 mm space between two bands. Samples are applied using the following parameters for HPTLC:

<table>
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<tr>
<th>Parameter</th>
<th>mm</th>
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<tr>
<td>Distance from lower edge of plate</td>
<td>10</td>
</tr>
<tr>
<td>Minimum distance from left and right edges of plate</td>
<td>10</td>
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(iv) Development

Plates are developed in a saturated TTC according to the following procedure:

1. Add appropriate volume of mobile phase (10 ml for 10 x 10 cm, TTC) and allow saturating for 20 minutes.
2. Mark the desired developing distance. Place the spotted TLC plate into the saturated TTC and put the lid immediately.
3. Allow the TLC plate to develop up to the mark.
4. Remove the plate from the chamber and dry (horizontally positioned) for 10-15 minutes at room temperature or under hot air current.
5. Freshly prepared mobile phase should be used for each development.
(v) Visualization

Photo-documentation of the plate developed as above, for various drugs after visualization either under ultra violet light (254 nm and 366 nm) or by any derivatization or spraying reagents.

(vi) Derivatization

Transfer of reagent for derivatization of samples on a TLC plate may be accomplished by spraying or dipping. Dipping is the preferred method and should be used wherever possible. Spraying is done in a TLC spray cabinet or in the fume hood. If derivatization includes heating, a plate heater is used alternatively a hot air oven may be used.

*Dipping:* Immersion devices with programming are available in the market. Charge tank of the immersion device with enough reagent to ensure complete immersion of chromatogram. Place plate in holder of immersion device, set parameters according to method, and press start. Let excess reagent drip off plate, and then wipe off back of the plate with paper towel. Remove plate from plate holder. Dry plate in air (horizontally positioned) or in a hot air oven at 105°C till spots appear. Alternatively manual methods of dipping are also used by quickly dipping the plate in the reagents and removing immediately.

(vi) Chemicals and Derivatizing Reagents

All the chemicals and solvents used should be as per the specifications prescribed in Ayurvedic pharmacopoeia of India.

1) **Vanillin- sulphuric acid reagent:**

Method of preparation –

Solution I - 5% ethanolic sulphuric acid

Solution II - 1% ethanolic vanillin

The developed and dried plate is sprayed uniformly with 5-10 ml solution I, followed immediately by 5-10 ml solution II. Heat the plate at 105°C until maximum colour formation (for 5-10 minutes) and observe under visible light.

Detection of essential oils (terpenoids, phenylpropane derivatives, phenols etc.).

2) **Anisaldehyde – sulphuric acid reagent:**

Method of preparation – 0.5 ml anisaldehyde is mixed with 10 ml glacial acetic acid, followed by 85 ml methanol and 5 ml concentrated sulphuric acid, in that order.

The developed and dried plate is sprayed uniformly with 5-10 ml reagent, Heat the plate at 105°C until maximum colour formation (for 5-10 minutes) and observe under visible light or UV 365 nm.

The reagent has limited stability and is no longer useable when the colour of the reagent has turned to red-violet.

Detection of essential oils, pungent principles, bitter principles, saponins etc.
3) **5% Methanolic - sulphuric acid reagent:**

Method of preparation – Add dropwise 5 ml sulphuric acid in 95 ml of ice-cold methanol. Spray the developed and dried plate with about 10 ml of reagent, heat at 105° for 5-10 minutes, and observe under visible light.

4) **Ninhydrin reagent:**

30 mg of ninhydrin is dissolved in 10 ml n-butanol, followed by 0.3 ml of 98% acetic acid. Spray the developed and dried plate with 8-10 ml of reagent, heat at 105° for 5-10 minutes, and observe under visible light.

Detection of amino acids, amines, aminosugars.

5) **Iodine Vapours:**

Expose the developed and dried plate to iodine vapours in an iodine chamber till the spots appear.
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