SCHEME : J

Name : _____

Roll No. : _____ Year : 20___ 20___

Exam Seat No. : _____

LABORATORY MANUAL FOR

PHARMACOGNOSY (20053)

FIRST YEAR D.PHARMACY

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI
(Autonomous) (ISO 9001: 2015) (ISO/IEC 27001:2013)

VISION

To ensure that the diploma level technical education constantly matches the latest requirements of technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

MISSION

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the challenging technological & environmental challenges.

QUALITY POLICY

We, at MSBTE are committed to offer the best-in-class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

CORE VALUES

MSBTE believes in the following:

- ✓ Skill development in line with industry requirements.
- ✓ Industry readiness and improved employability of Diploma holders.
- ✓ Synergistic relationship with industry.
- ✓ Collective and Cooperative development of all stake holders.
- ✓ Technological interventions in societal development.
- ✓ Access to uniform quality technical education.

LABORATORY MANUAL OF

PHARMACOGNOSY

(20053)

First Year

Diploma in Pharmacy

Maharashtra State Board of Technical Education, Mumbai.

(Autonomous)

(ISO 9001:2015) (ISO/IEC27001:2013)

PCI ER-2020/'J' Scheme Curriculum

Maharashtra State Board of Technical Education, Mumbai

(Autonomous) (ISO 9001:2015) (ISO/IEC27001:2013)

4th floor, Government Polytechnic Building, 49, Kherwadi, Bandra (E), Mumbai- 400 051

(Printed on – July 2024)

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

CERTIFICATE

This is to certify that Mr. /Ms. _____

Roll No. _____ of First Year Diploma in Pharmacy studying at

_____

has completed the practical work satisfactorily in Pharmacognosy (20053) for the academic year 20 - 20 as prescribed in the PCI ER 2020 syllabus.

Date: _____ Enrollment No.: _____

Place: _____ Exam Seat No.: _____

Course Teacher **Principal**

External Examiner

Seal of the Institute

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
MUMBAI

PROGRAM OUTCOMES

1. **Pharmacy knowledge:** Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy.
2. **Modern tool usage:** Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.
3. **Leadership skills:** Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfilment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.
4. **Professional identity:** Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
5. **Pharmaceutical ethics:** Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
6. **Communication:** Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
7. **The Pharmacist and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
8. **Environment and sustainability:** Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
9. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis

COMPETENCIES FOR THE INDIAN D. PHARM HOLDERS

Competency is defined as "A distinct composite of knowledge, skill, attitude and value that is essential to the practice of the profession in real life contexts".

The candidates who successfully complete the Diploma in Pharmacy (D. Pharm) program of Education Regulations 2020 (ER-2020), from the institutions approved by the Pharmacy Council of India are expected to attain the following professional competencies.

1. Review Prescriptions: The student should receive and handle prescriptions in a professional manner and be able to check for their completeness and correctness. Also, the prescribers should be contacted for any clarifications & corrections in the prescriptions with suggestions if any.

2. Dispense Prescription / Non-Prescription Medicines: The student should be able to dispense the various scheduled drugs / medicines as per the implications of the Drug & Cosmetic Act and Rules thereunder. Also, the non-prescription medicines (over-the-counter drugs) should be dispensed judicially to the patients as required.

3. Provide Patient Counselling / Education: The student should be able to effectively counsel / educate the patients / caretakers about the prescription / non-prescription medicines and other health related issues. Effective communication includes using both oral and written communication skills and various communication techniques.

4. Hospital and Community Pharmacy Management: The student be able to manage the drug distribution system as per the policies and guidelines of the hospital pharmacy, good community pharmacy practice and the recommendations of regulatory agencies. Also, be able to manage the procurement, inventory, and distribution of medicines in hospital / community pharmacy settings.

5. Expertise on Medications: The student should be able to provide an expert opinion on medications to health care professionals on safe and effective medication – use, relevant policies and procedures based on available evidence.

6. Proficiency on Pharmaceutical Formulations: The student should be able to describe the chemistry, characteristics, types, merits and demerits of both drugs and excipients used in pharmaceutical formulations based on her/his knowledge and scientific resources.

7. Entrepreneurship and Leadership: The student should be able to acquire the entrepreneurial skills in the dynamic professional environments. Also, be able to achieve leadership skills through teamwork and sound decision-making skills.

8. Deliver Primary and Preventive Healthcare: The student should be able to contribute to various healthcare programs of the nation including disease prevention initiatives to improve public health. Also contribute to the promotion of national health policies.

9. Professional, Ethical and Legal Practice: The student should be able to deliver professional services in accordance with legal, ethical, and professional guidelines with integrity.

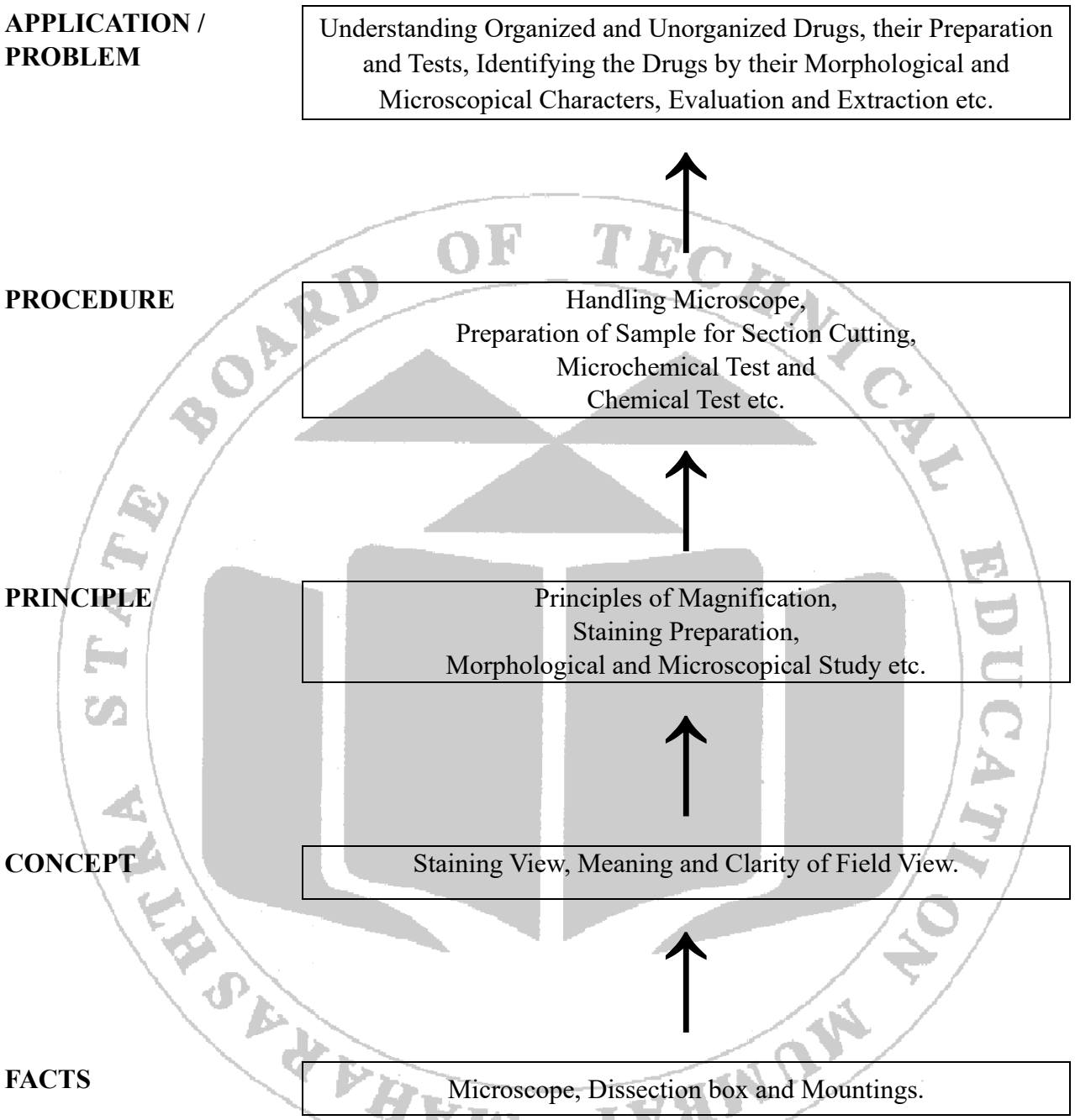
10. Continuing Professional Development: The student should be able to recognize the gaps in the knowledge and skills in the effective delivery of professional services from time to time and be self-motivated to bridge such gaps by attending continuing professional development programs.

COMPETENCY MAPPING WITH THE COURSE

Competencies	Pharmacognosy
1.Review Prescriptions	✓
2. Dispense Prescription / Non-Prescription Medicines	✓
3.Provide Patient Counselling / Education	✓
4.Hospital and Community Pharmacy Management	
5.Expertise on Medications	✓
6.Proficiency on Pharmaceutical Formulations	✓
7.Entrepreneurship and Leadership	
8.Deliver Primary and Preventive Healthcare	
9.Professional, Ethical and Legal Practice	
10.Continuing Professional Development	✓

GRAPHICAL STRUCTURE OF SUBJECT AREA

PHARMACOGNOSY (20053)



PHARMACOGNOSY – PRACTICAL

Course Code: 20053 75 Hours (3 Hours/week)

Scope:

This course is designed to train the students in physical identification, morphological characterization, physical and chemical characterization, and evaluation of commonly used herbal drugs.
Course Objectives:
This course will provide hands-on experiences to the students in

1. Identification of the crude drugs based on their morphological characteristics.
2. Various characteristic anatomical characteristics of the herbal drugs studied through transverse section.
3. Physical and chemical tests to evaluate the crude drugs.

Course Outcomes:
Upon successful completion of this course, the students will be able to

1. Identify the given crude drugs based on the morphological characteristics
2. Take a transverse section of the given crude drugs
3. Describe the anatomical characteristics of the given crude drug under microscopical conditions
4. Carry out the physical and chemical tests to evaluate the given crude drugs

Practicals

1. **Morphological Identification of the following drugs:**
   Ispaghula, Senna, Coriander, Fennel, Cardamom, Ginger, Nutmeg, Black Pepper, Cinnamon, Clove, Ephedra, Rauwolfia, Gokhru, Punarnava, Cinchona, Agar.
2. **Gross Anatomical Studies (Transverse Section) of the following drugs:**
   Ajowan, Datura, Cinnamon, Cinchona, Coriander, Ashwagandha, Liquorice, Clove, Curcuma, Nux vomica, Vasaka
3. **Physical And Chemical Tests For Evaluation of Any FIVE of the following drugs:**
   Asafoetida, Benzoin, Pale catechu, Black catechu, Castor oil, Acacia, Tragacanth, Agar, Guar gum, Gelatin.

Assignments
The students shall be asked to submit the written assignments on the following topics (One assignment per student per sessional period. i.e., a minimum of THREE assignments per student)

1. Market preparations of various dosage forms of Ayurvedic, Unani, Siddha, Homeopathic (Classical and Proprietary), indications, and their labelling requirements
2. Market preparations of various herbal formulations and herbal cosmetics, indications, and their labelling requirements
3. Herb-Drug interactions documented in the literature and their clinical significances

Field Visit
The students shall be taken in groups to a medicinal garden to witness and understand the nature of various medicinal plants discussed in theory and practical courses. Additionally, they shall be taken in groups to the pharmacies of traditional systems of medicines to understand the availability of various dosage forms and their labelling requirements. Individual reports from each student on their learning experience from the field visit shall be submitted.

STRATEGY FOR IMPLEMENTATION
It is suggested that 32-35% of experiments shall be completed before every sessional exam.

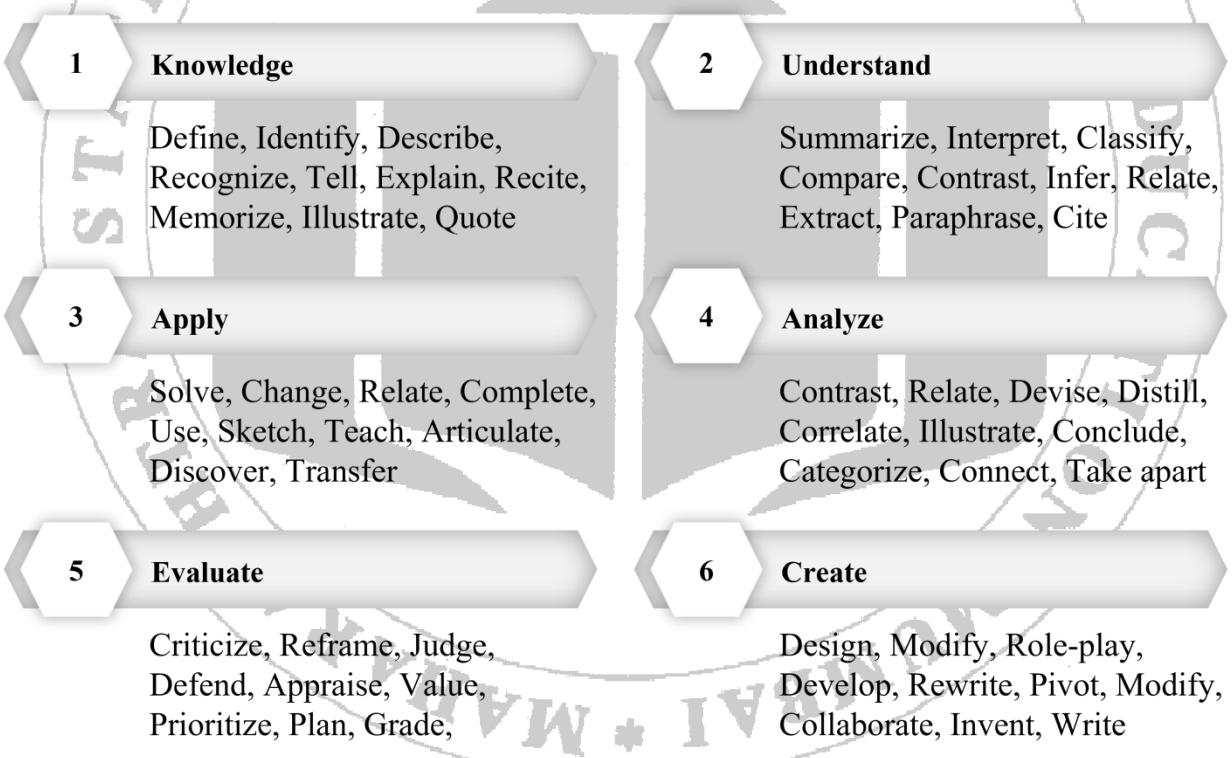
GUIDELINES FOR TEACHERS

Teacher shall explain the following points to the students before starting of the practical:

1. **Learning Objectives**: To foster better understanding of the subject and to inculcate the skills and attitude related practicals.
2. **Graphical Structure**: In graphical structure topics and subtopics are organized in systematic way so that ultimate purpose of learning the subject is achieved. This is arranged in the form of fact, concept, principle, procedure, application and problem.
3. **Elementary Guide to Work in Laboratory**: To create a conducive environment for appropriate planning of practical work within a timely schedule, teacher should explain procedure and other finer aspects of the equipment, including its specifications.
4. Teachers should verify and check the working conditions of the equipment and request the students to follow the standard operating procedures (SOP).
5. Before starting the practical, teachers should explain the strategies of the experiment.
6. Teachers should ensure the active participation of students while performing the experiment.
7. Observations should be checked individually and each student should be given a chance to perform the experiment.
8. Teachers should ask the students to complete the questions which are given at the end of the experiment accordingly.
9. Assessment of manuals should be done according to the assessment norms. Proper marks should be distributed according to the performance of the student.
10. Teachers should explain the competencies that student should achieve, in detail with their importance to students after completion of their course.
11. Apart from the syllabus, teachers should provide and cover extra topics which are beneficial for the students.
12. Explanation about various equipment with some interesting videos, reagents, chemicals and glassware should be given to students prior to commencing of the practical.
13. Teachers should observe the students when students are performing practical in groups, proper contributions of the individual student should be there and record of observation should be noted by all of them.
14. Teachers should also organize a visit to the pharmaceutical industries where students get a brief idea about the manufacturing processes of common dosage forms such as tablets, capsules, liquid orals, injectables, etc.
15. Teachers should also ask them to gather information about each type of dosage forms, their generic name, branded names and label contents.

16. Teachers may suggest the students to refer to sources of information such as literature, research papers, books, attending conferences, seminars for the updating knowledge.
17. According to the professional competencies given by PCI, teachers should develop the professional skills of the students.
18. Teacher should conduct different types of sessions for students such as quiz, group discussions projects on different topics, etc.
19. Teachers should ensure that revised CIAAN – 2017 norms or the latest norms given by MSBTE are followed simultaneously and implemented.
20. Teachers should follow the guidelines given by PCI & MSBTE from time to time.

BLOOMS TAXONOMY LEVELS



INSTRUCTIONS FOR STUDENTS

Students should follow the instructions given below for better understanding of the subject from a theoretical and practical concept of view.

1. As per the instructions, the students should wear an apron, cap, mask, gloves and slippers before entering the lab.
2. The students should keep their important things in the locker which is provided by the college.
3. While entering the laboratory, the students should carry manual, rough book and practical requirements as instructed.
4. Students should attend the practical regularly throughout the year, so as to understand the subject properly, and to develop the skills for performing the experiments and attaining the competencies.
5. The students should carry out the experiment individually and perform the experiment at the allotted specific work area.
6. The practical applications of every experiment should be noted by the students.
7. Students should answer the questions asked in the practical's and should ask the teacher about their difficulties without any hesitation.
8. After completion of practical's students should write the answers of the question given at the end of the experiment.
9. Students should develop different types of competencies to become competent Pharmacists.
10. Students should actively participate in group discussions, activities and strive to achieve the knowledge, skills, and attitude.
11. Student should submit the manual for assessing regularly on the scheduled date.
12. After completing the practical, the student should clean the platform and glassware used in the practical.

LABORATORY MANUAL OF PHARMACOGNOSY

MAPPING OF COURSE OUTCOMES

Expt No.	Title of Experiment	CO1	CO2	CO3	CO4
01	To study the Microscope and its Components.	✓	✓	✓	
02	To understand technique of Section Cutting, Staining and Mounting.	✓		✓	
03	To Study the Microchemical Reagent.	✓		✓	
04	To study Morphological Characters of Isapghula and Senna (Laxatives)	✓			
05	To study Morphological Characters of Coriander and Fennel (Carminatives)	✓			
06	To study Morphological Characters of Cardamom and Ginger (Carminatives)	✓			
07	To study Morphological Characters of Nutmeg and Black Pepper (Carminatives)	✓			
08	To study Morphological Characters of Cinnamon and Clove (Carminatives)	✓			
09	To study Morphological Characters of Ephedra (CNS Acting) and Rauwolfia (Antihypertensive)	✓			
10	To study Morphological Characters of Gokhru and Punarnava (Diuretics)	✓			
11	To study Morphological Characters of Cinchona (Antimalarial) and Agar (Pharmaceutical Aids)	✓			
12	To study the Morphological and Microscopical Characters of Coriander fruit.		✓	✓	
13	To study the Morphological and Microscopical Characters of Ajowan seed.		✓	✓	
14	To study the Morphological and Microscopical Characters of Cinchona bark.		✓	✓	
15	To study the Morphological and Microscopical Characters of Cinnamon bark.		✓	✓	
16	To study the Morphological and Microscopical Characters of Vasaka leaf.		✓	✓	
17	To study the Morphological and Microscopical Characters of Datura leaf.		✓	✓	
18	To study the Morphological and Microscopical Characters of Ashwagandha root.		✓	✓	
19	To study the Morphological and Microscopical Characters of Liquorice root.		✓	✓	
20	To study the Morphological and Microscopical Characters of Curcuma rhizome.		✓	✓	
21	To study the Morphological and Microscopical Characters of Nuxvomica seed.		✓	✓	
22	To study the Morphological and Microscopical Characters of Clove bud.		✓	✓	
23	To identify unknown unorganized powder drug with the help of physical and chemical tests (Asafoetida and Benzoin)				✓

Expt No.	Title of Experiment	CO1	CO2	CO3	CO4
24	To identify unknown unorganized powder drug with the help of physical and chemical tests (Pale catechu and Black catechu)				✓
25	To identify unknown unorganized powder drug with the help of physical and chemical tests (Castor oil and Acacia)				✓
26	To identify unknown unorganized powder drug with the help of physical and chemical tests (Tragacanth and Agar)				✓
27	To identify unknown unorganized powder drug with the help of physical and chemical tests (Guar gum and Gelatin)				✓

LIST OF EXPERIMENTS AND RECORD OF PROGRESSIVE ASSESSMENT

Expt No.	Title of Experiment	Page No.	Date of Performance	Date of Submission	Assessment Marks	Sign of Teacher
A. TO KNOW YOUR PHARMACOGNOSY LABORATORY						
01	To study the Microscope and its Components.	**1**				
02	To understand technique of Section Cutting, Staining and Mounting.	**8**				
03	To Study the Microchemical Reagent.	**16**				
B. MORPHOLOGICAL CHARACTERS OF CRUDE DRUGS						
04	To study Morphological Characters of Isapghula and Senna (Laxatives)	**20**				
05	To study Morphological Characters of Coriander and Fennel (Carminatives)	**26**				
06	To study Morphological Characters of Cardamom and Ginger (Carminatives)	**31**				
07	To study Morphological Characters of Nutmeg and Black Pepper (Carminatives)	**36**				
08	To study Morphological Characters of Cinnamon and Clove (Carminatives)	**41**				
09	To study Morphological Characters of Ephedra (CNS Acting) and Rauwolfia (Antihypertensive)	**46**				
10	To study Morphological Characters of Gokhru and Punarnava (Diuretics)	**51**				
11	To study Morphological Characters of Cinchona (Antimalarial) and Agar (Pharmaceutical Aids)	**57**				
C. GROSS ANATOMICAL STUDIES (TRANSVERSE SECTION) OF THE CRUDE DRUGS						
12	To study the Morphological and Microscopical Characters of Coriander fruit.	**62**				
13	To study the Morphological and Microscopical Characters of Ajowan seed.	**67**				
14	To study the Morphological and Microscopical	**71**				

Expt No.	Title of Experiment	Page No.	Date of Performance	Date of Submission	Assessment Marks	Sign of Teacher
	Characters of Cinchona bark.					
15	To study the Morphological and Microscopical Characters of Cinnamon bark.	**76**				
16	To study the Morphological and Microscopical Characters of Vasaka leaf.	**81**				
17	To study the Morphological and Microscopical Characters of Datura leaf.	**86**				
18	To study the Morphological and Microscopical Characters of Ashwagandha root.	**90**				
19	To study the Morphological and Microscopical Characters of Liquorice root.	**95**				
20	To study the Morphological and Microscopical Characters of Curcuma rhizome.	**100**				
21	To study the Morphological and Microscopical Characters of Nuxvomica seed.	**105**				
22	To study the Morphological and Microscopical Characters of Clove bud.	**110**				
D. PHYSICAL AND CHEMICAL TESTS FOR EVALUATION OF ANY FIVE OF THE UNORGANIZED DRUGS						
23	To identify unknown unorganized powder drug with the help of physical and chemical tests (Asafoetida and Benzoin)	**116**				
24	To identify unknown unorganized powder drug with the help of physical and chemical tests (Pale catechu and Black catechu)	**121**				
25	To identify unknown unorganized powder drug with the help of physical and chemical tests (Castor oil and Acacia)	**126**				

I) PRACTICAL RECORD MARKS*:

Sessional Exam	Experiment No.		Total no. of experiments conducted	Average marks obtained for the experiments conducted. (out of 10)	Teacher's Signature
	From	To			
First Sessional					
Second Sessional					
Third Sessional					

*Sessional wise marks should be considered for internal assessment of practical sessional examinations (out of 10M)

II) ASSIGNMENT MARKS#:

Sr. No.	Title of Assignment	Marks out of 05#	Assignment Marks (Average of three)	Teacher's Signature
1				
2				
3				

#Marks should be transferred from Appendix -1 A typical format for assessment of an assignment.

III) FIELD VISIT REPORT MARKS$:

Sr. No.	Title of Field Visit	Marks out of 05$	Field Visit Marks (Average of three)	Teacher's Signature
1				
2				
3				

$ Marks should be transferred from Appendix -2 A typical format for assessment of an assignment.

Average Sessional Mark out of 10	Assignments Mark out of 05 (Average of three)	Field Visit Mark out of 05 (Average for the reports)	Total Marks out 20	Teacher's Signature

Experiment No. 01
Study of the Microscope

1. Aim
To study the Microscope and its components.

2. Practical Significance
The experiment will provide particular information of various types of microscopes, its components and it's working along with applications. It is one of the best ways to view very small object in several hundred magnified times.

