



IPPC 2018

International Phytocosmetics & Phytotherapy Congress (IPPC2018)

19-21 February 2018, Udaipur, India

Section A

This section contains Abstracts of “Invited Lectures” presented by eminent scientists during IPPC - India 2018.



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ABSTRACT 1

Evidence-based scientific validation of plant-derived naturals for Health, Nutraceuticals and Cosmetics: Priorities and Roadmaps for Global Positioning

Anil K Tripathi

ABSTRACT

Use of plant-derived naturals for health, food and cosmetic benefits is on an unprecedented rise. Thanks to the extensive scientific efforts during the last three decades, their demand as observational therapeutics to precision bio-molecules has multi-folded in both oriental as well as western societies. New pharmacophores are being searched not only for offering more powerful, safer and affordable solutions for up-coming diseases but also as important ingredients of health-promoting functional foods to prevent adverse effects of lifestyle associated disorders.

India's priorities for improving its participation index and economic share in global business of plant based naturals are far more focused today. Research on herbals in the country must advance with fresh perspectives. Making claims of individual or combined clinical benefits of our botanical(s) on the basis of their tradition usage in ISM system may no longer help in the knowledge-driven market today. We must strive to support our traditional claims with convincing scientific validation data sheet. From good agricultural practices for procurement of raw materials to good manufacturing practices of our herbal preparations should now align with globally accepted norms of quality and clinical evaluation. Fortunately, last few decades have witnessed conscious efforts towards investigating several herbs and their natural bioactives for their chemistry, pharmacological dynamics, clinical efficacy and safety. Networking with modern medical sciences would be the best way to advance in this direction. However, during this amalgamation effort, one major distinction between a conventional modern medicine and a herbal preparation must be kept in mind. While former is primarily oriented toward the treatment of disease by eliminating a cause (micro-organism in case of infectious disease), the latter is more concerned with making necessary corrections in the imbalance caused to physical or mental elements of the body to rejuvenate body's defense mechanism to fight and eliminate the disease.

Most of the herbal formulations/supplements are poly-herbals. The famous immunity boosting product like Chyawanprash or the post-delivery weakness-recuperating health- tonic Dashmoolarishta that are often claimed to increase our stress tolerance; improve endocrine functions and; maintain positive body nitrogen (serum protein) levels are poly-herbal in nature. There are several points of concern with such products. Firstly, they contain a long list of constituent herbs; many of them are rare and threatened. Batch to batch inconsistency in composition, quality and efficacy is a concern that must be proven wrong by sound scientific back up in terms of chemical analysis and quality fingerprints of each batch. Sustained supply of raw herbs used in poly-herbal formulations must also be ensured. For this, India must re-assess and draw fresh real-time maps of occurrence of the 138 plant species that are required in more

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than ten herbal preparations. Plants that are required in excess of 100t/year must be brought into organized cultivations on a farmer's field to ensure genotype/chemotype purity. Indian herbs with proven or anticipated potentials of providing health protection/solutions against diseases like malaria, filariasis, leishmaniasis, cancers, rheumatic disorders, diabetes, hypertension, topical skin infection, bronchial asthma, liver disorders and dementias should occupy priority attention in this endeavor.

Plant Naturals often display a wide spectrum of therapeutic activity. For example, *guggul* is recommended in Indian systems of health for >25 ailments including liver inflammation, muscle spasm, cough, bronchitis, anemia, endometritis, obesity, osteoarthritis, and rheumatoid arthritis. The reason for this wide spectrum of activity is that it has anti-inflammatory, anti-coagulant, hypolipidemic, and antibacterial molecules in it. *Guggul* was also found to have anti-inflammatory activity in both polar and non-polar solvents, indicating that several chemical constituents present in it can impart similar anti-inflammatory action. This mutually complimentary and buffering actions of different plant constituents (vitamins; minerals; biologically active steroids, alkaloids, glycosides, tannins; and a variety of antioxidants) in the herbal preparations make them safer than a pure molecule-based medicine with acute biological action on our body.

Sometimes, none of the herbs present in a formulation exhibit similar therapeutic effects when applied individually as the combined formulation does. Recently, one such formula (*Trasina*) made up of *Withania somnifera*, *Tinospora cordifolia*, *Eclipta alba*, *Ocimum sanctum*, *Picrorrhiza kurroa* and *Shilajit* (rock sweat) has shown beneficial activity in treating diabetic rats, whereas no such effect was seen with individual herbs. This example illustrates the fact that a rapid screening program to assess biologic activity of single herbs or purified constituents of a herbal formulation may not necessarily confirm or disprove a health claim because of possible synergistic effects of the combination of drugs or adjuvant. It is therefore important that for clinical testing, Ayurvedic formulae must be used as they are described in Ayurvedic texts. This guideline was proven right when activity of famous Ayurvedic preparation "Triphala" was scientifically assessed. It is often considered to be a universal panacea of Indian system of medicine for rejuvenating the debilitated organs. The recent repurposing efforts in Triphala have shown that it has excellent radio-protective effect against gamma radiation. Contrary to their poly-herbal efficacies, the individual herbs, used in Triphala are reported to have other biological benefits.

Assigning new bioactivities to traditionally used phytomolecules is another research domain that can offer good dividends to India. For example, curcumin that is known to have several anti-septic, analgesic and bone-strengthening actions has now been shown to possess promising combinatorial potential for offering anti-neoplastic and nootropic solutions. Similarly, Indian Aloe that has so far been valued for its dermato-cosmetic properties is gaining new values as a strong anti-ageing herb. The plant *Adhatoda vasica* that is in use for treating cough related infection is gaining grounds for its use in bleeding disorders and tuberculosis infection. *Centella asiatica* valued for its memory enhancing nervine properties is now gaining importance in preparing skin grafts for burn healing. Plant naturals would soon capture global market of anti-oxidants for preventing cellular damage induced by oxidative stress that is implicated in the

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etiology of >100 human diseases including liver damage, bronchial tract infections, cardiac malfunctioning, dementias and neo-plasmas. Plant-based naturals such as vitamin C, vitamin E, β -carotene, zinc and selenium are being implicated with such health benefits. Pre-clinical studies undergoing in the area of plant naturals for health, food and cosmetic benefits in India suggest that plants like *Curcuma longa*, *Boswellia serrata*, *Picrorhiza kurroa*, *Terminalia chebula*, *Emblica officinalis*, *Bacopa monnieri*, *Boerhaavia diffusa*, *Phyllanthus niruri*, *Celastrus paniculatus*, *Ocimum sanctum*, *Gymnema sylvestre*, *Momordica charantia*, *Withania somnifera*, *Pterocarpus marsupium*, *Tinospora cordifolia*, *Trichopus zeylanicum*, and *Terminalia arjuna* and their poly-herbal formulations will occupy the bulk of attention for intense double blind, placebo-controlled pre-release clinical testing in coming years.

Keywords:

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ABSTRACT 2

Chemistry of medicinal plants: processing and structural modification of lead phytotherapeutics

R.S. Bhakuni

ABSTRACT

Medicinal plants represent a primary source for the pharmaceutical industry. About 25% of all available modern drugs are derived directly or indirectly from plants. Understanding the basic processes by which plants thrive, the sequence of processes of secondary metabolism work together to elicit the products of a particular pathway, for example, morphine biosynthesis; obtaining selected enzymes for the particular reproduction of secondary metabolic processes on more diverse array of substrates. Such biosynthetic studies are now an extremely important component of synthetic and Natural Products Chemistry. The two concepts of selectivity in organic synthesis and plant / fungal enzyme knowledge are intellectually and practically fused in realm of biocatalysis. The recent studies using locally available vegetables may offer an alternate opportunity for scientists to investigate their local resources for the key synthetic transformations with significant economic and ecological (green Chemistry) implications. Because of the great need of chiral drugs derived from prochiral precursors increased the interest in using enzymes for such transformations has increased steadily as agrochemical and pharmaceutical industries have grown. Consequently a number of major companies Bristol-Myers Squibb, Merck, Pfizer and Glaxo SmithKline have dedicated research efforts for the exploitation of use of biocatalysts to improve their drug synthesis processes. Our current research findings on Chemistry, processing and structural modification of some of the plant derived lead therapeutic molecules such as artemisinin, its synthone-artemisinic acid (*Artemisia annua*), phenolics-liquiritigenin, isoliquiritigenin and glabridin derivatives (*Glycyrrhiza glabra*) will be discussed in the presentation.

Keywords: Medicinal plants, structural modifications, bio-catalysis, green chemistry

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ABSTRACT 3

Agrobiodiversity conservation for sustainable agriculture development

D.C. Bhandari

ABSTRACT

Agrobiodiversity occupies a unique place within the overall ambit of biodiversity. It relates to the diversity among the agro-ecosystems, agriculture related plants, animals, avian, insects, microbes and the genetically modified organisms. Plant genetic diversity is the key component of agriculture production system. Conserving greater genetic diversity will ensure better chances of fulfilling the unpredictable and dynamic future demands. To ensure sustainable agriculture, it is imperative that priority be given to the conservation of the resources of agrobiodiversity while implementing good agricultural practices and new cropping and livestock systems to intensify agriculture and reduce the increasing pressures on natural ecosystems. Utilization of greater genetic diversity in production systems is strategic for both their sustainable use and conservation. Conservation of traditional crops could succeed when these are linked with the economic development of farmers. Pragmatic multi-disciplinary research and policy support are needed to evolve farming systems which can provide enough quality food and economic security to the local people. *In situ* conservation on-farm and crop improvement can complement each other in marginal production systems. Breeding programs that evaluate farmers' landraces and use them in local improvement efforts are expected to produce material of direct value for marginal agro-climatic zones as well as achieve significant local conservation. By including decentralized breeding as part of an *in situ* program, farmers and scientists can become partners in local crop improvement efforts. This 'grassroot breeding' can build upon existing knowledge and skills of farmers and link farmers from different regions through the exchange of information and genetic resources. New approaches to agricultural research and development are being tried globally, all emphasizing a much better harnessing and management of biological resources than has prevailed in the past. Although many institutions are already actively involved, more coordination is needed at all levels to ensure effective reforms and agricultural biodiversity conservation policies that benefit the public, especially the poor. Policy changes that address the root problems and ensure people rights are needed. Public participation is vital to develop agricultural and resource use policies, develop regulations and incentives to make agrochemical industries socially responsible, develop markets and business opportunities for diverse organic agricultural products and change consumer demands to favor diverse varieties instead of uniform products. Building complementarities between agriculture and biodiversity requires changes in agricultural research and development, and land use.

Keywords: Agrobiodiversity, *In situ* conservation, crop improvement, grassroot breeding

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ABSTRACT 4

Development and breeding of plants as a source of natural ingredients for phytotherapy and phytocosmetics

Nativ Dudai

ABSTRACT

Medicinal and aromatic plants (MAP) breeding for phytotherapy and the cosmetics industry is characterized especially by the relatively great importance of values such as the secondary metabolites content and composition, aroma, flavor, or bioactivity. However, the MAP consumer market commonly rejects GM methods. The conventional breeding process is based on the selection of the best individuals with the most ideal combination of traits to be the parents of the next generations. The main tools to achieve this goal are: diversity and variation in the source germplasm and cross-breeding in order to either instill new traits into an existing variety or to achieve "Hybrid vigor" (Heterosis). To achieve variation, an important task preliminary to the breeding process is creation of a wide germplasm collection. Plant material of the target crop is collected systematically in order to represent its natural diversity. One excellent way to enhance the genetic-variation is artificial crossing of distant genetic sources ("F1") and then either self-pollination of the hybrids ("F2"), or open pollination in the experimental field where all of the genetic types are grown together. In this way we can get new combinations of traits that never could be found in nature. Moreover, in some cases inter-specific crossing can be done, which may combine values desired by the consumer with those-desired by the producer such as resistances or suitability to environmental-conditions in the target cultivation area.

Keywords: Aromatic and medicinal plants, natural products, biodiversity, domestication, breeding, heterosis

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ABSTRACT 5

Biological benefits of peanuts pericarp

M.H. Hetta

ABSTRACT

Background: *Arachis hypogaea* L. (Peanuts) fruit is a legume, belonging to Family Leguminosae. It is a dietary source, containing stilbenoids and flavonoids, with diverse biological activities as antioxidant, anti-inflammatory, anti-Leishmanial, anticancer, antinitric oxide production and antimicrobial. Peanut hulls is produced in thousands of tons annually as by-products without benefit. More studies are needed to clarify the significant value of this natural waste product. The aim of this work is the evaluation of the potential biological activities of peanuts pericarp, *in vitro*, as amoebicidal and antidiabetic. Resveratrol content was also estimated.

Materials and Methods: Two different *in vitro* biological studies were carried out to evaluate the benefit of peanut pericarp, which is considered as a waste product: **a)** Amoebicidal activity was evaluated against two *Acanthamoeba* species isolated from keratitic patients. Different concentrations of ethanol extract of pericarp were evaluated on *Acanthamoebacastellanii* cysts. On the other hand, the ethanol extract and its successive fractions *n*-hexane, dichloromethane, ethyl acetate, methanol of peanut pericarp and resveratrol compound were all tested against *Acanthamoebaastrologyx* T7 genotype and compared to Chlorhexidine reference drug. **b)** Antidiabetic activity was tested by the evaluation of carbohydrate metabolizing enzyme inhibition activity on ethyl acetate and methanol extracts. Estimation of resveratrol content was also performed using chromatographic methods.

Results: **a)** Results showed that ethanol extract was effective against *Acanthamoebacastellanii* cysts and cause growth reduction with different proportions related to the dose and incubation period. For the second *Acanthamoeba* species, a highly significant difference was observed with all examined *A. hypogaea* L. pericarp extract and fractions and the reference Chlorohexidine, except for resveratrol compound where the difference was non-significant. **b)** The ethyl acetate showed higher percentage of inhibition of enzymes: α -amylase, α -glucosidase and β -galactosidase than methanol extract.

Conclusions: These findings could reflect the benefit of using peanuts pericarp, the waste product, as a natural agent anti-*Acanthamoeba* cysts and antidiabetic.

Keywords: Peanuts, by-product, amoebicidal, antidiabetic, *in vitro*

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ABSTRACT 6

Evaluation of phytochemical variations in medicinal plants of Rajasthan

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ABSTRACT

The medicinal plants are useful for healing as well as for curing of human diseases because of the presence of phytochemical constituents. Phytochemicals are naturally occurring in the medicinal plants, leaves, vegetables and roots that have defense mechanism and protect from various diseases. Phytochemicals are primary and secondary compounds. Chlorophyll, proteins and common sugars are included in primary constituents and secondary compounds have terpenoid, alkaloids and phenolic compounds. Terpenoids exhibit various important pharmacological activities, i.e. anti-inflammatory, anti-cancer, anti-malarial, inhibition of cholesterol synthesis, anti-viral, anti-bacterial activities, etc. Alkaloids are used as anaesthetic agents and are found in medicinal plants. The present study was conducted to evaluate economic utility and phytochemical parameters of seven medicinal plants, viz. *Ariseama tortuosum* (Whipcord lilly), *Chlorophytum tuberosum* (Adak musali), *Curculigo orchoides* (Kali musali), *Corbichonia decumbens* (Patar-chatti), *Dipcadi erythraeum* (Piazi), *Drimia indica* (Jungli piazi) and *Withania coagulans* (Paneer-bandth) were selected for present investigation. *A. tortuosum* (Wall.) Schott is a perennial dioecious herb with depressed globose tubers. Roots are considered as anthelmic and tubers in snake bite and detoxification of snake poison. In case of abscess in the neck, dried powder of tuber is applied over the neck. It helps in early healing. The decoction of tuber is given to animals for early recovery of fractured bone and also acts as anti-nematodal. *C. tuberosum* Baker. and *C. orchoides* Gaertn. are perennial herbs with thick tuberous rootstock without aerial stem. *C. tuberosum* holds an important position in Indian herbal medicine and their role in medicinal world dates back to classical Ayurveda references of 10th and 11th centuries where its particular properties such as an aphrodisiac, digestive power, rejuvenator and immunomodulator are well known. In Ayurvedic preparations, roots of *C. orchoides* are considered as aphrodisiac, appetizer, fattening and useful in treatment of piles, biliousness, fatigue, blood related disorders, etc. According to Unani systems of medicine, roots are carminative, tonic, aphrodisiac, anti-pyretic and useful in bronchitis, ophthalmic, indigestion, vomiting, diarrhoea, limbago, gonorrhoea, hydrophobia, joint pains, etc. In Indian medicine, powdered rhizomes with milk are taken as a restorative tonic and also for sexual debility. *C. decumbens* (Forssk.) Exell is a prostrate, glabrous, succulent and annual plant. An infusion of the root is used in biliousness, emetic, tonic, kidney stone problems, etc. *D. erythraeum* Webb. and Berth. is reported as an endemic and threatened plant in India and used as a substitute or adulterant of *Drimia indica*, the bulb of which resembles *Digitalis* in action and is used mainly as an expectorant in the treatment of cough. The bulb is reputed to be edible and leaves are used as a laxative and as an ointment for wounds. *D. indica* (Roxb.) Jessop is a perennial scapigerous herb. The tubers are remedy for skin disorders, worm infestation, diarrhoea, cardiac disorders, inflammation, chronic rhinitis, chronic cough, chronic pulmonary disorders, respiratory disease, cardiotonic, renal failure, male sterility, amenorrhea, dysmenorrhoeal, itching, cancer, etc. *W. coagulans* (Stock) Dunal is perennial and small genus of shrub.

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Fruits are the source of coagulating enzyme which is used for clotting the milk which is called 'paneer' so it is also known as "Doda Paneer". These are also used in dyspepsia, flatulent colic, nervous exhaustion, disability, insomnia, wasting diseases, etc. Green pigments are important sources of protective food which are highly beneficial for the maintenance of good health and prevention of diseases. Results revealed that total leaf pigments in *A. tortuosum*, *C. orchioides*, *C. tuberosum* and *D. indica* were higher during August-September, which may be due to maturity of leaves. In *D. erythraeum*, leaf pigments were higher in flowering, whereas in *C. decumbens* during vegetative stage, may be due to sprouting of new leaves. In *W. coagulans*, total chlorophylls were maximum during winter followed by summer and minimum in rainy season. Proline may also be helpful in maintaining the cell membrane integrity under stress. It acts as a reserve source of carbon, nitrogen and energy during recovery from stress. In *A. tortuosum*, proline was higher during September; whereas osmotic potential (OP) in August. Maximum values of proline and OP in *C. tuberosum* and *C. orchioides* were observed during August. Maximum amount of proline was observed during vegetative stage with maximum OP in *D. erythraeum*. The maximum amount of proline was reported during July in *D. indica*. The values of proline and OP were recorded to be maximum at flowering stage in *C. decumbens*. The higher values of both parameters in the flowering stage can be correlated with its tolerance towards environmental stresses. The OP and proline values were highest during winter in *W. coagulans*. Plant sugars can be used as artificial sweeteners and they can even help diabetics by supporting the body in its rebuilding. Total sugars values were maximum in September when plants are in maturity stage in *A. tortuosum*, *C. orchioides*, *C. tuberosum* and *D. indica*. The maximum values of total sugars were observed during fruiting and vegetative stages in *C. decumbens* and *D. erythraeum*, respectively. Maximum amount of total sugars during vegetative stage may be due to stress condition. The total sugars values were highest during winter in *W. coagulans*. Proteins are the primary components of living things. The presence of higher protein level in the plant points towards their possible increase food value or that a protein base bioactive compound could also be isolated in future. Maximum amount of crude protein was observed during September in *A. tortuosum* whereas during June in *C. tuberosum* and *C. orchioides*. In *D. indica*, it was maximum during July, while during vegetative stage in *C. decumbens* and *D. erythraeum*. In *A. tortuosum* and *D. indica*, the highest phosphorus content were reported during July, whereas in *C. orchioides* and *C. tuberosum* during June. In *C. decumbens*, it was highest during flowering and fruiting whereas in *D. erythraeum* during vegetative stage. The highest values of phosphorus during vegetative stage may be due to high level of available nitrogen in the soil. The maximum values of phosphorus contents were reported during rainy followed by summer and minimum during winter in *W. coagulans*. The biological function of alkaloids and their derivatives are very important and are used in analgesic, anti-spasmodic and anti-bacterial activities.

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The alkaloid values in *D. erythraeum* were maximum during reproductive stages, *i.e.* flowering and fruiting. In *D. indica*, it was maximum during August. Phenolic compounds are high level antioxidants because they have the ability to absorb and neutralize free radicals. Total phenols were maximum in *D. erythraeum* leaves during flowering stage, while during July in *D. indica*.

Keywords: Medicinal plants, phytochemicals, alkaloids, *A. tortuosum*

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ABSTRACT 7

Bioprospecting of medicinal plants

Nutan Kauhsik

ABSTRACT

The secondary metabolites, particularly those obtained from higher plants, have played a key role in economic development by providing medicines, pesticides, building material, dyes, flavoring agents etc. thus emphasizing the role and importance of biological resources. Plants and microbes including endophytic fungi are emerging as an alternative strategy for pest control by providing botanicals, attractants, repellents and biocontrol agents. The importance of biological resources is further reflected in the form of Convention on Biological Diversity (CBD) which emphasizes conservation and sustainable utilization of the genetic resources and fair and equitable sharing of resultant benefits arising out of its use. In view of CBD and environmental issues, bioprospecting of plant species for their various usages has become an important area of research. Our bio-prospecting activity focuses on two aspects. First approach focuses on study of the phytochemical diversity for the active molecule in different populations and second approach focuses on identification active molecules in the plants/ microbial extracts where activity is known but as yet not identified. Endophytic fungi having activity against *Rhizoctonia solani*, *Sclerotinia sclerotiorum*, *Fusarium oxysporum* and *Botrytis* have been identified and are being developed into formulation. The second approach focuses on study of phytochemical diversity of known biomolecules to identify elite plants. Once the elites are identified, they can be micropropagated utilizing tissue culture technique for mass plantations. Several plant species viz. Neem, *Jatropha*, *Withania*, *Tylophora*, *Chrolophytum* etc. have been investigated by our group. Results of these studies will be presented.

Keywords: Secondary metabolites, CBD, bioprospecting, endophytic fungi, micropropagation

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ABSTRACT 8

Formulation, manufacture and commercialization of plant based natural products in phytotherapeutics

B.P. Nagori

ABSTRACT

Phytotherapy is the use of plant-derived medications in the treatment and prevention of disease. Since phytotherapy is a system of medical practice that is based on scientific or medical evidence, its products are pharmacologically active medicines, similar to conventional pharmaceutical drugs. The World Health Organization (WHO) estimates that about 80% of the world populations rely totally on herbal medicine for some aspect of primary health care. Roughly 50,000 species of higher plants (about 1 in 6 of all species) are used for medicinal purposes and between 25 – 40% of pharmaceutical medicines are derived from plants. India is currently the largest producer of medicinal plants with 15,000 – 20,000 species of medicinal plants documented in Traditional Medicine. According to the WHO, the global market of herbal medicines is \$80 billion annually. It is expected to reach \$107 billion by 2017 and \$ 5 trillion by 2050. Current Indian market of herbal medicines is Rs. 550 Crores (\$140 million) annually. India's current share in world market of medicinal plant and products is only 2.5%. India's share in the total global exports of AYUSH products including medicinal herbs and their value added products is growing with a growth rate of about 10%. In developed countries such as United States, plant drugs constitute as much as 25% of the total drugs. In developing countries such as India and China, the contribution is as much as 80%. The major importers of medicinal plants/ products are the European Union, Russia and the USA. The major exporters are China, Japan and Russia. Herbal medicines include herbs, herbal materials, herbal preparations and finished herbal products, which contain as active ingredients, parts of plants, or other plant materials. About 8,000 herbal remedies have been codified in Ayurveda. At least 7,000 medicinal compounds derived from plants are included in the modern pharmacopoeia of drugs. The increased demand of herbal medicines has led to a sudden increase in herbal manufacturing units. Herbal manufacturing units are engaged in making Phytopharmaceuticals; Phytocosmetics; Phytoneutraceuticals. There are total of 9,493 manufacturing units, of which mostly are small scale units (8,000) having an annual turnover of less than one Crore. Some of the well known industrial houses with annual turnover of more than 50 Crores are Dabur, Zandu, Himalaya, Shree Baidyanath, Arya Vaidya Shala etc. and Divya Pharmacy. Commercialization is defined as a process or cycle of introducing a new product into the market. There is a tremendous potential and demand of herbal medicinal products which should be harnessed through improved formulation, manufacturing and commercialization efforts for the economic growth and development of the country. The main problems associated with herbal formulations are of standardization including controlling and evaluating the quality, safety, identity, purity and strength. Climatic variations, cultivation and collection periods, drying process, storage conditions, adulteration, availability of plant resources, presence of heavy metals etc. are the leading causes affecting the commercialization of these formulations.

