**AS-2849**
**B.Sc. (Hon's), Vth Semester Examination 2013**
**Botany**
**LBC- 505:** Herbal medicine
**Section A: Answer all the questions (1 X 10 = 10 Marks)**

Q. 1
i. a. The Herbell
ii. d. 10
iii. a. Cold deserts(Ladhakh)
iv. b. Ashwagangha
v. a. Legal's test
vi. d. Protein & amino acids
vii. b. Anola
viii. d. *Withania somanifera*
ix. a. 120
x. a. *Papaver somniferum*

**Section B : Answer any four question (Each question carry 5 Marks)**

**2. Describe history of herbal plants in India**

India has a rich culture of medicinal herbs and spices, which includes about more than 2000 species and has a vast geographical area with high potential abilities for Ayurvedic, Unani, Siddha traditional medicines. Plants had been used for medicinal purposes long before recorded history. Indigenous cultures (such as African and Native American) used herbs in their healing rituals, while others developed traditional medical systems (such as Ayurveda and Traditional Chinese Medicine) in which herbal therapies were used. In India, Ayurveda medicine has used many herbs such as turmeric possibly as early as 1900 BC, Sanskrit writings from around 1500 B.C., such as the *Rig Veda*, are some of the earliest available documents detailing the medical knowledge that formed the basis of the Ayurveda system. Many other herbs and minerals used in Ayurveda were later described by ancient Indian herbalists such as Charaka and Sushruta during the 1st millennium BC. The *Sushruta Samhita* attributed to Sushruta in the 6th century BC describes 700 medicinal plants, 64 preparations from mineral sources, and 57 preparations based on animal sources. Several other were compiled over the centuries such as Bela Samhita, Kashyap Samhita, Agnivesh Tantra, Vagbhata's Ashtang hridaya (600), Madhava Nidan (700 AD). Vegetable products dominated *Indian Meteria Medica* which made extensive use of bark, leaves, flower, fruit, root, tubers and juices. The theory of *rasa, vipaka, virya* and *prabhava* formed the basis of Ayurveda pharmacology, which made no clear distinction between diet and drug, as both were vital component of treatment. Charak, Sushruta and Vagbhata described 700 herbal drugs with their properties and clinical effects. Based on clinical effects 50 categories of drug have been decribed – such as appetizers, digestive stimulant, laxatives, anti-diarrhea, anti-haemorrhoid, anti-emetic, anti-pyretic, anti-inflammatory, anti-pruritic, anti-asthmatic, antiepileptic, anti-helminthic, haemoptietic, haemostatic, analgesis, sedative, promoter of life (Rasyana), promoter of strength, complexion, voice, semen and sperm, breast milk secretion, fracture and wound healing, destroyer of kidney stones etc.

**3. Comment on Botanical zones of India.**

The Indian sub continent is characterized with a variety of climate type and flora of the country in also correspondingly of different types in its different parts. The country has been divided into following nine floristic (Botanical) regions:

**1. Western Himalaya:**

Kumaun to Kashmir with an annual rainfall of 200 cm. Altitudinal these are following three zones of vegetation corresponding to three climatic belts.

**(i) Sub montane Zone:**

This extends upto 1500 metres altitude and comprises mostly of Siwalik ranges. The forests are tropical and subtropical having trees like Shorea robusta, Dalbergia sissoo, Cedrela toona, Ficus glomerata, Eugenia jambolana, Acacia catechu, Butea monospema (dhak), Zizyphus and thorny succulent euphorbias on slopes.

**(ii) Temperate Zone:**

Above submontane zone extend montane temperate forests upto 3500 m. They are dominated by plant species like Quercus, Acer, Ulmus, Rhododendron, Betula, Salix, Cornus, Populus, Pinus, Cedrus, Picea and Taxus.

**(iii) Alpine Zone:**

Between 3500 - 4500 m and characterized by alpine forest vegetation with scrub and meadow e.g. Abies, Betula, Junipers, Rhododendrons.

**2. Eastern Himalaya:**

It includes regions of Sikkim and NEFA and is characterized by more rainfall, less snow and high temperature. This is divided into 3 zones.