3. Practical Outcomes
After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Recall basic concepts and parts of Microscopes and their functions	CO1, 3	1
2	Describe handling and working of compound Microscope	CO1, 3	4
3	Observe microscopical characteristics of crude drugs	CO1, 3	5

4. Relevant Theoretical Background
Microscope is a device that magnifies minute objects and enables close examination of microscopic features at standardized criteria for observation and research.
Illumination: It is the light used to illuminate the slides or specimens from base of the Microscope.
Magnification: A microscope is used for viewing samples at high magnification (40 - 1000x), which is achieved by the combined effect of two sets of lenses, which are the objective and eyepieces

5. Requirements
Simple microscope, Compound microscope, Projection Microscope, Permanent slides etc

6. Theory
A. Simple Microscope
In Simple Microscope, single lens is used for the structural and morphological evaluation of crude drugs. Comparatively larger organs or it parts are usually observed or dissected with the help of this microscope.
The structure and uses of a Simple Microscope are stated below:

Structure:
It has a body, a stage made of thick glass for placing slides, two clips to fix the slides, a handle, an eyepiece placed with the handle and a mirror.
There is an adjustment knob by which the eye piece may be moved upward and downward.
The entire body stands on the base or foot.

Procedure

a. Fix the slide on the stage with the help of clips.
b. Adjust light that should be focused on the slide by moving the mirror.
c. Turn the adjustment knob to maximize visibility of the object on stage.
d. Examine the object closely.

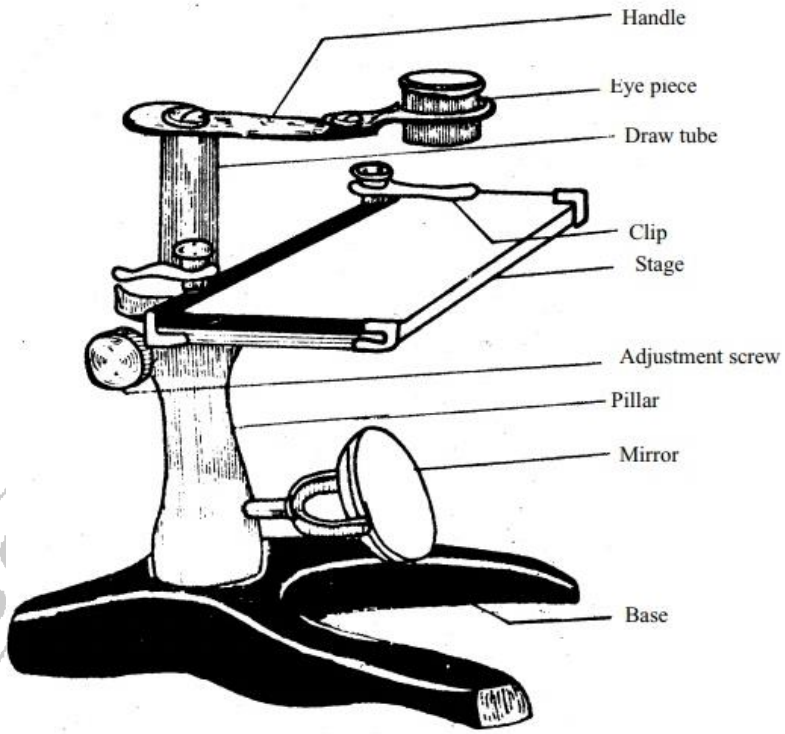


Fig.1.1: Simple Microscope

B. Compound Microscope.

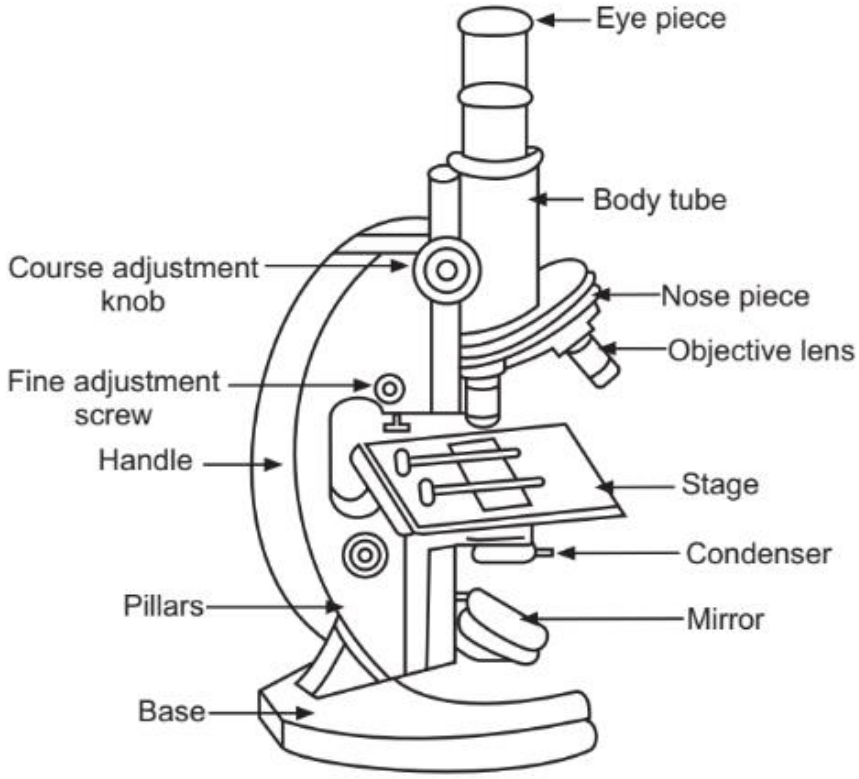


Fig.1.2: Compound Microscope

It is optical instrument consist of lens or combination of lenses that helps to produce a very enlarged and maximized view of microscopic organisms as well as other details like tissues and cells.

Parts of Compound Microscope

The Compound microscope is categorized mainly into two parts.

a. **Non-optical / Mechanical Parts**
b. **Optical Parts**

a. Non-optical / Mechanical Parts

a. **Base/Foot:** It is U-shaped or horseshoe-shaped, metallic framework that hold the entire microscope together.
b. **Pillar**: It acts as a connection between the base and the arm.
c. **Arm**: It is a metallic handle that connects the arm to the inclined joint, holds up the stage and the body tube.
d. **Stage**: It is a platform where specimen is placed for studying and examining purpose.
e. **Body Tube**: The body tube's primary function is to retain the objective and optical lenses at the two ends. The end with the optical lens is known as the head, while the end with the objective lens is known as the nose piece.
f. **Adjustment knob**: These are two pairs of adjusting screws that are used for either coarse or fine adjustment. An image may be obtained by careful adjustment.
   i. **Fine adjustment knob:** It is the smaller knob, which is used for sharp and fine focusing of the object.
   ii. **Coarse adjustment knob:** It is a large knob that is used for moving the body tube down and up for bringing the object to be examined under exact focus.
g. **Clips:** Clips help to hold the slide in position.
h. **Nose piece:** The nose piece is circular and a rotating metal part that is connected to the body tube's lower end. The nose piece has three holes wherein the objective lenses are embedded.
i. **Body tube:** The upper part of the arm of the microscope comprises a hollow and tubular structure known as the body tube. The body tube can be shifted down and up using the adjustment knobs.

B. Optical Parts

a. **Condenser**: It is found under the diaphragm. Light may be focused by changing the condenser, which can be moved up or down.
b. **Reflector/Mirror**: A reflector is a mirror mounted above the base. The mirror features a plain mirror on one side and a concave mirror on the other. The plane mirror side is utilized when the light is strong, while the concave mirror side is used when the light is faint. The light on the object is directed via the diaphragm and condenser with the aid of the reflector.
c. **Objective lenses**: These lenses are located above the nosepiece. The objective lens is a compound lens that creates a true inverted picture of the image within the body tube.
   - Oil immersion objective – 100X
   - High power objective – 45X
   - Low power objective – 10X
d. **Optical Lens**: The ocular lens is often referred to as the eyepiece. Through these lenses, the image of minute things may be seen.
e. **Diaphragm**

   The diaphragm is fastened below the stage. It controls and adjusts the intensity of light that passes into the microscope. The diaphragm can be of two types:
   - **Disc diaphragm**
   - **Iris diaphragm**

Facts and Figures about Microscope:
Magnifying Power

M.P=Magnification of Objective x Magnification of Eyepiece

Resolving Power of objectives
The resolving power of an objective lens is measured by its ability to differentiate two elements or points in an object situated a short distance apart. The greater the resolving power, the smaller the minimum distance between two lines or points that can still be distinguished. The larger the N.A (Numerical Aperture), the higher the resolving power.

Working Distance:
Working distance is the distance between an objective and object. Lesser the working distance, higher will be the power of objective.

Field of View:
Field of view (FOV) of the microscope is the maximum area of the object seen through the eyepiece.

C. Projection Microscope.

Fig 1.3: Projection Microscope

a. A projection microscope is a kind of optical microscope that is used to project the magnified image of a specimen onto a screen or a digital camera.
b. It consists of a light source, a condenser lens, an objective lens, and a projection lens.
c. The sample is placed on a glass slide, located on the stage of the microscope.
d. The light source, usually a halogen lamp, provides a bright and uniform illumination of the specimen.
e. The condenser lens collects and focuses the light onto the specimen to produce a sharp image.
f. The objective lens, which is mounted below the stage, magnifies the image of the specimen.
g. The magnified image is then projected onto a screen or a digital camera by the projection lens, which is located above the stage.
h. The projection lens also allows for adjustments of the magnification and the focus of the image.

7. Procedure of Compound Microscope:

a. Adjust the mirror in such way that adequate light passes into the microscope.
b. Clean the mirror, lenses, stage, and slide.
c. Place the slide in the middle of the stage.
d. Tightly secure the slide with clips at two edges of the slide to avoid movement of slide.
e. The nose piece is adjusted in such a way that the low power objective is aligned with the object of focus placed on the slide.
f. The coarse adjustment knob is used to adjust by shifting upwards or downwards such that the slide is well under focus.
g. Turn the fine adjustment knob by moving upwards or downwards to get a clear and sharp image of the object under focus.
h. All minute details of the object are observed under low power objective. Necessary diagrams are sketched.
i. The nose piece is now turned to bring the high-power objective aligning with the object. The fine adjustment knob is tuned as much as possible to get a bright and precise view of the object.
j. In high power, the details of the object are observed. Draw the necessary diagrams. The coarse adjustment knob should not be used when the object is being examined in high power as it can crush the slide.

8. Precautions while using Compound Microscope:

a. Leaning or shaking the microscope while it is in use must be avoided.
b. The light received by the lens is changed due to shaking or leaning, and the viewing of the focus item changes.
c. The sample must first be focused with a low-resolution lens before being targeted with a high-resolution lens.
d. Both arms and the base of the microscope should be used to lift the microscope.
e. When using an oil immersion lens, one should use the oil to get the best results as the refractive index can be altered without the use of oil, and the reading of the specimen can be manipulated.
f. Use a clean slide and wipe the slide so that any stains do not show up under the microscope. Otherwise, it can be difficult for the user to distinguish between a stain and a component of the specimen.
g. While focusing care must be taken that objective lens should never hit slide or stage
h. The lower power objective lens must be focused on the stage once you have finished using the compound microscope.
i. Use concave part of mirror under dim light.
j. Do not observe slide in direct sunlight.

9. Observation

(Subject teacher should provide permanent slide to students to focus under microscope and observe the components and mention it.)

(Space for Observations)

10. Conclusion

From observations it is concluded that component of given permanent slide is found to be - _____ and _____.

11. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.

12. Practical Related Questions

a. Define Microscope. Enlist its types.
b. Enlist Objective Lenses with their magnification power.
c. Give function of Diaphragm.
d. Which precaution should be taken while handling the Microscope?
e. State the meaning of a) Magnifying Power b) Resolving Power of Objective (R.P).

(*Space for Answers*)

13. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment no. 02
Section Cutting Techniques, Staining and Mounting of Sections

1. Aim
To understand the method of Section cutting technique, Staining, Mounting and Observation of section under microscope.

2. Practical Significance
Observation of section of a stem/root/stolon in T.S reveals the structure and morphology of a particular cell. Thinner the sections, more clearly the tissues can be observed. Microchemical reagents are used in pharmacognosy practical for diagnostic identification of crude drug, which stains the different components of T.S. of crude drug and thereby help in identifying various plant cells.

3. Practical Outcomes
After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2-3	3
2	Stain cells in the transverse section and observe under microscope	CO2-3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2-3	4

4. Relevant Theoretical Background
Transverse section

Transverse section is obtained by cutting along the radial plane of a cylindrical portion of the stem, root, stolen and perpendicular to long axis.

Staining

Staining is a process in which chemical dyes are used to impart to various tissues in a section of drug sample, which enables to distinguish the arrangement of various tissues in the sample.

Observation

For observation of section, selection of suitable place in the laboratory where sufficient light is available is important. Low power observation helps to draw a schematic diagram while high power observation is used for distinctive transverse section.

5. Requirements
Apparatus: Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps, test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor, etc.

Chemicals: Staining reagent, Glycerin and Water.

Crude Drug: Subject teacher shall give any single drug to the students amongst the root, stem, seed, leaf, bark, fruit, rhizome, etc, to understand the methods of section cutting, staining, mounting and its observation.

6. Procedure

A. Section of a Stem, Root, Stolon

Different sections can be obtained from a stem, root or stolon, depending on the plane of cutting, each section revealing details from a different angle.

B. Transverse Section:

Transverse section is obtained by cutting along the radial plane of a cylindrical portion of the stem/root/stolon and perpendicular to the long axis.

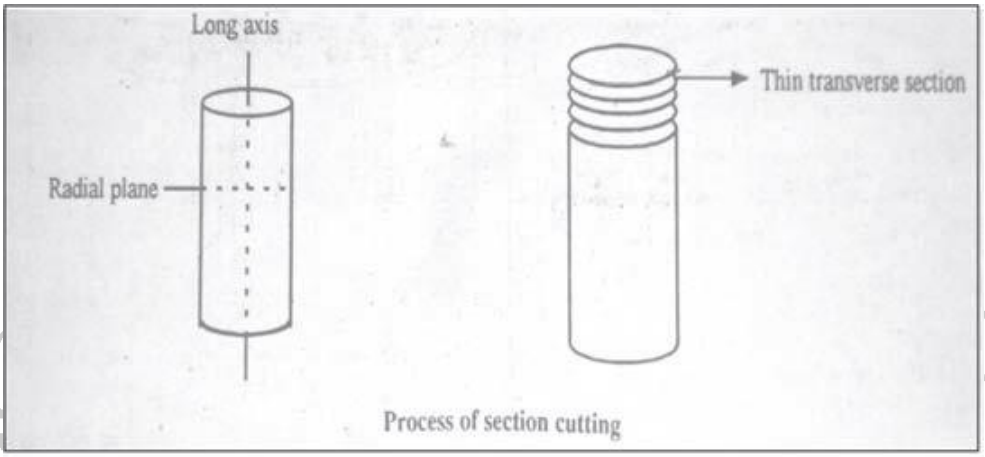


Fig 2.1: Process of Section Cutting

This section when prepared and observed under a microscope reveals the radial arrangement of tissues and shows concentric layers and vascular bundles.

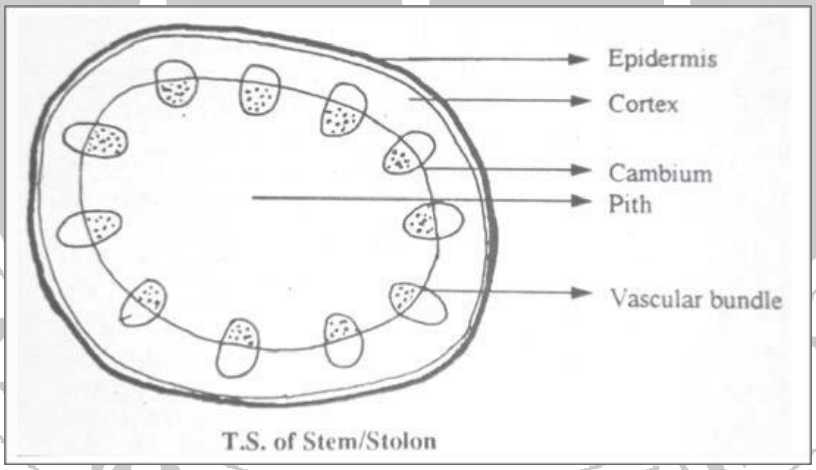


Fig 2.2: T.S. of Stem / Stolon

C. Section of a Leaf:

In case of leaf important aspect to study is a section through the midrib taken perpendicular to the midrib and observation of a surface preparation.

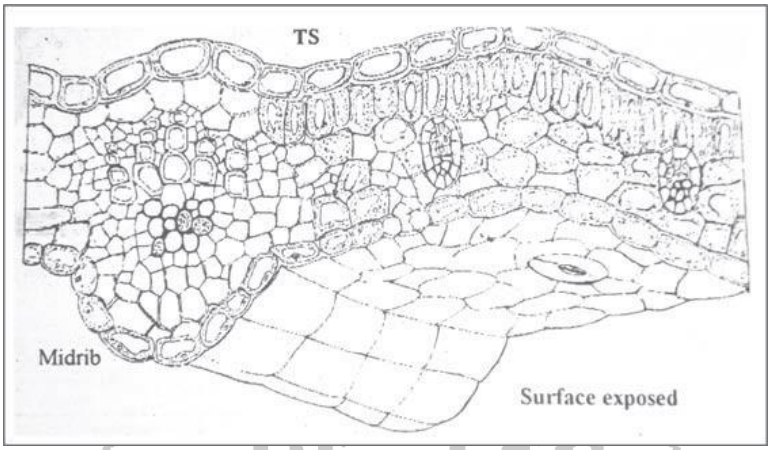


Fig 2.3: T.S. of Leaf

D. Section of a Bark:

In case of bark transverse section is important as it reveals the horizontal section of cells and shows lenticels.

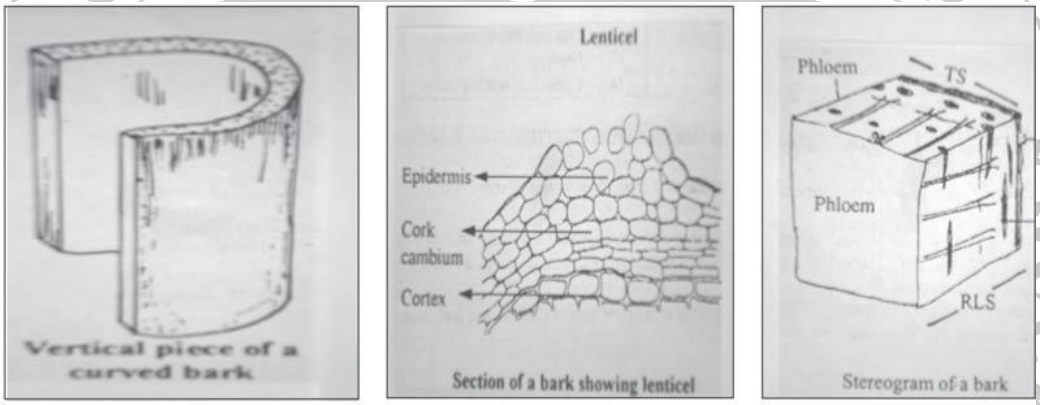


Fig 2.4: T.S. of Bark

E. Section of Fruit and Seed:

In case of fruits and seeds generally T.S. of various parts are observed under microscope. In case of fruit and seed drug separate section cutting technique is required for individual drug.

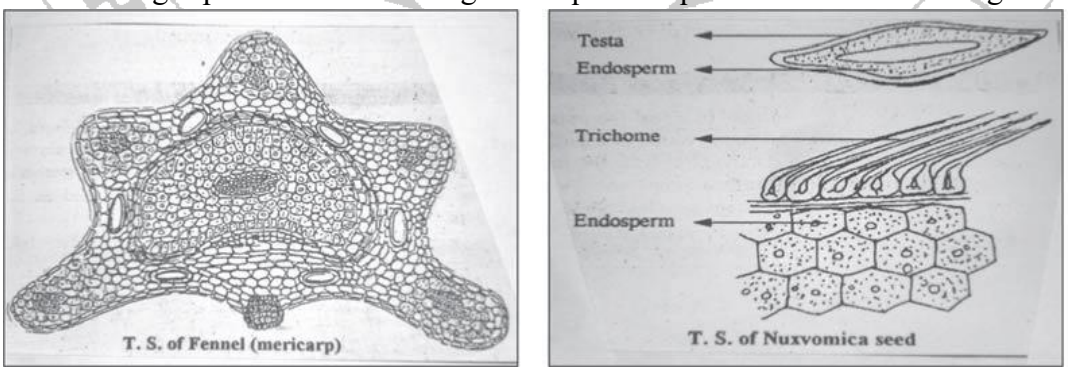


Fig 2.5: T.S. of Fruit and Seed

F. Section Cutting Technique:

Thinner the sections, more clearly the tissues can be observed. Various techniques of section cutting depends on the parts of plant used. For section cutting of leafpotato or unripe papaya is used.

Section cutting includes the following steps:

Preparation of Sample For Sectioning:

a. Boiling of the Sample

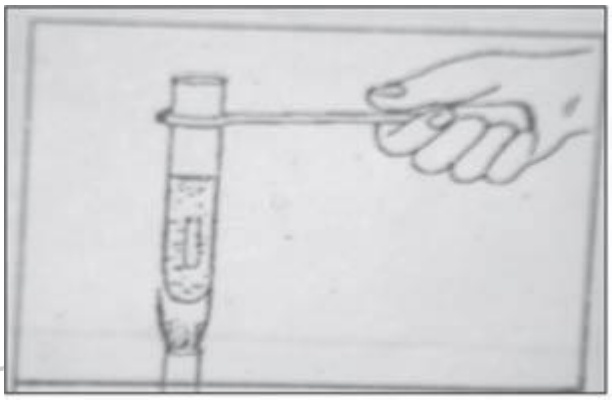


Fig 2.6

b. Section Cutting

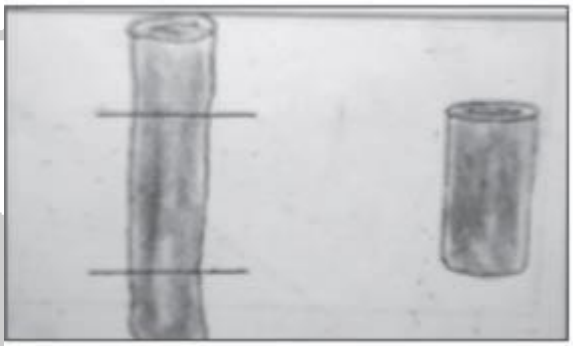


Fig 2.7

c. Transfer the sections to a watch glass containing water

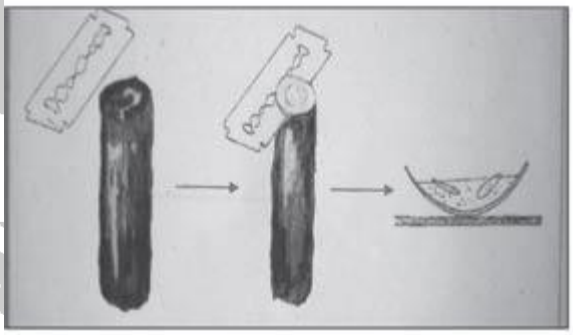


Fig 2.7

G. Staining:

Staining is a process in which chemical dyes are used to impart to various tissues in a section of drug sample, which enables to distinguish the arrangement of various tissues in the sample.

A Stain is a chemical dye (colorant) which combines chemically or physically with a cell content to impart color to it. e.g.,

- Safranin combines with the lignin present in cell wall and vessels and imparts a red color to the lignified tissues.
- Iodine solution combines with starch grains to give a blue color.

- Sudan Red III dissolves in the fixed oil present in the oil seeds to impart red color.

Staining Process:

a. Take a clean watch glass and add the staining solution to it.

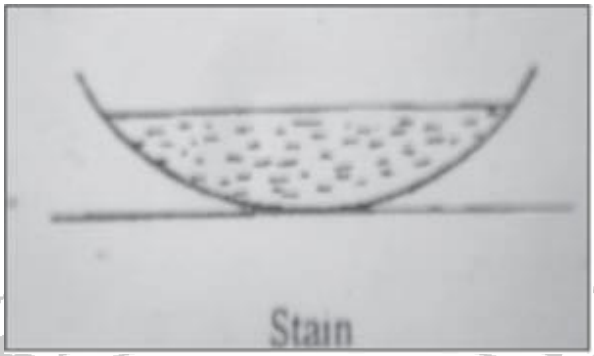


Fig 2.9

b. With the help of a brush, transfer the section taken from water to stain solution and keep for 2-3 minutes.

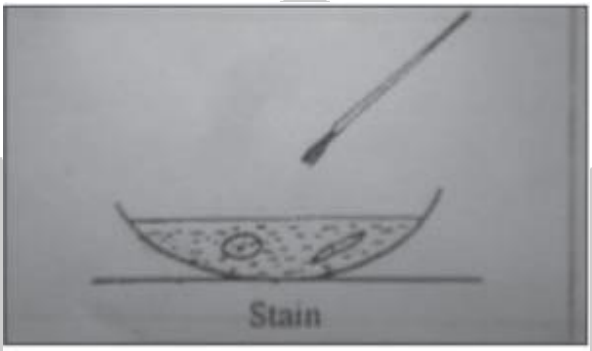


Fig 2.10

c. Pick up the section after 2-3 minutes and transfer it to watch glass containing plain water, so that excess stain is washed away. This section is ready for mounting on a side.