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These problems can be overcome by using the standard guidelines such as GAP (Good Agricultural Practices), GLP (Good Laboratory Practices), GCP (Good Clinical Practices), GMP (Good Manufacturing Practices) etc. during cultivation of medicinal plants, design and development of herbal products and the manufacturing of these formulations. To ensure and enhance the quality of ASU medicines, the Government of India has notified Good Manufacturing Practices (GMP) under Schedule 'T' of the Drugs and Cosmetics Act 1940.

Keywords: Phytotherapy, herbal medicines, herbal manufacturing units; commercialization; standardization

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ABSTRACT 9

Geraniin-enriched extract, a potential prebiotic for metabolic syndrome

Chung Yin Sir, Sunil Gurtu and Uma D. Palanisamy

ABSTRACT

Background: The elagitannin, geraniin has been verified in a number of plants, many of which are in traditional medicine. This compound has received widespread interest as a research focus due to its numerous beneficial biological and therapeutic ability, as well in understanding its chemical properties, pharmacokinetics and interaction with the body system. It has been demonstrated that geraniin possesses antioxidant, antimicrobial, anticancer, cytoprotective, immune-modulatory and analgesic properties. The objective of this research is to study geraniin's therapeutic potential in ameliorating diet-induced metabolic risks mimicking metabolic syndrome and its *in vivo* antioxidative potential.

Materials and Methods: Geraniin purified from the rind of *Nephelium lappaceum* L was used in his study. Male post-weaning outbred Sprague Dawley rats received a 60% high-fat diet (HFD), with and without the geraniin supplementation from 6th week onwards (10 and 50 mg/kg body weight), while the control group (ND) were fed rat chows for 10 consecutive weeks. At the 10th week, blood samples from fasted rats were analysed for plasma metabolic parameter, glucose homeostasis and its oxidative status. Histopathology of crucial organs were also examined for pathological changes.

Results and Discussion: HFD rats demonstrated elevated body weights, white adipose tissue depots (WAT), organ weights, triacylglycerol, renal and hepatic dysfunction biomarkers, insulin resistance, declined insulin sensitivity and percent of beta-cell function. Changes in redox balance were also demonstrated in these rats; increased protein carbonyl content, decreased levels of superoxide dismutase, glutathione peroxidase and glutathione reductase with a reduction in the non-enzymatic antioxidant mechanisms and total antioxidant capacity, indicating a higher oxidative stress index. HFD rats also demonstrated significant diet-induced changes particularly in the pancreas. A four-week *in vivo* geraniin treatment, particularly at 50 mg/kg body weight, exhibited significant therapeutic potential to safely mitigate obesity-induced metabolic dysfunction. Oxidative stress observed in the HFD rats was also restored with oral geraniin supplementation. Geraniin was not toxic to the HFD rats but rather exhibited protection against glucotoxicity and lipotoxicity particularly in the pancreas of the obese rodents.

Conclusions: This study is the first, to the best of our knowledge, to show that an orally available geraniin at doses achievable *in vivo* can safely ameliorate many negative pathological sequels of metabolic syndrome (MS). Geraniin therefore has the potential to be developed as a functional food, nutraceutical or therapeutic agent targeting the metabolite derangements of lipid and glucose in MS encompassing obesity, dyslipidaemia, type 2 diabetes mellitus (T2DM) and its associative complications.

Keywords: Geraniin, metabolic syndrome, obesity, oxidative stress, type 2 diabetes

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ABSTRACT 10

Need to choose among medicinal plant (MP), its magic bullet phytometabolite (MBP) or even MBP + MP

Dinkar Sahal

ABSTRACT

Medicinal plants have been the backbones of several medical systems from the ancient Ayurveda (3000 BC) to the recent Allopathy (1800 AD). Indeed since the earliest use of a medicinal plant described in the Rig Veda, >70% of the people in today's developing world continue to depend on medicinal plants to remain healthy. On the one hand modern medicine is unaffordable for most people across the globe, and on the other hand there is widespread drug resistance for modern medicine based drugs against almost all diseases including cancer, TB and Malaria. Although plant derived drugs like Quinine and Artemisinin worked like magic bullets when first introduced, their durations of efficacy were short-lived due to the bane of resistance. As a result while the bugs of the first half of the 19th century were drug sensitive, the bugs of the 2nd half of the same century were found to be drug resistant. Today single drug therapy against diseases of all kinds is a No and WHO is the biggest advocate of the use of drug combination therapy in the hope that chances of developing resistance against combinations are much lower than is the case with monotherapy. More importantly, recent meticulously done studies have been demonstrating that (a) Artemisinin at equivalent amounts is more efficacious in curing malaria when given as whole plant (Art^{WP}) vs as monotherapy (Art^{Mono}) using purified Artemisinin, (b) when given orally Artemisinin is far more bioavailable when given as Art^{WP} than is the case with Art^{Mono} and (c) there is delayed resistance in the case of Art^{WP} than is the case with Art^{Mono}. Hence the times we live in pose a dilemma where individually the patient and collectively the whole of mankind is not aware if modern or traditional medicine is better and more suited for the contemporary world. The virtues of modern medicine viz. precision of drug and its dose are generally absent in traditional medicines as practiced now. So there is need to grow medicinal plants of value under optimum conditions organically and free from pesticides and to monitor levels of biomarker molecules in them before using them judiciously for making formulations of authentic compositions and stability. In this context the option of doping the principle magic bullet into plant extracts must also be considered via careful quantitation of phytometabolites in traditional medicines. Thus, today there is a need for imbibing the virtues of modern medicine and incorporating them into standardization of traditional medicines to make drugs affordable and to ward off drug resistance towards a healthy and happy society.

Keywords: Magic bullet, phytometabolite, malaria, medicinal plants

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ABSTRACT 11

Medicinal plant diversity in Aravallis

Satish Kumar Sharma

ABSTRACT

Rajasthan is the largest state of the Indian union, occupying an area of about 34.22 million ha. The state may be divided into many regions like Western arid zone, Semi-arid zone, South-eastern zone, Chambal ravines, Aravalli zone and Eastern zone. The most striking geological feature of Rajasthan is the Aravalli mountain range- the one of the oldest folded mountain ranges in the world. Aravallis intersects Rajasthan state end to end diagonally, covering about 30% area of the state. This mountain chain is extending from Champaner in Gujarat in the south-west to near Delhi in the north –east for a distance of about 692 km. Within Rajasthan, this range runs from Khed Brahma in the south-west to Khetri in the north-east for a length of about 550 km. The Aravalli is rich in medicinal plants. As many as 13 wildlife sanctuaries are confined to Aravallis; 10 in Rajasthan, 2 in Gujarat and 1 in Delhi. As many as three protected areas are confined to confluence of Aravallis and Vindhyas, all are in Rajasthan. Out of these 16 protected areas, 6 are very rich in medicinal plants namely, Jassore Sloth Bear Sanctuary, Balaram Ambaji Sloth Bear Sanctuary, Mount Abu Sanctuary, Phulwari-ki-nal Sanctuary, Sitamata Sanctuary and Kumbhalgarh Sanctuary. First two sanctuaries are present in Gujarat state. It is very interesting to note that all these six sanctuaries are confined to southern Aravallis. There are certain features which make southern Aravallis rich in the medicinal and other type of plants. High rainfall, presence of soil layer of varying depth on slopes, presence of perennial or semi-perennial streams and water courses, inaccessibility in many pockets owing to towering height, deep valleys and parallel running mountain chains, presence of 'nals' etc. are certain factors which makes ecological conditions of this zone congenial to variety of medicinal plants. Presence of 'nals' is very interesting feature of Aravallis, specially of southern Aravalli hills, where they are called *nals* in local dialect. *nals* are present between two parallel mountain chains or in a deep fold, present in a hill itself. Essentially a *nallah* or stream or a river is always present in a *nal*. Stream of the *nal* may be perennial, seasonal or ephemeral. Moisture regime in a *nal* remains higher than adjacent areas. If many parallel *nals* are there, moisture regime becomes better in such landscape. Deposition of eroded soil is seen in the valleys which makes them fertile. A rich growth of plants is seen in fertile valleys. *Nals* and inner slopes are especially rich in medicinal plants. Aravallian forests and other habitats support many plants species of medicinal value. Some worth recording species are *Miliusa tomentosa*, *Cissampelos pariera*, *Cocculus hirsutus*, *C. pendulus*, *Tinospora cordifolia*, *Creteva nurvala*, *Caesaria elliptica*, *Sida acuta*, *S. cordata*, *Bombax ceiba*, *Helicteres isora*, *Sterculia urens*, *Corchorus depressus*, *Tribulus terrestris*, *Aegle marmelos*, *Balanites aegyptiaca*, *Boswellia serrata*, *Commiphora wightii*, *Azadirachta indica*, *Moringa concanensis*, *M. oleifera*, *Abrus precatorius*, *Butea monosperma*, *Desmodium gangeticum*, *Mucuna pruriens*, *Pongamia pinnata*, *Pterocarpus marsupium*, *Cassia fistula*, *Tamarindus indica*, *Acacia catechu*, *Terminalia arjuna*, *T. bellerica*, *Syzygium cumini*, *Diplocyclos*

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palmaris, Centella asiatica, Gardenia turgida, Eclipta alba, Plumbago zeylanica, Madhuca indica, Nyctanthes arbor-tristis, Carissa spinarum, Leptodermis reticulata, Sarcostemma viminalis, Hemidesmus indicus, Enicostemma hyssopifolium, Ehretia laevis, Evolvulus alsinoides, Solanum nigrum, Withania somnifera, Oroxylinum indicum, Martynia annua, Adhatoda zeylanica, Barleria cristata, Ocimum canum, Boerhavia diffusa, Achyranthes aspera, Aristolochia bracteolata, A. indica, Peperomia pellucida, Euphorbia fusiformis, Eulophia ochreatea, Costus speciosus, Curcuma amada, C. angustifolia, C. aromatic, C. inodora, C. pseudomontana, Enset superbum, Curculigo orchinoides, Dioscorea bulbifera, D. hispida, D. pentaphylla, Aloe vera, Asparagus asiaticus, A. royleanus, A. racemosus, Chlorophytum laxum, C. borivilianum, C. breviscapum, C. orchidastrium, C. tuberosum, Pandanus fascicularis, etc. To protect medicinal plants of the state a Conservation Assessment and Management Prioritization (CAMP) workshop on medicinal plants of Rajasthan was held during 2007 and 38 species were red listed. Of these 6 have been assessed as critically endangered (CR), 12 species as endangered (EN), 19 species as vulnerable (VU) while 1 species has near threatened status. Out of 38 species, 30 species are confined to Aravallis. To protect threatened and non-threatened medicinal plants a series of Medicinal Plant Conservation Areas (MPCAs), Medicinal Plant Development Areas (MPDAs) and Herbal Gardens are being created in different corners of Aravallis. State Medicinal Plant Board and State Biodiversity Board are playing very positive role in protection of medicinal plant wealth of Rajasthan.

Keywords: Medicinal plants, Aravallis, conservation, diversity, endangered species

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ABSTRACT 12

Biology and biotechnology of medicinal plants of fragile ecosystem – the Thar desert

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ABSTRACT

We are inhabitants of domesticated and humanized planet. Human activities have been altering climate; actions are dominant driver for planetary changes. Hence the present geologic epoch is called 'Anthropocene'. More than 50% of the Earth's land has been "colonized" for human uses. The characteristics of the Anthropocene are; population, profit making, preparing for war, pollution and poverty. Habitat fragmentation and loss of ecosystem services are rampant. This impact is exhibited in drylands too which cover around 41 percent of the land surface where 30 percent of the world's populations live. Productivity in dryland regions face a multitude of challenges, i.e. persistent water scarcity, frequent droughts, extremes of climatic- and edaphic-conditions, various forms of land degradation/habitat fragmentation leading to desertification, and loss of biodiversity. Our planet is fighting for life. The Indian Thar desert being no exception and is ecologically constrained and fragile system. During the last 50 years we have seen decline/loss of many plant species. Many of these are sources of pharmaceuticals/nutraceuticals and harbour potentially useful genes/genomes. Some of the species are rare, threatened and endemic. There is need for care, conservation and natural/assisted propagation/reproduction of many plant species of the desert ecosystem. We have studied biology and conservation of some of these plant systems. We made efforts to apply tools of biotechnology for characterization and propagation of desert plants. These plant species are sources of natural products used in cosmetics, therapeutics and nutraceuticals. Our research focused on *Aloe vera*, *Acacia* species, *Anogeissus* species, *Arnebiahispidissima*, *Asparagus racemosus*, *Balanites aegyptiaca*, *Blepharis* species, *Blyttia spiralis*, *Capparis* species, *Cadaba fructicosa*, *Ceropegia* species, *Caralluma edulis*, *Calligonum polygonoides*, *Celastrus paniculatus*, *Commiphora wightii*, *Cucumis* and *Citrullus* species, *Dipcadi erythraeum*, *Ephedrafoliata*, *Glossonemavarians*, *Leptadenia* species, *Lycium barbarum*, *Maerua oblongifolia*, *Momordica dioica*, *Morinda* species, *Maytenusemarginata*, *Prosopis cineraria*, *Salvadora* species, *Sarcostemma acidum*, *Tecomella undulata*, *Terminalia* species, *Tribulus* species, *Withania* species and *Ziziphus* species. We have been able to define tissue culture and micropropagation methods for conservation and assisted propagation. In some system there is need for further research. Aeroponic approaches of induced rooting have been very successful for some species. The results will be presented and discussed.

Keywords: Thar Desert, Biotechnology, medicinal plants, nutraceutical, cosmetics

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ABSTRACT 13

Nagoya protocol CBD, facilitating collaborative development of plant based phytocosmetics, phytotherapeutics and phytonutraceuticals

Anurudh K. Singh

ABSTRACT

Ever since mankind started looking for biological resources and practicing agriculture to ensure availability of food. He also identified biological resources, particularly plants to ensure wellness and health. These have often been part of traditional systems of medicine, which were mostly confined to presently developing tropical and subtropical regions of the old world. For a long time, biological/genetic resources were considered as part of the heritage of humankind and were available without restriction for scientific research and commercial use. Many were exploited by the technologically-rich countries earning major commercial benefits under the auspices of intellectual property rights (IPR) in near past. The realization in old world for not getting due benefits on their traditional knowledge and resources, led to global discontentment. Discussion on this issue, led to development of Convention on Biological Diversity (CBD) in 1992 that came into effect on December 1993 to support, a) conservation of biological diversity, b) sustainable use of it and its components, and c) fair and equitable benefit sharing arising out of its utilization. Based on CBD provisions, nations became the owners of biological diversity found in their territory, controlling access, ensuring community rights, IPR and equitable benefit sharing arising from commercialization by others. As this was the major concern in agriculture, particularly on use of genetic resources in varietal development, it led to development of International Treaty on Plant Genetic Resources for Food and Agriculture under FAO in 2001, to regulate access and benefit sharing. This took care of 64 food and agricultural crops responsible for 80% of food demand, leaving behind other biological resources used for diverse purposes. The Nagoya Protocol, an Access and Benefit System (ABS) is developed as supplementary agreement of CBD, applying to all biological/genetic resources covered under the CBD, and to the benefits arising from their utilization. It was adopted on 29 October 2010 in Nagoya, Japan and effect from 12th October 2014 with 93 parties, including India. The Nagoya Protocol also covers traditional knowledge (TK) associated with biological/genetic resources that are covered by the CBD and the benefits arising from utilization. It takes measures ensuring that biological resources, including plants utilized within their jurisdiction have been accessed in accordance with prior informed consent (PIC), and on mutually agreed terms, as required by Contracting Parties (CPs) for provisions of access and benefit-sharing compliance. CPs need to work on establishing national focal points (NFPs) and competent national authorities (CNAs) to serve as contact points for providing information, grant access and co-operate on Issues of compliance on use of biological/genetic resources, including plants. In case of India these

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powers were vested with National Biodiversity Authority (NBA), Chennai established as per Biological Diversity Act (BDA) of 2002. Nagoya Protocol needs to be exploited for providing facilitated access to global biological/genetic resources including plant material and develop international collaboration between the biodiversity-rich old-world countries, which are sites of old civilizations and domestication of many plants with associated knowledge, and technology-rich countries of the new world. Such collaborations would lead to validation of existing traditional knowledge associated with economically important plant resources, further research, and development of products with information desired for their protection under the present global/national IPR laws. Bilateral/multi-lateral agreements under Nagoya Protocol would ensure facilitated access to biological/plant/genetic resources, development of innovative products, and benefit sharing between collaborating nations to promote global human wellness and health.

Keywords: Nagoya protocol, biodiversity conservation, genetic resources, IPR, CBD

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ABSTRACT 14

Development of phytomedicine from Ayurvedic medicinal plants

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ABSTRACT

A critical analysis of Ayurvedic materia medica documented in Ayurvedic classics like Charakasamhita and Sushrutasamhita clearly indicates that herbal formulations (single & compound) have been utilized for the prevention and cure of illnesses. World health organization(WHO) has estimated that atleast 80% of all the global inhabitants rely on traditional system of medicine for their primary health needs which are largely plant based. WHO has listed over 21000 plant species are used around the world for medicinal purposes. One of the reported projects by National Medicinal Plant Board (NMPB) reported that the annual demand of botanical raw drugs in the country is 319500 metric tons (MTs). It also quoted that the volume of more than 100 MT of each species contribute from 178 medicinal plants. Out of 178 herbs which are in high demand, 21 species have been categorized as rare, endangered and threatened. In recent years, by adopting interdisciplinary research certain medicinal plants are reported with significant activity in the management of infectious diseases like malaria, filariasis and life style diseases like , Diabetes, Cancer, Obesity, Arthritis, Lung and Liver diseases. Central council for Research in Ayurvedic sciences (CCRAS) has developed Ayush -64, a phytomedicine for the management of Malaria including *P. falciparum* infestations. Piperine, isolates from oleoresin of fruits of *Piper longum* (pippali) is found to enhance the bioavailability of structurally and therapeutically diverse drugs(Bio enhancer).Accumulating evidence suggests that Curcumin (from *Curcuma longa*) has a diverse range of molecular targets. Under the programme of New millennium Indian Technology Leadership Initiative (NMITLI), a programme of CSIR, the drug Aswagandha (*Withania somnifera*) is considered as gold mine of a wide spectrum of steroidal lactone called withanolides. A large variety of withanolides found to have significant immune modulator activity and reported to have anticancer activity. Baba Atomic Research centre (BARC) reported that Triphala(*Terminalia chebula*, *Terminalia bellirica*, *Embllica officinalis*) are having significant antioxidant and anticancer properties. Indian Council of Medical Research (ICMR) published 12 volumes on quality standards of Indian medicinal plants. In one of the medicinal plant monographs on liver diseases, certain medicinal plants like *Andrographis paniculata*, *Tinospora cordifolia*, *Cichorium intybus*, *Glycyrrhiza glabra*, *Picrorrhiza kurroa* are reported to have significant hepatoprotective activity. Guggulusterone from oleoresin of *Commiphora mukul* is scientifically validated for its hypercholesterolemic and anti-inflammatory activity. In a nutshell, the research on Ayurvedic medicinal plants engendered the most potential and dependable phytomedicines for life style disorders and infectious diseases.

Keywords: : Phytomedicine, Ayurvedic materia medica

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Section B

This section contains Abstracts of “Oral Presentations” made during IPPC - India 2018.



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ABSTRACT 1

Pharmacognostic studies and antioxidant potential of the leaves of *Plumeria rubra* L.

Pradnya Anasane and Alka Chaturvedi

ABSTRACT

Background: *Plumeria rubra* L. is very common perennial garden tree used for the treatment of skin eruptions, abscesses, dysentery, herpes, syphilis, coughs and as a purgative. The aim of this study is to use leaves of this plant as safe herbal medicine by standardizing the plant material (leaves) with the Pharmacognostic studies as per guideline of the in Indian Pharmacopoeia. Also the anti-oxidant potential was determined on the basis of their scavenging of the stable DPPH free radical.

Materials and Methods: The powdered leaves suspended in some solvents to assess the fluorescence in the visible and UV light (254nm and 365nm). Initial and after drying weight of material was compared to calculate % moisture content and incinerated at a temperature $600 \pm 15^\circ\text{C}$, obtain % Total Ash, Acid Insoluble Ash and Water Soluble Ash. Maceration was done to determine the % extractable content in organic solvents. The total free radical scavenging activity of the extracts was evaluated (% inhibition).

Results and Discussion: Fluorescence observed in Shorter (254 nm) and Longer (365nm) UV range of light in different solvents, viz, NaOH in Distilled Water, NaOH in Alcohol, HCl (10%), conc. HCl, H_2SO_4 (10%), conc. H_2SO_4 , HNO_3 (10%), conc. HNO_3 , Acetone and Distilled water which showed visibly different colour patterns in it with suspended powder. 4.13 % Moisture content was estimated in leaves of *Plumeria rubra* L. Total Ash Content, Acid Insoluble Ash and Water Soluble Ash were found to be $10.93 \pm 0.375\%$, $1.36 \pm 0.101\%$ and $4.3 \pm 1.735\%$ respectively. Extractable Matter was observed 3.6% in Petroleum Ether, 2.8% in Chloroform, 5.4% in Acetone, 10% in Alcohol, 4.2% in Hexane, 17% in Water and 11.4% in Methanol. % Scavenging activity of extract was found to be $6.729 \pm 0.260\%$ in 100 $\mu\text{g/ml}$, 13.484 % in 200 $\mu\text{g/ml}$ and $29.592 \pm 2.996\%$ in 300 $\mu\text{g/ml}$.

Conclusions: Proximate analysis gives the confirmation of its identity and determination of its quality and purity and detection of nature of adulteration to make it qualitatively safe, functional for the further use and also give information regarding the authenticity of crude drug. Antioxidants play an important role in inhibiting and scavenging radicals, thus providing protection against infections and degenerative diseases.

Keywords: Perennial, latex, pharmacognostic studies, proximate analysis, DPPH

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ABSTRACT 2

Biotechnological approaches to *Pueraria* species for isoflavonoids biosynthesis

Jaya Arora

ABSTRACT

Medicinal and aromatic plants play an important role in the health care of people around the world, especially in developing countries. The Indian system of medicine is as old as Indian civilization and written records are available dating 3000 years. About 80% of the population of most developing countries still use traditional medicine derived from plants for their routine illness. China, Cuba, India, SriLanka, Thailand and a few other countries have endorsed the official use of traditional systems of medicine in their healthcare programmes. *Pueraria* is one of the important medicinal plants used in traditional system of medicine and known for its various pharmacological activities including anticancer, antidiabetic, hypolipemic effect, estrogenic activity, hepatoprotective activity, menopausal effect, neuroprotective effect, and osteoporosis minimizing effect. The various activities of the plant are due to the presence of several isoflavonoids. *Pueraria candollei* var. *candollei*, *P. candollei* var. *mirifica*, *P. candollei*, *P. lobata*, *P. phaseoloides* and *P. tuberosa* are the major species of *Pueraria* found all over the world. Biotechnological efforts made to produce isoflavonoids from various species of *Pueraria* are discussed in light of our own work. This line of approach has progressed through optimization (manipulation of medium salts, precursors and plant growth regulators, designing of production medium) in cell cultures grown in shake flasks and bioreactor, selection of cell lines for high yields, cell mutations, biotransformation, manipulations of biosynthetic pathways, organized cultures, and lastly genetic engineering. In the present review, a comprehensive account of various pharmacological activities of *Pueraria* spp. and biotechnological approaches for the production of puerarin and other isoflavonoids of interest with special reference to *P. tuberosa* is presented.

