



**Conference Proceeding**

**NMPB-Sponsored National Conference on Recent Advances in Ayurvedic Herbal Medicine - From Source to Manufacturing Organised by Faculty of Biomedical Sciences, Uttarakhand Ayurved University, Dehradun on 15-16 September 2017 at CSIR-Indian Institute of Petroleum, Dehradun, Uttarakhand, India**

**KEYNOTES/ INVITED PAPERS**

**MEDICINAL PLANTS OF INDIA: STATUS AND OPPORTUNITIES AND NMPB INITIATIVES**

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India has very strong traditional health care practices that are represented by the classical systems of medicine like Ayurveda, Siddha, Unani, and Sowa-Rigpa on one hand, and by a very diverse area-specific and community-specific folk healthcare practices on the other. The major commonality of the Indian classical and the folk health care traditions is their dependence upon the raw material derived from a large diversity of plant species.

The global Herbal and Ayurvedic medicines market is estimated to be around \$80 billion, out of which EU accounts for about 40%, Japan 20%, USA 10% and the remaining 30% is accounted by Asian countries together. Encouraging trend is that the market place for medicinal plants used as dietary supplements is growing in the European continent along with Japan and USA and in the present scenario India is the largest supplier of Ayurvedic medicines and herbs in the world. Indian Ayurvedic products market is projected to register a compound annual growth rate (CAGR) of 16% during 2016-2021.

According to global industry analysis, it is estimated that global herbal market will reach \$107 billion by end of 2017. A survey was conducted by National Medicinal Plants Board during the 2014-15 to assess the domestic as well as internal demand of medicinal plants of India. As the report, total commercial demand of herbal raw drugs in the country for the year 2014-15 has been estimated at 5.12 lakh MT which includes 1.95 lakh MT from Domestic Herbal Industry, 1.34 lakh MT from Export and 1.67 lakh MT from Households.

The trade value of 5.12 lakh MT of herbal raw drugs has been estimated around 70 billion INR (> One billion USD). The estimated trade value of herbal raw drugs in commercial demand for the year 2014-15 is about seven times higher than the trade value of 10 billion INR arrived at for the year 2005-06. The major increase has been in respect of the export which has increased from 3.45 billion INR in 2005-06 to rupees 32 billion INR in 2014-15, registering more than eight fold increase in ten years. The trade value of herbal raw drugs consumed by the domestic herbal industry has also registered more than two fold increase as per the latest estimates.

To meet out the Industrial Demand through sustainable Cultivation and Conservation of Medicinal Plants Biodiversity, research and developmental activities to scientifically validate the traditional uses of Medicinal Plants, Government of India has setup National Medicinal Plants Board in 2000 under Ministry of AYUSH.

Since its inception, NMPB has been supporting its stakeholders with grant in aid under Central Sector Scheme and National AYUSH Mission to promote various activities under conservation, cultivation, R&D and IEC activities of Medicinal Plants. The concerted efforts of NMPB has led to bringing 36 species of Medicinal Plants under large-scale cultivation along with bringing up the cultivation sourced raw material from 15 to 30% of total raw material consumption.

In the development of Ayurveda, NMPB has actively supported many Research and Development activities in the area of sustainable harvesting of 'Dashmula' plants, development of agro-technology and conservation of 'Astavarga' plants, identification of possible substitutes of RET species, use of Ayurveda drug wastages as a bio fertilizer, etc. NMPB is also supporting cultivation of medicinal plants to meet out the industrial demand of genuine quality raw material for manufacturing the efficacious Ayurvedic drugs.

To standardize the raw material for production of Ayurvedic drugs, NMPB has initiated the development of a National Raw Drug Repository (NRDR) and eight Regional Raw Drugs Repository (RRDR)

across the country. All genuine reference samples of medicinal plants used in Ayurveda, Siddha and Unani & Homoeopathic system for preparation of drugs and formulations will be deposited in these repositories. These NRDR and RRDR will enhance the quality and efficacy of Ayurvedic, Unani, Siddha and Homoeopathic drugs by way of supplying genuine quality raw material for production of Ayurvedic drugs. As an effort to streamline the markets, NMPB has developed an online portal along with a mobile application 'e-charak' wherein all the stakeholders can participate in sharing information, buy or sell their produce and also acquire knowledge about cultivation practices along with market prices of Medical Plants.

#### **For further reading**

1. Medicinal Plants in India: An Assessment of their Demand and Supply. Survey conducted by National Medicinal Plants Board (2017).
2. Market Access Handbook for AYUSH Products in USA, selected European Countries and other Priority Countries. Draft Report submitted by Pharmexcil to Ministry of AYUSH (March, 2017).

### **EVIDENCE BASED VALIDATION OF AYURVEDIC MEDICINE - FROM FIELD TO BEDSIDE**

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Evidence based validation of the ethnopharmacological claims on traditional medicine is the need of the day for its globalization and promotion. Combining the unique features of identifying biomarkers that are highly conserved across species this can offer a promising approach to biomarker-driven drug discovery and development. Globalization of traditional medicine (TM) is necessary for health care with assessment of its safety, efficacy, therapeutic and clinical evidences. New technology and science has developed many techniques and systems to raise the natural compounds for global existence. TMs are an integral component of alternative medical care. India has a rich wealth of TMs and the potential to accept the challenge to meet the global demand for them. Ayurveda, Naturopathy, Unani, Siddha and folk medicine are the major healthcare systems in Indian society, which fully depend upon natural resources. The plant species mentioned in the ancient texts of these Ayurveda and other Indian systems of medicines (ISM) may be explored with the modern scientific approaches for better leads in the health care. Natural product is the best sources of chemical diversity for finding new drugs and leads. Authentication and scientific validation of medicinal plants is a fundamental requirement of industry and other organizations dealing with herbal drugs. Quality control of botanicals, validated processes of manufacturing, customer awareness and post marketing surveillance are the key points which could ensure the safety and efficacy of TM.

The development of traditional systems of medicines with the perspectives of safety, efficacy and quality will help not only to preserve this traditional heritage but also to rationalize the use of TM in the health care. Biodiversity of natural resources have served not only for the primary human needs but also for health care, since time immemorial. The Indian subcontinent, with the history of one of the oldest civilization, harbours many traditional health care systems. Until recent past, the nature was considered as a compendium for templates of new chemical entities (NCEs). Globalization of TM is a need for harmonization in respect of its biomarker fingerprinting and metabolite profiling, chemical characterization, standardization, quality control, metabolomics study, scientific validation & documentation and regulatory aspects of herbal medicine which can dictate the quality of the natural products. Therefore the utmost attention is necessary for the promotion and development of TM through worldwide cooperation's by national and international programme.

### **STATUS OF CONSERVATION AND CULTIVATION OF HIGH ALTITUDE MEDICINAL HERBS IN UTTARAKHAND HIMALAYA**

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Variety of important high altitude medicinal plants viz; *Aconitum heterophyllum*, *Aconitum atrox*, *Picrorhiza kurrooa*, *Nardostachys jatamansi*, *Podophyllum hexandrum*, *Rheum emodi*, *Angelica glauca*, *Dactylorhiza hatagirea*, *Lilium polyphyllum*, *Paris polyphylla* etc are decreasing fastly from their natural habitat in Uttarakhand Himalaya due to our increasing dependance on them. In addition to grazing and anthropogenic pressure, unskilled exploitation and changing climatic conditions of these species have led to their rarity. It is observed that a large number of pockets of these species have vanished from their

natural habitat in last few years. The present in situ conservation measures like conservation of watersheds, protected area network, ban on the natural exploitation and trade etc are not adequate for the protection of these species in their natural habitat. It is very essential to bring these species upto the cultivation level by developing the appropriate packages for their cultivation. It is observed that most of these species are opportunistic in their seed production which mainly depends on the weather conditions prevailing in that particular growing season. Seeds of most of the species germinate under favourable conditions and showed favourable response for multiplication through vegetative means. Cultivation trials in different regions of Garhwal Himalaya showed that all these species can be cultivated in suitable agroclimatic regions of Upper Himalaya by the farmers of the region. The large scale cultivation of these species will ease the pressure on their natural populations by meeting the demand of the suppliers and thus will help in the conservation of these species in their natural habitat. Cultivation of these highly valuable medicinal plants by local people / farmers can also augment the economy of the people as well as of the region. The prospects of cultivation of these species are discussed here.

### **DRUG RESEARCH METHODOLOGY IN AYURVEDA MUST BE AS PER MODERN MEDICINE**

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Drugs (Dravyas) or the basis of entire drug research programme including medico-botanical survey, cultivation, pharmacognosy, phytochemistry, pharmacological, toxicological and finally clinical trials etc. In the ancient text of Ayurveda some of the important aspects of the drug research of the modern medicine have already been touched giving explanations to the various curiosities which are now being measured on modern parameters. A comprehensive account of the Ayurvedic research methodology and application of modern techniques has been discussed in the present paper giving scope for adopting the discussed drug research methodology in the various fields of drug research. The diseases, like cancer, diabetes, asthma, leprosy, rheumatoid arthritis, cardiac disorders, etc. are challenging to the research workers who should try to investigate some of the efficacies of Ayurvedic drugs for these diseases. Similar is the need for finding out some effective oral contraceptives and substitutes for modern drugs which are mostly toxic in nature. It is, therefore, arduous task to undertake a course country wise survey of the medicinal plants grown in the country and to assess the economy of the drugs available in different regions extended from coastal areas to Alpine Himalayas.

### **BIODIVERSITY PROTECTION STRATEGIES OF TRADITIONAL MEDICINAL PLANTS**

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The process of globalization has posed major challenges to developing countries of the world in context of emerging regime of intellectual property protection. The first step in this direction has been the formalization of the Agreement on TRIPs under the aegis of the World Trade Organization (WTO). The TRIPs agreement is designed to “promote effective and adequate protection of intellectual property rights” and to “reduce distortions and impediments to international trade” resulting from the enforcement of IPRs. The TRIPs Agreement includes a number of forms of IPR with implications for biodiversity conservation including patents, and “*sui generis* system” for plant variety protection. Patents and *sui generis* system are relevant to the implementation of the Convention on Biological Diversity as they play a key role in defining who gains access to information about genetic resources, how the benefits are shared (including with traditional communities), and what technologies are developed and transferred with implication for conservation and sustainable use of biological diversity. These impacts on biodiversity conservation are often indirect, and are difficult to measure with precision. Like the relationship between IPRs and access and benefit sharing, the relationship between IPRs and preservation of land races, genetic resources and indigenous farmers’ varieties is a subject of much debate. This is more relevant in the genetic resources rich third world developing countries as compared to the genetic resources poor developed countries. Thus, the interest of gene rich developing countries like India is best served by global action aimed at conservation, sustainable use of biodiversity and sharing of benefits from the use of bioresources and to prevent biopiracy of genetic resources. However, it is necessary to analyze what the genetic resources rich developing countries are doing to protect indigenous varieties so as to avoid biopiracy. Two international

instruments, TRIPs agreement and CBD determine ownership rights on IPR and biological resources, respectively as agreed to by the member countries. The TRIPs agreement affirms that IPRs are private rights available to natural or legal persons. Whereas CBD asserts that rights over biological / genetic resources are owned by states or nations and the traditional communities. The key development in India concerning biodiversity is the enactment of legislation on the Biological Diversity Act, 2002. The International Undertaking on Plant Genetic Resources, 1983 (IUPGR) that had been advocating free exchange of plant genetic resources (PGR) for research use, being the heritage of mankind, released a revised agreed interpretation in 1991 that such free access will be subject to the sovereign rights of nations over their PGR. This is directly relevant to both the CBD and the TRIPs Agreement. India is signatory to WTO agreements and it has to abide by the TRIPs legislation. In compliance to article 27.3(b) of the TRIPs India enacted an Act named as Protection of Plant Varieties and farmers' Rights Act 2001. We have recently developed a reactive strategy to protect ancient wealth by creating TKDL and taken effective measures to prevent biopiracy of genetic wealth.

### **AROMATIC SECTOR OF UTTARAKHAND - AN OVERVIEW**

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Uttarakhand is blessed with a variety of soil types and varying agro-climatic conditions, ranging from Sub-Tropical to Alpine, which is conducive for cultivation of various crops, yet farmers of Uttarakhand are suffering from several problems in agriculture such as continuous fragmentation of land holdings, far-off agriculture land from farmers houses, high cost of agricultural inputs, damage of traditional crops by wild and domestic animals, high transportation cost of agri-horti produce, non-availability of agricultural labour, lack of processing facilities at farmer fields, rainfed cultivation etc. Owing to the above reasons, traditional agriculture in mountains has become un-economical or unprofitable.

Therefore, the problem of migration has become intense and a large number of villagers have left out their agriculture and migrated elsewhere for better livelihood and employment opportunities. Apart from the above, the environment and biodiversity of the State has also been affected adversely. Keeping in view the problems in traditional agriculture, cultivation of aromatic crops seems to be a viable solution for raising the economy of the farmers of Uttarakhand as aromatic crops can be grown successfully in stress and adverse conditions.

Efforts have been made to develop aromatic sector in Uttarakhand as a major driver for upliftment of rural economy and to achieve this goal "Centre for Aromatic Plants (CAP)" was conceived in 2003 at Selaqui, Dehradun, where all the required end-to-end facilities and support services like suitable agro-technologies, crop demonstration, awareness & training, quality planting material, incentive to farmers, buy-back of aromatic produce, state-of-art laboratory for quality assessment, networking of field distillation units, marketing and buy-back of essential oils/aromatic produce have been created under one roof.

By adopting systematic and scientific approach, CAP has successfully introduced and commercialized aromatic crops cultivation, processing and marketing in Uttarakhand and Aromatic sector has been emerged as an important sector for upliftment of rural economy and employment generation. CAP has successfully extended the aromatic crops in Uttarakhand and the major crops emerged are: Damask Rose, Lemongrass, Japanese mint, Chamomile, Cinnamon, Caraway etc. Moreover, Lemongrass is being promoted as a waste land crop, Mint as inter crop, Chamomile as short duration crop, Damask rose as boundary crop and Cinnamon as agro-forestry crop.

At the outcome, presently more than 18000 farmers have been engaged in cultivation, processing and marketing of aromatic crops, covering more than 7200 ha. area of land under cultivation. Aromatic crop cultivation in the State has been extended in a cluster approach and 109 aroma clusters have so far been developed in which 178 field distillation units are working in the farmer's field and the overall turnover of aromatic sector in the State has reached upto 70 crore per annum.

### **FROM TRADITIONAL AYURVEDIC MEDICINE TO MODERN MEDICINE: POLYPHENOLIC COMPOUNDS FOR SUPPRESSION OF CANCER AND OTHER ALLIED DISEASES**

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Indigenous traditional healing is an ancient, deeply rooted, complex holistic health care system practiced by indigenous people worldwide. In last few decades, traditional knowledge on primary healthcare has

been widely acknowledged across the world. It is estimated that 60% of the world population and 80% of the population of developing countries rely on traditional medicine, mostly plant drugs, for their primary health care needs. Therefore, there is an urgent need to document the medicinal and aromatic plants associated traditional knowledge, because this knowledge orally passes on from one generation to the next; thus, have vulnerability to be wiped out. Over the past decade or so, biotechnology, pharmaceutical and human health care industries have increased their interest in natural products as sources of new biochemical compounds for drug, chemical and agro-products development. This kind of traditional knowledge is very important to modern pharmaceutical research in that it works as an initial screen and can help isolate the medically significant properties of plants and animals. Several modern drugs, including anti-cancer drugs, antibiotics, malaria drugs, and analgesics, were developed from plant and animal resources based on traditional knowledge. India is recognized as one of the world's top "Twelve Mega diversity" nations. The country has some of the richest, oldest and diverse cultural traditions associated with various aspects and one of the aspects is the use of medicinal plants which is still amply practiced in several parts of India. India has the indigenous plant based medicine system known as Ayurveda that works for complete cure of the body without leaving any side effects. The ancient Indian scriptures have a mention of several plants and their medicinal value. Plants with polyphenol activity have played a major role in traditional Chinese and Ayurvedic medicine for centuries. Epidemiological studies have repeatedly shown an inverse association between the risks of chronic human diseases and the consumption of polyphenolic rich diet. Hence in our laboratory we majorly focussed our work on pterostilbene, a polyphenolic compound isolated from *Pterocarpus marsupium* and studied its role in breast and prostate cancer prevention. Our result found pterostilbene to be potent anticancer agent by acting at various cellular targets. Simultaneously, another polyphenolic compound present in jamun i.e., kaemferol were also checked for their role in preventing of obesity linked diabetes and were found to protect the pancreatic cells from degenerations and improved diabetic conditions. Based on our current scientific understanding we feel that nature is a source of medicine and more extensive studies should be conducted to explore the healing properties of different types of medicinal plants to produce an alternative and effective treatment for the cure killer diseases like cancer and metabolic disorders like obesity and diabetes.

#### **MODERN TOOLS AND TECHNIQUES FOR IDENTIFICATION OF MEDICINAL PLANTS USED IN AYURVEDA**

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The first step in manufacturing of herbal medicines is ensuring the correct identity of the plant ingredients, essential for its quality control. Identification is the art and science of recognising a living entity and distinguishing it from others using an appropriate name. Plants and their products are used as source of food, spices, forage, fibres, fuel, medicines etc. since ages. They must have individual identity correctly ascertained with standardized circumscription and nomenclature. The events of misidentification of plant species, inadvertent use of totally unrelated species or closely related inferior quality species can hinder their medicinal use, the adverse effects of which may cause very serious consequences to a consumer. In ancient era, this task was performed by giving different synonyms to a plant according to its morphology, properties or medicinal use. There are several methods for identification, the simplest, most direct and least expensive is macroscopic identification. For this, morphological characteristics as well as organoleptic characteristics are used. Although, morphological characters of plants have been used extensively to determine plant's identity and are still indispensable to the systematics, in light of the modern developments, the complete knowledge of taxonomy is possible only when a synthetic approach is applied. It includes principles of various disciplines like plant anatomy, cytology, palynology, embryology, physiology, ecology, genetics, plant geography, cytotaxonomy, chemotaxonomy, molecular taxonomy etc. The development of microscopy, electronics and biochemistry as UV-Vis, FTIR Spectroscopy, electron microscope etc. have led to the separation and recognition of bio-active compounds present in the crude drug helping in its proper identification. In this way, modern tools and techniques help in removing the ambiguous identity of medicinal plants specially used in *Ayurveda*.

#### **POTENTIAL OF DEVELOPMENT OF MEDICINAL PLANTS IN HIGH ALTITUDE OF UTTARAKHAND HIMALAYA**

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Owing to its topographic, climatic and soil uniqueness, the high altitude of the Uttarakhand Himalaya is known as an important abode of highly valuable and economically important diversity of medicinal plants. The uniqueness of the Himalayan people, culture and the medicinal plants' diversity is well written and defined by many Saints and Sages in classical Indian literature including Vedas, Ayurveda, Samhitas, Nighantus, Ramayana, Mahabharata etc. from time to time and even today all the subjects related to the Himalayan medicinal and nutraceutical plants are main concern of research throughout the globe among the scientists and other researchers. Sanjeevani mentioned in the epic Ramayana is an example. The Himalaya is also known as a sacrosanct land as it exhibits unique diversity of flora and fauna, though not much in number but all is important. This is only Himalaya where it is believed and realized that the DIVYA AUSHADHIYA PLANTS can speak and themselves explain their medicinal benefits to the human beings.

As mentioned by WHO that we are all new in this game of medicinal plants, there are scopes in the field of medicinal plants in the Himalaya and especially in the Uttarakhand Himalaya. Attitudinally, Uttarakhand Himalaya can be divided into 4 sub-climatic zones i.e., sub-tropical, temperate, alpine and cold desert areas. This research is defined and mainly focuses on high altitude pockets of Uttarakhand Himalaya. Mainly following scopes can be tapped for making Uttarakhand the herbal destination.

*In-situ* conservation deals with conservation of species within their natural habitat so that the process of natural evolution is continued. Forest Department is the main stake holder in this subject. *Ex-situ* conservation deals with maintenance of germplasm outside the natural habitat and their reintroduction in the nature whenever needed. Cultivation is the easy and important alternative for conserving medicinal plants in wild as it reduces population pressure in the wild. Post-harvest technology, value addition and product development are to be processed along with cultivation.

## RECOMMENDATIONS FOR THE EFFICACY OF HERBAL MEDICINES

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Herbal formulations have reached extensive acceptability as therapeutic agents for several diseases. It is a known fact that over 80% of the world population depends on herbal medicines and product for healthy living. This rise in the use of herbal product has also given rise to various forms of adulteration of the products leading to consumer disappointment and in some instances fatal consequences. Majority of Ayurvedic practitioners uses traditional herbal preparations for the treatment purposes. So it is necessary to improve safety of herbal drugs by developing certain quality control parameters & by following the WHO guidelines for herbal medicines. Our ancient books has been mentioned many methods to standardize drug and also about adulteration. Nowadays, old methods are necessary but there are lots of limitations to these methods due to shortage of many drugs, unavailability or limited source, adulteration, lack of knowledge of drug identification. Today physician is totally depending upon mediators for drug collection. Adulteration, substitution, ignorance of dealers creates problem. So there is need to standardize Ayurvedic herbal preparations. Standardization is an important step for the establishment of a consistent biological activity, a consistent chemical profile, or simply a quality assurance program for production and manufacturing of herbal drugs. There are different newer techniques to standardize raw drugs and finished products. This can be achieved only if the herbal products are evaluated and analysed using modern techniques such as UV visible, TLC, HPTLC, GCMS and other methods as phytochemical analysis, fingerprinting, appearance, pH, viscosity, refractive index, saponification value, etc.

## DOES AYURVEDA NEED EVIDENCE?

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In the true sense to prove ourselves in the current scientific world, one needs evidences, reproducibility and ultimately confidence/ satisfaction to users, and researchers. As per modern science which is more supposed to be logical than the conventional methods, Ayurveda uses three tier system to know the truth or gain knowledge, the fourth one Yukti also is the ultimately one. In olden time, ancient sages used all tantra yukties, to conclude their findings, but now for acceptance of any theory or product there is need of proof of concept confirmed by physical-chemical or biological experiments, thus evidence based knowledge survives long. But nowadays, the medical-industrial complex or market driven research and side effects of chemical drug has invented lot of medicines or herbal or natural origin. The acceptance of these drugs as modern medicine is most of the time questionable. The current trend has shown that the voluminous

amount of research data, thousands of pages of scientific text, slanderous media campaigns make the drug successful.

On the contrary Ayurveda itself reveals its existence since time immemorial (*Soymayurvedah shashwato nirdishyate.....*) but lack of evidence in modern terminology or tools raises question over its scientific existence. In Ayurveda primarily there are four types of pramaan are described i.e. Pratyaksha Pramana, Anumana Pramana, Aptopadesha Pramana and Yukti. Pratyaksha Pramana is a means of knowledge. Here, knowledge is acquired by direct knowledge perception through sense organs. [*Aatmendriymanorthaanaam sannikarshaatprawartate; vyktaa tadaatve yaa buddhih pratyksham saa niruchyate. (Ch. Su. 11)*]. Anumana Pramana means the knowledge is acquired through guessing, interpretation and analysis. All Darshanas and Ayurveda accept this Pramana. [*Anumaanam khalu tarko yukti apekshah. (Ch. Vi. 4)*]. Aptopadesha Pramana means the words or speech from authoritative person (*Aaptaanaam vachanam aptavachanam*). Another one Yukti Pramana (Logical Reasoning) is also mentioned as the knowledge which sees the things produced by combination of multiple causative factors i.e. rationale or logical reasoning. With the advancement of the knowledge, the more practical ways are developing to gain the knowledge. Newer problems needs better response. In today's world the disease and drugs both are changing. The perception of knowledge is an outcome from the relationship existing between a *karana & karya* and for better survival of diseased, Ayurveda says know the cause and remove it (*Nidaan parivarjanam*), which still stands true, meaning there by *remove the cause*. The research can be considered as journey from hypothesis to thesis. To gain clear & entire knowledge of science of Ayurveda, it was necessary to search for scientific devices or methods of approach. This necessity has prompted by Acharya Charak to adopt Pramanas. In Ayurveda, scientific investigation and systematic studies should be considered as tools of research to generate evidence. With the emerging global interest in herbalism or plant based medicine, it's high time to invest in research and develop methodology for safe and efficacious medicine.

#### **INSECTICIDAL AND FUNGICIDAL ACTIVITIES OF STEM BARK OF *PRUNUS PERSICA* (L.) BATSCH**

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The present study was aimed to investigate the insecticidal and fungicidal activities of *Prunus persica* (L.) Batsch stem bark. The methanolic extract of stem bark of *Prunus persica* (L.) Batsch was tested for its insecticidal activity against mustard aphid *Lipaphis erysimi* under in vitro condition. The insect mortality percentage was found to be increase with the corresponding increase in dosage indicating a direct relationship between the percentage mortality and dosage %. The highest mortality percent (97%) of *Lipaphis erysimi* was observed with 2.0 mg/L concentration of methanolic extract of *Prunus persica* in 24 hrs, whereas the lowest mortality percent (6%) was found with 0.5 mg/L concentration in 24 hrs. The statistical probit range indicates good activity against *Lipaphis erysimi*. The extract was also tested for its fungicidal activity against *Fusarium oxysporum*. The extract showed 30.33% and 74.77% growth inhabitation with 2 % and 20 % concentration, respectively. Thus, the present study revealed that the plant extract have a remarkable insecticidal and fungicidal activities.

#### **MEDICINAL PLANTS TRADE - UTTARAKHAND SCENARIO**

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India is a nation where plant based drugs has been used in Indian system of medicine. The state of Uttarakhand is blessed with rich resource as medicinal plants. The varied physiography of the state right from *Tarai-Bhabar* and to the alpine meadows harbor significant medicinal plants. Most of the industrial demand of raw materials for preparation of ayurvedic drugs is met from forest. Although the cultivation of medicinal herbs is picking up in the state. In one of the studies carried out by ICFRE, Dehradun the estimated annual trade volume for the year 2014-15 was of the tune 5.12 lakh MT. The study also highlights that in the state of Uttarakhand conventional herbal raw drug mandis existed in Tanakpur and Ramnagar with annual trade of 8,000 MT and 5,000 MT respectively. These mandis receive most of their raw material from hills and Nepal. The state of Uttarakhand has got favorable environment for production of medicinal and aromatic plants (MAPs) particularly those growing in higher Himalayas. There are many governmental agencies working in the sector for cultivation, collection, R&D and marketing. The agencies as Herbal Research and Development Institute (HRDI), Mandal-Gopeshwar, Chamoli; Center for aromatic Plants (CAP), Selaqui; *Bhesaj Vikas Ikai* are carrying out cultivation and extension of medicinal

plants in farmers field. Whereas agencies as Uttarakhand Forest Development Corporation (UFDC), Bhesaj Sangh (BS) and Kumaon Mandal Vikas Nigam (KMVN) are involved in sale of raw medicinal herbs, most of the times the material is collected from forest. The policy guideline for the medicinal plant sector is very well defined in the state. All the cultivators of MAPs need to register themselves with HRDI and CAP as they initiate their cultivation. The cultivators are again provided with Transit permit as their crop matures by Bhesaj Vikas Ikai, by way of which they can sell their produce anywhere in the country. The forest department also plays key role in this sector, as they are guardian of the resources in the forest. The UFDC, BS and KMVN are involved in collection of medicinal plants from forest. The raw materials are auctioned at herbal mandis which are located in Rishikesh, Ramnagar and Tanakpur. The department also provides Certificate of Legal Procurement for export of medicinal plants in CITES list. The farmers of the state are cultivating medicinal plants as *Aconitum heterophyllum*, *Picrorhiza kurrooa*, *Saussurea costus*, *Rheu emodi*, *Cinnamomum tamala*, *Asparagus racemosus*, *Rauvolfia serpentina*, *Aloe barbedensis* etc. Whereas the collection from forest mainly is of lichen (Jhula), Reetha, Tejpat etc. The state has also initiated cultivation of aromatic plants. The CAP, Selaqui provides planting material and distillation units to the farmer groups. The state has potential for meeting demand of high altitude medicinal plants and aromatic oils. Some initiatives have already been initiated as aggregation of production by way of cluster approach. The National Medicinal Plants Board, New Delhi also promotes cultivation of medicinal plants in the state in its National Ayush Mission. The mission has component of cultivation, nursery development and post-harvest management. Still there are challenges that need to be addressed like those of research on development for quality planting material, aggregation of raw produce, good storage/ sanitary practices, assured price etc. The MAP sector has potential for developing livelihood opportunities for the state which has witnessed high incidence of out migration in recent times.

### **MODE OF DRUG ACTION IN AYURVEDA AND PHARMACOLOGY**

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Principles of drug action constitute the basics of pharmacology in any system of medicine. Ayurvedic materia medica is one of the large repositories of medicinal formulations. Classics of Ayurveda, viz., Charaka Samhita, Sushruta Samhita and Ashtanga Sangraha and Ashtanga Hridaya elaborate the principles drug action. The Ayurvedic principles explaining drug action are deep rooted in the Sankhya and Nyaya philosophies. Treatment is ultimately bringing a homeostasis in Tridosha, Sapta dhatu and Trimalas- through a modulation in Panchamahabhutas through the wise usage of Samanya-Vishesha Siddhanta. Treatment principle of Ayurveda can be summarized as “*Sarvada sarva bhavanam samanyam vridhhi karanam*”. Materials with similar properties support bodily tissues and vise a versa. Ayurvedic pharmacology has given pivotal importance to pharmacotherapeutics and clinical pharmacology and it revolves around rasa panchaka, bhesaj marga, kala, swarupa, matra, prayoga vidhi, etc. Modern bio-medicine lays out principles of stimulation, depression, irritation, replacement & cytotoxic actions to explain the pharmacodynamics of drug molecules. The mode of action can be through enzymes, ion channels, transporters, receptors like G protein coupled, kinase linked, serotonin, etc. The current presentation critically looks into the specialties in the principles and mode of drug action in Ayurvedic and modern pharmacological bio-medical perspective.