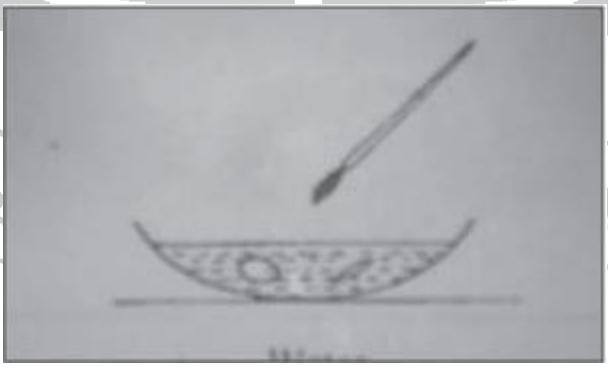


Fig 2.11

H. Mounting Process:

a. Take a clean glass micro slide.
b. On this slide transfer the section to be mounted, with the help of brush.
c. Add one or two drops of water on the section with a dropper. See that the section is submerged in the water.

d. Take a clean cover slip with the help of a forceps and needle. Place the cover slip on the section gently.
e. If any air bubbles are seen, slightly lift the cover slip and add a drop of water and replace the cover slip till the air bubble is removed.
f. With the help of a blotting paper, wipe off excess water present outside the cover slip. The slide is ready for observation.
g. To avoid evaporation of water and drying of section, glycerine water can be used instead of water.
h. Observe the sections under a microscope and note down the arrangement of tissues.

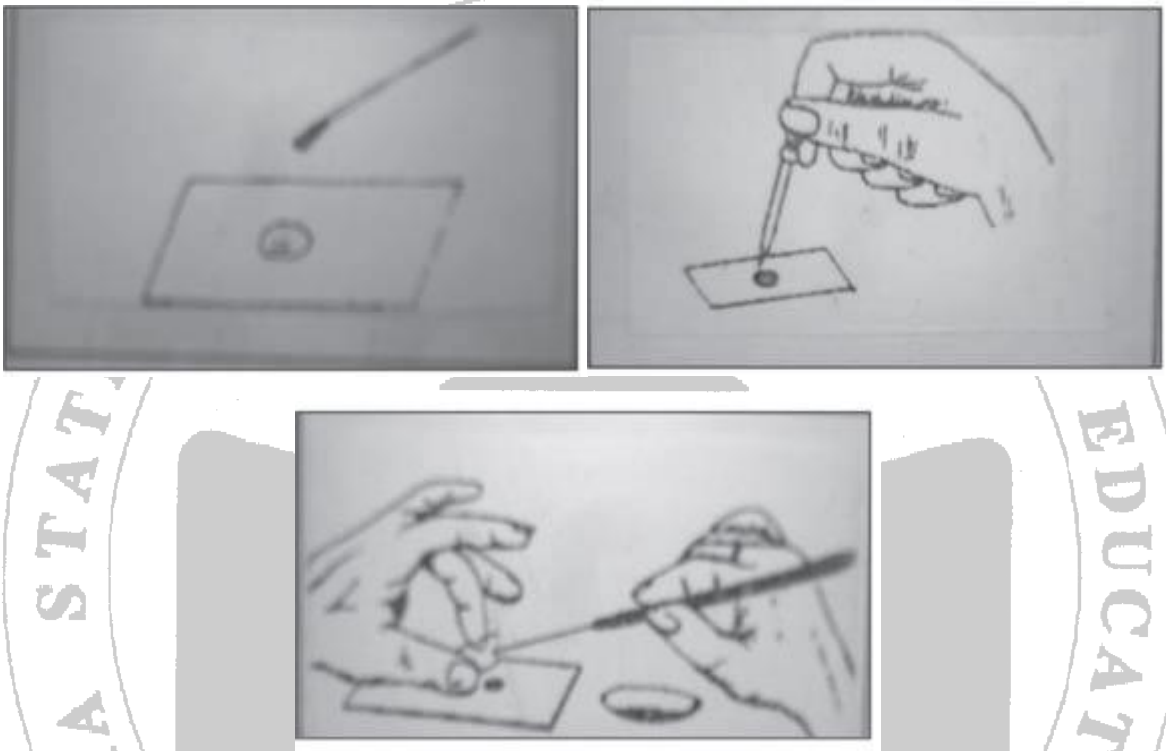


Fig 2.12

In order to prepare a permanent mount, a special process called as double staining technique is adopted.

7. Observations

Subject teacher on the basis of permanent slides shall give two to three exercises to the student.

(Space for Observations)

8. Conclusion

From the observation it is concluded that the given crude drug is found to be a _____(stem, root, leaf, bark, rhizome, fruit, seed, etc.) containing tissue components _____.

9. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar et al, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

10. Practical Related Questions

a. Explain the mounting process of a section.
b. List the necessary materials required for section cutting.
c. State the role of chemical dye during staining procedure.
d. Write procedure for a sample preparation for microscopic examination.
e. Mention special method, if any, for section cutting of leaf.

(*Space for Answers*)

11. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 03
Study of Microchemical Reagents

1. Aim

To study Microchemical reagents used in identification of plant cells.

2. Practical Significance

The microchemical reagents are required to identify crude drugs by staining various components of transverse section (T.S). Hence the study of microchemical reagents is important to decide the suitable reagent for staining the various cellular component of crude drugs and thereby helping in their identification.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Recall various micro-chemical reagents and their functions in staining of the plant cells.	CO1, 3	1
2	Identify specific cells or tissues when stained with micro-chemical reagent	CO1, 3	3
3	Collaborate and communicate with fellow students	CO1, 3	5

4. Relevant Theoretical Background

Microchemical Reagents

The reagents that are required in very small amounts (milligrams/milliliters) for staining of transverse section are called micro chemical reagents. Microchemical reagents are used in pharmacognosy practical for diagnostic identification of crude drug, which stains the different components of T.S. of crude drug.

5. Requirements

Apparatus: Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps, test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor, etc.

Chemicals: Microchemical reagents and water.

Crude Drug: Subject teacher shall give any single drug to the students amongst the root, stem, seed, leaf, bark, fruit, rhizome, etc, to understand the procedure of staining.

6. Procedure

A. Study of Microchemical Reagents:

Pharmacognosy includes study of drugs obtained from natural origin. These drugs can be studied with the help of their morphological or sensory characters and microscopical characters. For the study of microscopical characters they are treated with various micro-reagents such as:

a. **Cleansing Reagents**: These reagents are used to make the tissue clear in appearance. e.g. chloroform, acetic acid, distilled water, ethanol, ether-ethanol.

b. **Dehydrating Reagents**: These reagents are used to remove water from the section or tissue and to make the tissue clear in appearance. e.g. Absolute alcohol.

c. Bleaching Reagents: These reagents are used to bleach the section or tissue and to make the tissue clear in appearance. e.g. Hydrogen peroxide.

d. Mounting Reagents: These reagents are used to mount the section or tissue and to prevent the drying of sections. e.g. Glycerine or mixture of glycerin and water.

B. Specific Microchemical Reagents:

Individual Staining Solutions

Name of Reagent	Component	Observation
Phloroglucinol Solution + HCl	Lignin	Red or Pink Colour
Ruthenium Red Solution	Mucilage	Red or Pink Colour
Chlor-Zinc-Iodine Solution (Schulze's Solution)	Celluloses	Purple Colour
Sudan Red III	Fixed oils and Fats	Yellowish Brown Colour
Safranin	Lignin	Red or Pink Colour
Alcoholic Picric Acid	Proteins	Yellow Colour
Dilute Iodine	Starch	Deep to Pale Blue Colour
Conc. Sulphuric Acid	Saponins / Stone Cells	Green Colour
Ferric chloride	Tannins	Blue / Black Colour
Mercuric nitrate Solution B.P. (Millon's Reagent)	Proteins	Pink / Dark Red

C. Procedure

a. Take microchemical reagent in watch glass.
b. Take section of crude drug and transfer the section to a watch glass containing water.
c. Place the section to the watch glass containing microchemical reagent and keep it for specified period.
d. Mount the section on a slide and observe it under microscope.

7. Observations

Subject teacher on the basis of permanent slides shall give two to three exercises to the student.

(Space for Observations)

8. Conclusion

From the above microchemical tests _____(Name of the Microchemical Reagent) gives _____ colour indicating presence of _____ _____ components in the given crude drug.

9. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar et al, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

10. Practical Related Questions

a. Define Microchemical reagent. List out its different types.
b. Why dehydrating agent is used in microchemical test? Explain with the help of examples.
c. Which microchemical agent is used for the detection of tannin in cell?
d. Which cell component is detected by Ruthenium red?
e. Define cleansing and bleaching reagents with examples.

(*Space for Answers*)

11. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 04
Morphological Characters of Isapghula and Senna

1. Aim

To study Morphological characters of Isapghula and Senna (Laxatives).

2. Practical Significance

The experiment will provide identification of crude drugs by visualization of various morphological characters such as colour, odour, taste, size, shape and extra features.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Laxatives are the drugs or substances which causes evacuation or removal of faecal matter from the intestine. These are substances that loose stools and increase bowel movements. They are used to treat and prevent constipation.

Morphological characters of crude drugs are evaluated by colour, odour, taste, size, shape and extra features. Adulteration of crude drugs can be identified by morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary)

b. **Crude Drug:** Isapghula and Senna

6. Theory

A. Isapghula

a) **Synonyms:** Ispaghula, Ispagol, Ishabgula, Spongel seeds.

b) **Biological Source:** Isapghula consists of dried seeds of *Plantago ovata* Forskal, belonging to family Plantaginaceae. Its seeds contain about 10% mucilage. The husk consisting of epidermis is separated from the seeds which has its own importance.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Pinkish grey to brown
- **Odour:** None
- **Taste:** Mucilaginous
- **Size:** 10-35 mm long, 1-1.8 mm wide
- **Shape:** Ovate, boat shaped, cymbiform
- **Extra feature:** Seeds are hard, translucent and smooth, the dorsal (convex surface) consist of a small elongated glossy reddish-brown spot at the center while the ventricle (concave surface) has a cavity nil uncovered with a thin whitish membrane.

d) **Chemical Constituent:**
- It consists 10% mucilage.
- Mucilage consists of two complex polysaccharides, i.e pentosan and aldobionic acid.
- On hydrolysis yields xylose, arabinose, aldobionic acid yields galacturonic acid and rhamnose.
- Protein and fixed oil are also present

e) **Uses:**
- It is used as an excellent demulcent and bulk laxative in chronic constipation.
- It is also useful in dysentery, chronic diarrhoea, in cases of duodenal ulcers and piles.
- It works effectively as a soothing agent. Ispaghula husk is also used for similar purpose.
- It is also used as a stabilizer in ice cream industry.

f) **Diagram:**

Fig. 4.1a: Isapghula Seeds

Fig. 4.1b: Isapghula Husk

B. Senna

a) **Synonyms:** Alexandrian senna, Tinnevelly senna, Folia senna,Sonamukhi.

b) **Biological Source:**

Senna leaf consists of the dried leaflets of *Cassia acutifolia,* Delile (C. senna L.) known as Alexandrian senna and of *C. angustifolia,* Vahl., known as Tinnevelly senna, belonging to family Leguminosae.It contains Sennosides A and B (2.5%).

c) **Macroscopy or Morphological or Organoleptic Characters:**

Character	**Indian Senna**	**Alexandrian senna**
Appearance	Generally entire and less broken in good condition	Broken and brittle in nature
Size	25-50 mm long and 7–9 mm wide	20-40 mm long and 6–12 mm wide.
Shape	Lanceolate -ovate	Lanceolate
Apex	Less acute with a sharp spine	Acute with a sharp spine
Margin	Entire flat	Entire curled
Base	Less asymmetrical	Conspicuously asymmetrical
Veins	Pinnate, distinct towards the under surface and joint towards the margin.	Pinnate, distinct towards the under surface and joint towards the margin.

Character	Indian Senna	Alexandrian senna
Surface	Transverse and oblique impressions, less pubescent (hairy)	Without transverse and oblique impressions and more pubescent
Texture	Flexible and less brittle	Thin more brittle
Odour	Faint	Faint
Colour	Light green	Light greyish green
Test	Bitter mucilaginous	Bitter mucilaginous
Vein Islet Number	19–22.5	25–29.5
Stomatal index	14–20	10–15
Palisade ratio	4–12	4.5–17

d) **Chemical Constituents:**

- Anthraquinone Glycosides: Majorly Sennoside A, Sennoside B, and Sennoside C Sennoside D in minor amount.
- Aloe-emodin, Rhein, Kaempferol are present.
- Also contains free Chrysophanol, Emodin, dianthrones.
- Mucilage is present in the epidermis of the leaf.

e) **Uses:**

- It is used as laxative.
- It causes irritation of large intestine and have some griping effects so are prescribed along with carminatives.
- It is irritant purgative due to the presence of anthraquinone glycosides and exerts its action by increasing the tone of the smooth muscles in large intestine.

f) **Diagram:**

Fig 4.2: Senna

7. Procedure

a. Issue the Isapghula seeds and Senna leaf sample.
b. Place it in two different glass plates.
c. Observe the morphological characters of Isapghula seed.
d. Observe the morphological characters of Senna leaf.
e. Note down the morphological characters of Isapghula seed and Senna leaf in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Isapghula	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	
Senna	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of morphological study, the given unknown crude drugs are confirmed to be - _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar et al, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

a. Mention synonyms of Isapghula and Senna.
b. Write the chemical constituents of Isapghula.
c. Write the biological source of Isapghula.

d. Mention the chemical constituents present in Senna.
e. Write the biological source of Senna.
f. Differentiate between Alexandrian and Indian senna as per morphological characteristics.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 05
Morphological Characters of Coriander and Fennel

1. Aim
To study Morphological characters of Coriander and Fennel (Carminatives).

2. Practical Significance
The experiment will provide for the identification of crude drugs by visualization of various morphological characters such as colour, odour, taste, size and shape of the crude drug. This visualization of morphological characters is essential for the proper identification of crude drugs.

3. Practical Outcomes
After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background
Carminatives are the drugs that expel gases from the gastrointestinal tract by increasing peristalsis. The mode of action of carminative drugs is largely a result of the volatile oil they contain. These drugs act by increase in the gastric emptying or mildly irritate the gastric mucosa, increasing the peristalsis, thereby relieving cramps and expel gas. Thus they relieve pain from the stomach and intestine.

Morphological characters of crude drugs are evaluated by colour, odour , taste ,size , shape and special features like touch, texture etc. Adulteration of crude drugs can be identified with the help of morphological studies.

5. Requirements
a. **Apparatus:** Watch glass, microscope (if necessary)

b. **Crude Drug:** Coriander and Fennel.

6. Theory
A. Coriander

a) **Synonyms:** Fructus coriandri, Coriander fruits, Dhane, Dhaniya.

b) **Biological Source:**
Coriander consists of dried ripe fruits of *Coriandrum sativum* Linn., belonging to family Umbelliferae and should contain not less than 0.3 percent of volatile oil.

c) **Macroscopy or Morphological or Organoleptic Characters:**
- **Colour:** Yellowish- brown
- **Odour:** Aromatic
- **Taste:** Spicy and characteristic
- **Size:** 3 to 4 mm in diameter
- **Shape:** Subspherical, Subglobular

d) **Chemical Constituents:**
- It contains 0.3 to 1 % volatile oil.
- The chief constituent of volatile oil is Coriandrol (90%) or D-linalool.
- It also contains small quantities of L-borneol, geraniol, pinene.
- Protein and fixed oil are also present.
- Coriander leaves contain vitamin A.

e) **Uses:**
- It is used as an aromatic, carminative, stimulant and flavouring agent.
- It is used as an ingredient of compound spirit of orange and cascara elixir.

f) **Diagram:**

Fig. 5.1 Coriander Fruits

B. Fennel

a) **Synonyms:** Fructus foeniculum, Fennel fruits, Badishep, Saunf.

b) **Biological Source:**
Fennel consists of dried ripe fruits of cultivated species of *Foeniculum vulgare* Miller., belonging to family Umbelliferae and should contain not less than 1.4 percent of volatile oil.

c) **Macroscopy or Morphological or Organoleptic Characters:**
- Colour: Greenish to Yellowish brown
- Odour: Sweet, aromatic and characteristic
- Taste: Sweet, mucilaginous, agreeable, aromatic and characteristic
- Size: 5 to 10 mm long, 2 to 4 mm broad. The fruit is an entire cremocarp with pedicels
- Shape: Oval-oblong
- Extra Features: Fennel exhibits cremocarp. It consists of two equal portions called as Mericarps connected by a central stalk called as Carpophore.

d) **Chemical Constituents:**
- It contains 3 to 7 % volatile oil.
- The chief constituents of volatile oil are Fenchone (20%) that gives pungent odour and Anethole (50%) which is responsible for its sweet taste.
- It also contains small quantities of phenandrene, limonene, and anisic aldehyde.
- Protein and fixed oil are also present.

e) **Uses:**
- It is used as an aromatic, carminative, stimulant and flavouring agent.

- It is a respiratory stimulant and used as an expectorant.

f) **Diagram:**

Fig. 5.2 Fennel Fruits

7. Procedure

a. Issue the Coriander fruit and Fennel fruit sample.
b. Place it in two different glass plates.
c. Observe the morphological characters of Coriander fruit.
d. Observe the morphological characters of Fennel fruit.
e. Note down the morphological characters of Coriander fruit and Fennel fruit in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Coriander	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	
Fennel	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of morphological study, the given unknown crude drugs are confirmed to be - _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

a. Which principle gives carminative action to Coriander?
b. Which vitamin is present in Coriander leaf?
c. Write the biological source of Coriander.
d. Write two therapeutic uses of Coriander.
e. What is mode of action of carminative drugs?
f. Write two active principles of fennel along with their action.
g. What is the role of Carpophore?
h. Write the biological source of Fennel.
i. Describe organoleptic characters of Fennel.
j. Write two therapeutic uses of Fennel.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 06
Morphological Characters of Cardamom and Ginger

1. Aim

To study Morphological characters of Cardamom and Ginger (Carminatives).

2. Practical Significance

The experiment will provide for the identification of crude drugs by visualization of various morphological characters such as colour, odour, taste, size and shape of the crude drug. This visualization of morphological characters is essential for the proper identification of crude drugs.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Carminatives are the drugs that expel gases from the gastrointestinal tract by increasing peristalsis. The mode of action of carminative drugs is largely a result of the volatile oil they contain. These drugs act by increase in the gastric emptying or mildly irritate the gastric mucosa, increasing the peristalsis, thereby relieving cramps and expel gas. Thus they relieve pain from the stomach and intestine.

Morphological characters of crude drugs are evaluated by colour, odour , taste ,size , shape and special features like touch, texture etc. Adulteration of crude drugs can be identified with the help of morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary)

b. **Crude Drug:** Cardamom and Ginger.

6. Theory

A. Cardamom

a) **Synonyms:** Cardamom fruits, cardamom seed, elaichi.

b) **Biological Source:**
Cardamom consists of dried ripe fruits of *Elettaria cardamomum* belonging to family Zingiberaceae. The seeds should contain not less than 4 percent of volatile oil.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Greenish to pale buff or yellow and whitish inside
- **Odour:** Aromatic, agreeable and pleasant
- **Taste:** Sweet and strongly aromatic
- **Size:** Cardamom capsules are about 2 cm in length

- **Shape:** Ovoid or oblong, three sided, sharply beaked at the top, with smooth or longitudinal striated surface
- **Extra Features:** Each capsule contain three chambers which have two rows of seeds about 5 to 10 in numbers. The seeds are hard to touch, reddish brown in colour, and are irregularly triangular in shape, covered with transverse wrinkles known as Rugae.

d) **Chemical Constituents:**

- It contains 3 to 6 % volatile oil.
- The chief constituent of volatile oil is Cineole (Eucalyptol).
- It also contains other aromatic compounds like borneol, terpinene etc.
- Proteins, starch and fixed oil are also present.

e) **Uses:**

- It is used as an aromatic, carminative, stimulant and flavouring agent.
- It is used in the form of compound tincture for sore throat, piles and skin diseases.

f) **Diagram:**

Fig. Cardamom Fruits

B. Ginger

a) **Synonyms:** Rhizoma zingiberis, Zingiber, Ale, Adrak, Sonth.

b) **Biological Source:**

Ginger consists of rhizome of *Zingiber officinale* Roscoe., belonging to family Zingiberaceae, scrapped to remove the dark outer skin and dried in the sun.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- Colour: Externally buff coloured
- Odour: Agreeable and aromatic
- Taste: Agreeable, pungent and characteristic
- Fracture: Short and fibrous
- Extra Features: Scaly leaves, sympodial branching, horizontal rhizome. Transversely cut surface shows well marked endodermis and stele, Nodes and internodes are present.

d) **Chemical Constituents:**

- It contains 1 to 2 % volatile oil, acrid resinous matter and starch.
- Ginger oil contains zingiberene as chief constituent, pungent principle gingerol, shogaol, citral, borneol, terpenes and mucilage.

e) **Uses:**
- It is used as an aromatic, carminative, stomachic, stimulant and flavouring agent.
- Ginger oil is used in mouthwashes, ginger beverages and liquors.

f) **Diagram:**

Fig. Ginger Rhizome

7. Procedure

a. Issue the Cardamom fruit and Ginger rhizome samples.
b. Place it in two different glass plates.
c. Observe the morphological characters of Cardamom fruit.
d. Observe the morphological characters of Ginger rhizome.
e. Note down the morphological characters of Cardamom fruit and Ginger rhizome in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Cardamom	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	
Ginger	Colour	
	Odour	
	Taste	

Drugs	Morphological characters	Observations
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of morphological study, the given unknown crude drugs are confirmed to be - _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

a. Which principle gives pungent taste to Ginger?
b. Mention volatile oil present in Ginger.
c. Write the biological source of Ginger.
d. Write two therapeutic uses of Ginger.
e. Define Stomachic with examples.
f. What are the major active constituents of volatile oil in Cardamom?
g. Write the biological source of Cardamom.
h. Enumerate the uses of Cardamom.
i. Write the chemical constituents of Cardamom.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 07
Morphological Characters of Nutmeg and Black Pepper

1. Aim

To study the morphological characters of Nutmeg and Black pepper (Carminatives).

2. Practical Significance

The purpose of experiment to identify crude drugs by observation of various morphological characters such as colour, odour, taste, size and shape of the crude drug. This observation of morphological characters is essential for the proper identification of crude drugs.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Carminatives are the drugs that expel gases from the gastrointestinal tract by increasing peristalsis. The mode of action of carminative drugs is largely a result of the volatile oil they contain. These drugs act by increase in the gastric emptying or mildly irritate the gastric mucosa, increasing the peristalsis, thereby relieving cramps and expel gas. Thus they relieve pain from the stomach and intestine.

Morphological characters of crude drugs are evaluated by colour, odour, taste, size, shape and special features like touch, texture etc. Adulteration of crude drugs can be identified with the help of morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary).

b. **Crude Drug:** Nutmeg and Black pepper.

6. Theory

A. Nutmeg

a) **Synonyms:** Myristica, Nux moschata, Semen myristicae, Jaiphal, Jayepatri.

b) **Biological Source:**

Nutmeg consists of dried ripe seeds of *Myristica fragrans* belonging to family Myristicaceae and should contain not less than 5 percent of volatile oil. The seeds are free from arillus and seed coat.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Externally the kernels are greenish brown or brown
- **Odour:** Strongly aromatic
- **Taste:** Pungent and aromatic

- **Size:** Kernels are about 20 to 30 mm in length and 20 mm broad
- **Shape:** Ellipsoidal
- **Extra Features:** Outer surface is rough, dark brown with reticulate furrows. At one end there is a small projection. Micropyle and hilums are present in the projection. The hilum is surrounded by raised ring.
- **Mace:** The arillus of the seeds of nutmeg are known as mace, which arises in the region of hilum before the flowers open and fertilization takes place. The mace is an orange-coloured modification of the nutmeg seeds. Mace is used as condiment and flavouring agent, especially for biscuits, pickle, meat and fish preparations.

d) **Chemical Constituents:**

- Nutmeg contains fixed oil which is solid at room temperature known as Nutmeg butter.
- It contains 5 to 15 percent of volatile oil. The chief constituents of volatile oil are myristicin, elemicin and saffrole. Myristicin and elemicin are reported to be responsible for the narcotic or hallucinogenic activity of nutmeg.
- Starch and proteins are also present.
- Fixed oil contains myristic, oleic, palmitic and lauric acids.
- It also contains fats. The fat of nutmeg is called nutmeg butter.

e) **Uses:**

- It is used as an aromatic, carminative, stimulant and flavouring agent.
- Nutmeg butter known as Banda soap is used in soap industries.
- The fat and volatile oil of nutmeg is used in the treatment of rheumatism.

f) **Diagram:**

Fig. 7.1 Nutmeg Seeds

B. Black Pepper

a) **Synonyms:** Kali miri, Kali mirch, Golmirch

b) **Biological Source:**

Black pepper consists of dried, fully developed unripe fruits of *Piper nigrum* belonging to family Piperaceae.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Blackish brown or greyish black
- **Odour:** Aromatic and pungent
- **Taste:** Strongly aromatic
- **Size:** 4 to 5 mm in diameter with characteristic coat with reticulated wrinkles

- **Shape:** Globular
- **Extra Features:** The pericarp is thin and encloses single seed with hollow centre.

d) **Chemical Constituents:**

- It contains alkaloid piperine, piperidine, piperitine, chavicine.
- It also contains volatile oil. The constituents of volatile oil are piperonal, phellandrene, caryophyllene.
- Starch is predominantly present in black pepper.

e) **Uses:**

- It is employed as an aromatic, stimulant, stomachic.
- It is used as a stomachic and used in dyspepsia and flatulence.
- It is used as an anti periodic in malarial fever.
- It is used as condiment in spice due to its pungent taste.

f) **Diagram:**

Fig. 7.2 Black pepper Fruits

7. Procedure

a. Issue the Nutmeg seed and Black pepper fruit sample.
b. Place it in two different glass plates.
c. Observe the morphological characters of Nutmeg seed.
d. Observe the morphological characters of Black pepper fruit.
e. Note down the morphological characters of Nutmeg seed and Black pepper fruit in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Nutmeg	Colour	
	Odour	
	Taste	
	Size	
	Shape	

Drugs	Morphological characters	Observations
	Extra features	
Black pepper	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of Morphological study, the given unknown crude drugs are confirmed to be _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

a. Write biological source and chemical constituents of Black pepper.
b. Which constituent is responsible for pungent taste in Black pepper?
c. Write the biological source of Nutmeg.
d. Write the therapeutic uses of Black pepper.
e. Mention the alkaloids present in Black pepper.
f. What are the uses of Nutmeg?
g. What is Banda soap?
h. In which condition fat and volatile oil of Nutmeg are used?
i. Write the synonyms of Black pepper.
j. Mention the synonyms of Nutmeg.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 08
Morphological Characters of Cinnamon and Clove

1. Aim

To study the morphological characters of Cinnamon and Clove (Carminatives).

