AR-7480

B. Pharm. (Fifth Semester) Examination, 2013

Pharmacognosy-III

Section-A

(Short Answer Type Questions)

Note: Attempt all questions. Each question carries 02 marks. **24**

1. **Describe a general chemical test for the detection of glycosides.**
   Molisch's test is used as a general chemical test for detection of glycosides. In this test, to a small volume of dilute extract of the test sample, a few drops of alcoholic solution of α-napthol is added. Then one ml of conc. sulphuric acid is added from the side of the inclined test tube. Violet ring at the junction of two layers indicated the presence of glycosides.
2. **What is Red Ginseng?**
   The roots of *Panax ginseng,* family Araliaceae, after collection are subjected to steaming and then dried by using artificial drying method. The steamed and dried roots that attain reddish color are known as red ginseng.
3. **Write important medicinal uses of diosgenin.**
   Diosgenin is converted to 16-dehydropregnenolone acetate which is further used as a starting material in the synthesis of steroidal hormones namely corticosteroids, sex hormones, oral contraceptive agents and other steroidal drugs.
4. **Explain the role of deoxy sugars in cardiac activity.**
   The presence of deoxy sugars at 3-β-hydroxy position renders the glycoside more soluble and increase its power of fixation to the myocardium.
5. **Describe botanical and geographical source of Cape aloe.**
   Cape aloe consists of the drug collected from *Aloe ferox* family Liliaceae and its hybrid with *Aloe africana.* It is mostly produced in South Africa and Kenya.
6. **Explain Bourntrager test and its application.**
   Bourntrager test is used for the detection of anthraquinone glycosides. Small quantity of crude drug is extracted with organic solvents like chloroform. The dilute extract is treated with small volume of ammonia. Ammoniacal layer develops pink to red colour indicating the presence of anthraquinone glycosides.
7. **Write the pharmaceutical uses of khellin and visnagin.**
   Khellin and visnagin are potent coronary vasodilator. It is used in the form of tablets and injections for the treatment of angina pectoris and bronchial asthma.
8. **Name important bitter constituents of Quassia.**
   Quassia wood contains bitter diterpenoid lactones compounds which are also termed as amaroids or quassinoids. It mainly contains lactone quassin, neoquassin and isoquassin.
9. **Write biological source and one ayurvedic formulation of Amla.**

Amla is the traditional drug of India obtained from the fresh or dried mature fruits of *Emblica officinalis* or *Phylanthus emblica* family Euphorbiaceae. Triphala churna is one of the most popular ayurvedic formulation which consist of the equal proportion of Amla, Baheda (*Terminalia belerica*) and Harde (*Terminalia chebula*).

10. Write the names of the chemical constituents of Guggal which are responsible for cholesterol and lipid lowering activity.

Guggulsterone (e-guggulsterone & z-guggulsterone) and guggulsterol are the main steroidal constituents of Guggal which are responsible for cholesterol and lipid lowering activity.

11. Explain the term, 'Hay Fever'.

Inhalant plant allergens come in contact of the nasal and buccal mucosa during respiration. The symptom is restricted to the nasal mucosa and manifested by sneezing, lacrimation, eatching and swelling of nose and eyes. This condition is known as hay fever or sinusitis.

12. Write the source and activity of diastase.

Diastase is the amylolytic enzyme obtained from the dried barley grains of one or more varieties of *Hordeum vulgare*, family Poaceae. It is also known as malt extract.

Section-B

(Long Answer Type Questions)

*Note: Attempt any **four** questions. Each question carries 14 marks.*

Section-II (Long Type Question-Solve any four Questions, All Questions carry equal marks) 56

1a. Write descriptive note on the pharmacognosy of Indian Senna.

Synonyms: Tinnevelly Senna, Indian Senna

Biological Source: Indian Senna leaf consists of dried leaflets of *Cassia angustifolia* which is commercially known as Tinnevelly senna. It belongs to subfamily Caesalpinoideae, family Leguminosae.

Geographical Source: Indian or Tinnervelly senna is indigenous to southern Arabia and cultivated in Tinnevelly and Ramnathpuram districts of Tamilnadu. It also grows in Somaliland, Sindh and Punjab region.

Cultivation, Collection and Preparation: Tinnevelly senna is mostly cultivated in well ploughed, levelled, rich clayed semi-irrigated land sometimes after the paddy crop in South India. Propagation is done by seeds which are rubbed with coarse sand and sown thinly by broadcasting or in rows 30 cm apart, first in February - March, and second after the rains in July. Seeds germinate on the third day. The crop becomes ready for harvesting after about two months but first, plucking of leaflets is done after three months of sowing when the leaves appear mature, thick and bluish in colour. The second plucking is followed after a month and subsequent pluckings after 4 to 6 weeks. Leaflets of Tinnevelly senna are collected by careful plucking from luxuriantly grown plants and compressed into bales.

Characteristics: Senna leaflets are 3 to 5 cm long, 2 cm wide and about 0.5 mm thick. It shows acute apex, entire margin and asymmetric base. The outline is lanceolate to ovate lanceolate. Leaves of Indian senna are yellowish green, less broken and firmer in texture. The odour of the leaves is slight but characteristic. The taste is bitter and mucilagenous.

Chemical Constituents: Senna leaves consist of anthraquinone glycosides as the major thera-peutically active chemical constituents. Two major crystalline glycosides sennoside A and sennoside B are present. Sennoside A is dextrorota-tory while sennoside B is a meso compound. These are homodianthrone of rhein with a glycosyl unit at 8 and 8-position of homo-dianthrone moiety. Hydrolysis of sennoside A and B affords respectively, two molecules of glucose and two aglycones, that is, sennidin A and B which retain the same stereochemical configuration as that of their original glycosides. Indian senna gives 1.2 to 2.5 per cent of these two glycosides.