### **PHARMACOVIGILANCE IN AYURVEDIC PHARMACY**

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Pharmacovigilance is the practice of monitoring the effects of medical drugs after they have been licensed for use, especially in order to identify and evaluate previously unreported adverse reactions. According to WHO “*Pharmacovigilance (PV) is defined as the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other drug-related problem.*” Pharmacovigilance program plays a vital role in ensuring the drugs’ safety. In many countries (including India) a pharmacovigilance system is operational; however, under-reporting is a major problem. The main function of spontaneous reporting is the early detection of signals of new, rare and serious ADRs. Adverse drug reactions (ADRs) have been reported to be among leading causes of morbidity and mortality. Adverse Drug Reaction (ADR) May result in sudden death. The spontaneous reporting of ADRs is considered as the foundation of post marketing surveillance of drug safety. Adverse drug reaction of herbal drugs has been reported on several occasions. Sometimes this is due to mis-identification. These ADRs may be in the form

of Puritis, Urticaria, rash, Rash erythematous, nausea, vomiting, diarrhea, fever, abdominal pain and dyspnoea. The most common reported critical terms for ADRs on herbal drugs are face oedema, hepatitis, angioedema, thrombocytopenia, hypertension, chest pain, convulsions, purpura and dermatitis. Adverse drug reaction of herbal drugs has been reported on several occasions. *Mucuna pruriens* is used for patients suffering from Parkinson's disease. The adverse effects are mild and are mainly gastrointestinal in nature. In Parkinsonism, the average dose of atropine is 0.5mg. The effect of the same is toxic in most cases of 10mg or more. Some other drugs which have shown ADR include Digitalis (Cardiac arrhythmias), Podophyllum (Podophyllum poisoning), Aconitum (cardio toxicity) etc. One of the major causes of adverse events is directly linked to poor quality of herbal medicines including raw medicinal plant material, and to the wrong identification of plant species. Cultivating, collecting and classifying plants correctly are therefore of the utmost importance for the quality and safety of products. The worldwide consumption of herbal medicines today is enormous, so that, in terms of population exposure alone, it is essential to identify the risks associated with their use. Safety of herbal medicines is therefore an important public health issue. Despite the growing interest in the safety of herbal medicines, national surveillance systems to monitor and evaluate adverse reactions associated with herbal medicines are rare, even among the more than 70 Member States participating in the WHO International Drug Monitoring Program. The thalidomide tragedy in the late 1950s and early 1960s served as a wakeup call and raised questions about the safety of medicinal products. Pharmacovigilance is therefore one of the important post marketing safety tools in ensuring the safety of pharmaceutical and related health products.

### **DEVELOPMENT OF NOVEL TRANSDERMAL PATCH OF HERBAL MEDICINE FOR ANTI-ATHEROSCLEROTIC ACTIVITY**

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The modern era has witnessed development of alternate and successful routes of drug delivery system i.e. Transdermal Drug Delivery System (TDDS). Aim of the study was designed to formulate matrix type herbal transdermal patches of *Embllica officinalis* for anti-atherosclerotic activity. Medicated patches were evaluated for physicochemical parameters like thickness, percentage flatness, weight variation, moisture uptake, moisture content, folding endurance, elongation and drug content values. Further, in vivo drug release was also analyzed by HPLC in rabbit serum. Four formulations were prepared using different ratio of matrix forming polymers, plasticizer and penetration enhancers. Formulations EOTP-1, EOTP-2, EOTP-3 and EOTP-4 were composed of Ethyl cellulose and Hydroxypropyl Methylcellulose with the following ratios: 6:4, 7:3, 8:2 and 9:1. All the formulations were subjected to in vitro cumulative permeation revealed 48.53%, 55.46%, 73.26% and 99.72% permeation after 48 hrs of application. The release profile of EOTP-4 showed that permeation of the drug controlled by a diffusion mechanism i.e.  $r^2 = 0.984$  (Higuchi). The cumulative amount of the permeated drug after 48hrs from EOTP-4 was 343.95mcg/cm<sup>2</sup>. Permeability coefficient was calculated 7.16mcg/cm<sup>2</sup>/hr. On the basis of physicochemical and in vitro skin permeation studies, EOTP-4 was selected for further in vivo studies. Blood plasma concentration of EOTP-4 after 48 hrs was 0.2914mcg/cm<sup>2</sup>. Skin permeation performance and Scanning Electron Microscopic studies revealed that EOTP-4 medicated patch may be better than other patches and it was selected as the optimized formulation. There were negligible sign of erythema and edema in skin irritation tests. Therefore, present study indicated that transdermal patches may increase the efficacy of *E. officinalis* for their therapeutic use.

### **PLANT TISSUE CULTURES AS SOURCES OF BIOACTIVE COMPOUND PRODUCTION IN IMPORTANT MEDICINAL PLANTS**

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The discoveries of plant tissue culture furnished novel concept that expansion of modern techniques. These current techniques are useful in explore modern applications of plant biotechnology. Plant biotechnology has been worldwide recognized as one of the important tools for direct application in fields; commercially

available tissue culture plants, natural product research, crop improvement in agricultural fields etc. Organized cultures contribute toward the creation or maintenance of defined structures whereas unorganized mass cultures frequently aim toward growth of undifferentiated mass of cells called callus. Growth and development of such cultures are mainly dependent on the type and composition of supplemented nutritional medium. The morphology plant tissue cultures are subdivided into organized and unorganized cultures. Based on nature of explants and purpose of in vitro studies there are dissimilar types of media available. Compositional analysis of plant growth medium assists optimization and selection of the appropriate medium for the popular explants. Supplementation of single or multiple plant growth hormones plays significant role in directing the growth of callus. Induction, sub-culture, and maintenance of callus require appropriate protocols for their important plant growth and development. A number of nations are installing more units to increase plantlets productivity. Indian industries are now flourishing with multidirectional growth and multimillion dollar turnovers. It's emerged alternative of entire plant cultivation the production of important secondary metabolites. Therefore, plant tissue culture concepts at present well transformed into next level in the form of commercialization. The elicitor's studies also recent methods into the induction mechanism, including signal molecules, functional genes. Media and their preparation require a lot of precautionary measures.

Moreover, the potential to use this method production of some bioactive compounds, such as phenolic compounds, is enormous since it allows the manipulation of biosynthetic routes for increase production and accumulation of particular compounds. Plant phenolic compounds production in in vitro cultures, as well as on the type of elicitors used to increase of the same production; also succinct highlighting phenolic compounds serve as elicitors. Elicitation procedures are often used to increase the production of phenolics, achieve in most cases higher yields than in non-elicited cultures. The increasing production of bioactive phenolic extracts/compounds allows for applicability, namely in the industry of functional foods or in pharmaceutical/medical fields. Numerous cereals, medicinal, aromatic, ornamental, and other crops are regularly propagated by tissue culture techniques and have been traded nationally and worldwide for many years. Plant tissue culture-based industries have an influential role in national and global economies. Plant tissue culture has turned out to be an important tool in the farming and nursery industries, medical, pharmaceutical fields.

### **SCIENTIFIC VALIDATION OF TRADITIONAL AYURVEDIC AND HOMEOPATHIC FORMULATION USING METABOLOMICS TECHNIQUE**

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Most of the Ayurvedic formulations (AF) and homeopathic medicines (HM) are mixture of several metabolites, organic and inorganic components. However, the actual metabolites of AF and HM responsible for biological activity remain largely unknown. As a result these products are not very well defined or characterized particularly with reference to the composition, quality, safety points, molecular disease target and mode of action. The aim of my research group is to scientifically validate existing life-saving AF and HM to cure metabolic disorders such as cancer, diabetes, obesity and cardiovascular disease. Scientific validation of medicinal plant is a fundamental requirement of industry and other organizations dealing with herbal drugs. Quality control of AF and HM, validated processes of manufacturing, are the two key points, which could ensure the quality, safety and efficacy of this traditional system of medicine. Metabolomics is a modern omic-technique for comprehensive analysis of all metabolites present in a plant or AF/HM. Currently we are applying metabolomics and transcriptomics tool to identify the metabolite or metabolite combinations, actually responsible for the biological activity in selected AF and HM and their source medicinal plants. Presently we are focusing on GC-MS/MS and LC-MS/MS based metabolomics of *Ruta graveolens* (Ruta), *Withania somnifera* (Ashwagandha) and *Boerhaavia diffusa* (Punarnava) to identify potential anticancer metabolites and their underlying mode of actions. Our research emphasizes the importance of metabolomics of medicinal plants, important for quality evaluation, understanding mechanisms of action and scientific validation of herbal products.

### **PHARMACOGNOSTICAL EVALUATION OF FLORA FOR DRUG PREPARATION FROM ANCIENT TO PRESENT ERA**

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Pharmacognostical evaluation of flora deals with the identification and standardizations tools to bring successful conclusion with herbal drug preparations. The proper identification of flora is the coarse step to improve herbal drug quality. The drug standardization tools deals with proper identification of the flora, to detect adulteration or substitution, for maintaining quality, purity, safety & efficacy of herbals, it will provide reference standards for future. In Ancient Period, identification of flora can only be done with the help of Namarupajnanam. Namarupajnanam deals with characterization of medicinal plants based on etymological derivation of names and synonyms. Lexicons provide a good range of synonyms originate on the basis of plant morphology and actions. In present era different standardization tools are present like morphology and organoleptic evaluation, microscopic and histologic evaluation, quantitative microscopic study, physical evaluation, qualitative chemical evaluation, quantitative chemical evaluation, toxicological study, microbiological parameters. The morphology of different parts of flora accommodates a track for identification. First collect information about what you see the overall form of the plant and the characteristics of individual plant parts. Organoleptic evaluation includes colour, odour, taste, shape, size, fracture, texture and venation. Microscopic and Histologic evaluation of whole plant is the Study of characteristics like parenchyma, trichomes, vascular bundles arrangements, stomata, fibres etc. Quantitative microscopic study deals with Vein islet number, stomatal index, stomatal number, vein termination number, size of fibres, palisade ratio. Physical evaluation goes with moisture content, solubility, viscosity, refractive index, melting point, optical rotation, ash value, extractives and foreign organic matter.

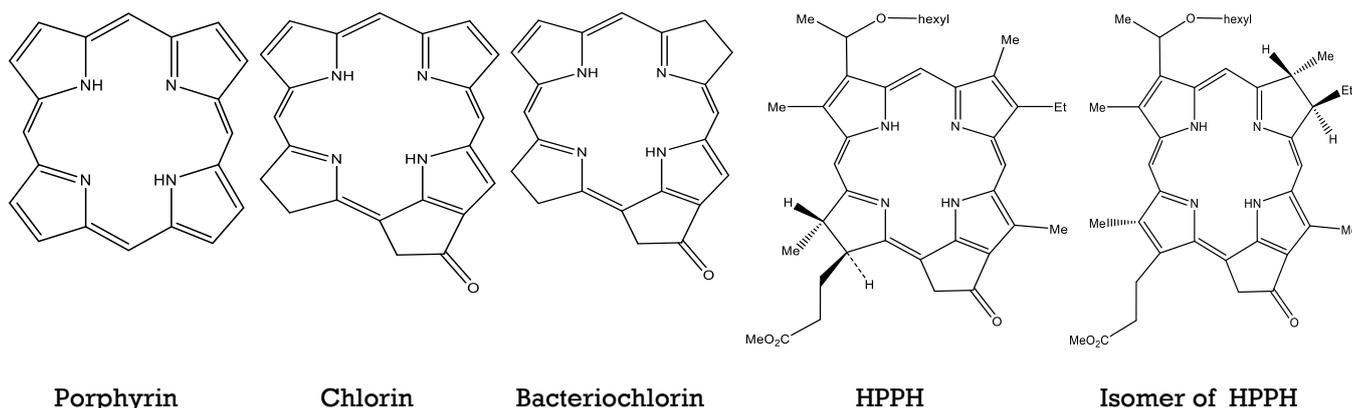
Chemical evaluation includes qualitative and quantitative chemical evaluation. Toxicological study is assessment of pesticide residues, potentially toxic elements, safety studies in animals like LD<sub>50</sub>, microbial assay. Microbiological parameters are Content of Viable, total mould count and amount of Impurities. Conventional methods for standardization are Thin layer chromatography (TLC), High performance thin layer chromatography (HPTLC), Gas chromatography, High performance liquid chromatography (HPLC), Super critical fluid Chromatography (SFC), Infrared spectroscopy, Electrophoretic methods. The whole study deals with the different tools of pharmacognostical evaluation of flora for drug preparation from ancient to present era to achieve the goal for enrichment of herbal drug preparations potentiality. Pharmacognostical tools alter from ancient to present era. In ancients period the only base of identification is by way of synonyms, but it also bring on controversy as many plant have same synonyms. So, the need of hour is to deal with different standardization tools to make possible standards to achieve the goal of better therapeutic potential of herbal drug preparations.

### CHLOROPHYLL DERIVATIVES AS A BETTER AGENT FOR CANCER TREATMENT VIA PHOTODYNAMIC THERAPY

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Porphyrins, chlorophyll and bacteriochlorophyll contain tetra-pyrrole system and are useful photosensitizers for the treatment of cancer by using photodynamic therapy. Biosynthesis chlorophyll is believed to complete in two steps i.e. (i) dark step, this type of process takes place in dark and the (ii) step is light dependent and other steps are known as late steps. The later steps of biosynthesis forms three types of chromophores (1) porphyrins, all the four rings are unsaturated. (II) chlorins in which pyrrole ring 'D' is saturated or hydrogenated and (iii) bacteriochlorins where pyrrole ring B and D are saturated (hydrogenated). It is not possible to understand why the nature selected these three porphyrins for the life on earth. Chemistry and anticancer properties of chlorin and bacteriochlorin derivatives will be discussed.



Synthesis of these two compounds was carried out by applying simplified method. The main compounds hexyloxy pyropheophorbide (HPPH) and hexyloxy ethyl-3-deacetyl-7,8-dihydrophyloerythrin (isomer of HPPH) are promising agents used in photodynamic therapy for the treatment of various type of cancer will be discussed.

### **e-CHARAK – AN ONLINE PORTAL TO TRADE MEDICINAL PLANTS**

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In India nearly 9000 registered herbal industries and a multitude of unregistered cottage-level herbal units depend upon the continuous supply of genuine raw material / medicinal plants for manufacturing of efficacious herbal products, formulations and drugs. Even raw drugs from medicinal plants are being used in households to a great extent. A survey was conducted by National Medicinal Plants Board during the 2014-15 to assess the domestic as well as internal demand of medicinal plants of India. As the report, total commercial demand of herbal raw drugs in the country for the year 2014-15 has been estimated at 5.12 lakh MT which includes 1.95 lakh MT from Domestic Herbal Industry, 1.34 lakh MT from Export and 1.67 lakh MT from Households.

The trade value of 5.12 lakh MT of herbal raw drugs has been estimated around 70 billion INR (> One billion USD). The estimated trade value of herbal raw drugs in commercial demand for the year 2014-15 is about seven times higher than the trade value of 10 billion INR arrived at for the year 2005-06. The major increase has been in respect of the export which has increased from 3.45 billion INR in 2005-06 to rupees 32 billion INR in 2014-15, registering more than eight fold increase in ten years. The trade value of herbal raw drugs consumed by the domestic herbal industry has also registered more than two fold increase as per the latest estimates.

To complete the National and International Demand of genuine medicinal plant based products and raw materials, Government of India under the Ministry of AYUSH has constituted the National Medicinal Plants Board (NMPB) with the mandate of promoting the medicinal plant sector of the country by way of supporting the cultivation, conservation, promotion, resource augmentation, research and development programmes, etc.

In a sequence of giving effect to its mandate, NMPB has recently launched a web portal named "e-charak". It is a modern substitute to traditional trade system. This is a virtual market place where farmers, traders, manufacturers or any other person who wish to buy or sell medicinal plants can register and participate in the trading of medicinal plants. Apart from web portal, an android based mobile app is also developed. It may be downloaded from google play store and all the features of the portal can be accessed from mobile phones anytime and anywhere.

The web portal is presently active in six languages i.e., English, Hindi, Kannada, Tamil, Telugu and Ashami its version in other languages will follow. Live chat facility is available for real time response. Also, resource database of licenced manufacturers is available on the same portal for reference.

This new initiative may surely be beneficial for the industry which is facing a setback in the field of trade mechanism or we can say that the trade in this field is limited to few traditional ways. This platform is a modern initiative in the field to promote trade by providing exposure to large number of stakeholders on both the sides of Demand and Supply. Often networking is an issue faced by many farmers who are then restricted to sale their produce either to the local Mandis or manufacturers who have been regularly buying from them. By registering to the portal, seller can now interact directly with multiple potential buyers across the country or even across the globe and can explore new trade linkages.

'e-Charak' is the abbreviation of 'e-channel for Herbs, Aromatic, Raw material and knowledge'. 'Charaka' the name symbolises a strong relation with medicinal plants. It is a name of one of the principal contributors to the ancient art and science of Ayurveda, a system of medicine and lifestyle developed in Ancient India. He is well known as the "father of medicine". He is famous for authoring the medical treatise, Charaka Samhita.

### **IN VITRO AND IN VIVO THROMBOLYTIC ACTIVITIES OF ANDROGRAPHIS PANICULATA AND ARBUTUS UNEDO**

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The present study aimed to investigate *in-vitro* and *in vivo* thrombolytic activity of extracts of *Andrographis paniculate* (APE) and *Arbutus unedo* (AUE). Thrombolytic activity of hydroalcoholic extracts of APE and AUE was evaluated against thrombin-, collagen-, arachidonic acid-, ADP-, and epinephrine-mediated platelet aggregation and clot lysis method at different doses. Then APE (100 & 200 mg/kg) and AUE (20 & 40 mg/kg) were evaluated for thrombolytic activity in FeCl<sub>3</sub>-induced thrombosis model in rats. APE was able to inhibit platelet aggregation by 58% at 50 µg/mL and 100% at 75 µg/mL whereas AUE by 83% at 100 µg/mL only in thrombin-induced platelet aggregation. Further, APE lysed 45% of the formed clot while AUE lysed 35% of formed clot. Both, APE and AUE showed dose dependent antithrombolytic activity as evidenced by significant reduction size and weight of thrombus in FeCl<sub>3</sub>-induced thrombosis model. APE and AUE remarkably attenuated plate aggregation, clot formation *in vitro* along with reduction in thrombus formation *in vivo* which confirms their thrombolytic activity. Obtained thrombolytic activity with APE and AUE could be attributed to the flavonoids and total phenols present in both the plants.

### NEW ERA OF HERBAL THERAPY

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Herbal sources have been an integral part of several traditional medicine systems like Ayurveda, Chinese medicine, Siddha and Unani system. The universal role of herbal sources in the treatment of disease is exemplified by their employment in all the major systems of medicine, irrespective of the underlying philosophical premise. Herbal medicinal agents are efficacious and safer to be used for the management of various diseases. Ayurveda is a lifestyle science that was developed in India nearly 4000 years ago. In the Ayurvedic era, the herbal sources were the only way of medication for majority of population pertaining to the holistic approaches consisting of easier method of use, low cost of treatment and better results. Moreover, use of herbal medicines is very important in developing countries where the cost of conventional medicines is a burden to the population. More than 30% of all plant species, at one time or another was used for medicinal purposes. Ayurveda offers a wide choice of products for daily well-being, for adjuvant support in disease treatment, for treating health conditions with fewer side effects. According to WHO report, more than 100 plant-derived medicines are being used in the modern medicine. Moreover, many pharmaceutical companies are exploring plant materials for their potential medicinal value. Ayurvedic management of numerous diseases should be focused on the need of investigating new potent, safer as well as standardized herbal medicines. It is important that suppliers of Ayurvedic products educate retailers and consumers about the herbs *i.e.* medicinal value, storage conditions, dosage, low cost and side effect, methods of use to get more effect etc. which is a way that creates differentiation. Ayurvedic products must stand out rather than "blend in" to the crowded field of herbal supplements. Without this, there may not be a compelling reason for consumers to switch from an herb (or brand) that they are already using. However, there is a particular need for education on healthy diet and for interventions that show potential improvement in the quality of a patient's life.

### SUSTAINABLE HARVESTING OF MEDICINAL TREES: PROSPECTIVE APPROACH TO AUGMENT CONSERVATION AND ECONOMIC BENEFITS

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Interest in traditional systems of medicine and, in particular, Ayurveda, has increased substantially in both developed and developing countries over the past two decades. Due to continued collection and increasing market demand, numerous plant species are threatened with extinction. Sustainable harvesting of medicinal plants holds great potential as a method for integrating the utilization and sustainable management of resources. Therefore, sustainable harvesting of medicinal plants is not only essential for conservation of plant species, but also for ensuring livelihoods of many rural communities, dependent on these resources. This paper gives an account on sustainable harvesting practices of *Terminalia arjuna* (Arjuna), *Litsea glutinosa* (Maida), *Saraca asoka* (Ashoka), *Holarrhena antidysentrica* (Kutaj), *Oroxylum indicum* (Sheonak), *Bauhinia variegata* (Kachnar) bark yielding species; *Phyllanthus emblica* (Aonla), *Terminalia belerica* (baheda) : fruit yielding species. Key aspects to a harvest system for bark include strip width and length, harvest rotation, minimum diameter of trees, percentage of the trees in the population to be exposed to bark stripping and the number and rotation of strips on selected trees. Whereas, Aonla and Baheda fruits should be harvested after maturity and nearly 10-20% fruits should be left on tree for

regeneration. Sustainable harvesting practices may provide a simple and effective method for conservation of precious medicinal plants resources. It is reasonable to expect that sustained supply of quality produce will result in increased economic benefit for local collectors, farmers, and dealers.

## NATURAL ANTIOXIDANTS - NOVEL TREND IN FOOD APPLICATION AND NUTRACEUTICALS

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Food quality is defined in terms of consumer acceptability: taste, aroma, and characteristic appearance. Oxidation decreases consumer acceptability of foods by producing low-molecular-weight off-flavour compounds, as well as by destroying essential nutrients, and it produces toxic compounds and dimers or polymers of lipids and proteins. Oxidation of food can be minimized by removing pro-oxidants or chemicals that induce oxidative stress usually through formation of reactive species or by inhibiting antioxidant systems such as, free fatty acids, metals, and oxidized compounds, and by protecting foods from light. The antioxidant mechanism of protection of processed foods against oxidative damage, can be found since, the evolution of aerobic life forms in an increasing oxidizing atmosphere. Vinegar, oils and spices were used since ancient times for food preservation and quality enhancement. Antioxidants are substances that are present at low concentrations compared to oxidizable substrates and significantly delays or prevent the oxidation of that substrate. The rising awareness of consumers toward the health benefits of foods and their nutritional benefits for potential disease prevention and health enhancement is the driving force for the global functional food and nutraceutical market. The effective extraction and proper assessment of antioxidants from food and medicinal plants are crucial to explore the potential antioxidant sources and promote the application in functional foods, pharmaceuticals and food additives. Furthermore, natural compounds not only improve the marketability of the product but also add extra features like anticancer, nutraceutical properties etc. Soluble natural antioxidants such as tocopherols and ascorbate act by chain breaking mechanism. Once initiated, food oxidation processes tend to proceed auto catalytically, therefore, breaking the chain reaction is a critical step in affording stability. Free radical-scavenging property of these natural antioxidants is believed to be the basis for its essentiality and the pathologies associated with their deficiency. This property makes them excellent antioxidants at low concentrations. However, at high concentrations its ability to reduce metal initiators can actually lead to a pro-oxidant effect. In response to a perceived desire by consumers for less chemically processed food ingredients, several naturally occurring, chain-breaking antioxidants are being introduced to accomplish essentially the same effects as those of substituted phenols such as butylated hydroxy hydroxyanisole (BHA) and butylated hydroxytoluene (BHT), propyl gallate and TBHQ; synthetic antioxidants that are particularly widespread in their use in foods.

## ANTIMICROBIAL POTENTIAL OF WILD AND MICROPROPAGATED *MEIZOTROPIS PELLITA* - AN ENDEMIC AND ENDANGERED PLANT OF KUMAUN HIMALAYAS

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Comparative analysis of leaf extracts of micropropagated and wild *Meizotropis Pellita* was conducted against eight highly pathogenic bacteria. Methanol, Hexane and Aqueous crude extracts from dried leaves of wild and micropropagated plants were used for the study. Standard Agar Well Diffusion and Minimum Inhibitory Concentration (MIC) determining techniques were deployed to determine antimicrobial potential and variation in micropropagated plant in respect to wild specimen. Methanol extract from wild plant presented a prominent Zone of Inhibition (ZOI) and MIC with *K. pneumoniae*, values were determined to be  $28.67 \pm 0.67$  mm and  $0.222 \pm 0.022$  mm/ml respectively. Similarly methanol extract of *in vitro* raised plant showed ZOI of  $26.67 \pm 0.88$  mm and MIC of  $0.289 \pm 0.022$  mg/ml with *K. pneumoniae*, whereas ZOI of  $10.33 \pm 0.88$  mm was observed when  $30 \mu\text{l}$  of  $30 \mu\text{g/ml}$  Gentamycin was used with *K. pneumoniae* which is highly promising, similar results were obtained with other bacteria too. Results indicate that both the specimen contain very potent antimicrobial properties hence could be utilized for pharmaceutical research. When compared with wild almost similar antimicrobial potential was observed in micropropagated plant. Hence it could be concluded that not much difference has accumulated in the micropropagated plant.

**ORAL PRESENTATIONS****ETHNO-PHARMACOLOGY: AN APPROACH TO VALIDATE AYURVEDIC MEDICINAL PLANTS THROUGH MODERN ASPECTS****Aparna Dixit and V. K. Joshi***Department of Dravyaguna, IMS, BHU, Varanasi*

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India is a continent with various languages and dialects; enough geographical and climatic diversity; and different tribal and folklore knowledge. The country is also very rich to have a vast classical literature about herbal drugs and their therapeutic uses. Plants used for traditional medicine contain a wide range of substances that can be used to treat chronic as well as infectious diseases. Due to the development of adverse effects and microbial resistance to the chemically synthesized drugs, men turned to ethno-pharmacology. The word ethno-pharmacology can be understood as study of plants based on ancient literature and folklore knowledge; and investigation and characterisation based on modern concept. It is with various aspects of this heritage handed down through many centuries, as well as with newer acquisitions, that the subject of ethno-pharmacology is concerned. Pharmacology is described as the study of the morphological, physical, chemical, biochemical and biological properties of natural products along with history, cultivation, collection, extraction, isolation, bio assaying, quality control and preparation of crude drugs of natural origin. The scope of Ethno-pharmacology has expanded from the traditional morphological description of plants to encompass the most modern aspects of molecular science. The search for new drugs from natural sources and their application to treat the illness of human being is the ultimate task of this. According to Ayurvedic principle of medicine, the concept of drug and disease is entirely different, although it is successfully alleviating the physical ailments. In present scenario, it is necessary to demonstrate the effectiveness of a natural product obtaining as pure compounds or as a whole drug, to verify these traditional claims. That's why it becomes mandatory to evaluate our medicinal system according to parameters of the new world. In presented article, the evaluation of medicinal plants and products according to pharmacological parameters along with Ayurvedic specifications are summarised.

**ROLE OF AYURVEDIC TREATMENTS FOR DIABETES MELLITUS****Preeti Sharma***Department of Home Science, Government Post Graduate College, New Tehri, Tehri Garhwal, Uttarakhand*

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Diabetes mellitus is a metabolic disorder resulting from defect in insulin secretion, insulin action or insulin secretion and action. A consequence of this chronic hyperglycemia is disturbances of carbohydrate, fat and protein metabolism. Long term complications of diabetes mellitus include retinopathy, nephropathy and neuropathy. The risk of cardiovascular disease is increased. There are two types of diabetes mellitus; type 1 insulin dependent (IDDM) and type 2 non-insulin dependent (NIDDM). Ayurvedic treatment aims to restore the equilibrium through various techniques, procedures, regimens, diet and medicines. Ayurvedic treatments consist of drugs, diet, exercise and general mode of life. Ayurvedic practitioners treat diabetes with a multi-pronged approach, using diet modification, panchkarma to clean the system, herbal preparations, Yoga and breathing exercises. The herbs which are used to treat diabetes are shilajit, turmeric, neem, *Coccinea indica*, amalaki, triphala, bitter melon, bilva, cinnamon, fenugreek, gymnema, bay and aloe vera. The Ayurvedic preparations Vasanta Kusuma Kar Ras and Chandra-Prabhavati are believed to lower sugar levels proprietary Ayurvedic medications are also used to treat diabetes.

**ANTIOXIDANT POTENTIAL OF SMOKE OF AGNIHOTRA YAGYA- SOME PRACTICAL EXPERIENCES****Ruchi Singh<sup>1</sup>, R. K. Dutta<sup>2</sup> and A. N. Garg<sup>3</sup>**<sup>1</sup>*Department of Applied Medicinal Plant Sciences, Dev Sanskrit University, Haridwar 249411, India*<sup>2</sup>*Department of Chemistry, Indian Institute of Technology, Roorkee 247667, India*<sup>3</sup>*Institute of Nuclear Science and Technology, Amity University, Sector 125, Noida 201313, India*

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Yagya (known as a fire-ritual) is an ancient Indian method of herbal inhalation therapy. Yagya is a spiritual experiment of sacrificing and sublimating the *havan samagri* in the *yagyagni* with chanting of Vedic mantras. This *agni yagya* when performed at small scale is also known as *havan* or *agnihotra*. From time immemorial, human beings have used smoke of medicinal plants to lead a healthy life. Plant-derived

smokes are used in medicinal as well as ritual contexts worldwide. Medicinal applications are reported for approximately 740 plant species while ritual and religious uses are documented for around 400 species. In medicine, the intertwining of cultural and pharmacological aspects of healing has been put forward with the placebo effect and later, the meaning response. The meaning response conceptualizes how both the administered drug and the cultural meaning of the treatment context influence the efficacy of a medicinal treatment. Therefore, in analogy to medicine, it might be argued that the effects that rituals including *yagya* have on human beings are also dependent on both the cultural and the pharmacological context. Free radicals or reactive oxygen species (ROS) are formed in our body as a result of biological oxidation and are potential agents to initiate oxidative stress related diseases like cancer.