2. Practical Significance

The experiment will provide for the identification of crude drugs by observation of various morphological characters such as colour, odour, taste, size and shape of the crude drug. This observation of morphological characters is essential to identify the crude drugs.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Carminatives are the drugs that expel gases from the gastrointestinal tract by increasing peristalsis. The mode of action of carminative drugs is largely a result of the volatile oil they contain. These drugs act by increase in the gastric emptying or mildly irritate the gastric mucosa, increasing the peristalsis, thereby relieving cramps and expel gas. Thus they relieve pain from the stomach and intestine.

Morphological characters of crude drugs are evaluated by colour, odour, taste, size, shape and special features like touch, texture etc. Adulteration of crude drugs can be identified with the help of morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary)

b. **Crude Drug:** Cinnamon and Clove

6. Theory

A. Cinnamon

a) **Synonyms:** Cinnamon bark, Kalmi dalchini

b) **Biological Source:**
Cinnamon consists of the dried inner bark of the shoots of coppiced trees of *Cinnamomum zeylanicum* Nees., belonging to family Lauraceae and should contain not less than 1.0 percent of volatile oil.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Outer surface dull yellowish brown, inner surface darker in colour
- **Odour:** Fragrant
- **Taste:** Warm, sweet and aromatic
- **Size:** 1 m length, 0.5 mm thickness and 6 to 10 mm in diameter

- **Shape:** Single or double closely packed compound quills
- **Fracture:** Splintery
- **Extra Features:** Bark is free of cork. The outer surface has longitudinal lines of pericyclic fibres and scars and holes representing the position of leaves or the lateral shoots.

d) **Chemical Constituents:**

- It contains 0.5 to 1 % volatile oil.
- The chief constituent of volatile oil is Cinnamic aldehyde, eugenol, benzaldehyde, cumin aldehyde.
- It also contains terpenes like phellandrene, pinene, cymene, caryophyllene.
- Tannins, mucilage, calcium oxalate, starch and sweet substance mannitol are also present.

e) **Uses:**

- It is used as an aromatic, carminative, stimulant, flavoring agent and mild astringent.
- It is used as spice and condiment in cooking, home remedies, preparation of candies, dentifrices and perfumes.

f) **Diagram:**

Fig. 8.1 Cinnamon Bark

B. Clove

a) **Synonyms:** Clove flower, Clove bud, Laung, Lavang, Caryophyllum.

b) **Biological Source:**

Clove consists of dried flower buds of *Eugenia caryophyllus* Sprange., belonging to family Myrtaceae and should contain not less than 15 percent of volatile oil.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Dark brown or crimson red
- **Odour:** Aromatic
- **Taste:** Pungent followed by numbness
- **Size:** 10 to 13 mm long, 4 mm wide and 2 mm thick
- **Shape:** Sub-cylindrical and tapering at the end
- **Extra Features:** The hypanthium has schizolysigenous oil glands and a bilocular ovary.The crown region consists of the calyx, corolla, style and stamens. Calyx has four thick sepals, Corolla is dome shaped and has four pale yellow coloured petals ovules.

d) **Chemical Constituents:**

- It contains 15 to 20 % volatile oil.

- The chief constituents of volatile oil is eugenol. The other constituents are eugenol acetate, caryophyllenes, methyl amyl ketone, small quantities of ester and alcohol.

e) **Uses:**

- It is used as an aromatic, carminative, stimulant and flavouring agent, dental analgesic and antiseptic.
- Oil is used in perfumery and in manufacturing of vanillin.

f) **Diagram:**

Fig. 8.2 Clove Buds

7. Procedure

a. Issue the Cinnamon bark and Clove bud samples.
b. Place it in two different glass plates.
c. Observe the morphological characters of Cinnamon bark.
d. Observe the morphological characters of Clove bud.
e. Note down the morphological characters of Cinnamon bark and Clove bud in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Cinnamon	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	
Clove	Colour	
	Odour	
	Taste	

Drugs	Morphological characters	Observations
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of Morphological study, the given unknown crude drugs are confirmed to be _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

a. Write biological source of Cinnamon bark.
b. Mention the synonyms of Cinnamon bark.
c. Which volatile oil constituents are present in Cinnamon bark?
d. Write the morphology of Cinnamon bark.
e. What are the therapeutic uses of Cinnamon bark?
f. Mention the synonyms of Clove.
g. Which part of Clove is used as crude drug?
h. Write the biological source of Clove.
i. Describe organoleptic characters of Clove.
j. Write two therapeutic uses of Clove.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 09
Morphological Characters of Ephedra and Rauwolfia

1. Aim

To study Morphological characters of Ephedra (CNS acting) and Rauwolfia (Antihypertensive).

2. Practical Significance

Plant morphology is useful in the primary identification of plants and very useful to identify the adulterants. The experiment will provide identification of crude drugs by visualization of various morphological characters such as odour, taste, colour, size, shape and extra features.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Antihypertensives are the medicaments used in the treatment of hypertension.eg, Rauwolfia.

Morphological characters of crude drugs are evaluated by colour, odour, taste, size, shape and special features like touch, texture etc. Adulteration of crude drugs can be identified with the help of morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary)

b. **Crude Drug:** Ephedra and Rauwolfia

6. Theory

A. Ephedra

a) **Synonyms:** Ma Huang

b) **Biological Source** Ephedra consists of the dried aerial parts of *Ephedra gerardiana* Wall, *Ephedra nebrodensis* Tineo and other Ephedra species, belonging to family Ephedreaceae.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Grey or greenish
- **Odour:** Aromatic
- **Taste:** bitter, astringent
- **Size:** Stem length is 30-35cm long with appr.5 cm width
- **Shape:** Ovoid or oblong and rounded at the base
- **Extra features:** Nodes, internodes, scaly leaves and terminal buds are present in the stems.

d) **Chemical Constituents:**

- It mainly contains Alkaloids: Ephedrine, Pseudoephedrine, Norephedrine.

- Other constituents present are tannins, saponin, flavones and volatile oils.

e) **Uses:**

- Antiallergic, Antiasthmatic, Antispasmodic, Decongestant, Cough suppressant, Stimulant and Vasoconstrictor.
- Pseudoephedrine is decongestant and cough suppressant.
- Nor pseudoephedrine is peripheral vasodilator used to treat angina.
- Diuretic, CNS stimulant, raises blood pressure, alleviates aches and rheumatism, alleviates hay fever/colds.
- It is used in hay fever, asthma and whooping cough.

f) **Diagram**:

Fig. 9.1 Ephedra

B. Rauwolfia

a) **Synonyms: Sarpagandha, Chandrika, Chootachand, Indian snake root.**

b) **Biological Source:**

It consists of dried roots of *Rauwolfia serpentina* Benth., belonging to family Apocynaceae. It consists of 0.7–2.4% total alkaloid.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour:** Greyish-yellow, light-brown or brown
- **Odour:** Slight
- **Taste:** pungent and agreeable
- **Size:** 2–10 cm long, 1-3 cm in diameter
- **Shape:** Cylindrical or slightly tapering, tortuous pieces
- **Extra features:** Roots are rough, slightly wrinkled, short fractures

d) **Chemical Constituents:**

- Alkaloids: The main alkaloid is Reserpine and other alkaloids include Rescinnamine, Rescidine, Raubescine and Deserpidine, Ajmalinine, Ajmaline, Ajmalicine, Serpentine, Serpentinine, Tetrahydroreserpine, Raubasine, Reserpinine, Isoajamaline and Yohambinine.
- Phytosterols, fatty acids, unsaturated alcohols and sugars.

e) **Uses:**

- It is hypnotic, sedative and antihypertensive.
- It is given in labours to increase uterine contractions and in certain neuropsychiatric disorders as tranquilizer.
- Ajmaline is used for the treatment of cardiac arrhythmias.

f) **Diagram:**

Fig. 9.2 Rauwolfia Root

7. Procedure

a. Issue the Ephedra stem and Rauwolfia root samples.
b. Place it in two different glass plates.
c. Observe the morphological characters of Ephedra stem.
d. Observe the morphological characters of Rauwolfia root.
e. Note down the morphological characters of Ephedra stem and Rauwolfia root in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Ephedra	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	
Rauwolfia	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of Morphological study, the given unknown crude drugs are confirmed to be _____and_____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.

11. Practical Related Questions

a. Mention Synonyms of Ephedra and Rauwolfia.
b. Write the chemical constituents of Ephedra and Rauwolfia.
c. Write biological source of Ephedra.
d. Define Antihypertensives with examples.
e. Write biological source of Rauwolfia.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No.10
Morphological Characters of Gokhru and Punarnava

1. Aim

To study Morphological characters of Gokhru and Punarnava (Diuretics).

2. Practical Significance

Plant morphology is useful in the primary identification of plants and very useful to identify the adulterants. The experiment will provide identification of crude drugs by visualization of various morphological characters such as odour, taste, colour, size, shape and extra features.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Diuretics are the drugs or medicaments that increase flow and secretion of urine.eg: - Gokhru, Punarnava.

Morphological characters of crude drugs are evaluated by colour, odour, taste, size, shape and extra features. Adulteration of crude drugs can be identified by morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary)

b. **Crude Drug:** Gokhru and Punarnava

6. Theory

A. Gokhru

a) **Synonyms:** Puncture vine, Caltrops fruit, Bada and Chota Gokhru.

b) **Biological Source:**
Gokhru is the dried ripe fruits of *Tribulus terrestris* Linn. belonging to family Zygophyllaceae.

c) **Macroscopy or Morphological or Organoleptic Characters:**

- **Colour**: Yellowish
- **Odour**: Odourless
- **Taste**: Bitter
- **Size**: Diameter 1.2 cm
- **Shape**: Globose
- **Extra features**: It is five woody, densely hairy, spiny cocci, Large pointed spines at each coccus.

d) **Chemical Constituents:**

- Alkaloids: Harman and Harmine.

- Saponins on hydrolysis yield steroidal sapogenins like diosgenin, gitogenin, chlorogenin and ruscogenin.
- Flavonoids, Quercetin, Kaempferol and Isorhamnetin.
- Phytosterols like β-sitosterol, stigmasterol and cinnamic amide derivative, terestiamide.

e) **Uses:**

- It is used in Kidney stone and nephritis.
- Antiinflammatory, Antiarthritic, Diuretic, Tonic, Aphrodisiac properties.
- It is used in building immune system, in painful micturition, calculus affections and impotency.
- It is ingredient of Ayurvedic preparation like Chavanprash.

f) **Diagram:**

Fig. 10.1 Gokhru fruit

B. Punarnava

a) **Synonyms:** Hog Weed, Rakta Punarnava

b) **Biological Source:**
It consists of dried, matured whole plant of *Boerhaavia diffusa* Linn, Family Nyctaginaceae

c) **Macroscopy or Morphological or Organoleptic Characters:**
Stem:

- **Colour:** Greenish purple
- **Extra Features**: stiff, slender, cylindrical, swollen at nodes, prostrate divaricately branched, often more than a metre long
- **Root:**
- **Colour**: Yellowish brown to brown coloured.
- **Odour:** Odourless
- **Taste**: Slightly bitter
- **Size and Shape**: Well developed fairly long, tortuous, cylindrical, 0.2-1.5 cm in diameter
- **Extra Features**: Surface soft to touch but rough due to minute longitudinal striations and root scars, fracture, short.

Leaves: Opposite, unequal pairs, larger is 25-37 mm long and smaller is 12-17 mm long, ovate-oblong or suborbicular, apex rounded or slightly pointed, whitish below, margin entire, dorsal side pinkish, thick in texture, petioles nearly as long as the blade, slender.

Flowers: Very small, pink coloured, nearly sessile or shortly stalked, 10-25 cm, in small umbels, arranged on slender long stalks.

Fruit: One seeded nut, 6 mm long clavate, rounded, broadly and bluntly 5 ribbed, glandular.

d) **Chemical Constituents:**
- Alkaloid: Punarnavine
- 0.03–0.05% - A phenolic glycoside punarnavoside.
- β-ecdysone-an insect moulding hormone.
- Urosolic acid and potassium nitrate.

e) **Uses:**
- It is a potent Antifibrinolytic and Antiinflammatory.
- Diuretic, Expectorant, Stomachic
- In treatment of Jaundice, relieving abdominal pains, nephritic syndrome.

f) **Diagram:**

Fig. 10.2 Punarnava

7. Procedure

a. Issue the Gokhru seeds and Punarnava samples.
b. Place it in two different glass plates.
c. Observe the morphological characters of Gokhru.
d. Observe the morphological characters of Punarnava.
e. Note the morphological characters of Gokhru and Punarnava in the observation table.

8. Observation

Drugs	Morphological characters	Observations
Gokhru	Colour	
	Odour	
	Taste	

Drugs	Morphological characters	Observations
	Size	
	Shape	
	Extra features	
Punarnava	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of Morphological study, the given unknown crude drugs are confirmed to be - _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.
h. A Detailed Review of The Plant *Boerhaavia Diffusa* Linn [Punarnava] on Its Phytopharmacology And Therapeutic Uses, *WJPMR*, 2023,9(9), 78-86.

11. Practical Related Questions

a. Mention the synonyms of Gokhru and Punarnava.
b. Write chemical constituents present in Gokhru and Punarnava.
c. Write biological source of Gokhru and Punarnava.
d. Define Diuretics with examples.
e. Which drug has synonym Puncture vine?

(Space for Answers)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No.11
Morphological Characters of Cinchona and Agar

1. Aim

To study Morphological characters of Cinchona (Antimalarial) and Agar (Pharmaceutical Aid).

2. Practical Significance

Plant morphology is useful in the primary identification of plants and very useful to identify the adulterants. The experiment will provide identification of crude drugs by visualization of various morphological characters such as odour, taste, colour, size, shape and extra features.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to identify crude drugs with help of morphological characteristics	CO1	3
2	Identify the part of plant	CO1	4
3	Identify some special features, if any	CO1	3
4	Handle crude drugs for observation	CO1	4

4. Relevant Theoretical Background

Antimalarial drugs are drugs used in treatment of malarial infection due to Plasmodium species. eg: Cinchona bark.

Pharmaceutical aids are drugs having no or less therapeutic value but necessary for formulation. Morphological characters of crude drugs are evaluated by colour, odour, taste, size, shape and extra features. Adulteration of crude drugs can be identified by morphological studies.

5. Requirements

a. **Apparatus:** Watch glass, microscope (if necessary).

b. **Crude Drug:** Cinchona and Agar.

6. Theory

A. Cinchona

a) **Synonyms:** Cortex Cinchonae, Peruvian or Jesuit's bark, Cinchona bark.

b) **Biological Source:**

Cinchona is the dried bark of the stem or the root of *Cinchona calisaya* Wedd., *Cinchona ledgeriana* Moens., *Cinchona officinalis* Linn., and *Cinchona succirubra* Pavon, belonging to family Rubiaceae. It contains not less than 6% of total alkaloids.

c) **Macroscopy or Morphological or Organoleptic characters:**

- **Colour**: The outer surface is yellowish to brown, with short fractures and the inner surface varies Cinchona calisaya and Cinchona ledgeriana is yellowish, Cinchona officinalis is slightly brown and Cinchona succirubra is reddish brown
- **Odour**: Distinctive, characteristic
- **Taste**: Highly bitter and astringent
- **Shape**: Curved, quill or double quill
- **Size**: 30 cm long and 2–7 mm thick

- **Extra features**: The outer surface consist of longitudinal and transverse cracks, fissures, ridges.

d) **Chemical Constituents:**
- Alkaloids are Quinine, Quinidine, Cinchonine and Cinchonidine.
- It also consists of bitter glycoside, starch grains, calcium oxalate crystals and crystalline acid like Quinic acid
- Glycosides like Quinovin, Cinchotannic and Quinic acids.

e) **Uses:**
- It is used as Antimalarial.
- It is also used as analgesic, antipyretic, protoplasmic, bitter stomachic and tonic.
- Quinidine is cardiac depressant and Cinchonidine is used in rheumatism and neuralgia.

f) **Diagram:**

Fig.11.1 Cinchona Bark

B. Agar

a) **Synonyms:** Agar-agar, Japanese Isinglass.

b) **Biological Source:**
It is the dried gelatinous substance obtained by extraction with water from *Gelidium amansii* or various species of red algae like *Gracilaria and Pterocladia*, belonging to family Gelidaceae.

c) **Macroscopy or Organoleptic or Morphological characters:**
- **Colour**: Yellowish white to grey or colourless
- **Odour**: Slight/odourless
- **Taste**: Mucilaginous
- **Shape**: Strips, flakes or coarse powder
- **Size**: Strips are about 60 cm in length and 4 mm wide. Wide sheets are 50–60 cm longand 10–15 cm wide.

d) **Chemical Constituents:**
- Two different polysaccharides known as agarose and agaropectin
- Agarose is responsible for gel property of agar.
- Agaropectin is responsible for the viscosity of agar solution.

e) **Uses:**

- It is used to treat chronic constipation, as a laxative, thickening agent, suspending agent, an emulsifier, a gelating agent for suppositories, as surgical lubricant, as a tablet excipient, disintegrant, in production of medicinal encapsulation and ointment and as dental impression mould base
- It is used as a gel in nutrient media for bacterial cultures.
- It is used as thickening agent in food especially confectionaries and dairy products, in meat canning, sizing for silk and paper, in dyeing and printing of fabrics and textiles and in adhesives.

f) **Diagram:**

Fig.11.2 Agar

7. Procedure

a. Issue Cinchona and Agar samples.
b. Place it in two different glass plates.
c. Observe the morphological characters of Cinchona.
d. Observe the morphological characters of Agar.
e. Note down the morphological characters of Cinchona bark and Agar in the observation table.

8. Observations

Drugs	Morphological characters	Observations
Cinchona	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

Agar	Colour	
	Odour	
	Taste	
	Size	
	Shape	
	Extra features	

9. Conclusion

On the basis of Morphological study, the given unknown crude drugs are confirmed to be _____ _____ and _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.

11. Practical Related Questions

a. Mention synonyms of Cinchona and Agar.
b. Give chemical constituents present in Cinchona and Agar.
c. Give biological source of Cinchona and Agar.
d. Define Antimalarial agents with examples.
e. Write the uses of Agar.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 12
Morphological and Microscopical Characters of Coriander Fruit

1. Aim

To study the Morphological and Microscopical characters of Coriander fruit.

2. Practical Significance

The experiment will provide for the identification and evaluation of crude drug by the study of microscopical characters. This visualization of microscopic characters is essential for confirming the identity of crude drugs.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus:** Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps,test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor.

b. **Microchemical Reagents:** Phloroglucinol, Conc. HCl, Alcoholic picric acid, Sudan red III, Glycerin, water.

c. **Crude Drug: Coriander**

6. Theory

Coriander

a) **Synonyms:** Fructus coriandri, Coriander fruits, Dhania.

b) **Biological Source:**

Coriander consists of dried ripe fruits of *Coriandrum sativum* Linn., belonging to family Umbelliferae and should contain not less than 0.3 percent of volatile oil.

c) **Morphology:**

- **Colour:** Yellowish-brown
- **Odour:** Aromatic
- **Taste:** Spicy and characteristic
- **Size:** 3 to 4 mm in diameter
- **Shape:** Sub-globular

d) **Microscopy:** The transverse section of coriander shows the presence of a dorsal surface and a commissural surface.

i. **Dorsal Surface:** The dorsal surface consists of two vittae and a carpophore. The dorsal surface has five less pronounced primary ridges and four pronounced secondary ridges.

Each mericarp is broadly divided into pericarp, testa and kidney shaped endosperm.

- **Pericarp**: Pericarp consists of three layers such as Epicarp, Mesocarp and Endocarp.
- **Epicarp**: The epicarp consists of a single row of small thick-walled cells with calcium oxalate crystals covered by smooth cuticle.
- **Mesocarp**: The mesocarp is divided into three layers.
  - **Outer Layer:** Loosely arranged tangentially elongated parenchyma cells and the middle layer consisting of sclerenchyma.
  - **Middle Layer:** It is again divided into; the outer region of sclerenchyma is represented by longitudinally running fibres, whereas the inner region has tangentionally running fibres. The vascular bundles are present below the primary ridges.
  - **Inner Layer:** It has polygonal, irregularly arranged parenchyma cells.
- **Endocarp:** The endocarp has the typical parquetry arrangement of cells.
- **Testa:** It consists of single-layered, yellowish brown coloured non-lignified parenchymatous cells.
- **Endosperm:** It consists of thick walled, polygonal, colourless parenchyma with fixed oil and aleurone grains. Small eye shaped embryo is seen at the ventral side of the endosperm containing raphae at the centre.

ii. **Commissural Surface:**
The commissural surface is flat with two vittae (secretory canal that secretes volatile oil) and carpophore in the middle region.

e) **Diagram:**

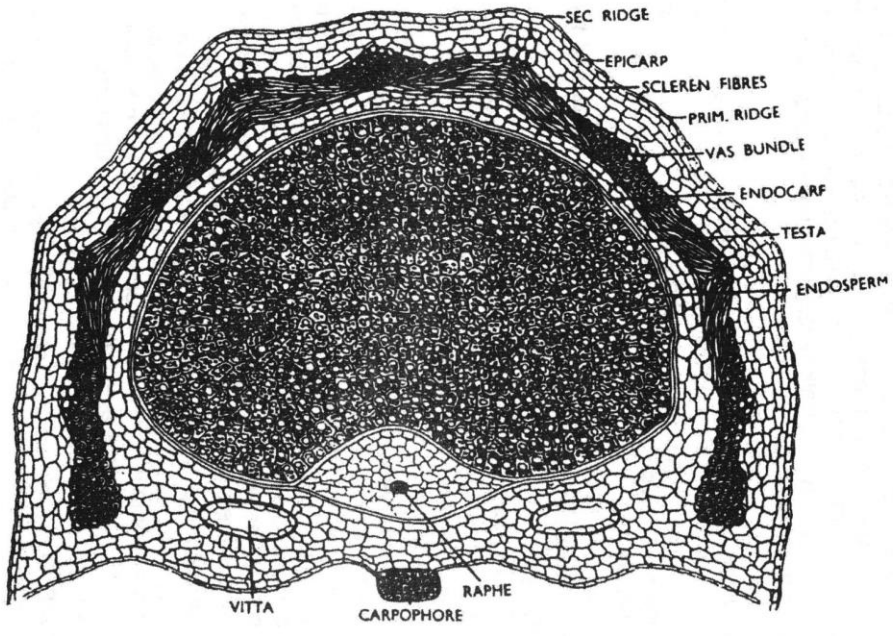


Fig 12.1: T.S. of Coriander Fruit.

f) **Chemical Constituents:**
Coriander consist of about 1% of volatile oil the chief volatile components are D-linalool (coriandrol), along with other constituents like, borneol, p-cymene, camphor, geraniol, limonene, and alpha-pinenes. The fruits also contain fatty oil and hydroxycoumarins.

g) **Uses:**
Aromatic, carminative, stimulant, antispasmodic, diaphoretic and flavouring agent. It is also used as refrigerant, tonic, appetizer, diuretic, aphrodisiac, and stomachic. Coriander can be applied externally for rheumatism and painful joints.

7. Procedure

a. Issue the sample of Coriander fruit and boil it for 30 to 60 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl or Sudan red III or alcoholic picric acid and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerine on the section with the help of a dropper.
g. Place a clean coverslip over the section by using forcep and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condensor, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of coriander as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Coriander + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified sclerenchyma, vascular bundles.
2	T.S. of Coriander + Alcoholic picric acid	Yellow colour.	Aleurone grains present in the cells of endosperm
3	T.S. of Coriander + Sudan red III	Red colour.	Oil globules, cuticle.