Keywords: Aromatic plants, *Pueraria candollei*, bioreactor

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ABSTRACT 3

Conservation of *Rhanterium eppaposum* Oliv. native medicinal plant of Kuwait

N. Habibi, F. Al-Salameen, V. Kumar, S. Amad, L. Talebi and B. Doaij

ABSTRACT

Background: *Rhanterium eppaposum* Oliv. (Arfaj) the national plant of Kuwait, has been reported to consist of essential oils bearing medicinal properties. It is a perennial bushy shrub with the only species found in the region. The local people, uproot the plant to treat gastrointestinal disorders and skin infections. Further, activities such as overgrazing, off-road driving, desert camping and Iraqi invasion have depleted the plant populations at a great extent. Conservation of Arfaj is therefore, important for its sustainable use. Molecular markers such as ISSR, are known to aid in conservation management.

Materials and Methods: We employed the technique of ISSR markers to assess the existing genetic diversity within the populations present in Kuwait. Samples were collected from six different locations. DNA were isolated (GenElute™ kit, Sigma, St. Louis, MO) and amplified with 17 ISSR primers. PCR products were analyzed by the Bionumerics v7.5 software (Applied Maths, Belgium), to obtain the binary file. Genetic diversity within each population was estimated through Nei's gene diversity (h'), by using the GenAlix 6.5 software. Pairwise genetic distance (D_s) between each population was used to construct a dendrogram following the Unweighted Pair Group Method (UPGMA) by the POPGene v 1.32 software.

Results and Discussion: ISSR markers have been reported to study the genetic diversity of many medicinal and aromatic plants. The values of PIC, h' and D_s are indicative of the existing genetic variability. Effective strategies for conservation can be devised based on these findings. Our results indicated high values of h' (0.286) as compared to other plants with narrow distribution in following order Al Kabd > SANR > Al Salmi > Mina Abdullah > Om Qaser > Al Maqwa. Pairwise genetic distances (D_s) based on Nei's analysis were closest between Kabd and SANR (0.061) to farthest between Mina Abdullah and Al Maqwa (0.158) among the different populations in the present study. Cluster analysis of *R. eppaposum* populations of Kuwait revealed three distinct groups. First group consisted of Kabd, Salmi and SANR areas, the second group had the populations of Om Qaser and Maqwa with the third group consisting of a single population of Mina Abdulla.

Conclusions: *R. eppaposum* although declining from the Kuwaiti deserts, maintains its variability through cross pollination. However, areas of Maqwa exhibit low diversity, therefore plants from high diversity area such as Kabd should be mixed with populations from Maqwa, *in situ* or *ex situ* to introduce more variability.

Keywords: ISSR, medicinal plant, genetic diversity, conservation

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ABSTRACT 4

Some natural extracts from plants as low-cost alternatives for synthetic PGRs in rose micropropagation

Urmi Chauhan, Anil Kumar Singh and Preetam Joshi

ABSTRACT

Background: Above and beyond the persuasive expediency of tissue culture technology over conventional methods of propagation of rose, the exorbitant production cost per plant has restricted the tissue culture industries to choose rose as their exigent product. Besides the two petty components of the medium (agar and sucrose) the synthetic PGRs and other organic supplements also significantly contribute to the cost of tissue culture (7.78% and 4.12% of total medium cost). In the current study we tested some natural extract from plants as low cost alternatives for synthetic PGRs in rose micropropagation.

Materials and Methods: Shoot cultures of *Rosa hybrida* L. cv. bush rose were established using nodal explant. We tested a range of natural plant extracts viz. orange juice, coconut water, tomato fruit extract, sweet corn extract and sweet lime juice, in varied concentration (3-15%) to study its regulatory effects on growth of micropropagules. Plant extracts were incorporated in the medium before autoclaving (PrA). Alternatively, filter-sterilized extracts were added after autoclaving it (PoA). Growth parameters viz. shoot length number and total biomass as well as metabolites such as total chlorophyll, carbohydrates, protein, phenols and proline and stress enzymes (peroxidase and IAA-oxidase) were measured after one month of growth.

Results and Discussion: Significant increase in shoot multiplication, shoot length, fresh weight and dry weight was observed when coconut water (@10% v/v) was added in the medium. Tomato fruit extract did not show any noteworthy effect on growth in rose micropropagules. Total chlorophyll and other metabolites recorded significant changes corresponding to type and concentration of the plant extracts. Maximum accumulation of metabolites was recorded with coconut water (@10% v/v) followed by sweet corn extract and orange juice. Although tomato fruit extract (@10% v/v) enhanced the total chlorophyll but reduced the amount of other metabolites. Similarly, no changes in the activity of peroxidase and IAA-oxidase enzymes were recorded.

Conclusions: Use of natural plant extracts in place of PGRs conventionally used in propagation of rose can prove cost effective even if the rate of shoot multiplication is compromised. Coconut water in the present case proved to be highly beneficial.

Keywords: Rose micropropagation, synthetic PGRs, natural plant extract, growth parameter, low-cost alternatives

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ABSTRACT 5

Optimization and characterization of surface modified dendrimers for tumor targeting

Hemant Khambete, C. P. Jain, N.P. Jain, Sanjay Jain and Manish Kumar

ABSTRACT

Background: The present work was an attempt to develop a formulation which will deliver the drug directly to the target site (tumour cells) and reduce side effects of the drug. The current therapies used for cancer treatment have severe side effects due to lack of targeting to tumour cells. In the present work surface modified dendrimer were synthesized using polyethylene glycols, pH dependent polyphenols and targeting moiety (folic acid) for better targeting of paclitaxel to cancer cells.

Materials and Methods: The different batches of PAMAM dendrimers from -0.5 to 4.0 generation were synthesized by using divergent growth method. Three process variables studied were solvent system, reaction temperature and reaction time. The different generations of dendrimer were evaluated for their physical characteristics, boiling point and intrinsic viscosity. The Dendrimers were further characterized by UV, IR, ¹H NMR and mass spectroscopy. The surface modification was done by conjugation with polyethylene glycol (PEG) and different polyphenols like 2,4-dihydroxy benzoic acid (BA), ferulic acid (FA) and gallic acid (GA). The surface modification was confirmed by copper sulphate test, UV, IR, ¹H NMR and mass spectroscopy. The targeting ligand folate was attached as folic acid (FA) to surface modified dendrimer. The conjugate structure was checked and confirmed by FTIR and ¹H NMR spectroscopy.

Results and Discussion: The prepared formulations were subjected to different *in-vitro* characterizations like drug entrapment efficiency, % yield, release rate studies and hemolytic toxicity. The cytotoxicity assay of 4.0 generation PAMAM and different surface modified dendrimer was performed using cell line study. The optimized formulation (4.0 generation PAMAM dendrimer –folic acid- PEG conjugate) showed least IC₅₀ Value and 98.62% inhibition was observed at 45 µg/ml. From tumour uptake and apoptosis studies it was observed that optimized formulation not only have higher tumour uptake but it also shows better tumour cell apoptosis as compared to marketed Paclitaxel formulation (Intaxel).

Conclusions : Finally, it can be concluded that the optimized formulation (4.0 generation PAMAM dendrimer –folic acid- PEG conjugate) is more efficient than marketed Paclitaxel formulation (Intaxel) and hence can be used as alternative dosage form having more targeting to tumour cells with less side effects.

Keywords: Dendrimer, targeting, tumor, polyethylene glycol, surface modification.

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ABSTRACT 6

The power of phytocosmetics: A review

S. Panchawat

ABSTRACT

The concept of beauty and cosmetics is as ancient as mankind and civilization. Indian herbs and its significance are popular worldwide. Our country popularly known as the “Botanical garden of the world”, happen to produce the maximum variety of herbs which have the power to heal the mind, body and soul. The word cosmetic was derived from the Greek word “Kosm tikos” meaning having the power, arrange, skill in decorating. The science of Ayurveda had utilized many herbs and floras to make cosmetics for beautification and protection from external effects. The cosmetics are the utility products used extensively throughout the world for maintaining and improving general appearance of face and other parts of body. It includes creams, powders, face pack, lotions, moisturizers, shampoo, hair oil, conditioners etc. Cosmetics alone are not sufficient to take care of skin and body parts; it requires association of active ingredients to check the damage to skin. Herbal cosmetics or phytocosmetics are formulated using different cosmetic ingredients to form the base in which one or more herbal ingredients are used to cure various skin ailments. Herbal formulations always have attracted attention because of their good activity and comparatively mild, biodegradable and have low toxicity profile. Apart from traditionally documented applications, some modern trials have also established the utility of Indian herbs in Personal Care Products. There has been a recent advancement, is ‘Phytosomes’ as a novel cosmoceutical carrier, which enhances the absorption of the herbal constituent thereby increasing bioavailability. It is interesting to mention that besides the advances in many fields of science and technology, natural products are still crucial for any field of economy. Taking all advantages of all technological advances the phytocosmetic sciences are improving enormously with the advantage of having a quicker path of development if compared to that of drug development, even considering the rigor need to launch safe and effective products. New and advanced Phytocosmetics based on the perfect synergy between nature and technology. In many ways, Phytocosmetics are a far better choice than synthetic cosmetics for beauty and personal care.

Keywords: Phytocosmetics, phytosomes, biodegradable, cosmoceutical

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ABSTRACT 7

Anti-obesity activity of *Syzygium cumini* (Linn.) seed and *Terminalia chebula* (Retz.) fruit extract on monosodium glutamate and high fat diet induced obese mice

Ashok Pattnaik, Toffa Dasmohapatra, Shakti Pattanayak and Shivani Sharma

ABSTRACT

Background: Obesity is considered as a multi-factorial disease invading worldwide at an alarming rate in both developing as well as developed countries making it a major health challenge. Presently, very few treatment options are available in the market and popular ones are orlistat and sibutramine that also are not devoid of side effects. In this regard, many researchers have explored several plants for their anti-obesity potential.

Materials and Methods: The present investigation was carried out to evaluate the anti-obesity potential of butanolic extract of seed of *Syzygium cumini* (Linn.) (BESC) and hydroalcoholic extract of fruit of *Terminalia chebula* (Retz.) (HETC). In this experiment obesity was induced in Swiss albino mice by parental administration of MSG and feeding HFD. Animal model was developed and evaluated for various body as well as biochemical parameters.

Results and Discussion: Anti-obesity activity of BESC and HETC were evaluated and it was found that both the extracts showed significant reduction in body weight gain, food intake, waist circumference, periepididymal fat, glucose, and other biochemical parameters. Following treatment, result showed that lipid levels of orlistat, BESC and HETC treated groups significantly suppressed the elevated lipid levels. Correction in the lipid profile is may be due to decrease in food intake. The slight reduction in serum enzymes may be contributed to the prevention of liver damage by the antioxidant properties of the extracts. Among histopathological examination of all the sections of liver, BESC treated group indicated better protective effect against obesity and dyslipidemia associated liver toxicity and histopathological examination of adipose tissue showed that orlistat and BESC have similar effects and both have reduced the adipocytes hypertrophy significantly. Among these two plants *S. cumini* (Linn.) have shown more promising effects compared to *T. chebula* (Retz.). Histopathological examination revealed that BESC and HETC significantly reduced the fatty infiltration in liver and exhibited beneficial effects in reducing adipocytes hypertrophy.

Conclusions: These results suggest that BESC and HETC is possibly effective against weight gain, fat accumulation, maintaining blood glucose, and correcting lipid levels.

Keywords: Obesity, *Terminalia chebula*, *Syzygium cumini*, orlistat, dyslipidemia, adipocytes hypertrophy

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ABSTRACT 8

Chemistry and Biology of pharmacologically active herbs: *Erythrina velutina* and *Erythrina mulungu*

Joohee Pradhan

ABSTRACT

There are many known species of *Erythrina* (Fabaceae) in the tropics and subtropics including the species *Erythrina mulungu*, a medium-sized well-branched tree native to Southern Brazil and *Erythrina velutina*, a plant endemic to the semi-arid regions in Northeastern Brazil. These and other species are used in some Brazilian communities to treat insomnia and other disorders of the central nervous system. Central effects such as anticonvulsant, anxiolytic and analgesic effects have been demonstrated in several species belonging to the *Erythrina* genus, including *Erythrina mulungu* and *Erythrina velutina*. The studies with hydroalcoholic extracts from the stem bark of *Erythrina velutina* and *Erythrina mulungu* showed central nervous system depressant activity through the potentiation of pentobarbital induced sleeping time and through the anticonvulsant action in strychnine-induced seizure model. The chemical fractionation of the stem bark from *Erythrina velutina* gave homohesperetin and phaseollidin. The phytochemical analysis of the hydroalcoholic extracts from *Erythrina velutina* has allowed so far, the characterization of 5,7,3-trihydroxy- 5-prenyl-6-methoxyisoflavanone, phaseolin, a 1:1 mixture of beta sitosterol and stigmasterol, erythrodiol and lupeol, besides phaseollidin demonstrated the presence of several constituents such as erysotrine, erythartine, hypaphorine, and two novel alkaloids, erysotrine-N-oxide and erythartine-N-oxide in the flowers from *Erythrina mulungu*.

Keywords: *Erythrina mulungu*, *Erythrina velutina*, pharmacological activity, chemical constituents.

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ABSTRACT 9

Adjustment in primary and secondary metabolic pathways of *Withania somnifera* under drought

Ruchi Singh, Pankhuri Gupta and Sunita Singh Dhawan

ABSTRACT

Background: *W. somnifera* plant produces an important constituent which is used in a large number of medicinal formulations including anti-inflammatory, anti-aging, anti-cancer, immunomodulatory, immunoprophylactic, rejuvenating and aphrodisiac. Several studies have shown that withanolide content can vary widely among different chemotypes. It has been demonstrated that plant growth, physiological behaviour and production of withanolides are influenced by environmental factors like, elicitation, seaweeds treatment, methyl jasmonate treatment. The effect of water stress imposed for short duration on withanolides content is reported and reveals that withanolide content of the plant is affected by short duration water stress.

Materials and Methods: In the present study, experimental data related to drought tolerance phenomenon have been collected and a putative mechanistic concept considering growth responses, physiological behaviour, and metabolite content and gene expression aspects are presented. Low water availability imposes drought induced metabolic and physiological responses as well as the uptake of CO₂ were monitored regularly during the drought treatment. Primary metabolites were estimated by using gas chromatography mass spectrometry (GCMS) system comprised an AS 3000 autosampler, a Trace gas chromatograph Ultra, and a DSQII quadrupole mass spectrometer (Thermo Electron Corporation, Germany).

Results and Discussion: Medicinal plants grown under water limiting conditions showed much higher concentrations of secondary metabolites in comparison to control plants. As a result, the consumption of reduction equivalents (NADPH²⁺) for CO₂ assimilation via the calvin cycle declines significantly results in the generation of a large oxidative stress and an oversupply of antioxidants enzymes. It results in the shifting of metabolic processes towards biosynthetic activities that consume reduction equivalents. Thus, biosynthesis of reduced compounds (isoprenoids, phenols and alkaloids) is enhanced. Genes encoding enzymes of pathways leading to glucose, fructose and fructan production, conversion of triose phosphates to hexoses and hexose phosphorylation were up-regulated in the drought stressed leaves. The down-regulated Calvin cycle genes were co-ordinately regulated with the down-regulation of chloroplast triosephosphate/ phosphate translocator, cytoplasmic fructose-1,6-bisphosphate aldolase and fructose bisphosphatase. Up regulated expression SQS gene showed partitioning of carbon flux towards phytosterol biosynthesis pathway from isoprenoid pathway which leads to formation of enhanced plant sterols, cytokinin and withanolide under drought stress condition. Qualitative and quantitative analyses withanolides was achieved by CYBERLAB model LC 100 system HPLC-UV comprising LC-100 dual pump system, LC100 UV detector system.

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Conclusions: This study showed that carbon flux diverted towards secondary metabolism to consume more NADP^{2+} . Down regulation of genes involved in carbon and withanolide pathway in root tissue confirmed synthesis of primary and secondary metabolite occurs only in leaf tissue under drought condition. Upregulation of TPT gene in root showed that withanolides are transported to the roots and stored in it.

Keywords: Withanolide biosynthesis, carbon metabolism, drought, GCMS, HPLC

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ABSTRACT 10

Fabrication and preliminary screening of microwave irradiated Crg-GG IPN: as scaffold

Sabyasachi Swain, Ashok Kumar Pattnaik and Trishna Bal

ABSTRACT

Background: Biomedical applications like Scaffold, adhesion barriers, soft tissue replacement etc. are dependent on the physico-mechanical properties of the biomaterials like it should contain both hydrophilic and hydrophobic property. It should be capable for cell adhesion, cell proliferation. The present paper explores fabrication and preliminary screening of an Crg-GG Interpenetrating polymer network film by looking at the increasing demand of natural phytochemically originated scaffold. These two natural polymers are advantageous because of the predominance of hydrophilic groups present on the external helical which is supported by various researchers and naturally occurring biomacromolecules for synthesis of scaffold are also in recent trend because of biocompatibility and biodegradability in comparison to the synthetic polymers.

Materials and Methods: The contact angles of films were performed by using a contact angle meter. The AFM analysis (NT-MDT Solver Pro 47) was done to check the surface morphology. The swollen samples were first freeze dried at -50°C and the interior morphology was observed by SEM method. Muco-adhesion testing of the sample film was carried out using a texture analyzer (TA.XT plus) with 50 N load.

Results and Discussion: The contact angle was measured by OCA instrument using data physics software and surface free energy by OWRK/Fowkes method. The OCA confirms the adhesive property of the material. The surface morphology was observed by using AFM. The AFM analyses reveal the surface roughness of the blended films, favoring cell attachment and cell proliferation. Internal architecture of the swollen freeze dried IPN was studied using SEM. From the SEM image it was confirmed that a Honey comb like networked structure obtained from swollen sample provide the three dimensional frame for the cell growth, which was confirmed by SEM. The dragging force of 0.209N confirmed the mucoadhesive property of material.

Conclusions: The contact angle data and the dragging force confirmed the mucoadhesive property of the material. Roughness of IPN shows favoring cell attachment and cell proliferation. Honey comb like networked structure obtained from swollen sample provide the three dimensional frame for the cell growth. From the above study it was concluded that an Interpenetrating polymer network of natural phytochemically originated Crg-GG can be applied as scaffold.

Keywords: Phytochemical polymers, scaffold, muco-adhesion, cell proliferation

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Section C

Abstracts contained in this section of IPPC-India 2018 are being published to fulfill an obligation towards Indian Society of Chemists and Biologists, Local Chapter, Udaipur which was a collaborating organization with ISPS for this congress besides the Department of Pharmaceutical Science, Mohanlal Sukhadia University, Udaipur, Rajasthan, India



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ABSTRACT 1

Importance of exploring desert algae for bioremediation of heavy metals

S. Sundaramoorthy, Harish, Renu and Deepti Sharma

ABSTRACT

Most of the desert algae are unexplored for their bioremediation potentials and the explored ones have shown higher tolerance to the heavy metals. Blatter and Hallberg have reported a few species of *Chara* among the 'masses of algae' from a water reservoir near Jodhpur. Ratnam in an investigation upon the Algal Flora of the Sambhar Lake reports a few species of algae belonging mainly to Myxophyceae and also to Chlorophyceae. Godbole while tracing the origin of the salt in Sambhar Lake mentions five species of algae present in the Sambhar Lake, as identified by Prof. M.O.P. Iyenger. Some interesting algal taxa from alkaline pond of GudaVishnoi, near Jodhpur (Rajasthan, India) were observed having dominant blue green algal taxa, mainly various species of genera: *Oscillatoria*, *Anabaena*, *Nostoc*, *Calothrix*, *Phormidium* and *Haplosiphon* and the green algal taxa *Scenedesmus*, *Botryococcus*, *Pediastrum* and *Cosmarium*. Vishnoi and Shrivastava reported 46 species of phytoplankton species were identified comprising 10 species of Chlorophyta and 36 species of Cyanophyta. The newer addition to these survey were observed that includes *Chlorococcum hemicolum* (Harish), locally isolated from industrial area at Boranada, Jodhpur, is not only just a tolerant species but also found to be Cu^{2+} , Ni^{2+} and Cd^{2+} hyper-accumulator. *Cocconis scutellum* from Jojari River, *Trebouxiahumicola* from alkaline pond of GudaVishnoi (Sharma⁶) and both the isolated algae showed heavy metal tolerance in order for $\text{Cd}^{2+} > \text{Cu}^{2+} > \text{Ni}^{2+} > \text{Zn}^{2+}$ and $\text{Cd}^{2+} \geq \text{Ni}^{2+} > \text{Cu}^{2+} > \text{Zn}^{2+}$, respectively; these algal strains revealed appreciable bioremediation potentials. The studies of Harish revealed comparatively higher accumulation factor of 1.38, 1.37 and 1.4 for Cd^{2+} , Ni^{2+} and Cu^{2+} by *Chlorococcum hemicolum*. The continuing efforts (Renu) led to the new addition of two Chlorophycean members (*Chlorella vulgaris* and *Chlorococcum humicolo*) from this region. *C. vulgaris* exhibits great efficiency to combat Cd^{+2} , Ni^{+2} and Zn^{+2} stresses with the maximum accumulation factor of 4.2, 2.08 and 2.66, respectively. Metal tolerance efficiency and higher uptake rates makes it a significant algal species for bioremediation purpose, more specifically for Cd^{+2} . Similarly, *C. humicolo* also exhibits great efficiency to combat Cd^{+2} , Ni^{+2} and Zn^{+2} stress with the maximum accumulation factor of 2.57, 2.07 and 2.70, respectively. Most of these newly collected and studied algal strains from the arid zone climate during the last ten years revealed higher potential to remove heavy metals with comparatively higher accumulation values warranting further explorations of other algal strains and also their genetic makeup that enable them to be very heavy metals tolerant.

Keywords: Bioremediation, algae, hyper-accumulator, desert algae

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ABSTRACT 2

Synthesis of hydroxytriazenes and their anti-diabetic and anti-oxidant activities

Prabhat Kumar Baroliya

ABSTRACT

Background: Diabetes is a common metabolic disease characterized by abnormally high plasma glucose levels, leading to major complications, such as diabetic neuropathy, retinopathy, and cardiovascular diseases. One of the effective management strategies for diabetes mellitus, particularly non-insulin-dependent diabetes mellitus (NIDDM) is to decrease post-prandial hyper-glycemia, is to retard the absorption of glucose by inhibition of carbohydrate hydrolyzing enzymes, such as α -glucosidase and α -amylase in the digestive organs. α -glucosidase is the key enzyme catalyzing the final step in the digestive process of carbohydrates. Hence, α -glucosidase inhibitors can retard the liberation of d-glucose from dietary complex carbohydrates and delay glucose absorption, resulting in reduced post-prandial plasma glucose levels and suppression of post-prandial hyperglycemia. In recent years, many efforts have been made to identify effective α -glucosidase inhibitors from natural sources as well as synthetic molecule in order to develop a physiologic functional food or lead compounds for use against diabetes. In this presentation, the focus will be on the synthesis of various hydroxytriazenes based on sulfa drugs such as sulphanilamide, sulfathiazole, sulfafurazole, sulfamirazine, sulfadiazine and sulfapyridine and their screening for α -glucosidase inhibitory and antioxidant activities.

Materials and Methods: Hydroxytriazenes based on sulfa drug such as sulphanilamide, sulfathiazole, sulfafurazole, sulfamirazine, sulfadiazine and sulfapyridine have been synthesized by the standard method as reported in literature and characterized by recording M.P, IR, NMR and MASS spectra. Anti-diabetic activity of synthesized hydroxytriazenes was determined by α -glucosidase inhibition method reported earlier. All the samples were run in triplicate and acarbose was taken as a standard reference compound. Several dilutions of primary solution (5 mg/ml DMSO) were made and assayed accordingly to obtain concentration of the test sample required to inhibit 50% activity (IC_{50}) of the enzyme. The anti-oxidant activity of hydroxytriazenes was done using 1,1-diphenyl-2-picrylhydrazyl (DPPH) method as reported in literature were recorded concentration of the test sample required to inhibit 50% activity (IC_{50}) of the DPPH.