Other heterodianthrone glycosides of rhein, and aloe-emodin, sennoside C (dextrorotatory) and sennoside D (meso) are also present in the leaves. Among the other compounds are palmidin A, aloe-emodin, dianthrone diglycoside, rhein anthrone glycoside, rhein diglucosides, aloe-emodin glucoside and aloe-emodin diglucoside.

Two naphthalene glycosides tinnevelin and 6-hydroxy musizin have been reported in senna leaves . Senna also contains kaempferol, its glucoside kaempferin and isorhamnetin. It also shows the presence of phytosterol, its glycoside, resin, mucilage and calcium oxalate.

Uses: Senna is used as a purgative drug. Primary glycosides of reduced derivatives are more active than free anthraquinones. Purgative activity is markedly due to sennosides A and B while sennosides C and D exert a powerful synergistic effect upon the purgative action of previous two glycosides. Senna glycosides stimulate the gastrointestinal mucosa and produce the purgative effect. It is used, especially, in cases of habitual constipation but when used alone, it causes gripping effect on the intestine. To avoid the side effect, senna is usually combined with carminative drugs like Dill, Cardamom and anti-spasmodic agents such as Belladonna or Hyoscyamus.

Substitutes and Adulterants: Dog senna is obtained from *Cassia obovata* found in upper Egypt and France. It is cultivated in Italy and sometimes ref-erred to as Italian senna.

Palthe senna leaves are obtained from *Cassia auriculata.*

Arabian Senna and Mecca or Bombay Senna leaves are obtained from the wild plants of *Cassia angustifolia* grown in Arabia.

1b. Write a detailed note on Gentian as a bitter glycoside containing drug.

Synonyms: Gentian, Gentian root

Biological Source: Gentian root consists of dried or dried and fermented roots, and rhizomes of yellow gentian, *Gentiana lutea*, family Gentianaceae.

Geographical Source: Gentian is a perennial herb indigenous to Central Europe. It is abundantly grown in the mountainous regions of Central and Southern Europe, important regions being Pyrenees, Jura, Vosges mountains and Black Forest. It is also grown in Turkey,Yugoslavia and Spain..

Collection and Preparation: The drug is generally collected in the wild. However, as these plants are rapidly disappearing, cultivation has started in some countries of Europe. The plant is a perennial herb that flowers from June to August. The plant produces an erect rhizome which gives away large fleshy roots that runs horizontally a short distance below the surface of the earth. When the plants are 2 to 5 years old, rhizomes and roots are dug up in autumn. When fresh, they are whitish internally and almost odourless, but during slow drying its colour changes to yellowish brown and also develops distinctive odour. In some areas the drug is not directly dried after collection. It is made into heaps and sometimes covered with earth. This process is practiced for allowing the fresh drug to heat and ferment. The drug darkens in colour and acquires the desired odour and loses some of its bitterness by the process of heaping and fermentation. It is then washed and cut into suitable lengths and subjected to drying, first in the open air and then in shed.

Characteristics: Fermented and dried drug is referred to as red gentian is a commercial drug whereas unfermented and dried 'white' gentian is also found in market. The plant produces cylindrical rhizomes of about 4 cm diameter and roots more than 1 m in length. The fresh root is whitish and fleshy internally and practically odourless. The rhizomes are generally larger in size. They frequently bear some apical buds and scars of leaves and rootlets. Dried rhizomes bear transverse wrinkles while roots are longitudinally wrinkled. Scattered small circular scars of rootlets are found on the dried roots. The drug is brittle when perfectly dry but readily absorbs moisture during storage. The drug has a short and even fracture when dry, but is tough and flexible when moist. The odour is pleasant and characteristic and the taste is sweetish initially and afterwards intensely bitter.

Chemical Constituents: Gentian roots and rhizome contains bitter glycosides, alkaloids, yellow colourinig matters, pectin, sugars and fixed oil.

Gentian contain secoiridoid glycoside gentiopicroside as a principal constituent to the extent of about 2%. Gentropicroside on hydrolysis yield gentiogenin and glucose. A biphenolic acid ester of gentiopicroside known as amarogentin is present upto about 0.025 to 0.05 per cent is considered to be 5000 times more bitter than gentiopicroside. The other bitter compounds include sweroside and swertiamarin.

The yellow colouring matter of gentian consists of xanthones and include gentisin, isogentisin and gentioside. Gentian also contains gentisic acid and about 0.03 per cent of the alkaloids gentianine and gentialutine. Gentian is rich in trisaccharide gentianose and the disaccharides gentiobiose and sucrose.

The bitterness value of gentian roots should not be less than 10,000 when determined by comparison with quinine (2,00,000). It should yield 33 to 40 per cent of water soluble extractive but fermented roots yield lesser extractives.

Uses: Gentian is used as a bitter tonic. Internally, the drug is used in the form of infusions, tinctures and extract as a tonic and stomachic, in eradicating intestinal worms and in veterinary medicine. An alcoholic infusion of gentian, along with bitter orange peel and lemon peel, has been used as an ingredient in a number of bitter mixtures. Gentian is also used in homeopathic medicine. Gentian is employed by the food industry in the preparation of bitter beverages and aperitifs in which case use is made of fermented drug.