Observation Table for Staining:

Sr. No	Test	Observation	Inference
1	T.S. of Coriander + Phloroglucinol - HCl (1:1).		
2	T.S. of Coriander + Alcoholic picric acid		
3	T.S. of Coriander + Sudan red III		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.

b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.

11. Practical Related Questions

a. Describe the endocarp which is observed in the T.S. of coriander.
b. What is pericarp? Enlist the classes of pericarp.
c. Enlist the layers of mericarp.
d. Mention the surfaces exhibited in the T.S. of Coriander.
e. How many ridges are there on the dorsal surface?
f. What are Vittae?

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 13
Morphological and Microscopical Characters of Ajowan Fruit

1. Aim

To study the Morphological and Microscopical characters of Ajowan fruit.

2. Practical Significance

The experiment will provide microscopical information of Ajowan. Study of microscopical characters is necessary for confirmation of identity of Ajowan fruit.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus**: Compound microscope, projection microscope, watch glass, slides, cover slips, beakers, dropper, filter paper, forceps, sharp razors, etc.

b. **Microchemical Reagents:** Phloroglucinol, Conc. HCl, Alcol.Picric acid, Sudan red, Glycerin, Alcohol.

c. **Crude Drug**: Ajowan fruit

6. Theory

Ajowan fruit

a) **Synonym:** Bishop's weed, Trachyspermum copticum, Ova.

b) **Biological Source:**
Ajowan is the dried ripe fruits of *Trachyspermum ammi* (L.) Sprague, belonging to family Umbelliferae (Apiaceae). It contains volatile oil (2–3.5%).

c) **Morphology:**
- **Colour:** Yellowish-brown colour
- **Odour:** Aromatic and agreeable
- **Taste:** Aromatic and warm
- **Size:** 2 mm long and 1 mm wide
- **Shape:** It contains two mericarps, ovoid and compressed

d) **Microscopy:**

- Transverse section of fruit shows two hexagonal structures attached with each other by a carpophore.
- Epicarps consists of a single layer of tangentially elongated tubular cells.

- Mesocarp consists of moderately thick-walled, rectangular to polygonal tangentially elongated cells having some vittae, carpophores and vascular bundles present as groups of thick-walled radically elongated cells, barrel shaped of tangentially elongated cells. Reticulate and lignified parenchyma are seen at vascular strands
- Endosperm consists of thin-walled cells filled with embryo, oil globules, small and circular, composed of polygonal thin-walled cells. It consists of narrow elongated cells having a parquetry arrangement.
- Tracheid's show helical thickening. Polyhedral, thick-walled endosperm contains aleurone grains and oil globules.
- Vittae are six in number, four on the dorsal surface at the mesocarpic region below the secondary ridges and two on the commissural surface of the mericarp. Vittae long, slender composed of thin-walled polygonal cells and is lined by an epithelium of small polygonal tubular cells; 10-15 separate, septum transverse or curved.

e) **Diagram:**

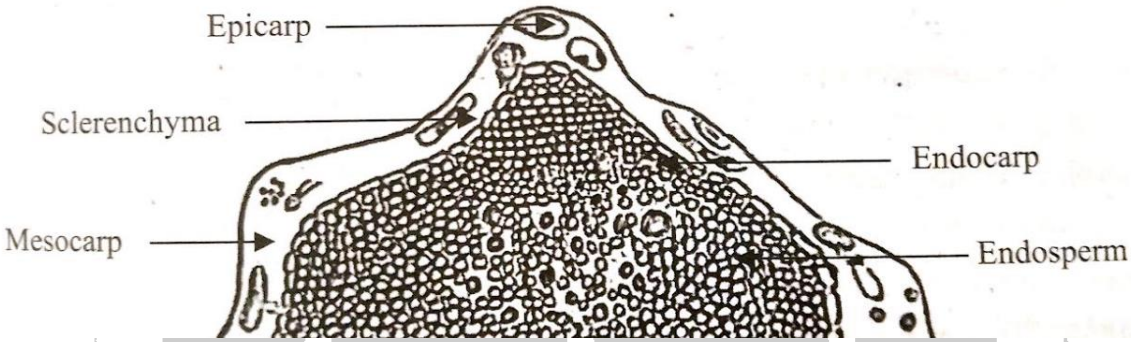


Figure 13.1: T. S of Ajowan Fruit

f) **Chemical Constituents:**

- Volatile oil**:** Thymol (35–60%), carvacrol, p-cymene, γ-terpinene, α- pinene,β-pinene and dipentene.

g) **Uses:**

- It is used as antispasmodic, stimulant, tonic and carminative.
- It is given in flatulence, atonic dyspepsia, diarrhoea, and cholera.
- Also effective in sore throat and in bronchitis, and often constitutes as an ingredient of cough mixture.
- It is widely used as a spice and in beverages.
- Ajowan oil is used as an antiseptic, aromatic, carminative, for perfuming disinfectant soaps, and as an insecticide. The oil is useful as an expectorant in emphysema, bronchial pneumonia and some other respiratory ailments.

7. Procedure

a. Issue the sample of Ajowan and boil it for 30 to 60 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl or Sudan red III or alcoholic picric acid and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.

f. Add 1-2 drops of water/ glycerin on the section with the help of a dropper.
g. Place a clean cover slip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Ajowan as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Ajowan + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified sclerenchyma, vascular bundles.
2	T.S. of Ajowan + Alcoholic picric acid	Yellow colour.	Aleurone grains present in the cells of endosperm
3	T.S. of Ajowan + Sudan red III	Red colour.	Oil globules, cuticle.

Observation Table for Staining:

Sr. No	Test	Observation	Inference
1	T.S. of Ajowan+ Phloroglucinol - HCl (1:1).		
2	T.S. of Ajowan + Alcoholic picric acid		
3	T.S. of Ajowan + Sudan red III		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be _____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.
h. https://www.pharmacy180.com

11. Practical Related Questions

a. What are characteristics of Umbelliferae fruits?
b. Describe the morphology of Ajowan.
c. What is role of Carpophore?
d. Which reagents are used for staining?
e. Write synonyms and biological source of Ajowan.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 14
Morphological and Microscopical Characters of Cinchona Bark

1. Aim

To study the Morphological and Microscopical characters of Cinchona bark.

2. Practical Significance

Antimalarial drugs are the drugs used in the prophylaxis or the treatment of malaria which occurs due to infections by protozoa of plasmodium species. The experiment will provide microscopical information of Cinchona bark. Study of microscopical characters is necessary for confirmation of identity of Cinchona bark.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus:** Compound microscope, Projection Microscope, watch glass, slides, cover slips, beakers, dropper, filter paper, sharp razors.

b. **Microchemical Reagents**: Phloroglucinol, conc. HCl, Iodine Solution, Glycerine, Alcohol.

c. **Crude Drug:** Cinchona bark

6. Theory

Cinchona bark

a) **Synonyms:** Cortex Cinchonae, Peruvian or Jesuit's bark, Cinchona bark.

b) **Biological Source:**
Cinchona is the dried bark of the stem or of the root of *Cinchona calisaya* Wedd., *Cinchona ledgeriana* Moens., *Cinchona officinalis* Linn., and *Cinchona succirubra* Pavon, belonging to family Rubiaceae.It contains not less than 6% of total alkaloids**.**

c) **Morphology:**

- **Colour:** The outer surface is yellowish to brown, with short fractures and the inner surface varies *Cinchona calisaya* and *Cinchona ledgeriana* is yellowish, *Cinchona officinalis* is slightly brown and *Cinchona succirubra* is reddish brown.
- **Odour:** Characteristic
- **Taste:** Highly bitter and astringent.
- **Shape:** Curved, quill or double quill
- **Size:** 30 cm long and 2–7 mm thick
- **Extra features:** The outer surface consist of longitudinal and transverse cracks, fissures, ridges

d) **Microscopy:**
Transverse section of Cinchona bark shows well developed periderm, a wide cortex and a large secondary phloem.

i. Periderm

- **Cork:** Cork is composed of uniform radially arranged rows of thin-walled cells, with dark brown contents such as suberin.
- **Phellogen:** It consists of 2 to 3 layers of thin-walled rectangular parenchymatous cells without any cell contents.
- **Phelloderm:** It consist of 6 to 7 layers of thin-walled rectangular shaped parenchymatous cells with yellow colour matter and are arranged radically like cork cells.

ii. **Cortex**

- It consists of yellow colour several layers of thin walled tangentially elongated parenchymatous cells. Micro-sphenoidal crystals of calcium oxalate and starch grains are present in some cortical cell. It is present below cork composed of tangentially elongated parenchymatous cells. Idioblasts containing microcrystals of calcium oxalate (2-6 μ long), and secretion cells are scattered.

iii. **Secondary Phloem:** Secondary phloem consists of phloem parenchyma, lignified phloem fibres and medullary rays.

- **Phloem parenchyma:** It consists of thin walled, non-lignified, smaller and larger cells.
- **Phloem fibres:** It is thick walled, strongly lignified, oval or rounded shaped with small lumen at the centre and stratifications on the surface and occur singly or in the form of a single row or in a group of 2 or 3. Phloem fibres are useful for evaluation or identification of different species of Cinchona due to its size and shape.
- **Phloem:** It consists of compressed and collapsed sieve tubes, phloem parenchyma similar to cortex, and irregularly arranged, large spindle-shaped lignified fibres.
- **Medullary rays:** These are narrow, two to three cells wide and almost straight brick-shaped cells.

e) **Diagram:**

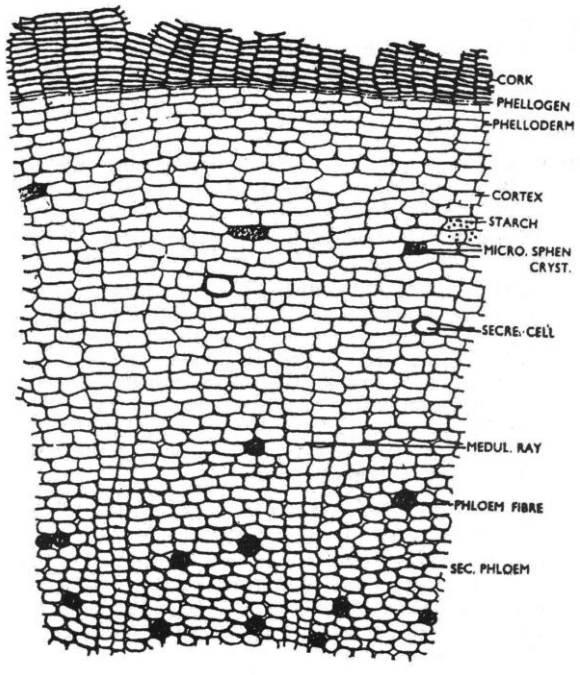


Fig. 14.1: T.S of Cinchona Bark

f) **Chemical Constituents:**
- Alkaloids: Quinine, Quinidine, Cinchonine and Cinchonidine.
- It also contains bitter glycoside, starch grains, calcium oxalate crystals and crystalline acid like Quinic acid.
- Glycosides: Quinovin, Cinchofullum, Cinchotannic and Quinic acids.

g) **Uses:**
- It is used as Antimalarial.
- It is also used as an analgesic, antipyretic, bitter stomachic and tonic.
- Quinidine is cardiac depressant while Cinchonidine is used in rheumatism and neuralgia.

7. Procedure

a. Issue the sample of Cinchona bark and boil it for 30 to 60 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol- HCl or Iodine and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerine on the section with the help of a dropper.
g. Place a clean cover slip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Cinchona bark as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Cinchona Bark + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified pericyclic fibres,stone cells.
2	T.S. of Cinchona Bark + Iodine sol.	Blue Colour	Starch present
3	T.S. of Cinchona Bark + dil.HCl	Soluble	Calcium Oxalate crystals
4.	T.S. of Cinchona Bark + dil.Acetic acid	Insoluble	Calcium Oxalate crystals

Observation Table for Staining

Sr. No	Test	Observation	Inference
1	T.S. of Cinchona Bark + Phloroglucinol - HCl (1:1).		
2	T.S. of Cinchona Bark + Iodine sol.		
3	T.S. of Cinchona Bark + dil. HCl		
4	T.S. of Cinchona Bark + dil.Acetic acid		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be _____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.

c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.

11. Practical Related Questions

a. Draw a neat well labelled diagram of T. S. of Cinchona bark.
b. Write the biological source Cinchona Bark.
c. Name the alkaloids and glycosides present in Cinchona.
d. Mention four species of Cinchona Bark.
e. Which staining test is used to detect starch?

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 15
Morphological and Microscopical Characters of Cinnamon bark

1. Aim

To study the Morphological and Microscopical characters of Cinnamon bark.

2. Practical Significance

The experiment will provide microscopical information of Cinnamon bark. Study of microscopical characters is necessary for confirmation of identity of Cinnamon bark.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus**: Compound microscope, Projection Microscope, watch glass, slides, cover slips, beakers, dropper, filter paper, sharp razors etc.

b. **Microchemical Reagents:** Phloroglucinol, Conc.HCl, Iodine Solution, dil.HCl, dil.acetic acid, Glycerin, Alcohol.

c. **Crude Drug:** Cinnamon bark

6. Theory

Cinnamon bark

a) **Synonyms: Ceylon cinnamon, Cinnamomum bark , Kalmi dalchini.**

b) **Biological Source:** Cinnamon consists of dried inner bark of the shoots of coppiced trees of *Cinnamomum zeylanicum* Nees., belonging to family Lauraceae. It contains not less than 1.0% v/w of volatile oil.

c) **Morphology:**

- **Colour:** Outer surface is dull yellowish brown, inner surface is darker
- **Odour:** Fragrant
- **Taste:** Warm, sweet and aromatic
- **Shape:** Single or double compound quills
- **Size:**1 m length, 0.5 mm thickness, and 6 to 10 mm diameter
- **Extra features**: Bark is free of cork

d) **Microscopy:**

Transverse section of the Cinnamon bark shows the following characters:

i. **Cork and cortex:** These are absent.

ii. **Pericycle (Stone cell layer):** It produces the light colored wavy, longitudinal lines on the outside of the bark.
- **Pericyclic fibres:** There are small groups of about 6 to 15 pericyclic fibres (lignified) occurring at intervals. These are present on the outer margin.
- **Sieve tubes:** These are completely collapsed and are arranged tangentially.
- **Sclereides:** There are 3 to 4 layers of isodiametric,pitted sclereides, thickened lignified walls, slightly elongated tangentially (U-shaped thickening), with starch grains.

iii. **Secondary phloem**
- **Parenchyma:** These are sub-rectangular shaped consisting of starch grains and calcium oxalate crystals.
- **Medullary rays:** There are biseriate medullary rays with needle-shaped calcium oxalate crystals longitudinally elongated idioblast consisting of volatile oil. These are narrow at inner side, wider in the sclereides band side, contains starch, acicular raphides.
- **Phloem fibres:** These are single, isolated, circular, lignified with stratification, being above 12 to 22 to 35 µ wide and 200 to 500 to 600 µ long. These are arranged as tangential rows of four to five cells. Mucilage cells: They can be identified after staining with Ruthenium red (shows pink /red colour).
- **Oil cells:** These are big and isolated.

e) **Diagram:**

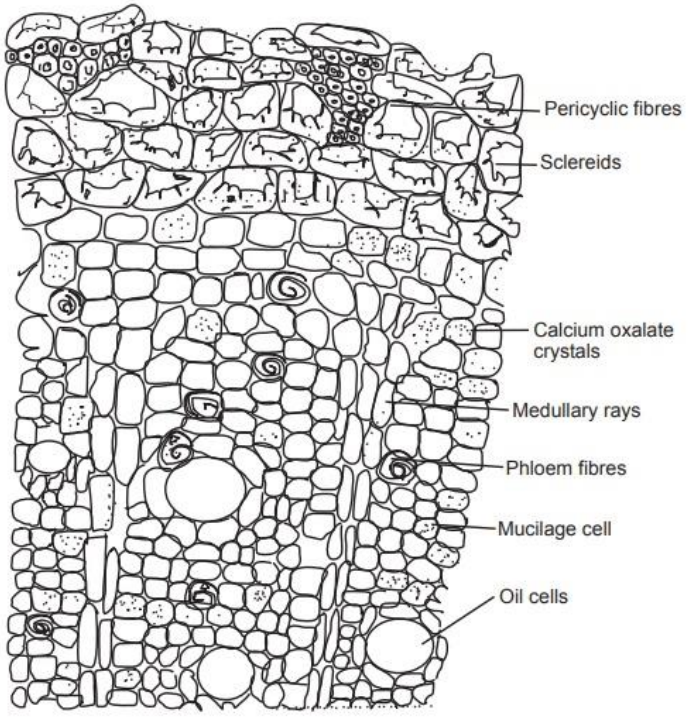


Figure 15.1: T.S of Cinnamon Bark.

f) **Chemical Constituents:**
- Volatile oil: 0.5 to 1 % of Cinnamon oil is present. Cinnamon oil contains 60 - 70 % Cinnamic aldehyde, 5 to 10 % eugenol, terpene hydrocarbons, ketones, alcohols.
- Tannin, mucilage, calcium oxalate and sweet substance Mannitol are also present.

g) **Uses:**
- It is used as aromatic, carminative, flavouring agent, analgesic, antiseptic, antirheumatic, antispasmodic, demulcent, digestive, expectorant, stomachic, diaphoretic, antibacterial, antifungal.
- It stops vomiting, relieves flatulence and used as astringent in diarrhoea and hemorrhage of the womb.

- It is also used in the treatment of bronchitis, colds, nausea, congestion, and liver problems.

7. Procedure

a. Issue the sample of Cinnamon Bark and boil for 30 to 60 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl or Iodine or Acetic acid or dil HCl and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerin on the section with the help of a dropper.
g. Place a clean cover slip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Cinnamon bark as seen under the microscope.

8. Observation

Sr. No	Tests	Observation	Inference
1	T.S. of Cinnamon Bark + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified pericyclic fibres,stone cells.
2	T.S. of Cinnamon Bark + Iodine sol.	Blue Colour	Starch present
3	T.S. of Cinnamon Bark + dil.HCl	Soluble	Calcium Oxalate crystals
4.	T.S. of Cinnamon Bark + dil.Acetic acid	Insoluble	Calcium Oxalate crystals
5	T.S. of Cinnamon Bark + Rheuthenium red	Pink red	Mucilage present

Observation Table for Staining:

Sr. No	Tests	Observation	Inference
1	T.S. of Cinnamon Bark + Phloroglucinol - HCl (1:1).		
2	T.S. of Cinnamon Bark + Iodine sol.		
3	T.S. of Cinnamon Bark + dil.HCl		
4	T.S. of Cinnamon Bark + dil. Acetic acid		
5	T.S. of Cinnamon Bark + Rheuthenium red		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be _____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.
h. https://www.pharmacy180.com

11. Practical Related Questions

a. Draw neat well labeled diagram of T.S. of Cinnamon bark.
b. What are the uses of Cinnamon bark?
c. Mention four allied species of Cinnamon bark.
d. Which volatile oil is present in Cinnamon bark?
e. Write biological source Cinnamon bark.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 16
Morphological and Microscopical Characters of Vasaka Leaf

1. Aim

To study the Morphological and Microscopical characters of Vasaka leaf.

2. Practical Significance

The experiment will provide microscopical information of Vasaka leaf. Study of microscopical characters is necessary for confirmation of identity of Vasaka leaf.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allow more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirement:

a. **Apparatus** Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps,test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor.

b. **Microchemical Reagents** Phloroglucinol, Conc. HCl, Glycerin, water.

c. **Crude Drug:** Vasaka leaf

6. Theory:

Vasaka leaf

a) **Synonyms:** Adhatoda, Adulsa.

b) **Biological Source:** Vasaka consists of dried or fresh leaves obtained from *Adhatoda vasica* Nees., belonging to family Acanthaceae.

c) **Morphology:**

- **Colour:** Dull brownish-green
- **Odour:** Characteristic
- **Taste:** Bitter
- **Shape:** Entire,Lanceolate
- **Size:** 10 to 20 cm long, 3.5 to 6 cm wide
- **Extra features**: The margin of leaves is crenate and apex is acuminate with glabrous surface and smooth texture.

d) **Microscopy:**

Transverse section of Vasaka leaf shows the following characters.

i. **Lamina:** Lamina consists of epidermis (upper and lower), mesophyll, palisade and spongy parenchyma.

- The leaf is covered on both surfaces by a single layered epidermis. The upper epidermis is single layered and made up of compactly arranged barrel shaped parenchymatous cells.

The outer surface of the epidermis is covered with cuticle. Stomata are found in both upper and lower epidermis.

- The mesophyll tissue is differentiated into palisade tissue towards upper epidermis and it contains double layered columnar cell compactly arranged with chloroplast. Spongy tissue towards lower epidermis, cells are polygonal, loosely arranged with numerous intercellular spaces.
- The lower epidermis is similar to that of the upper one but has more number of trichomes and stomata when compared with upper epidermis.
- Covering and glandular trichomes are present in vasaka leaf.
- Caryophyllaceous or Diacytic stomata is present in vasaka leaf.

ii. **Midrib:** Midrib consists of collenchyma, cystoliths and vascular bundles.

- It has 2 to 4 layers of collenchyma below the upper epidermis and above the lower epidermis. It contains thick-walled cellulosic cells.
- It contains a few cystoliths which can be seen in conical parenchyma. These are crystals of calcium oxalate and calcium carbonate.
- Collateral vascular bundles are present at the centre of midrib. Xylem is lignified. Phloem is non lignified.

e) **Diagram:**

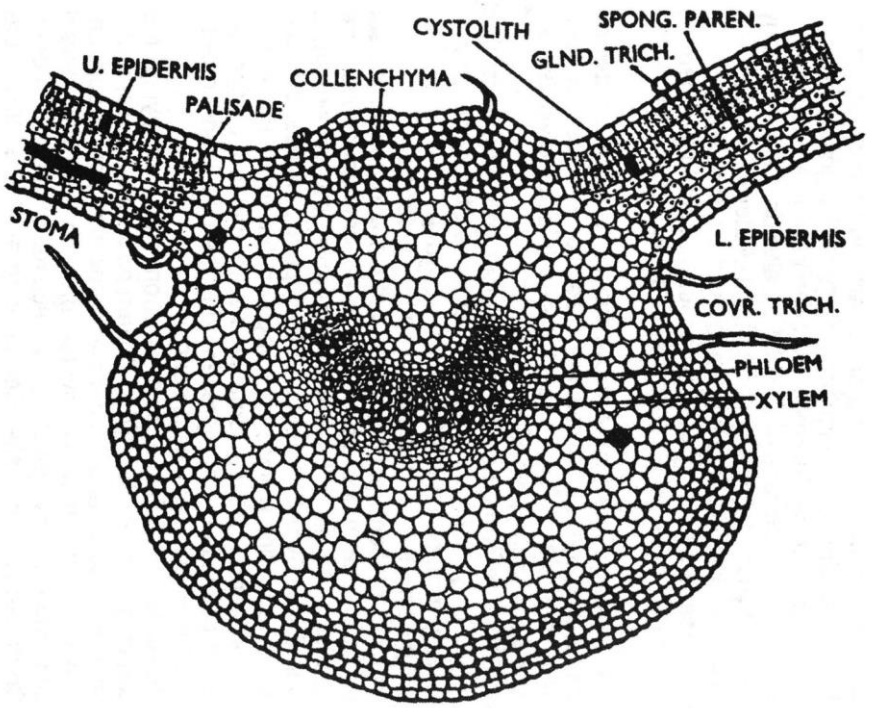


Fig 16.1: T.S. of Vasaka Leaf.

f) **Chemical Constituents:**

- The chemical constituents of Vasaka are alkaloids, tannins, flavonoids, terpenes, sugar and glucosides.
- The major chemical constituents of Vasaka are its several alkaloids, and the chief one is Vasicine. Leaves are composed of major constituents vasicine and vasicinone.
- Also, the leaves of vasaka contain vitamin C in large amount.
- They also contain a yellow colouring substance called Vasakin.

g) **Uses:**

- It is used as an expectorant.

- The leaves of vasaka are used to treat asthma, fever, tuberculosis, piles, jaundice and bleeding gums.
- It has used as bronchodilator.
- Its decoction is used to treat cold and rheumatism.

7. Procedure

a. Issue the sample of Vasaka leaf.
b. Take a thin section of midrib ofleaf with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerin on the section with the help of a dropper.
g. Place a clean coverslip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Vasaka leaf as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Vasaka leaf + Phloroglucinol - HCl (1:1).	Pink colour.	Xylem vascular bundles

Observation Table for Staining:

Sr. No	Test	Observation	Inference
1	T.S. of Vasaka leaf + Phloroglucinol - HCl (1:1).		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, NiraliPrakashan, Pune.
d. A Practical Book on Pharmacognosy& Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and C. S. K. Nayak.

11. Practical Related Questions

a. Write the biological source of Vasaka.
b. What types of trichomes are present in Vasaka leaf?
c. Draw well labelled diagram of T. S. of Vasaka leaf.
d. Name the types of stomata present in vasaka leaf.
e. Enlist the cells of lamina.
f. Enumerate the cells of midrib.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 17
Morphological and Microscopical Characters of Datura Leaf

1. Aim

To study the Morphological and Microscopical characters of Datura leaf.

