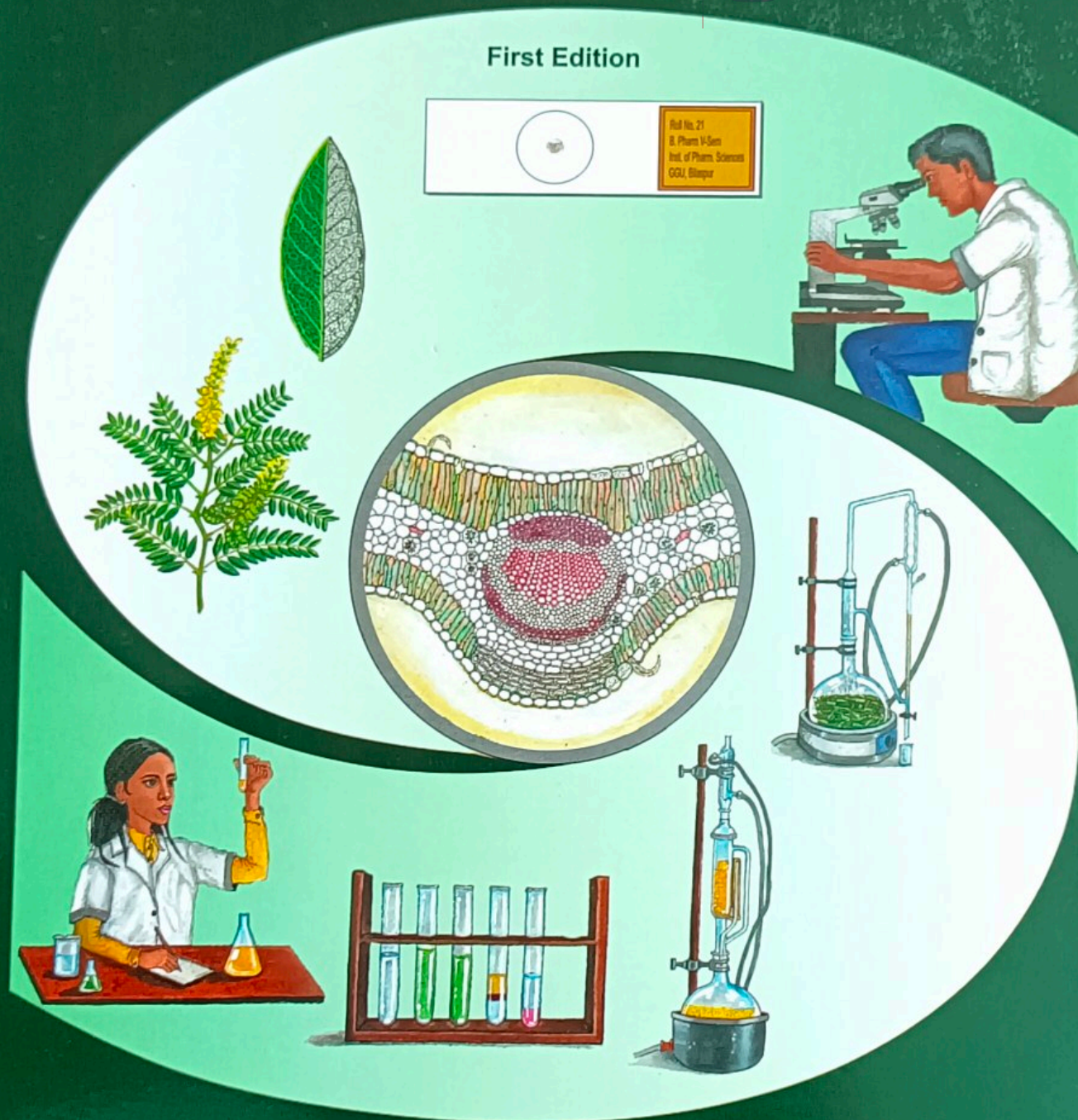


PRACTICAL PHARMACOGNOSY & PHYTOCHEMISTRY

Vinod D. Rangari

First Edition



PHARMA
CAREER
PUBLICATIONS
www.pharmacareerbooks.com

PRACTICAL PHARMACOGNOSY AND PHYTOCHEMISTRY

First Edition

January 2019

© **Dr. Vinod D. Rangari**

ISBN : 978-93-82322-80-1

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording otherwise, without the prior written permission of the publishers.