Antioxidants are well known agents for neutralizing these ROS. Antioxidants from plant sources are more bioavailable and are safe for human consumption. Plant-derived smokes can play an important role as it can be inhaled actively or passively as ambient smoke. So the main objective of the study was to identify the chemical constituents of the smoke produced during *yagya* and determination of its antioxidant potential. The plant material selected for *yagya* is a complex mixture of odoriferous and medicinal herbs *havan sámagri* (material used for fire oblation) obtained from Shantikunj Pharmacy, Haridwar, India, that includes *M. indica*, *S. album*, *T. cordifolia*, *C. rotundus*, *H. spicatum*, *A. marmelos*, *C. deodara*, *N. jatamansi*. An apparatus was designed to simulate the burning process and the smoke fractions were analyzed for volatile organic compounds by gas chromatography-mass spectrometry (GC-MS). The anti-oxidant activity of methanolic extract of smoke has been determined in terms of DPPH• scavenging activity and reducing power. In the present study, smoke released due to *yagya* was analyzed and 17 compounds were identified in the smoke of *yagya*. The compounds were identified by comparing spectral data with the NIST (Version 08) and Willey (Version 8) Chemical library. The DPPH• radical scavenging activity ( $IC_{50}$  value  $80.4 \pm 0.03 \mu\text{g/ml}$ ) and reducing power of *yagya* smoke was found significant. The present study suggested that the smoke produced during *yagya* could be potential source of natural antioxidant that could have great importance as therapeutic agents in preventing or slowing the progress of aging or age associated oxidative stress. In many cultures, smoking has been a popular route for drug administration and this method stands a better chance of being acceptable by people.

## **AN EVIDENCE BASED ETHNOMEDICINAL STUDY OF UNDOCUMENTED MEDICINAL PLANTS OF UTTARAKHAND REGION**

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Himalayas have a great wealth of medicinal plants and traditional medicinal knowledge. Medicinal plants have played an important role of primary health care system among the local people of Himalayan region. As the local people are settled far from urban area, they cannot take modern health care facilities so they are totally dependent on traditional medicinal practices for their primary health care. According to World Health organization (WHO) nearly 80 per cent of the world population depends on traditional medicines. Recent surveys have revealed that almost 50 per cent of the prescription drugs are based on natural products and raw materials. India and China are the largest users of herbal medicines. The Central Himalayan Region covers the Uttarakhand has a rich variety of herbs, medicinal and aromatic plant species. Now-a-days increasing demand, deforestation, adulteration, decreasing quality of medicine, is burning problem, so enrichment of pharmacopoeia is the need of the hour. In this paper, I will present critical evidence based review study on the undocumented medicinal plant of Uttarakhand region.

## **NIRGUNDI (*Vitex negundo* L.) - AN USEFUL MEDICINAL PLANT**

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*Vitex negundo* L., commonly known as Nirgundi belongs to family Verbenaceae. It is a large woody and aromatic shrub attaining a height of about 6-12 feet, flourishing mainly in Indian subcontinent. It is found throughout the greater part of India, ascending to an altitude of 1500 meter in outer Himalayas, especially found in hot provinces. There are two varieties in classical texts viz. Nilapushpi and Svetapushpi which are named as Nirgundi and Svetpushpi, considered blue and white varieties respectively. Mostly Nilapushpi or Nilanirgundi (*Vitex negundo*) is described as Nirgundi. Leaves, roots, seeds, flowers and fruits are used in medicinal value; leaves are trifoliate or pentafoliate. Flowers are bluish-purple in colour, small in peduncle cymes. Fruits are succulent drupe, globose, black when ripe. The recommended doses for nirgundi are as leaves decoction 50-60 ml, leaves juice 10-20 ml and leaves churna 3-6 gm. The formulation is prepared as

Nirgundi Tail, Vishagarbha Tail, Jatyadi Tail, Acne-n-Pimple Cream, Pilex tablet and cream, Rumalaya tablet and gel. Maharshi Charaka mentioned drug Nirgundi under 'Visaghna Mahakasaya' and 'Krimighna Mahakasaya'.

Leaves of Nirgundi contain two glucosidic iridoids designated as Nishidaside and Negundoside. Leaves also contain Rotundial (a potent mosquito repellent), Bioflavonoids (which have analgesic and anti-inflammatory action), two alkaloids, tannic acid, vit. C and some volatile constituents. Drug nirgundi has katu, tikta (rasa), laghu, ruksh (guna), ushna (virya), katu (vipaka) and kaphavata- shamaka (karma). It is vataghna, vedana sthapana, aampachan, yakriduttejaka, krimighna and jwaraghna. Drug nirgundi is used in vatavyadhi-gridhasi, amavata, sandhivata; sirahsule, nadi-varna, Jwara-vishmajwara. The decoction of the leaves was found to prevent the development of swelling of joints. It is a constituent of Ayurvedic preparation Vishagarbha Tail and other compound oils. The leaves are reported to possess insecticidal, insect repellent and antiseptic properties. Heated leaves are applied to painful and rheumatic swellings. The roots possess tonic, febrifungal, expectorant and diuretic properties. The drug Nirgundi is an effective analgesic and anti-inflammatory herbal agent. The leaves are ground and paste is prepared which is externally applied to wound, ulcer, swollen joints, inflammations and various other ailments including skin affections. The leaves are ground (Kalka) and cooked in oil (Tila Tail or Sesume oil) for preparing Nirgundi taila, which is very effective remedy for rheumatism, sprain and old/ deep gangrenous wound.

### CLINICAL STUDY OF GARLIC PREPARATIONS

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Seven preparations of Garlic have been taken for this study named as Rasone ghrit, Rasone guggula, Rasone asava, Rasone sura, Rasone satva, Rasone kalka with rasone asava and Rasone kshirpaka with rasone guggulu. Seven groups of patients have been formed for clinical study of pharmaceutical; 7 groups of patients of rheumatoid arthritis (each group contents 6 patients) have been treated with seven different preparations of Garlic; medicine is given for 40 days. Results showed that rasone ghrit, rasone guggula, rasone asava, rasone sura, rasone satva, rasone kalka with rasone asava and rasone kshirpaka with rasone guggul are effective upto 56.05%, 68.77%, 46.05%, 60.30%, 63.67%, 56.87% and 70.83%, respectively. From comparative study of different garlic preparations on R.A. patients, it is found that Rasone guggula preparation with rason kshirapak was most effective, has given 70.83% results.

### A CLINICAL STUDY OF TRIKATU WITH KUMARI W.S.R. TO DYSLIPIDEMIA

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Dyslipidemia is a very common metabolic disorder in these days, and it is the main disposing factor for the atherosclerosis, which is the main pathogenesis factor for Coronary heart disease (CHD) and Cardiovascular disease (CVD). *Ayurvedic* classics have mentioned many efficacious herbs which act on liver, digestive system and metabolism. Two such drugs are *Trikatu* and *Ghritakumari* (*Aloe vera*). The first drug in the study is *Trikatu*, which literally means three *Katu dravyas* (pungent substances), i.e. ginger (*Zingiber officinale*), black pepper (*Piper nigrum*), and long pepper (*Piper longum*). *Trikatu*, has been described in *Ayurvedic text* as *Kaphamedoghana* (alleviate *Kapha dosha*, viz. lipids & fats) and *Deepana* (appetizer), which means that it removes the *Kapha dosha* and *Meda* and improves the *Agni* (metabolism). The second drug, *Ghritakumari* (*Aloe vera*), plays the dual role of medicine, *Yakrituttejaka* (stimulates liver functions) and *Bhedana* (breaking down of fecal matter) as well as *Rasayana* (rejuvenator). Both the trial drugs are easily available and economically affordable. On these accounts, a clinical study has been done to observe the synergic effect of *Trikatu powder* with *Kumari pulp* in the management of Dyslipidemia, i.e. *Medoroga*.

For the clinical trial, 68 patients of Dyslipidemia were selected and randomly divided into two groups – A and B of 34 patients each. The patients of group A i.e. placebo group were administered two capsules of 500mg filled with wheat flour orally twice a day with luke warm water. The patients of group B i.e. trial drug group were treated with 2 gm *Trikatu powder* and with 20 gm *Aloe vera pulp* orally twice a day with luke warm water. The duration of the trial was 3 months, with monthly follow up. Analysis of overall effect of trial drugs on subjective & objective parameters of both groups revealed that the results of Group B (Trial drug) were highly significant (p<.001). According to basic concept (*Samanya –Vishesha Siddanta*) of

*Ayurveda* It is generally proposed that similar properties enhance the respective qualities inside the body while the opposite properties reduce. With this back ground *Trikatu* and *Ghridakumari* both are *Katu*, *Tikta rasa* and *Katu vipaka* in nature, i.e. just opposite of *Medodhatu*, (lipids and fat) reduce the quantity of *Medodhatu*. Along with this *Trikatu* has also *Tikshna* (sharp), *Laghu* (light) and *Sukshma* (micro in size) properties, which is also opposite to *Medodhatu* (Lipids and fat). By virtue of the therapeutical actions like *Deepana* (appetizer), *Pachana* (digestive), *Rukshana* (producing dryness), *Lekhana* (producing sliminess), and *Shoshana* (absorption) etc., as a whole *Trikatu* reduces the quantity of *Meda* (lipids) and also makes the channels potent to carry on the nutrients to subsequent *Dhatu*s as per the chronological order mentioned in *Ayurveda*. On the basis of modern researches, these pharmacological actions may be due to its chemical substance piperine which enhances the secretion of digestive juices and might catalyze the functions of enzymes in small intestine too, and in this way it helps in improving the functions of *Jatharagni* (digestive fire) and also facilitates the function of *Dhatvagni* and *Bhutagni* (metabolism).

### **MUSTADI KWATHA: ITS GUNA-KARMA AND ROLE IN STHOULYA (OBESITY)**

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In Ayurvedic classics the terms like *sthula*, *Sthoulya*, *medovridi* and *medoroga* has been used by the Acharyas in different contexts, sometimes often taken as relative terms, but by observing the references and signs and symptoms sight changes can be observed in the pattern of *medovridi*, *medodosha*, *Sthoulya* etc. According to *Charak samhita*, one can be cured of all *santarpankrut* diseases by over-refreshing regimen if he takes every morning the *kwatha* (decoction) of *Musta* (*Cyperus rotundus* Linn.), *Aragvadha* (*Cassia fistula* Linn.), *Patha* (*Cissampelos pareira* Linn.), *Triphala* (*Terminalia chebula* Linn, *Terminalia belerica* Roxb. and *Emblica officinalis* Gaertn), *Devadaru* (*Cedrus deodara* Loud.), *Svadamstra* (*Tribulus terrestris* Linn.), *Khadira* (*Acacia catachu* Willd.), *Nimba* (*Azadirachta indica* A.Juss.), *Haridra* (*Curcuma longa* Linn.), *Daruharidra* (*Berberis aristata* DC.) and the skin of *Vastaka* (*Holarrhena antidysenterica* Wall.). These drugs mixed with some unctuous substance and applied unction with or without massage or as bath cure skin diseases. In 13 ingredients of *Mustadi kwatha* are- there are 10 drugs are of *Laghu* guna and 8 drugs are of *Ruksha* guna, 12 drugs are of *Tikta rasa* and 9 drugs are of *Kashaya rasa*, 5 drugs are of *Katu rasa*, 7 drugs are of *Sheeta veerya* and 6 drugs are of *Ushna veerya*. 8 drugs are of *Katu vipaka* and 5 drugs are of *Madhura vipaka*. 11 drugs are having *Kaphashamaka/ Kaphaghna* action, 12 drugs are having *Pittashamaka* action and 8 drugs are having *Vatashamaka* action respectively. So, finally as *Samhitakar* says if some formulation is having more ingredients in it, Its action will be considered as the combined effect of the whole drug and not according to their individual action.

### **ROLE OF SAPTACHAKRA (*Salacia reticulata* WIGHT.) IN THE MANAGEMENT OF MADHUMEHA (TYPE 2 DIABETES MELLITUS)**

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Almost all Ayurvedic text books have explained about the disease *Madhumeha*; some of the Acharyas (ancient authors) termed it as *Kshudrameha* as *Kshoudra* is the synonym of *Madhu* (honey). *Diabetes mellitus* is correlated with this disease. People are anxious to know regarding this disease elaborately. Now in the whole world, nearly about 24% of the population is suffering from this disease. According to WHO, its percentage may go as high as 40-45% in 2020. So, there is intense need to know the graveness of the disease and to understand the possible ways of preventive aspects of this disorder. Ancient Ayurvedic scholars have grouped *Madhumeha* (*Diabetes mellitus*) under one among the 20 *Prameha* (urinary disorders); particularly one of the kind of vatic disorder. Also, any of the *prameha* (urinary disorder) if neglected ultimately it ends up in *madhumeha* due to nature of the illness. *Saptachakra* (*Salacia reticulata* Wight.) of the family *Celastraceae* has potent antioxidant properties, and triglycerides and LDL cholesterol-lowering effects that aid in weight loss. It contains *mangiferin*, a poly phenol, which enhances the body sensitivity to the insulin and contains inhibitors of sugar digestion and absorption. *Salacia* is also been found to inhibit *aldose reductase*, an enzyme that is normally present in eye and in other part of the body that helps change glucose into sugar alcohol called *sorbitol*. Too much *sorbitol* trapped in eye and nerve cells can damage these cells, leading to neuropathy, retinopathy and cataract.

**DIVERSE BIOLOGICAL PROPERTIES OF ASHWAGANDHA (*Withania somnifera* (L.) DUNAL)****Ravindra Semwal<sup>1</sup> and Sonali Dimri<sup>2</sup>**<sup>1</sup>Faculty of Pharmacy, Govt. Polytechnic Gauchar, Chamoli, Uttarakhand<sup>2</sup>Department of Agriculture, SGRR (PG) College, Dehradun

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Ashwagandha (*Withania somnifera*) of the family Solanaceae is one of the most powerful medicinal plants used in Ayurvedic medicine for more than 3,000 years. In Ayurvedic classic, Charaka Samhita, the plant is described as Balya (group of herbs to improve strength and immunity) and Brimhaneeya (group of herbs to improve body mass and nourishment). It is useful in anxiety, leucoderma, depression, insomnia, weight management, immunity, muscle strength, antioxidant and sexual stimulation. Various parts of *W. somnifera* especially the roots have been proved effective against different kinds of cancers. The most active components withanolides and withaferins along with a few other metabolites including withanone and withanosides have been reported to have effective anticancer activity against different types of cancer cell lines. Withaferin A showed inhibition of tumor growth and metastatic lung nodule formation with minimal systemic toxicity. Other bioactive compounds reported from the plant are withanone, withanolide withanolide A to Y; somnirol, somnitol, withasomniferin A, nicotine, pseudotropine, tropine, solasodine, withasomnine, Sitoindosides VII-X, sominone and Somnolide. Root, stem and leaves extracts from the plant showed cytotoxicity activity various cell lines. Ethanol leaves extract showed strong activity against PC-3 and HCT-15 with 80-98% growth inhibition.

**COMPARATIVE STUDY OF ASHODHITA AND SHODHITA HARIDRA WITH RESPECT TO THEIR INHIBITORY PROPERTIES AGAINST  $\alpha$ -AMYLASE AND  $\alpha$ -GLYCOSIDASE****Anuj Kumar<sup>1</sup>, Jayanta Kumar Maji<sup>2</sup>, Prashant Bedarkar<sup>1</sup>, C. R. Harisha<sup>3</sup> and M. B. Nariya<sup>3</sup>**<sup>1</sup>Departments of Rasa Shastra and Bhaisajya Kalpana, <sup>2</sup>Pharmaceutical Sciences, <sup>3</sup>Pharmacognosy, IPGT & RA, Gujarat Ayurveda University, Jamnagar, Gujarat.

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Ayurvedic classic (lexicon) have been recommended to administer internally some non-poisonous drug (turmeric, guggulu) before passing through the specific shodhan process. Aim of this study is to create an unorthodox valid database in favor of shodhan impact on Haridra undergone phyto-pharmacological environment. Authenticated raw turmeric (rhizome) samples purified through different sodhana processes by using medias such as cow's urine, Panchapllava (five different plants tender leaves), inflorescence of mundi (*Sphaeranthus indicus*, Linn) decoction, and water and butter milk. Resultant samples undertaken microscopy (TS) then dried, pulverized and accepted for powder microscopy, image-processing (L\*a\*b colour based image segmentation), physico-chemical and quantification of curcumin by High performance thin layer chromatography finally methanolic extract examined for inhibitory effect on  $\alpha$ -amylase and  $\alpha$ -glucosidase. The multi-vitiate analysis (PCA) and image processing analyzed with the help of Unscrambler and Matlab software. Pharmacognostical finding showed the addition & alteration of characters drug with turmeric powders after shodhana like crystal of gomutra, pollen grain and starch grain of mundi, epidermis, fibre, crystal of panchapllava. Various plant powders shown distinct L\*a\*b colour value after image acquisition toolbox. Applying principal component analysis PC<sub>1</sub> and PC<sub>2</sub> explained (90 + 9) % total variance in score plot of respective purify turmeric samples shown clear grouping in relation to physico-chemical constant. Quantification of curcumin in various treated turmeric samples displayed variation due to additive and reductive effect after shodhana in HPTLC fingerprinting. This study proves the alteration in the inhibitory effect of raw and shodhita samples of *Haridra* on  $\alpha$ -amylase of IC<sub>50</sub> in decreasing order TZ (113.72) < TW (119.22) < TR (121.861) < TT (161.35) < TGM (218.85) and  $\alpha$ -glycosidase TZ (121.32) < TW (139.48) < TR (145.29) < TT (185.51) < TGM (276.12) respectively. This study proved that purification in Ayurveda not only refers to the elimination of toxin but also transformation in the properties in the primary substance rendering it safe as well as many desired qualities are imbibed in it.

**CLINICAL EVALUATION OF HAEMATINIC PROPERTY OF CERTAIN INDIGENOUS DRUG IN IRON DEFICIENCY ANEMIA****Swapnil Singhai<sup>1</sup> and Jaya Kala Saklani<sup>2</sup>**<sup>1</sup>Department of Kayachikitsa, Uttarakhand Ayurved University, Gurukul Campus, Haridwar, U.K., India<sup>2</sup>Department of Kayachikitsa, Uttarakhand Ayurved University, Rishikul Campus, Haridwar, U.K., India

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In developing countries, a large population is affected by Nutritional Deficiency Disease. Iron deficiency anemia produces vague symptoms such as lethargy, body ache, and weakness. The course of these diseases is generally very slow. Over a prolonged period the patient is devoid of the nutritional factors through the diet and the other sources of such nutritional factors. As the deficiency persists due to deficient production of blood, pallor of skin, nails and palpebral conjunctiva, edema of eyelids, pedal edema and dyspnoea on exertion gets appeared. Angular stomatitis, Koilonychia, Glossitis also gets appeared. The CCF and Cardiac Arrest are the rare complications develop due to cardiac overload. Due to the advancement of the pathology, various investigations were carried out to rule out the other pathologies and put the patient on aggressive therapy. It is not only a time consuming and costly job but also causes the psychological upset of the patient. The early diagnosis of the disease and its appropriate treatment are the best answers to such problems. It is an effort to evaluate the merits and demerits of certain indigenous oral preparation, its effectiveness, and the amount of haemoglobin percentage increase in the proposed time period and its adverse effects if any. Thirty patients of iron deficiency anemia were diagnosed on the basis of signs and symptoms along with the investigations-blood haemoglobin level between 6 to 9 gm%, microcytic and hypochromic peripheral smear and serum iron level were included in this study. In Agnimandya, Dhaturukshata and Raktakshaya various herbal drugs are used with Mandur or Louha. These drugs are generally Agnideepak, Yakrituttejak, Snighdha, Krimihar, Raktashodhak, Raktavardhak and some of them are good sources of iron. In present study Gud, Shunti, Til, Mandur in equal quantity and Pippali in double quantity were administered orally to alleviate Iron deficiency anemia. Patients were advised to take 2 capsules of drugs, two times a day with luke warm water after meals. The total duration of treatment was one month. The relief percentage in pallor was 79.37%, in edema was 77.78%, in fatigue was 82.54%, in anorexia was 87.5%, in lethargy was 80%, in giddiness it was 82%, in lassitude was 73.21%, in dyspnoea was 73.33%, in palpitations was 75%, in muscle cramps was 86.44% and in pedal edema was 62.63%. The overall result showed 50% are totally cured, 30% are moderately improved and 10% are mildly improved and 10% patients didn't respond to the treatment. Pippali, and shunti are considered as one of the best Agnideepaka, Aamapachaka Yakrituttejak and Krimihar drugs, are used to increase the digestive power. Gud and Til are good source of iron. The Sheeta Veerya of Mandur & Gud and Kashaya rasa of Mandur & Til act as Haemostatic. The drugs used in this study are very effective, safe and good Agnideepaka, Raktavardhaka and Yakrutottejak for iron deficiency anemia. It is very easy to take, all the constituents are readily available, cost effective and with rare adverse effects.

## CLINICAL EFFICACY OF BODHI VRIKSHA KASHAYA IN THE MANAGEMENT OF HYPERURICEMIA

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When the plasma (or serum) urate concentration becomes > 6.8 mg/dl, it is defined as Hyperuricemia. Hyperuricemia can result from increased production or decreased excretion of uric acid or from the combination of the two processes. In the general population, the prevalence of hyperuricemia ranges between 2.0 and 13.2%, and the prevalence of gout is in between 1.3 and 3.7%. Uric acid crystal deposits in the joint cause inflammation of the joint leading to pain, redness, heat, and swelling. Uric acid is normally found in the body as a normal by product of the way the body breaks down certain proteins called purines. Causes of elevated blood uric acid level (Hyperuricemia) include genetics, obesity, and certain medications. The most recognized complication of hyperuricemia is Gouty Arthritis. As the disease is having a chronic nature, modern medicines only subsides the disease for short time period along with various side-effects and relapse also occur on withdrawing the medicines. To identify an alternative, safer and permanent cure *Bodhi Vriksha Kashaya Paan* was selected for the study to see their effect on Hyperuricemia. 15 patients aged between 20-60 years and serum uric acid more than 6.8mg/dl were selected for the research study. The patients were treated by *Bodhi Vriksha Kashaya Paan* in quantity of 40 ml BD for 60 days. *Bodhi Vriksha* has *Kashaya*, *Madhura Rasa*, *Virya Sheeta*, *Vipaka Katu* and *Pitta Shamaka*, *Raktashodhaka* and hence pacifies the *Rakta Dosha*. The clinical study was found to be significantly effective in reducing *Kandu*, *Daha*, *Rug*, *Toda*, *Sandhi Sotha*, *Stabdhatta* and Serum Uric Acid.

## STANDARD PROTOCOLS IN THE MANUFACTURE OF NATURAL HEALTH PRODUCTS-HERBAL MEDICINES

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Herbal medicines widely used in health-care in both developed and developing countries are complex chemical mixtures prepared from plants, have reached widespread acceptability as therapeutic agents for diabetics, arthritics, liver diseases, cough remedies, memory enhancers and adaptogens. As per WHO definition, there are three kinds of herbal medicines: raw plant material, processed plant material and medicinal herbal products. Herbal Drug involves conversion of botanical materials into medicines where standardization and quality control with proper integration of modern scientific techniques and traditional knowledge is practiced. Conventional pharmaceutical products, herbal medicinal products may vary in composition and properties. Increasing reports of their ill effects have drawn the attention of many regulatory agencies for the standardization of herbal formulations. In this context, correct identification and quality assurance is an essential prerequisite to ensure reproducible quality of natural herbal products, which contributes to its safety and efficacy. Standardization of herbal medicines comprises total information and controls to essentially guarantee consistent composition of all herbals including analytical operations for identification, markers and assay of active principles. There is no legal control model over medicinal plants. Different countries define medicinal plants or products derived from them in different ways and have adopted different approaches to licensing, dispensing, manufacturing and trading to ensure their safety, quality and efficacy. Hence there is need for standard protocols for the authenticity and quality control of herbal preparations and products. This review article deals with various techniques employed in extraction, characterization and standardization of herbal, polyherbal as well as nanoherbal medicines.

### **IDENTIFICATION OF BIOMOLECULES CONTAINED IN *Asparagus racemosus* WILLD. ROOT TUBERS USING MODERN TECHNIQUES**

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*Asparagus racemosus* Willd. (Shatavari) is extremely healthful Ayurvedic drug which has been exploited since ancient time. Although, a lot of literature on *Asparagus racemosus* Willd. is available, but crystal clear identification of its constituents and biomolecules have not been reported till date. In this view, characterization of this medicinal plant becomes quite necessary. The plant extracts usually are occurring as a combination of various types of bioactive compounds or phytochemicals having different polarities. Thus, their separation still remains a big challenge for the process of identification and characterization of bioactive compounds. Various modern techniques have been employed to determine and estimate the presence of such biomolecules in medicinal plants. Spectroscopic techniques are the most useful and popular techniques to identify and authenticate the phytoconstituents/natural drugs. FT-IR and UV-Vis measurement encompasses a wide variety of chemical and biochemical applications which involves in research.

### **BIODIVERSITY OF MEDICINAL PLANTS OF UTTARKASHI DISTRICT AND THEIR CONSERVATION FOR DISEASE PROTECTION**

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Himalaya covers 18% geographical area of the India, which extends over 12 states and broadly categorized into Northern, North-Eastern and Central Himalaya. Of the total population of the country 6% people are inhabited in this region. The rich biological diversity of the Himalayan region is managed and utilized by these native communities in a variety of ways. Study area falls under the Uttarkashi district. The present study was based on intensive and extensive field made during December 2015 to April 2016 periodic field visits were made once in study area to collect detailed information about the diversity and utilization of medicinal plants. So, medicinal plant were surveyed by us, which are directly used by Bhotiya and local community of the area. But regular use and illegal poaching may become serious problem for these medicinal plants in near future. The allopathic system of medicine though expanded with a high growth rate has caused a lot of side effects and people are again returning to medicine extracted from vegetation. India and China is the repository of world's best system of natural herbs and medicine. The Garhwal region was the place of Rishi Charak for making research on herbs and he composed Charak Samhita. The market for the herbs is now going upward with the craze for Ayurveda and traditional curing system. Demand for the cosmetics based on herbs and plant extracts is increasing with unprecedented rate. Now, it is up to the planners of the region to ride the crest of this opportunity and take benefit from production of Medicinal and Aromatic Plants.

## IDENTIFICATION AND PROCUREMENT OF GENUINE HERBS IN HERBAL INDUSTRY- CHALLENGES AND SOLUTIONS

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Indian culture is enriched with flora and their medicinal uses. *Ayurveda* is an ancient science which deals with lifestyle and various disorders. Ailments are treated with herbal therapies in *Ayurveda*. Earlier *Acharyas* had vast knowledge of plants and their uses. But with due course of time mankind regressed from traditional and classical information regarding herbs. Classics written in different parts of India used various languages hence resulting in confusion. In Sanskrit also there were many scholars who in the process of identifying, gave many Sanskrit names to a single plant. In present scenario, herbal market is blindly dependent on herb traders (*pansari*). These herb traders (*pansari*) provide spurious drugs, giving a major setback to *Ayurvedic* drugs in international market. These herb traders driven by their commercial motives usually provide adulterated, spurious and substituted material. Adulteration is intentionally or unintentionally added during harvesting and storage. Lack of classical knowledge, botanical experts, cultivation skills, and well trained personals for handling herbal goods, over exploitation of resources lead to serious issues in herbal industry. The aim of the study is to properly botanically identify plant species by re-evaluating the classics, to find out new cultivation and storage techniques to enhance yield within short interval like micropropagation, tissue culture etc., to maintain potency and availability for continuous supply, drugs manufactured from endangered or toxic drugs should be regulated by government and to regulate regulation authority for quality maintenance. The results showed that tissue culture could be useful for eliminating disease, which can accure in stock plants. TCPs may have increased branching and flowering, greater vigour higher yield. Through micropropagation and tissue culture the propagation of large quantity of good quality planting material from mother plant within short interval. Hence, it can be concluded that after proper botanical identification of plants amendments should be done in cultivation techniques through green house, micropropagation, tissue culture, callus culture, seed culture etc. Only Government authorized herb traders should procure and supply genuinely tested herb drugs. And they should be registered and validated regularly by State Government. Better production is possible because of greater plant uniformity and availability in mass at any time. The propagation can increase availability of extinct plant species. There should be a collaborative effort from all the stakeholders to produce effective and potent medicines.

### SURVEY OF SOME IMPORTANT MEDICINAL HERBS OF SAHASTRADHARA, DEHRADUN

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Medicinal plants are an important source of raw material for traditional medicines and a large number of people derive employment and income from the collection, processing and trade of these plants. Plants still constitute one of the major raw materials for drugs for treating various ailments of human beings although there has been significant development in the field of synthetic drug chemistry and antibiotics. The objective of the study is to do survey and collection of different species of herbs having important medicinal values grown in the area of Sahastradhara, Dehradun. The great importance of collecting good herbarium material for taxonomic identification of the collected species must be stressed. There is need for conservation of all useful plants species, and also cultivation ,maintenance and assessment of germplasm for future use, since among the most vulnerable plant species in India the most over exploited are the medicinal plants.