2. Practical Significance

The experiment will provide microscopical information of Datura leaf. Study of microscopical characters is necessary for confirmation of identity of datura leaf.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus:** Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps, test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor.

b. **Microchemical Reagents** Phloroglucinol, Conc. HCl, Alcoholic picric acid, Sudan red III, Glycerin, water.

c. **Crude Drug:** Datura leaf

6. Theory

Datura leaf

a) **Synonyms: Dhatura, Dhotara, Dhusturapattai.**

b) **Biological Source:** Datura consists of dried leaves and flowering tops of *Datura metel* Linn., and *Datura metel* var Fastuosa Safford., belonging to family Solanaceae and should contain not less than 0.2 percent of total alkaloids calculated as Hyoscyamine.

c) **Morphology:**

- **Colour**: Pale Green
- **Odour**: Disagreeable characteristic
- **Taste**: Unpleasant, bitter
- **Shape**: Broadly ovate
- **Size**: 15 to 20 cm long
- **Extra Features**: Thin and minutely hairy with prominent midrib on lower surface

d) **Microscopy:** Transverse section shows a bifacial structure. The following characters were observed in the lamina and the midrib region.

i. **Lamina:** Lamina consists of epidermis (upper and lower) and mesophyll.

- The upper epidermis is single layer, rectangular cells covered with cuticle. Both covering and glandular trichomes are present. The covering trichomes are uni-seriate, multicellular, warty and with blunt apex. The glandular trichomes have one stalk consisting of one cell and multicellular head.
- The mesophyll has spongy parenchyma and palisade in it. Palisade cells are radially elongated, single layer and compactly arranged. Spongy parenchyma are several layers, loosely arranged consisting of micro-sphenoidal crystals and vascular strands.
- The lower epidermis is similar to that of the upper one but has a greater number of trichomes and stomata when compared with upper epidermis.

ii. **Midrib:** In the midrib, strips of collenchyma appear below the upper and above the lower epidermis followed by the cortical parenchymatous cells containing calcium oxalate. Bicollateral vascular bundles are present at the centre of midrib.

e) **Diagram:**

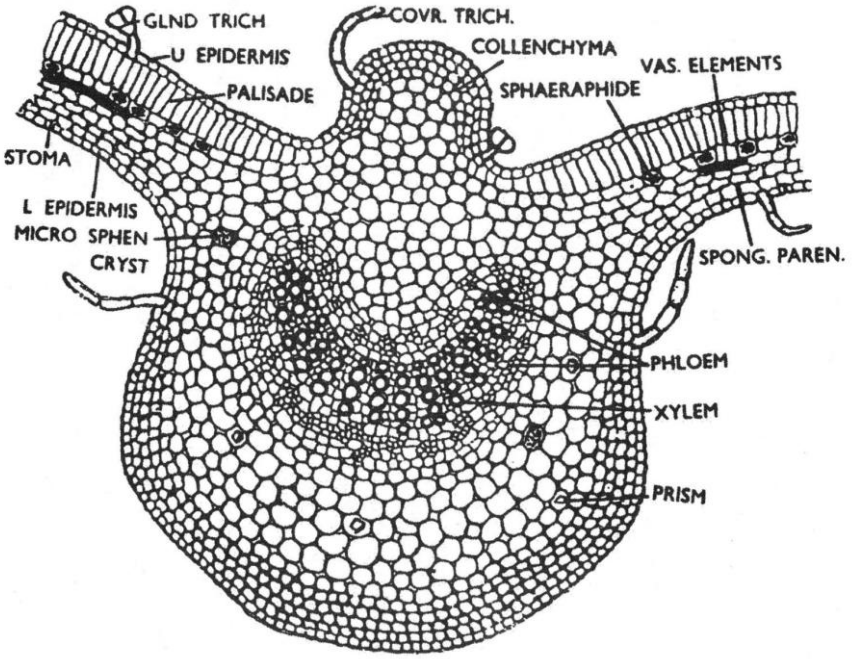


Fig 17.1: T.S. of Datura Leaf.

f) **Chemical Constituents:**
Datura herb contains up to 0.5% of total alkaloids, among which hyoscine (scopolamine) is the main alkaloid, while l-hyoscyamine (scopoline) and atropine are present in very less quantities.

g) **Uses:**
It exhibits parasympatholytic with anticholinergic and CNS depressant effects. It is also used as mydriatic, anti-spasmodic. The drug is used in cerebral excitement, asthma and in cough. Hyoscine hydrobromide is used in motion sickness, gastric or duodenal ulcers.

7. Procedure

a. Issue the sample of Datura leaf.
b. Take a thin section of midrib of leaf with the help of a sharp blade and transfer the section to a watch glass containing water.

c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerin on the section with the help of a dropper.
g. Place a clean coverslip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Datura as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Datura leaf + Phloroglucinol - HCl (1:1).	Pink colour.	Xylem vascular bundles

Observation Table for Staining:

Sr. No	Test	Observation	Inferences
1	T.S. of Datura leaf + Phloroglucinol - HCl (1:1).		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be _____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy& Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

1. Give two examples of crude drugs belonging to Solanaceae family.
2. Which types of trichomes are present in Datura leaf?
3. Draw well labelled diagram of T. S. of Datura leaf.
4. Is datura a leaf or leaflet? Justify your answer.
5. Where is mesophyll located on datura leaf?
6. Enumerate the cells of midrib.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 18
Morphological and Microscopical Characters of Ashwagandha Root

1. Aim

To study the Morphological and Microscopical characters of Ashwagandha root.

2. Practical Significance

The experiment will provide microscopical information of Ashwagandha root. Study of microscopical characters is necessary for confirmation of identity of Ashwagandha root.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus**: Compound microscope, Projection Microscope, watch glass, slides, cover slips, beakers, dropper, filter paper, sharp razors.

b. **Microchemical Reagents:** Phloroglucinol, Conc. HCl, Iodine Solution, Glycerin, Alcohol, etc.

c. **Crude Drug:** Ashwagandha root

6. Theory

Ashwagandha root

a) **Synonyms:** Indian Ginseng, Withania root

b) **Biological Source:**
Ashwagandha consists of the dried roots and stem bases of *Withania somnifera* Dunal, belonging to family Solanaceae.

c) **Morphology:**
- **Colour:** Buff- grey-yellow
- **Odour:** Strong
- **Taste:** Bitter and mucilaginous.
- **Shape:** Straight, unbranched and conical
- **Size:** Thickness varies according to age and usually it is 5–12 mm below crown
- **Extra features**: Outer surface is buff to yellow and longitudinally wrinkled**.** Secondary roots are also present.

d) **Microscopy:**

Transverse section of Ashwagandha root consists of following characters:

- **Cork:** Cork is exfoliated or crushed. When present it is isodiametric and non-lignified.
- **Cork cambium**: Two to four diffused rows of cells.
- **Secondary cortex:** There are approximately twenty layers of compact parenchymatous cells.
- **Phloem:** It consists of sieve tubes, phloem parenchyma, companion cells.
- **Cambium:** Cambium shows four to five rows of tangentially elongated cells.
- **Secondary xylem:** It is hard-forming and has a closed vascular ring separated by multiseriate medullar rays and a few xylem parenchyma.

e) **Diagram:**

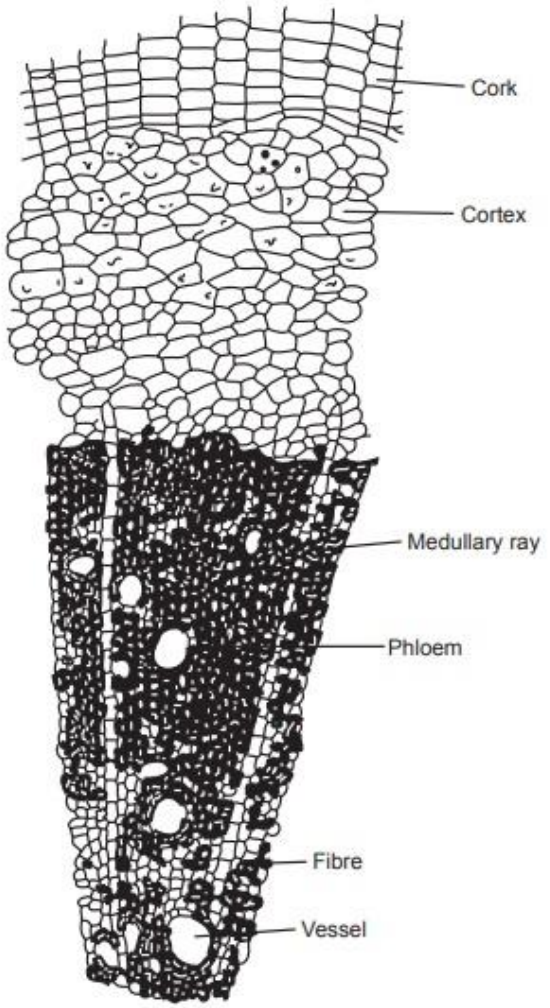


Figure 18.1: T.S of Ashwagandha Root

f) **Chemical Constituents:**

- Tropane alkaloid: Withanine as the main constituent, Somniferine, Pseudowithanine, Tropine and Pseudotropine, Hygrine, Isopellederine, Anaferine, Anahygrine and steroid lactones.
- The leaves contain steroid lactone, known as Withanolides which contain Withaferin A.

g) **Uses:**

- It is used to treat nervous disorders, intestinal infections and leprosy.
- It is used as tranquillizer.
- It acts mainly on the reproductive and nervous systems, having a rejuvenative effect on the body.

- It is used to improve vitality and aid recovery after chronic illness.
- It is also used to treat nervous exhaustion, debility, insomnia, impotence, infertility and multiple sclerosis.
- Externally it is applied as a poultice to boils, swellings and other painful parts.

7. Procedure

a. Issue the sample of Ashwagandha root and Boil for 30 to 60 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol- HCl or Iodine and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerine on the section with the help of a dropper.
g. Place a clean cover slip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Ashwagandha root as seen under the microscope.

8. Observations

Sr. No	Test	Observation	Inference
1	T.S. of Ashwagandha root + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified fibres and vessels.
2	T.S. of Ashwagandha root + Iodine sol.	Blue Colour	Starch present

Observation Table for staining

Sr. No	Test	Observation	Inference
1	T.S. of Ashwagandha root + Phloroglucinol - HCl (1:1).		
2	T.S. of Ashwagandha root + Iodine sol.		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. https://www.pharmacy180.com
f. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.

g. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
h. Anatomy of Crude Drugs - M. A. Iyengarand C. S. K. Nayak.

11. Practical Related Questions

a. Draw a neat well labelled diagram of T. S. of Ashwagandha root.
b. Write biological source Ashwagandha root.
c. Name the alkaloids present in Ashwagandha root.
d. Write characteristics of secondary xylem and phloem present in Ashwagandha root.
e. Write synonyms of Ashwagandha root.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 19
Morphological and Microscopical Characters of Liquorice Root

1. Aim

To study the Morphological and Microscopical characters of Liquorice root.

2. Practical Significance

The experiment will provide information of microscopical characters of Liquorice root. Study of microscopical characters is necessary for confirmation of identity of Liquorice root.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus**: Compound microscope, Projection Microscope, watch glass, slides, cover slips, beakers, dropper, filter paper, sharp razors.

b. **Microchemical Reagents**: Phloroglucinol, Conc. HCl, Iodine Solution, Glycerine, Alcohol.

c. **Crude Drug**: Liquorice root

6. Theory

Liquorice root

a) **Synonyms:** Radix Glycyrrhizae, Sweet liquorice, Glycerrhiza, Liquorice root,Mulethi.

b) **Biological Source:**
Liquorice consists of dried peeled and unpeeled stolons, roots and stems of *Glycyrrhiza glabra* Linn, and other species of *Glycytrhiza*, belonging to family Leguminosae.

c) **Morphology:**

- **Colour:** Unpeeled pieces, externally greyish brown to dark brown, warty; internally tawny yellow, the peeled pieces of root are a pale yellow, slightly fibrous externally
- **Odour:** Faint and Characteristic
- **Taste:** Sweet, very slightly acrid.
- **Shape:** Cylindrical, longitudinally wrinkled.
- **Size:** Thickness from 1/4 inch to about 1 inch,
- **Fracture:** It is fibrous in bark and splintery in wood.
- **Extra Features:** Unpeeled pieces show presence of small buds encircling scale leaves and longitudinally the drug is wrinkled, while peeled drug is fibrous without wrinkles

d) **Microscopy:** Transverse section of Liquorice root shows the following features:

- **Cork:** 10-20 more layers of tubular cells. Outer layer has reddish brown matter and inner layers have colourless cells.
- **Phellogen:** Indistinct.
- **Phelloderm:** It consists of 1 or 3 layers of radially arranged parenchymatous cells and sometimes collenchymatous cells having prisms of calcium oxalate crystals and starch grains.
- **Phloem Fibres:** Found in group,thickened and cellulosic wall in the inner part and lignified in the outer part. Each bundle is surrounded by parenchymatous sheath containing calcium oxalate crystals.
- **Phloem Parenchyma:** It consists of sieve tissue alternating with thick walled, lignified fibres surrounded by a sheath of parenchymatous cells containing prisms of calcium oxalate.
- **Medullary Rays**: Radially elongated,distinct bi-to multiseriate parenchymatous cell narrow in the xylem region and wider in the phloem region.
- **Cambium:** It is thin walled and has three or more layers.
- Secondary phloem
- **Xylem Fibres:** Lignified containing calcium oxalate crystals.
- **Xylem Parenchyma:** There are starch grains and calcium oxalate crystals (15 - 25) which are lignified. **Medullary Rays:** These are parenchymatous and multiseriate.
- **Cortex:** It is a narrow zone composed of parenchyma cells containing isolated prisms of calcium oxalate and simple starch granules.
- **Pith:** It is present in rhizomes and absent in root.

e) **Diagram:**

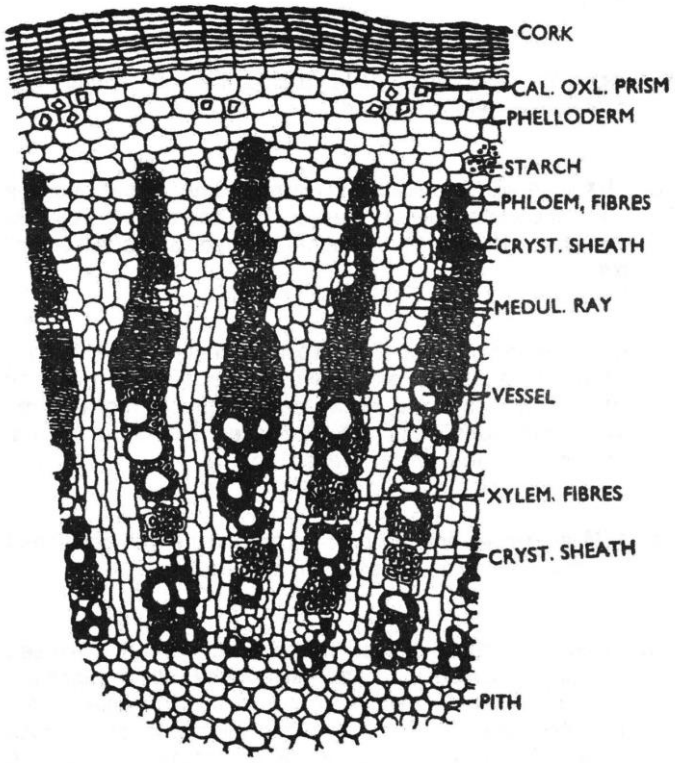


Figure 19.1: T.S of Liquorice Root

f) **Chemical Constituents:**
- Saponin glycoside: It contains triterpenoid saponin like glycyrrhizin (6–7%) sweet principle,consisting of the calcium and potassium salts of Glycyrrhizic acid that on hydrolysis yields glycyrrhetic or glycyrrhetinic acid.
- It contains sugar, starch (29%), gum, protein, fat (0.7%), resin, asparagin (2–4%), a trace of tannin, 0.03% of volatile oil.
- Yellow colour due to Chalcone glycoside and Isoliquiritin.

g) **Uses:**
- It used as a sweetening agent and in bronchial problems such as bronchitis, cold, flu and coughs.
- It reduces irritation of the throat and yet has an expectorant action.
- Demulcent, antipyretic, antibacterial and expectorant effects.
- It is used in relieving stress and potent healing agent for tuberculosis.
- It is used in the treatment of chronic inflammations such as arthritis and rheumatic diseases, chronic skin conditions.

7. Procedure

a. Issue the sample of Liquorice root and boil for 30 to 60 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol- HCl or Iodine and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerine on the section with the help of a dropper.
g. Place a clean cover slip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Liquorice root as seen under the microscope.

8. Observations

Sr. No	Test	Observation	Inference
1	T.S. of Liquorice root + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified fibres and vessels.
2	T.S. of Liquorice root + Iodine sol.	Blue Colour	Starch present

Observation Table for Staining:

Sr. No	Test	Observation	Inference
1	T.S. of Liquorice root + Phloroglucinol - HCl (1:1).		
2	T.S. of Liquorice root + Iodine sol.		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy& Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengarand C. S. K. Nayak.

11. Practical Related Questions

a. Write the biological source of Liquorice root.
b. Name the glycosides present in Liquorice root.
c. Write characteristics of secondary phloem present in Liquorice root.
d. Write synonyms of Liquorice root.
e. Draw a neat well labelled diagram of T. S. of Liquorice root.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 20
Morphological and Microscopical Characters of Curcuma Rhizome

1. Aim
To study the Morphological and Microscopical characters of Curcuma rhizome.

2. Practical Significance
The experiment will provide the identification and evaluation of crude drug by the study of microscopical characters. This visualization of microscopic characters is essential for confirming the identity of crude drugs.

3. Practical Outcomes
After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background
Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements
a. **Apparatus**: Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps, test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor.

b. **Microchemical Reagents:** Phloroglucinol, Conc. HCl, Glycerine, water.

c. **Crude Drug:** Curcuma rhizome

6. Theory
Curcuma rhizome

a) **Synonyms:** Turmeric rhizome, Indian saffron, Haldi.

b) **Biological Source:**
Curcuma consists of fresh as well as dried rhizomes obtained from plant *Curcuma longa* Linn., and *Curcuma domestica* Vaal., belonging to family Zingiberaceae.

c) **Morphology:**
- **Colour:** Externally it is yellowish to yellowish-brown and internally it is yellowish-orange to orange
- **Odour:** Characteristic
- **Taste:** Slightly bitter
- **Size:** 2 to 5 cm in length and 1 to 2 cm inthickness. Root scars and annulations are present
- **Shape:** Round rhizomes are ovate or oblong, while the long rhizomes are cylindrical and short branched. The fracture of rhizome is horny.

d) **Microscopy:**

The transverse section of Curcuma rhizome consists of following characters.

a. Mostly thin-walled rounded parenchymatous cells.
b. Scattered vascular bundles.
c. Definite endodermis.
d. A few layers of cork developed under the epidermis.
e. Scattered oleo resin cells with brownish contents.

- **Epidermis**: The epidermis consists of thick-walled cells, cubical in shape, of various dimensions.
- **Cork cambium**: The cork cambium is developed from the sub-epidermal layers and even after the development of the cork, the epidermis is retained.
- **Cork**: Cork is generally composed of four to six layers of thin-walled brick-shaped parenchymatous cells. Pith and Cortex: The parenchyma of the pith and cortex contains grains altered to a paste, in which sometimes long lens shaped unaltered starch grains of 4–15 μm diameter are found. Oil cells have suberised walls and contain either orange-yellow globules of a volatile oil or amorphous resinous masses.
- Cortical vascular bundles are scattered and are of a collateral type. The vascular bundles in the pith region are mostly scattered and they form discontinuous ring just under the endodermis. The vessels have mainly spiral thickenings and only a few have reticulated and annular structure.

e) **Diagram:**

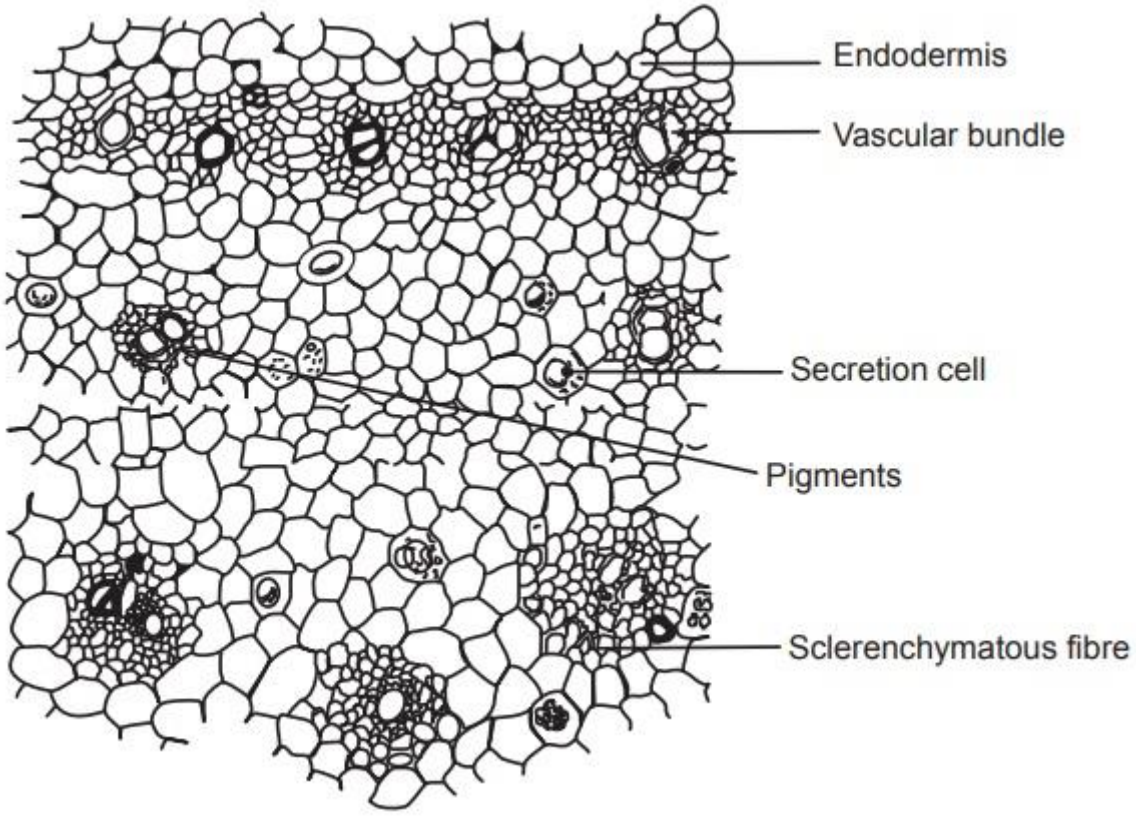


Fig 20.1: T.S. of Curcuma rhizome

f) **Chemical Constituents:**
It contains mainly yellow colouring matter such as curcuminoids which consists of Curcumin I, Curcumin II, Curcumin III. It also contains resins, volatile oil. Volatile oil contains turmerone, zingiberene, borneol and starch.

g) **Uses:**
- It is used as an aromatic, stimulant and flavouring agent.
- It is used as spice and condiment in cooking, home remedies, expectorant.
- It is used as coloring agent in ointments and creams.

7. Procedure

a. Issue the sample of curcuma rhizome and boil for 15 to 30 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerin on the section with the help of a dropper.
g. Place a clean coverslip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of curcuma rhizome as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Curcuma rhizome + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified sclerenchyma, vascular bundles.

Observation Table for Staining:

Sr. No	Test	Observation	Inference
1	T.S. of Curcuma rhizome + Phloroglucinol - HCl (1:1).		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar et al, Career Publications.

f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.
h. https://www.pharmacy180.com

11. Practical Related Questions

a. Write the synonyms of Curcuma.
b. Write the biological source of Curcuma.
c. Enlist the microscopical characters identified in Curcuma rhizome.
d. Mention the chemical constituents of Curcuma.
e. Draw a neat well labelled diagram of T. S. of Curcuma rhizome.
f. What are the uses of Curcuma?

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 21
Morphological and Microscopical Characters of Nux Vomica Seed

1. Aim

To study the Morphological and Microscopical characters of Nux vomica seed.