Adulterants: The rhizomes of *Rumex alpinus*, family Polygonaceae are sometimes found along with official drug. These are reddish brown, astringent, bitter and gives the test of anthraquinone, derivatives. *Laserpitium latifolium*, family Umbelliferae yield roots alike to white gentian. The rhizomes of *Veratrum album* are occasionally found in gentian due to careless collection.

2a. Describe biological source, cultivation, collection, chemical constituents and uses of Stropanthus.

Biological Source: Strophanthus consists of dried, ripe seeds of *Strophanthus kombe* Oliver, family Apocynaceae which are freed from the awns and endocarps.

Cultivation, Collection and Preparation: Most of the drug of commerce is obtained from wild plants because the natural habitat of Strophanthus can not be easily reproduced. As the drug is required in small quantities, the present supplies fulfil demands. No specialised technical workers are necessary for the collection and preparation of Strophanthus seeds. However, if suitable conditions for the cultivation of Strophanthus are available, the cost of the drug would be higher.

The plants are very large, woody climbers which take the support of large trees in the forests of Africa. The mature fruits are collected mostly from wild plants and to some extent from the cultivated plants in June-July. The fruits contain two dehiscent divergent follicles and many seeds. After the collection of fruits, the outer epicarp and fleshy mesocarp is removed completely and the seeds are separated from yellow brown leathery endocarp. The awn is usually removed and the seeds are washed and dried thoroughly before drying.

Chemical Constituents: trophanthus seeds contain 8 to 10 per cent of the total glycoside known as K-strophanthin which possesses about 40 per cent of cardiotonic activity as compared to the activity of ouabain. K-strophanthin is a mixture of many glycosides out of which at least twelve have been reported. Some of the major glycosides are K strophanthoside, K-strophanthin β, erysimoside, cymarin and cymarol. Most of these glycosides gives strophanthidin except cymarol, as an agly-cone and different sugars as mentioned in table 14.8.

Strophanthus glycosides and their hydrolytic products

	Hydrolysis Products	
Glycoside	Aglycone	Sugars
K-Strophanthin β	Strophanthidin	Cymarose + β-D-glucose
K-strophanthoside	Strophanthidin	Cymarose + β-D-glucose + α-D-glucose
Cymarin	Strophanthidin	Cymarose
Cymarol	Strophanthidiol	Cymarose

The strophanthus seeds produce green colouration with sulphuric acid. The seeds also contain about 30 per cent of fixed oil, kombic acid, bases such as choline and trigonelline, resins and mucilage.

Uses: Strophanthus seeds show cardiotonic activity which resembles that of digitalis leaves. However, it is a powerful cardiac poison and is more potent as compared to digitalis, and given in the cases of emergency. It is also an efficient diuretic. Unlike digitalis, it is not cumulative and causes lesser gastrointestinal irritation. It has practically no side effects.

2b. Describe Pharmacognosy of Sarsaparilla.

Synonym: Sarsaparilla , smilax

Biological source:: Sarsaparilla consists of dried roots of rhizomes of various species of *Smilax*, fam. Liliaceae. Some species and varieties of *Smilax* are as follows.

Smilax aristolochiifolia, Synonym-Vera cruz, (Mexican sarsaparilla),

Smilax regelii, Synonym-Brown, (Honduras, Jamaican sarsaparilla) and

Smilax febrifuga, Synonym-Guayaquil, (Ecuadorian sarsaparilla)

Cutivation, Collection and Preparation: Sarsaparilla is a climbing plant with woody stem, ascending big tall trees and springing from a stout naughty rhizomes. From the rhizomes, slender roots grows horizontally and creep for many feet below the surface of soil. During collection the roots are first laid bare and then cut off near the rhizomes. Sometimes rhizomes are also collected along with roots. The roots are sun dried and made into bundles. Number of such bundles are placed over one another and tied with wires into bales.

Characteristics: Sarsaparilla roots are about 3m or so in length. Jamaican sarsaparilla is imported in bundles about half a meter long and 12 cm in diameter weighing about one kg. Each bale consists of numerous long slender roots about 3mm thickness doubled up and bound loosely with one of the same root. Dried roots are dark reddish brown in color much shrunken and furrowed longitudinally bearing numerous branching rootlets. Roots are tough yet flexible, not breaking easily even when bent. Drug is nearly odorless but has somewhat sweetish acrid taste.

Chemical constituents: Many Smilax species contain a number of steroidal saponins. Sarsaparilla contains approximately 2% steroidal saponins, including sarsaponin, smilasaponin, sarsaparilloside and its aglycones sarsasaponin, sarsasapogenin, and smilagenin. Other saponins include diosgenin, tigogenin, and asperagenin. Glycoside sarsaponin (sarsaponoside) on hydrolysis yields sarsapogenin, 2 mole of glucose and a mole of rhamnose sugar. Phytosterols listed are sitosterol, stigmasterol, and pollinastanol.

Other constituents present in sarsaparilla include starch (50%), resin, acetyl alcohol, volatile oil, caffeoylshikimic acid, shikimic acid, ferulic acid, sarsapic acid, kaempferol, and quercetin.

Uses: Sarsaparilla has been used for treating syphilis and other sexually transmitted diseases (STDs) throughout the world for 40 years and was documented as an adjuvant for leprosy treatment in 1959. It is used in other skin diseases and in rheumatism. It has also been reported to enhance absorption of other drugs. It is used as a vehicle are large quantities are employed in the manufacture of nonalcoholic drinks. The genin is used in the partial synthesis of steroidal drugs.