### SURVEY OF MEDICINAL PLANTS OF PITHORAGARH DISTRICT

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Man is dependent on plants from time immemorial and the history of usage of plants is as old as history of development of civilization. Human life and culture has been directly or indirectly influenced by its surrounding environment as man continues to use plants for various needs, the primary ones being requirement for food and curing ailments. The objective of this paper is to study and evaluate the

traditionally used medicinal plants found in Dharchula areas of Kumaon Himalayas in Pithoragarh district Uttarakhand, North India. The reported plant species have found innumerable significant uses in the Indian, Tibetan and Chinese systems of medicine and continue to be highly valued by their practitioners. Based on interactions with locals and traders and taking into consideration the potential of some species for developing new drugs, an attempt has been made to work out the value of the species found in the aforementioned geographic areas with regards to its medicinal importance. This value has been found to be high enough to justify taking appropriate measures towards conservation of these valuable species and their sustainable usage for the economic upliftment of the region. Further, the high medicinal value of such plant species was communicated (in local Kumaoni language) to the locals and traders to make them aware of the same and restrict free irrelevant usage of such plants which could lead to extinction of certain breed of plant. To allow for prudent use and judicious conservation of these plant resources, one of the ways is creation of 'Sacred Groves' usually dedicated to a local deity.

A traditional means of biodiversity conservation, these groves can be considered the ancient equivalent of natural sanctuaries where all forms of living creatures are given protection by a deity. No one is permitted to cut any tree or plant or harm any form of life in this area. International organizations have also recognized the importance of sacred groves, their positive influence in preventing the destruction of medicinal plants thereby promoting sustainable development. The significance of medicinal plants from Himalayan region is well known to the world. This present study identifies the various sacred groves of Kumaon Himalayas and further investigates and documents the utilization of medicinal plants by various local communities and tribes in that area.

### **X-RAY DIFFRACTION ANALYSIS OF A TRADITIONAL BIOMEDICINE - GODANTI BHASMA**

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Godanti Bhasma (GB) is traditionally prepared calcium containing Ayurvedic formulation, widely used as an antipyretic agent. As it is sheeta in property it is useful in pittaja jwara, jirna jwara, kasa, swasa, balya and deepana. It is also helps in urahksata, ksaya, shirashula, pandu roga and it is specially indicated in balshosha and shweta pradara. Externally it is used in raktasrava. The present study was conducted for the quality assessment of Raw Godanti Churna (RGC) and processed Godanti Bhasma (GB). A sample of GB was prepared by purification (shodhana) of Godanti followed by repeated calcinations (marana). Resultant product was subjected to organoleptic tests and classical tests for quality control such as Rekhapurnatwa, Varitartva, Unama, Nirdhumatva and Niswadu. For quality assessment, crystalline phase identification with powder X-ray diffraction (XRDP) was carried out on RGC and GB. The study showed that the GB which on repeated calcinations was converted into a more stable aragonite form.

### **EVALUATION OF NUTRACEUTICAL PROPERTIES OF SELECTED WILD EDIBLE CROPS OF GARHWAL HIMALAYA**

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The present study aims to develop new food supplements with potential pharmacological activity from readily accessed natural products. Medicinal plants represent a rich source of potent and powerful drugs. The treatment of human and animal disease depends mainly on natural products derived from plants, animals, microorganisms and minerals. *Oplismenus frumentaceus*, also known as Jhangora belongs to the Poaceae family and the seeds are used as rice. *Eleusine coracana* (Poaceae) is commonly known as Koda in Uttarakhand. It is rich in protein, iron, calcium, phosphorus, fiber and vitamin content. Its calcium content is higher than all cereals and iodine content is said to be highest among all the food grains. The extraction process involved fractionation with various solvents and estimation of nutrients and minerals using AOAC method and ICPMS techniques. The level of crude protein, carbohydrates, crude fiber and ash content in *E. coracana* seeds were found to be 7.30%, 68.10%, 3.60% and 8.50%, respectively whereas 2.87%, 80.93%, 5.80% and 5.30%, respectively were measured in the seeds of *O. frumentaceu*. The seeds of *E. coracana* and *O. frumentaceu* were found as highly medicinal and nutritional due to rich sources of vitamins, minerals, calories and other needful nutrients.

## THIN LAYER CHROMATOGRAPHIC STUDY OF CERTAIN GENUINE MEDICINAL PLANT AND THEIR MARKET SAMPLES

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Adulteration in market samples is one of the greatest drawbacks in promotion of Ayurvedic products. Since both the industry and the individual physician use these plants in a dry form, therefore a method to assess their genuineness in the dry form is the need of hour. The chief methods employed in evaluating drugs are Organoleptic i.e. practical & on the spot tool, Physical & Phytochemicals – Lab based tools, Experimental and Clinical-final confirmative tools. Practical, physiochemical studies are inadequate and chromatographic along with other Phytochemical studies are more beneficial in identification. Although chromatographic evaluation like HPLC is overpriced criteria for the identification of drugs and developing countries like India may not afford these costly identification techniques. TLC is a competent tool to standardize Ayurvedic herbs. It is relatively a simple, handy, easier, convenient, efficient and inexpensive technique for quick assessment of the quality of herbal drugs. It can be used to efficiently demonstrate the characteristic constituents of a drug or raw plant extract. The present study was carried out to make a database related to exact identification of *Sariva* (root of *Hemidesmus indicus* (Linn.) R.Br.), *Trivrit* (*Operculina turpethum* (Linn.) Silva Manso) and *Bharangi* (*Rothica serrata* (Linn.) Steane and Mabb.) from its market samples with the help of TLC. The genuine samples were collected from the hills of Western Ghat, Pune and Chitrakoot forest (M.P.) and authentication of plant materials collected for study were done at BSI Allahabad UP. The market samples were collected from four major raw drug selling market (Kochi, Kolhapur, Delhi and Jaipur) of India. Comparative TLC study were performed on genuine and market samples in Dravya guna lab of NIA Jaipur. The findings of the study will be systematically compiled as a database and critically analyzed with an aim to evolve Thin Layer Chromatographic identifying features of genuine drugs. After studying market samples of drugs, it was found that all samples were adulterated & no one market sample was found as genuine drug. After organoleptic study of market samples of *Sariva*, it had been observed that, sample of Kochi, Kolhapur & Delhi are same, which have similar characters that like of *Decalepis hamiltonii* (Root). TLC profile again suggests that these samples are similar & also have similar phytochemical constituents (i.e. have same Rf values). Interestingly the TLC spot of Jaipur sample was also somewhat coincided with that of genuine, which was totally differ organoleptically. Therefore, this sample may be investigated clinically to explore the possibilities of a cheaper substitute of the genuine. After study of market samples of *Trivrit*, TLC profile of Kochi sample (*Ipomea petaloidea*) matches with the genuine sample and all other samples can be safely differentiated by TLC from the genuine sample. After studying market samples of *Bharangi* it was found that the sample of Kochi market having Pharmacognostical similar characters to that of root of *Premna herbacea*. Keeping this in mind, TLC of this sample was compared with the published TLC of *Premna herbacea* and found to be the same. This confirms that the Kochi sample was *Premna herbacea*. Kolhapur sample may be stem pieces of *Clerodendrum* spp. and it has almost similar TLC profile to that of genuine drug. Delhi and Jaipur sample have similar TLC profiles.

## CULTIVATION OF MEDICINAL HERBS BY TISSUE CULTURE TECHNIQUES

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Haberlandt envisioned the concept of plant tissue culture and provided the basic work for the cultivation of plant cells, tissues and organs culture. In recent years, a number of plants have been investigated and reported possessing medicinal values. Over-utilization and continuous depletion of traditional medicinal plants have affected their supply and loss of genetic biodiversity. The Term Plant Tissue Culture is generally used for the aseptic culture of cells, Tissues, organs, and their components under defined Physical & Chemical Conditions in Vitro. The Concept is primarily based on the idea that a medicinal Plant body can be dissected into smaller Parts Termed "explant" and that any explant can be developed into a whole medicinal Plant. Scientists have achieved remarkable success in the application of Plant tissue culture or plant biotechnology to various problems in basic and applied plant science. Plant Tissue culture has significantly contributed to the conventional methods of herbal farming, Herbal garden and herbal forestry. The tissues culture techniques are including micropropagation (large scale micro propagation and mechanized approaches for many more species are needed), somatic embryogenesis and synthetic seed technology and gene transfer for genetic engineering of plants. The laboratory requirements for the experiments are culture room, sterile transfer room, media preparation, cleaning and washing area, herbal nursery advantages of using tissue culture systems.

**STANDARDIZATION OF MEDICINAL PLANTS FOR THERAPEUTIC PURPOSE****Rashmi Bhaskar<sup>1</sup>, Parul Sharma<sup>1</sup>, Ved Bhushan Sharma<sup>2</sup>**<sup>1</sup>Departments of Panchkarma and <sup>2</sup>Agad Tantra, Uttarakhand Ayurved University, Rishikul Campus, Haridwar  
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Medicinal plants are those plants that are used (parts, extract etc) in treating and preventing specific ailments and disease that affect human beings. Hence the important role of medicinal plants in health care delivering is very important. With the changing pattern of life style most of the diseases are now becoming lifestyle diseases. The world is witnessing an unprecedented growth in the usage of herbal products globally. These have necessitated development of modern and objective standards for evaluating the safety, quality and efficacy of these medicines. The current standards, parameters and protocols available to test the quality of herbals medicines were originally developed for allopathic drugs and can at best authenticate the safety and efficacy of the drug not the identity of that drug. Herbal medicines are natural products and their phytoconstituents depends on time and region, processing and storage. Variations in the collection, processing or storage of an herb could impact its efficacy profile. Since prior knowledge regarding appropriate collection and usage of most medicinal plants exists in tradition, it can be used as a guide to quality standardization. The parameters of testing the quality of materials (dravya) in traditional medicines, such as rasa (taste), guna (properties, potency), virya (active principal) vipaka (post digestion effect) and karma (action) are very different from the western method like macro and microscopic examination of the plant, TLC, HPTLC, chromatographic examination etc. These traditional parameters reflect not only the quality but also efficacy. The written protocols available in traditional medicines either for collection or for testing the action is not being explored enough to be implicated. The methods of testing need revivification in present era. With the tremendous increase in the global use of medicinal plants, several concern regarding the safety and quality of herbal medicines have also been observed, Hence, it has become necessary to standardize the quality and safety assurance measures so as to ensure supply of medicinal plants of good quality.

**SHATAVARI (*Asparagus racemosus* WILLD.) – A STEROIDAL-RICH AYURVEDIC MEDICINAL PLANT****Ruchi B. Semwal<sup>1</sup> and D. K. Semwal<sup>2</sup>**<sup>1</sup>Department of Pharmaceutical Sciences, Tshwane University of Technology, Pretoria-0001, South Africa,<sup>2</sup>Department of Phytochemistry, Faculty of Biomedical Sciences, Uttarakhand Ayurved University, Dehradun-248001, Uttarakhand, India

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Shatavari (*Asparagus racemosus*) of the family Asparagaceae is a well-known Ayurvedic medicinal plant for a variety of therapeutic purposes including gastric ulcers, dyspepsia, cancer and sexual disorders. Because of destructive harvesting, combined with habitat destruction, and deforestation, the plant is now considered endangered in its natural habitat. Its discussion in many Ayurvedic texts confirmed its use in various ailments. In Charaka Samhita it is described as Balya (strength and immunity promoting group of herbs), Vayasthapana (anti-aging group of herbs) and Madhura skandha (sweet tasting group of herbs). Vagbhata described this plant as Vidarigandhadi, whereas in Susruta Samhita, the plant is described as Vidarigandhadi, Pitta Shamaka (Pitta balancing group of herbs) and Kantaka Panchamula. Bhavaprakash Nighantu Shutra No. 159 stated that the plant has Gulmajit (useful in abdominal tumor) property. Various investigations confirmed the anticancer efficacy of this herb. The plant has various steroids together with some alkaloids. An aqueous extract from the roots of *A. racemosus* was found to be an effective formulation to prevent the patocarcinogenesis induced by treatment with DEN. Immunohistochemical staining of the hepatic tissues of rats treated with DEN showed the presence of clusters of cells expressing the mutated p53 protein, whereas an absence of mutated p53 foci was observed in rats pretreated with the root extract, which revealed that the aqueous extract of the roots prevent the incidence of hepatocarcinogenesis. This plant also showed inhibitory activity on DMBA-induced mammary carcinogenesis in rats. As rats fed on a 2% *A. racemosus* diet showed a decline in both tumour incidence and mean number of tumours per tumour bearing animal. In addition, shatavarins (active constituents of the plant) exhibit potent anticancer activity in both *in vitro* and *in vivo* experimental models.

**SYNERGISTIC ROLE OF RHIZOSPHERIC ENDOMYCORRHIZAE IN ACCUMULATION OF SOME PHYTOCHEMICALS IN *Abroma augusta* L.: AN ENDANGERED MEDICINAL PLANT SPECIES OF BRAHMAPUTRA VALLEY IN ASSAM****Vipin Parkash<sup>1</sup>, Akshita Gaur<sup>1</sup>, S. C. Biswas<sup>2</sup>**<sup>1</sup>Forest Pathology Division, Forest Research Institute (Indian Council Forestry Research & Education, Autonomous Council under Ministry of Environment & Forests, Government of India), Dehradun-248006, Uttarakhand, India

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The overexploitation of *Abroma augusta* L. has resulted this plant species to its threshold and it is need of the hour to protect and conserve this medicinally important plant species. It is mainly used for the treatment of various gynecological disorders in the traditional system of medicine and is also gaining importance in the other phyto-therapeutic disciplines. The present study was an attempt to study the endomycorrhizae associated with *A. augusta* and to see the synergistic effect of bio-inoculation on status and accumulation of some phytochemicals associated with this endangered plant species. Through this study, it was observed that a total of 22 species of AM fungi belonging to 3 genera (i.e. *Glomus*, *Gigaspora* and *Acaulospora*) were isolated from the rhizospheric soil of *A. augusta*. Natural occurrence of AM fungal isolates was observed maximum (10) in Amsoi study site, roadside and paddy field habitats (16, each) along with low elevation range (50-80 m amsl) (37), while the studied parameters were lowest in Kokilamukh (1) location, fallow and riverine habitats (1, each) along with mid-elevation range (80-110 m amsl) (5). The maximum species richness value (16.94) was observed in Amsoi whereas minimum or approximate no species richness (0.00) was observed in Kokilamukh. The highest diversity index value was in Amsoi (0.06) while Titabor and Kokilamukh locations had almost meager diversity index value (0.01). Species richness and diversity index with respect to AM fungal spore populace associated with rhizosphere of *A. augusta* exhibit a direct proportionality (0.91). The inoculated plants were analyzed for Seed fatty oil (%), total root (bark) alkaloids, total protein content (%), total saponins (%) and kernel proteins (%). It was observed that all the studied parameters as cited above were highest in case of the inoculated plant ( $37\pm 0.57$ ,  $0.32\pm 0.05$ ,  $0.30\pm 0.001$ ,  $0.09\pm 0.003$ ,  $30\pm 0.20$ , respectively), with respect to both the wild and experimental control plants. Total protein content (%) and Seed fatty oil (%) were quantified more in the wild plant samples rather than the experimental control sets; while total root (bark) alkaloids, total saponins (%) and kernel proteins (%) were approximately the same. Again, quarterly quantitative analyses of *A. augusta* leaves indicated fold increase in total plant alkaloids in inoculated plants.

#### **NEED TO CONSERVE *Swertia speciosa* WALL D.DON: AN ALTERNATE SOURCE OF XANTHONE AND AMAROSWERIN COMPOUNDS**

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*Swertia speciosa* is one of the most important substitutes of *Swertiachirayita* belong to family Gentianaceae and is locally known as Bambiri. It is a perennial herb distributed in marshy localities of timber zone in the Himalayan region to Bhutan between 2240 and 4000 m. This species had reported to contain bioactive compounds like xanthone, antioxidants, amaroswerin, amarogentin and ursolic acid as in *S. chirayita*. These major bioactive compounds of *S. speciosa* play significant role as hepatoprotective, anti-hepatotoxic, anti-microbial, anti-inflammatory, anti-carcinogenic, anti-leprosy, hypoglycemic, antimalarial and anti-tumor. As *S. chirayita* was critically endangered medicinal and is now on the verge of extinction and original populations of many of them have been vanishing due to high demand of Pharmaceutical industries, traditional use and the developmental human activities. Keeping this in view, large scale propagation of *S. speciosa* should be taken up immediately by developing appropriate technologies as this species is an alternate source of many valuable bioactive compounds which were found in *S. chirayita*. In this direction, we have initiated work on development of suitable Agro techniques and *in vitro* culture for large scale propagation of this species.

#### **EFFECT OF VARIOUS PLANTING GEOMETRIES AND WEED CONTROL MEASURES ON HERBAGE YIELD AND QUALITY OF KALMEGH [*Andrographis paniculata* (BURM F.) WALL NEES]**

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A field experiments was conducted during *khari* season of 2014 and 2015 at MRDC of G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand), India to study the effect of planting geometries and weed control measures on weeds and herbage yield of *kalmegh* (*Andrographis paniculata* Nees). The soil of experimental site was sandy clay loam in texture having high organic carbon, low available nitrogen, high available phosphorus and medium in exchangeable potassium with slightly alkaline in reaction. The

experiment, treatments comprising of three level of planting geometries ( $P_1 = 30 \text{ cm} \times 20 \text{ cm}$ ,  $P_2 = 40 \text{ cm} \times 25 \text{ cm}$  and  $P_3 = 50 \text{ cm} \times 30 \text{ cm}$ ) and six level of weed control practices ( $W_1 =$  Pendimethalin 30 E.C. PE @1 kg a.i./ha followed by mechanical weeding by hand hoe at 30-35 DAT,  $W_2 =$  Quizalofop ethyl 5 E.C. PoE @ 50 g a.i./ha at 3-5 leaves stage of weeds followed by mechanical weeding by hand hoe at 30-35 DAT,  $W_3 =$  Pendimethalin 30 E.C. PE @1 kg a.i./ha + Quizalofop ethyl 5 E.C. PoE @ 50 g a.i./ha at 3-5 leaves stage of weeds,  $W_4 =$  Pendimethalin 30 E.C. PE @1 kg a.i./ha + Quizalofop ethyl 5 E.C. PoE @ 50 g a.i./ha at 3-5 leaves stage of weeds followed by mechanical weeding by hand hoe at 30-35 DAT,  $W_5 =$  Weedy check and  $W_6 =$  Weed free) were laid out in split plot design keeping planting geometries in main plot treatment and weed control practices as sub plot treatment with three replications. Planting geometries and weed management practices had a significant effect on density and dry weight of weeds, crop growth and development, herbage yield and quality of kalmegh, at harvest during both the years. Maximum plant height (61.6 cm and 63.6 cm) and the significant more dry matter accumulation  $\text{g/m}^2$  (625.74 g and 667.82g), dry herbage yield q/ha (29.2q and 31.7q) and andrographolide yield kg/ha (24.36 kg and 29.53kg) were recorded under closer planting geometry at harvest during both years respectively. However, wider planting geometries recorded significantly higher andrographolide content (1.29% and 1.34%) during both the years respectively. The density and total weeds dry weight significantly decreased with the increased planting geometries during both the years. Weed free at all planting geometries recorded significantly higher values of dry herbage and andrographolide yield during both years. This treatment was followed by  $W_4$  and  $W_1$  during both the years. However, the higher content of andrographolide in kalmegh was produced under weedy check conditions under all the planting geometries during both the years. Therefore, based on two years experimental findings it is recommended that for the higher herbage yield, planting geometry  $P_1$  (30 cm  $\times$  20 cm) with either of the three weed control practices viz.  $W_4$  (pendimethalin 30 E.C. PE @1 kg a.i./ha + quizalofop ethyl 5 E.C. PoE @ 50 g a.i./ha at 3-5 leaves stage of weeds followed by mechanical weeding by hand hoe at 30-35 DAT) or  $W_1$  (pendimethalin 30 E.C. PE @1 kg a.i./ha followed by mechanical weeding by hand hoe at 30-35 DAT) or  $W_6$  (weed free) are at par and may be adopted for higher herbage yield and best quality of Kalmegh.

#### **ANTIDEPRESSANT ACTIVITY OF *Nyctanthes arbor-tristis* FLOWER EXTRACT ON RAT MODELS OF DEPRESSION**

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Depression is a common affliction that spares no geographical area or demographic. It is a leading cause of mental illness and disability worldwide with an estimated number of 300 million people affected with this debilitating illness round the globe. *Nyctanthes arbor-tristis* or night jasmine locally known as Harshringar or Parijata is a plant largely distributed in sub-Himalayan region. It finds wide applicability traditionally in a variety of diseases including depression. But any study reporting the scientific validation of the antidepressant activity of the flowers of *N. arbor-tristis* is still lacking. The study aims at evaluating the same in quest for a plant based treatment option for depression which might prove to be beneficial as compared to the existing therapeutic options available. The aim of the study is to evaluate the antidepressant activity of *Nyctanthes arbor-tristis* flower extract on rat models of depression. Hydro-ethanolic extract of the flowers of *N. arbor-tristis* was screened for antidepressant activity in forced swim test and tail suspension models of depression in Wistar rats. Highly significant and dose dependent decline in immobility time was observed in groups that received *N. arbor-tristis* extract as compared to the vehicle control group in forced swim test ( $P < 0.01$  for 250 mg/kg and  $P < 0.001$  for 500 mg/kg) as well as tail suspension test ( $P < 0.05$  for 250 mg/kg and  $P < 0.001$  for 500 mg/kg). Results for the higher dose of the extract were found similar to that of the standard drug imipramine. *N. arbor-tristis* flower extract was found to be highly efficacious in alleviating induced depression in rats. The antidepressant effect of the higher dose of the extract (500 mg/kg) was found similar to that of the imipramine paving path for a medicinal alternative for treating depression.

#### **FUNGAL DISEASES OF MEDICINAL PLANTS AND THEIR BIOLOGICAL MANAGEMENT**

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Fungal diseases seriously affect the cultivation of medicinally important plants and cause extreme losses. As a result of growing concern about health and environmental burdens associated with fungicides, there are accelerated efforts from the scientists to effectively promote biological disease management strategy.

The present study aimed to generate knowledge regarding the fungal pathogens causing serious losses in the cultivation of medicinal plants. Further, efforts were made to identify efficient *Trichoderma* strains as an eco-friendly option for disease management. During 2013–2017, disease surveys were conducted in Medicinal and Aromatic Plant (MAP) Gardens of Assam Forest Department and some private MAPs nurseries. The disease symptoms and signs were recorded. The fungal pathogens were isolated, purified and identified. *Trichoderma* spp. were recovered from forest soil, and identified using sequence analysis of internal transcribed spacer (ITS) region of the rDNA. The strains were tested for their antagonistic potential following dual culture, inverted plate, and culture filtrate assay. Further, greenhouse experiments were performed to see the effect of application of *Trichoderma* isolates against *Curvularia andropogonis*—the incident of leaf blight of Java Citronella. The cultivation of MAPs was found to be drastically affected by several diseases. Leaf spot, quick wilt, fruit rot, leaf blight, target leaf spot, root rot, wilt, anthracnose, mosaic etc., were frequently encountered in the surveyed MAP gardens. Plant pathogens, viz., *Curvularia andropogonis*, *Alternaria alternata*, *Curvularia maculans*, *Pestalotiopsis theae*, *Colletotrichum gloeosporioides*, *Fusarium solani*, *Rhizoctonia solani*, *Septoria* sp., *Phytophthora* sp. were found responsible for serious disease problems in MAPs. *T. asperellum*, *T. virens* and *T. harzianum* were found effective in laboratory assays against the target pathogens. Analysis of variance (ANOVA) revealed significant differences among *Trichoderma* isolates in checking the mycelial growth of fungal pathogens in dual culture, inverted plate and culture filtrate assay ( $P < 0.05$ ). Further, *T. asperellum* was found effective against *C. andropogonis* in greenhouse conditions. The successful cultivation of medicinal plants using eco-friendly approach has vast potential as consumers are more health conscious and prefer natural products having zero pesticides and other contaminants. The findings of the present study confirm significant antifungal activity of *Trichoderma* isolates against major pathogens of medicinal plants. These findings necessitate further testing of effective *Trichoderma* isolates in field conditions.

#### **CLINICAL TRIAL FOR THE EFFICACY OF *Carica papaya* LEAF EXTRACT ON PLATELET COUNT**

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For the past few years, *Carica papaya* L. (Caricaceae) gaining popularity world over due to the possible effect of its leaves against thrombocytopenia in dengue fever by increasing platelet count in patients. It is however, a matter of great concern that till the date there is no experimental validation regarding its mechanism to increase the platelet count. Viral infections are most common and a vast number of patients come for the routine clinical examinations with symptoms of hemorrhagic fever due to viral infection. In most of the cases, there is a sudden fall in platelet count. Currently, the peoples of about 125 countries are infected somehow by such viral infections. The juice of *Carica papaya* leaves was chosen for the study to prove the efficacy of leaf extract in increasing the platelet count. This plant has been used since ancient times for the treatment of viral infections. Various scientific studies proved the beneficial effects of the papaya leaf extract against different ailments. The chymopapain and papain extracts are useful in the treatment of many disorders whereas the extracts from fruits and seeds have bactericidal and antiviral properties. To assess the efficacy of the extract on platelet count, a proforma has been designed to know the effect of the extract after oral administration (decoction of 1 g powder thrice a day) for a certain time period (24/48/72 h) with follow-up upto 3 months. Fifty patients are already selected for this study came to the OPD for the treatment of acute viral fever. Preliminary results showed significant effect of papaya leaf extract on the patients.

#### **DOSE RELATED ANTIHYPERGLYCEMIC ACTIVITY OF AMALAKI RASAYANA IN SWISS ALBINO MICE**

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*Amalaki swarasa bhavita Amalaki churna* (ASBAC) is commonly regarded as *Amalaki Rasayana* (AR) and is widely practiced formulation for *Rasayana*. *Amalaki* is recommended in Ayurvedic classics, proven efficacious and widely practiced in the management (treatment, prevention of complications) of *Madhumeha* (Diabetes Mellitus). *Amalaki Rasayana* assures perennial availability of drug, improves palatability, shelf life and potentiate the classical dosage forms of *Amalaki* i.e. *Churna* and *Swarasa*. Prevalence of Diabetes is growing worldwide and India is leading. *Amalaki* is plenty of available in India,

cheap, safe and having wide therapeutic utility especially in conditions associated with Diabetes hence capable to reduce cost of management of diabetes and will enhance Indian financial profit in global market. Dose related antihyperglycemic activity of *Amalaki swarasa bhavit Amalaki churna* has not been evaluated till the date. The aim of this study is to evaluate dose related antihyperglycemic activity of *Amalaki swarasa bhavita Amalaki churna*. The *churna* was prepared with 16 *Bhavana* of equal quantity of *Amalaki Swarasa* to *Amalaki churna* with modified method of soaking and *churnakriya*. Antihyperglycemic study of *Amalaki swarasa bhavita Amalaki churna* (ASBAC) was conducted after approval of IAEC at 2 dose levels (43.29 and 260mg/kg) and Standard control (SC) Glibenclamide (0.065 mg/kg) given orally 1hr before Glucose overload, in acclimatized and overnight fasted Swiss albino mice. BSL were recorded initially and at 30, 60, 90 and 120 min after glucose overload. Statistically insignificant difference in between initial BSL of test drugs, water control and standard control shows cohort conditions initially. Water control group showed statistically significant hyperglycemia at all test intervals and hyperglycemia at 120mins whereas ASBAC exhibited comparative reversal of hyperglycemia at all test intervals and statistically significant reversal in BSL at 60 min and onwards at higher dose and at 90 min and 120 min at lower dose. ASBAC at both the dose level showed dose related reversal of BSL at all test intervals. At higher dose, ASBAC exhibited more reversal of hyperglycemia at all test intervals even more than that of standard control glibenclamide. *Amalaki swarasa bhavita Amalaki churna* exhibited dose related antihyperglycemic effect at 43.29 and 260mg/kg, orally corresponding to 0.33gms and 2gms single human dose which is even more than that of standard control glibenclamide.

### **STUDY ON LEAF SPOT DISEASE OF *Aloe vera* (L.) BURM., MANAGEMENT STRATEGY AND ANTIFUNGAL ACTIVITY OF ITS GEL**

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*Aloe vera* (L.) Burm. is an important medicinal plant and its leaf gel is known to possess great medicinal value for skin, stomach ailments along with antiseptic properties against fungi, bacteria and viruses. Appearance of leaf spot disease in such a valuable medicinal plant raises questions regarding the previously established antiseptic activity of gel or whether this activity is visible only in laboratories. This also demands for the management strategies required to control the disease. The present study attempts to identify the causal agent of the leaf spot disease, management strategies required for the control of the disease and reattempts the study of antifungal activity of *Aloe vera* gel. Isolation from the diseased plant parts along with pathogenicity tests were conducted, chemical and Biological control was done for management strategies. *Alternaria alternata* was identified as the causal organism for leaf spot disease of *A. Vera*. For chemical control, 4 different fungicides namely Benfil (Carbendazim 50% WP), Indofil M-45 (Mancozeb 75% WP), Blue Copper (Copper Oxychloride 50% W/W), Tilt (Propiconazole 25% EC) were tested against the pathogen at three concentrations of 0.1%, 0.2%, 0.3% in triplicates and the percent mycelial growth inhibition was calculated. Blue Copper and Tilt were highly effective and showed 100% growth inhibition at very low concentration (0.1%) whereas Benfil was effective but could not completely inhibit the pathogen at high concentration (0.3%). Indofil was found to be the least effective fungicide and could not show 100% inhibition at any of the tested concentrations. In Biocontrol, three species of *Trichoderma* viz. *Trichoderma harzianum*, *T. viride*, *T. koningii* were found to be effective with the maximum antagonistic efficacy of 88.2% shown by *T. harzianum* followed by *T. viride* (88%) and *T. koningii* (86%). *In vitro* testing for antifungal activity of the gel showed the absence of any antifungal activity against the pathogen even *in vitro* as considerable growth of pathogen was observed within 2 days of inoculation. Thus, host pathogen interaction for qualitative mutual effects on quality of bioactive compounds can be a future aspect for further study.