2. Practical Significance

The experiment will provide for the identification and evaluation of crude drug by the study of microscopical characters. This visualization of microscopic characters is essential for confirming the identity of crude drugs.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study of crude drugs allows more detailed examination of a drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. **Apparatus**: Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps, test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor.

b. **Microchemical Reagents:** Phloroglucinol, Conc. HCl, Sudan red III, Glycerine, water.

c. Crude Drug: Nux vomica seed

6. Theory:

Nux vomica seed

a) **Synonyms:** Nux vomica seed, Semen strychini, Crow fig, Kuchala.

b) **Biological Source:**
Nux vomica consists of dried ripe seeds obtained from plant *Strychnos nuxvomica Linn*., belonging to family Loganiaceae. It should contain not less than 1.2% Indole alkaloids calculated as strychnine.

c) **Morphology:**
- **Colour:** Grey or greenish-grey
- **Odour:** Odourless
- **Taste:** Extremelybitter
- **Shape:** Spherical, flattened discs
- **Size:** 10 to 30 mm in diameter and 3 to 5 mm inthickness

- **Extra Features:** Silky surface due to the presence of radially arranged, densely covered, unicellular covering trichomes.

d) **Microscopy:** The transverse section of nux vomica shows a hairy testa and a bulky endosperm.

i. **Testa:** It consists of hairy epidermis and collapsed parenchyma.

a. **Lignified Trichomes**: Thick walled, bent and twisted lignified trichomes, immerge from epidermis, parallel in one direction.

b. **Epidermis**: Single layered. Each epidermal cell forms a lignified trichome comprising of a pitted bulbous base and a projection which is narrowly elongated and slightly bent beyond the base. The trichomes of all epidermal cells run parallel in one direction giving the testa of seed a silky appearance.

c. **Collapsed Parenchyma**: It is 2 layered, collapsed parenchymatous cells with yellowish brown contents.

ii. **Endosperm**: The endosperm forms the bulk of the seed. Outermost layers of the endosperm below the collapsed parenchyma appear palisade like whereas the inner layers contain cells which are polyhedral, thick walled (cellulose) but unlignified parenchymatous cells. A characteristic feature of the endosperm of nux vomica is the presence of well interconnected Plasmodesmata (fine protoplasmic strands between the different walls of endosperm cells) which can be clearly seen by staining the section with dilute iodine. The cells of endosperm also contain aleurone grains and oil droplets.

e) **Diagram:**

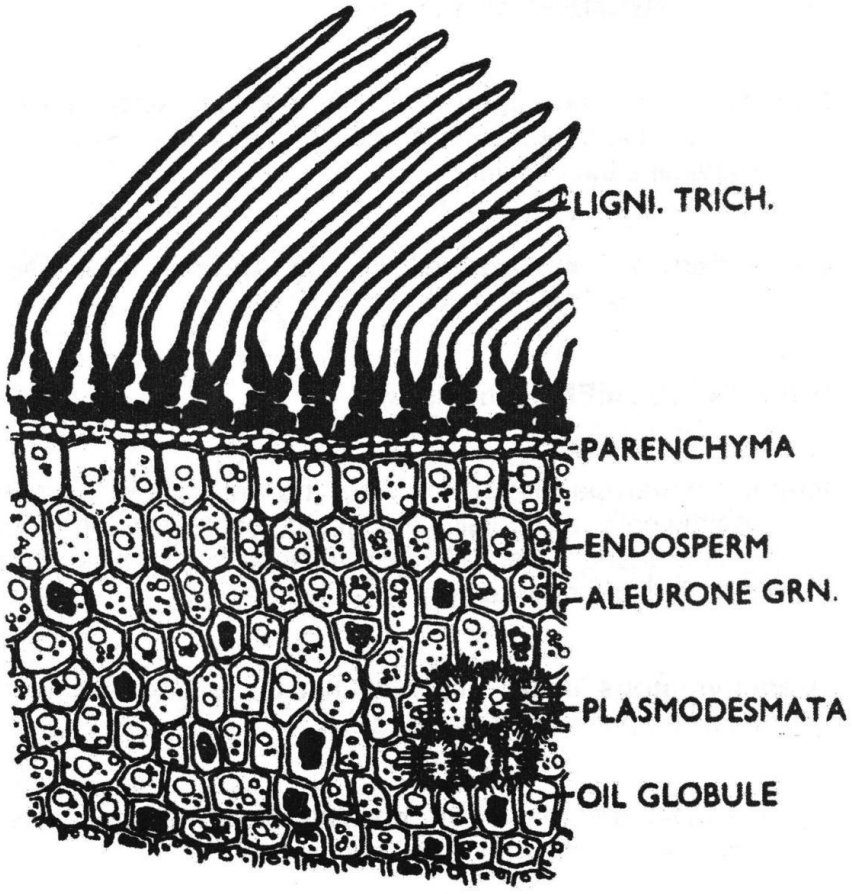


Fig 21.1: T.S. of Nux- vomica seed.

f) **Chemical Constituents:**
It contains bitter indole alkaloids strychnine and brucine. It also contains vomicine, loganine, pseudostrychnine, pseudotannins. Other constituents include hemicellulose in the cell wall, fixed oil and proteins.

g) **Uses:**
It is used as a CNS stimulant, bitter tonic, bitter stomachic and sex tonic. It is also used to relieve chest constriction during asthma attacks.

7. Procedure

a. Issue the sample of Nux-vomica seed and boil for 15 to 30 minutes.
b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.
c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl or Sudan red III and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerine on the section with the help of a dropper.
g. Place a clean coverslip over the section by using forcep and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condensor, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of Nux-vomica seed as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inference
1	T.S. of Nux-vomica + Phloroglucinol - HCl (1:1).	Pink colour.	Lignified xylem, medullary rays.
2	T.S. of Nux-vomica + Sudan red III	Red colour.	Oil globules present in the endosperm.

Observation Table for Staining:

Sr. No	Test	Observation	Inference
1	T.S. of Nux-vomica + Phloroglucinol - HCl (1:1).		
2	T.S. of Nux-vomica + Sudan red III		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.

e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

11. Practical Related Questions

a. Which types of trichomes are present in Nuxvomica seed?
b. Name the principle imparting bitter taste to Nuxvomica seed.
c. Mention three examples of drugs acting on CNS.
d. Draw a well labelled diagram of the T.S. of Nuxvomica seed.
e. What is Plasmodesmata?
f. Write the biological source of Nux vomica.

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 22
Morphological and Microscopical Characters of Clove Bud

1. Aim

To study the Morphological and Microscopical characters of Clove bud.

2. Practical Significance

The experiment will provide for the identification and evaluation of crude drug by the study of microscopical characters. This visualization of microscopic characters is essential for confirming the identity of crude drugs.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Develop ability to take a transverse section of the given crude drug	CO2, 3	3
2	Stain the transverse section and observe under microscope	CO2, 3	3
3	Identify and interpret the microscopic characters of given crude drug	CO2, 3	4

4. Relevant Theoretical Background

Section cutting technique, staining, mounting and observation of transverse section of crude drug. Gross anatomical or microscopic study allows more detailed examination of a crude drug. It is used to identify the organized drugs by means of their known histological characters. The various reagents or stains are used to distinguish cellular structure.

5. Requirements

a. Apparatus: Microscope, watch glass, camel hair brush, glass slides, cover slips, beaker, dropper, filter paper, forceps, test tubes, test tube holder, tripod stand, wire gauze, dissecting needle, sharp razor.

b. Microchemical Reagents: Phloroglucinol, Conc. HCl, Dil. HCl, Dil. H_2SO_4, Glycerin, water.

c. Crude Drug: Clove bud

6. Theory:

Clove bud

a) **Synonyms:** Clove buds, Clove flowers, Caryophyllum, Laung.

b) **Biological Source:**
Clove consists of the dried flower buds of *Eugenia caryophyllus* Thumb., belonging to family Myrtaceae.

c) **Morphology**

- **Colour:** Crimson to dark brown
- **Odour:** Slightly aromatic
- **Taste:** Pungent and aromatic followed by numbness
- **Size:** 10 to 17.5 mm in length, 4 mm in width and 2 mm inthickness.
- **Shape:** Hypanthium is surrounded with 4 thick acute divergent sepals surrounded by dome shaped corolla. The corolla consists of unexpanded membranous petals with several stamens and single stiff prominent style.

d) **Microscopy:**
The transverse section of clove can be taken both through the short upper portion (immediately below the calyx) containing bilocular ovary and as well as through the long solid, sub cylindrical lower portion (hypanthium) of the bud.

A. T. S. Through Hypanthium:

Following are the important tissues from the periphery to the centre.

i. **Epidermis:** Single layered straight walled cells with anomocytic (ranunculaceous) stomata and a very thick cuticle.

ii. **Cortex:** Cortex is divided into three zones.
   a. **Peripheral or outer zone**: Roughly radially arranged parenchymatous cells with 2 to 3 layers of big, ellipsoidal, schizolysigenous oil glands embedded in it. Parenchymatous cells contain tannins, hence show dark colour when stained with ferric chloride.
   b. **Middle zone**: Middle region containing a ring of bicollateral vascular bundle. Xylem is composed of 3 to 5 lignified spiral vessels. About 15 vascular bundles are present in the ring. Lignified isolated pericyclic fibres may be present around the vascular bundle.
   c. **Inner zone**: It consists of loosely arranged aerenchyma having more intercellular spaces.
   d. **Aerenchyma**: Parenchyma containing air spaces or lacuna is known as aerenchyma.

iii. **Columella:** It forms the central cylinder containing thick walled parenchyma with a ring of bicollateral vascular bundles towards the periphery. Calcium oxalate prisms, starch, stone cells are absent.

e) **Diagram:**

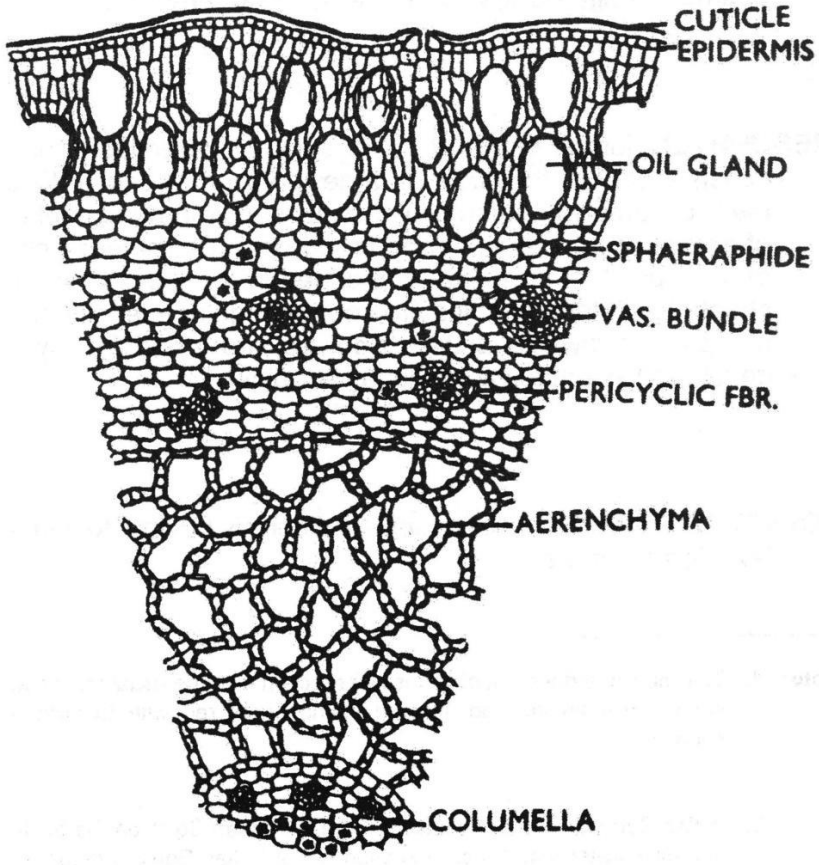


Fig 22.1: T.S. of Clove Bud Passing Through Hypanthium

B. T. S. Through Ovary:

Following are the important tissues from the periphery to the centre.

i. **Epidermis:** Single layered straight walled cells with anomocytic (ranunculaceous) stomata and a very thick cuticle.

ii. **Cortex:** Cortex is divided into three zones.

a. **Peripheral or outer zone**: Roughly radially arranged parenchymatous cells with 2 to 3 layers of big, ellipsoidal, schizolysigenous oil glands embedded in it. Parenchymatous cells contain tannins, hence show dark colour when stained with ferric chloride.

b. **Middle zone**: Middle region containing a ring of bicollateral vascular bundle. Xylem is composed of 3 to 5 lignified spiral vessels. About 15 vascular bundles are present in the ring. Lignified isolated pericyclic fibres may be present around the vascular bundle.

c. **Inner zone**: It consists of loosely arranged aerenchyma having more intercellular spaces.

d. **Aerenchyma**: Parenchyma containing air spaces or lacuna is known as aerenchyma.

iii. **Central Region:** Columella is absent. The central region is occupied by a bilocular ovary with several ovules showing an axile placentation.

f) **Diagram:**

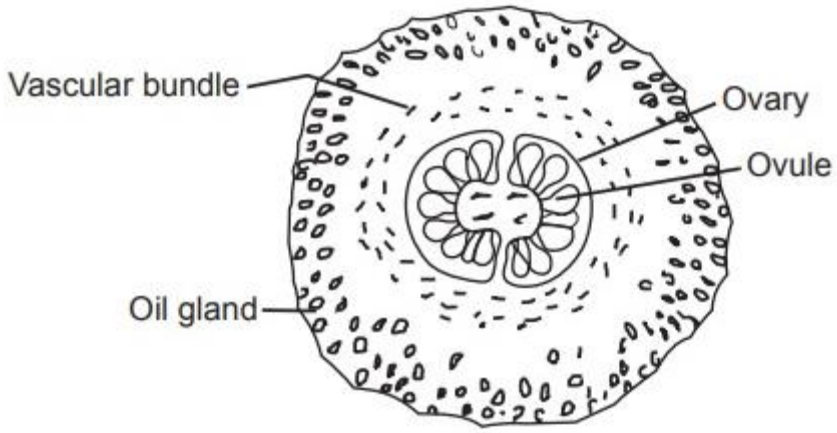


Fig 22.2: T.S. of Clove Bud Passing Through Ovary

g) **Chemical Constituents:**

Clove contains 14–21% of volatile oil. The major constituents of volatile oil are the eugenol, eugenol acetate, gallotannic acid, and two crystalline principles; α- and β- caryophyllenes, methyl furfural, gum, resin, and fibre. Clove oil has 60–90% eugenol, which is the cause of its anesthetic and antiseptic properties.

h) **Uses:**

Clove is used as an antiseptic, stimulant, carminative, aromatic, and as a flavouring agent. It is also used as dental analgesic, antiemetic. Dentists use clove oil as an oral anesthetic and to disinfect the root canals. Eugenol is also used as local anaesthetic in small doses. The oil stimulates peristalsis; it is a strong germicide, also a stimulating expectorant in bronchial problems.

7. Procedure

a. Issue the sample of Clove bud and boil for 15 to 30 minutes.

b. Take a thin section of it with the help of a sharp blade and transfer the section to a watch glass containing water.

c. Again, transfer the section to another watch glass containing staining solution such as Phloroglucinol-HCl or Dil. HCl or Dil. H_2SO_4 and keep aside for 2-3 minutes.
d. Transfer the sections again to the watch glass containing water to wash off the excess stains.
e. Mount the section on a glass slide with the help of a brush.
f. Add 1-2 drops of water/ glycerin on the section with the help of a dropper.
g. Place a clean coverslip over the section by using forceps and needle.
h. Place the slide on the stage of the microscope, adjust the light with the help of diaphragm, mirror and condenser, adjust and fix the slide in between the clips.
i. Observe the section under microscope and draw the transverse section of clove bud as seen under the microscope.

8. Observation

Sr. No	Test	Observation	Inferences
1	T.S. of clove bud + Phloroglucinol - HCl (1:1).	Pink colour.	Vascular bundles and fibres.
2	T.S. of clove bud + Dilute HCl.	Soluble.	Calcium oxalate crystals.
3	T.S. of clove + Sulphuric acid.	Soluble.	Needles of calcium sulphate on standing. Calcium oxalate crystals.

Observation Table for Staining:

Sr. No	Test	Observation	Inferences
1	T.S. of clove bud + Phloroglucinol - HCl (1:1).		
2	T.S. of clove bud + Dilute HCl.		
3	T.S. of clove + Sulphuric acid.		

9. Conclusion

On the basis of microscopic study, the given unknown crude drug is confirmed to be_____ _____.

10. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.
h. https://www.pharmacy180.com

11. Practical Related Questions

a. Write the biological source of clove bud.
b. Name the major layers of the transverse section of clove.
c. Mention different zones of cortex.
d. Write a brief account on collenchyma.
e. What is aerenchyma?
f. What are the characteristics of parenchyma?

(*Space for Answers*)

12. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No.23
Identification of Asafoetida and Benzoin by Physical and Chemical Tests

1. Aim

To identify unknown unorganized powder drug with the help of physical and chemical tests (Asafeotida and Benzoin)

2. Practical Significance

The organized drugs can be identified by their histological characters while the unorganized drugs which do not have microscopic characters are confirmed by physical and chemical test of the powder drug. The solubility, physical characteristics and chemical tests are important parameters for the study of unorganized drugs. Performance of physical and chemical test will identify and confirm the powdered unorganized drug.

3. Practical Outcomes (PrO)

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Perform physical and chemical test for identification and confirmation of Asafeotida and Benzoin	CO4	4
2	Recall physical and chemical test for identification and confirmation of Asafeotida and Benzoin	CO4	2

4. Relevant Theoretical Background

The factors considered under physical tests include mainly the colour, odour, taste, solubility, etc. The chemical tests should be performed to confirm the genuine identity of the unorganized crude drug.

5. Theory:

A. Asafeotida

a) **Synonyms:** Devil's dung, Gum asafoetida, Hing

b) **Biological Source:**

Asafoetida is an oleo-gum resin obtained as an exudation by incision of the living rhizome and roots of *Ferula foetida* L, *F. foetida*, Regel, *F. rubricaulis* Boiss, and some other species of *Ferula*, belonging to family Umbelliferae.

c) **Physical Tests:**

- **Colour:** Dull yellow which changes into reddish brown on storage.
- **Odour:** Aromatic, penetrating, persistent, alliaceous.
- **Taste:** Bitter, acrid and alliaceous.
- **Forms:** Paste, tear (pure form) and mass bulk (block or lump).
- **Shape:** Tears are separate, rounded or flattened.
- **Size:** 0.5-4 cm in diameter.
- **Extra features**: Fresh tears are tough but when dried they become hard and brittle. Tears are internally milky whitish-yellow, translucent or opaque.
- **Solubility:** Soluble in water.

d) **Chemical Constituents:**

- It contains volatile oil (4–20%), resin (40–65%), and gum (25%)

- The resin of the drug consists chiefly asaresinotannol in the free or combined form with ferulic acid. Oil of asafetida is obtained by steam distillation of oleo-gum resin.
- The chief constituents of oil are secondary butyl propyl disulphide.
- Ferulic acid yields umbellic acid, when it is treated with hydrochloric acid, loses water molecule and forms umbelliferone.
- Free umbelliferone is absent in asafoetida.
- It also contains phellandrene, sec-butylpropenyldisulphide, geranyl acetate, bornyl acetate, α-terpineol, myristic acid, camphene, myrcene, limonene, fenchone, eugenol, linalool, geraniol, isoborneol, borneol.

e) **Uses:**
- It is used as carminative, nervine tonic, flavoring agent, and intestinal antiseptic.
- It is used as bowel stimulant, expel flatulence, relieves constipation
- Also used in veterinary medicine and for culinary purposes.

B. Benzoin

a) **Synonyms:** Sumatra Benzoin, Gum Benzoin, Loban, Siam benzoin.

b) **Biological Source:**
Benzoin is a balsamic resin obtained from *Styrax benzoin.* Dyrand or *Styrax paralleloneurus* Perkins and other species of *Styrax* known in the market as Sumatra Benzoin or it may also contain the balsamic resin from *Styrax tonkinesis* and other species, commercially known as Siam Benzoin, Family: Styraceae.

c) **Physical Tests:** Sumatra Benzoin
- **Colour: G**reyish-brown.
- **Odour:** *A*greeable, characteristic and balsamic.
- **Taste:** *S*lightly acrid and sweet.
- **Solubility:** Insoluble in water and soluble in alcohol
- Siam Benzoin
- **Colour:** Yellowish-brown to rusty-brown.
- **Odour:** Agreeable and vanilla-like
- **Taste: *S***lightly acrid and sweet
- **Solubility:** Insoluble in water and soluble in alcohol

d) **Chemical constituents:**
- Sumatra benzoin consists of free balsamic acid (cinnamic and benzoic acids) and their esters.
- It also contains Siaresinolic acid and Sumaresinolic acid traces of vanillin, phenylpropyl cinnamate, cinnamyl cinnamate.
- Siam benzoin consists of coniferyl benzoate (60–70%), free benzoic acid (10%), triterpene siaresinolic acid (6%), vanillin, and benzyl cinnamate.

e) **Uses:**
- It is used as an expectorant, antiseptic, carminative, stimulant, and diuretic.
- It is used in cosmetic lotions, perfumery.
- It is used to fix the odour of incenses, skin-soaps, perfumes and other cosmetics and for fixing the taste of certain pharmaceutical preparations.
- It retards rancification of fats.

6. Requirements

a. **Glassware**: Test-tube, test-tube holder, beaker, matchbox

b. **Powder crude drug**: Asafeotida, Benzoin

c. **Chemicals**: Alcohol, ether, chloroform, carbon tetrachloride, sodium hydroxide, alcoholic KOH solution, vapors of bromine or fumes of nitric acid, alcohol, water, Sulphuricacid, solution of potassium permanganate, water, etc.

7. Precautions to be taken (if any):

Handle concentrated chemicals carefully.

8. Procedure

A. Asafeotida

Sr. No	Tests	Observation
1	Triturate drug with water	Yellowish orange emulsion
2	To the fractured surface of the drug add 50% nitric acid.	Green colour
3	Umbelliferone test: -The drugs (0.5 g) is boiled with hydrochloric acid (5 ml) and add water. It is filtered and equal amount of ammonia is added to the filtrate.	A blue fluorescence
4	To the fractured surface of the drug, add sulphuric acid (1 drop).	A red colour is obtained.

B. Benzoin

Sr. No	Tests	Observation	
		(Sumatra Benzoin)	(Siam Benzoin)
1	Add alcohol and water to solution of benzoin	Milky solution and acidic	Milky solution and acidic
2	Heat Benzoin (1 g) with 4 ml of $KMnO_4$ solution.	Strong odour of benzaldehyde due sufficient quantity of cinnamic acid	Slight odour of benzaldehyde due less cinnamic acid
3	To a petroleum ether solution of Benzoin (0.2 g), two to three drops of sulphuric acid are added in a China dish.	reddish-brown colour	purple-red colour
4	Heat benzoin in the test tube covering mouth of test tube with glass slide. Observe under microscope.	Crystals of cinnamic acid are observed	Crystals of cinnamic acid are observed

9. Observations (Write the observation and inference)

Unorganized powdered drug	Tests	Observation	Tests	Observation	Inference
Asafeotida	Colour		1		
	Odour		2		
	Taste		3		
	Solubility	Soluble in: Insoluble in:	4		
Benzoin	Colour		1		
	Odour		2		
	Taste		3		
	Solubility	Soluble in: Insoluble in:	4		

10. Conclusion

With the help of above physical and chemical tests, the given unknown crude drugs are confirmed to be _____ and _____

11. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate et al, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy& Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar et al, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

12. Practical Related Questions

a. Differentiate Sumatra and Siam Benzoin with physical characteristics.
b. Describe umbelliferone Test for Asafeotida.
c. Write biological source of Benzoin.
d. How will you differ Sumatra and Siam Benzoin with help of Chemical Test.?
e. Write biological source of Asafeotida.

(Space for Answers)

13. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 24
Identification of Pale Catechu and Black Catechu by Physical and Chemical Tests

1. Aim

To identify unknown unorganized powder drug with the help of physical and chemical tests (Pale catechu and Black catechu).

2. Practical Significance

The organized drugs can be identified by their histological characters while the unorganized drugs which do not have microscopic characters are confirmed by physical and chemical test of the powder drug. The solubility, physical characteristics and chemical tests are important parameters for the study of unorganized drugs. Performance of physical and chemical test will identify and confirm the powdered unorganized drug.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Perform physical and chemical test for identification and confirmation of Pale catechu and Black catechu.	CO4	4
2	Recall physical and chemical test for identification and confirmation of Pale catechu and Black catechu.	CO4	2

4. Relevant Theoretical Background

The factors considered under physical tests include mainly the colour, odour, taste solubility, etc. The chemical tests should be performed to confirm the genuine identity of the unorganized crude drug.

5. Theory:

A. Pale catechu

a) **Synonyms:** Gambier catechu

b) **Biological Source:**
Gambier or Pale catechu is dried aqueous extract prepared from the leaves and young twigs of *Uncaria gambier* family Rubiaceae.

c) **Physical Tests:**
- **Colour:** Reddish brown and inner surface is porous and its colour is pale brown to buff.
- **Odour:** No odour.
- **Taste:** Astringent but somewhat bitter and later sweet.
- **Shape:** Pale catechu occurs in cubes, each side of which is about 2.5 cm. Sometimes cubes are broken or attached to one another.
- **Solubility:** Soluble in water or alcohol.

d) **Chemical Constituents:**
- It contains condensed tannins which on hydrolysis gives catechu tannic acid.
- On heating it produces a water insoluble red coloured complex known as catechu red or phlobaphene.
- It also contains quercetin, chlorophyll and gambier florescin.

e) **Uses:**
- It is used as an astringent and in the treatment of diarrhoea and dysentery.

- It is used in tanning and dyeing industries.