**(i) Tropical zone:**

Up to 1800 m, this zone has tropical semi-evergreen or moist deciduous forest. These forests comprise the plants Shorea robusta, Acacia catechu, Dalbergia sissoo, Terminalia, Albizia, Dendrocalamus etc.

**(ii) Temperate zone:**

1800 m - 3800 m and has typical montane temperature forests like oaks, Michelia, Quercus, Pyrus, Synplocos, Eugenia and Conifers like Juniperus, Cryptomeria, Abies, Pinus, Larix, Tsuga, Salix, Rhododerdron, Arundinaria.

**(iii) Alpine zone:**

Beyond the temperate zone extends alpine zone up to 5000 m. e.g. Juniperus, Rhododendron.

**3. Indus plain:**

Arid and semi arid zone of Punjab, Rajasthan, Kutch, Gujarat and Delhi. The rainfall is less than 70 cm. The vegetation is tropical thorny forest in semi arid zone and typically desert in the arid region as Xerophytic e.g. Acacia nilotica, Salvadora, Capparis.. Zizypus, Calotropis, Saccharum, Euphorbia.

**4. Gangetic Plains:**

Uttar Pradesh, Bihar, Bengal and part of Orissa and is characterized by moderate amount of rainfall and most fertile (alluvial) soils. Vegetation is chiefly tropical moist and deciduous and dry deciduous forest type.

The common plants of this zone are Dalbergia sissoo, Acacia nilotica, Saccharum munja, Terminalia arjuna, Acacia catechu (Khair), Azadirachta indica (Neem), Ficus religiosa (Pipal), and weeds, grasses like Xanthium, Argemone, Amaranthus. In Gangetic delta (Bengal south) mangrove vegetation is common.

**5. Central India:**

It comprises Madhya Pradesh, parts of Orissa and Gujarat. The rainfall is 150 - 200 cm. and its vegetation is thorny, mixed deciduous and teak type. The chief plants are Tectona grandis, Madhuca, Butea, Dalbergia, Terminalia, Zizypus, Acacia, Mangifera etc.

**6. Malabar (West Coast):**

This region include western coast of India from Gujarat to comorin with heavy rainfall. The forests are tropical evergreen in extreme west, semi evergreen towards interior subtropical or montane temperate evergreen forests in Nilgiris and mangroves near Bombay and Kerala Coast.

**7. Deccan Plateau:**

This region extends all over Peninsular India (Andhra Pradesh, Tamil Nadu and Karnataka) and has rainfall up to 100 cm. Its central hilly plateau has tropical dry deciduous forests of Bowsellia scrrata, Tectona grandis while the low eastern dry coromondal coast has tropical dry evergreen

forests of Santatum albums, Cedrela toona, e.g. Acacia, Prosopsis, Euphorbia, Capparis, Phyllanthus etc.

**8. Assam:**

This region is characterized by heavy rainfall (200 to 1000 cm). The vegetation is either dense evergreen forests or subtropical. The evergreen forests include trees like Dipterocarpus macrocarpa, Shorea robusta, Ficus elastica etc grasses like Saccharum sp. Themeda sp. Insectivorous plants as Nepenthes sp. and also Epiplytes (ferns and orchids). In the northern cooler region wet hill forests include plants like Alnus, Betula, Rhododendron, Magnolia etc.

**9. Andamans:**

Mangrove and beech forest at its coasts and evergreen forests of tall trees in the interior. Important plant species of this island are Rhizophara, Calophyllum Lagerostroemia etc.

**4. Mention features, bioactive molecules and therapeutic value of Withania.**

*Withania somnifera*, known commonly as *ashwagandha*, Indian ginseng, poison gooseberry, or winter cherry, is a plant in the Solanaceae family.

Bioactve Molecules: The main chemical constituents are alkaloids and steroidal lactones. These include tropine and cuscohygrine. The leaves contain the steroidal lactones, withanolides, notably withaferin A, which was the first to be isolated from the plant.

Therpeutic Value: In Ayurvedic, Indian, and Unani medicine,***Withania*** (ashwagandha) is described as "Indian ginseng." Ashwagandha is also used in traditional African medicine for a variety of ailments.

The name Ashwagandha is from the Sanskrit language and is a combination of the word ashva, meaning horse, and gandha, meaning smell. The root has a strong aroma that is described as "horse-like."