### **CYTOTOXIC EFFECT OF AYURVEDIC BIOPESTICIDES OF FAB BEANS**

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Ayurvedic-biopesticides had mild effect at lower concentrations on the growth and seed germination as compared to control. Test concentration of 800ppm of Ayurvedic-biopesticides solution for 4,6,8 hrs showed seedling height 2.88, 2.75 & 2.68cm respectively but the higher concentrations of malathion produced significant decrease in comparison to control that is 3.11, 3.01 & 2.97cm for 4,6,8 hrs

respectively. The study material was exposed pesticide and Ayurvedic pesticides. The mitotic index was seen in decreasing order. When compared the mitotic index showed declination to the exposure of both malathion and Ayurvedic pesticides in higher concentration in different duration (4,6, 8 hrs). The mitotic index that is 14.50, 13.95 and 12.88 showing reducing effect at 800ppm of malathion for 4,6,8 hrs exposure period respectively, while in case of Ayurvedic-biopesticides solution the reduction in mitotic index observed 18.95, 17.86, 16.81 at 800 ppm for 4,6,8 hrs duration. The mitotic index in control was 22.11. The higher concentration of Malathion showed the genotoxic effect and appeared to cause damage the chromosomal activities whereas the Ayurvedic-biopesticides (solution) to an extent affected the meristematic cells. The Malathion showed mitostatic effect on the mitotic index (MI) which decreased with the increase in concentration and duration. It is inferred on the basis of comparative studies that the Ayurvedic-biopesticides (solution) is more safe side as compared to chemical pesticide malathion.

### **A COMPREHENSIVE STUDY OF VATANKUR (*FICUS BENGALENSIS* L.) AS VARNYA DRAVYA W.S.R. TO VYANGA**

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Since ancient times, plants have been an ever dependent source of medicine. Herbal formulations an invaluable gift of nature always have attracted considerable attention because of their good activity and comparatively lesser or nil side effects with synthetic formulations. "*Ficus bengalensis* Linn" is a large evergreen tree found throughout various forests in India. It is a well-known and popular plant in the indigenous systems of medicine like *Ayurveda*, *Siddha* Unani. Ayurvedic texts e.g. *Ashtanga Hridaya*, *Sharangdhara Samhita*, *Bhavprakash Nighantu* etc. advocate the various therapeutic of this tree. *Vyanga* is said to be a skin disease described in *Kshudra roga* occurring on face. Fresh vegetative leaf buds of sacred *Vat* tree known to be *Vatankur* finds its use on *Vyanga*. The present study entitled "A Comprehensive Study of *Vatankur* (*Ficus bengalensis* L.) as *Varnya Dravya* w.s.r. to *Vyanga*" was undertaken to evaluate the effect of *Vatankur* as *Varnya Dravya* in management *Vyanga*, with modern scientific approach and technique; and establish its effect in contrast to a placebo. In the present study vegetative buds of *Vat* (*Ficus bengalensis* Lin) in the form of *Vatnakur* Cream was used for its *Varnya & Vyangahar* action was studied for its phytochemical and clinical findings. For this a qualitative analysis of *Vatankur* aqueous extract is done for presence of starch, terpenoids, flavonoids etc. and a fluorescence characteristics in various organic solvents was also worked out. Besides this TLC/HPTLC testing chemical profile was also worked out for the quality assurance of *Vatankur* extract & the cream along with microscopic, physio-chemical findings of *Vatankur* as well as microbial contamination and; a control clinical trial was also conducted on 30 patients in the hospital. This section must describe material and methods used in the current study. The formulated *Vatankur* cream was found to be safe & effective on *Vyanga* through observed facts. Thus it can be concluded that this formulation is effective in management of *Vyanga* thus making it a point that cost effective herbal *Ayurvedic* formulation can be developed for this condition and may be used as general ailing community suffering from *Vyanga*. The work is much fruitful for cosmetic industry yet it needs more to work so as to make the formation for large scale industrial production.

### **STUDIES ON CHEMICAL COMPOSITION AND ANTIBACTERIAL ACTIVITY OF ESSENTIAL OIL OF *Ocimum gratissimum* L.**

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Essential oil obtained from aerial parts of *Ocimum gratissimum* collected from Chamba (Tehri Garhwal), Uttarakhand, India by hydrodistillation, was analyzed by GC and GC-MS for its chemical profile, and evaluated for antifungal activity. The analysis revealed the presence of 35 compounds which constitutes 96.27% of the total oil. The major components of the oil were found to be eugenol (32.86%),  $\alpha$ -terpenolene (22.83%), *cis*-8-methylbicyclo (4,3,0) non-3-ene (9.08%), camphene (2.65%),  $\alpha$ -phellandrene (2.12%),  $\alpha$ -pinene (1.56%),  $\beta$ -bourbonene (1.46%),  $\beta$ -pinene (1.36%), carophyllene (1.32%), dodecatetraene (1.23%),

3-cyclohexen-1-ol (1.15%) and tert-butylbenzene (1.02%). The essential oil exhibited good antibacterial activity against few strains.

### **PULMONARY INHALATION OF MEDICINAL SMOKES – AN ASPECT OF YAGYA THERAPY: AN EFFECTIVE THERAPEUTIC APPLICATION AND EFFICIENT DRUG DELIVERY MODEL OF MULTIPLE HERBS**

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In modern therapeutics, 80% of all the drugs are natural products or their derivatives. Vedic/Ayurvedic as well as modern researches show tremendous therapeutic potential of herbs. However, therapeutic applications of multiple herbs have two major limitations. 1) extraction medium extracts limited active ingredients (secondary metabolites), and 2) oral administration of herbal extracts pass through first pass metabolism allowing limited active ingredients to reach blood stream in intact form. One solution to overcome both the limitations is to convert herbal mixtures into medicated-smoke and deliver through pulmonary inhalation. One such method described in both Ayurveda and AtharvaVeda is Yagya Therapy or Yagyopathy. With reference to Ayurveda and Atharva Veda along with traditional use in various cultures and modern innovations, the study aimed to find methods and mechanisms for multiple herbs to be therapeutically applied simultaneously, and successfully administered bypassing first pass metabolism. This paper took narrative review approach with authors' experiences, existing theories and recent researches regarding medicinal-smoke aspect of Yagyopathy, and attempted to explain the mechanisms for generation of herbal-smokes through Yagya-fire for therapeutic purposes and their pulmonary administration as efficient drug delivery system. Mankind has used medicinal-smokes for therapeutic purposes since ancient-times globally. Mohagheghzadeh, A et al. (2006) in his extensive review 'Medicinal Smokes' describes that mono and multi-ingredients herbal-smokes have been used by humans to cure illness (primarily for pulmonary, neurological and dermatological) in 50 countries across the 5 continents. In India, therapeutically medicinal-smokes have been used in different forms since Vedic-times. In Ayurveda (Bhaishajya-Ratnavali, Yog-ratnakar), the inhalation of specific herbal-medicinal-smoke (*Dhoomapana/Dhoomnasya/Dhooanvidhi*) is recommended for various diseases/conditions such as fever, pregnancy, epilepsy, worm infections, syphilis, etc. Yagyopathy is Vedic method used for medicinal-smoke inhalation. AtharvaVeda- source of Ayurvedic therapeutics (Sushrut Sanhita 1/1/5), and Ayurveda itself recommended application of Yagya through herbal-smoke inhalation for treating diseases. Atharva Veda refers it as Bhesaj Yagya i.e. Yagya in which herbs are burned to cure diseases or epidemic. Maharshi Charak has also referred applications of homa (another term of Yagya) for curing diseases. AtharvaVeda describes Yagyopathy for treating worm infections (1/8; 5/29/4,6,7,8,9), fever (1/12/2,3; 5/22/1,2,10/13), mania (6/111/1,2), and goiter (6/83/1-4; 7/78/4), etc. In Yagya, coarse powder (havan samagri) of herbs (phyto-medicines) undergoes transformation/sublimation through slow-controlled combustion process in Yagya-fire and generates medicinal-smokes imparting therapeutic advantage when inhaled. Moreover, pulmonary administration is previously indicated as better route for drug delivery by Joshi et al. (2006). Using pharmacokinetic modeling and evaluation, they showed that pulmonary inhalation significantly imparted higher lung-deposits (of non-toxic phytomedicines), bio-availability and residence time as compared to oral and intravenous administration. Additionally, Yagyopathy is successfully practiced by Center for Ayurveda Studies at Dev Sanskriti Vishwavidyalaya since past 10 years by providing 31 types of disease-specific multi-herbs preparations. Anecdotally, in past 11 months more than 250 patients from different states were benefited. Yagyopathy is an ancient-Vedic non-conventional Indian method of pulmonary administration of multiple herbs for therapeutic application and drug delivery with minimum loss due to systemic circulation, and has cost-effectiveness.

### **AMELIORATIVE EFFECT OF HEMPSEED (*Cannabis sativa*) AGAINST EXPERIMENTALLY INDUCED HYPERCHOLESTEROLEMIA**

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The elevated levels of blood lipids called hyperlipidemia or hypercholesterolemia is one of the main causes of various cardio vascular diseases (CVDs). Plethora of genetic, environmental and nutritional factors contributes to the hypercholesterolemia induced CVDs, due to exacerbation of ROS mediated

oxidative stress. These oxidative stress mediated changes might lead to chronic inflammatory conditions like atherosclerosis. Therefore, preventive strategies that can combat these inflammatory pathways in redox regulatory manner might be effective against patho-physiological conditions associated with hypercholesterolemia. In this direction, literature is replete with studies, where use of classical NSAIDs has been shown to have significant protective/therapeutic role. However, side effects and toxicity of these drugs limit their use. Therefore, current study is designed to screen hempseed for its potential to modulate the molecular pathways of inflammation in a redox sensitive manner in experimental hypercholesterolemia. High fat diet (HFD) containing 2% cholesterol was fed to female wistar rats for 1 month to induce experimental hypercholesterolemia. In treatment group HFD along with 10% hempseed/kg diet was administered. Respective control groups were also run simultaneously. After completion of diet feeding schedules lipid profiles were checked to establish hypocholesterolemia and protective effects of hempseed if any. Histopathological and ultra-structural studies along with enzymatic and non-enzymatic markers of oxidative stress were measured in aorta. ECG recordings of rats and biophysical parameters such as impedance across the aortic tissue were recorded to correlate with biochemical and structural changes. Finally, protein expression of pro and anti-inflammatory factors involved in COX pathway was studied using ELISA. Hempseed oil being rich in omega 3/6 fatty acids and phytosterols demonstrated antioxidant, anti-inflammatory, anti-hypercholesteremic and cardio protective properties. There was a significant decrease in LDL/HDL ratio, cholesterol levels and modulation of enzymatic and non-enzymatic markers of oxidative stress. Further histological and ultra-structural changes along with ECG and changes in expressions of factors involved in COX-2 mediated inflammatory pathways are concomitant with the protective effects of Hempseed against hypercholesterolemia through redox modulation of inflammatory pathway.

#### ***Urtica pulcherrima* MITIGATED HEPATOTOXICITY IN ALCOHOL INDUCED LIVER DAMAGE MODEL OF RATS: A STUDY WITH SPECIFIC BIOMARKERS**

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Alcoholic liver disease (ALD) is a major cause of morbidity and mortality worldwide. The spectrum of disease ranges from fatty liver to hepatic inflammation, necrosis, progressive fibrosis and hepatocellular carcinoma. The menace of alcohol consumption increases with increasing dose and time. Present study is significant to find out newer treatment with lesser side effects for alcohol induced hepatotoxicity. The objective of our current work was to examine the outcome of *Urtica pulcherrima* extract administration in alcohol induced liver damage. Male wistar rats were grouped into five groups comprising six animals in each. Group one served as negative control. Groups 2-5 were administered 10% ethanol for four weeks. Groups 3 and 4 were given plant extract at doses of 50mg/kg and 100mg/kg orally, Group 5 animals were given silymarin along with alcohol and it served as positive control. Changes in the hepatotoxicity specific biomarkers i.e., alanine aminotransferase (glutamic-pyruvate transaminase (ALT1)), alcohol dehydrogenase (ADH), Glutamate Dehydrogenase (GLDH), human paraoxonase (PON1) were recorded. Its antioxidant activity was determined by measuring  $\gamma$ -Glutamyltransferase, glutathione S-transferase, glutathione, malondialdehyde and glutathione reductase. Histopathological analysis of liver tissue was also done. Final outcomes indicated restoration of all tested parameters to the physiological levels following administration of the extract. Treatment with *Urtica pulcherrima* extract alleviates alcohol-related damage and protects hepatic tissue from alcohol-induced toxicity.

#### **EVALUATION OF ANTIOXIDANT POTENTIAL OF ETHANOLIC EXTRACT OF *Spilanthes acmella* USING HYDROXYL RADICAL SCAVENGING METHOD**

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With increasing knowledge about the role of oxidative species in the involvement of numerous diseases considerable research is now being carried out in the field of oxidative stress. Oxidative stress in our body is a condition in which there is increased production of reactive oxygen and nitrogen species, and insufficient removal of these species. The increasing use of green tea and other herbal preparations to counteract stress like geriforte (Himalaya) suggests that herbal drugs have been effective in counteracting oxidative stress. The present study deals with the hydroxyl radical scavenging activity of *Spilanthes acmella* Murr. (Compositae). The importance of the study lies in the fact that in the present study *Spilanthes acmella*

showed antioxidant activity at low concentrations and thus *Spilanthes acmella* can be developed into a natural and effective antistress herbal medicine. The present study deals with hydroxyl radical scavenging activity of *Spilanthes acmella*. Aerial parts of *Spilanthes acmella* were dried, powdered and extracted with absolute ethanol (99.9%) using soxhlet's assembly. The extract was then dried using rotatory vacuum flash evaporator. The dried extract obtained was sent to Deshpande laboratories private limited, Bhopal, Madhya Pradesh, India for analyzing hydroxyl radical scavenging activity. The results of the present study indicate that the extract of *Spilanthes acmella* showed concentration dependent scavenging of hydroxyl radical. The percentage inhibition produced by *Spilanthes acmella* was studied at various concentrations (0.0001, 0.001, 0.01, 0.1, 1, 10, 50 µg/ml). As the concentration of the solution of *Spilanthes acmella* extract increased the percentage inhibition of hydroxyl radical also increased, with highest percentage inhibition of 53.47 at 50 µg/ml. *Spilanthes acmella* showed almost comparable effects as ascorbic acid (standard) at concentrations of 0.1 and 1 µg/ml. Thus, in conclusion it can be said that *Spilanthes acmella* showed good antioxidant potential and it can be tried as an effective antistress medicine.

### **CONTROL OF BROWNING IN TISSUE CULTURE OF AONLA (*Emblica officinalis*)**

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*Emblica officinalis* has been considered as Mother of Herbs due to its high medicinal and nutritional value and therefore it is being highly propagated through vegetative means, which are difficult and slow processes. In recent years tissue culture techniques (Micro-propagation) have been used for rapid multiplication of this tree. The major problems in micro-propagation of *Emblica officinalis* and other species of woody plants is browning of explants and the surrounding medium caused by phenolic compounds secreted by these plants. Phenolic compounds are aromatic compounds possessing one or more hydroxyl group. They are defensive molecules secreted by wounded tissues of the plants which are oxidized to growth inhibiting dark brown colored compounds. These browning compounds are highly toxic to plant tissues and check the growth of tissues in culture media. Hence a study was conducted to check the effect of Phenolic compounds. This study was carried out using different explants viz. young and old nodal segments and leaf segments taken from 10-12 year mature juvenile trees. The Murashige and Skoog (MS) basal medium was used in the study. The browning of cultures started within 24 hours of inoculation in all explants. The phenolic secretions were first noticed at cut surfaces and later it gradually spread into the surrounding medium. The growth of explants was completely stopped and they died within three days of inoculation. To stop the effect of browning on the explants, different combinations (PVP 250 mg+ AC 0.1 mg, PVP 250 mg+ AC 0.2 mg, PVP 250 mg+ AC 1.0 mg, PVP 250 mg+ AC 1.5mg, PVP 250 mg+ AC 2.0 mg, PVP 250 mg + AC 2.5 mg, PVP 250mg + AC 3.0 mg) of Activated Charcoal (AC) with Polyvinylpyrrolidone (PVP) in MS media were used. Addition of PVP could not completely stop the browning of explants and the medium but it reduced the intensity and rapidity of the browning process. Activated charcoal (AC) being the good absorbent clearly hampered the browning process. From different combinations used, low browning was observed in the media containing PVP 250 mg+AC 1.0 mg and moderate browning was observed in the media containing PVP 250 mg+AC 1.5 mg combination. 1.0mg and 1.5 mg of Activated charcoal reduced browning in explants. Below and above this combination browning was high in explants.

### **STUDIES ON COMBINING ABILITY ANALYSIS BETWEEN 11- COMPONENTS IN FIELD PEA (*Pisum sativum* L.)**

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The present investigation was undertaken through a diallel crossing involving 12 parents. The experiments were started during rabi season 2006-07. The material for the present study included 12-genotypes, 66 F<sub>1</sub>s and 66 F<sub>2</sub>s. The observations were recorded on 11-characters, namely days to flowering, days to maturity, plant height, number of primary branches, number of pods per plant, pod length, pod width, number of seed per pod, 100-grain weight, yield per plant and protein content. On the basis of per se performance and Gca effects, the good general combiners, common in both F<sub>1</sub> & F<sub>2</sub> generation were Local, Pant P-66, Pant P-13, for days to flowering; Pant P-66 and Pant P-14 for Days to maturity; Pant P-86 and Pant P-108 for plant height, Pant P-13, Pant P-14, Pant P-40 and Pant P-41 for number of primary branches, Pant P-86, Local, Pant P-108, and Pant P-31 for number of Pod per Pant, Pant P-66, Pant P-14 and Pant P-26 for Pod length, Pant P-66 and Pant P-74 for pod width, Pant P-14 and Pant P-40 for number of seed per pod, Pant P-74, Pant P-86, Pant P-66 and Pant P-14 for 100-grain weight, Local, Pant P-86, Pant P-74 and Pant P-108 for seed yield per plant Pant P-86, Pant P-13 for protein content.

**POSTER PRESENTATIONS****A CONCEPTUAL STUDY OF EMETIC DRUG MADANPHALA IN REFERENCE TO ITS DIFFERENT FORMULATIONS****Maheshwar and Uttam Kumar Sharma***Department of Panchakarma, Uttarakhand Ayurved University, Gurukul Campus, Haridwar-249404, Uttarakhand*

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Madanphala (*Catunaregam spinosa*) is considered as a best among emetic drugs used for vamana karma (therapeutic emesis) due to having no adverse effects. The plant madanphala is a small thorny tree occurs throughout India up to 4000 feet of altitude. Its rind and fruits show emetic diaphoretic and antispasmodic properties. There are many formulations and compounds prepared with madanphala described in different Ayurvedic texts to perform vamana karma in different diseases and conditions. Charak samhita contains 133 formulations and combinations of madanphala in form of decoction, powder, avaleha, utkarika (bread like recipe), pupa (fried form), mamsa rasa (meat soup), yusha (prepared with pulses), madya (alcoholic product by fermentation), panaka (syrup), Tarpana (water based recipe ) etc. There is a need of ready availability of this drug in form of various palatable and convenient formulations. This step will uplift and provide more help to promote panchkarma procedures like vamana karma. The above described preparations may be taken as guideline for the same.

**TRADITIONAL AND MODERN CONCEPT OF TULSI IN VARIOUS DISORDERS****Abhishek Saxena and Pushpa Rawat***Department of Panchakarma, Himalayiya Ayurvedic College, Doiwala, Dehradun*

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The Tulsi plant or Indian basil or *Ocimum santum* occupies an important place in the Hindu religion. The name 'tulsi' connotes "the incomparable one". It is an erect, much branched, fragrant and erected plant attaining a height of about 20-50 cm. The plant grows in the wild in the tropics and other warm regions. Dark or Shyama tulsi and light or Rama tulsi are the two main varieties, with the former possessing greater medicinal value. Of the many varieties, the Krishna or Shyama tulsi is also commonly used for worship. Traditionally, a Hindu household was considered incomplete if it didn't have a Tulsi plant in the courtyard. It is beneficial in fever, common cold, sore throat, respiratory disorder, kidney stone, heart disorder, mouth infection, insect bite, tooth problems, eye disorder, skin disorders, headache. Women's disease are also cured by tulsi i.e., excessive menstrual bleeding by using its decoction. Post delivery pain, leucorrhea, are also cured by different tulsi formulations. Tulsi makes the uterus healthy and strong. Tulsi is highly appreciated for having antioxidant activity, anticancer activity. The leaf juice of *Ocimum sanctum* along with triphala is used in ayurvedic eye drop preparations recommended for glaucoma, chronic conjunctivitis and other painful eye disease.

**THERAPEUTIC APPLICATIONS OF YAGYA (WITH DIFFERENT HERBAL COMBINATIONS) FOR VARIOUS DISEASES****Alka Mishra and Vandana Shrivastav***Department of Yoga and Health, Dev Sanskriti Vishwavidyalaya, Gayatrikunj-Shantikunj, Haridwar-249411, Uttarakhand, India*

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Yagya Therapy (Yagyopathy) is an ancient Indian method of herbal inhalation therapy that allows for the pulmonary administration of plant medicines. In the process of Yagya, coarse powder (havan samagri) made up of disease specific combinations of dry plant-medicines, as well as selected nutritious and aromatic substances, undergoes transformation into vapor phase, sublimation or decomposition by gradual heating; these phytomedicines spread along with the volatile substances and gases released by the slow and controlled combustion process in Yagya fire. Medicinal phytochemicals, vapours of some essential oils and certain other volatile healthy constituents released in this process impart therapeutic advantage. In addition, frequent oral and nasal inhalation of phytomedicines in medicinal-fumes generated in Yagya takes place because of the rhythmic deep breathing exercise (pranayam) and chanting of certain Vedic hymns by the subjects (patients) throughout the duration of the Yagya, which contributes in the efficient pulmonary administration of phytomedicine. Thus, Yagya is a promising non-conventional method of pulmonary drug administration, with applications for various diseases. The present work reviews the

method and application of Yagyopathy for the management of various diseases. Based on Ayurvedic concepts, different kinds of herbal combinations (havan samagri) have been prepared at Dev Sanskriti Vishwavidyalaya, Haridwar for treatment of about 30 diseases, which include (the numbers given in brackets indicate the number of patients over past 11 months- more than 250 patients from 16 States have taken these havan samagri): Arbud (Cancer-63), Tantrikatantra Vikriti (Nervine disorder-24), Madhumeha (Diabetes-21), Yakrit-Pliha Vikriti (Liver-Spleen disorder-19), Vaat Vyadhi (Arthritis-16), Vrikka Dosha (Renal-12), Twak-Vikar (Skin-12), Avasad (Depression-10), Hridaya-Rog (Cardiac-8), Kshaya-Rog (Tuberculosis-7), Bandhyatva (Infertility-7), etc. The disease specific havan samagri is mixed in 3:1 ratio with a common havan samagri (for sustenance of general health), and the patient is supposed to do Yagya daily at sunrise with this herbal combination. After the Yagya, the patient does breathing exercises for about 30 minutes while sitting in the generated medicinal fumes. One cycle of Yagyopathy is complete in 40 days. It showed encouraging healing possibilities in pulmonary tuberculosis and significantly reduced the levels of inferiority and insecurity feeling of the AIDS patients (n=40). Yagya has ability to reduce stress. This observation is further strengthened by the fact that over the past 5 months, more than 40 patients have taken the same havan samagri two or more times. Over the past decade, Yagyopathy has shown encouraging results in the treatment of various chronic and life-threatening diseases.

### **ROLE OF HERBS IN RASASHASTRA**

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Rasashastra is specialized branch of Ayurved dealing with mainly use of certain minerals, metals and other organic and inorganic substances in the treatment of disease. It is generally considered that Rasashastra deals only with metals and minerals, but it uses drugs of diverse origins in formulations ranging from herbals to metals. Formulations may be polymineral, herbomineral or herbomineralometalic. Actually Rasaushadis are combination of metal/minerals and herbal products together forms herbomineral/ herbometalic formulations. Herbs are used in many processing steps of Rasashastra and also are the ingredient of most of the Rasaushadhis. In the full article an attempt has been made to put out the role of herbs in the different procedures and formulations of Rasashastra to break down the myth that this is only alchemy dealing with metals and minerals alone. The review centralises on published research articles in the MEDLINE, PubMed, Google Scholar, ScienceDirect and Scopus. Search criteria included research articles & publications, and also based on various text books of Rasashastra. Purpose of this study is to provide a scholarly review on role of herbs in the Rasashastra. Rasashastra is ayurvedic branch dealing with various metals and minerals for medicinal purpose centralised chiefly on mercury. But herbs are equally involved in its several processing steps and formulations. At many places in Rasa texts importance of herbs are placed. So as conclusion we find that herbs are an essential part/ requirement in Rasashastra.

### **EVALUATION OF EFFICACY OF ERAND TAIL IN THE MANAGEMENT OF RHEUMATOID ARTHRITIS**

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Rheumatoid arthritis (RA) being triggered by genetic and environmental factors remains a major health burden on today's society and economy. Drug free remission is still a dream in spite of all advances in medicine with respect to this crippling disease. Exploring the possibilities of treatment in herbal medicine is thus of utmost importance to save patients from side effects of allopathic medicines. *Erand tail* is described as drug of choice in the management of R. Arthritis by *Bhavprakash*. Thus present study was done to evaluate efficacy of *Erand tail* and tried to explain mode of action on subjective and objective parameters. The aim of this study is to evaluate efficacy of *Erand tail* in management of Rheumatoid arthritis according to parameters of research set by international societies like American college of rheumatology (ACR) and European League against Rheumatism (EULAR). A single arm clinical pilot study done on 13 patients of RA selected randomly from OPD of Himalyia Ayurvedic Medical College and Hospital, Dehradun. Fifteen ml twice a day dose of *Erand tail* was administered to all patients satisfying EULAR diagnostic criteria. All the parameters like Clinical Disease Activity Index (CDAI), Haematological Parameters, Physical Disability Parameters and ACR Response Criteria were recorded before treatment and after treatment and statistical analysis of data was done. Duration of treatment was 1 month. Highly significant results on ESR (Erythrocyte Sedimentation Rate), CDAI scores, and Physical disability were obtained. 61 % patients satisfied ACR20 response criteria and 16% patients satisfied ACR50 response

criteria while 23% patients were non responders to the therapy. It was clearly concluded that *Erand tail* is a highly effective drug of herbal origin in management of acute and chronic RA without any side effects. It should be further studied and promoted clinically.

### **USES, FORMULATIONS AND COMPOUNDS OF TRIPHALA WITH DIFFERENT INDICATIONS**

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The combination of three drugs- Amalaki, Haritaki and Vibhitak is known as Triphala. This compound is used mostly in maximum compound drugs (Aushadhi Yoga) described in almost all important texts of Ayurveda. Triphala is popularly used in the form of powder which is also indicated to prepare in different proportions of three drugs. There are many preparations made by only Triphala to make it more palatable and convenient in administration i.e. Qwath, Ghrit, Vati, Avaleha, Swaras, Syrup etc. This conceptual study has been focused to point out the description of Triphala in different medicinal compounds indicated in management of different disorders from three important texts i.e. Charak Samhita, Sushrut Samhita & Ashtang Sangrah. The study and its analysis revealed that Triphala has some specific properties to make a compound more effective and safe, as its contents have rasayana and tridosha-shamak properties.

### **RECENT ADVANCES IN AYURVEDIC HERBAL MEDICINES**

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Ayurveda is a science of life. It has a vast literature covering various aspects of diseases, therapeutics and pharmacy. Ayurvedic medicinal preparation are result of a great effort as it includes complex mixtures of plants and animal –derived products, metals and minerals. Charaka samhita and Susruta samhita are milestones of Ayurveda in which special emphasis has given on medicine and surgery respectively. Like these Madhava Nidana, Astang hridaya, BhavParkasha, Nighantus etc. are also major landmark in the field of Ayurveda. There are approximately 1300 medicinal plants that are used in various preparations of Ayurvedic drugs. These are including Sarpghandha (for insomnia, hypertension etc.), Giloy (for fever, diabetes and it is also very beneficial in dengue fever which has no allopathic treatment till now), Bakuchi (useful in treatment of psoriasis, vitiligo and inflammatory skin diseases), Papaya leaves (used to increase platelet count which decreases in dengue fever) and IME-9 (used for diabetes is also a major landmark for curing diabetic patients). There is no doubt that Ayurveda is rapidly spreading all over the world because of its new advanced research in treatment of diseases and preventing to be ill.