B. Black catechu

a) **Synonyms:** Cutch, kattha, khadir, khair.

b) **Biological Source:**
Black catechu is the dried aqueous extract prepared from the heartwood of *Acacia catechu* family Leguminosae.

c) **Physical Tests:**
- **Colour:** Light brown to black.
- **Odour:** None.
- **Taste:** Very astringent.
- **Size:** About 2.5 to 5 cm.
- **Shape:** Cube or irregular fragments of broken cube or brick shaped pieces.
- **Solubility:** Soluble in water or alcohol.

d) **Chemical Constituents:**
- It contains condensed tannins which on hydrolysis gives catechu tannic acid.
- It also contains quercetin, gum and catechu red.
- It does not contain chlorophyll and gambier florescin.

e) **Uses:**
- It is used as an astringent.
- It is used for digestive purposes, for the treatment of sore throat, mouth ulcers and in cough.
- It is used in tanning and dyeing industries.
- It is used for the manufacture of stencils and printer inks.

6. Requirements

a. **Apparatus:** Test tubes, test tube holder, test tube stand, watch glass, china dishes, beaker, brush, match box.

b. **Crude Drugs:** Pale catechu and Black catechu.

c. **Chemicals:** Ferric chloride solution, vanillin, hydrochloric acid, lime water, alcohol, sodium hydroxide solution, light petroleum, chloroform, water.

7. Precautions to be taken (if any):
Handle concentrated chemicals carefully.

8. Procedure

Sr. No	Tests	Observation	
		Pale catechu	**Black catechu**
1	Gambier Fluoroscein Test: Boil a little powdered drug with alcohol, filter and add sodium hydroxide solution to the filtrate, stir and add few ml of light petroleum.	Petroleum layer shows green fluoroscence.	Black catechu does not show this test
2	Heat about 0.5 gm of powdered drug with 5 ml of chloroform in a dish and evaporate the filtrate on water bath.	A greenish yellow residue is left due to the presence of chlorophyll in the drug.	In black catechu this test is negative because there is no chlorophyll present in it.

Sr. No	Tests	Observation	
		Pale catechu	**Black catechu**
3	Match Stick Test: Dip the wooden match stick in the solution of the drug and dry it over a flame. Moisten the stick with hydrochloric acid and warm.	Purple colour appears on the match stick due to the conversion of catechu into phloroglucinol.	Purple colour appears on the match stick due to the conversion of catechu into phloroglucinol.
4	Vanillin Hydrochloric Acid Test: Make a solution containing vanillin 1 ml, alcohol 10 ml and dilute hydrochloric acid 10 ml.	Pink or red colour due to the formation of phloroglucinol.	Pink or red colour due to the formation of phloroglucinol.
5	Ferric chloride Test: To 2 ml of test solution add 2 - 3 drops of ferric chloride solution.	Greenish black coloured precipitate	It gives bluish black colour
6	Aqueous solution of drug with lime water	--	It gives brown colour

9. Observations (Write the observation and inference)

Observation Table:

Unorganized Powder Drug	**Physical Test**		**Chemical Test**		
Pale catechu	Test	Observation	Test No.	Observation	Inference
	Colour		1.		
	Odour		2.		
	Taste		3.		
	Solubility	Soluble in: Insoluble in:	4.		
Black catechu	Colour		1.		
	Odour		2.		
	Taste		3.		
	Solubility	Soluble in: Insoluble in:	4.		

10. Conclusion

On the basis of physical and chemical tests, the given unknown crude drugs are confirmed to be _____ and _____.

11. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, Nirali Prakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy& Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

12. Practical Related Questions

a. Write the biological source of pale catechu.
b. Write match stick test for pale catechu.
c. What are the chemical constituents of black catechu?
d. Write the biological source of black catechu.
e. How chemically pale and black catechu are differentiated from each other by chemical test?

(Space for Answers)

13. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 25
Identification of Castor Oil and Acacia by Physical and Chemical Tests.

1. Aim

To identify unknown unorganized powder drug with the help of physical and chemical tests (Castor oil and Acacia).

2. Practical Significance

The organized drugs can be identified by their histological characters while the unorganized drugs which do not have microscopic characters are confirmed by physical and chemical test of the powder drug. The solubility, physical characteristics and chemical tests are important parameters for the study of unorganized drugs. Performance of physical and chemical test will identify and confirm the powdered unorganized drug.

3. Practical Outcomes (PrO)

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Perform physical and chemical test for identification and confirmation of Castor Oil and Acacia.	CO4	4
2	Recall physical and chemical test for identification and confirmation of Castor Oil and Acacia.	CO4	2

4. Relevant Theoretical Background

The factors considered under physical tests include mainly the colour, odour, taste solubility, etc. The chemical tests should be performed to confirm the genuine identity of the unorganized crude drug.

5. Theory:

A. Castor oil

a) **Synonyms:** Oleum Ricini, Ricinus oil

b) **Biological Source:**
Castor oil is the fixed oil obtained by cold expression of the seeds of *Ricinus communis* Linn., belonging to family Euphorbiaceae.

c) **Physical characters:**
- **Colour:** Colourless or slightly yellow coloured
- **Odour:** Nauseating
- **Taste:** Slightly Acrid
- **Solubility:** Castor oil is miscible (soluble) in alcohol and immiscible in water

d) **Chemical Constituents:**
It consists of glyceride of ricinoleic acid (90%), isoricinoleic, stearic acids. The viscosity of castor oil is due to ricinoleic acid.

e) **Uses:**
- It is cathartic, fungistatic, used as an ointment base, as a lubricating agent, bowel stimulant and relieves constipation.
- It is used as an emollient in the preparation of lipsticks, in tooth formulation, as an ingredient in hair oil.
- It is used in abortificient creams and jellies

B. Acacia

a) **Synonyms:** Acacia gum, Indian Gum and Gum Arabic.

b) **Biological Source:**
It is dried gummy exudation obtained from the stems and branches of *Acacia arabica* Willd, belonging to family Leguminosae.

c) **Physical Tests:**
- **Colour:** Tears are usually white, pale-yellow and sometimes creamish-brown to red incolour. The powder is offwhite, pale-yellow or light-brown in appearance
- **Odour:** Odourless
- **Taste:** Bland and mucilaginous
- **Shape and Size:** Tears are mostly spheroidal or ovoid in shape and having a diameter of about 2.5–3.0 cm
- **Appearance:** Tears are invariably opaque either due to the presence of cracks or fissures produced on the outer surface during the process or ripening. The fracture is usually very brittle in nature and the exposed surface appears to be glossy
- **Solubility**: Soluble in water, the watery solution is viscous and insoluble in alcohol.

d) **Chemical constituents:**
- It consists mainly of Arabin which is complex mixture of calcium, potassium, magnesium salt of Arabic acid. Arabic acid on hydrolysis gives D-Galactose and L-Rhamnose.
- It contains 12–15% of water and enzymes such as oxidases, peroxidases and pectinases.

e) **Uses:**
- It is used as a demulcent, binding agent, as colloidal stabilizer, pharmaceutical aid as emulsifying and thickening agent.
- It has consistency similar to blood and is administered intravenously in haemodialysis.
- It is used in the manufacture of adhesives and ink, and as a binding medium for marbling colours

6. Requirements

a. **Glassware**: Test-tube, test-tube holder, beaker, matchbox.

b. **Crude drug**: Castor Oil, Acacia

c. **Chemicals**: Alcohol, light petroleum, Lead subacetate, dil.HCl, Fehling's A solution, Fehling's B solution, Borax, Ruthenium red.

7. Precautions to be taken (if any):
Handle concentrated chemicals carefully

8. Procedure

A. Castor Oil

Sr. No	Tests	Observation
1	5 ml of light petroleum (50° to 60°) when mixed with 10 ml of castor oil at 15.5°	A clear solution, partly soluble in two volumes
2	Add equal volume of alcohol to Castor oil	A clear solution is obtained,on cooling upto three hours liquid remains clear

B. Acacia

Sr. No	Tests	Observation
1	Lead sub acetate Test: An aqueous solution of acacia when treated with lead sub acetate solution	Gelatinization of solution.
2	Reducing sugars Test: Treat an aqueous solution of Acacia with dilute HC1, add Fehling's A solution and Fehling's B solution and boil.	A brick-red precipitate of cuprous oxide
3	Borax Test: An aqueous solution of acacia on treatment with borax	Stiff translucent mass
4	Ruthenium Red Test: Mount small quantity of drug, add ruthenium red on slide, examine under microscope.	Particle does not become pink

9. Observations (Write the observation and inference)

Unorganized powdered drug	Tests	Observation	Tests	Observation	Inference
Castor Oil	Colour		1		
	Odour		2		
	Taste				
	Solubility				
Acacia	Colour		1		
	Odour		2		
	Taste		3		
	Solubility		4		
			5		

10. Conclusion

On the basis of physical and chemical tests, the given unknown crude drugs are confirmed to be _____ and _____.

11. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.

d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

12. Practical Related Questions

a. Enlist the uses of Castor oil.
b. Describe various chemical Tests for Acacia.
c. Write biological source of Castor oil.
d. Write pharmaceutical uses of Acacia.
e. Write biological source of Acacia.

(Space for Answers)

13. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 26
Identification of Tragacanth and Agar by Physical and Chemical Tests

1. Aim

To identify unknown unorganized powder drug with the help of physical and chemical tests (Tragacanth and Agar).

2. Practical Significance

The organized drugs can be identified by their histological characters while the unorganized drugs which do not have microscopic characters are confirmed by physical and chemical test of the powder drug. The solubility, physical characteristics and chemical tests are important parameters for the study of unorganized drugs. Performance of physical and chemical test will identify and confirm the powdered unorganized drug.

3. Practical Outcomes (PrO):

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Perform physical and chemical test for identification and confirmation of Tragacanth and Agar.	CO4	4
2	Recall physical and chemical test for identification and confirmation of Tragacanth and Agar.	CO4	2

4. Relevant Theoretical Background

The factors considered under physical tests include mainly the colour, odour, taste solubility, etc. The chemical tests should be performed to confirm the genuine identity of the unorganized crude drug.

5. Theory:

A. Tragacanth

a) **Synonyms:** Gum tragacanth

b) **Biological Source:**
Tragacanth is the air-dried gummy exudates, flowing naturally or obtained by incision, from the stems and branches of *Astragalus gummifer* Labill and certain other species of *Astragalus*, belonging to family Leguminosae.

c) **Physical Tests:**
- **Colour:** The flakes are white or pale yellowish-white
- **Odour:** Odourless
- **Taste:** Mucilaginous
- **Size and shape:** Tragacanth occurs in the form of ribbon or flakes. Flakes are approximately 25 x 12 x 2 mm in size
- **Appearance**: The gum is horny, translucent with transverse and longitudinal ridges.
- **Fracture:** Fracture is short
- **Solubility:** Partly soluble in water and insoluble in alcohol.It swells with water.

d) **Chemical Constituents:**
- It contains mainly water-soluble fraction called tragacanthin (30–40%) and water insoluble fraction called bassorin (60% to 70%).
- On hydrolysis it gives Galactose, xylose and galacturonic acid.

- The viscosity of tragacanth is due to the water insoluble part.

e) **Uses:**
- It is used as a demulcent, an emollient a thickening, suspending and as an emulsifying agent, a binding agent, an adhesive and as a stabilizer.
- It is also used in lotions and in spermicidal jellies.
- In industrial production of coatings, employed to make pharmaceuticals and cosmetics.
- It is used in the textile and leather industries and for manufacturing plastics and fibres.

B. Agar

a) **Synonyms:** Agar-agar, Japanese Isinglass

b) **Biological Source:**
It is the dried gelatinous substance obtained by extraction with water from *Gelidium amansii* or various species of red algae like *Gracilaria and Pterocladia*, belonging to family Gelidaceae or Rhodophyceae.

c) **Physical Tests:**
- **Colour:** *Y*ellowish white to grey or colourless
- **Odour:** Slight/odourless
- **Taste:** *M*ucilaginous.
- **Shape:** Strips, flakes or coarse powder
- **Size:** Strips are about 60 cm in length and 4 mm wide. Wide sheets are 50–60 cm long and 10–15 cm wide
- **Solubility**: Insoluble in organic solvents, swells in cold water but soluble in hot water and forms a gelatinous solution after cooling the hot solution.

d) **Chemical constituents:**
- It contains two different polysaccharides known as agarose and agaropectin
- Agarose is responsible for gel property of agar.
- Agaropectin is responsible for the viscosity of agar solution.

e) **Uses:**
- It is used to treat chronic constipation, as a bulk laxative, thickening agent, suspending agent, an emulsifier, and a gelating agent for suppositories, as surgical lubricant, as a tablet excipient, disintegrant, in production of medicinal encapsulation and ointment and as dental impression mold base
- It is used as a gel in nutrient media for bacterial cultures.
- It is used as as thickening agent in food especially confectionaries and dairy products, in meat canning
- It is used for sizing for silk and paper; in dying and printing of fabrics and textiles; and in adhesive

6. Requirements

a. **Glassware**: Test-tube, test-tube holder, beaker, matchbox
b. **Crude drug**: Tragacanth, agar
c. **Chemicals**: Alcohol, light petroleum, $FeCl_3$, lead acetate, KOH, barium chloride, Fehling's solution, conc. HCl, Ruthenium red

7. Precautions to be taken (if any):

Handle concentrated chemicals carefully

8. Procedure

A. Tragacanth

Sr. No	Tests	Observation
1	When a solution of tragacanth is boiled with few drops of FeCl3 [aqueous 10% (w/v)]	Deep-yellow precipitate
2	A 10% aqueous solution of tragacanth treated with dilute solution of lead acetate	A voluminous flocculant precipitate
3	Tragacanth with Iodine solution	Olive green colour is produced.
4	Add 5% Caustic potash to Tragacanth.	Cannary yellow colour.
5	Tragacanth with ruthenium red solution.	Particles does not acquire red colour

B. Agar

Sr. No	Tests	Observation
1	Agar when warmed with solution of KOH	A canary yellow colour
2	Prepare an aqueous solution of agar (1%) in boiling water. Add iodine solution to the jelly	On cooling it sets into a stiff jelly Jelly turns deep blue
3	Add N/20 iodine soution to agar solution	A deep crimson to brown colour is obtained
4	To Agar powder a solution of ruthenium red is added and observe under microscope.	Red or pink colour agar particles.
5	Hydrolyse aqueous solution of agar (1%) with concentrated HCl by heating for 5–10 min. On addition of barium chloride solution to the reaction mixture.	A white precipitate is obtained.

9. Observations (Write the observation and inference):

Unorganized powdered drug	Tests	Observation	Tests	Observation	Inference
Tragacanth	Colour		1		
	Odour		2		
	Taste		3		
	Solubility	Soluble in:	4		
			5		

Unorganized powdered drug	Tests	Observation	Tests	Observation	Inference
		Insoluble in:	6		
Agar	Colour		1		
	Odour		2		
	Taste		3		
	Solubility	Soluble in:	4		
		Insoluble in:	5		

10. Conclusion

On the basis of physical and chemical tests, the given unknown crude drugs are confirmed to be _____ and _____.

11. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy & Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

12. Practical Related Questions

a. Explain barium chloride test for Agar.
b. Describe various chemical Test for Tragacanth.
c. Write biological source of Agar and Tragacanth.
d. Write the pharmaceutical uses of Tragacanth
e. Write any two distinguishing chemical test between Tragacanth and Agar.

(Space for Answers)

13. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

Experiment No. 27
Identification of Guar Gum and Gelatin by Physical and Chemical Tests

1. Aim

To identify unknown unorganized powder drug with the help of physical and chemical tests (Guar gum and Gelatin).

2. Practical Significance

The organized drugs can be identified by their histological characters while the unorganized drugs which do not have microscopic characters are confirmed by physical and chemical test of the powder drug. The solubility, physical characteristics and chemical tests are important parameters for the study of unorganized drugs. Performance of physical and chemical test will identify and confirm the powdered unorganized drug.

3. Practical Outcomes

After completion of this practical, the students will be able to

PrO	Practical Outcomes	Mapped CO	BTL
1	Perform physical and chemical test for identification and confirmation of Guar Gum and Gelatin	CO4	4
2	Recall physical and chemical test for identification and confirmation of Guar Gum and Gelatin	CO4	2

4. Relevant Theoretical Background

The factors considered under physical tests include mainly the colour, odour, taste solubility. The chemical tests should be performed to confirm the genuine identity of the unorganized crude drug.

5. Theory

A. Guar gum

a) **Synonyms:** Guar flour, Jaguar gum

b) **Biological Source**

Guar gum is the powder of the endosperm of the seeds of plant *Cyamopsis tetragonolobus* Linn., family Leguminosae.

c) **Physical Tests:**

- **Colour:** Yellowish white coloured
- **Odour:** Characteristic
- **Taste:** Gummy, mucilagenous, characteristic
- **Solubility:** It is dispersible in water forming a thick colloidal solution because it swells rapidly in water. It is insoluble in alcohol.

d) **Chemical Constituents:**

- It contains mainly water-soluble fraction called Guaran (high molecular weight hydro-colloidal polysaccharide) and a water insoluble fraction.
- Guaran on hydrolysis gives galactose and mannose.

e) **Uses:**

It is used as a stabilizer, protective colloid, thickening agent, binding agent, disintegrating agent, emulsifying agent and film forming agent.

B. Gelatin

a) **Synonyms:** Gelatine.

b) **Biological Source:**
Gelatin is a protein derivative obtained by evaporating an aqueous extract made from bones, skins, and tendons of various domestic animals.

c) **Physical Tests:**
- **Colour:** Colourless or pale yellow.
- **Odour:** Characteristic.
- **Taste:** Slight and broath like.
- **Size:** It is obtained in the form of shreds, sheets, flakes and coarse or fine powder.
- **Solubility:** It is practically insoluble in cold water but swells and softens when immersed.

d) **Chemical Constituents:**
Gelatin mainly consists of protein gluten and 17 to 20 % of moisture. It also contains nitrogenous substances and amino acid lysine.

e) **Uses:**
- Gelatin is mainly used in the manufacture of hard and soft gelatin capsules.
- It is also used for preparing pastes, pessaries and suppositories.
- Gelatin is used in the preparation of bacteriological culture media.
- It is used in the treatment of brittle finger nails.
- Combined with zinc, it forms zinc gelatin which is employed as a topical protectant.
- It is used for inhibiting crystallization in bacteriology, for preparing cultures and as a nutrient.

6. Requirements

a. **Apparatus:** Test tubes, test tube holder, test tube stand, watch glass, china dishes, beaker, brush, match box, etc.

b. **Crude Drug:** Guar gum and Gelatin.

c. **Chemicals:** Lead acetate solution, borax, benzidine, ethanol, hydrogen peroxide, copper sulphate solution, nitric acid, Millon's reagent, sodalime, picric acid, etc.

7. Precautions to be taken (if any):

Handle concentrated chemicals carefully.

8. Procedure

A. Guar gum

Sr.No	Tests	Observation
1	A 2 % solution of lead acetate with guar gum	A white precipitate is obtained
2	Add small amount of borax in aqueous solution of Guar gum.	Gel is formed
3	A solution of guar gum (0.25 gm in 10 ml of water) when mixed with 0.5 ml of benzidine solution (1 % in ethanol) and 0.5 ml of hydrogen peroxide.	No blue colouration.
4	Guar Gum with Ruthenium red.	Particles does not aquire pink colour

B. Gelatin

Sr.No	Tests	Observation
1	Biuret reaction: To alkaline solution of a gelatin (2 ml), a dilute solution of copper sulphate is added.	A red or violet colour is formed
2	**Xanthoproteic reaction:** Gelatin when warmed with concentrated nitric acid.	Forms a yellow colour. This colour becomes orange when the solution is made alkaline.
3	**Millon's reaction:** Add Millon's reagent (mercuric nitrate in nitric acid containing a trace of nitrous acid) to gelatin solution which turns red on heating.	A white precipitate is obtained.
4	On heating gelatin (1 g) with soda lime.	Smell of ammonia is produced.
5	Aqueous solution of gelatin add few drops of tannic acid / picric acid	A precipitate is formed.

9. Observations (Write the observation and inference):

Unorganized Powder Drug	Physical Test		Chemical Test		
	Test	**Observation**	**Test No.**	**Observation**	**Inference**
Guar gum	Colour		1.		
	Odour		2.		
	Taste		3.		
	Solubility	Soluble in: Insoluble in:	4.		
Gelatin	Colour		1.		
	Odour		2.		
	Taste		3.		
	Solubility	Soluble in: Insoluble in:	4.		
			5		
			6		

10. Conclusion

On the basis of physical and chemical tests, the given unknown crude drugs are confirmed to be _____ and _____.

11. References

a. Pharmacognosy - Trease and Evans, Elsevier Publications, London.
b. Pharmacognosy - C. K. Kokate *et al*, NiraliPrakashan, Pune.
c. Practical Pharmacognosy - Techniques and Experiments - Dr. K. R. Khandelwal, Nirali Prakashan, Pune.
d. A Practical Book on Pharmacognosy& Phytochemistry - Dr. Harshal A Pawar, Everest Publications.
e. Experimental Techniques of Pharmacognosy and Phytochemistry - Dr. Sunil Pawar *et al*, Career Publications.
f. Textbook of Pharmacognosy and Phytochemistry - Biren N. Shah, A.K. Seth, Elsevier Publications, Delhi.
g. Anatomy of Crude Drugs - M. A. Iyengar and S. C. K. Nayak.

12. Practical Related Questions

a. Write the biological source of Guar gum.
b. Write Biuret test for Gelatin.
c. What are the chemical constituents of Guar gum?
d. Write the biological source of Gelatin.
e. Write the pharmaceutical uses of Guar gum and Gelatin.

(*Space for Answers*)

13. Assessment Scheme

Particular	Understanding the basic concept (Intellectual skill)	Activities (Motor skill)	Cleanliness & Handling (Affective domain)	Viva-voce / Answers Written	Total	Signature of teacher
Marks Obtained						
Max Marks	**02**	**05**	**01**	**02**	**10**	

GUIDELINES FOR CONDUCTING SESSIONAL PRACTICAL EXAMINATION

Course Name: Pharmacognosy – Practical (PYP)

Course Code: 20053 Year: First Year (PH1J)

Max Time: 3 Hrs Max. Marks: 80

Q. 1. Synopsis **(10 M)**

Five questions of 02 marks each based on theoretical parts related with the crude drugs such as extra features of drug or identification of different varieties of same drug, specific identification tests for crude drugs, specific anatomical characters of crude drugs, pharmacognostic study of crude drugs

Q. 2. Experiments **(50 M)**

a) **Major experiment** **(30 M)**
Identify the given crude drug with the help of microscopical characters. (Coriander, Ajowan, Cinnamon, Cinchona, Vasaka, Datura, Ashwagandha, Liquorice, Curcuma, Clove, Nux Vomica).

b) **Minor experiment - I** **(10 M)**
Identify the given crude drug with the help of physical and chemical tests. (Asafoetida, Benzoin, Pale catechu, Black catechu, Castor oil, Acacia, Tragacanth, Agar, Guar gum, Gelatin).

c) **Minor experiment – (Spotting)** **(10 M)**
Identify the given crude drug with the help of morphological characters and give its biological source, chemical constituents and uses.
(Isapghula, Senna, Coriander, Fennel, Cardamom, Ginger, Nutmeg, Black pepper, Cinnamon, Clove, Ephedra, Rauwolfia, Gokhru, Punarnava, Cinchona, Agar).

Q. 3. Viva-voce **(10 M)**

Q. 4 Practical Record Maintenance **(10 M)**

Internal assessment: The marks secured by the students out of the total of 80 shall be reduced to 10 in each sessional, and then the internal assessment shall be calculated based on the best two averages for 10 marks from the sessional; 05 marks shall be awarded based on the average of all three assignments and 05 marks awarded for based on average of field visit reports.

GUIDELINES FOR CONDUCTING ANNUAL PRACTICAL EXAMINATION

Course Name: Pharmacognosy – Practical (PYP)

Course Code: 20053 Year: First Year (PH1J)

Max Time: 3 Hrs Max. Marks: 80

Q. 1. Synopsis **(10 M)**

Five questions of 02 marks each based on theoretical parts related with the crude drugs such as extra features of drug or identification of different varieties of same drug, specific identification tests for crude drugs, specific anatomical characters of crude drugs, pharmacognostic study of crude drugs

Q. 2. Experiments **(60 M)**

A. Major experiment **(30 M)**

Identify the given crude drug with the help of microscopical characters. (Coriander, Ajowan, Cinnamon, Cinchona, Vasaka, Datura, Ashwagandha, Liquorice, Curcuma, Clove, Nux Vomica).

B. Minor experiment - I **(20 M)**

Identify the given crude drug with the help of physical and chemical tests. (Asafoetida, Benzoin, Pale catechu, Black catechu, Castor oil, Acacia, Tragacanth, Agar, Guar gum, Gelatin).

C. Minor experiment – (Spotting) **(10 M)**

Identify the given crude drug with the help of morphological characters and give its biological source, chemical constituents and uses.

(Isapghula, Senna, Coriander, Fennel, Cardamom, Ginger, Nutmeg, Black pepper, Cinnamon, Clove, Ephedra, Rauwolfia, Gokhru, Punarnava, Cinchona, Agar).

Q. 3. Viva-voce **(10 M)**

Viva should be conducted on theory and practical based questions.