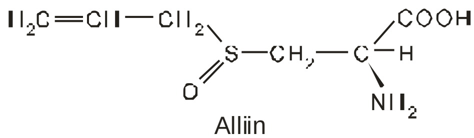
3a. Write a descriptive note on the biological source, morphological features, chemical constituents and uses of Lahsun.

Synonym: Garlic, Allium

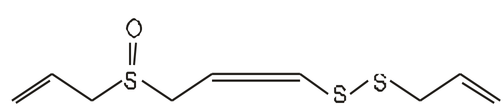
Regional names: Lahsan (Hn.); Lasun (Mr.); Lashuna (Sn.)

Biological source: The drug consists of the fresh ripe bulbs of *Allium sativum* Linn. family Liliaceae. Garlic is a native of Central Asia, from where it spread to the Mediterranean region. Today it is practically worldwide in cultivation. Garlic is a biennial and perennial herb, flowering from June to August. Garlic is propagated from the cloves or the segments of bulbs. They are harvested as soon as the leaves turn yellow for, if this is left till later, the bulbs break up into their individual cloves. When thoroughly dry, the bulbs are stored in dry, frost free premises. Garlic consists of the main ovate bulb and 5 to 15 secondary bulbs, both being surrounded by common white, dry, scaly leaves (Fig.9.6). Garlic has a very strong and disagreeable odour and a strong pungent and persistent taste.

Chemical constituents: The intact cloves of garlic contain odourless sulphur containing amino acid derivative (+)-S-allyl-L-cysteine sulfoxide. This component is called alliin and occurs in garlic upto about 1.2 per cent fresh weight.



Alliin



(Z)-Ajoene

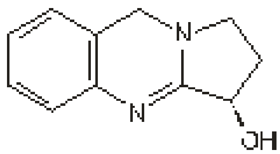
When garlic cloves are crushed, alliin comes in contact with enzyme alliinilase which is present in vacuoles and is converted to allicin or diallyl thiosulphinate as illustrated in Fig. 9.7. Allicin is highly unstable and in the presence of water and oxygen it gets decomposed into polysulphide which is responsible for the unpleasant odour.

The various products of decomposition of allicin include diallyl disulphide, diallyl trisulphide and the corresponding poly-sulphides all of which are strong smelling compounds. (E)-Ajoene and (Z)-Ajoene are formed from allicin which are responsible for its antithrombotic properties.

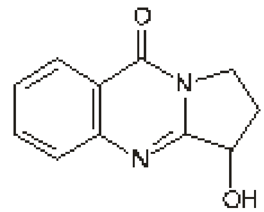
Uses: Since a long time garlic has been consumed both as a food spice and medicine. It is now categorised under the group of nutraceuticals due to its nutritional and medicinal properties. Garlic has expectorant, diaphoretic, disinfectant and diuretic properties. Its juice was formerly used alone or in syrup in the treatment of pulmonary conditions. Garlic juice and extracted essential oil possess antihyperlipidemic activity, enhances blood fibrinolytic activity and inhibits platelets aggregation. Garlic and its component allicin show potent antibacterial and larvaecidal properties. It has also been found useful in the treatment of hypertension. It is also useful in indigestion and intestinal infections. Most of the biological activities of garlic depend upon its ability to produce allicin which, in turn, results in the formation of other active principles.

3b. Name few traditional drugs of India which are used for the treatment of Cough. Write a note on Adusa.

Synonym: Vasaka
Regional name: Arusa (Hn.); Adulsa (Mr.); Vasaka (Sn.)
Biological source: The drug consists of fresh, dried leaves of *Adhatoda zeylanica* medic. Syn. *Adhatoda vasica* Nee, family, Acanthaceae.
Characteristics: *A. vasica* is an evergreen gregarious stiff perennial shrub, 1 to 6 m in height. It is distributed throughout the plains of India, and in the Himalayan ranges upto 1500 m, in Sri Lanka and Malaysia. The shrub grows on water lands and in a variety of habitats and soil. It is sometimes cultivated as a hedge but no systematic cultivation has been undertaken. The shrub is the source of the drug vasaka, well known in the traditional system of medicine. Leaves are elliptic-lanceolate, entire, about 5-30 cm long and light green coloured. The dried leaves are dull brown on the upper surface and light greyish brown on the lower surface. Flowers are white with red or yellow-barred throats in spikes with large bracts (Fig.9.4). The drug has a characteristic odour and a bitter taste.
Chemical constituents: Vasaka contains several alkaloids but the major ones include pyrralazoquinazoline alkaloids vasicine, about 1.3 per cent accompanied by vasicinol, vasicinone and adhatonine. Aliphatic hydroketones such as 37-hydroxy hexateracont-1-en-5 one and 37-hydroxy hentetracontan 19- one have also been reported from vasaka.



Vasicine



Vasicinone

Uses: Traditionally, Vasaka is mainly used as an expectorant and for the treatment of bronchial troubles. The expectorant bronchodilatory properties of the leaves are attributed to vasicine. The drug is employed in different forms such as fresh juice decoction, infusion and powder and also given as an alcoholic extract, liquid extract or syrup. Vasicine exhibits strong respiratory stimulant activity, moderate hypotensive activity and cardiac depressant effect. It also exhibits an abortifacient effect and action similar to oxytocin. It also shows significant antimicrobial activity against gingival inflammation and pyorrhea.Vasaka in large doses causes vomiting and diarrhoea.

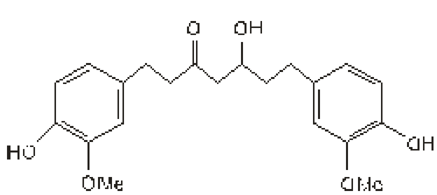
4a. Write a descriptive note on the biological source, morphological features, chemical constituents and uses of Rasna.