### **PREVENTION OF PREMATURE AGEING THROUGH AYURVEDA**

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Ageing is unavoidable and natural phenomenon of life. Modern gerontologists are realizing the fact that aging is a disease, which Ayurveda had accepted as natural disease since long. Rate of aging is determined by one's biological, social, lifestyle, and psychological conditions and adversity of which leads to accelerated form of aging (Akalaja jara or premature aging). In Ayurveda it is possible to slow down the process of aging, restore physical and mental strength and prevent the consequences of aging up to certain extent. Incompatible diet, unsuitable diet, excessive dry and alkali food, heavy foods, irregular food habits ultimately leading to premature ageing. Excessive exercise induces damage to mitochondria and DNA of muscle cells. Untimely sleeping causes lot of ill-effects on the body and take away the longevity and health. Acharyas explain rasayan therapy to prevent premature ageing. Rasayana as a way to attain excellent rasadi dhatu and it imparts healthy long life, good memory and other benefits Rasayan therapy promotes memory and intelligence; immunity against disease and decay; the preservation of youth, luster, complexion and voice; the maintenance of optimum strength of the body and sense. So to prevent the old age and to attain healthy long life, rasayana therapy is the best choice. To prevent the akala jara achara rasayana is the best rasayana therapy. The aim of this study is to review Ayurvedic herbs to Prevent Premature Ageing. A web and manual based literature survey was conducted to assess the amount of literature present on Prevention of Premature Ageing through Ayurveda. Traditional literature, Pubmed,

Google Scholar and publication with abstract / full articles and books are reviewed in this research. Vata pacifying aahar vihar and certain Rasayan Therapy and Ayurvedic herbs helps in prevention of premature ageing. Ayurvedic approach to manage premature ageing through herbal drugs by decreasing vata dosha and other factors causing premature ageing. These herbs promotes memory and intelligence; immunity against disease and decay; the preservation of youth, luster, complexion and voice; the maintenance of optimum strength of the body and sense. So, to prevent the old age and to attain healthy long life, Ayurveda is a best way.

### **JATYADI OIL – AN ANALYTICAL STUDY**

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Wound management is the fundamental unit in the surgical practice. Once ulcer or wound is confined, the surgeon's task is to minimize the adverse effects of the wound, repair or remove damage structures and speed up the wound healing process to restore function. *Acharya Sushruta*, the father of Ancient surgery, was well aware for normal wound healing. He propounded, practiced and described a number of drugs and procedures for *vrana shodhana* and *vrana ropan*. According to *Acharya Sushruta kashaya*, *tikta*, *madhur*, *katu* and *ushna dravya* are used in wound healing (*vrana ropan*). *Jatyadi* oil has *tikta pradhan*, *kashya madhyam* and *madhur heena rasa*. The current study shows the effect of *jatyadi* oil on a variety of wounds. The phyto-medicines for wound healing are not only cheap and affordable but also purportedly safe as hyper sensitive reactions are rarely encountered with the use of these agents. These natural agents induce healing and regeneration of lost tissue by multiple mechanisms. The literature on *jatyadi* oil was taken from various journals, research papers and reference books. Data collected from a number of patients admitted or enrolled in shalya department for various types of wounds viz. contusion, incised, abrasion, lacerated, crushed, penetrating, burn, varicose ulcer etc are treated with *jatyadi* oil and got the excellent results. The literature revealed that wound healing properties of *jatyadi* oil were because of *vrana shodhan*, *vana ropan*, *kandughan*, *kusthghana*, *jantughan*, *vana pachan*, *vedana sthapana*, *putihar*, *daha prashaman*, *rakta sthmbhak*, *rakta prashadak*, *rakta shoghak*, *vishaghan* properties. Apart from these excellent properties it also acts by its anti-inflammatory, analgesic, antioxidant, anti-ulcer, anti-microbial, immunomodulator, and hemostatic. By analyzing its properties, we can say that it's the perfect blend of medicines which shows its positive response in various types of wounds. Through its enormous wound healing properties, it provides a miraculous positive result, that's why it is most popular medicine in the *Shalya* department.

### **HARITAKI – A BOON TO LIFE STYLE DISORDER**

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The demand for herbal therapeutics is increasing gradually in the world day by day. According to World Health Organization (WHO) more than 80% of the people living in the developing countries depend on traditional medicine for their primary health needs. *Haritaki* (*Terminalia chebula* Ritz), which is a member of the Combretaceae family and is called "King of Medicine" in Tibet and is always listed at the top of the list of "Ayurvedic Meteria Medica" because of its extraordinary power of healing. It is also frequently used medicinal herb in *Ayurved*, *Unani*, *Siddha* & Homeopathy system of medicine. *Acharya Charaka* highlighted its rejuvenation properties in *Chikitsa sthan*. He specifically stated that *Haritaki* is best among the herbs to be used regularly i.e. "*Haritakee pathyanam*". The traditional Indian systems of medicines support the importance of medicinal plants to treat most of the systemic disorders. This systematic review was conducted with an objective to search, explore & compile the phyto-chemical constituents & their efficacies to understand its potential as therapeutic agent. In today's hectic life style, hurry worry curry one and all results in several disharmonies in the biological system of human beings. The incidence of lifestyle diseases like indigestion, anorexia, overweight/obesity, hypertension, diabetes mellitus, dyslipidaemia, and other systemic diseases are on the rise greatly now a days . The present review attempts to highlight updated information on the therapeutic effectiveness of *Haritaki*. Published scientific literature on *Haritaki* (*T. chebula*) by various research scholars, organizations & Pharmacopeia's were reviewed. The review criterion was restricted to bio-efficacy and phyto-pharmacological activities of drug. *Haritaki* is extensively used in the preparation of many *Ayurvedic* formulations for the treatment of various lifestyle disorders as well as infectious diseases from head to toe. Management of such ailments by *Haritaki* with many formulations have given significant improvement. The whole plant possesses high medicinal value because several existing medicines are directly or indirectly derived from the plants. This review shows that various

experimental studies conducted on Bio-active compounds isolated from Haritaki(T. chebula) has prospective use in alleviating ageing, various GIT disorders, cancer etc. It has proved that it balances the three *doshas* that are main reasons for illness and herbal medicine treats the cause of the disease rather than suppressing the symptoms. In the management of lifestyle diseases, Ayurveda offers various regimens including *Dinacharya*, *Ritucharya*, *Panchakarma* (five detoxification and bio-purification therapies), and *Rasayana* (rejuvenation) therapies. The inclusive utilization of all these treatment modalities has a great effect on lifestyle disorders. Moreover, the application of organ-specific *Rasayana* herbs also provides enough scope not only for prevention of disease, but also for the promotion of health and cure of diseases too. *Haritaki* (*Terminalia chebula*), provide valuable treatment for various serious diseases, without any side effects.

## ROLE OF AYURVEDIC HERBAL MEDICINE IN OBESITY MANAGEMENT

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Accumulation of fat over the limit led to ill or adverse effects in the body is known as Obesity. As per WHO, a BMI greater than or equal to 25 is overweight and greater than or equal to 30 is obesity. Obesity and overweight occurs due to imbalance between calories consumed and calories utilized. Overweight and obesity are the fifth leading risk for global deaths. At least 2.8 million adults die each year as result of being overweight or obese. Obesity is associated with an increased risk of diseases that are major cause of morbidity and mortality, notable type2 Diabetes Mellitus, Coronary Heart Disease, Hypertension, and Osteoarthritis. In Ayurveda *Sthaulya* (obesity) is included under eight undesirable conditions (*Ashtau Nindita*), *Shleshma Nanatmaja*, *Samtarpana Nimittaja*, *Atinindita*, *Ati Brihmana Nimittaja* and *Bahu Dosha Janit Vikara*. In this paper an endeavour has been made to give a glimpse of certain Ayurvedic herbs and formulations which have been studied for management of obesity. The aim of the study is to review Ayurvedic herbal formulation and their efficacy in obesity management. A web and manual based literature survey through traditional literature, PubMed, Google Scholar databases were screened and reviewed. Evidences are emerging to support that consumption of Ayurvedic herbs are effective strategy for obesity management. There are several herbs described in Ayurveda for management of obesity which are easily available, have less or no effects, less demanding than accepted lifestyle changes like diet and exercise and provide significant effect in weight management. A better understanding on science of herbs will further give a qualitative research in obesity management.

## PRAGYA PEYA - A COMBINATION OF SELECTED HERBAL MEDICINES USED AS A HEALTHY ALTERNATIVE TO TEA/COFFEE

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In present times, tea or coffee is taken on a regular basis in almost every household; however, the harmful effects of their caffeine content are well known. Thus, there is a definite need to look for healthy herbal alternative to these drinks, which can be consumed on a daily basis, and is also cost effective. This article describes Pragya Peya (manufactured by Shantikunj Pharmacy, Haridwar since 1980's - License Number A-1055/84) as a healthy alternative to tea/coffee for daily use, and gives an account of its widespread usage in present times. Pragya Peya is composed of 12 herbal ingredients, i.e. Brahmi-Centella asiatica-5%, Shankhpushpi-Convulvulus pluricaulis-5%, Tulsi-Ocimum sanctum-5%, Saunf-Foeniculum vulgare-7%, Lal Chandan-Pterocarpus santalinus-25%, Dalchini-Cinnamomum zeylanicum-3%, Yashtimadhu-Glycyrrhiza glabra-5%, Nagarmotha-Cyperus rotundus-5%, Tejpatra-Cinnamomum tamala-5%, Arjuna Chhal-Terminalia arjuna-10%, Sharpunkha-Tephrosia purpurea-5%, Aagya Ghas-Andropogon schoenanthus-20%. These herbal ingredients are known to be beneficial for human health as Memory Enhancing, Immuno-Modulator, Anti-oxidant, Relaxant, Anti-Allergic, Cardiac Tonic, etc. These herbs cause no hazard for the human health or the environment, both with regards to their composition and the amounts present in Pragya Peya. Three different methods can be adopted to make this healthy drink i.e. Black Tea (boil 1 tea-spoon powder with water and add sugar according to taste; filter this mixture and use), Hot Tea (put 1 tea-spoon powder in a cup/ 120 ml. Pour boiling water, cover and leave for 3 to 4 minutes. Add sweetener, if desired. Add a tea-spoon of honey for added benefit and flavour. Strain, add milk and use) and Iced Tea (after straining the tea in the above case, let it cool for 15 to 20 minutes. Refrigerate for 1 hour. Add ice cubes and some drops of lemon juice to enhance the taste). Pragya Peya can be taken on a daily basis just

like tea/coffee. An earlier research analyzed the 12 herbal ingredients of Pragma Peya for 7 minor (Al, Ca, Cl, Mg, Na, K, P) and 15 trace (Ba, Br, Co, Cr, Cs, Fe, Hg, La, Mn, Rb, Sc, Se, Th, V, Zn) elements by instrumental neutron activation analysis (INAA), as well as Cd, Cu, Ni and Pb contents by atomic absorption spectrometry (AAS), and found that Pragma Peya is rich in several nutrient elements such as Ca, K, V, Fe, Mn, Se and Zn, which justify its medicinal properties and uses. Pragma Peya is a nervine tonic, which preserves energy and safeguards against various diseases. It is being widely used in India, as well as in various other countries; more than 22 tonnes (22,000 kg) were manufactured and consumed over the past one year. Pragma Peya, a combination of 12 herbal ingredients, is a nervine tonic, which preserves energy and safeguards against various diseases. Over past three decade, it has been established as a healthy alternative to tea/coffee for daily use.

### **TRADITIONAL AND MODERN CONCEPT OF MANJISTHA IN VARIOUS DISEASES**

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Manjistha, scientifically known as *Rubia cordifolia*, also known as Red madder Root, grows in hilly areas. The dried Root of the plant has excellent medicinal properties, and is cooling, astringent and has affinity for blood. It is commonly used for varicose veins, bruising, eczema, psoriasis and bleeding disorders, etc. In Ayurvedic medicine, Manjistha used as immune regulator, scientific studies have shown that it regulates blood pressure, blood vessel constriction, and helps, prohibit blood clot formation. Various forms of Manjistha, i.e. kwath, asava, arista, etc. are used to treat increased uric acid levels, arthritis associated with gout, glandular swellings, reoccurring skin infections and other skin diseases such as pigmentation anomalies and leukoderma. In females, Manjistha is also used to treat irregular menstruation. This herb works very well both internally and externally to promote skin glow and luster. It also helps to remove pimples, freckles, other discolorations and promotes the healing of skin tissues damaged by injuries or infections. Nowadays in modern formulations, Manjistha is the herb using in many types topical agents like oils, creams, lotions, soaps, etc.

### **A SURVEY OF LESSER KNOWN MEDICINAL PLANT SPECIES OF KOTDWARA REGION OF UTTARAKHAND**

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Plants are an enormous source for different services to mankind and livestock globally. In India, more than thousand species of plants are used for important purposes such as food and medicine by rural communities, particularly tribal communities. The interest in under-utilized plants was originated from a variety of human concerns, themes and perspectives. Some of these are ethical and others relate to, economic gains, resource management, agricultural diversification, germplasm conservation or augmentation, nutrition and self-sufficiency. The themes that tend to be associated with under-utilized plants are appealing both for their simplicity and poignancy. In the recent years throughout the world traditional knowledge is seeking great attention to excavate endemic heritable information, which has been maintained by tribals and local doctors (vaidyas) in different patches throughout the history. Thus, exploration of secluded information is not only important for traditional knowledge documentation but also to add substantial understanding on culture, traditions and commencement of civilization with relation to paradigm shift. Uttarakhand a rich state of the western Himalayas has very large diverse flora. The local people in different localities of state use different plant species for various purposes in their daily life. In the present study an effort has been made to enlist the less known plant species growing in and surroundings of Kotdwara region of Uttarakhand mainly by inquiring about their traditional uses by the local communities and Vaidhyas (local doctors). Field survey, interaction with villagers and local doctors was carried out in different regions of Kotdwara. Some villages such as Kalalghati, Shibunagar, Durgapuri, Motadhak, Kashirampur, Manpur, Padampur, Haldukhata, Kishanpur and Saneh were surveyed to observe the habit of plants suggested after the discussion with villagers and local people. All plant species samples were collected from lesser known plants through interaction with regional people of Kotdwara and forest department of Kotdwara (Lansdowne division). Identification of plants was done by the Botany department (P.G. College Jaiharikhal, Lansdowne). Out of all the surveyed plant species; there were six species which are lesser known and not documented in literature much but have a high economic, livelihood and

medicinal significance. The list may form as the baseline data for further investigation with reference to their active ingredients and documentation of information about these plants would be useful in future for medicine and research purpose.

### **A COMPARATIVE CLINICAL STUDY OF PUSHKARMOOLADI CHURNA WITH ANUPANA BHEDA IN THE MANAGEMENT OF TAMAK SHVASA WITH SPECIAL REFERENCE TO BRONCHIAL ASTHMA**

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*Tamak Shvasa* is a common disease of *Pranavahasrotas*. It is a *Swatantra Vyadhi* having its own etiology, pathology and management. It is mentioned as *Yapya vyadhi* i.e chronic in nature. Sign and symptoms of *Tamak Shvasa* resemble with bronchial asthma. The aim of this study is to review conceptually the etiopathogenesis and principles of management of disease *Tamak Shvasa* in ayurvedic and modern view, and to evaluate the effect of *Pushkarmooladi churna* with *anupana* bheda in the management of *Tamak Shvasa*. This study was randomized, parallel group and open clinical trial study. This study was done in two groups each of 20 patients. Patients of Group I were treated with *Pushkarmooladi Churna* in dose of 2gms twice a day with luke warm water as *anupana* and Group II patients were treated with *Pushkarmooladi Churna* in the dose of 2 gms twice a day with honey as *anupana*. The total duration of trial was 60 days with follow up after every 15 days. Subjective parameters were frequency and intensity of attack, duration of attack, *Shvasakrichata*, *kasa*, *peenasa*, *parshvashool*, wheezing and *asino labhate saukhyam*. Objective parameters were AEC and PEFR. Statistical analysis shows significant improvement in both groups but comparatively better results were found in patients treated by *Pushkarmooladi churna* given with honey.

### **IDENTIFICATION, CLASSIFICATION AND DIFFERENT FORMULATIONS OF TRIVRITA (*Operculina turpethum*) FOR VIRECHANA KARMA**

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Trivrita (*Operculina turpethum*) considered as a most safe and moderate laxative drug for virechana karma. It is perennial herbaceous, hairy, vines growing 4-5 meter in length, endemic to India. It is commonly found in north circars and Deccan region up to 3000 feet. The leaves are alternate, variable in shape, ovate, oblong, and truncate, cordate at the base. It is classified in Charak samhita as two types- shyama trivrita (black) and aruna trivrita (white/red) according to the color of dried root. Plant root and leaves are the parts used as medicine in form of different formulations i.e., powder, decoction, avaleha, processed ghrita, etc. This drug shows mild purgative effect so it is used mostly in children, old age people, person having delicate personality and sensitive gut. Trivrita is commonly used in management of krimi (worms), ascites, fever, inflammation, anemia, skin disorder, hyperacidity, liver disorder, splenomegaly, etc. This study reveals that trivrita is easily accessible drug, so there is very less chance of adulteration. The formulations should be more modified to make their application more palatable and convenient. The references of different formulations of trivrita will be discussed in full paper.

### **FTIR: TECHNIQUE FOR CHARACTERISATION OF BIOACTIVE MARKERS FROM PLANTS EXTRACTS**

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Natural products, such as plants extracts; either as pure compounds or as standardized extracts, provide unlimited opportunities for new drug discoveries because of the unmatched availability of chemical diversity. Plants used for traditional medicine contain a wide range of substances that can be used to treat chronic as well as infectious diseases. There are thousands of phytochemicals found from plants as safe and broadly effective alternatives with less adverse effects. The huge secondary metabolite resources of medicinal plants are fascinating with unique chemical and biological features. Although the chemical composition of 'crude extracts' from plants is not completely known, the traditional formulations contain a large number of phytochemicals with different medicinal properties, and have complex therapeutic properties. In present scenario, it becomes essential to isolate and characterised the phytochemicals of medicinal plants listed in our classical texts to ensure their proper identification, mode of action and new

drug discoveries. FTIR is the recent technology introduced in scientific world with more accuracy and reliability. Fourier Transform Infrared Spectrometer has proven to be a valuable tool for the characterization and identification of compounds or functional groups (chemical bonds) present in an unknown mixture of plants. The wavelength of light absorbed is characteristic of the chemical bond as can be seen in the annotated spectrum. By interpreting the infrared absorption spectrum, the chemical bond in a molecule can be determined. In addition, FTIR spectra of pure compounds are usually so unique that they are like a molecular “fingerprint”. Since bioactive compounds occurring in plant material consist of multi-component mixtures, their separation and determination still creates problems, FTIR is found an effective technique to overcome these problems.

### **IDENTIFICATION AND CULTIVATION OF MEDICINAL PLANTS MENTIONED IN AYURVEDIC CLASSICS**

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It may also be noted that physicians in the other regions of India have at the same time indulged in an extensive use of mineral and mercurial compounds, which we seldom meet with in our above classical texts. In our ancient classical Ayurvedic texts, namely, Caraka Samhita, Susruta Samhita and Astanga – hrdaya- samhita – the Brhatrayi as they are together called – a good number of medicinal plants, besides cereals, minor corns, divine drugs and vegetable poisons are found mentioned; but to our disappointment, many of them still remain to be properly identified. The total number of Sanskrit names of plants is about 1270, 1100 and 1150 in the S.S, C.S. and A.H. respectively. Vahata has borrowed freely from both the S.S. and C.S., to make his treatise more comprehensive and practical, and at the same time he has dropped most of the divine drug – plants and vegetable poisons from his preview; but still, the higher number of plants in the A. H. than the C.S may account for the slightly larger number of plant names used by him. The common people are not expected to know much about the medicinal plants or their uses, and hence we have to rely on the knowledge of those who are acquainted with them. A situation has now arisen that the present-day practitioners are almost entirely dependent on the drug dealers for their supplies, without their own capacity to distinguish between the real materials and their substitutes. Due to the encroachment of waste lands and forest areas, as well as due to the indiscriminate felling of trees, and consequent changes in the ecological system, many important plants have almost disappeared, and many have almost become extinct even in the forest areas. As a result, Ayurvedic practitioners in general experience much difficulty in getting sufficient supplies of genuine materials.

### **IDENTIFICATION OF AYURVEDIC MEDICINAL HERBS**

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A great number of plants grow throughout the country, but certain plants are very limited in their distribution. That result into use of substitutes. In recent years identification of medicinal plants has become difficult. Due to Introduction of a number of synonyms for single plants, Use of certain terms for more than one plant, Absence of a work containing morphological description of plants, Loss of contact with plants in their natural habitat. This created great confusion in the matter correct identification of medicinal plant. For a proper identification of medicinal plants, Susruta says *Gopalas tapasa vyadha, Ye canye vanacarinah, Mulaharas caye tebhyo, Bhesajavyaktir isyate S. S., Su. 37: 11* or Medicinal plants should be recognized and identified with the help of cowherds, hermits, huntsmen and others who trek the forest as well as with the help of those who cull and eat the edible roots and fruits of the forests. Charaka also holds the very same view in the matter of identification of medicinal plants. He says: *Osadhir namarupabhyam, Janate hy ajapa vane, Avipas caiva gopas ca, Ye canye vanavasinah C. S., Su. 1: 120* or the goatherds, the shepherds and the cowherds and other foresters help in identical of plants .For the identification of medicinal plants. It is important to do detailed field study in their natural habitat in the tribal and forest areas, with the aid of those who trek the forest and collect raw drug materials.

### **AN ETHNOBOTANICAL SURVEY OF MEDICINAL PLANT IN GANGOTRI VALLEY (UTTARAKHAND)**

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Traditional medicine has remained as the most affordable and easily accessible source of treatment in the primary health care system. Uttarakhand is known as a green state among other Himalayan states of India. Approximately 70% of the state comprises natural forest and rangelands. Folk knowledge or non-literature knowledge is completely indigenous, which had its origins when early humans interacted with the ambient environment to take out their livelihood. Here Garhwali and Bhotia tribal people in Gangotri Valley in Uttarakhand have been using medicinal plants from a long time in various diseases. Many of which are such plants, which have not been mentioned in Ayurvedic texts, such medicinal plants have been called as *Anukta Dravya* (undocumented medicinal plants) in Ayurveda. The aim of the study is documentation of the knowledge about the traditional medicinal plants and *Anukta dravyas* which are being used by local people, farmers and traditional Vaidyas in Gangotri valley, Uttarakhand. Following criteria has been adopted to collect primary data related to Traditional medicinal plants and *Anukta Dravya* research works was carried out. The field survey was conducted in Gangotri Vally; documentation through folklore works related to the study was conducted and comprehensive survey of literature was carried out. For the information of traditional medicinal plants, field survey was conducted in Gangotri area and information on medicinal plant obtained from local people, farmers and traditional vaidyas etc. This information compared with Ayurveda Samhitas, Nighantus, API and other texts and *Anukta dravyas* were identified. Some of such *Anukta dravyas* are described in this research paper such as *Burans* (*Rhododendron arboreum* Smith.), *Simru* (*Rhododendron campanulatum* D. Don.), *Kedarpati* (*Skimmia laureola* DC.), *Bichu buti* (*Urtica ardens* Link.), *Kafal* (*Myrica esculenta* Buch.) etc. Further, this study has revealed that there are many traditional medicinal plants which have not been mentioned in Ayurveda and which are still being used by locals in various diseases. There is a need for synthesis of contemporary and Ayurvedic knowledge which will help the future generation to use *Anukta Dravya*. These medicinal plants are required to be researched, after which they can be included in the API.

#### **MAPPING AND APPLICATION OF GEOGRAPHICAL INFORMATION SYSTEM TO STUDY ALGAL BIODIVERSITY OF DEHRADUN DISTRICT, UTTARAKHAND**

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Plant biodiversity is a unique natural resource which has been the source of obtaining compounds used in Ayurvedic medicines and treatment. The management of plant biodiversity is of utmost importance for environmental sustainability. Remote sensing and Geographical Information System have been used extensively in many sectors and is providing positive results for better planning and management of natural resources. Algae are microorganisms belonging to the plant kingdom having essential compounds useful in Ayurvedic medicines. This study is a comprehensive work on Dehradun district's water sources and algal biodiversity with the application of RS and GIS. In this study algal biodiversity (Taxonomy) in Dehradun district's water sources have been studied along with the physico-chemical parameters of the water sources. Remote sensing and Geographical Information System tool has been used to map the sampling locations and study the algal and water characteristics. Water samples from ten rivers viz. Ganga, Song, Suswa, Bindal, Rispana, Asan, Tons, Nimi, Nun, Yamuna; three lakes viz. Lakes Chandrabani, ITBP Seemadwar, Defence Colony and a stream viz. Sahastradhara located within Dehradun district and parts of Pauri district were collected. Physico-chemical parameters of water like pH, temperature, turbidity, colour and odour were studied. The various algae occurring in the different sites were identified using algal keys and online databases. ArcGIS was applied to create prediction maps for the water parameters studied and algal biodiversity. The pH of water sources ranged between 7.52 ( $\pm 0.09$ ) to 8.03 ( $\pm 0.05$ ). pH of the water sources was within acceptable range with Lake ITBP Seemadwar having the highest pH 8.03 ( $\pm 0.05$ ) while River Song having the lowest, viz. 7.52 ( $\pm 0.09$ ). The temperature ranged between 18.9°C ( $\pm 0.3$ ) [River Yamuna] to 21.57°C ( $\pm 0.3$ ) [River Suswa and Lake ITBP]. Turbidity ranged from 18.7 NTU ( $\pm 0.62$ ) [River Nimi] to 99.53 NTU ( $\pm 1.05$ ) [River Ganga] while Colour ranged from clear, moderately clear and muddy with Odour ranging from odourless and unpleasant. Rivers Suswa, Bindal, Rispana were highly polluted while Rivers Nimi, Nun were least polluted as deciphered from GIS map. The algal species that found in the water sources belonged to the Chlorophyta, Myxophyta, Chrysophyta, Euglenophyta and Dinophyta divisions. Chlorophyta was the dominant division ubiquitous in all the water sources closely followed by Myxophyta and Chrysophyta. *Pseudokirchneriella sp.*, *Scenedesmus sp.*, *Chlorella sp.*, *Monoraphidium sp.* was found in almost every water source. *Nitzschia sp.*, *Navicula sp.*, *Fragilaria sp.* were the common Chrysophyta members. Presence of large numbers of diatoms indicates good health of the water. Rivers Nimi, Nun and Tons had good number of diatoms. The various algae, especially Chlorophyta and Myxophyta members are a good source of beneficial omega - 3, 6 and 9 fatty acids, saturated fatty acids (Nervonic, Lignoceric) and proteins which are used in Ayurvedic medicines and as health supplements.

ArcGIS analyses gave comprehensive results depicting the water parameters maps and algal diversity. Algal diversity is rich in Dehradun district which needs to be investigated more for biomedical compounds which are beneficial in Ayurveda.

### **TRADITIONAL KNOWLEDGE ON HEALTHCARE PRACTICES BY THE INDIGENOUS PEOPLE OF TRIPURA, NORTH-EAST INDIA**

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Tripura is small state, located in the North-Eastern part of the country. The region is home to a very large number of medicinal plants species that are extremely valuable for their role in traditional healthcare practices among the different 19 tribes. Numbers of traditional practitioners among the tribes are day to day decreasing, due to lack of documentations of different important traditional knowledge has spoiled with time. Ayurveda medicine is present in folklore that need to be studied for bring in the mainstream of Ayurveda. The study aims to explore the traditional medicinal uses of various plants species in many diseases by the indigenous people. The study was conducted through field survey and information furnished from local people, traditional practitioners, focused mainly 50 medicinal plants species reported belonging to 40 families are presented. The collected plants are trees, shrubs and herbs which are used by the Indigenous people. The Indigenous people are successfully using since long decade many plant species for preventive and curative purpose in fever, diarrhoea, dysentery, gastritis, skin diseases, joint pain, cold and cough etc. The parts of used are found mainly leaf, bark, root and rhizomes. Their preparation are used orally in fresh juice approx 5 to 10 ml and decoction form about 100 ml twice daily in the morning and evening time for adult person and less quantity for child and also used external application. Hence the present study suggesting for further scientifically study about the medicinal plants which are using for their health care by the Indigenous people of Tripura.

### **A HEALING PLATE FROM SACRED LOTUS: BIOPACKAGING APPLICATION OF *Nelumbo nucifera* LEAVES**

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Biopackaging is a new age technology that focuses on development of environment friendly, biodegradable packaging material derived from biological sources. Packaging is one of the most important aspects in preservation of quality and increasing the shelf life of a food product. It is a barrier between the food material and environmental as well as biological fouling agents such as water vapour, oxygen, solute migration and microorganisms. Majority of the packaging available is non-biodegradable and poses a great threat to the ecosystem. Packaging materials derived from biodegradable natural sources and edible films are the major parts of biopackaging techniques. There has been an upsurge in the use of bio based polymers as promising packaging material for food and medicine. The sacred lotus or *Nelumbo nucifera* has long been used in traditional Ayurveda, Chinese, Japanese and Korean medicine for various purposes. Lotus leaf possesses high medicinal value which can be utilized in enrichment of the food products and preparation of special biodegradable utensils and containers. The leaves were used as an effective drug for hematemesis, epistaxis, hemoptysis, hematuria, and metrorrhagia. Extracts of lotus leaves have shown antihelminthic, antidiabetic and anti-angiogenic properties in recent studies. The "lotus leaf effect" or the superhydrophobicity of the lotus leaf points towards its potential usage in biopackaging. Self-cleansing nature of the sacred lotus is aided by the superhydrophobicity of lotus leaf surface where water droplets take other contaminants along with them and roll of the surface rendering it clean. The aim of the study is to find out the possibility of usage of lotus leaf in production of environment friendly, biodegradable utensils and containers and observe their effect in enrichment of food material with respect to active compounds possessing healing properties hence establishing the nutraceutical potential of these utensils. Traditionally, containers and utensils were made from leaves of different plants. We propose to use Lotus leaves for making biodegradable utensils and containers by traditional methods (e.g. leaf plates called as *pattal* in Hindi) and all natural sources and find out their effectiveness for short term storage of food material and whether or not these utensils enrich the food material with the bioactive or healing compounds present in the lotus leaf such as Roemerine, Nuciferine, Nornuciferine, Quercetin, Rutin, Isoquercitrin, Hyperin etc. Qualitative tests will be performed to observe the transfer/leaching out of bioactive and healing compounds. The biopackaging potential of biodegradable utensils / containers from

lotus leaf will be established and the nutraceutical potential of these utensils / containers by enrichment of food by bioactive compounds like Roemerine, Nuciferine, Nornuciferine, Quercetin, Rutin, Isoquercitrin, Hyperin etc. offer a novel and interesting area of research. Lotus leaf is superhydrophobic and is a promising candidate for biopackaging application. Moreover biodegradable containers and utensils will be all natural and can be produced at low costs. This can also help in providing new employment opportunities to tribal and village communities as it can be manufactured by them in cottage industry supported by a scientific proof of concept.