Ashwagandha is a plant. The root and berry are used to make medicine.

Ashwagandha has a lot of uses. But so far, there isn't enough information to judge whether it is effective for any of them.

Ashwagandha is used for arthritis, anxiety, trouble sleeping (insomnia), tumors, tuberculosis, asthma, a skin condition marked by white patchiness (leukoderma), bronchitis, backache, fibromyalgia, menstrual problems, hiccups, and chronic liver disease.

Ashwagandha is also used as an "adaptogen" to help the body cope with daily stress, and as a general tonic.

Some people also use ashwagandha for improving thinking ability, decreasing pain and swelling (inflammation), and preventing the effects of aging. It is also used for fertility problems in men and women and also to increase sexual desire.

Ashwagandha is applied to the skin for treating wounds, backache, and one-sided paralysis (hemiplegia).

**5. Describe stomatal index, veinislet number, vein termination number, palisade ratio.**

**Palisade ratio:** Palisade ratio is the average number of palisade cells under one epidermal cell.
Palisade Ration = No. of palisade / no of epidermal cells

**Stomatal index:** Stomatal index is the percentage which the number of stomata forms to the total number of epidermal cells, each stomata being counted as one cell. Stomatal index can be calculated by using following equation.

$$\mathbf{SI = S/E + S \times 100}$$

SI = Stomatal index, S = No. of stomata per unit area,

E = No. of epidermal cells in the same unit area.

**Vein-islet number:** A vein-islet is the small area of green tissue surrounded by the veinlets. The vein-islet number is the average number of vein-islets per square millimeter of a leaf surface. It is determined by counting the number of vein-islets in area of 4 sq. mm. of the central part of the leaf between the midrib and the margin.

**Veinlet termination number :**Veinlet termination number is defined as the number of veinlet termination per sq. mm of the leaf surface, midway between midrib of the leaf and its margin. A vein termination is the ultimate free termination of veinlet.

**6. Write a note on commercial cultivation of Anola (*Emblica Officinalis*).**

Commercial cultivation of AONLA

| | | | |
|---|---|---|---|
| 1. | Name of Medicinal Plant | Emblica officinalis Gaertn | |
| 2. | Family | Euphorbiaceae<br>A deciduous tree, found in deciduous forests of the country upto 1350 m. on hills. Often cultivated. | |
| 3. | Area | 1300 ha | |
| 4. | Production | 88200 t | |
| 5. | Important States | UP, Gujarat, Rajasthan, Maharashtra | |
| 6. | Cultural Practices<br>i.Varieties/Types/Clones released/identified | Banarasi, Chakaiya, Francis, Kanchan, Krishna, Balwant, NA-6, NA-7, NA-9, Anand-2 and BS-1. | |
| | ii. Propagation methods and planting time | Modified ring, patch and shield budding as well as soft wood grafting.<br>June to August | |
| | iii.Fertilizer dozes | 1000 gm N, 500 gm $P_2O_2$ and 750 gm K 2O per plant/year. The fertilizer should be given in two split doses viz. Sep – Oct and April – May. | |
| | iv.Irrigation schedule | Irrigation to young plantation at 10 days interval during the summer. To fruit bearing plantations, first irrigation should be given just after manuring and fertilization and then at 15 days intervals after fruit set (April) till onset of monsoon. Avoid irrigation during flowering period. | |
| | v. Diseases, pests and their control: | Diseases/causitive/Organism/agent<br>----------<br>Aonla rust<br>(Ravenellia emblica)<br>Fruit rot<br>(Pencillum islandlium)<br>Necrosis (Boron Deficiency)<br>Bark eating caterpillar<br>(Inderbela tetraonis)<br>Shoot gall maker (Betousa stylophora)<br>Aphid (Cerciaphis emblica)<br>Scale insect<br>Anar butterfly<br>(Virachola isocrates) | Control measures<br>----------<br>Spray (twice) Dithane Z 78(0.2%) during July-September.<br>Treating the fruits with Nacl solutions.<br>Spray of 0.5% - 0.6% borax in Sept–October Months.<br>Injecting kerosene oil/ Dichlorovols or Endo-Sulfan (0.05%) in holes and plugging with mud |