Synonym: Lesser Galangal

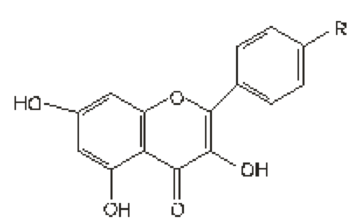
Regional names: Rasna (Hn.); Koshtkulayan (Mr.); Kulanjan (Sn.)

Biological source: The drug consists of rhizomes of *Allpinia officinarum* Hance, family Zingiberaceae. *A. officinarum* is native to China. It is produced in China, Malaysia, Indonesia and India. In India, the drug is cultivated in the plains of West Bengal, Assam, in Eastern Himalayas and also in South India. It is a perennial herb with thick, creeping, reddish- brown rhizomes (Fig.9.8). The plant is propagated from rhizomes like ginger. Rhizomes of lesser galangal are cylindrical, irregularly branched pieces of 5-10 cm length and 2-3 cm thickness. The outer surface shows fine annulations and it breaks with fibrous fracture. Rhizomes have a spicy odour and a pungent taste.

Chemical constituents: Lesser galangal consists of about 0.5-1 per cent essential oil which contains mainly 1,8-cineol, α-pinene, β-pinene, methyl isovalerate, camphene, limonene, camphor, terpen-4-ol and eugenol. It consists of a variety of flavonoids such as quercetin, kaempferide, isorhamnetin, galangin and alpinin. It contains about 20 per cent resins, primarily containing alpinol and galangol. New diarylheptanoids such as 1,7-diphenylhept-4-en-3-one, 7 (4''-hydroxy -3''methoxy phenyl)-1-phenylhept-4-en-3 one and 3R, 5R 1-(4''- hydroxyphenyl)-7-phenylheptan-3,5-diol have been reported from rhizomes.



1,7-bis-(4-Hydroxy-3-methoxyphenyl)-5-hydroxy-heptone-3-one



GalanginR - H

KaempferolR - OH

Uses: Lesser galangal is used as a stomachic, stimulant and carminative. It is used in the treatment of rheumatism. Rhizome shows antifungal activity against a variety of patho-genic fungi including *Trichophyton rubrum, T. mentagrophytes* and *Epidermophyton floccosum.* It is also active against a number of gram-positive and gram-negative bacteria. Diaryl heptanoids present in the rhizome show prostaglandin biosynthesis inhibiting activity.

The essential oil is reported to be used as a modifier in flavours for soft drinks. It blends well with lavender, pine needle, citrus and patchouli oils. Genuine drug is not available in sufficient quantities and most of the drug has been found to be heavily adulterated with rhizomes of *Acorus calamus*. The rhizomes of *A. galangal,* popularly known as greater galangal, are also used as a substitute but they can be easily distinguished from lesser galangal due to the absence of flavonoids in greater galangal.

4b. Describe Apamarg as an important traditional drug of India.

Synonym: Prickly Chaff flower

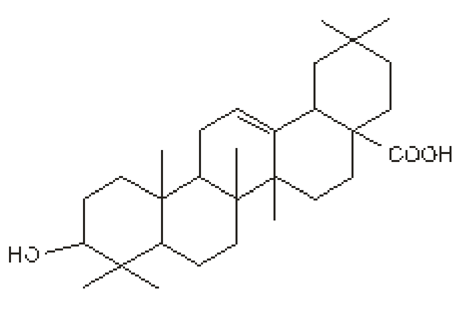
Regional names: Chirchira (Hn.); Aghada (Mr.); Apamarga (Sn.)

Biological source: The drug consists of a dried whole plant of *Achyranthes aspera* Syn. *A. canescens*, family Amaranthaceae.

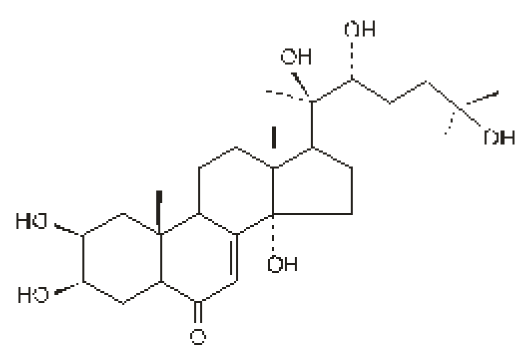
Characteristics: Apamarg is an erect herb or undershrub, annual or perennial, about 1 to 2 m in height often with a woody base. It is commonly found throughout India as a wayside weed. It is also found in the South Andaman Islands.

The stem is angular, ribbed and branched from the base, tinged with reddish-purple colour, leaves ovate-elliptic or obovate-rounded and variable in shape and size. Flowers are greenish-white, in small dense axillary heads or spikes upto 75 cm. long. Seeds are subcylindric, truncate at the apex and rounded at base.

Chemical constituents: *A. aspera* contains triterpenoid saponins as major constituents of the whole drug. The triterpenoid saponins yield oleanolic acid as an aglycone. It also shows the presence of an insect moulting hormone, Ecdysterone, long chain alcohols such as 17-penta-triacontanol, 27-cyclohexylheptacosan-7-ol, long chain ketones and a water soluble base betaine. Two new saponins C and D have been isolated from the fruits.