### **MEDICINAL AND ECONOMIC POTENTIAL OF SEABUCKTHORN: A WONDER PLANT**

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This review explores the medicinal and economic potential of seabuckthorn (*Hippophae salicifolia* D. Don) in curing different types of ailments. The plant is being used in different parts of the world for its nutritional and medicinal properties. Seabuckthorn based preparations have been extensively exploited in the treatment of cardio vascular problems, liver injury, slow digestion, tendon and ligament injuries, stomach malfunctioning, skin diseases and ulcers. Seabuckthorn has been scientifically analyzed and many of its traditional uses have been established using several biochemical pharmacological studies. Various pharmacological activities such as anti-stress, anti-atherogenic, cytoprotective, hepatoprotective, immunomodulatory, radioprotective, anti-microbial, anti-tumor, and tissue regeneration have been reported. The present study also documents indigenous techniques of product development like pulp, tea, jam, wine etc and assess economic potential of this species in Chamoli and Uttarkashi districts of Uttarakhand, India. During the survey, economic potential of seabuckthorn for socio-economic development of the area and major hurdles in the process are thoroughly discussed and documented. It is clear that seabuckthorn is an important plant because of its immense medicinal and economic potential. However several knowledge gaps identified in this paper would give impetus to new academic and R&D activities especially for the development of seabuckthorn based products and herbal medicines. The study concludes that tribal communities of the region are great beneficiaries of seabuckthorn and it has great potential and is an important resource to accelerate pace of their socio-economic development.

### **EVALUATION OF TRACE ELEMENT CONTENTS IN *Berberis aristata* DC ROOTS**

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Medicinal plants are being used in oriental medicine for the treatment of various ailments ranging from the common cold to cancer. *Berberis aristata* DC locally known as Kingore is one of the traditional medicinal plants from Ayurvedic system and its herbal formulations are used to treat malaria, bleeding, fever, skin and eye infections, jaundice, diarrhea, diabetes and hepatitis for a long time. Its roots, stem, bark, leaves, rhizomes and fruits are used in many classical Ayurvedic preparations like Rasaut, Darvyadi kvatha, Darvyadi leha, Darvyadi taila, Rasanjana, Dasanga lepa and many more. Extracts obtained from the plant find application in pharmaceuticals, nutraceuticals and cosmeceutical preparations. The roots of *B. aristata* are widely used in the preparation of crude Ayurvedic drugs. In order to evaluate the quality and efficacy of *B. aristata* plant material, focusing on pharmacologically relevant groups of compounds and inorganic elements is therefore required. Much work has been done on quantification of alkaloids and other organic constituents of *B. aristata*, but determination of trace metals remains undiscovered. Therefore, present study was designed to estimate the essential trace elements and electrolytes in roots of *B. aristata* occurring at different altitudes. The matured roots (100 g) of *B. aristata* DC were collected from three different sites viz. Adibadri (1,750 m), Nagnath- Pokhari (1870 m) and Ghat (2,550 m), covering the entire altitudinal range of this species. Multi-element working standard solutions (10, 100, 150, 200 ppb) were prepared by appropriate dilution of the stock ICP multi-element standard (Merck) 10 ppm. All analyses were performed on ICP-MS (Perkin Elmer NexION 300X) using both Standard and Kinetic Energy Discrimination (KED) modes. The concentrations of total 13 elements (Li, Na, Mg, K, Ca, Cr, Mn, Fe, Ni, Zn, Mo, Ag and Pb) were determined. The overall concentration of K was found to be the highest, whereas the level of Ag was lowest. The highest concentrations of Na, Mg, K, Ca, Fe, Ag and Pb were found to be  $7.8 \pm 0.26$ ,  $1.48 \pm 0.11$ ,  $9.93 \pm 0.20$ ,  $9.83 \pm 0.10$ ,  $9.19 \pm 0.19$ ,  $0.044 \pm 0.009$  and  $1.68 \pm 0.29$  ppb respectively. This is the first investigation

regarding the mineral composition of *B. aristata* DC roots. The microwave digestion method has considerable advantages, which includes good precision and accuracy, reduced contamination, speed and safety. The use of concentrated nitric acid and sulfuric acid (4:1) mixtures allowed the complete digestion of samples. Mean intake of Li, Na, Mg, K, Ca, Fe, Cr, Mn, Ni, Zn, Mo, Ag and Pb falls within the recommended range. The concentrations of Li were quite low in all samples, whereas Mg, Mn, Ni, Zn, Mo, Ag and Pb were present in moderate concentrations, but Na, K, Ca and Fe were present in very high concentrations in all the samples. The mineral contents were well within the permissible range for human consumption, therefore, recommended for medicinal uses.

### RECENT ADVANCEMENTS IN IDENTIFICATION OF HERBAL MEDICINES WITH SAFETY CHALLENGES

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Herbal medicines are used all over the world. Since last 30 years, people are increasingly becoming aware about health care. For better healthcare, the purity of drug is very important. However, the identification of the correct species, its purity and concentration of required material in drug is a great challenge in the commercial era. Herbal medicines in market are shown to have efficacy of each herb in adequate amount, but many of them remain untested or not even monitor at all. Since, safety is also a major issue with the use of herbal medicines, so for identification of herbal species, DNA barcoding and other recent chemical analysis techniques are now being used. This paper emphasises on identification related latest techniques and major safety challenges arising from the use of herbal medicinal products associated with effective monitoring of their safety.

### EVALUATION OF ANTIOXIDANT POTENTIAL AND CHEMICAL COMPOSITION OF *Caryopteris odorata* (D.DON) ROBIN

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Reactive oxygen species (ROS) including singlet oxygen ( ${}^1O_2$ ), superoxide ion ( $O_2\cdot^-$ ), hydroxyl ion ( $OH\cdot$ ) and hydrogen peroxide ( $H_2O_2$ ) are highly reactive and toxic molecules generated in cells under normal metabolic activities. ROS can cause oxidative damage to proteins, lipids, enzymes and DNA and they have also been linked to pathogenesis of oxidative diseases. Living cells possess an excellent scavenging mechanism to avoid excess ROS-induced cellular injury, however, with ageing and under influence of external stresses these mechanisms become inefficient and dietary supplementation of synthetic antioxidants is required. In recent years, due to toxicological concerns associated with the use of synthetic substances in food and increasing awareness about natural foods, there has been an increased interest in the use of natural substances as food preservatives and antioxidants. In this context, aromatic plants, particularly their essential oils, are being evaluated for antioxidant activity. It is thus pertinent to evaluate the natural antioxidant activity of essential oils since they find extensive use in the food and beverage industry. *Caryopteris odorata* is an aromatic plant of Verbenaceae family and have large medicinal importance. In traditional medicine systems it is used as remedies for arthritic pains, cough, sore throat, bronchitis and eczema. Keeping in view the medicinal importance of this plant we evaluated the phytochemical composition and antioxidant activity of the essential oil of *Caryopteris odorata*. The essential oil obtained from the leaves and flowers of *Caryopteris odorata* was analyzed by Gas Chromatography (GC) and GC-Mass Spectrometry (GC-MS). The in vitro antioxidant potential of essential oil was assessed by DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging activity, iron chelating, reducing power and nitric oxide radical scavenging activity. A total of seventy four compounds were identified constituting 98.4% of total oil composition. The oil was found to be rich in sesquiterpene hydrocarbons (62.3%). The major constituents detected were  $\beta$ -caryophyllene (33.1%),  $\beta$ -elemene (7.0%),  $\alpha$ -bisabolene (11.0%),  $\beta$ -longipinene (4.0%) and  $\beta$ -caryophyllene oxide (5.0%). The oil exhibited very good DPPH radical scavenging activity ( $IC_{50}$  1.83 $\pm$ 0.04) with respect to synthetic antioxidant BHT ( $IC_{50}$  0.34 $\pm$ 0.12), and metal chelating activity ( $IC_{50}$  1.59 $\pm$ 0.46). It also exhibit a significant reducing power ( $RP_{50}$  5.95 $\pm$ 0.92). This study concludes that essential oil from *C. odorata* could serve as an important bioresource to extract essential oils containing ~ 62% sesquiterpenoids including  $\beta$ -caryophyllene,  $\beta$ -elemene,  $\alpha$ -bisabolene, and  $\beta$ -longipinene. Further, the strong antioxidant and radical scavenging activity of the oil points towards its strong protective

role against oxidative diseases. The strong antioxidant activity indicates a possible use of essential oil as a natural antioxidant, food supplement and potential pharmaceutical application.

### **IMPACT OF DIFFERENT IRRIGATION REGIMES ON GROWTH, YIELD AND ACTIVE CONSTITUENTS OF *Picrorhiza kurroa* UNDER CULTIVATED CONDITIONS AT MID-ALTITUDES**

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*Picrorhiza kurroa* Royle ex Benth is an important medicinal herb belonging to family Plantaginaceae. The species is indigenous to the Himalayan region and is distributed between 3000-4500 masl. Due to high medicinal properties, the market demand of species increased worldwide. The status of species was declining at an alarming rate due to over-exploitation through the illicit collection from wild. Considering the market demand and wild status, the species is recommended for cultivation in Himalayan states, especially in Uttarakhand Himalaya. In high altitude villages of Uttarakhand Himalaya, numbers of farmers were engaged in the cultivation of *Picrorhiza kurroa* but till now there is not any proper protocol for irrigation. The aim of present study is to study the impact of irrigation on growth, yield and active constituents of *Picrorhiza kurroa* under cultivated conditions at mid altitudes. The experiment was carried out under polyhouse conditions at Herbal Research Garden of High Altitude Plant Physiology Research Centre at Pothivasa (22,00 masl) in district Rudraprayag, during 2014-16. The plants were irrigated by Drip and Micro-sprinkler irrigation system. The amount of irrigation water was equal to 50%, 80% and 100%. The growth parameters such as plant height, number of leaves, leaf length, leaf width, number of shoots, number of stolons and stolon length was found maximum in 80% level of irrigation in drip where as 100% irrigation level in micro-sprinkler. The maximum yield was also found in 80% and 100% irrigation levels of both. The active constituents i.e. picroside (P-I & P-II) were recorded maximum in roots of 80% irrigation levels of both drip and micro-sprinkler irrigation. In the case of stolons, the picroside content was found maximum in 80% drip and 100% in micro-sprinkler irrigation. The present study was concluded that balanced water requirement is necessary for the growth, yield and active constituents of *Picrorhiza kurroa*. The results of this experiment showed that the growth improved as a result of applying 80% irrigation levels in drip and 100 % in sprinkler irrigation. This study is useful for farmers who are actively engaged in the cultivation of medicinal plants in mid altitudes of the Himalayan region.

### **UTTARAKHAND: PHENOMENAL SOURCE OF ANTICANCEROUS HERBS**

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Cancer is one of the most dreadful disease and spreading further with continuation in 21st century. Although, contemporary science has made some major step in understanding cancer and its molecular basis but the knowledge about how to prevent or treat cancer is still lagging behind. In Ayurveda, lots of medicinal plants have been used to prevent or treat chronic diseases and arbuda (tumour/cancer) is one of them. India has a rich source of medicinal plants since ancient times. Due to unique agro-climatic conditions and physio-geographical features, the Himalayan region has high value medicinal plants, which serve as the source of many life saving drugs. Acharya Charaka in Rasayana chapter has also described the Himalayan region as the best habitat for medicinal plants concurrently Himalayan herbs are useful for longevity and rejuvenation. Despite extensive use in traditional medicine, information on active constituents and scientific evidence for the disease-curing mechanism of most of the Himalayan herbs are still elusive. The aim of the present paper is to divulge the enlightening of some Ayurvedic herbs of Uttarakhand Himalayan region which are useful to restrict tumor growth and prevent or to diminish the various side effects during or after chemotherapy and radiotherapy. Concurrently pharmacodynamic properties of some medicinal herbs along with their botanical name, useful part as well as recent research works are included in this paper. This study may also to raise awareness and implementation of medicinal plant in daily routine.

## PHYTOCHEMICAL ANALYSIS WITH ANTIOXIDANT POTENTIAL AND MAJOR CONSTITUENT $\beta$ -ASARONE FROM *Acorus calamus* L.

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*Acorus calamus* L. is a native herb in India. The herb belongs to family Araceae. It is perennial and grows in marshy land with scented rhizomes and tapered reed like leaves with 80-100 cm in height. It is also known as sweet flag in English and vernacularly as Bach. It is a source of essential oil which is responsible for the medicinal properties. *Acorus calamus* L. (Araceae) has long been used as a folk remedy in treating various allergic symptoms including asthma, cough, bronchitis and throat irritation. The present investigation reveals the chemical diversity and antioxidant activity of *Acorus calamus* rhizome essential oils from different altitudinal regions of Uttarakhand. The essential oil composition of *Acorus calamus* (Araceae), collected from different ecological niches of Uttarakhand, in India, was analyzed by GC-MS. The major compound isolated from essential oil of *A. calamus* was characterised by  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectroscopic method. The antioxidant potential of the essential oils of *A. calamus* was studied by using reducing power, ferrous chelation and DPPH radical scavenging assay. The major constituents in the rhizome essential oil of most of the population were  $\beta$ -asarone (62.3-75.9%),  $\alpha$ -asarone (2.2-6.1%), *Z*-isoelemicin (2.4-6.2%), *Z*-methyl isoeugenol (2.3-6.4%), shyobunone (1.5-5.3%), elemicin (0.7-1.7%) and calarene (0.2-3.4%). The antioxidant activity of essential oil was studied by their ability to scavenge free radicals, metal chelating and reducing power with different  $\text{IC}_{50}$  values in comparison to standard antioxidant. The vast chemical diversity of the herb essential oil and its antioxidant potential can be good natural source for herbal nutraceuticals and phenyl propanoids, the biologically important class of terpenoids.

### ANUKTA DRAVYA FOUND IN UTTARAKHAND

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The knowledge about medicinal plants in ancient time is scientifically documented and systematically organized in Ayurveda. Codified information regarding plants of folklore origin is not documented in classical text. They are referred to Anukta dravya (undocumented) in classical text of Ayurveda. It is used to describe, understand, adopt and extend new things such as identification of new drugs based on the existing principles. It is useful to understand and incorporate new concepts from the contemporary science. The description of Anukta is very interesting because it clarifies the confusions that arise from the terms and definitions which are not clearly dealt. A good number of medicinally useful plants have been discretely mentioned at numerous places but the complete description of such plants i.e. pharmacodynamic properties (rasa, guna, virya, vipaka etc.) may not available in Ayurveda. So there is an urgent need to first demarcate, identify and analyze them in terms of rasa, guna, virya, vipaka etc. concurrently they should be described pharmacognostically and phytochemically for their chemical composition so that they can be utilize therapeutically and documented in Indian materia medica. In the present paper it is a preliminary attempt to review on some anukta (undocumented) medicinally useful plants such as rhododendron, stevia, ginko biloba etc. found in Uttarakhand.

### STUDY ON SOME MEMBERS OF LAMIACEAE FAMILY OF NEW TEHRI TOWN

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The Lamiaceae family is rather large family containing 180 genera and 3500 species worldwide. In India this family is represented by 64 genera and 3800 specie chiefly in comparatively dry area and moderate altitude. Plants of this family are chiefly valuable as source of volatile essential oils which are used for flavoring for perfumery, for medicine and as garden ornamentals. Present study was done in New Tehri Town and its adjacent areas which is situated in Tehri Garhwal district of Uttarakhand. It deals with the exploration of members of Lamiaceae in wild forms. 20 different plant species belonging to 11 genera were

screened out. Of which, 95% are used medicinally, 30% for oil and 20% as ornamentals. Species of *Ocimum*, *Ajuga bractesoa*, *A. parvifolia*, *Clinopodium*, *Origanum majorena*, etc. are used for fever, malarial fever, digestive disorder and bronchitis respectively. Uttarakhand is hilly state and have generally xerophytic condition favouring wild habitat of this family. Exploration and extensive study of such economically important families can enhance the status of our state.

### **DIFFERENT APPLICATION OF *PANCHATIKA* COMPOUND IN FORM OF VARIOUS FORMULATIONS**

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The five medicinal herbs namely *guduchi*, *nimba*, *patola*, *vasa*, *kantakari* predominantly with characteristics of tikta ras (bitter taste) are together to enhance and enrich the efficacy of compound. There are various formulations available in texts as indications of the treatment of various diseases. Tikta rasa is highly appreciated as having best *pittashamak*, *jwaraghna* (antipyretic), *raktaprasadan* (blood purifier), *deepan pachan* (improve appetite), *vishaghna* (detoxifying), *krimighna* (anti-helminthic), *twakmamsa sthirikaran* (improve compactness and elasticity of skin and muscles). *Tikta rasa* is specially used in management of disorders of skin, blood, bone, muscles, eye and GIT. *Panchatikta* is used as an important part of many drug compounds and many preparations specifically made by only itself i.e., *kwath*, *churna*, *ghanavati*, *grhita*, *ksheerpaka* etc. It is a drug of choice for many formulations used in *panchakarma* for *snehan karma* and *panchatikta ksheera* is used for *basti karma*. There is a great need for standardization of the drugs of *panchatikta* and scope to modify the formulation according to acceptability, safety and convenience in administration to the patients.

### **NEED FOR CONSERVATION OF A VALUABLE HIMALAYAN MEDICINAL PLANT SPECIES, *Trillium govanianum***

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Renewed interest in Indian System of Medicine, especially Ayurveda, has led to increased demand of medicinal plants at regional as well as global level. Many plant species are facing varying degree of threat to their survival due to their overexploitation from nature to meet the demand. Medicinal plants inhabiting the alpine and subalpine region of the Himalayas are more vulnerable to this owing to their stressful habitat characteristics and regeneration behavior. *Trillium govanianum* Wall. ex D. Don is one such species exploitation of which has increased in recent years and therefore needs an in depth study of its status as well as medicinal applications. Major aim of the study was to determine status of the species in its natural distribution region and the factors associated with recent upsurge in its demand and subsequent overexploitation. Exploratory survey in the habitat region of the species in sub-alpine and alpine areas of Garhwal region for its occurrence was undertaken. Interaction with local population for its traditional use as well as commercial exploitation and collection of documentary evidences for scientific validation was done. *T. govanianum* is valued for its wide range of medicinal properties including anti-cancerous activity. The species was found growing scarcely in association with *Rhododendron campanulatum* around 3100 m altitude in the humus rich soil. Disappearance of the individuals of the species in same growing season from identified locations possibly indicated their collection in unauthorized manner. Most common ethno-medicinal use of the species was cited for sexual disorders. However, the exploitation from the nature was mainly for commercial than local usage. Morphological resemblance of *T. govanianum* rhizome with *Paris polyphylla* has been attributed to its use as adulterant or substitute for the latter species that has already been overexploited from the region. This along with its medicinal potential is possibly the main factors associated with its overexploitation from its natural habitat. The overexploitation of the species from nature has led to dwindling of its natural populations and therefore strategies for its conservation need to be devised to check its further erosion.

### **ASSAYING THE EFFECT OF PRE-SOWING TREATMENTS ON SEED GERMINATION OF *Jurinea macrocephala* ROYLE (C.B CLARKE)**

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*Jurinea macrocephala* (Asteraceae) is a threatened medicinal and aromatic herb of Western Himalaya. Due to its tremendous overexploitation, the species has been listed as endangered in Himalayan region which has raised concerns amongst many scientists, ecologists and conservationists. Consequently this species has been included in the negative list of exports by the Government of India. Based on the extensive collection for trade and dwindling population in the wild, the plant has been categorized as "Vulnerable" in Himachal Pradesh and endangered for Jammu and Kashmir in the Conservation Assessment and Management Planning (CAMP) Workshop held at Kullu. Considering its potent medicinal properties, cultural significance, declining population density and its endangered status, it is imperative to take urgent measures for the conservation of *J. macrocephala*. Studying its population status and ecological attributes, would play a vital role to formulate the conservation plans and are required to develop appropriate strategies for its long term monitoring and sustainable use. The plant is propagated naturally by means of seeds and vegetative propagules. Apart from growing naturally, its ex-situ cultivation should be promoted. In this direction, the present work is carried out to test seed germination under controlled condition of light and temperature and under the influence of different treatments at different concentration and duration. The objective of the present study is to determine the effective pre-sowing treatment, to improve the seed germination. An experiment was conducted in the laboratory with total 16 treatments and 3 replicates each in a completely randomized design. The different treatments used in the experiment are Gibberellic acid GA<sub>3</sub>, Thiourea, Potassium nitrate (KNO<sub>3</sub>) with concentrations 50 ppm, 100 ppm, 250 ppm and 500 ppm. The surface sterilant Sodium hypochlorite (NaHClO<sub>3</sub> 4%) was used as one of the treatment and was given to the seeds for four different time duration i.e. 15 minutes, 30 minutes, 45 minutes and 60 minutes. The distilled water was used as a control. The collected mature seed were soaked for a period of 40 hours in the respective treatments at different concentration before transferring them on a Whatman filter paper no. 1 placed in a petri plate. Out of all treatments, germination of seeds pre-treated with NaHClO<sub>3</sub> and KNO<sub>3</sub> were found to be significantly enhanced and also reduced the mean germination time as compared to control. Our study suggests that the use of less expensive nitrogenous compounds like thiourea and potassium nitrate and use of surface sterilants like sodium hypochlorite can be used as a handy tool for mass multiplication of *Jurinea macrocephala* which would ease the pressure of overexploitation of the target species in its natural habitat.

### SCIENTIFIC VALIDATION OF TRADITIONAL AYURVEDIC AND HOMEOPATHIC FORMULATION USING METABOLOMICS TECHNIQUES

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Most of the Ayurvedic formulations (AF) and homeopathic medicines (HM) are mixture of several metabolites, organic and inorganic components. However, various components of AF and HM and their mode-of-actions remain largely unknown. As a result these products are not very well defined or characterized particularly with reference to the composition, quality, safety points, molecular disease target and mode of action, although their clinical efficacy is well established. Our research is focusing on scientific validation of few existing life-saving AF and HM to cure metabolic disorders such as cancer, diabetes and obesity in terms of understanding their modes of actions at cellular level using both in vitro cell based and in vivo animal experiments. Currently we are employing mass-spectrometry-based metabolomics technology to decipher all bioactive metabolites present in the various parts of *Aswaganda* plant (*Withania somnifera*) and the AF and HM prepared from the *W. somnifera*. Each bioactive metabolites and their rational combinations will be further analyzed for identification of disease target for curing cancer and underlying mode-of-action using in vitro cell based assays and finally their validation using in vivo animal experiments This comprehensive scientific validation of AF and HM will bring international recognition to these traditional medicines.

### CULTIVATION OF MEDICINAL PLANTS

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Today in this modern world it is seen that many of the practitioners are entirely dependent on the drug dealers for their supplies. Due to the encroachment of waste lands and forest areas, as well as due to the consequent changes in the ecological system, many important plants have almost disappeared, and many

have almost become extinct even in the forest areas. As a result, Ayurvedic practitioners experience great difficulty in getting sufficient supplies of medicinal drugs. To promote cultivation of medicinal plants, Central Institute of Medicinal and Aromatic Plants (CIMAP) has developed a number of high yielding varieties, worked out agro-technologies and processing technologies. In order to promote medicinal plants sector, Government of India set up National Medicinal Plants Board (NMPB) on 24th November 2000. Currently the board is working under the Ministry of AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha & Homoeopathy), Government of India. In order to ensure sufficient supply of genuine raw materials, we have no other resource than to cultivate all varieties of medicinal plants in extensive areas, In different regions of the country for this, firstly selection of plots should be done. Regarding the Selection of a plot of ground for the cultivation of medicinal plants, Sushruta says "A plot of ground, whose surface is not rendered uneven by the presence of ditches, gravel and stones, and which is not disfigured by ant-hills, nor used for the purposes of cremation or execution, and which does not come under the precincts of temples, and which does not abound in sand, is favorable for the cultivation of medicinal plants. A ground which does not contain alkaline soil and which is untilled, and which is supplied with water from a close by source may be selected. A ground possessed of soil which is soft, firm and equally distributed and coloured black, yellowish or red, and at the same time is favourable to the growth of vegetation is recommended for the cultivation of medicinal plants". With regard to the selection of plant material Sushruta say that plant even if found growing in such a commendable site, should further be examined as to its being infested with worms (or insects), or infested with poison or cut with metal implements or affected by excessive atmospheric heat, winds, fire or water, or by animals. In the event of its being found sound, and is possessed of its particular taste, and is well nourished, grown large and deep into the soil, it should be culled for the purpose of getting the respective parts.

### **EFFECT OF DIFFERENT CONCENTRATIONS OF PLANT GROWTH REGULATORS (PGRS) ON GROWTH OF TOP EDGE CUTTINGS OF *Nardostachys grandiflora* DC.**

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*Nardostachys grandiflora* DC. (Jatamansi) is a small herbaceous species of family Caprifoliaceae, commonly known as Jatamansi, Indian nard or spikenard. It is a perennial, dwarf, hairy, rhizomatous medicinal herb and grows in steep, moist, rocky, undisturbed grassy slopes between 3000-5000 m asl in random forms in higher Himalayan region. It has a long history of use in ethno medicine, perfume, incense and modern medicine. The species has become endangered due to over exploitation for medicinal use, habitat degradation and other biotic interference in its distribution ranges. Initially the observations of experiment indicated that the large number of *N. grandiflora* plants can be obtained through using top edge cuttings without damaging the plants before senescence period. The experiment was conducted at HAPPRC, Srinagar Garhwal (550 m asl) during the month of December-March 2017. Top edge cuttings (10.30±2.07 cm L; 6.63±1.27 mm Dia.; 3.06±0.83g wt.) prepared from five year old plants growing at Tungnath nursery and were treated with different concentrations of PGRs i.e. BAP, IAA, IBA, and NAA (50, 100, 500 and 1000 µM) and for 24 hours and then planted in Styrofoam trays at greenhouse condition containing mixture of soil, sand, Farm Yard Manure (FYM), and Forest litter. The cuttings were also treated with Bavastine through direct dip method and same cuttings were planted in Styrofoam trays containing mixture of soil as control. After three months planting of cuttings, it was observed that the cuttings treated with NAA (50µM) gave maximum percentage of Survivability (80%), maximum no of leaves (5.06±1.18), maximum length of leaves (6.85±2.25), and maximum width of leaves (0.73±0.11), while IBA (100µM) shows minimum percentage of Survivability (35.56%), minimum no. of leaves (1.66±1.15), minimum length of leaves (2.63±1.61), minimum width of leaves (0.29±0.21), and minimum shoot width of cuttings (2.68±1.34). NAA 100µM show maximum shoot length of cuttings (2.59±0.65) and maximum shoot width (4.63±1.71) while IAA 50µM show minimum shoot length of cuttings (1.68±0.49). Plant growth regulators play important roles in growth and other vital activities in plants. Therefore, experimental trails have been for development of reliable and most beneficial vegetative propagation through top edge cuttings. The present experiment shows that NAA (50µM) shows maximum result, while IBA (100µM) shows minimum result to other PGRs.

### **TRIPHALA – A MIRACLE FORMULATION**

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India has ancient heritage based traditional herbal medicine Ayurveda: “science of life,” because it focuses on views of man and his illness. Herbal medicines are being used increasingly as medicinal and dietary supplements to fight or prevent common diseases. Triphala is a well-known compound preparation of equal proportion viz. Haritaki (*Terminalia chebula* Retz.), Vibhitaki (*Terminalia balerica* Roxb.) and Amalaki (*Embllica officinalis* Gaertn.). Triphala is such a miracle combination of these three herbs which has a ability to correct the imbalance of doshas as well as bring them to normalcy to maintain the harmony of health. When these herbs combined in proper form; synergy enhances the efficacy and healing quotient exponentially. Major classics reported triphala is having tridoshasamaka property, kosta shodhaka and well established Cakshushya. Triphala is indicated for both shaman (procedure by which accumulation of vitiated doshas from the body is pacified) and shodana. Haritaki mainly contain Tannins, anthraquinones, and polyphenolic compounds. Vibhitaki mainly contain Gallic acid, tannic acid, and glycosides. Gallic acid is a common phyto-constituent present in all three herbs used in Triphala. Fruit juice of *Embllica officinalis* (EO) contains the highest vitamin C (478.56 mg/100 mL) content. The fruit when blended with other fruits boosted their nutritional quality in terms of vitamin C content. The whole formulation possesses immunomodulatory properties and helps in improving the body's defence system. Triphala is reported to have visual function enhancer activity, antimutagenic, anticancer, antioxidant, antimicrobial, antidiabetic, analgesic, radio protective, hypolipidaemic and also benefecial in many other disorders.