| | | | |
|---|---|---|---|
| | | | Galled twigs should be pruned. Spray of 0.05% monocrotophos during rainy season<br>Spraying of dimethoate @ 0.03%<br>Application of mono-Crotophos @ 0.05%<br>Remove and destroy all the affected fruits. |
| 7. | Planting time<br>i) Rainy season<br>ii) Spring season | July to September<br>Mid of January to March | |
| 8. | Biochemical analysis (Active ingredients) | The fruit is rich source of vitamins and minerals. High vitamin C content (750-850 mg/100 gram pulp) | |
| 9. | Post Harvest Management | Different varieties mature at different period e.g Chakaiya (January), Banarasi (October end), Krishna (December) and Francis (mid November – December). Large size fruits (4 cm. & above) free from blemishes are used for preserve, candy and pickle. Small sized fruits are used for chavanprash making and defective fruits are used for Trifala making. Generally, basket for pigeon pea stem and gunny bag of 40-50 kg capacity with newspaper as liners are used for packing of aonla fruits. However, wooden crate with polythene lines is most suitable for packing and long distance transportation. Aonla fruits can be stored upto 15-20 days at low temperature (10-15$^{o}$ C). However Chakaiya can be stored upto 45 and 75 days in 10% and 15% salt solution respectively without any decay. | |
| 10. | Cost of Cultivation | Cost benefit ratio is 1:4. Pay back period is six years. | |
| 11. | Internal consumption and export potential | Export potential yet to be exploited. Huge internal demand in ISM. | |
| 12. | Action and uses | Aperient, aphrodisiac, astringent, digestive, diuretic, laxative, refrigerant and tonic. Useful in anaemia, jaundice, dyspepcia, haemorrhagic disorders, bilionsness, diabetes, asthma, bronchitis. An Ayurvedic preparation Chyavanprasha is very much valued for its restorative action | |
| 13. | Compound Preparations | Chyavanprasha, Dhatri Lauha, Amalki Rasayana. | |

## 7. Give examples of *turmeric* and *neem as* Biopiracy of traditional knowledge

***Turmeric (Curcuma longa Linn.)***

The rhizomes of turmeric are used as a spice for flavouring Indian cooking. It also has properties that make it an effective ingredient in medicines, cosmetics and dyes. As a medicine, it has been traditionally used for centuries to heal wounds and rashes.

In 1995, two expatriate Indians at the University of Mississippi Medical Centre (Suman K. Das and Hari Har P. Cohly) were granted a US patent (no.5, 401,504) on use of turmeric in wound healing. The Council of Scientific & Industrial Research (CSIR), India, New Delhi filed a re-examination case with the US PTO challenging the patent on the grounds of existing of prior art. CSIR argued that turmeric has been used for thousands of years for healing wounds and rashes and therefore its medicinal use was not a novel invention. Their claim was supported by documentary evidence of traditional knowledge, including ancient Sanskrit text and a paper

published in 1953 in the Journal of the Indian Medical Association. Despite an appeal by the patent holders, the US PTO upheld the CSIR objections and cancelled the patent. The turmeric case was a landmark judgment case as it was for the first time that a patent based on the traditional knowledge of a developing country was successfully challenged. The US Patent Office revoked this patent in 1997, after ascertaining that there was no novelty; the findings by innovators having been known in India for centuries.

**Neem** extracts can be used against hundreds of pests and fungal diseases that attack food crops; the oil extracted from its seeds can be used to cure cold and flu; and mixed in soap, it provides relief from malaria, skin diseases and even meningitis. In 1994, European Patent Office (EPO) granted a patent (EPO patent No.436257) to the US Corporation W.R. Grace Company and US Department of Agriculture for a method for controlling fungi on plants by the aid of hydrophobic extracted Neem oil. In 1995, a group of international NGOs and representatives of Indian farmers filed legal opposition against the patent. They submitted evidence that the fungicidal effect of extracts of Neem seeds had been known and used for centuries in Indian agriculture to protect crops, and therefore, was unpatentable. In 1999, the EPO determined that according to the evidence all features of the present claim were disclosed to the public prior to the patent application and the patent was not considered to involve an inventive step. The patent granted on was Neem was revoked by the EPO in May 2000. EPO, in March 2006, rejected the challenge made in 2001 by the USDA and the chemicals multinational, W. R. Grace to the EPO's previous decision to cancel their patent on the fungicidal properties of the seeds extracted from the neem tree.