Oleanolic acid



Ecdysterone

Uses: *A. aspera* is much valued in the indigenous medicine. It is reported to be an astringent and diuretic. A decoction of the plant is useful in pneumonia and renal dropsy, while the juice is useful in opthalmia and dysentery. The leaves are used to cure gonorrhoea while the flowers are used in the treatment of menorrhagia. The roots are astringent and their paste is applied to clear opacity of cornea. It is also reported to be useful in cancer. The plant shows significant abortifacient activity in mice and rabbit. The drug also shows hypoglycemic activity in the normal and diabetic rabbits. Unripe fruits are used in treatment of respiratory diseases. *A. aspera* shows very good abortive activity in experimental animals.

5a. Describe the traditional methods of pest control. Add a note on Neem as a versatile pesticidal agent.

Pest is any animal, plant or micro-organism that causes trouble, injuries or destruction. Thus pesticides may be defined simply as chemical agents used to control or eliminate pest. Worldwide, traditional pesticides represent big business in which the majority of the synthetic pesticides are utilised for agriculture or other purposes.

Methods of pest control: The methods used for the control of pests can be categorised as natural or artificial types of pest controls. Some details of these types of pest controls are discussed below.

Natural Controls: Nature is full of examples of prey-predator relationships. Every pest is more or less hindered in its increase by other predacious organisms. Parasitic pests, predators, and diseases caused by pests are usually the most important factors in natural methods of insect controls. Influence of changes in seasons, topography, changing temperatures, rainfall, soil, atmospheric humidity and other natural factors also show their effect on insects and their hosts. However, in tropical, temperate and frigid climates, pest control methods are generally adapted to topographic conditions.

Artificial Control: Artificial control of pests has been developed by man. These methods can be categorised as mechanical, agricultural, chemical and biological controls which are discussed below.

***Mechanical Control*:** It employs manual labour as well as mechanical devices for collection or destruction of pests. Techniques such as handpicking, pruning, trapping and burning are employed for the destruction of eggs, larvae, pupae and insects.

Agricultural Control: Agriculture control is the oldest in its approach. Deep ploughing for the eradication of weeds and early stages of insects, alternate crop rotation or changing environmental conditions are some methods which lead to obstruction of the life cycle of pests. Nowadays advanced plant breeding techniques such as hybridisation, mutation, polyploidy and biotechnological manipulations are greatly used for production of pest resistant species.

***Chemical Controls* :** Chemical agents are major pesticide agents used for the control of pests throughout the world. These are materials used for the purpose of killing pests or for protecting crops, animals or other properties against the attack of the pest. Insect repellants, attractants, fumigants such as insecticides, parasiticides used for killing mites, ticks, and sterilising agents which employ radioisotopes or chemicals to interfere with reproductive capabilities are nowadays widely used.

New groups of compounds called insect growth regulator (IGR) pesticides or bio-insecticides consist of natural chemicals present in the insects that control their development, e.g., Methoprene prevents the pupate stage which develop the reproductive adults. In such cases larvae grow larger, molt repeatedly and eventually die. Biopesticides of this type are very specific for their toxicity and safety.

Biological controls: Biological approach is a natural approach in which predators, parasites, weed feeding invertebrates and living organisms are used for controlling pests or their biological activities. All these are referred to as Biorational pesticides. Microorganisms may be used to kill by causing fatal disease in insects. For example, *Bacillus thuringiensis* selectively kills only larvae of butterflies and moths, and *B. popillae* kills the grubs of Japanese beetles. *B. thuringiensis* Var. *israelensis* is a new strain which specifically attacks only mosquito larvae. Microbial controls are safer for most of the non-targeted organisms and also humans and pets. Biologically derived pest control agents such as pheromones, allomones and kairomones, combinedly known as semiochemicals and hormones also attract, retard, destroy or otherwise exert a pesticide activity.

Neem as a versatile pesticidal agent: Neem consists of almost all parts of the plant, which are used as a drug. Some important morphological parts are dried stem bark, the root bark, the leaves and the fruits of *Azadirachta indica,* also known as *Melia azadirachta,* family Meliaceae.

The pest control usage of neem and neem products can be properly exploited depending upon the nature of the pest. The various reported pest control activities are given in table 6.2 along with the neem and the neem products used on specific pests. It is well known that neem possesses low to medium contact toxicity which is restricted to soft bodied insects and its use as an insecticide alone does not carry much conviction with the user. Various pesticidal activities of Neem products is as follows:

Activity	Neem products	Pests
Antifeedant	Neem seed extract	Locust, grain insects
	Neem oil	Brown plant hoppers
Attractants	Neem leaves and twigs	White grub
Repellant	Neem cake	Termites
	Neem oil	Potato tuber moth
Insecticide	Seed kernel	Aphicidal
	Neem cake extracts	Aphicidal
	Neem oil extractive (0.04%)	Mosquito larvicide
Nematicide	Neem cake	Reduces root galls of Tomato and Okra
Growth disruptor	Neem oil extractive (0.01%) caterpiller, army worm etc.	Diamond back moth, cabbage
Antimicrobial	Neem cake extractive (3%)	Soil microorganisms (Inhibitor of pesticide degradation)

5b. Write a note on plant derived proteolytic enzyme from Papaya.

Synonyms: Papain, Papayotin

Biological Source: Papain is the dried and purified latex obtained from the milky juice of unripe fruits of *Carica papaya* Linne, family Caricaceae.

Geographical Source: Papaya is indigenous to tropical America and cultivated in almost all parts of the world. On large scale it is cultivated in Sri Lanka, Tanzania, India, Hawaii, Florida, the Philippines, South Africa and Australia. In India, it is successfully cultivated in Maharashtra, Bengal, Bihar and Uttar Pradesh. Two major industries (Enzochem Labora-tories Ltd. Yeola, Nasik and Biocon Limited, Bangalore) produce large quantities of commercial papain.