Results and Discussion: Series of hydroxytriazenes based on sulfa drug such as sulphanilamide, sulfathiazole, sulfafurazole, sulfamirazine, sulfadiazine and sulfa-pyridine were synthesized. These compounds having hydroxyl and diazo moiety possess notable inhibitory action against alpha glucosidase and also show remarkable antioxidant activities in DPPH assays. The IC_{50} values of alpha glucosidase inhibition and antioxidant activity of all the synthesized hydroxytriazenes were ranging from 140-400 μ g/mL and 260-850 μ g/ml, respectively. Many studies suggest that compounds having phenolic and hydroxyl group inhibit α -glucosidase enzyme significantly decreasing the digestion and uptake of carbohydrates, thereby decreasing the postprandial blood glucose level in non-insulin-dependent diabetes mellitus.

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Conclusions: This class of compounds can be good antioxidants as well as antidiabetic agent in biological systems and may have substantial potential in the field of pharmacology.

Keywords: Hydroxytriazene, anti-oxidant activity, anti-diabetic activity

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ABSTRACT 3

An alternative or optional source of non-wood fiber material (weeds) for papermaking

Vinayak Fasake and Kavya Dashora

ABSTRACT

World demand for paper has increased at an average annual rate of 4.7% over the past 40 years. Wood fiber makes longer-term impacts of forest harvesting. It is therefore, necessary to consider alternative fiber sources for papermaking. Non-wood fibers are alternate fibers presence non-woody cellulosic plant materials from which papermaking fibers can be extracted. Most widely used non-woods for papermaking are straws, sugarcane bagasse, bamboo, kenaf, hemp, jute, sisal, abaca, cotton linters, and reeds. Most non-wood plants are annual plants that develop full fiber potential in one growing season. Apart of that, we will be tested loss of weeds presence in our rural areas which is substitute or alternative to any other cellulose material (for Ex. Bagasse) and completed our paper demand as well as generating the new employment and increase livelihood in a rural area. Paper-making from non-wood fiber materials (weeds) are a major and one of the most rapidly growing sources of livelihood in rural areas. Responsible pulp and paper operations can bring many benefits to forests, local economies and people, particularly in rural areas. For the collection of weed, storage, transportation and handling require lots of skilled and unskilled human power, ultimately its increase a livelihood in a rural sector and build our villages beautiful in absence of such exotic weeds.

Keywords: Non-wood fibers, papermaking, rural, livelihood

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ABSTRACT 4

Potential applications of repurposed Cas9 for structural and functional genomics of plants

Kunal Seth and Harish

ABSTRACT

CRISPR and CRISPR-associated (cas) genes is an RNA mediated adaptive immune system in bacteria and archaea against invading foreign genetic material. CRISPR are Clustered Regularly Interspaced Short Palindromic Repeats separated by short segments of “spacer DNA” acquired from previous exposures to phage infection. In 2012, CRISPR-Cas9 emerged as a new gene editing tool. It is different from earlier methods for targeting specific genomic sites such as meganucleases, zinc finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs) which are protein (customized DSB-inducing nuclease) based platforms. Redesigned Cas9 has emerged as a tool with various applications like gene editing, gene regulation, epigenetic modification and chromosomal imaging. Target specific single guide RNA (sgRNA) can be used with Cas9 for precise gene editing with high efficiency than previously known methods. Further, nuclease-deactivated Cas9 (dCas9) can be fused with activator or repressor for activation (CRISPRa) and repression (CRISPRi) of gene expression, respectively. dCas9 fused with epigenetic modifier like methylase or acetylase further expand the scope of this technique. Fluorescent probes can be tagged to dCas9 to visualize the chromosome. dCas9 mediated fluorescence imaging (CRISPR-Display), can be helpful in mapping crop genes and crop improvement. Due to its wide-spread application, simplicity, accessibility, efficacy and universality, this technique is expanding the structural and functional genomics studies of plant and developing CRISPR crops.

Keywords: CRISPR, CRISPRa/i, CRISPR-Display, dCas9, epigenetics, gene editing

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ABSTRACT 5

Applications of botanical methods in mineral exploration: Present status and future prospects

Bhagawatilal Jagetiya

ABSTRACT

An unprecedented surge in exploration and prospecting for precious minerals across the world now-a-days is because of the increasing demands placed on the planet's dwindling resources by expanding economies and burgeoning populations. Easily discoverable mineral deposits of the earth were identified and discovered years ago. Those that remained or tend to present either under the deep sea or in inaccessible parts of the earth, perhaps covered by dense forest and bush or ice caps where these outcrops were hard to detect. To explore these hard to detect, mineral deposits geologists and geochemists have wide arrays of systems and strategies at their disposal, ranging from aerial geophysics to various geochemical techniques including the analysis of a diversity of sources such as air, water, soils, stream sediments, rocks, plants, animals, bogs etc. In many countries of the world interest has been shown in last many years that the use of vegetation as a guide to discover untraced mineral deposits. There are two distinct strategies of botanical exploration and prospecting of mineralisation. Out of these two, a group of methods are visual and rely mainly on an interpretation of the plant cover to detect morphological changes or plant associations typical to specific types of geologic environments or of ore deposits or mineralization within these environments. Other set of methods involve chemical analysis of the plant organs to detect mineralization. The first set of methods are known as geo-botanical prospecting or geo-botanical monitoring, has been defined as the study of plants specifically to their geologic environment or as a visual survey of vegetation used to define geologic patterns in the landscape. It involves two fundamental aspects of plant geography, the concepts of flora and of vegetation. This is the method relating vegetation properties to geological features, and understanding the underlying strata. Another group of techniques known as biogeochemical prospecting or biogeochemical monitoring, depends on the chemical analysis of the vegetation in which reliance is placed on the accumulation of the elements from the substrate to an extent proportional to the amount present. Geo-botanical prospecting or prospecting by studying these indicator plants was proposed and tried out by researchers in only few countries of the world with limited success but biogeochemical methods have been used successfully in many countries especially in Australia, U.S., Canada and former U.S.S.R. Limited number of studies have been carried out in India for applications of botanical exploration of mineralization. Recently, under Department of Atomic Energy, Government of India, these technique have been applied successfully for prospecting and exploration of uranium mineralization in Rajasthan near Sikar. Present paper deals with these methods of mineral exploration and a part of work carried out under DAE-BRNS project programme.

Keywords: Prospecting, exploration, geo-botany, biogeochemistry

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ABSTRACT 6

Integrated management of downy mildew (*Peronospora arborescens*) of opium poppy through organic practices to increase the yield and morphine content

Pokhar Rawal, Arunabh Joshi and Lekha

ABSTRACT

Background: Opium poppy (*Papaver somniferum* L.) family *Papaveraceae* is a highly valuable herbaceous annual medicinal crop cultivated for its pharmaceutically important alkaloids as well as for seeds and seed oil for culinary purposes. Morphine, codeine, thebaine, narcotine and papaverine are the most important alkaloids produced by the plant and are exploited by the pharmaceutical industry as analgesics, antitussives and anti-spasmodic. In India, its production and productivity is low due to lack of improved disease resistant cultivars and attack of downy mildew disease. Since, it can be managed by use of fungicides; however use of chemical fungicides in medicinal crops is banned and hazardous for human health. Therefore, organic management practices comprising of de-oiled cakes and potent bio- agents formulation were evaluated to develop chemical free practices for the effective management of downy mildew disease and to increase the latex yield and morphine content.

Materials and Methods: IDM practices were evaluated under sick plot and inoculation condition. The experiment was conducted in randomized block design using crop geometry 30 x 10 cm in plots size of 3 x 2 m. Treatments of de-oiled neem-cake mixture enriched with bio-formulation were properly mixed in soil before sowing. Treatments were sprayed first at initiation of disease followed by 15 days interval and per cent disease incidence (PDI) was recorded at 15 days of third spray using 0-9 rating scale. The PDI and percentage efficacy of disease control were calculated. Yield of latex, seed and capsule husk was recorded at harvest following the standard of opium crop and morphine content in dry latex was analyzed.

Results and Discussion: The organic disease management practices comprising in-furrow soil application of neem-cake mixture (100gsm⁻¹) enriched with *Trichoderma* + *Pseudomonas* bio-formulation each @ 2.0 per cent at sowing plus three foliar sprays of garlic bulb extract @10 per cent was best effective and resulted in maximum control of downy mildew disease (81.5%) and yielded maximum dry latex powder (23.06 kgha⁻¹), seeds (8.15 q ha⁻¹), capsule husk (7.12q/ha) with higher morphine content (11.28%). This treatment was closely followed by module comprising in-furrow soil application of neem cake mixture (100gsm⁻¹) enriched with *Trichoderma* + *Pseudomonas* bio- formulation each @ 2.0 per cent at sowing plus three foliar sprays of fresh cow urine @10 per cent that resulted significantly inhibited downy mildew disease (19.9 %), higher disease control (76.6%) with increased yield of dry latex, seed, capsule husk (22.01kgha⁻¹, 7.72 qha⁻¹ and 6.75qha⁻¹, respectively) and improved 11.13 per cent morphine content compare to control and rest of the treatments. Organic amendments, botanical extracts and biological control agents are recommended to reduce the incidence of several diseases

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due to release of some inhibitory substances, antimicrobial activities, active antagonism, mainly antibiosis and competition and may have a possible role in enhancing the host growth and vigor, increasing antagonistic microbial activity that enhance plant growth by production of volatiles and enabling them to withstand or resist the attack of pathogen.

Conclusions: The integrated organic management practices, comprising in-furrow soil application of neem cake mixture (100gsm^{-1}) enriched with *Trichoderma* + *Pseudomonas* bio-formulation each @ 2.0 percent at sowing plus three foliar sprays of garlic bulb extract or fresh cow urine @10 percent or fresh cow urine @10 per cent first at initiation of disease followed by 15-days-interval were found best effective in management of downy mildew disease of opium poppy as well as in increasing yields of dry latex, seed, capsule husk and morphine content.

Keywords: *Papaver somniferum*, downy mildew, organic management, garlic extract, cow urine, morphine content

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ABSTRACT 7

Amelioration of zinc tolerance in *Triticum aestivum* L. by inoculation of *Pseudomonas aeruginosa* PSB51

Monica Sen and Harshada Joshi

ABSTRACT

Background: Soil contamination with heavy metals has become a worldwide problem today which has resulted in loss of agricultural yield. Among various solutions, plant growth-promoting rhizobacteria (PGPR) are proven to be the best model systems which support environmental sustainability and agriculture. Besides nutrient solubilization PGPR also produce siderophores that act as chelating agents to limit heavy metal availability for plants. Therefore, an attempt has been made in the present study, to determine the effect of *Pseudomonas aeruginosa* PSB51 on the growth of *Triticum aestivum* L. in zinc contaminated soil.

Materials and Methods: The effect of zinc tolerant and plant growth promoting *Pseudomonas aeruginosa* PSB51 (previously characterized) on growth parameters (shoot and root length) of *Triticum aestivum* L (var. RAJ 4238) was studied. Experiments were conducted with four treatments - T0 [Control i.e., soil without tricalcium phosphate (TCP)], T1 [(soil amended with TCP (200mg/kg)], TZ1 [soil amended with zinc sulphate heptahydrate ($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$) (1000mg/kg)] and TZ2 [soil amended with TCP (200mg/kg) and $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ (1000mg/kg) inoculated with *Pseudomonas aeruginosa* PSB51]. All the experiments were performed in triplicates. Shoot length and root length for all the treatments was recorded after 45 days. Shoot length stress tolerance index (SLSTI) and root length stress tolerance index (RLSTI) were calculated.

Results and Discussion: The strain PSB51 was isolated on Pikovskaya agar containing 0.5% TCP from rhizospheric soil of *Tridax* species growing in tailing dam of Zawar mines Udaipur, India. It was identified as *Pseudomonas aeruginosa* PSB 51 on the basis of 16SrRNA sequencing and was found to tolerate $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ (MIC 15 mg/ml). In the pot experiment, significant increase in shoot (18.43 cm) and root length (9.04 cm) was observed in T1 as compared to those of T0 plants (16.17 and 8.71cm) whereas, significant decrease in both the shoot (9.32 cm) and root length (5.1 cm) was observed in TZ1 plants as compared to T0 after 45 days. However, on inoculation of wheat plants with *P. aeruginosa* PSB51 (in TZ2 treatment) a notable increase in shoot (22.74 cm) and root length (10.3 cm) was recorded. The stress tolerance index for shoot and root were calculated as 2.44 and 2.02 respectively.

Conclusions: *P. aeruginosa* PSB 51 supported the growth of wheat plant which confirmed its potential for plant growth promotion and tolerance to zinc. The isolate *P. aeruginosa* PSB51 can be further explored to study the mechanism of action for zinc tolerance and can be applied for plant-assisted bioremediation in zinc-contaminated soils.

Keywords: *Pseudomonas aeruginosa* PSB 51, *Triticum aestivum* L., zinc sulphate heptahydrate

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ABSTRACT 8

Synthesis of 1,2,4-Triazolo fused 1,5-Benzodiazepine, 1,5-Benzoxazepine and 1,5-Benzothiazepine as medicinally potent agents

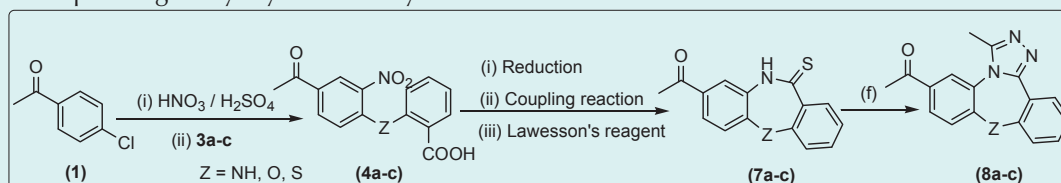
Bhawani Singh

ABSTRACT

Background: The triazole and azepine derivatives are the valuable synthons for drug discovery because of their high pharmacological profiles. Triazolo[1,5]benzodia / ox / thiazepines may be synthesized from [1,5]benzodia/ox/thiazepines respectively. On the basis of importance of heterocyclic compounds herein, 1-(3-methyl-9*H*-dibenzo[*b,f*][1,2,4]triazolo[4,3-*d*][1,4]diazepin-6-yl)ethanone, 1-(3-methyldibenzo[*b,f*][1,2,4]triazolo[4,3-*d*][1,4]oxazepin-6-yl)ethanone and 1-(3-methyldibenzo[*b,f*][1,2,4]triazolo [4,3-*d*][1,4]thiazepin-6-yl)ethanone derivatives are synthesized in the present research work.

Materials and Methods: All reagents and solvents were purchased from Sigma-Aldrich, Alfa-Aesar, Molechem and Loba Chemie. All the solvents were distilled and dried before use and melting points were recorded in open glass capillaries. The IR spectra were recorded at Department of Pure and Applied Chemistry, University of Kota, Kota using Bruker FT-IR spectrometer (Model: Tensor-27) on KBr pellets. ¹H NMR and ¹³C NMR spectra were recorded at SAIF/CIL, Punjab University, Chandigarh and IIT Delhi on Bruker ADVANCE II 400 NMR spectrometer with peak values shown in δ ppm using TMS as an internal standard. Mass spectra were recorded on Waters, Q-TOF Micromass (LC-MS) mass spectrometer from SAIF/CIL, Punjab University, Chandigarh.

Results and Discussion: 1-(4-Chlorophenyl) ethanone **1** was treated¹ with fuming HNO₃ and H₂SO₄ to give 1-(4-chloro-3-nitrophenyl) ethanone² **2**. Compounds **4a-c** was obtained via the application of Ullmann condensation reaction on heating of 1-(4-chloro-3-nitrophenyl) ethanone **2** and **3a-c** with potassium carbonate, Cu, CuI and nitrobenzene³. The Ullmann condensation was reported by Irma Goldberg⁴ where copper used as a catalyst. Compounds **4a-c** undergo selective reduction of aromatic nitro group into amine group followed by reaction with Fe / HCl in aqueous ethanol⁵ to give **5a-c** which subsequently underwent cyclization using *N,N'*-dicyclohexylcarbodiimide (DCC) in THF (rt, 7-8h) to give the **6a-c**⁶. The **6a-c** were converted to the thioamide derivatives **7a-c** by treatment with Lawesson's reagent. The methyltriazoles **8a-c** was afforded via the initial reaction of thioamide **7a-c** and hydrazine monohydrate to form a hydrazone which reacted *in situ* with acetyl chloride and triethyl amine in THF to yield the corresponding acetyl hydrazone. Cyclization in acetic acid furnished the **8a-c** derivatives.



Scheme 1

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Conclusions: [1,5]benzodia / ox / thiazepinones and triazolo[1,5]benzodia / ox / thiazepines were synthesized, characterized and screened for anti-bacterial, anti-fungal and antioxidant activities. The compounds **6c**, **7c** and **8c** exhibited good activities as compared to the standards. Some of these heterocycles may be used as prominent medicinally potent agent.

Keywords: Triazolobenzodia / ox / thiazepines, pharmacophores, biological activities, IC_{50} , analytical and spectral data

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ABSTRACT 9

Effect of different culture vessels and closures on *in vitro* shoot growth and multiplication in peanut

Rohini Trivedi

ABSTRACT

Background: Peanut (*Arachis hypogaea* L.) is an important crop valued for its seed oil and high nutritional content. Hydrogenated peanut oil, peanut oil derived glycerides and peanut acid are widely used in cosmetics and personal care products. Plant tissue culture techniques have become an integral part of progress in plant science research due to its applicability in mass propagation of elite germplasm and crop improvement through transgenic approach. The development of tissue culture protocols is a rigorous procedure that involves optimizing the various factors of *in vitro* growth. Optimization of different vessels and closures in influencing the multiplication rate and health of the shoots in the same external growth room conditions on *in vitro* peanut propagation were studied.

Materials and Methods: Multiple adventitious shoot buds were induced in mature de-embryonated cotyledon explants of groundnut cultivar 'JL-24' on Murashige and Skoog's medium (1962) supplemented with 5.0 mg l⁻¹ 6-benzylamino purine (BAP) and 2.0 mg l⁻¹ 2, 4-dichlorophenoxyacetic acid (2, 4-D). Shoot multiplication (SM) medium consisted of MS medium supplemented with 2.0 mg l⁻¹ BAP, 3.0 % sucrose and gelled with 0.8 % agar. Flasks of 100 ml capacity wide mouth conical flasks of 100 ml capacity of BOROSIL glass and glass bottles of 400 ml capacity of neutral glass, Magenta vessels of polycarbonate were used to see the effect of vessel type on shoot growth and multiplication. A cluster of 3 shoots was cultured on SM medium in all the vessels. For closures, cotton-wool plugs for conical flasks and polypropylene caps with or without vent for culture bottles were used.

Results and Discussion: Shoot multiplication rate was higher in ventilated vessels. The highest multiplication rate of 7.0 folds with an average of 22 shoots/ explant was produced in 100 ml narrow mouth conical flask with cotton plugs after 63 days. In the present investigation, rate of shoot multiplication and shoot length was lower in larger vessel with ventilation (400 ml culture bottle with vented caps and 100ml wide mouth culture flask with cotton plug) than in culture vessel with moderate ventilation (100 ml narrow mouth flask with cotton).

Conclusions: Improved *in vitro* morphogenic response was recorded in ventilated vessels, but a dilemma exists between plant quality and quantity in relation to ventilation.

Keywords: Peanut oil, culture vessels, vessel closures, multiplication rate, *in vivo* growth

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ABSTRACT 10

Micropropagation potential of *Feronia limonia* (L.) Swingle under different culture environment

Priyanka Babel and S.D. Purohit

ABSTRACT

Background: *Feronia limonia* (L.) Swingle endemic to south-east Asia is a fruit tree of immense ecological and economic importance for Aravallis in Rajasthan. Unmindful exploitation has led to depleted wild populations of *F. limonia*. The present study was undertaken to test the suitability of liquid culture system eliminating the need of agar for large scale micropropagation of *F. limonia*. Effect of other factors such as vessel and stopper types, CO₂ enrichment in conjunction with liquid medium were also investigated.

Materials and Methods: For present study shoot cultures were established using cotyledonary nodes derived from seedling. For liquid culture, shoot clusters were aseptically harvested from *in vitro* multiplying shoots and inoculated on MS medium containing 0.5 mg l⁻¹ BAP, 1.5 mg l⁻¹ Kn and 0.01 mg l⁻¹ NAA omitting the agar completely. In case of liquid medium, borosilicate glass beads (10 mm diameter) were used as support matrix. To test the suitability of vessel, shoot cultures were grown in a variety of culture vessels using liquid medium. Growth parameters viz. shoot length, number, rate of multiplication and total biomass content were recorded under different culture conditions.

Results and Discussion: Liquid medium stimulated *in vitro* shoot growth and multiplication. Culture vessel types significantly influenced the growth of cultures. The best shoot multiplication was achieved in 400 ml round culture bottles. Vessels stoppered with polypropylene caps recorded maximum shoot growth. Improvement in *in vitro* growth and multiplication was observed when sucrose-free cultures were grown under a controlled and CO₂-enriched environment. The best response was obtained when cultures were multiplied on sucrose-free liquid medium and placed under 10.0 g m⁻³ CO₂ enriched environment. Shoots grown on liquid medium recorded maximum fresh and dry weight contents. Other factors such as carbon dioxide enrichment with sucrose, larger size of the culture vessel, also promoted fresh and dry weight accumulation.

Conclusions: Liquid medium proved promotory for shoot growth. Modifications in culture vessel environment also supported growth in combination with liquid medium. The suitability of liquid medium for large-scale production of this important medicinal plant species would definitely open up new opportunities for developing a cost-effective production system.

Keywords: *Feronia limonia*, liquid medium, ventilation, micropropagation,

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ABSTRACT 11

In vitro responses of *Corbichonia decumbens*: A medicinal plant from hot desert rocks

Meena Barupal and Vinod Kataria

ABSTRACT

Background: Plant tissue culture is well established technique for germplasm conservation and large scale regeneration of plant which is depend on optimized protocol of *in vitro* growth and development. In desert, there are many plants that can serve as vital aid in medicinal field. One of these desert medicinal plants *Corbichonia decumbens* (family- Lophiocarpaceae) is a hot rock thriving plant which survives well in extreme hot desert and have annual shoots and remain perennial though only by roots in soil. The plant has anti-ulcer activities. In this article, we are summarizing responses of *C. decumbens* in tissue culture experiments for micropropagation and conservation of the plant throughout the year.

Materials and Methods: The *in vitro* profile of plant was obtained from axillary bud activation (bud break) in explants (single node shoot segments) and regeneration of callus originated from hypocotyl of 2 weeks old *in vitro* seedlings, inoculated on MS basal medium incorporated with 3% sucrose, 0.8% agar, supplements and respective plant growth regulators PGRs (auxins and cytokinin) under *in vitro* culture environments.

Results and Discussion: In responses, the bud breaking for shoot multiplication was achieved within one week with 91.71 ± 6.46 SD% / treatment on applying of single cytokinin (BAP or Kin) with concentration from 0.5 - 2 mg/l into basal medium. In callus proliferation responses after induction of callus from hypocotyl, an image based analysis was conducted to compare initial area calli (24.72 ± 12 SD mm per treatment) with final area calli after treatments and resulted the callus mass increased with 156.65 ± 116 SD mm area per treatment, the result shows the rapid growth of callus which can be help in secondary metabolites production from the plant. In induction of shoot regeneration from friable proliferated callus, the percentage mean 64.81 ± 25.19 SD % was gained in all gross treatments including the highest 100% regeneration induction on PGR combination BAP (1 mg/l) + kin (0.5 mg/l) + NAA (0.2 mg/l) + TDZ (0.2 mg/l).

Conclusions: In gross *in vitro* observations, *C. decumbens* actively responded in culture condition which is suitable for large scale micropropagation of the plant. These findings help in optimization of *in vitro* development protocol for the plant in hot tropical area.

Keywords: Plant tissue culture, shoot multiplication, *in vitro* responses, callus mass area, PGR

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ABSTRACT 12

In vitro studies on *Vitex negundo*- a plant of immense medicinal potential

Geeta Batra and S.D. Purohit

ABSTRACT

Background: *Vitex negundo* commonly known as 'Nirgundi' or 'Negad' is a member of family Verbanaceae. It occurs in tropical East Africa, Medagaskar, Malaya India and Japan. Leaves of the plant are used to relieve catarrh and headache. They are also considered to have insecticidal properties. The powder of roots is prescribed for piles and dysentery. Oil prepared from infusion of leaves is marvellous cure for wound and ulcers. Bark is used for fever and rheumatic swellings. Conventionally *V. negundo* is propagated by seeds but poor germination potential restricts its natural multiplication.