### IDENTIFICATION AND TRADITIONAL USES OF SOME COMMON EXOTIC CULTIVATED MEDICINAL AND AROMATIC PLANTS IN TARAI BELT OF UTTARAKHAND, INDIA

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Exotic plants may be introduce or arrived there by human activity either deliberately or accidentally, where they do not naturally occur. These are consider as non native, non indigenous or simply aliens to a particular area. A survey of such plants was conducted in Pantnagar area of Uttarakhand State. Cultivated exotic flora is important because of dependency of human beings on it for food, shelter, medicine ecosystem services, aesthetic enjoyment and cultural identity. Exotic species can also help an ecosystem by providing a missing link in a failing food chain. Introductions can also be beneficial by conserving species in cases where they are endangered or threatened in their natural habitats. The present paper deals with study of 90 exotic cultivated medicinal and aromatic plants of Tarai belt of Pantnagar region of Uttarakhand. Medicinal plants belong to a big plant group with a great interest due to its pharmaceutical, cosmetic and nutritional application. In addition, they are also an alternative to traditional crop with species in high demand at the current international market. G. B. Pant University is a unique place in Tarai region of Uttarakhand. Tarai region is situated near the outer Shivalik hills of the Himalaya. Geographically the land area covered by the University which lies in between the latitudes N 28° 59' 36" – 29° 02' 34" and longitude E 79° 28' 33" - 79° 31' 12" with an altitude range of 213 to 238 m above sea level. The present study deals with comprehensive list of exotic cultivated medicinal and aromatic plant species at Pantnagar with background information on their family, utility and habit. The present work involves exploration of exotic cultivated medicinal plants in the entire area of Pantnagar in different seasons. This is the first assessment of alien cultivated medicinal and aromatic flora of the Pantnagar region. There is a lot of scope of these exotic cultivated medicinal and aromatic plants in herbal medicines. The different parts of the plants are used to cure several kinds of illnesses. The leaf is predominantly used, and is followed by roots, tubers, and rhizomes. The indigenous community prefers these plants as home remedy against fever, skin problems, leucorrhoea, rheumatism, headache, indigestion, etc.

### EFFECT OF INTEGRATED NUTRIENTS ON GROWTH AND YIELD OF PARIS POLYPHYLLA SMITH UNDER CULTIVATED CONDITIONS

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*Paris polyphylla* Smith belonging to family Melanthiaceae is an important medicinal herb mostly used in traditional medicine and has the medicinal properties like anticancer, antimicrobial, antioxidant, antitumour, cytotoxicity and steroidal, etc. It is considered vulnerable in many parts of the world. Due to overexploitation of the natural resources, the species has rapidly declined from its natural habitat over the

last few decades. In Uttarakhand also, the status of the species is on decline due to illegal exploitation from natural habitats. Poor seed germination and overexploitation reduce the population of this species. Thus, keeping in view the importance of this species an investigation was conducted to determine the best suited growing media for its growth by taking morphological characters as a parameter using various soil compositions. The experimental design was completely randomised with four treatments, three replications, and one control experimental plot at Pothibasa nursery (2200 m. asl) in Rudraprayag district during 2014-2016. Treatments included litter (50%), farmyard manure (50%), sand (50%), inorganic fertiliser (NPK 25%) and one without any treatment was considered as control. Observations of different morphological parameters such as plant height, numbers of leaf/plant, leaf length, leaf width and petiole length were recorded at different growth stages and rhizome length, width and weight were recorded at the end of plant growth period. Analysis of variance indicated that maximum height, numbers of leaf, leaf length, leaf width, rhizome length, rhizome width and rhizome weight was recorded in litter rich soil. The present study can be a useful tool for its *ex-situ* cultivation practices, and thus we can conserve this medicinal species in their natural habitats for sustainable development and also useful for its domestication.

### SCREENING OF ANTIMICROBIAL POTENTIAL OF *ERYTHRINA INDICA* LAM. LEAVES AGAINST EAR PATHOGENS.

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The importance of medicinal plants to the world is very well established. The extensive utilization of medicinal plants has been doing throughout the world in areas of health management. Compounds which show either inhibition or cidal activity against microbes/ pathogens is believed to have antimicrobial activity. Medicinally important plants have such compounds which show antimicrobial properties. Further, systemic screening and evolution of plant extracts from various parts of plants i.e. root, bark, flowers, leaves and seeds are being used for medicinal purposes and represent a continuous effort to find out new compounds with potential antimicrobial properties. Ear infections are one of the most common diseases encountered in medical practice nowadays. Ear infection is a very common problem and diagnosed in infants, children and adults as ear is one of the most delicate sense organs. Lack of proper care may lead to ear infections. These affect people of all ages from neonate to adult group and common reasons that compel an individual to seek for a medical attention. Ethno-botanical and traditional uses of natural compounds, mainly of plant origin established much interest as they are well tested for their efficacy and generally believed to be safe for human use. The evaluation of antimicrobial potential of *Erythrina indica* leaves extract against ear pathogens might supports its medicinal application. The antimicrobial activity of different extracts of *E. indica* leaves was determined by agar well diffusion method for bacteria and poisoned food technique for fungi. The phytochemical analysis was performed by using standard qualitative methods. The methanol extract of *E. indica* leaves was found active against *Staphylococcus epidermidis* ( $14.6 \pm 0.28$ mm), *Staphylococcus aureus* ( $12.3 \pm 0.28$  mm), *Haemophilus influenzae* ( $11.3 \pm 0.57$  mm), *Streptococcus pneumoniae* ( $10.0 \pm 0.50$  mm) and *Candida albicans* ( $8.3 \pm 0.28$  mm). The acetone extract was found effective against *Aspergillus niger* ( $22.2 \pm 0.88$ mm), *A. flavus* ( $25.3 \pm 0.60$ ) and *A. fumigatus* ( $45.0 \pm 0.29$  mm). The activity of reference drug (Erythromycin) was higher in comparison to tested crude extracts at similar concentration. The results of MICs showed that they ranged from 3.12 – 12.5 mg/ml. *E. indica* presented MICs against *S. pneumoniae* and *C. albicans* (6.25 mg/ml), *S. epidermidis* and *H. influenzae* (3.12 mg/ml) and *S. aureus* (12.5 mg/ml). The phytochemical screening for methanol extract of *E. indica* revealed the presence of phenols, glycosides, alkaloids, steroids, terpenoid and tannins. The study indicates that the leaves of *Erythrina indica* has shown moderate antimicrobial potential and can be used for therapeutic purpose, as plant possesses antimicrobial compounds which are inhibiting the growth of tested organisms. Thus, *E. indica* can provide a natural cure against microbial infections in ear as well as a way for the preparation of novel drugs.

### LAWSONIA INERMIS: A GREENER WAY OF SILVER NANOPARTICLE SYNTHESIS

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A single-step green synthesis process can be used to reduce metal ions to nanoparticles by the usage biomolecules present in plant extracts. In the present work, we describe inexpensive, nontoxic,

unreported and simple procedure for synthesis of silver nanoparticles (Ag NPs) using leaf aqueous extract of *Lawsonia inermis*. Biologically synthesized silver nanoparticles have been widely used in the field of medicine. The objective of the present work is the synthesis of silver nanoparticles (AgNPs) using leaf aqueous extract of *Lawsonia inermis* (mehndi), well known for its availability and medicinal property. Aqueous solution (1 mM) of silver nitrate ( $\text{AgNO}_3$ ) was prepared by adding 0.0421 gm of silver nitrate to 100 mL of double distilled water. The aqueous leaf extract of mehndi was mixed with the 1 mM  $\text{AgNO}_3$  solution in the ratio of 1:4, 1:10 and 1:20, and incubated. The AgNPs were dually characterized and tested for their antibacterial activity and toxicity. The silver nanoparticle formation was confirmed by the colour change of plant extracts. The AgNPs were characterized by UV-visible (vis) spectrophotometer, scanning electron microscopy (SEM) and Fourier transform infrared spectrometer (FTIR). AgNPs obtained showed significant antimicrobial activities against both Gram-negative and Gram-positive bacteria, *E. coli* (Gram - ve), *Micrococcus luteus* (Gram+ ve), *Pseudomonas aeruginosa* (Gram + ve) in comparison to both  $\text{AgNO}_3$  and raw plant extracts. Additionally, a toxicity evaluation of these AgNP containing solutions was carried out on seeds of Chickpea (*Cicer arietinum*). Results showed that seeds treated with AgNP solutions exhibited better rates of germination. This work proved the capability of being used as a biomaterial for the synthesis of silver nanoparticle, by adopting the principles of green chemistry. The plant extract demonstrated the ability to actively cap and produce nanoparticles of controlled size and morphology. AgNPs may also be efficiently utilized in agricultural research to obtain better health of crop plants as shown by our study. They have an important advantage over commercial antibiotics and may prevent the risk for generation of antibiotic resistant bacterial strains. Henceforth, applications of these ecofriendly nanoparticles in bactericidal, wound healing and other medical and electronic fields makes this method potentially helpful for the large scale synthesis of other nanomaterials.

#### **EFFECT OF PRE-SOWING TREATMENTS ON ENHANCEMENT IN GERMINATION OF ACONITE SEEDS**

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Genus Aconite is one of the important medicinal Genus of Indian Himalaya, mainly two species (*A. balfourii* and *A. heterophyllum*) of the genus Aconite are being used by traditional healers. It is because of the intensive stress on nature for herbal medicines that these plants require cultivation practices as well as farmer's attention. Cultivation using seeds is the primary method for plant propagation, although seed germination is a challenging task for alpine plants but using suitable concentration of PGRs (Plant growth regulators) germination can be achieved. The present study has been carried out to develop cost effective procedure for seed germination of *Aconitum balfourii* and *Aconitum heterophyllum*. Seeds were collected from natural pockets of Tungnath Himalaya and stored in polybags at 4°C for three months prior experiment, germination was then conducted using various chemical and hormonal treatments. Treated seeds were sown in the Styrofoam tray filled with soil: compost: sand, and observed for germination percentage and seedling growth. Seed germination and seedling growth was observed very low in control as compared to the treatments in both *A. balfourii* and *A. heterophyllum*. Highest seed germination percentage in *A. balfourii* was 65% at 200 ppm  $\text{GA}_3$  and in *A. heterophyllum* it was 50% at 100 ppm  $\text{GA}_3$ . Seedling growth viz, root length, shoot length, leaf number etc. was also observed highest in  $\text{GA}_3$  in both species. Study conducted revealed that there is lower germination percentage in *Aconitum* species, which was enhanced by the chemical and hormonal treatment  $\text{GA}_3$  was found to be most effective in breaking dormancy and enhancing germination in seeds and seedling growth in both *A. balfourii* and *A. heterophyllum*.

#### **POTENCY OF MEDICINAL PLANT CAN BE INCREASED BY PLANTING ACCORDING TO NAKSHATRA**

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Myths and rituals and spirituality and science coexist in the Indian psyche whereas it may be an amusement or bewilderment in the western mind. Though the cultural and technological changes brought in by scientific advancements have influenced the folk traditions, they have reemerged as a spiritual science and have wide acceptance even in the west where all the Vedic literature is being translated and accepted. Nakshatra Vatika, a garden developed on the theme of astrology, where one can plant saplings to counter the ill-effects of planets. There are total 27 nakshtras and our 9 planets correspond to these nakshtras. It is

believed that each tree here keeps giving energy to that particular person / people born during that particular star. So any ailments or health problems are set right / healed / cured when you spend / request / talk / meditate near or under that particular tree, corresponding to their star. So the presence of the complete set of 27 trees directly creates healthy and sound physical, mental, psychological and spiritual beings. This is the ultimate and absolute bliss to oneself and to the earth too. It also shows how significant are the trees for our survival that our sages and saints have woven the trees in our life in such a way so that we realize their significance in every possible way and are eager to protect the jungles and trees. They are also the source of Oxygen prana yaau without which no life can exist on earth apart from being source of medicine & wood. In this direction, scientifically it has been proved that air quality is good and particulate matter is lesser in the vicinity of the Navgrah Vatika as compared to a distant location. Studies have also shown that high phytochemical profile and high antibacterial activity of plant grown in nakshtra vatika. These are some pilot studies which suggest that plantation according to Nakshtra are beneficial and can help in treatment of diseases.

### **DIFFERENCES IN ANTIOXIDANT POTENTIAL OF *HIPPOPHE SALICIFOLIA* D. DON LEAVES EXTRACTS OF MALE AND FEMALE PLANTS**

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Plants are a rich source of antioxidant compounds, which can combat the oxidative free radicals in a human being when used as food or food additives. *Hippophae salicifolia* D. Don was reported rich in antioxidant compounds in various studies, but due to its dioecious nature, it is unclear which sex of plant is rich in antioxidant potential. To investigate differences in antioxidant potential of male and female leaves of *Hippophae salicifolia* D. Don. In the present study, leaves of male and female plants of *H. salicifolia* were extracted separately in three different solvents (Ethanol, acetone and distilled water) to know the most effective solvent for their antioxidants extraction. Phytochemical screening and antioxidant assays performed for each extract. This study illustrates considerable differences in antioxidant properties of both male and female plant leaves extracts of *H. salicifolia*, female leaves possessed overall higher antioxidant activity than male leaves extract. There was no difference in phytochemical constituents in leaves extract of male and female plants of *H. salicifolia*, showing positive results for phenols, flavonoids, saponins and coumarins, etc. Female leaves extract showed higher Total Phenolic content than the male in respective solvents. Free radical scavenging activity was significantly higher in ethanol extracts of both female and male plants as compared to other extracts. Total reducing power was found higher in female leaves extracts than male leaves extracts; ethanol extracts showed higher total reducing potential in both respective extracts in dose dependent manner. Among all three extraction solvent used in the study, ethanol was proved to be best extraction solvent. All extracts illustrated antioxidant activities correlated with TPC in respective extracts. In female leaves extract SOD scavenging activity, and total reducing activity was highest in ethanol and lowest in aqueous extract, the same pattern followed in male leaves extract. According to IC<sub>50</sub> value calculation, antioxidant efficiency was highest for acetone female leaves extract. Thus, *H. salicifolia* leaves can be considered as a rich source of antioxidants and female leaves are richer in antioxidant activity than male leaves.

### **EVALUATE THE SALUTARY ACTION OF VARUNA (*CRATAEVA NURVALA*)**

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Medicinal plants are the rich source of various alkaloids, flavonoids, saponins, tanins, glycosides etc, aimed for different pharmacological action in various health ailments. Currently, According to WHO, approximately 80% of the world's population uses herbal medicines directly in healthy persons, diseases and even in cancer condition, in form of teas, decocts or extracts forms with easily accessible liquids such as water, milk etc. *Crataeva nurvala* Buch Ham, (family: Cappariaceae) is one of the most common species among them. The whole plant possess high medicinal value and traditionally used in treating various illness for human beings. In Ayurveda, *Crataeva nurvala* bark has been used to heal urinary bladder and kidney stones for more than 3,000 years ago. A detailed description of Varuna in urolithiasis is mentioned under the chapter of Ashmari. So, Varuna has been used for the treatment of urolithiasis, dysuria and crystalluria. Stem bark of this plant contains saponins, flavonoids, sterols, lupeol, betulinic acid and diosgenin. Lupeol (triterpenoid) is the predominant bioactive constituent of Varuna. Lupeol showed potent anti-urolithiatic

activity and nephroprotective activity. After several studies it have been authenticated that the herb (Varuna) demonstrated to possess multiple pharmacological activities like as antiinflammatory, urolithiatic, antibacterial, analgesic effect. The review emphasizes primarily on pharmacological activities of the extracts of *Crataeva nurvala* to provide a comprehensive data for researchers to hit upon its claimed traditional uses.

### **SCREENING OF HERBAL PLANT FOR THEIR ANTIBACTERIAL (IN VITRO) ACTIVITY ASSOCIATED WITH VARIOUS DENTAL PROBLEMS**

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Dental caries is a multifactorial human disease that has widely affected man populations all over the world. Antibiotic resistance has increased substantially in the recent years and is posing an ever-increasing therapeutic problem one of the methods to reduce the resistance to antibiotics is by using antibiotic resistance inhibitors from plants. Medicinal plants have been used as traditional treatments for numerous human diseases for thousands of years and in many parts of the world. Our aim is to study Screening of herbal plant for their antibacterial (in vitro) activity associated with various dental problems, also to analyze total phenolic, tannin, terpene and flavonoids and alkaloid profile of selected herbal plants. Phytochemical determination of *Holoptelia integrifolia* (chirvilb), *Meliaazedarach* (Mahanimb,denkan) *Ficus bengalensis* (barghad), *Spilanthes acmella* (akarkara), *Achyranthes aspesa* (apamarg) *Vitex nigundi* (nirgundi), *Ficus racemosa* (gular), *Utrica diocia* (bicchoo ghas), *Mimosa pudica* (lajja wati), *Mangifera indica* (mango tree) with different solvent show different phytochemicals (phenolic, alkaloids, tannin, terpenoids and flavonoides) present in various extract with significant quantity when analyses on spectrophotometer with their respective wavelength. *Mangifera indica* showed max. zone of inhibition/MIC against all oral pathogen followed by *Holoptelia integrifolia*, *Ficus racemosa*, *Mimosa pudica*, *Vitex nigundu*, *Ficus racemose*, *Melia azedarach*, *Ficus bengalensis*, *Achyrenthes aspera* and *Spilenthos acemella*.

### **ETHNO-MEDICINAL VALUE OF FABA BEANS**

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Faba bean is the highest nitrogen fixing legume and it is an excellent rotational crop. Faba bean can fix upto 80 percent of nitrogen requirements of their own, which means very less fertilizer needs to be applied in the spring season. Faba bean are also used for animal feed usually have a small seeds to reduce the cost. Now varietal development for cattle use includes low-tannin cultivars with reduced anti-nutritional factors like trypsin inhibitors. Copper also maintains blood pressure, immune system and bones healthy. Phosphorus and magnesium are important bones, and magnesium, along with potassium, helps regulate blood pressure. According fava beans are a nutrient-dense food, meaning they provide lots of nutrients essential for proper body function without being rich in calories. Fava beans have a unique flavor and texture that makes them wide varieties. These beans are a good food source of vitamin B1 like thiamin, iron, copper, phosphorus, potassium and magnesium, meeting 8 to 20 percent of the recommended daily value, Vitamin B1 is important for a nervous system function and energy metabolism; iron is an essential component of a protein responsible for oxygen transport in the bloodstream; and copper, along with iron, helps to form red blood cells. Broad beans are also rich in both folate and B vitamins, which we need for nerve and blood cell development, cognitive function and energy. Apart from their taste, these beans are also known for their high protein and fiber content. They are among the rare sources of naturally occurring L-dopa, which is one of the significant chemicals used for treating Parkinson.

### **ANTIFUNGAL ACTIVITY OF SYNTHESIZED ZnO NANOPARTICLES USING AQUEOUS LEAVES EXTRACT OF GERANIUM NEPALENSE SWEET**

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Garhwal Himalaya received significant attention throughout the ages and in the ancient treatises such as Rigveda, Ayurveda, Charak Sanhita, etc. The Garhwal Himalaya is known for its rich bio-resources and

diversity. The plant *Geranium nepalense* Sweet belongs to family Geraniaceae. It is common in montane zones, above 1400m height, widely distributed in Himalaya, China, Japan and Myanmar. Plant infusion used in fever and renal disorders, roots paste are applied in itching and also have roots in tanning industry. And in this study, Zinc oxide (ZnO) nanoparticles were synthesized using the aqueous leaves extract of *Geranium nepalense* Sweet, maintaining the pH range between 8 and 12. The formation of nanoparticles was monitored by visualizing color changes and the resulted nanoparticles were characterized using techniques; XRD, FTIR, UV-Visible spectroscopy, etc. The obtained nanoparticles were highly crystalline in nature and of size less than 30 nm. ZnO nanoparticles were studied for antifungal activities and these nanoparticles showed effective potential against different pathogens.

### **IN VITRO ANTIMICROBIAL EVALUATION OF PONGAMIA PINNATA EXTRACTS AGAINST PATHOGENS CAUSING SCALP INFECTION**

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Scalp infections are one of the world's major causes of hair damage and loss. At the present time, most of the clinically utilized synthetic allopathic drugs suffer from many disadvantages such as toxicity, side effects and emergence of resistant strains. The increase in the Multiple Drug Resistant strains of microbes and reports of new incidences of diseases promote the discovery of new antimicrobial compounds extracted from medicinal plants and it is now look upon as a source of safe and potential alternative for synthetic drugs. World Health Organization (WHO) estimates that 4 billion people (80% of world's inhabitants) still believe in conventional medicines which are made up of medicinal plants for their primary health requirements. Moreover, 20% of prescribed drugs presently are formulated from the medicinal plants only. The medicinally potential plants contain some chemical compounds known as phytochemicals, which have specific physiological action on the human body. This has been clinically proven that herbal formulations enhance the growth of hair and stop hair fall. Plants produce certain bioactive compounds which are naturally toxic to microorganisms and so have been investigated as therapeutic agents. To evaluate the *in vitro* antimicrobial potential of seed extracts of medicinal plant *Pongamia pinnata* against *Staphylococcus aureus* causing scalp folliculitis and *Microsporum audouinii* causing tinea capitis (ringworm of the scalp). Seed material of *P. pinnata* was crushed with electric grinder and then extracted in four different solvents namely petroleum ether, ethyl acetate, methanol and water by using Soxhlet apparatus. The study of *in vitro* antibacterial assessment of extracts against *Staphylococcus aureus* was carried out by agar well diffusion method and antifungal evaluation against *Microsporum audouinii* by poisoned food technique. The results showed that ethyl acetate extract of *P. pinnata* seeds exhibited most effective antibacterial activity against *S. aureus* (26.33 mm) followed by methanol extract (13.0 mm) Petroleum ether and water extracts were unable to show effective antibacterial activity against *S. aureus*. Maximum antifungal activity was observed in ethyl acetate extract (21.5 mm) followed by methanol (36.5 mm) and petroleum ether (42.0 mm) against *M. audouinii*. Water extract (63.5 mm) did not show much effective antifungal potential against *M. audouinii*. Erythromycin was used as positive control to establish the sensitivity of strains. This study confirms the efficacy of *P. pinnata* seed extracts as a natural antimicrobial and suggests the possibility of their use in the treatment of scalp infections and to discover the new bioactive compounds.

### **A CONCEPTUAL STUDY OF HARSINGAR IN CONTEXT OF TRADITIONAL AND MODERN USES IN TREATMENT OF VARIOUS DISODERS**

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The plant Harsingar (*Nyctanthes arbon-tristis*) also known as Raj Harsingar, Night jasmine, Parijat occupies an important place in Hindu culture. It is a shrub with flaky grey bark. The characteristics of the plant include leaves opposite side and simple with an entire margin, flowers having pleasant fragrance, white and orange in colour. Traditionally the orange coloured corolla tubes are separated from flowers and dried and used for dyeing silk and cotton. The Harsingar is also commonly used for worship. Traditionally Parijat flowers are very aromatic and used for making garlands that are used in puja. It is commonly used by Indian people in form of powder and decoction of leaves and bark. This is traditionally practiced in stress, chronic fever, dry cough, piles, fracture, diabetes, skin disorder, digestion, malaria, constipation. Some researches carried out on this medicinal herb show the powder of stem bark useful in treatment of rheumatic joint pain and diabetes. The laxative and cholagogue properties of the leaves make it useful in

destroying intestinal worms. It has also antibacterial and antioxidant action. This is a proved drug for blood detoxification. According to many studies this drug is very effective in management of sciatica.

### **ANTI-INFLAMMATORY EFFECTS OF GINKGO BILOBA EXTRACT AGAINST TRIMETHYLTIN INDUCED HIPPOCAMPAL NEURONAL INJURY**

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Despite, immense neuromodulatory potentials of Ginkgo biloba extract as a memory enhancer, its underlying mechanism seems inadequate particularly with regards to its anti-inflammatory properties. The objective of the present study is to investigate the protective potentials of Ginkgo biloba extract (GBE) against hippocampal neuronal injury induced by trimethyltin (TMT) a potent neurotoxicant. Male S.D rats were administered trimethyltin (8.5 mg/kg b.w) single intraperitoneal (i.p) injection followed by Ginkgo biloba extract (100 mg/kg b.w i.p) for 21 days. The co-administration of GBE with TMT showed marked improvement in cognitive functions. Concomitantly, there was a significant decrease in oxidative stress as evident by reduction in MDA and total ROS levels. In addition there was marked suppression of astrocyte activation (GFAP), transcription factor NF $\kappa$ B and proinflammatory cytokines (TNF- $\alpha$ , IL-1 $\alpha$ , IL-6) which were found to be elevated by TMT administration. Histopathological observations showed remarkable improvement in hippocampal neuronal injury in the conjunctive group. Therefore, it is suggested that ginkgo biloba extract is an effective agent against trimethyltin induced hippocampal neuronal loss owing to its antioxidative as well as anti-inflammatory properties.

### **MODE OF ACTION OF LEKHANIYA MAHAKASHAYA DRAVYAS W.S.R. TO OBESITY**

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Today's sedentary lifestyle, high content of refined sugars and fats in food, lazy habits and busy routine has ultimately lead to low levels of physical activity and sometimes complete absence of exercise thus made the lifestyle disorders. Obesity is one of them. It is mainly metabolic disorder. Obesity is very near to Medoroga or Sthaulya. Charaka has described fifty mahakashaya in sutrasthana chapter three according to karma i.e. mode of action. Lekhaniya mahakashaya is one of them. Lekhaniya mahakashaya dravyas have great potential to treat obesity or sthauilya roga. The research in this area is a hot topic and lekhaneya dravyas from Charak samhita has anti-lipid properties. More the mode of action and pharmacological properties of these drugs are understood, more practical and easy it becomes to use them in clinical settings. In the present study, the treatment and reduction in severity and prevalence of obesity through pharmacological properties of lekhaneya mahakashaya dravyas were evaluated. In this study, pharmacogonistic and pharmacological description of lekhaneya mahakashaya dravyas is done with the help of Vaidika literature, Charak samhita, Susruta Samhita, Vagbhata and available Nighantus. The first line of treatment for sthauilya is to avoid those factors, which are responsible for the causing sthauilya. All these factors are having snigdha guna dominance in general. All drugs works on "principle of Samanya – Vishesh". Lekhaniya Mahakashaya dravyas having katu, tikta, kashaya rasa, katu vipaka, laghu and rooksha guna and ushana veerya have antagonistic properties to kapha and meda and exert lekhaneya karma action. The drugs of lekhaneya mahakashaya having rooksha (dryness), laghu (lightness), tikta- kashaya rasa and katu vipaka, lekhaneya and shoshana karma, exerts anti hyperlipidemic and anti-obesity actions resulting in increased metabolism of fat and other tissues thus effective in metabolic disorders as obesity or sthauilya.

### **MECHANISM OF DRUG ACTION IN AYURVEDA**

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*Ayurveda*, the Indian traditional system of medicine is based mostly upon plant drugs. There is description of many plants in the form of medicine to treat various ailments in *Vedic compendia*. In *Brihatrayi*, probable mode of action of *dravya* is described. Herbal drugs act according to *rasa, guna, virya, vipaka* or by *prabhava* or by combination of all these. All *dravya* are *panchabhautika*, our body is also made from *panchmahabhuta*. Concept of *Tridosha (Vata, Pitta, Kapha)* is also derived from these. The ancient *Aacharyas*

applied their intuition to give leads in explaining this action on the basis of *panchabhautika* elements. Hence, drugs are used in body according to *Samanya-vishesha siddhanta*. But, this has to be determined according to modern scientific knowledge for better understanding of the subject. The explanations for drug action given by ancient *Acharya* were based mainly on *Pramana* (Tools of valid truth) that are *Pratyaksa* – cognizable or perceivable and *Anumana* or inferred. On the basis of this, it is stated that the action of *dravyas* is due to its *rasa, guna, vipaka, virya* and *prabhava* in different conditions. The action of *rasa* is up to the stage of *avasthapaka*, then, this action is super ceded by *vipaka*. The action of accomplishing power of *virya* is over powered by the superior *vipaka* and the action is exhibited accordingly. The different actions that are mentioned and discussed in *Ayurveda*, on the principles of *rasa, guna, virya, vipaka* and *prabhava* does not give satisfactory explanation as to understand the subject matter in the present scientific era. These actions can be understood by the concept of *dravyagata karmukansha* (active principles), which reveals the chemical identity of drugs. The modern science also states, that the action of drug on the organism is by active principle or chemical constituent present in it.

### CONSUMER DECISION MAKING PROCESS FOR AYURVEDIC PATANJALI PRODUCTS

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Consumer behavior is a decision making process and physical activity involved in acquiring, evaluating, using and disposing of goods and services. The current scenario shows an inclination of consumer interest towards the consumption of herbal and ecofriendly products which do not have side effects in future. Presently consumers are more conscious for their health and maintaining the quality of life. They prefer to consume the products which help them to protect the good state of their health as well as their environment. This particular tendency has been responsible for the extraordinary popularization of Ayurvedic products. Ayurvedic products are herbal and ecofriendly in nature which do not have any side effects on individual's health as well as on their environment. In this study an attempt has been made to know the consumer decision making for Patanjali products. For this a survey was conducted on 90 randomly selected consumers who consume the Patanjali products since its starting in Pantnagar market (February, 2008). The findings of the study revealed that most of the consumers purchase these products due to their medicinal value. They reported that neighbours/relatives/family members were the major source of information about these products. The major evaluative parameters were found better quality and medicinal value of products. Advice and preference of family members and past experience with these products are the major factors that affect the decision of the consumer. Patanjali products are ayurvedic products which are pure, herbal and effective in nature and satisfy the needs of consumers without affecting environment and health of consumers.

### VARIOUS MODES OF ACTION OF SHANKHPUSHPI (*Convolvulus pluricaulis*)

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Shankhpushpi is an indigenous and very significant herb that is considered as gift of nature in *Ayurveda*. It is a perennial, prostrate or sub-erect spreading hairy herb. Recommended therapeutic form is fine paste of whole plant. It is a natural medicine which enhances the memory power and rejuvenates the nervous function. According to *Acharya Charaka* it is most important *medhya rasayana*. It shows anti-depressant, cardiovascular, anxiolytic, antioxidant and neuro-protective activity. It also shows antimicrobial, insecticidal, antifungal, antibacterial and anthelmintic properties.

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