Published by

Career Publications

Office : Second Floor, Kaveri Smruti, Ashok Stambh, Nashik 422001. Maharashtra, India.

Ph. : +91-0253-2311422, 2576175

E-mail : publications@careerandyou.com

Website : www.pharmacareerbooks.com

Co-ordinating Editor

Sudhanva Tipare

Typeset, Layout

Satish V. More

Cover Design

Dr. Vinod D. Rangari

Printed in India by

Replica Printers

Nashik

Price : ₹ 360/-

CONTENT

No.	Subject	Page No.
	Part-1: Microscope and Microscopic Techniques	01
	Part-2: General Morphology and Microscopy of Crude Drugs	14
	Part-3: Microscopy of Organized Crude Drugs	22
	General Introduction	22
	3.1 Glycosides and aglycones containing crude drugs	24
	Anthraquinone glycosides:	
	Senna (<i>Cassia angustifolia</i>)	26
	Aloe (<i>Aloe vera</i>)	28
	Rhubarb (<i>Rheum officinale</i>)	30
	Cascara (<i>Rhamnus purshiana</i>)	32
	Cardiac glycosides:	
	Digitalis (<i>Digitalis purpurea</i>)	34
	Digitalis lanata (<i>Digitalis lanata</i>)	36
	Yellow oleander (<i>Thevetia peruviana</i>)	38
	Squill (<i>Urginea maritima</i>)	40
	Strophanthus (<i>Strophanthus kombe</i>)	42
	Steroidal glycosides:	
	Shatavari (<i>Asparagus racemosus</i>)	44
	Ashwagandha (<i>Withania somnifera</i>)	46
	Dioscorea (<i>Dioscorea deltoidea</i>)	48
	Sarsaparilla (<i>Smilax ornata</i>)	50
	Triterpenoid glycosides:	
	Liquorice (<i>Glycyrrhiza glabra</i>)	52
	Ginseng (<i>Panax ginseng</i>)	54
	Senega (<i>Polygala senega</i>)	56
	Cyanogenic glycosides:	
	Wild cherry (<i>Prunus serotina</i>)	58
	Isothiocyanate glycosides:	
	Black mustard (<i>Brassica nigra</i>)	60
	Coumarin glycosides:	
	Psoralea (<i>Psoralea corylifolia</i>)	62
	Ammi majus (<i>Ammi majus</i>)	64
	Flavonoid glycosides:	
	Bitter orange peel (<i>Citrus aurantium</i>)	66
	Chromone glycosides:	
	Visnaga (<i>Ammi visnaga</i>)	68
	Bitters:	
	Gentian (<i>Gentiana lutea</i>)	70
	Picrorhiza (<i>Picrorhiza kurroa</i>)	72
	Kalmegh (<i>Andrographis paniculata</i>)	74
	Chirata (<i>Swertia chirata</i>)	76
	Quassia (<i>Picrasma excelsa</i>)	78
	Neem (<i>Azadirachta indica</i>)	80
	3.2: Alkaloids containing crude drugs	82
	Tropane alkaloids:	
	Datura (<i>Datura stramonium</i>)	84
	Henbane (<i>Hyoscyamus niger</i>)	86
	Belladonna (<i>Atropa belladonna</i>)	88