Materials and Methods: Seeds were treated with 0.1% mercuric chloride solution, were washed 4-5 times with autoclaved double distilled water and transferred to water agar (0.8%). Cotyledonary nodes served as explants for multiple shoot proliferation. Mature nodes treated with NaOCl (1.0 % active chlorine) were implanted on MS medium supplemented with 0.5 mg/l BAP. Effect of cytokinins, types of media and salt concentration in medium were studied during shoot multiplication. Shoots obtained from multiplying cultures were used for root induction. Rooted plantlets were transferred to culture bottles one-fourth filled with Soilrite™ for hardening. After one month, these bottles were transferred to greenhouse where 70% humidity and 25-28°C temperature were maintained.

Results and Discussion: Average 5.0 shoots proliferated from each cotyledonary node. They were sub-cultured on the same fresh medium every three weeks for further multiplication. BAP proved to be the best cytokinin for shoot multiplication. Medium supplemented with 0.5 mg /l BAP proved to be better as compared to kinetin. Combination cytokinins reduced the number of shoots. MS medium proved to be best for shoot multiplication compared to Gamborg's and White's media. NH_4NO_3 and KNO_3 added in the medium maintained as control proved to be the best. The rooting response was more than 66.6% on MS medium without any growth regulator. With the reduction in MS salt concentration to three-fourth, half and quarter, the rooting response was improved. MS medium with quarter strength of salts proved to be best with 90.0 % rooting. *In vitro* hardening involving maintenance of plantlets in bottles containing Soilrite™ and gradual opening of caps allowed survival of 80% plantlets.

Conclusions: For shoot proliferation 0.5 mg/l BAP showed best response. MS medium with normal concentrations of nitrogen nutrients matched optimum nutritional requirement of shoot cultures. Reduced salt concentration evoked best rooting response. Micropropagated plants hardened in culture bottles having autoclaved Soilrite™ showed better survival.

Keywords: Micropropagation, rooting, Soilrite™, auxin, nitrogen source

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ABSTRACT 13

Optimization of polyphenolics from leaves of *Paris polyphylla*: A high value Himalayan medicinal herb

Laxman Singh Bhouriya

ABSTRACT

Background: The genus *Paris*, one of the important sources of useful saponins and bioactive compounds has attracted the interest of pharmaceuticals across the globe. The bioactive compounds are mainly located in the rhizome and its overharvesting, made several species of the genus threatened in the wild and *Paris polyphylla* being no exception. The present investigation was therefore, carried out to look for an alternate source of bioactive compounds from the leaves and to optimize the extraction process for obtaining maximum yield.

Materials and Methods: A total of 32 experimental trials were conducted for screening variables (i.e. ethanol concentration, sample to solvent ratio, HCl concentration, extraction temperature and time). Total phenolics (TP), flavonoids (TF), tannins (TT) along with *in vitro* antioxidant activity (ABTS, DPPH and FRAP) have been estimated as dependent variables. Among all the five independent factors, ethanol concentration (X1), sample-to-solvent ratio (X2), and extraction temperature (X3) showed significant variations. **Results and Discussion:** Among all the tested independent factors, the optimal extraction condition was found to be a combination of 60% ethanol, 40 ml sample to solvent ratio and 45°C for 45 min, which resulted in maximum content of polyphenolics, namely TP (5.36 mg GAE/g dw), TF (44.27 mg QE/g dw), TT (65.41 mg TAE/g dw), ABTS (2.28 mM AAE/g dw), DPPH (12.30 mM AAE/g dw) and FRAP (0.31 mM AAE/g dw) were found to be closer to the model predicted value. Further, High Performance Liquid Chromatography (HPLC) analysis of extract obtained under optimal condition, revealed the presence of 5 phenolic compounds. Among the detected polyphenolics, catechin (31.1 mg/100g dw) was found to be higher in concentration followed by gallic acid (9.6 mg/100g dw), chlorogenic acid (8.0 mg/100g dw), 4-hydroxybenzoic acid (4.2 mg/100g dw) and caffeic acid (0.5 mg/100g dw).

Conclusions: The extraction optimization using RSM was found effective in harnessing the polyphenolic content from *P. polyphylla* leaves and thus can be utilized for extraction of bioactive compounds from other species including high value medicinal plants of the IHR. This will reduce destructive harvesting of rhizomes or the entire plant and reduce the pressure in the wild.

Keywords: flavonoids, HPLC, polyphenolics

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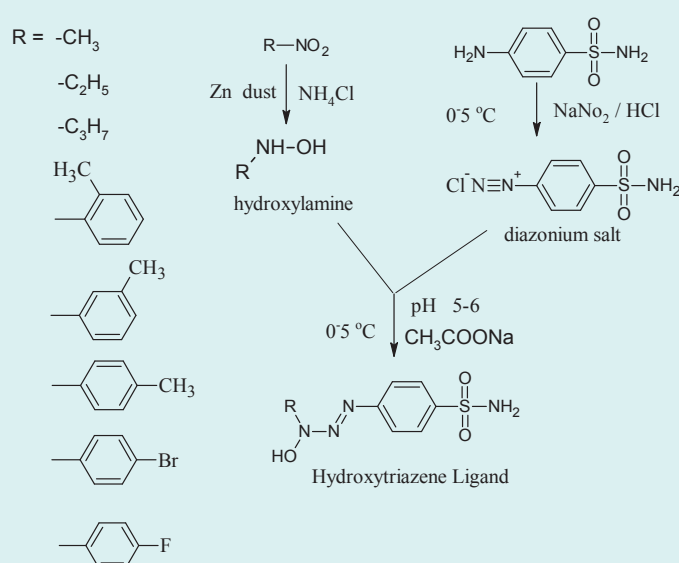
Synthesis, characterization and biological studies of some sulpha drug based hydroxytriazenes

L.K. Chauhan and A. K. Goswami

ABSTRACT

Background: In drug discovery biologically active lead generation is an important research area in field of pharmaceutical research. Molecules containing the sulphonamide moiety have found importance because of their applications as anticancer, antibacterial, antifungal and antitumor agents. This report is based upon synthesis, characterization and biological activities of molecules containing one of the standard drugs having diazotizable amino group. In view of this, in the present work, sulpha drug based hydroxytriazenes have been synthesized and studied for their biological activity. **Materials and Methods:** Synthesis of eight hydroxytriazenes bearing a sulphonamide moiety has been described. These hydroxytriazenes have been synthesized by coupling of hydroxylamine obtained by reducing substituted nitro compounds and diazonium salt obtained from sulphanilamide taking hydroxyl amine in excess at the temperature between 0-5°C. This product was washed and re-crystallized using appropriate solvent. The purity of synthesized compounds was checked by TLC and physical characteristics like melting point, crystal shape, IR, NMR and MASS spectral analysis. All synthesized compounds have been screened for probable biological activities using PASS. Further, synthesized compounds have been screened for anti-inflammatory activities as predicted by PASS.

Reaction scheme



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Results and Discussion: The anti-inflammatory activity results indicate that these compounds possess moderate to good anti-inflammatory activities as predicted theoretically.

Conclusions: The purpose of present research is to synthesize biologically active hydroxytriazenes. The newly synthesized compounds may be more potent if explored further. The present paper is an attempt to plan synthesis according to application of the compound. Thus, the present approach can be very useful in designing drug molecules according to their properties. The present paper paves way for CADD.

Keywords: Hydroxytriazenes, PASS, sulphonamide moiety, anti-inflammatory activity

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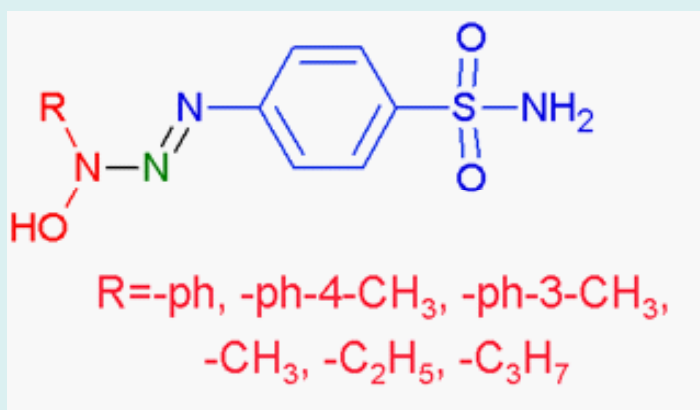
Anti-diabetic activity evaluation of hydroxytriazenes derived from Sulphanilamide

Jaishri Chopra and Prabhat Kumar Baroliya

ABSTRACT

Background: Diabetes is a metabolic disorder that occurs when the body cannot produce enough insulin or cannot use insulin effectively. It is characterized by chronic hyperglycemia, with disturbances of carbohydrate, fat and protein metabolism resulting defects in insulin secretion and insulin action, or both. In this report, sulphanilamide based hydroxytriazenes have been found effective in reducing the blood glucose level in animals which helps to overcome this chronic disease.

Materials and Methods: In the present study, sulphanilamide based hydroxytriazenes (scheme 1) have been synthesized via standard method as reported in literature and structures of these synthesized compounds have been confirmed on the basis of spectral studies (IR, ^1H NMR, MASS). The synthesized compounds have been studied for their anti-diabetic activity via α -glucosidase and α -amylase method.



Scheme 1

Results and Discussion: α -glucosidase and alpha-amylase inhibitive action is normally explained in terms of presence of enzymes in small intestine and those enzymes are responsible for breaking dietary carbohydrates thus facilitating their absorption into the body. Inhibition of this enzyme allows less dietary carbohydrate available for absorption which in turn makes it less available in the blood following the meal. Sulphanilamide based hydroxytriazenes perform enough inhibitive action for both the enzymes when compared to standard acarbose taken in α -glucosidase and α -amylase inhibitive method. **Conclusions:** Hydroxytriazenes derived from sulphanilamide exhibit sufficient *In-vitro* anti-diabetic activity for both the alpha-glucosidase and alpha-amylase inhibitive method.

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Keywords: Hydroxytriazene, sulphanilamide, anti-diabetic activity

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ABSTRACT 16

Micro-morphological studies and plant regeneration from callus cultures of selected genotypes of *Momordica balsamina*: an important medicinal plant of family cucurbitaceae

Sumitra Choudhary and N. S. Shekhawat

ABSTRACT

Background: *Momordica balsamina* is an important medicinal plant of arid region and occurs naturally on boundary wall of fields and natural conservatories during rainy season and locally known as “Desi karela.” It is a wonder plant as the fruits, seeds, leaves and bark are reported to possess various medicinal and nutritional properties. An *in vitro* method for plant regeneration of *M. balsamina* through callus culture was developed.

Materials and Methods: Callus cultures were established using cotyledons of *in vitro* developed seedlings and cultured on MS medium having different types of plant growth regulators. Regenerative type of callus was transferred to MS medium containing NAA (0.25 mg/l) + BAP (1.0 mg/l) + Kinetin (0.25 - 1.0 mg/l). Micro-shoots were rooted using *ex vitro* root induction method. Micro-morphological studies were also conducted for the purpose of identification and to study developmental changes in *ex vitro* and *in vitro* environment.

Results and Discussion: The callus produced on different growth regulators was different in texture and morphology. Yellow colored, fast growing and fragile callus initiated on MS medium containing combination of BAP (0.25mg/l) and NAA (0.5mg/l). Regenerative callus were obtained on MS medium containing BAP (1.0mg/l) and NAA (0.25mg/l). Approximately 8-9 shoot buds were produced on MS medium containing kinetin (0.5mg/l) + NAA (0.25mg/l) + BAP (1.0mg/l) with simultaneous callus formation. The maximum shoot length (6.48 ± 0.13 cm) without callus formation was observed on MS medium containing BAP (0.5 mg/l) and kinetin (0.25mg/l) with no NAA. Seventy eight per cent of root induction was observed from *ex vitro* method when shoots were treated with IBA (250 mg/l) for 3 minutes. Use of habitat soil improved the survival (70%) of *ex vitro* rooted plants which were successfully hardened after the polybags were transferred in green house and later in nursery.

Conclusions: The present protocol may be applicable for germplasm conservation, large -scale plant production, genetic transformation, protoplast fusion and selection of superior somaclonal variants of this multipurpose medicinally important plant. Studies on microscopic features such as epidermal cells and surface modifications / ornamentation, stomata, cuticle, surface, pollen grains can shed more light on structural features and their possible functional attributes.

Keywords: *Momordica*, micro-morphological, *in vitro*, micropropagation, *ex vitro*, conservation

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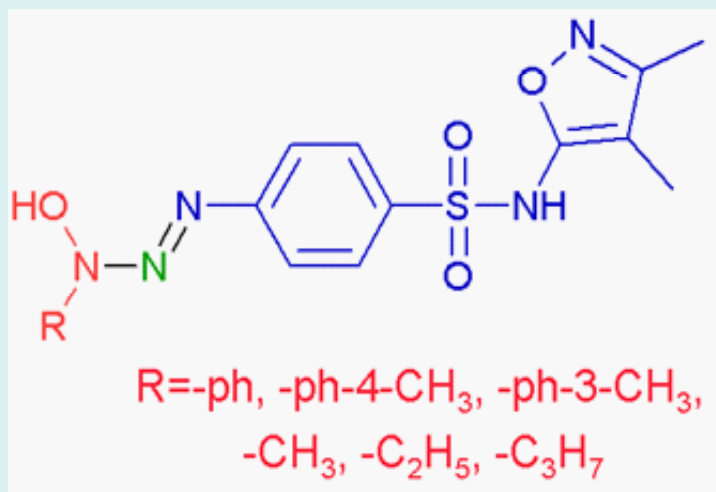
Synthesis, characterization, antioxidant property evaluation of sulfisoxazole based hydroxytriazenes

Varsha Dayma and Prabhat Kumar Baroliya

ABSTRACT

Background: The role of free radicals in disease pathology is well established and known to be involved in many acute and chronic disorders in human beings such as diabetes, atherosclerosis, aging, immunosuppression and neurodegeneration. Review of the literature reveals that studies on nitrogen and oxygen having molecules indicated the presence of antioxidant property. Thus the search for novel antioxidants has ever since increased. In this poster antioxidant property of hydroxytriazenes have been described. These activities were evaluated by 2,2'-diphenyl-1-picrylhydrazyl (DPPH) and 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) scavenging method.

Materials and Methods: Here we report the synthesis, characterization and antioxidant activity of hydroxytriazenes containing sulpha drug moiety. Hydroxytriazenes have been derived from sulfisoxazole and characterized by CHN, ^1H and ^{13}C NMR, FTIR and Mass spectra. Antioxidant property of hydroxytriazenes was evaluated from DPPH and ABTS scavenging method.



Structure of Hydroxytriene

Results and Discussion: The results of elemental analysis and spectral techniques confirmed the purity of the hydroxytriazenes. The ability of the hydroxytriazenes to scavenge DPPH and ABTS radicals was determined using Synergy H4 Hybrid Multi-Mode Reader. In accordance with the

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data obtained from antioxidant activity, by both method. **Conclusions:** In the present study of analysis free radical scavenging activity results showed that all synthesized compounds exhibit good antioxidant property. Further studies have to be carried out to modification of the structure for higher antioxidant activity.

Keywords: Sulfisoxazole, hydroxytriazenes, DPPH, ABTS, antioxidant.

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ABSTRACT 18

Natural polysaccharides as carrier for site specific delivery of drugs to colon

Vikas Fenin and C. P. Jain

ABSTRACT

The incidences of colonic diseases like inflammatory bowel diseases, crohn's disease or ulcerative colitis, amoebiasis and colon cancer are increasing day by day due to modern dietary habits (fast food) and lifestyle. Increase in prevalence of such diseases has augmented the interest of researchers in colon targeted drug delivery systems. Colon, the distal part of the intestine is hosted by a large variety of anaerobic gram negative microflora which secrete many enzymes e.g. amylase, pectinase, β -D-glucosidase, β -D-galactosidase, xylanase, dextranase etc. These enzymes play a vital role in the drug release mechanism of polysaccharide based systems. Natural polysaccharide polymers are being exploited as carrier for colon specific delivery of drugs mainly because they are nontoxic and can be easily degraded in colon to release the drug. Natural polysaccharide can be designed for the targeted delivery to the colon. Premature drug release in the upper part of the GIT can be controlled by minimal chemical modification without affecting the degradability of natural polysaccharides such as amylose, chitosan, guar gum, xanthan gum, pectin, chondroitin sulphate, cyclodextrin, dextrans, inulin, locust bean gum, furcelleran, glucomannan, gellan gum, hyaluronic acid, karaya gum, scleroglucan, pullulan and xylan. These polysaccharides may be used as a biodegradable coating, as carriers for prodrugs, for film formation, or as matrices for colon targeted delivery. Most of these polysaccharides that are being used as food can be exploited for the colon specific delivery of nutraceuticals. They also may be used as bioactive ingredients for the development of future functional foods.

Keywords: Natural polysaccharides, colon specific delivery

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ABSTRACT 19

Effect of certain growth factors on *in vitro* adventitious shoot bud differentiation in *Celastrus paniculatus* - A plant of medicinal value

Nikita Goswami and S.D. Purohit

ABSTRACT

Background: The use of plant growth regulators in tissue culture is well established. Classical plant hormones like auxins, cytokinins, abscisic acid are known to play an important role in plant growth and development. In addition to the classical plant growth hormones, new growth substances with regulatory roles have been discovered. These include phloroglucinol and thidiazuron. It would be useful if new growth factors are tested for their ability to influence regeneration process in plants to improve and integrate their use in large scale *in vitro* propagation of plants in general and *C. paniculatus* in particular.

Materials and Methods: Internodes obtained from *in vitro* multiplying shoot cultures of *C. paniculatus* were used as explants in the present investigation. Internode segments measuring Ca. 1.0 cm in length were harvested aseptically and were placed firmly on the slanted surface of the medium in culture tubes. Murashige and Skoog's (1962) basal medium containing 3.0%, sucrose and gelled with 0.8% agar was used. Different concentrations of phloroglucinol (50, 100 and 250 mg l⁻¹) and TDZ (0.1–1.0 µM) were incorporated in the culture medium alone and in combination with BAP. MS medium containing 1.0 mg l⁻¹ BAP served as control.

Results and Discussion: The combination of BAP (1.0 mg l⁻¹) and PG (250 mg l⁻¹) was effective in inducing adventitious shoot buds. An average of 10.2 shoot buds per explant were produced which was higher than the shoot buds produced by 1.0 mg l⁻¹ of BAP alone. The role of PG to stimulate adventitious shoot buds has been reported in other cases. Addition of TDZ alone in the medium produced single shoot per explants. The combination of 1.0 mg l⁻¹ of BAP and 0.1 µM of TDZ produced average of 9.7 shoot buds per explant which was almost equal to the average number of shoot buds produced by 1.0 mg l⁻¹ of BAP alone. Similar results have been observed in *F. limonia* and *Prunus* spp.

Conclusions: It can be concluded that new growth factors in combination with BAP are effective in producing adventitious shoot bud induction. It is recommended that these growth factors can be used for *in vitro* regeneration and can be further tested for enhancing shoot growth and multiplication in *in vitro* grown plants.

Keywords: Growth factors, micropropagation, medicinal plants, *in vitro* differentiation

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ABSTRACT 20

Analyzing gene expressions and adaptive behaviour towards cold stress in a new perennial evergreen cold tolerant *Ocimum* HYBL-1 (inter specific hybrid back cross)

Pankhuri Gupta, Raj K. Lal and Sunita Singh Dhawan

ABSTRACT

Background: *Ocimum* is an important member of Lamiaceae; the genus includes about 35 species of aromatic annual and perennial herbs and shrubs. *Ocimum* genotypes were used for culinary and medicinal purposes. It is an important source of essential oils and aroma chemicals especially eugenol, methyl eugenol, linalool, methyl chavicol etc. Cold temperature caused stress in *Ocimum* species. Therefore a new perennial evergreen cold tolerant *Ocimum* HYBL-1 (inter specific hybrid back cross) with high herb and essential oil yielding linalool rich strain was developed, which demonstrated adaptive behaviour towards cold stress.

Materials and Methods: Cold tolerant and sensitive genotypes (HYBL-1, OB1 and OK) of *Ocimum* plants were divided into two groups: one group was under normal temperature as control and the other were subjected to low temperature at 4°C in cold room under the light and photoperiodic conditions for 10 days. We have analysed the morphology, glandular and non glandular trichome numbers, essential oil yield and oil content during cold stress treatment and during normal temperature as well physiology and gene expression analysis.

Results and Discussion: Glandular and non glandular trichome numbers, oil yield and oil content (Linalool) were increased in cold tolerant *Ocimum* HYBL-1 during cold stress treatment. The expression of genes involved in cold stress tolerance like HOS1, WRKY 53, LOS4, MYC4, COL5, MYC4, and BBD2 shows Upregulation. Phenylpropanoid biosynthesis pathway and trichome development genes was also analyzed by gene expression analysis that shows high expression in cold tolerant genotype of *Ocimum* during cold environment. Cold stress leads to many changes of physiological parameters such as membrane permeability, free proline content, malondialdehyde (MDA) content, and chlorophyll content. We have measured and compared under low temperature and normal temperature. The proline and MDA contents were increased compared with control; the chlorophyll content gradually decreased with the prolongation of low temperature stress.

Conclusions: This stress tolerance of the hybrid may involve changes at the whole-plant, tissue, cellular, physiological and molecular levels. In response to cold, many genes may be regulated differentially and their gene products function in providing stress tolerance to plants. Therefore, in this way, the traditional methods were being complemented by molecular techniques for enabling and supporting breeding programs. The developed evergreen hybrid could become a boon to various industries which are dependent upon the bioactive constituents of *Ocimum* species.

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Keywords: Cold tolerant, sensitive genotypes, *Ocimum*, glandular, non glandular trichome, gene expression analysis

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ABSTRACT 21

In vitro antidiabetic activity of *Eruca sativa*

M.H. Hetta

ABSTRACT

Background: *Eruca sativa* Mill. (Rocket) is a well-known vegetable and commonly used as a food by many people all over the world. This cruciferous plant contains a structurally unique glucosinolate in the edible leaves. Its potential effect as a preventive for cancer and its antioxidant activity were reported. The seed oil of Rocket showed amelioration not only in hyperglycemia but also in oxidative stress. The aim of this work is evaluation of the *in vitro* biological effect of Rocket as a leafy – green vegetable in diabetes by two mechanisms: Carbohydrate metabolizing enzymes and insulin – responsive tissues.

Materials and Methods: Evaluation of the antidiabetic activity of the edible leaves of *Eruca sativa* was performed *in vitro* by two ways: **a)** by testing the ethanol and water extracts on carbohydrates hydrolyzing enzymes (α -amylase, α -glucosidase and β -galactosidase); **b)** by the investigation of different extracts of Rocket: aqueous, ethanol, defatted ethanol, n-hexane – soluble fraction, saponifiable and unsaponifiable fractions by measuring muscle glucose uptake, assessment of the effect on G6Pase and adipogenesis.

Results and Discussion: Results of a) showed inhibitory effect for both extracts on the tested enzymes as a dose dependent, in a linear relationship with the concentrations used. Ethanol was more potent than water extract as inhibitor of the three tested enzymes when compared to Acarbose antidiabetic standard. For b) the ethanol extract and the saponifiable fraction showed the best results in stimulation of glucose uptake, inhibition of G6Pase and adipogenic activity.

Conclusions: These findings encourage the use of Rocket leaves as a potential nutraceutical in treatment and prevention of type 2 diabetes.

Keywords: *Eruca sativa*, rocket, antidiabetic, *in vitro* expression analysis

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ABSTRACT 22

Formulation and *in vitro* evaluation of colon specific drug delivery system of anthelmintic herb

Nishi Prakash Jain

ABSTRACT

Background: Colon targeted drug delivery is an appropriate approach to treat colonic diseases including helminthiasis. There are various approaches available to formulate CTDD like pH, time, pressure and bacteria dependent. Bacteria dependent approach seems quite promising due to its site specificity. Natural polysaccharides are not digested by upper GIT enzyme but they are degraded by bacteria present in colon. Selection of such natural polysaccharides has certain advantages to develop colon specific drug delivery of natural anthelmintic drug.