Cultivation, Collection and Preparation: *C. papaya* is a herbaceous tree of 10 to 15 m. height. It is normally dioecious but rarely monoecious. Papayas thrive best on the well-drained soil. The fruits are borne near the top of the trunk, gregariously packed at the base of the leaves (Fig. 19.1). The fruits are spherical to cylindrical weighing up to 44 kg. Shallow incisions are given on the full grown, green unripe fruits on the four sides. Milky juice flows freely for a few seconds but soon coagulates. Incisions and collection of latex is done at weekly intervals till the fruit exudes latex. The collected coagulated latex is shredded and dried under sun or by artificial heat to yield crude papain. The crude papain is purified by dissolving in water and precipitating with alcohol. Iso-lation of proteolytic activity based fractions of crystalline papain is best accomplished at pH 5.3 from dried latex. The term papain is currently applied to both the crude dried latex and the purified crystalline proteolytic enzyme.

Characteristics: Purified papain is white or greyish white, slightly hygroscopic powder. It is completely soluble in water and glycerol, and practically insoluble in most organic solvents. Its potency varies according to process of prepa-ration. Papain can digest about 35 times its own weight of lean mean. The best quality papain digest 300 times its own weight of egg albumin. It should be kept in well closed containers. The best pH for its activity is 5.0 but it functions also in neutral and alkaline media. Total ash value should not exceed 1 per cent.

Chemical Constituents: Papain is referred to as vegetable pepsin as it contains enzymes similar to those in pepsin. The papain molecule consists of one folded polypeptide chain of 212 amino acids with molecular weight upto 23400 dalton. Papain contains several proteolytic enzymes such as peptidase-I, rennin like milk coagulating enzyme, amylolytic enzyme and a clotting enzyme similar to pectase. Peptidase-I has the ability to convert proteins into dipeptides and polypeptides.

Uses : Being a proteolytic enzyme, papain is used as a digestant for proteins. It shows the proteolytic activity much like pepsin but, unlike pepsin, it can act in acid, neutral or alkaline media. It can be combined with other enzymes such as amylases to produce digestive aids. It is extensively used as a meat tendering agent in the meat packing industries. Papain (10 per cent) is used in ointment, for wound debridement, that is, for the removal of dead tissue. It is also used in the treatment of contact lenses to prolong wearing time in keratoconic patients with papillary conjunctivitis.

6. Write precise notes on any two of the following:

a) Indian Squill

Synonym: Indian Squill, Urginea

Biological Source: Indian Squill consists of longitudinally sliced and dried bulbs of *Urginea indica* Kunth., family Liliaceae.

Geographical Source: Indian Squill generally grows abundantly in the sandy soil near coastal areas in India. It is found in the Deccan Peninsula, Bundel-khand and Konkan. It also grows in the drier hills of the lower Himalayas.

Collection and Preparation: Urginea is a bulbous plant (Fig. 14.22). The onion like bulbs are collected by digging or uprooting, soon after flowering. The dry outer scales and the adventitious roots are removed. The bulbs are cut longitudinally into slices. The bulbs or the sliced drug material is dried in the sun, packed in the bags and exported.

Description: Dried scales of urginea bulb are curved or sickle-shaped pieces connected together or separated. These scale bulbs are 1 to 5 cm long and 5 to 10 mm wide. They are brittle and can be easily pulverised when dry. The colour, odour and taste resemble those of European squill.

Microscopy: Most of the microscopical features of Indian squill bulbs are quite similar to those of *U. maritima.* The epidermal cells of Indian squill are 3 to 5 times longer than their breadth while in

European squill epidermal cell length is about twice the breadth. Urginea mucilage stains red with corallin soda and reddish-purple with iodine water.

Constituents: The Indian squill contains major active constituents which are similar to those of the European squill. It has been reported to contain more proscillaridin A. It also contains an inactive glycoside scillian and bitter principles scillapicrin and scillatoxin, mucilage, sugar and ash. The water soluble extractives of urginea are 60 to 70 per cent and alcohol (60 per cent) extractive is 20 to 40 per cent. In case of *U. maritima*. water soluble extractive is 79 to 81 per cent while the alcohol extractive comes to about 70 to 81 per cent.

Uses: *U. indica* is used in India as a cardiotonic agent in place of European squill. It is also used as an expectorant, a tonic and a diuretic agent. Its use in cases of dropsy has also been reported. Urginea has been introduced into the BP. It is largely exported to Germany.

b) Safron

Synonyms: Saffron, Crocus, Croci stigma

Biological Source: Saffron consists of dried stigmas and tops of styles obtained from *Crocus sativus,* family Iridaceae.

Geographical Source : Saffron is a native of eastern Mediterranean region extending to Middle East. Saffron was cultivated at Derbena and Isphan in Iran in the tenth century. In medieval times the cultivation of saffron was widespread throughout the whole Mediterranean region and Central Europe where it was used as a dye. It is grown in Southern France, Italy, Sicily, Hungary, Greece, Turkey, Iran, India, Myanmar and China. Some varieties of saffron also grow wild in Italy, Greece and Iran, which are used for medicinal and dye purposes.