	Belladonna Roots (<i>Atropa belladonna</i>)	90
Indole alkaloids:	Vinca (<i>Catharanthus roseus</i>)	92
	Rauwolfia (<i>Rauwolfia serpentina</i>)	94
	Nux vomica (<i>Strychnos nux vomica</i>)	96
	Ergot (<i>Claviceps purpurea</i>)	98
Quinoline alkaloids:	Cinchona (<i>Cinchona calisaya</i> & other Spp.)	100
Isoquinoline alkaloids:	Ipecac (<i>Cephaelis ipecacuanha</i>)	102
Steroidal alkaloids:	Kurchi (<i>Holarrhena antidysenterica</i>)	104
Quinazoline alkaloids:	Vasaka (<i>Adhatoda vasika</i>)	106
Amide alkaloids:	Black Pepper (<i>Piper nigrum</i>)	108
Pyridine-pyrolidine alkaloids:	Tobacco (<i>Nicotiana tabacum</i>)	110
Tropolone alkaloids:	Colchicum (<i>Colchicum autumnale</i>)	112
Imidazole alkaloids:	Jaborandi (<i>Pilocarpus jaborandi</i>)	114
Amino alkaloid:	Ephedra (<i>Ephedra equisetina</i> & other Spp.)	116
Pseudoalkaloids (Purine bases):	Tea (<i>Camelia sinensis</i>)	118
3.3: Essential oil containing crude drugs		120
Alcohols :	Fennel (<i>Foeniculum vulgare</i>)	122
	Coriander (<i>Coriandrum sativum</i>)	124
	Mentha (<i>Mentha piperita</i>)	126
	Sandalwood (<i>Santalum album</i>)	128
Aldehydes :	Cinnamon (<i>Cinnamomum zeylanicum</i>)	130
	Cassia (<i>Cinnamomum cassia</i>)	132
	Cumin (<i>Cuminum cyminum</i>)	134
	Lemon (<i>Citrus limon</i>)	136
	Lemongrass (<i>Cymbopogon citratus</i>)	138
Ketones :	Dill (<i>Anethum graveolens</i>)	140
	Caraway (<i>Carum carvi</i>)	142
	Khus (<i>Vetiveria zizanioids</i>)	144
Ethers :	Eucalyptus (<i>Eucalyptus globulus</i>)	146
	Nutmeg (<i>Myristica fragrans</i>)	148
	Anise (<i>Pimpinella anisum</i>)	150
Acetates :	Cardamom (<i>Elettaria cardamomum</i>)	152
Nonterpenoids (Phenols):	Clove (<i>Eugenia caryophyllus</i>)	154
3.4: Microscopy of crude drugs containing Resins, Mucilages, and Fixed Oils		156
Resins:	Cannabis (<i>Cannabis sativa</i>)	158
	Podophyllum (<i>Podophyllum peltatum</i>)	160
	Turmeric (<i>Curcuma longa</i>)	162
	Ginger (<i>Zingiber officinalis</i>)	164