Materials and Methods: *Embelia ribes* (Vidanga) fruit's methanolic extracts were used as natural anthelmintic herb. guar gum and xanthan gum were taken as natural polysaccharides for CTDD. Tablets were prepared by direct compression method. Cellulose acetate phthalate is used for enteric coating of the prepared tablet. The coated tablets were tested *in-vitro* for their suitability as CTDD system. The drug release studies were carried at pH 1.2 for 2 h followed by at pH 7.4 and then at pH 6.8.

Results and Discussion: Preformulation study of *Embelia ribes* extract were performed for organoleptic properties, solubility study, FT-IR, Partition coefficient and UV estimation of *Embelia ribes* extract in 0.1 N HCl and 6.8 pH Phosphate buffer. Drug and excipient interaction study was performed by FT-IR and found no interactions. Twenty batches of CTDD of *Embelia ribes* extract were prepared and evaluated for various pharmacopeial tests. The weight of all tablets was found to be uniform with low standard deviation value which varies between 321 ± 0.135 to 320 ± 0.110 . The Percentage friability for all the formulations varies between 0.162 to 0.201. The percentage of drug content for batches were found between 97.15 to 98.67. The *in vitro* dissolution was carried out for all the batches. Three tablets were taken from each batch the release of colon targeted *Embelia ribes* extract tablet varied according to the type and concentration of polymer. The observation of research work suggested that the increasing polymer concentration of guar gum and xanthan gum the release of drug was slow.

Conclusions: Colon targeted drug delivery tablet of natural anthelmintic herb was developed. It was prepared by using guar gum and xanthan gum as natural polymers. Batches of guar gum and xanthan gum polymers resulted in good drug releasing properties and also better control in the release of the drug in colon for site specific treatment of helminthiasis.

Keywords: *Embelia ribes*, Cellulose acetate phthalate, xanthan gum

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ABSTRACT 23

Investigation of the pharmacognostical, phytochemical and antioxidant studies of *Phoenix sylvestris* Roxb. leaves

Pankhuri Gupta, Raj K. Lal and Sunita Singh Dhawan

ABSTRACT

Background: *Phoenix sylvestris* is a folk medicinal plant widely known as 'wild date palm'. This plant exhibits many pharmacological activities like antioxidant, anthelmintic, antimicrobial, cytotoxic, erythropoietic, antidiarrhoeal, analgesic, diuretic, anti-ulcer etc. properties. The identity, quality, purity and safety of herbal drugs should be assured by standardization and authentication techniques. The current research aimed to investigate the pharmacognostical, phytochemical and antioxidant activity of leaves of *P. sylvestris*.

Materials and Methods: The leaf parts of *P. sylvestris* were studied for their organoleptic and microscopic characteristic was carried out using standard procedures. The physico-chemical constants such as moisture content, ash value, percentage extractive value with different solvents and fluorescence analysis were studied. Various extracts of leaf of *P. sylvestris* were prepared in different solvents namely petroleum ether, chloroform, methanol, hydroalcoholic (50% methanol) and aqueous respectively by cold maceration method. Percentage yield of respective extract was calculated and subjected to various chemical tests for detection of various secondary metabolites as well as to determine amount of total phenolic content (TPC) and total flavonoids content (TFC) by Folin-Ciocalteu and aluminum chloride colorimetric assay respectively in different plant extracts. Various extract of leaves were subjected for antioxidant activity using two *in vitro* assay methods viz. DPPH and super oxide scavenging assay and calculated IC_{50} value.

Results and Discussion: Morphology and microscopic study revealed the presence of bluish green appearance on both side and sclerenchymatous patches, more or less in parallel series and used as I-girders in order to bear withstanding shearing stress. Powder analysis displayed the presence of square-like and pentagonal prismatic crystals of calcium oxalate crystals, ovoid and globular starch grains, boarded pitted vessel and unicellular trichomes. Moisture content was found to be $6.0307 \pm 0.59\%$ w/w whereas ash value demonstrated more amounts of inorganic content ($6.492 \pm 0.36\%$ w/w) and maximum extractive value were found in hydro-alcoholic and minimum in petroleum ether solvent. The florescent studies confirmed and authenticated purity of drug. The results of phytochemical screening of various extracts showed the presence of glycosides, alkaloids, carbohydrates, phenolic compounds, flavonoids, fixed oils and fats. The methanolic extract was found to have maximum amount of TPC (85.81 mg GAE/g) and TFC (125.6 mg RU/g). The methanolic extract of leaves showed maximum DPPH and superoxide scavenging activity or minimum IC_{50} value (4.29 ± 0.67 ; 10 ± 0.68 μ g/ml) respectively.

Conclusions: Various pharmacognostical and physico-chemical parameters have pivotal roles in identification, authentication and establishment of quality parameters of this plant. TPC and TFC in various extracts of leaves of *P. sylvestris* could be used as good antioxidants in curing different diseases.

Keywords: *Phoenix sylvestris*, TPC, TFC, physico-chemical constant

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ABSTRACT 24

Quantification of flavonoids by HPTLC in methanolic leaf extract of *Phoenix sylvestris* Roxb.

Pankaj kumar Jain, Sonika Jain, Swapnil Sharma and Sarvesh Paliwal

ABSTRACT

Background: Herbal therapy is eventually based on the knowledge and practitioner skills. In India, local plants, as well as shrubs, can be procured easily due to influence of ancient Ayurveda. Taking into due considerations, we investigated *Phoenix sylvestris* which is also commonly known as wild date palm. Phenolic, flavonoid and tannin contents are usually associated with antioxidant ability of medicinal plants. Antioxidant activities of the plant also found to be linked with various pharmacological activities, such as anti-tumor, anti-ulcer and anti-diabetic activities. In the current research studies, our aim was to quantify flavonoid metabolites in methanolic extract of leaves of *P. sylvestris* by using HPTLC analysis.

Materials and Methods: Methanolic extract of leaves of *P. Sylvestris* was prepared and further performed phytochemical screening to confirm the presence of phenol and flavonoids. These flavonoid (rutin and quercetin) which were found positive by thin layer chromatography quantified by HPTLC method. Stock solution of methanolic leaf extract (1mg/ml) was prepared and stock solutions of rutin (0.1 mg/ml) and quercetin (0.025mg/ml) were also prepared in methanol. Different volume of stock solution 2-10 μ l was spotted on HPTLC plate to obtain desired concentration. Evaluation by using a scanning TLC scanner was carried out in the absorbance mode at 254nm and the results were visualized using CAMAG Visualizer.

Results and Discussion: HPTLC analysis was carried out in chloroform: methanol: formic acid (2: 8: 0.2) and toluene: ethyl acetate: formic acid (5:4:1) as mobile phase for rutin and quercetin respectively. The presence of rutin and quercetin was further confirmed by different RF value (0.71 and 0.53). Calibration graph of rutin was also plotted and found linear with $r^2 = 0.99094$, $sdv = 9.54\%$. From the calibration graph LOD and LOQ was also calculated and found as 125.01 and 204.92 ng/spot. Amount of rutin quantified was approximately 464.26ng and 546.57ng in 5 μ l and 10 μ l concentration of methanolic leaf extract. Similarly, calibration graph of quercetin was also plotted and found linear with $r^2 = 0.99811$, $sdv = 4.42\%$. From the calibration graph LOD and LOQ was also calculated and found as 61.92ng/spot and 253.395ng/spot. Amount of quercetin quantified was approximately 45.78ng and 61.42ng in 5 μ l and 10 μ l concentration of methanolic leaf extract.

Conclusions: Present study clearly indicated presence of the bioactive quercetin and rutin in methanol extract of *P. sylvestris*. Notably, HPTLC fingerprinting profile in the present study will be helpful as diagnostic tool in identifying and determining the quality and purity of various *P. sylvestris* formulations.

Keywords: *P. sylvestris*, HPTLC, rutin, quercetin

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ABSTRACT 25

In vitro tuber formation and plant regeneration in *Ceropegia bulbosa*

Sunita Jain

ABSTRACT

Background: *Ceropegia bulbosa* is a member of family Asclepiadaceae. Active principles of tuberous roots contain an alkaloid ceropegin and other components that form important ingredients in several conventional drug preparations. Naturally plant is propagated through seeds and tubers. Removal of tubers associated with poor seed set and germination, made it an endangered species. *In vitro* tuber formation has added advantages over clonal propagation in terms of handling, storage, transport and better survival of pathogen-free stock in soil. Thus attempts were made to micro-propagate through tuber formation.

Materials and Methods: *In vitro* grown hypocotyl explants were grown on B₅ medium containing varying concentrations and combinations of NAA and Kn. Callus obtained was transferred to B₅ medium with different concentrations of BAP and 25mg/l adenine sulphate. Nodal stem explants were also placed horizontally on the same medium. Multiple shoots were separated and transferred on B₅ (1/4 salts) medium containing 0-9.8µM IBA. To initiate tubers, *in vitro* produced plantlets and stem explants were transferred on B₅ (1/4salts) medium containing 2.2-17.6µM BAP and 0.58 or 0.1168M sucrose.

Results and Discussion: Hypocotyl explants produced callus on B₅ medium containing NAA (1.33-2.65µM) with Kn (0.1µM). Callus produced a few shoots on B₅ medium (1/2 and 1/4 salt strengths) containing 4.4µM BAP. In case of stem explants, 2-3 shoots per node with 1-2 cm length is observed. Low concentrations (0.49-4.9µM) of IBA were stimulatory to root induction. Optimum was 4.9 µM IBA. 100% shoots rooted within 5 days with maximum number (10 per shoot) of roots. Thus plantlets could be obtained in 8 weeks. *In vitro* produced plantlets and callus produced tubers on B₅ medium containing BAP (8.8 µM) and sucrose (0-12 M) while stem explants placed vertically on the same medium produced single tuber. Direct tuber formation at the base of stem explants and their transfer to field with better survival produced one plant per explant. This rate of multiplication was low but an endangered species can be safely multiplied without destroying the mother plant.

Conclusions: Low salt strength supported better growth. Direct tuber formation at the base of stem explants was achieved. High sucrose and cytokinin induced multiple tubers through callus which can provide a rapid rate of multiplication. Thus it may be concluded that although success has been achieved in multiplication of *C. bulbosa* there is a scope for further improvement and refinement of the technique.

Keywords: Endangered species, clonal propagation, *in vitro*, multiple tubers

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ABSTRACT 26

Photo-degradation of erythrosin-b in the presence of tin dioxide

Yuvraj Kunwar Jhala, Brajpal Singh and Vishnu Priya Jhala

ABSTRACT

Background: Water pollution is one of the world's greatest problems today. The domestic use and industrial activity, especially in developed countries, produce large amount of wastewater. The release of dyes into the environment constitutes a large proportion of water pollution. The coloured waste waters represent a serious environmental problem and a public health concern. Several methods have been used for the removal of dyes from the environment, including physical, chemical and biological processes, but each one has its own advantages and limitations. Photocatalytic treatment methods are favored as they are considered eco-friendly and relatively low cost for the degradation of these pollutants.

Materials and Methods: The photocatalytic degradation of erythrosine-B was studied in presence of semiconductor tin dioxide. The progress of the reaction was observed spectrophotometrically at 520 nm. The effect of various operating variables like pH, concentration of dye, amount of semiconductor and light intensity on the rate of degradation was observed.

Results and Discussion: It was found that the solutions of the first three beakers had almost the same optical density as their initial value while it decreases in the solution of the fourth beaker. From this observation, it becomes clear that this reaction required the presence of both; light and the semiconductor tin dioxide. Hence, this reaction is photocatalytic in nature. A decrease in optical density of erythrosine- B solution was observed with increasing time of exposure. The typical run for the photocatalytic degradation of erythrosine- B in the presence of SnO_2 photocatalyst has been observed

Conclusion: On the basis of the experimental observations photocatalytic degradation of erythrosine-B may be proposed that erythrosine- B (EB) absorbs radiation of suitable wavelength and it is excited to its first singlet state followed by intersystem crossing (ISC) to triplet state. On the other hand, the semiconducting tin dioxide also utilizes the incident light energy to excite its electron from valence band to conduction band thus, leaving behind a hole. This hole may abstract an electron from hydroxyl ions to generate hydroxyl radicals. These hydroxyl radicals will then oxidize the dye to its leuco form, which may ultimately degrade to products.

Keywords: Photocatalytic degradation, erythrosine-B, water pollution, semiconductor

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ABSTRACT 27

Assessment of plant growth promoting characteristics of *Pseudomonas oryzae* PSB 55 isolated from rhizospheric soil of *Acacia* species

Monica Sen and Harshada Joshi

ABSTRACT

Background: Plant growth-promoting rhizobacteria are commonly used in agriculture as biofertilizers for improving crop yields. They promote plant growth directly by either facilitating resource acquisition (nitrogen, phosphorus and essential minerals) or modulating plant hormone levels, or indirectly by acting as bio-control agents. Rhizobacteria possessing plant growth promoting characteristics can provide an option for revegetation of barren lands. Considering the above facts plant growth promoting characteristics of *Pseudomonas oryzae* PSB 55 were determined in the present study.

Materials and Methods: The plant growth promoting characteristics including phosphate solubilization, production of indole acetic acid (IAA), siderophore and ammonia of *Pseudomonas oryzae* PSB55 were studied. The content of inorganic phosphate solubilized by the isolate was estimated in Pikovskaya (PVK) broth (pH 7) containing 0.5% tricalcium phosphate (TCP) at 37°C and 180 rpm for 10 days by molybdate-blue method. The production of IAA by the isolate was determined in nutrient broth supplemented with 1000µg/ml of L-tryptophan at 37°C after 48 h at 180 rpm. Qualitative estimation of production of siderophore and ammonia was done by standard methods. All the experiments were done in triplicate.

Results and Discussion: The strain PSB 55 was isolated on Pikovskaya (PVK) agar containing 0.5% TCP from rhizospheric soil sample of *Acacia* species growing in tailing dam of Zawar mines Udaipur, India. It was identified as *Pseudomonas oryzae* PSB 55 by 16S rRNA sequencing. The isolate solubilized 233µg/ml phosphate in PVK broth (pH 7) containing 0.5% TCP at 37°C and 180 rpm after 10 days. The amount of IAA produced *in vitro* was 29.2µg/ml in nutrient broth supplemented with 1000µg/ml of tryptophan at 37°C after 48 h of incubation at 180 rpm. The yellow-orange halo zone (10 mm) was observed around the colonies of *P. oryzae* PSB 55 on CAS agar plate which confirmed the production of siderophores. The isolate (grown in peptone water at 37°C for 48 h) produced yellow-brown colour on addition of 0.5 ml Nessler's reagent confirming the production of ammonia.

Conclusions: The isolate *P. oryzae* PSB 55 showed tremendous plant growth promoting characteristics. In future optimization studies for phosphate solubilization can be conducted which may reveal the use of isolate as an efficient approach to replace chemical phosphorus fertilizers for fostering sustainable agriculture.

Keywords: Phosphate solubilization, *Pseudomonas oryzae* PSB 55, Pikovskaya agar, Indole acetic acid, siderophores

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ABSTRACT 28

Diversity-oriented synthesis of novel benzimidazole via IMCR

Irfan Khan and A.K. Goswami

ABSTRACT

Background: Benzimidazole with unsubstituted NH groups, exhibit fast prototropic tautomerism which leads to equilibrium mixtures of asymmetrically substituted compounds. The benzimidazole scaffold is a useful structural modification for the development of molecules of pharmaceutical or biological interest. Appropriately substituted benzimidazole derivatives have found diverse therapeutic applications such as in antiulcer, antihypertensive, antiviral, antifungal, anticancer, and antihistaminics. The optimization of benzimidazole-based structures has resulted in various drugs that are currently on the market, such as omeprazole (Proton pump inhibitor), pimobendan (Ionodilator), and mebendazole (Anthelmintic). It played a very significant role in various multicomponent reactions which have become increasingly popular as tools for the rapid generation of small-molecule libraries.

Materials and Methods: Recently, multicomponent reactions (MCRs) have been emerged as a powerful tool for the synthesis of biologically important heterocycles. Among these MCRs, the isocyanide based multicomponent reactions have attracted the chemist attentions during the past years. The most popular IMCR is probably the Ugi reaction in which a carboxylic acid, a primary amine, an aldehyde, and an isocyanide react in a one-pot manner to afford N-substituted acyl aminoamide containing four independently varying groups in one reaction.

Results and Discussion: In an experiment, equimolar amounts of diverse acid, aldehyde, amine and tert-butyl isocyanide were stirred in methanol at room temperature, which further used without purification in subsequent deprotection-cyclization with 10% trifluoroacetic acid in dichloromethane yielded various diverse benzimidazole derivatives.

Conclusions: In summary, we have developed a new methodology to the synthesis of highly diverse benzimidazole derivatives in excellent yields via post Ugi reactions. In our first approach we have used isocyanide based Ugi-reaction followed by acid catalyzed condensation reaction in microwave conditions for the synthesis of benzimidazole.

Keywords: Isocyanide, ugi-reaction, benzimidazole derivatives

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ABSTRACT 29

Assessment of genetic stability in micropropagated *Wrightia tomentosa* (Roxb.) Roem et Schult using molecular markers

Khushdil Khan and S. D. Purohit

ABSTRACT

Background: *Wrightia tomentosa* (Roxb.) Roem et Schult. locally known as “Dudhi” or “Khirna” is a small, deciduous tree found as an undergrowth in the open mixed deciduous forests in Aravallis in south-east Rajasthan. The tree is valued for its wood used for turnery, carving and toy making. The aim of this study was to assess variability/ stability among tissue culture raised plantlets of *W. tomentosa* using molecular markers.

Materials and Methods: For the present study, DNA isolation was done using CTAB method, various parameters of PCR, like concentration of genomic DNA, primers, dNTP, Taq polymerase, MgCl₂, annealing temperature, and number of cycles were optimized using different concentrations. After the optimization of PCR conditions genomic DNA was subjected to PCR amplification using RAPD at their different culture cycles.

Results and Discussion: A total of 53 decamer primers were used for initial screening, out of which 37 primers gave 259 distinct and scorable bands. Each primer produced a unique set of amplification. ranging from 200 bp to 3000 bp in size. The number of bands for each primers varied from 3 to 11 with an average of 7 bands per primer. All regenerants at their different culture cycles produced monomorphic bands showing complete uniformity among them and with their mother plant. Although minor variations in RAPD profiles were detected in terms of band intensity but the number and size of the bands were similar in all the samples. No significant variation was observed in any of the profiles.

Conclusions: In the present study the results indicated that plants were genetically stable in long-term cultures. Our results confirm that genetic markers are reliable in testing of plant genetic stability among *in vitro* raised propagules and in present case it was proved that all the plants up to nine culture cycles of three subculture passage (21 d) showed complete genetic stability.

Keywords: Explants, micropropagation, indole 3-butyric acid, RAPD markers, genetic stability, micropropagation, axillary branching

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ABSTRACT 30

Upgradation of biomass cracked bio-oil by olefination/esterification method

Nishu Khurana, Dharambeer Singh and Puneet Kaur

ABSTRACT

Background: Different bio-oil up-gradation techniques, like hydro-deoxygenation, catalytic cracking, emulsification, steam reforming, esterification and reactive rectification have been investigated by different researchers. Nevertheless, these are complicated techniques due to reasons, e.g., complex equipment for hydro-treatment, catalyst deactivation, reactor clogging and high cost of emulsification. The present investigation was aimed to solve the bio-oil upgradation associated problems. Upgradation of the biomass cracked bio-oil using alcohol-acid catalyzed olefination/esterification was explored. In this work, a low-cost solvent and reagent, ethanol was used.

Materials and Methods: The feedstock with 10% moisture (dry weight) yields 60% of the bio-oil at 400–450°C. For the study, alcohol (30 % weight), olefin (10 % weight) and K_2CO_3 (5% weight) were added to bio-oil in a high pressure autoclave reactor, at reaction temperature of 250°C followed by continuous stirring for 90 minutes. Following this the reactor was allowed to cool down and olefinated bio-oil was collected and centrifuged at 4000 rpm for 3 hours. The resultant phases were separated by separating funnel. The olefinated bio-oils obtained were later, characterized using ASTM methods.

Results and Discussion: The olefination/esterification of the raw bio-oil produced the bio-oil with improved stability. These upgradation reactions decreased the acid value, moisture content and raised calorific values. Ethanol has less viscosity as compared to butanol and was less effective in improving the characteristic properties of the raw bio-oil. The butanol demonstrated the moderate upgradation whereas olefination reaction with octanol exhibited 60% decrease in acid value and calorific value was elevated to twice as compared to the calorific value of the raw bio-oil. The water content has also been observed to decrease by 80%. The resulting olefinated bio-oils were found to have improved stability and enhanced fluidity.

Conclusions: Catalytic olefination and esterification has a key role in bio-oil upgradation. In the present study, olefination of raw bio-oil with three different alcohols produced upgraded bio-oil. However, octanol was proved to be the best option for the olefination process. The study shows that there is need of better and low cost reagents and catalyst to provide upgraded bio-oil, a promising alternative fuel.

Keywords: Bio-oil; upgradation; esterification; olefination

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ABSTRACT 31

Applications of nanoemulsion system in delivery of bioactive compounds

Manish Kumar

ABSTRACT

Food components with health benefits are known as bioactive compounds and naturally found in small quantities in certain foods. The health-promoting bioactive compounds are generally sensitive to oxygen, light, heat, and water. These compounds have low bioavailability due to their poor aqueous solubility and high first-pass metabolism in gastrointestinal tract after oral administration. These factors limit the shelf life and systemic bioavailability of bioactive compounds. Nanoemulsion systems have the potential to overcome the above-mentioned problems associated with the oral administration of the bioactive compounds. Nanoemulsion is a thermodynamically unstable colloidal dispersion with droplet size from 10-200 nm. Nanoemulsion systems are an efficient approach for the systemic delivering of bioactive compounds. These food grade nanoemulsion systems are more stable and less sensitive to oxygen, light, and heat. Nanoemulsion systems are effective in reducing the high first-pass metabolism in gastrointestinal tract thus enhancing the bioavailability of bioactive compounds. The nano-size of droplets of nanoemulsions enhance the bioavailability, bio-distribution and improve the pharmacokinetic parameters. Thus, nanoemulsion systems are the appropriate carriers for delivering bioactive compounds. This review is mainly focused on different techniques for the preparation of nanoemulsion systems of bioactive ingredients. Both high energy and low energy methods have been used for the formulation of nanoemulsion systems. High energy approaches such as ultrasonicators, microfluidizer, and high-pressure homogenizers have been widely used to form nanoemulsion of bioactive ingredient. Low energy methods such as phase inversion and self-nanoemulsification methods have also been used for formulation of nanoemulsion containing bioactive compounds.

Keywords: Nanoemulsion, colloids, bioactive compounds, bioavailability

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ABSTRACT 32

Synthesis of bis ethoxyphthalimido derivatized Schiff's bases and evaluation of antimicrobial activity

Monika Kumawat and G.L. Talesara

ABSTRACT

Background: Alpha substituted hydroxylamine derivatives including alkoxyphthalimide and related moieties are a class of functionality which has considerable interest in field of pharmaceutical chemistry. Combination of these two moieties in a molecule may cause appreciable modification in their biological behavior and other life activities. Present investigation involves the synthesis, characterization and biological evaluation of some heterocyclic combinations containing oxygen substituted hydroxylamine derivatives.