Cultivation, Collection and Preparation Saffron is a perennial herb with a flattened underground corm (Fig. 16.31). The corms are planted in rows 6 in a part in a well pulverised soil in the month of July. The plant flowers in September to November. Collection of the stigma is a laborious job. The stigmas are either plucked out of the open flowers or first the flowers are collected and then the yellow stigma and part of the style are picked out and collected. Up to about 200,000 stigmas are required to yield 1 kg of the drug. The collected drug is first dried in the shade and then on fine mesh over a small fine. After the third crop the roots are taken up, divided and transplanted.

Characteristics: Saffron is found in small thread like pieces with a bright reddish - orange colour and has a pungent odour and taste. It must be stored in tightly stoppered tins as it easily loses its colour, aroma and flavour. As saffron is an expensive drug, it is often mixed with raw materials of a similar colour, such as the flowers of marigold or safflower.

Chemical Constituents: Saffron contains mainly pigment and essential oil. Saffron yield about 8 to 10 per cent of essential oil which contains terpene, terpene alcohols and esters. The chemical component of pigment includes crocin and crocetin. It also contains a colourless bitter glycoside, picrocrocin, responsible for the characteristic odour of saffron.

Uses: Saffron is one of the world’s most expensive spices. It is used as carminative, diaphoretic and emmenagouge. It is used as a diaphoretic for children and for chronic haemorrhage of the uterus in adults. It was once widely used as a glycerin syrup and tincture for colouring medicines but it has largely been replaced for this purpose by solutions of sunset yellow and tetrazine. Today the drug is only of marginal impor-tance partly because of its price and the enormous quantities necessary to yield only a tiny amount of drug. In Asian and Mediterranean cuisines it is used as a food dye and flavouring agent for rice dishes, desserts. Saffron cannot be used for fabric dyeing because it is water soluble.

c) Trypsin

Trypsin is a serine protease found in the digestive system of many vertibrates including human beings. It is produced in pancreas as an inactive proenzyme trypsinogen. Commercially it is obtained from Hog, *Sus scrofa*, family Suidae or Ox, *Bos Taurus*, family Bovidae.

Production: Trypsin is produced in the pancreas in the form of zymogen protease. When the pancreas is stimulated by cholecystokinin, it is then secreted in the first part of the small intestine i.e duodenum via pancreatic duct. Once it reaches small intestine, the enzyme enteropeptidase activates it into trypsin by proteolytic cleavage. Trypsin can then function to activate additional trypsinogen (Autocatalysis). This activation serves to prevent autodegradation of pancreas.

Characteristics: Trypsin has an optimal operating pH of about 7.5 to 8.5 and optimum operating temperature 37^0c. It should be stored at very low temperature 37^0c. I should be stored at very low temperature (-20^0c to $-80\ ^0$c) to prevent autolysis which may also be caused by storage at pH 03.

Functions: In duodenum, trypsin catalyses the hydrolysis of peptide bonds so that the proteins can be broken down into smaller peptides. These peptides may then be further hydrolysed into amino acids by other protease enzymes before they enter into the blood stream. Tryptic digest is a necessary step to protein absorption because protein is generally to big to be absorbed through the lining of the small intestine.

Applications: Trypsin is available in the abundant quantity in pancreas and can be purified rather easily. It is used in various biotechnological processes. In tissue culture it is used to resuspend cells adherent to the sides of the cell culture dish. It is also used to dissociate dissected cells and to break down casein in breast milk which makes the milk translucent.

Commercial protease preparations usually consists of mixtures of various protease enzymes that often includes trypsin. These preparations are generally used in food processing:

- As a baking enzyme to inprove workability of doughs
- In the extraction of, seasoning and flavouring of vegetable and animal proteinsand in the manufacture of sauce.
- To control aroma formation in cheese and milk products.
- To improve the texture of fish products.
- To tenderize the meat and
- In the production of hypoallergic food where protease breakdown specific allergic proteins into nonallergic peptides.

d) Bilawa

Bilawa is a traditional drug of India which is also known as Ballataka, Bibba of Marking nut .

Biological source: Bilawa consists of the mature and dried nuts of *Semecarpus anacardium* family Anacardiaceae. It is distributed in sub-Himalayan region, tropical and central part of India.

Characteristics: Bilawa is a medium sized deciduous tree growing upto 10-15 m height. The plant grows naturally in tropical and dry climate. Bark is gray in colour and exudes an irritant secretion on incising. Leaves are simple, alternate 30-60 cm long and 12-30 cm broad. Fruits which makes the commercial drug ripens between December to March. Fruits are 2-3 cm broad, ovoid and smooth with lustrous black colour. Dried Mature nuts exudes irritant oily liquid from the oil glands if the pressure is exerted on the cuticle of the fruits

Chemical constituents: Bilawa nut shells contain the biflavonoids namely biflavone A, A1, A2, C, tetrahydrorobustaflavone, B-tetrahydroamentoflavone, jeediflavone, semecarpuflavone and guluflavone. It also shows the presence of phenolic constituents. The abundant quantity of fixed oil is present in the nuts.

Uses: Detoxified nuts of Bilawa are incorporated in prescriptions for toxic conditions, obstinate skin diseases, tumors, malignant growth, fever, haemotysis, excessive menstruation, vaginal discharge, deficient lactation, constipation and intestinal parasites. A decoction with milk or purified butter, in gradually increasing doses is given in peripheral neuritis, sciatica, facial paralysis, hemiplegia. Charaka has mentioned it as a potent rejuvenating tonic.

Variety of nut extract preparations from Bilawa are effective against many diseases. Such as arthritis, tumors and infections. In traditional system nuts are highly valued for the treatment of tumor and malignant growth. It has also been reported to have hepatoprotective, neuroprotective, antispermatogenic, anti-inflammatory and antiatherogenic activities.

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