	Capsicum (<i>Capsicum annum</i>)	166
Mucilages:	Ispaghula (<i>Plantago ovata</i>)	168
	Psyllium (<i>Plantago psyllium</i>)	168
Fixed oils:	Castor oil (<i>Ricinus communis</i>)	170
	Linseed (<i>Linum usitatissimum</i>)	172
Part-4: Microscopy of Unorganized Crude Drugs		174
4.1: Starches: Maize (<i>Zea mays</i>), Wheat (<i>Triticum aestivum</i>), Rice (<i>Oriza sativa</i>), Tapioca (<i>Manihot utitissima</i>), Arrowroot (<i>Maranta arundinacea</i>), Potato (<i>Solanum tuberosum</i>)		176
4.2: Gums and Mucilages: Acacia (<i>Acacia Senegal</i>), Tragacanth (<i>Astragalus gummifer</i>), Sterculia (<i>Sterculia urens</i>), Gaur (<i>Cyamopsis tetragonolobus</i>) Ghati (<i>Anogeissus latifolia</i>), Agar (<i>Gelidium & Pterocladia</i> Spp., <i>Gracilaria</i> Spp.), Alginate (<i>Laminaria</i> Spp., <i>Laminariaceae</i> , <i>Fucus</i> Spp.)		178
4.3: Tannins: Gambier (<i>Uncaria gambier</i>), Black catechu (<i>Acacia catechu</i>)		183
4.4: Latex/Juices: Aloe (<i>Aloe</i> Spp.), Opium (<i>Papaver somniferum</i>)		185
4.5: Resins: Colophony (<i>Pinus palustris</i>), Myrrh (<i>Commiphora molmol</i>), Guggul (<i>Commiphora mukul</i>), Asafoetida (<i>Ferula foetida</i>), Benzoin (<i>Styrax paralleloneurus & S. tonkinensis</i>), Storax (<i>Liquidamber orientalis</i>) Balsam (<i>Myroxylon balsamum & Myroxylon pererae</i>), Shellac (<i>Laccifer lacca</i>).		187
4.6: Fixed oils: Castor (<i>Ricinus communis</i>), Bitter almond (<i>Prunus amygdalus var. dulcis</i>), Olive (<i>Olea europaea</i>), Linseed (<i>Linum usitatissimum</i>), Cod liver oil (<i>Gadus morrhua</i>)		192
4.7: Fats: Theobroma (<i>Theobroma cacao</i>), Lard (<i>Sus scrofa</i>), Suet (<i>Ovis aries</i>), Wool fat and lanolin (<i>Ovis aries</i>)		197
4.8: Waxes: Bees wax (<i>Apis mellifera</i>), Carnauba wax (<i>Copernicia cerifera</i>) Spermaceti (<i>Physeter cotodon</i>)		199
4.9: Carbohydrates: Honey (<i>Apis mellifera</i>)		200
4.10: Proteins: Gelatin (Ox: <i>Bos taurus</i> & Sheep: <i>Ovis aries</i> bones)		201
Part-5: Quantitative Microscopy		203
5.1: Quantitative microscopy using Eyepiece micrometer		203
5.2: Study of Leaf surface constants by with Camera lucida		204
Determination of stomatal number and stomatal index		204
Determination of Palisade ratio		205
Determination of vein islet number and vein islet termination number		206
5.3: Determination of size of starch grains by eye piece micrometer		207
5.4: Determination of calcium oxalate crystals by eye piece micrometer		208
5.5: Determination of the length and width of the phloem fibre with		209

eye piece micrometer	
5.6: Quantitative microscopy with Lycopodium spore method	209
Part-6: Preliminary Phytochemical Screening Test	211
6.1: Collection, processing and preservation of plant material	211
6.2: Preparation of Extracts	212
6.3: Preparation of Test solutions	212
6.4: Preparation of Test reagents	212
6.5: Record of Test Results	212
6.6: Phytochemical Screening Tests for Primary Metabolites	212
6.7: Phytochemical Screening Tests for Secondary Metabolites	214
6.7.1: Alkaloids	215
6.7.2: Specific Test for Alkaloids	215
6.7.3: Glycosides	216
6.7.4: Tannins	218
6.7.5: Test for Phenols and Polyphenols	219
6.7.6: Essential Oils	220
Part-7: Phytochemical Estimations and Analysis	221
7.1: Determination of various Ash value	221
7.2: Determination of Loss on drying	222
7.3: Determination of Bitter value	223
7.4: Determination of Swelling index	224
7.5: Determination of foaming index	225
7.6: Evaluation of Fixed oils and fats	225
7.7: Determination of Extractive values of crude drugs	227
7.8: Hydrodistillation of volatile oils	228
7.9: Thin layer chromatography of herbal extracts and essential oil	229
7.10: Separation of sugars / amino acids by Paper chromatography	230
Part-8: Isolation of Phytopharmaceuticals	232
8.1: General Introduction	232
8.2: Isolation of Polysaccharides: Starch, Pectin	233
8.3: Glycosides and aglycones: Sennoside, Aloin, Diosgenin, Glycyrrhizin, Rutin, Psoralen and Andrographolide	234
8.4: Isolation of Alkaloids: Atropine, Quinine and quinidine, Strychnine and brucine, Vasicine, Piperine, Solasodine and Caffeine	239
8.5: Essential oils: Menthol, Camphor and Eugenol	245
8.6: Resins: Curcumin, Podophyllotoxin and Gingerol	247
Part-9: WHO Guidelines for Herbal Medicine	250
Appendix - I	253
Reagents and solutions	253
Selected Bibliography	255
Subject index	257