Materials and Methods: 2,2'-(1,4-phenylenebis (azan-1-yl-1-ylidene)) dithiazolidin-4-one has been synthesized by the reaction of chloroacetic acid with 1,4-phenylene dicarbamimidothioate in the presence of anhydrous sodium acetate in absolute alcohol which in turn was obtained from 1, 4- diaminobenzene and ammonium thiocyanate in hydrochloric acid media. The reactive methylene group on the thiazolidinone ring of compound was condensed with various substituted aldehydes to give 5-benzylidene-2-(4-5-benzylidene-4-oxothiazolidin-2-ylidene) amino) phenylimino) thiazolidin-4-one. These on condensation with bromoethoxy phthalimide afforded 2-(2-5-benzylidene-2-(4-5-benzylidene-3-(2-(1,3- dioxoisindolin-2-loxy)ethyl)-4-oxothiazolidin-2-ylidene) amino)phenylimino)-4-oxothiazolidin-3-lyethoxy)isoindoline-1,3-dione. Alkali assisted cyclization of in dioxane media with guanidine nitrate furnished 2,2'-(1,4-phenylenebis(azan-1-yl-1-ylidene))bis(5-amino-7-phenylthiazolo[4,5-d]pyrimidine-3(2H)-yl-2(2H)-ylidene)bis(ethane-2,1-diyl))bis(oxy)diisoindoline-1,3-dione. The free amino group on pyrimidine ring of was condensed with substituted aldehydes to yield Schiff's bases 2,2'-(1,4-phenylenebis(azan-1-yl-1-ylidene))bis(5-(-4-chlorobenzylidene-amino)-7-phenylthiazolo[4,5d]pyrimidine-3(2H)-yl-2(2H)-ylidene)bis(ethane-2,1-diyl))bis(oxy)diisoindoline-1,3-dione.

Results and Discussion: Formation of NH_2 substituted pyrimidine rings in was confirmed by ^1H NMR spectra as singlet at δ 6.78 for NH_2 proton. These compounds were condensed with various 4-substituted aldehydes in the presence of anhydrous sodium acetate/glacial acetic acid to furnish corresponding 2,2'-(1,4-phenylenebis(azan-1-yl-1-ylidene))bis(5-(-4-chlorobenzylideneamino)-7-phenylthiazolo[4,5-d]pyrimidine-3(2H)-yl-2(2H)-ylidene)bis(ethane-2,1-diyl))bis(oxy)diisoindoline-1,3-dione derivatives. Formation of these was confirmed by disappearance of NH_2 peak of its precursor.

Conclusions: Compounds having ethoxyphthalimide moiety are more active against bacterial and fungal strains than lacking this moiety. Compounds having methoxy and chloro substituents show enhanced activity.

Keywords: Bromoethoxyphthalimide, pyrimidine, Schiff's bases, thiazolidinone

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ABSTRACT 33

An efficient microwave-assisted regioselective synthesis of imidazo[2,1-b]thiazole scaffold

Arpita Matta, Maruti N. Naik and Renu Rathor

ABSTRACT

Background: Thiazoles scaffold represent one of the most crucial classes of bioactive compounds, and have been playing a pivotal role in modern medicinal chemistry. They also are present in various natural products and organic dyes. Among all thiazoles derivatives, Imidazo[2,1-b]thiazole ring systems are one of the most attractive construction. Groebke- Blackburn- Bienayme (GBB) reaction is an important class of isocyanide based multicomponent (IMCR) name reaction employed widely for the synthesis of Imidazo[2,1-b]thiazole ring systems.

Materials and Methods: Classically GBB reaction is a, four-centre, three-component reaction, which necessarily involves a reaction among an aldehyde (1), thiazol-2-amine (2) and an isonitrile (3) in the continuation of a appropriate catalyst, which is usually a Bronsted acid or Lewis acid, to afford a highly substituted and fused thiazoles derivatives (4) (Fig. 1).

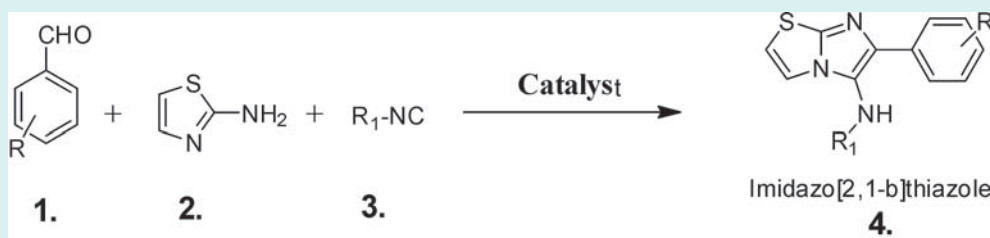


Fig 1. Groebke – Blackburn – Bienayme MCR

Results and Discussion: A set of experiments were carried out using 2-aminothiazole (1a), 3,4,5-trimethoxybenzaldehyde (2a), and t-butyl isocyanide (3a) in solvent-free condition as a test reaction for optimum reaction conditions.

Conclusions: In summary, we have accounted a exceptionally efficient approach for the synthesis of thiazole-fused polyheterocycles via Groebke- Blackburn- Bienayme reaction catalyzed by iodine catalyzed. This synthetic approach has various excellent characteristics such as good yields, less reaction time, operational simplicity, ultimately foremost to a diverse array of medicinally-relevant Imidazo[2,1-b]thiazole ring systems.

Keywords: Groebke- Blackburn- Bienayme reaction, thiazole-fused.

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ABSTRACT 34

Synthesis of silver nanoparticles through medicinal plants and its antimicrobial activity against pathogens

Mansi Mishra and Kavya Dashora

ABSTRACT

Nanotechnology has now become one of the promising technologies in all the areas of science. Among several metal nanoparticles silver nanoparticles have attained a great focus. Silver nanoparticles are usually synthesized by chemical method by using chemicals as a reducing agents which could later cause various biological risks to the environment due to its toxicity. Thus, an alternative approaches are coming up which include the biological synthesis of silver nanoparticles. The present review explores the biological synthesis of silver nanoparticles using various medicinal plant extracts which is easy, cost effective and ecofriendly green technology as it does not involves the use of harmful toxic chemicals. This review also describes the antimicrobial activity of biologically synthesized silver nanoparticles from extract of medicinal plants against various pathogens of bacteria. As recent studies showed that medicinal plants are found to be very effective in treating diseases caused by the microbes by producing active compounds during secondary metabolism but have low penetrating ability. Since nanoparticles have high penetrating ability so it was found through various reports that silver nanoparticles synthesized from the extracts of medicinal plants have shown good antimicrobial efficacy as compared to the other plant extracts any may prove to be an efficient antimicrobial agent against wide range of microbes.

Keywords: Nanoparticles, biological synthesis, green technology, antimicrobial activity

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ABSTRACT 35

The adsorptive removal of cadmium (II) ions from aqueous solution using “sawdust” as an adsorbent

Kshipra Nimodia and A. K. Goswami

ABSTRACT

Background: Adsorption is the most used process for its inexpensiveness, ease of operation and insensitivity to toxic pollutants. Among the recently investigated adsorbent materials sawdust is one of the most appealing agricultural waste materials for removing heavy metals from water and waste water. The use of heavy metals along with the associate risks of metal pollution has increased to a great extent over the recent times. Cadmium is one of the most harmful toxic metals. In present study, removal of the Cd (II) ions with the economical and efficient adsorbent sawdust was investigated. In view of this, the present paper describes the removal of Cd (II) ions from sawdust which is a low cost adsorbent.

Materials and Methods: In this work, adsorption of Cd (II) ions on sawdust has been studied by using batch technique. For the removal of Cd (II) ions from aqueous medium various adsorption parameters such as effect of temperature, pH, soaking time, adsorbent dosage and metal ion concentration were optimized. Determination of Cd (II) was done using Atomic Absorption Spectrophotometer.

Results and Discussion: Both Freundlich and Langmuir isotherms were studied and it was observed that the system followed both isotherms at room temperature. The pH range it best works is between 5.5-6.5. The material has shown good removal capacity 94-95% from solutions having Cadmium concentration varying between 100-1000 ppm from synthetic solution. It has been found that 40 minute soaking time with stirring is sufficient for removal. The optimum quantity of adsorbent for removal of Cd (II) is 0.08 g/ml of solution.

Conclusions: From these results, it can be concluded that the sawdust with removal efficiency 94-95% is a good adsorbent for toxic metal ions from aqueous solution.

Keywords: Groebke- Blackburn- Bienayme reaction, thiazole-fused.

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ABSTRACT 36

Low cost technology development for mass scale production of *Podophyllum hexandrum* Royale

Monu Dinesh Ojha

ABSTRACT

Podophyllotoxin is a natural occurring lignin and potent cytotoxic which acts on the spindle fibres during mitotic division showing anticancer properties similar to drugs like paclitaxel and camptothecin. Semi-synthetic derivative of podophyllotoxin viz., etoposide, teniposide and etopophos are widely used as anticancer drugs showing good clinical effects against several types of neoplasms, including testicular and small cell lung cancers, lymphoma, leukemia, Kaposi's sarcoma, etc. This has led to the over-exploitation of *Podophyllum* as an economic source of lignans. Currently the commercial sources of podophyllotoxin are the rhizomes and roots of *P. hexandrum* an endangered species from the Himalayas having scarcity of plant occurrence and lack of organized cultivation. *P. hexandrum* plant has a long juvenile phase, poor fruit setting ability, and prolonged germination period, low yield which makes it an expensive raw material for chemical synthesis of its derivatives. The starting material for synthesis of etoposide and teniposide is very complicated and hence the production of the drug ultimately depends on the availability of raw materials. The seeds of *P. hexandrum* remain dormant for about 10 months under natural conditions. The mass production of plant can be done through plant tissue culture to increase the availability of plant and raw material for extraction of phytolignan. To reduce the seed dormancy duration, plant cell and organ cultures are considered as an attractive alternative. Destruction of plant populations due to over exploitation or natural calamities affects the content of bioactive secondary metabolite in the plant and drug manufacturing and supply. Therefore, immediate thrust has to be given for generating reliable conventional protocols of mass cultivation of *P. hexandrum*. The pathways for chemical synthesis of phytolignan is not well defined for *in vitro* synthesis which can be a potential way for sustainable supply of phytolignan for medicinal purpose. The standardization of procedure for *in vitro* synthesis of semi-synthetic molecules needs to be done. Currently, Etoposide, Vumon, Etopophos, Pod-Ben-25, Condofil, Verrusol, and Warticon are available in the market. In fact, podophyllotoxin is used as main ingredient by many pharmaceutical companies. Condylone, are using it as its main constituent for the treatment of various skin diseases. Due to increasing industrial demand, highly complex synthesis and low cell culture yields of podophyllotoxin (0.3%), the supply of raw material cannot be met. Further increase in podophyllotoxin content can only be achieved through genetic interventions in podophyllotoxin biosynthetic pathway. However, knowledge of podophyllotoxin biosynthetic is fragmentary with missing links in the pathway as well as lack of relative contribution of pathway steps in podophyllotoxin content. Podophyllotoxin and its derivatives are derived from the shikimic acid/phenylpropanoid pathway. Few studies on *Forsythia* (Oleaceae), *Linum* and *Podophyllum* led to the proposition of a pathway. Phenylalanine may be used for preparation of Coniferyl alcohol using phenylpropanoid enzymes, which is further used to prepare lignin and lignans to yield pinoresinol. This compound is converted ...contd.



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into matairesinol, produces deoxypodophyllotoxin. Using enzymology studies the enzymes involved in the biosynthesis and the incorporation into podophyllotoxin of ferulic acid and methylenedioxy substituted cinnamic acid. The preparation of podophyllotoxin using synthetic chemical is the also a suitable option. The low cost technology development for increasing the population of *P. hexandrum* through mass production both *in vitro* and *in vivo* is being developed at Indian Institute of Technology, Delhi in Centre for Rural Development and Technology. The *in vivo* cultivation will also help in plant restoration and livelihood generation for the native rural population.

Keywords: *Podophyllum hexandrum*, *Forsythia*, enzymes

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ABSTRACT 37

A validated HPTLC method for quantification of ellagic acid- an important flavonoid from leaf, bark, fruit and root of *Terminalia arjuna*, *T. bellerica* and *T. chebula*

Masuma Hakim, Jitendriya Panigrahi and Illa Patel

ABSTRACT

Background: *Terminalia* species contain polyphenolic compounds such as caffeic acid and gallic acid derivatives and other flavonoids which have antioxidant properties. Even though a large information is exist related to the antitumour activities of ellagitannins and relevant compounds. Ellagic acid derives from the hydrolysis of ellagitannins in plants, which is used as chemopreventive agent and natural dietary antioxidant.

Materials and Methods: In the present work, a validated HPTLC method has been embellished for the simultaneous quantification of Ellagic acid from three *Terminalia* species viz. *Terminalia arjuna*, *T. bellerica* and *T. chebula*. It was validated for intra and interday precision, reproducibility and specificity and for quantification of Ellagic acid from its different parts viz. leaf, bark, fruit and root.

Results and Discussion: The intraday precision and interday precision was RSD 1.5% and 1.2% for respectively. The reproducibility of standard ellagic acid was precise and the seven lanes provides similar band pattern. The linearity curve for the Ellagic acid produce a correlation coefficient (r) value of 0.98992 with regression equation $Y=6330.441+935.150 \cdot X$ with an sdv value of 4.59%. For chromatogram development, toluene: ethyl acetate: formic acid (5: 5: 2.5) was optimized and used as mobile phase The above method was followed for the quantification of ellagic acid content in leaf, bark, fruit and root of *Terminalia arjuna*, *T. bellerica* and *T. chebula*. Except fruits of *T. bellerica*, all the other parts proficiently contain Ellagic acid and among them the highest content of Ellagic acid (0.733 $\mu\text{g}/\mu\text{g}$ dry weight) was found in the roots of *T. bellerica*.

Conclusions: The proposed HPTLC method for the simultaneous quantification of Ellagic acid was brought to be simple, sensitive, specific, and precise and can be recommended for routine quality control and the quantification of Ellagic acid in plant materials.

Keywords: Ellagic acid, HPTLC, quantification, *Terminalia bellerica*

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ABSTRACT 38

Molecular studies on microbes constructed wetlands and their applications for wastewater treatment

Bhagawatilal Jagetiya and Sunny Pathak

ABSTRACT

Constructed wetlands are becoming popular as decentralized wastewater treatment for smaller communities, where land is easily available and frequent power tripping prohibits the advocacy of highly mechanized plants. Constructed wetlands have proved for their treatment performance for physico-chemical and microbiological contaminants removal. This review covers a meta-analysis on microbial community assessment, methodology and its applications for focused pollutant degradation, system size and design, and regional trends. Future horizons indicate that the combination of high-powered meta-genomic sequencing, the development and utilization of functional assays such as DNA microarrays, and community level physiological profiling, in concert with activity assessment, enumeration, and newly-implemented stable isotope methodologies are moving the knowledge on CWs beyond the black-box paradigm. Most stable microbiota in these systems is found in the bio-film associated to the plant's roots and/or attached to the surface of the filter bed material. This complex microbial community created by interactions with wastewater, is mainly responsible for the degradation performance of the system. Furthermore, the diversity of microorganisms in this environment may be critical for its proper functioning and maintenance. To improve the design of CWs, a detailed knowledge of the structure of these communities should be acquired in order to understand the biological processes that are taking place within them. Recently, several studies have characterized microbial populations in laboratory scale units, sand filters and full scale constructed wetlands under specific conditions. However, there is a general lack of information on the diversity and changes of the microbial communities in long-term operation systems treating domestic wastewater at real time scale. There are rare or limited studies on finding new and beneficial endophytic microorganism and modulate their potential application for improving efficiency of CW.

Keywords: Constructed wetlands, endophytic microorganism, metagenomic, biofilm

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ABSTRACT 39

Biological activity of sulphanilamide based hydroxytriazenes and their cobalt complexes

Girdhar Pal Singh, N.S. Chundawat, Sultan Ismail Pathan, Vinay Kumar Singh, Shahnawaz Khan, R.S. Chauhan and A.K. Goswami

ABSTRACT

Background: A number of hydroxytriazenes and their metal complexes have been reported as antifungal, antibacterial, insecticidal, analgesic, anti-inflammatory and wound healing agents. However, only few complexes of transition metal ions with hydroxytriazenes have been screened for their biological activities. In the light of above facts the present work has been devoted to studies of biological activities of sulphanilamide based hydroxytriazenes and their Cobalt (II) complexes and compare them with the biological activities of pure ligands.

Materials and Methods: Biological activity of four hydroxytriazenes and their cobalt (II) complexes studied by cup or agar well assays method at 1000 ppm, antibacterial study screened against four bacterial strain *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Escherichia coli* and antifungal activities also screened against two fungal strains namely *Aspergillus fumigatus* and *Candida albicans*.

Results and Discussion: Results of studies have been expressed as zone of inhibition in millimeter and compare with standard drugs ciprofloxacin. It is interesting to note that HT No.(ii) and (iii) are most active and against all the three bacterial strains and most of the cobalt (II) complexes have shown better activities against three bacterial strains as compared to their respective hydroxytriazenes.

Conclusions: All the Cobalt (II) complexes are more active as compare to corresponding hydroxytriazenes against bacterial strain Thus, there is scope for further investigation for the use of hydroxytriazenes and their Cobalt (II) complexes as antibacterial agents. But in case of fungal studies all the four hydroxytriazenes and their Cobalt (II) complexes are moderate active against fungal strain but less active as compare to standard drugs ciprofloxacin.

Keywords: Hydroxytriazenes, Cobalt (II) complexes

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ABSTRACT 40

Neem leaf waste as a scavenger material for Cd (II) ions from aqueous medium

Meena Kunwar Rathore and A. K. Goswami

ABSTRACT

Background: The present work describes removal of Cd from aqueous matrix using neem leaf (dried powder) at room temperature. The metal removal has been determined by AAS. The effluent released from industries contains heavy metals which lead to the deterioration of the water quality. Day by day increased pollution in water needs development of an efficient way for purification and treatment of waste water. Among all the available methods, adsorption is proven to be an efficient technique. There are so many adsorbents like fly ash, marble slurry, clay, fuller earth etc but neem leaf and neem bark are low cost adsorbents, easily available and have good efficiency to adsorb heavy metals. The present paper describes application of neem leaf for removal of heavy metals from effluents.

Materials and Methods: For study of removal of Cd from aqueous matrix neem leaf (dried powder) was used as adsorbent at room temperature. Atomic adsorption spectroscopy is used to determine concentration of Cd (II) in aqueous matrix after adsorption experiment. For optimization of experimental parameters were studied in detail. They included: (I) concentration of Cd (II) adsorbent (III) solution pH (IV) stirring time (V) Effect of temperature.

Results and Discussion: The adsorption of Cd (II) ion onto neem leaf powder is well described by Langmuir and Freundlich adsorption isotherms. The maximum Cd (II) removal was 502.20mg of Cd (II) per gram of neem leaf as evaluated from Langmuir isotherm. Thermodynamic parameters like enthalpy, entropy and Gibbs free energy have been calculated and found to be 226.97 kJ/mol, 32.86kJ/mol K, and -9.74 kJ/mol, respectively. These parameters indicated that the process was spontaneous and endothermic in nature. It has been found that 1 g/l neem leaf is capable to removal of Cd (II) ions in the pH range of 5-10.

Conclusions: Neem leaf is an efficient adsorbent and having adsorption about 97-98% and this adsorbent is easily available and easily biodegradable.

Keywords: Neem leaf, Cadmium (II), Langmuir isotherm, Freundlich isotherm

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ABSTRACT 41

Micropropagation studies on *Terminalia bellerica* Roxb.- a review

Pravina Rathore

ABSTRACT

Terminalia bellerica Roxb. is an important medicinal plant forming essential ingredient of many ayurvedic formulations like "Triphala". Protocols using enhanced axillary bud proliferation method of micropropagation have been developed for mass multiplication of *T. bellerica*. These micropropagation method used nodal segments derived from 15-days old seedling and 10-30 year old mature tree. Sterilized nodal segments were placed on MS medium containing cytokinins (BAP/Kn) and/or auxins (NAA/IAA) for axillary bud proliferation. For multiplication same or modified medium have been used. Tissue cultured shoots were rooted *in vitro* and *ex vitro* using auxin/s. Various protocols differed in their medium composition and additives or elimination of ingredients was incorporated at various stages of micropropagation. Both types of explants exhibited bud proliferation easily on MS medium containing cytokinin. Of the hormones used during bud break, BAP was found most suitable for eliciting the response. Use of GA₃ along with combination of BAP and IBA resulted in lengthening of shoots after bud break. For multiplication same or modified medium was used. Protocols differed in their medium composition for multiplication stage. Auxins were incorporated to improve shoot multiplication while agar was reduced to improve shoot length. Additives like ascorbic acid, adenine sulphate, arginine and citric acid were used to control phenolic exudates in case of shoots derived from mature explant. Tissue cultured shoots were successfully rooted with IBA. Medium containing reduced strength of MS salts and IBA was most favorable for *in vitro* rooting. Better rooting response was obtained with *ex vitro* rooting. Shoots were pulse treated with IBA prior to their implantation on sterile Soilrite™ for *ex vitro* rooting. Rooted plants were successfully transferred to field.

Keywords: *Terminalia bellerica*, protocol, medium, multiplication, rooting.

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ABSTRACT 42

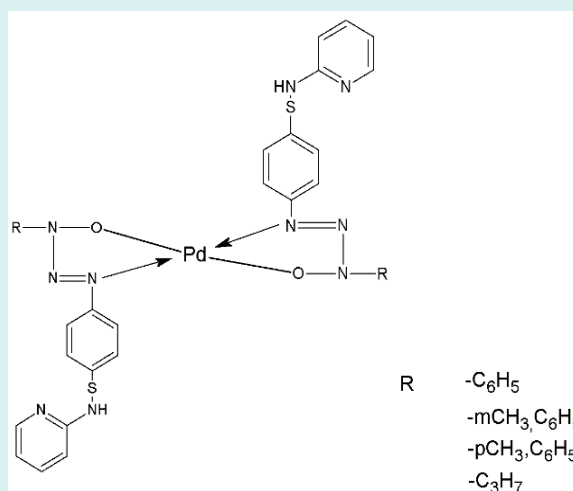
Anti-inflammatory, anti-oxidant activity of some hydroxytriazene-Pd (II) complexes

Pushplata Salvi, R. Dashora and A. K. Goswami

ABSTRACT

Background: Antioxidants are important in the prevention of human diseases and have ability to reduce the oxidative damage associated with many diseases, including cancer, cardiovascular disease, cataracts, atherosclerosis, diabetes, arthritis, immune deficiency diseases and ageing. Inflammation is the means by which the body deals with injury. Result may be caused: mechanically, physically, and by microorganism. Anti-inflammatory drugs that help to reduce inflammation, often helps to relieve pain. In the present study hydroxytriazene-Pd (II) complexes are used as antioxidant and anti-inflammatory agents.

Materials and Methods: Four hydroxytriazene-Pd (II) complexes were synthesized and screened for their anti-oxidant and anti-inflammatory activities. The composition of metal complexes was determined by Job's and mole ratio method of Yoe Jone's. Anti-inflammatory activity was screened by carrageenan induced paw edema method. The mean paw volume at different time intervals was calculated and compared with control. Antioxidant activity was screened by DPPH (Diphenylpicrylhydrazyl) method assay.



Results and Discussion: The composition of metal complexes was found to be ML₂ in alcoholic medium at pH 1.8-2.8, with a probable square planar geometry. The percentage inhibition was calculated and found 86.11% - 91.42% after four hours of treatment. The DPPH scavenging activity for complexes at 20-300 µg/ml are significant as evidenced by IC₅₀ value.

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Conclusions: Complexes revealed significant results for both activities comparable to standard drug.

Keywords: Hydroxytriazene-Pd (II) complexes, antioxidant, anti-inflammatory, DPPH.