**8. Describe pros and cons of Bioprospecting.**

**Pros**

1. Bioprospecting has been an important phenomenon of discovering new drugs since the dawn of civilization. Several millions of people throughout the world have been using more than 8000 species of medicinal plants for the health care needs. Over 800 medicinal plant species are currently in use by Indian herbal industry alone. In pharmaceutical industry, many well known and useful drugs have been derived from leads provided by the medicinal plants.
List of some common drugs derived from plants

| | | | |
|---|---|---|---|
| 1. | Atropine | Atropa belladonna | Anticholinergic |
| 2. | Codeine | Papaver somniferum | Analgesic, antitussive |
| 3. | Digitoxin/Digoxin | Digitalis purpurea | Cardiotonic |
| 4. | Ephedrine | Ephedra vulgaris | Sympathomimetic |
| 5. | Morphine | Papaver somniferum | Analgesic |
| 6. | Nicotine | Nicotiana tabacuum | Insecticide |
| 7. | Podophyllotoxin | Podophyllum peltatum | Anti-neoplastic |
| 8. | Quinidine | Cinchona ledgeriana | Antiarrhythmic |
| 9. | Theophylline | Theobroma cacao | Diuretic, vasodilator |
| 10. | Vincristine | Catharanthus roseus | Anti-neoplastic |

2. The economic value of plants or living organisms for pharmaceutical purposes is enormous and benefiting not only to the pharmaceutical industries engaged in R & D but to host country and indigenous community also, who gain from ownership of the biological resources and expect adequate compensation for resource use, especially after the Convention on Biological Diversity (CBD) in 1992.
3. In high-technology laboratories, extracts from biological specimens undergo rapid and precise screening procedures that allow for the isolation of chemicals displaying a specifically targeted activity. In 1980, it is estimated that over 200 companies and research organizations world wide are screening plant and animal components for medicinal purposes.

4. Discovery of several life-saving drugs including anti-neoplastic drugs (e.g. vinblastine, taxol, topotecan and etoposide) in recent past has renewed the interest of pharmaceutical industries in bioprospecting. Efforts are being made to isolate anti-HIV drugs from natural resources. At least three anti-HIV drugs, (+) calanolide A, (-) calanolide B (costatolide) and conocurovone, isolated from plants are currently undergoing pre-clinical or early clinical trials.
Prostratin and Homoharringtonine, the other two anti-AIDS drugs isolated from plants, are also under investigation with variable success.
5. Bioprospecting collaborations between pharmaceutical companies and countries supplying the medicinal raw material and knowledge offer not only the revenue source for under- developed countries, but also opportunities for society for better education and employment avenues. Many studies have suggested that if the bioprospecting search is based on the information and knowledge from local people, then the value of bioprospecting benefits will be higher.

**Cons**

1. There is a growing concern that a number of pharmaceutical firms and biotechnology companies are exploring the forests, fields and waters of developing world in search of biological riches and indigenous knowledge with sole aim of developing patented and profitable products. Under the vast majority of cases, no money has changed hands and no recognition has been given to indigenous communities who selected, maintained and improved traditional plant varieties for medicine.
2. The multinational companies engaged in bioprospecting are free to patent bio-materials but there are no effective guidelines and conditions defined for recognising and rewarding the contributions of indigenous people and other informal innovators who are responsible for nurturing, using and developing biodiversity.
3. There is no regulation in place to ensure that the source countries of these plants will be adequately compensated.
4. The monetary offer by multinational pharmaceutical firms to resource countries in most cases in not sufficient. Many nations in the third world suffer from crushing burden of external debt hence the monetary offer by multinational firms often allure them to sell off their biological resources for pittance.
5. Several pharmaceutical firms do not bid directly for access to biodiversity, but instead, work through intermediaries. Therefore, it is often difficult for indigenous people and organizations to know precisely with whom they are negotiating or to whom they are providing their information and genetic material.
6. Imbalance in ecosystem due to excessive exploitation of material resources is always a possibility, mainly due to multitude of commercial interests including bioprospecting.