1

MICROSCOPE AND MICROSCOPIC TECHNIQUES

1.1 General Introduction to Practical Pharmacognosy : Pharmacognosy is the study of crude drugs derived from plants or other natural sources. As these crude drugs are derived from various plant species and varieties of diverse geographical and climatic conditions, it shows the variations in the morphological characters, phytochemical composition and thereby therapeutic activity. It is a duty and responsibility of the knowledge bearers of pharmacognosy to develop suitable methods for the standardization and quality control of the crude drugs so that the authentic drug would reach the end users. Practical pharmacognosy has the major aim and objective to provide the practical laboratory experience about the study of the drugs of natural origin to the students of pharmacy and other related discipline. Since the subject of pharmacognosy closely associates with the botany, phytochemistry and pharmacology, the practical study of the crude drug requires the study of morphology, microscopy and chemical constituents of the drugs. Therefore practical pharmacognosy covers the practicals associated with the study of:

1. Microscopy of Organised Crude Drugs
2. Microscopy of Unorganised Crude Drugs
3. Quantitative Microscopy
4. Preliminary Phytochemical Screening
5. Extraction and Isolation of Phytopharmaceuticals

Before dealing with the various aspects of the practical pharmacognosy it is important for the students to understand the instructions associated with these practical.

1.2 Instructions for Students : Students are required to be fully prepared for understanding theoretical concepts and applications associated with the study of particular drugs.

1. Students should wear clean white apron during the practical. If necessary the mask and gloves may be used while handling the crude drug.
2. They should always carry practical record, rough notebook and required material associated with the practicals.
3. Listen carefully to the lecture given by teacher about importance of subject, skills to be developed, information about equipment, instruments, procedure, method of continuous assessment, tentative plan of working laboratory, and total amount of work to be done.
4. Students should perform the practical only at the place which allocated to them.
5. Understand the purpose of experiment and its practical applications.

6. Write the answer of the questions allotted by teacher during practical hours if possible or afterwards, but immediately.
7. Students should not hesitate to ask any difficulty faced during the practical.
8. Students shall develop maintenance skill as expected by the industries.
9. Students shall attempt to develop related hands-on -skills and gain confidence.
10. Students shall focus on development of practical skills rather than theoretical or codified knowledge.
11. Students shall develop habits of evolving more ideas, innovations, skills etc. than included in the scope of the manual.
12. Students should develop the habit of not to depend totally on the teachers but to develop self- learning techniques.
13. Students should develop the habit to complete the practical exercise continuously and progressively on the scheduled dates and should get the assessment done.
14. Students should clean the platform before leaving the laboratory.

The students has to deal with the crude drugs for the practicals. Brief information has been furnished here about the crude drugs, selected for the practical study in this book.

1.3 Crude Drugs : One of the important aspect of the practical pharmacognosy is the morphological and microscopic study of the crude drugs using microscope. These crude drugs are used in medicine due to the characteristic phytochemical constituents that are responsible for their biological activity. To facilitate the categorization of the crude drugs, they can be grouped together in their specific chemical classes. The crude drugs which are described in this book for the pharmacognostic study are enlisted in Table-1.1 and 1.2.

Table 1.1: List of selected organized crude drugs.

Glycosides and Aglycones	Essential Oils
1. Senna Leaf	1. Fennel Fruits
2. Senna Pods	2. Coriander Fruits
3. <i>Digitalis purpurea</i> Leaf	3. Caraway Fruits
4. <i>Digitalis lanata</i> Leaf	4. Cumin Fruits
5. Thevetia Leaf	5. Dill Fruits
6. Rhubarb Rhizome	6. Anise Fruits
7. Cascara Bark	7. Nutmeg Fruit
8. Strophanthus Seed	8. <i>Mentha piperita</i> Leaf
9. Indian Squill	9. <i>Mentha spicata</i> Leaf
10. European Squill	10. <i>Ocimum sanctum</i> Leaf
11. Asparagus Roots	11. Eucalyptus Leaf
12. Liquorice roots and stolones	12. Lemongrass Leaf
13. Ginseng Roots	13. Cinnamon Bark
14. Withania Roots	14. Cassia Bark
15. Dioscorea Rhizome	15. Sandalwood
16. Wild Cherry Bark	16. Clove Buds
17. Black Mustard Seeds	17. Cardamom seeds