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ABSTRACT 43

Exploring algae as an unconventional source of cosmetics, therapeutics and nutraceuticals

P. Saxena, M. Kumar, V. Sangela, P. K. Tak and Harish

ABSTRACT

Global demand for micro-algal based food is increasing mainly because of its benefits related with nutrition and health. Many algae have been explored and there are substantial evidences that show the nutraceutical potential of algae. More than one hundred species of algae at present are known to have good amount of proteins, carbohydrates, lipids, vitamins and minerals. But still at industrial level exploitation of these valuable aspects are not seems to be attractive till now. Very few attempts have been made at large scale such as use of *Spirulina* spp. as protein substituent, cyanovirin, a protein from *Nostoc* spp. as HIV inhibitor, for bioremediation and recently for biofuel production. Other than that products like agar, alginates, carrageenin are also obtained via algae. Food value of *Porphyra* spp. known as "nori" in Japan chiefly used in diet due to having fair amount of protein in dry weight (20-30%). *Fucus*, *Laminaria*, *Sargassum* and other algae are in use as fodder for animals. Some algal species have been identified which contain good amount of omega-3 fatty acid which is favoured by vegetarians and also have desirable amount of docosahexanoic acid (DHA), eicosapentanoic acid and astaxanthin. *Chara*, *Fucus* are the major source of phosphorous, calcium, potassium and several other elements and application of these algae helps to overwhelm from mineral deficiency. Medicinally some algae used as a source of antioxidants in cancer because it reduce the free radicals and prevent oxidative spoilage of the cells. Antiviral property of some marine algae is tremendous because their use is not associated with immune suppression which is generally carried out by the traditional antiviral vaccines. Algal oil is not subjected to production of peroxides and accumulation of toxins in food chain such as mercury, dioxins and polychlorinated biphenyls (PCBs) unlike fish oil which also contain omega-3 fatty acid. Algal oil is used in cosmetics and medicinally in cardiovascular disorders like in irregular heartbeats, reduce blood pressure, it reduce blood clotting formation time and also cause decrement in Low Density Lipid (LDL) level of blood and inflammation.

Keywords: Omega-3 fatty acid, astaxanthin, microalgae, high value compounds

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ABSTRACT 44

Leaf Succulence in some Desert Plants

Seema Sen and S. Sundaramoorthy

ABSTRACT

Background: Desert areas are characterized by poor and erratic precipitation, extremes of temperature with high diurnal and seasonal variation, and intense radiation. Such areas house sparse vegetation consisting mainly of true xerophytic, semi-tree form, semi-shrub, shrub or xerophytic succulent plants. Succulence is often seen as an anatomical trait common to plants with a high development of a water storage tissue, in one or various plant organs.

Material and Methods: To study leaf succulence, five plants viz. *Salvadora persica*, *Azardirachta indica*, *Cordia gharaf*, *Zizyphus mauritiana* and *Calotropis procera* were selected from rocky and gravelly habitat having broad leaves of different developmental stage. Leaf succulence was estimated using modified Delf's index.

Results and Discussion: *S. persica* and *A. indica* showed more succulence in mature leaves as compared to the young ones whereas in *C. procera* young leaves were more succulent than the matured. *C. gharaf* and *Z. mauritiana* didn't show any marked variation between young and mature leaves.

Conclusion: Leaf succulence has important physiological and ecological implications to cope with harsh and erratic climatic conditions of Indian Desert.

Keywords: Succulence, temperature, developmental stage, *Azardirachta indica*, *Cordia gharaf*, *Zizyphus mauritiana*

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ABSTRACT 45

Constituents from *Tridax procumbens*

Zai Mohd Shahrukh Khan and Dinesh Kumar Yadav

ABSTRACT

Background: India is a country where rich culture, folk medicine and nature go hand in hand. India is blessed with such a wide spread folk medicine called *Tridax procumbens* Linn commonly known as “Ghamara” and in English popularly known as coat buttons. *Tridax procumbens* is a procumbent herb found throughout India. It is related to compositae family. Leaves are ovate – lanceolate 2 to 7 cm and lamina pinnatisect.

Materials and Methods: In the isolation of compounds from plant parts we used methanolic or ethanolic crude extract of plant. Extract is fractionated and it is fractionated by solvents as n-hexan, chloroform, n-butanol and water on the basis of their polarity. Now the active compound is isolated and identified. Every step of fractionation and isolation is usually guided by bioassays, and the process is called bioassay-guided isolation. Compounds are separated by column chromatography and identification of compound is done by different spectroscopic techniques UV, IR, MS, NMR and high-throughput screening (HTS). Isolation of methyl 14-oxononacosanoate, 3-methyl-nonadecylbenzene, 14-oxoacagaecunoate, heptacosanyl cyclohexane carboxylate 1-(2,2, dimethyl-3-hydroxypropyl) isobutyl phthalate, 12-hydroxytetracos-15-one, 32-methyl-30-ozotetraatriacont-31-en-ol along with β -amyrine, fucosterol, β -amyrone and sitosterol arachidic, bathenic, lauric, linoleic, linolenic, myristic.

Results and Discussion: All isolated compounds are bioactive agent.

Conclusions: Leaf gel posse's antiseptic, insecticidal and parasitic properties. Leaves also uses in bronchial catarrh, dysentery, preventing hair loss and to check hemorrhage from cuts. It is also a potential source of the protein supplements and pro vitamin A (carotenoid).

Keywords: *Tridax procumbens*, antiseptic, insecticidal

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ABSTRACT 46

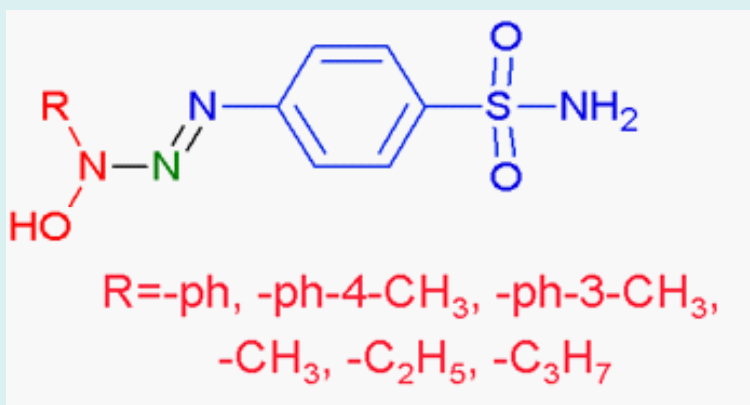
In vitro anti-radical activity of sulphanilamide based hydroxytriazenes

Poonam Sharma, R. S. Chauhan and A. K. Goswami

ABSTRACT

Background: Free radicals, generated in several biochemical reactions in the body, have been implicated as mediators of many diseases. Thus, there is an increasing interest in anti-radicals, particularly in those intended to prevent the presumed deleterious effects of free radicals in the human body. In literature there are many reports available on natural compounds used as antioxidants. In this study synthetic compounds have been screened for antiradical activities.

Materials and Methods: In the present study, compounds of sulphanilamide based hydroxytriazenes (scheme 1) have been synthesized via standard method and structures of these synthesized compounds have been confirmed on the basis of spectral studies (IR, ^1H NMR, MASS). The synthesized compounds have further been studied for their anti-radical activity using DPPH (Diphenylpicrylhydrazyl) and ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) method.



Scheme 1

Results and Discussion: The antiradical activity of sulphanilamide based hydroxytriazenes was determined using DPPH and ABTS reagent and was expressed in terms of percentage of inhibition (%). Parallel to examination of the antiradical activity, the values for standard ascorbic acid was obtained and compared with the antiradical activity of the synthetic molecules. The examination of antiradical activity of sulphanilamide based hydroxytriazenes showed concentration dependent response and varied from 2.91 to 51.14 % for 20 to 300 $\mu\text{g/ml}$, respectively. In both antiradical assays it shows strong antiradical activity thus these molecules can be regarded as promising candidate as antiradicals.

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Conclusions: Hydroxytriazene compounds of sulphanilamide exhibit sufficient *In-vitro* anti-radical activity for both using DPPH and ABTS.

Keywords: Hydroxytriazene, sulphanilamide, antiradical activity, DPPH, ABTS

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ABSTRACT 47

Isolation and characterization of tamarind seed gum as pharmaceutical excipient

Ajay Kumar Shukla and Chandra Prakash Jain

ABSTRACT

Background: Tamarind seed gum is a polysaccharide having galactomannans as chemical constituents and it is extracted from the seeds of *Tamarindus indica*. Generally, polysaccharides play most important roles as thickening, gelling, and emulsifying, hydrating, and suspending agents in pharmaceutical formulations. **Materials and Methods:** The extraction of tamarind seed gum was done by water based extraction method. The extracted gums was characterized for various evaluating parameters such as organoleptic evaluation test, identification test, FTIR study, swelling index, pH, powder flow property, viscosity, loss on drying, ash value and solubility. **Results and Discussion:** The yield of gum was found to be 18.90%. The qualitative tests of isolated gum showed carbohydrates nature. The isolated tamarind gum exhibited excellent water uptake capacity and wetting property. The pH values of the tamarind gum were found 6-7 near neutral, indicating non-irritant nature of the gum to different mucous membranes of the body, and skin. The other pharmaceutical evaluating parameters such as swelling index, powder flow property, viscosity, loss on drying, ash value and solubility were found to be good. **Conclusions:** These results conclude that tamarind seed gum has promising properties as pharmaceutical excipient.

Keywords: Tamarind gum, pharmaceutical excipient, natural polymer

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ABSTRACT 48

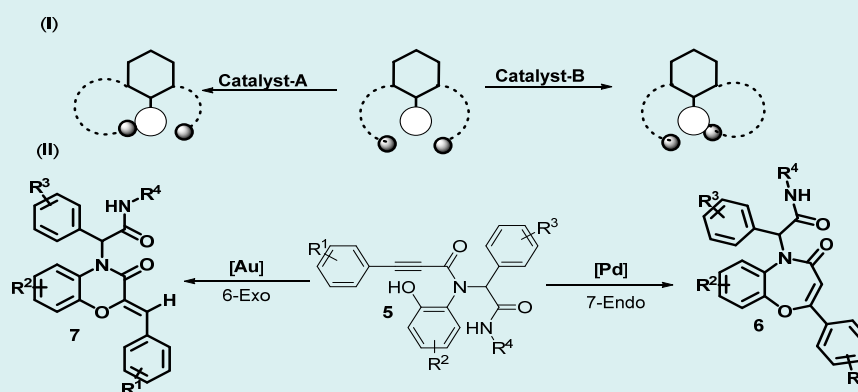
Catalyst-controlled selectivity: metal catalyzed intramolecular 7-endo-dig and 6-exo-dig post-Ugi cyclization

Siddharth Sharma and Karandeep Singh

ABSTRACT

Background: Diversity oriented synthesis (DOS) defines as one of the most concise approaches for the synthesis of highly skeletal diverse small molecules which are ubiquitous in pharmaceuticals, agrochemical, and complex natural products. Generation of skeletal diversity in a small number of steps is commonly known as reagent-based differentiation, where two or more compounds are obtained subjecting to a common starting molecule to diverse reaction conditions (Figure-1). Although the benefits of skeletal diverse process are evident, their development posed the major challenge in this realm. **Materials and Methods:** Except as otherwise indicated, all reactions were magnetically stirred and monitored by analytical thin layer chromatography (TLC) using pre-coated silica gel glass plates (0.25 mm) with a F254 indicator. ^1H and ^{13}C NMR spectra were recorded on a Bruker 500 MHz NMR spectrometer using $\text{CDCl}_3/\text{DMSO}-d_6$ as a solvent for deuterium locking.

Results and Discussion:



Concept of Reagent-based Differentiation. (II) Synthesis of

Benzoxazepinones and Benzoxazinones by Different Mode of Cyclization

The cyclization precursors 5 were first synthesized *via* an Ugi reaction using alkyne, 2-hydroxyaniline, aldehyde, and isocyanide in methanol without any catalysts or additives at ambient temperature. The Ugi products obtained as a pure solid without column chromatography

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were directly used for further reaction. After careful consideration of the optimization parameters, we finally found that cationic Pd catalyst, $\text{Pd}(\text{CH}_3\text{CN})_4(\text{BF}_4)_2$ was not only the most efficient in controlling the regioselectivity for the formation of benzoxazepinone derivative with low catalytic loading but afforded the desired product in good yields (84%). To evaluate the scope of the optimized process for the benzoheterocycle library construction, Ugi reactions were carried out following the usual procedure and subjected to intramolecular cyclization. First, the scope of the 7-*endo-dig* cyclization was examined for benzoxazepinones derivatives. Various substituents on the alkynes, isocyanides, aldehydes and amines were well tolerated with high selectivity. **Conclusions:** In summary, a catalyst-controlled divergent regioselective cyclization of bis-amides was developed by integrating the modularity of the Ugi reaction. The Ugi adducts were in turn prepared *via* reaction of alkyne, isocyanides, aldehyde, and 2-hydroxyanilines. A variety of substituted benzoxazepinones and benzoxazinones were assembled using Pd and Au catalysts respectively.

Keywords: Diversity oriented synthesis, Ugi, Palladium, Gold.

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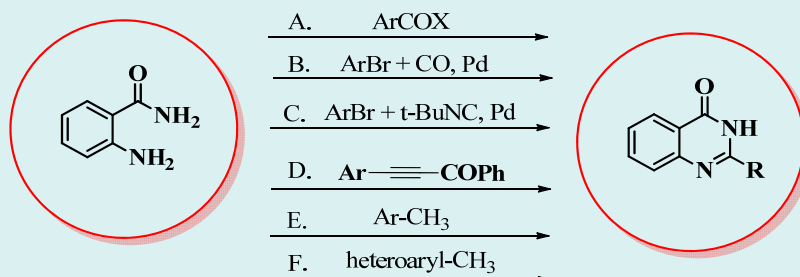
ABSTRACT 49

Facile synthesis of quinazolin-4-ones via metal catalyzed tandem C-C/C-O/C-N cross-coupling reaction sequence

Vinay Kumar Singh, N.S. Chundawat, Girdhar Pal Singh, Sultan Ismail Pathan, Shahnawaz Khan, R.S. Chauhan and A.K. Goswami

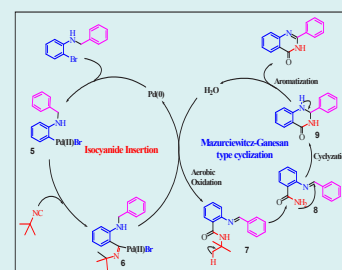
ABSTRACT

Background: Among various transformations reported for synthesis of quinazolinones, the condensation of 2-aminobenzamide with various simple aryl precursors using metal or metal-free conditions is one of the most elegant and widely studied approach. Various reports on this approach summarized in the following Figure:



Materials and Methods: All reaction were perform in seal tube on .3 mmol scale using Benzyl bromide 1a (1.0 equiv.), 2-bromoaniline (2a) tert-butylisocyanide 3a (3.0 equiv.) Pd(OAc)₂ (5 mol %), and ligand (5 mol %) and base (1.0 equiv.) in 0.1mL of H₂O in 1.0 mL of solvent at 160°C for 4h.

Results and Discussion: A plausible mechanism for the synthesis of quinazolin-4-one of type 4a is depicted in scheme 3. Thus, oxidative insertion of Pd to the amide precursor 1a leads to the intermediate 5 which on insertion of t-butyl isocyanide leads to Pd(II) species 6. Intermediate 6 via intramolecular cyclization followed by subsequent reductive elimination provides species 8. Intermediate 8 then undergo Mazurciewitz-Ganesan type 34 with de tert-butylation to afford 4a.



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Conclusions: In conclusion, we have reported the first undocumented utilization of isocyanide transformation ability into amide functionality. This method not only expands the scope of the Pd-catalyzed tandem isocyanide insertion and intra-molecular cyclization reactions but also provide a straightforward and efficient way to synthesize diverse quinazolin-4-one framework.

Keywords: Pd-catalyzed tandem, isocyanide insertion

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ABSTRACT 50

Improved rooting conditions for *in vitro* derived shoots of *Achras sapota*

Anamika Singhvi

ABSTRACT

Background: *Achras sapota* Linn. (Sapotaceae) is cultivated in India mainly for its sugary fruits. In view of the constraints in its natural propagation, tissue culture methods were developed for large-scale production of identical clones. Quality of roots in tissue culture derived plantlets determines the success of these plants in field conditions. It is therefore necessary that a suitable method of rooting is developed which ensures higher rate of survival of plantlets.

Materials and Methods: Rooting of shoots was attempted both under *in vitro* conditions and directly on Soilrite kept in culture bottles. For *in vitro* rooting, auxins such as IAA, NAA, 2, 4-D and IBA were incorporated individually in agar-solidified medium containing different salt concentrations. In another experiment, a two-step root induction method was attempted. In this case, the cut ends of shoots were dipped in different concentrations of IBA solution for different durations. The pulse-treated shoots were subsequently implanted on agar-solidified SH medium containing different salt concentrations. Other method involved combining both rooting and hardening phase together. Here excised shoots were pulse-treated with different IBA solution for different durations and implanted directly on Soilrite irrigated with ¼ SH salts.

Results and Discussion: Auxins when incorporated into SH medium containing different salt concentrations failed to induce roots and caused callusing. Sixty-six percent rooting response was obtained when the shoots were given a pulse treatment with 200 mg l⁻¹ pre-autoclaved IBA for half-an-hour followed by their implantation on half-strength SH salt medium. Root induction was very slow and produced callus. Direct rooting on Soilrite, a relatively simple, cheaper, labor saving method combining both rooting and hardening phase together better where 77 per cent shoots were rooted when they were pulse-treated with 200 mg l⁻¹ IBA for 2 h and were implanted directly on the Soilrite irrigated with one-fourth SH salt solution. No callus was noticed and such plants could easily be transferred to pots.

Conclusions: Direct rooting on Soilrite proved superior to *in vitro* rooting because a major culture manipulation was eliminated and acclimated plants were produced in lesser time. This also saved roots from transplantation shock and injury during transfer from culture medium to soil.

Keywords: *Achras sapota*, Schenk and Hildebrandt, IBA, Soilrite™, micropropagation, pulse treatment

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ABSTRACT 51

Aswagandha: A natural remedy for various illnesses

Kiran Sirvi, Kamal S. Rathore and Meenakshi Bharkatiya

ABSTRACT

Withania somnifera (Ashwagandha) is a well known plant used in medicine since a long time. The root of plant is dried and used as medicine in different formulations for nervous and sexual disorders. Ashwagandha is known to possess antioxidant, anxiolytic, adaptogen, memory enhancing, antiparkinsonian, antiinflammatory, antitumor properties from different in vitro and in vivo studies conducted on the plant. Laboratory analysis on the has discovered over 35 chemical constituents contained in the roots of *Withania somnifera*. The biologically active chemical constituents are alkaloids (isopellertierine, anferine), steroidal lactones (withanolides, withaferins), saponins containing an additional acyl group (sitonidoside VII and VIII), and withanoloides with a glucose at carbon 27 (sitonidoside XI and X) of which withanolides are believed to account for its extraordinary medicinal properties. Much of Ashwagandha's pharmacological activity has been attributed to two main withanolides, withaferin A and withanolide D. Withanolides are steroidal and bear a resemblance, both in their action and appearance, to the active constituents of Asian ginseng (*Panax ginseng*) known as ginsenosides. Anti-inflammatory activity has been attributed to biologically active steroids, of which Withaferin A is a major component. Studies on *Withania somnifera* discovered that animals given the herb an hour before the foot shock experienced a significantly reduced level of stress. This research confirms the theory that Ashwagandha has a significant anti-stress adaptogenic effect. Ashwagandha is found to produce GABA-like activity, which may account for the herb's anti-anxiety effects. The antibiotic activity of the roots as well as leaves has been observed in experiments conducted on animals. Withaferin A in concentration of 10µg/ml inhibited the growth of various Gram-positive bacteria, acid-fast and aerobic bacilli, and pathogenic fungi. Antibiotic activity of Withaferin A is found to be due to the presence of the unsaturated lactone-ring. The lactone showed strong therapeutic activity in experimentally induced abscesses in rabbits, which was found to be somewhat stronger than that of Penicillin. Various other effects like immunomodulation, hypolipidemic, cardiovascular protection, sexual behaviour, tolerance and dependence have also been studied. This poster aims to compile the known and unknown facts of *Withania somnifera* (Ashwagandha) which has been proved by different studies conducted on the plant.

Keywords: *Withania somnifera*, antiparkinsonian, GABA, antibiotic, gram-positive bacteria, withaferin A

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ABSTRACT 52

Synthesis and characterization of sulfa-drug based hydroxytriazenes

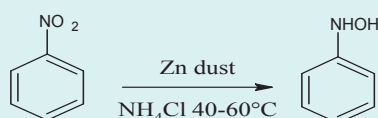
Aruna Solanki and A. K. Goswami

ABSTRACT

Background: Hydroxytriazenes are extensively used as analytical reagents for determination of transition as well as non-transition metal ions. In the present work, Sulfa drugs based hydroxytriazenes have been synthesized and studied for their spectrophotometric determination. Sulfa drugs are known antibiotics and have been exhaustively used for treatment of infection in respiratory and urinary tract in human. Some hydroxytriazenes based on sulfacetamide and sulfanilamide has also been screened for their biological activities such as anti-bacterial, antifungal, insecticidal, wound healing, anti-inflammatory and anti-tubercular activities.

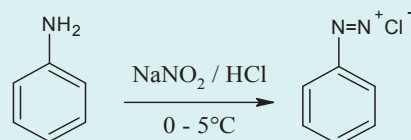
Materials and Methods: In the present study, we have prepared different hydroxytriazene's derivatives from sulfacetamide by standard method. This method includes coupling of alkyl or aryl hydroxylamine with diazonium salt of sulfacetamide and sulfanilamide in acetate buffer medium of 5-6 pH at the temperature between 0-5°C. The products of coupling are washed firstly and then crystallized using appropriate solvent. Formation of hydroxytriazenes was verified by spot test methods as reported by Purohit. The compounds were checked for their purity by thin-layer chromatography (TLC) and melting point detection. The standard method for synthesis of hydroxytriazenes involved following three steps:

Step I -



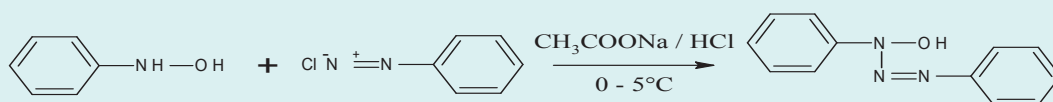
Phenyl hydroxylamine

Step II -



Phenyl diazonium chloride

Step III-



3-Hydroxy-1, 3-diphenyltriazene

Results and Discussion: We synthesized a series of hydroxytriazenes having sulpha drug. The compounds were fully characterized by FT-IR, and ¹H NMR. The IR bands provide valuable information to determine structure and the chemical functional groups in the organic compounds.

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The final products thus synthesized are 3-hydroxy-3-(3-methylphenyl)-1-(4-acetylsulfonyl) phenyltriazene (ASPT-1), 3-hydroxy-3-(4-methylphenyl)-1-(4-acetylsulfonyl) phenyltriazene (ASPT-2), 3-hydroxy-3-methyl-1-(4-acetylsulfonyl) phenyltriazene (ASPT-3), 3-hydroxy-3-ethyl-1-(4-acetylsulfonyl) phenyltriazene (ASPT-4), 3-hydroxy-3-propyl-1-(4-acetylsulfonyl) phenyltriazene (ASPT-5).

All prepared compounds gave various characteristic IR bands and physical properties which is described in tabular form.

Hydroxytriazene code	M.F.	M.W.	m.p.	IR Analysis in cm ⁻¹						
				ν_{O-H}	ν_{N-H}	$\nu_{C=O}$	ν_{N-O}	$\nu_{N=N}$	ν_{C-N}	$\nu_{S=O}$
ASPT-1	C ₁₅ H ₁₆ N ₄ O ₄ S	348.3769	170°C	3299	3196	1716	1590	1421	1330	1150
ASPT-2	C ₁₅ H ₁₆ N ₄ O ₄ S	348.3769	110°C	3202	3065	1697	1587	1437	1337	1146
ASPT-3	C ₉ H ₁₂ N ₄ O ₂ S	272.2809	220°C	3188	3091	1700	1590	1438	1333	1144
ASPT-4	C ₁₀ H ₁₄ N ₄ O ₄ S	286.3075	210°C	3596	3191	1697	1591	1434	1337	1145
ASPT-5	C ₁₁ H ₁₆ N ₄ O ₄ S	300.3341	158°C	3597	3191	1697	1591	1435	1335	1145

Conclusions: The structures of all synthesized compounds have been confirmed by IR, NMR spectral techniques. These compounds have been synthesized for the spectrophotometric determination of transition metals in synthetic as well as biological samples. Further, these results may be used to develop new compounds involved in analytical, catalytic, bioorganometallic or medical applications.

Keywords: Hydroxytriazenes, sulfacetamide, sulfanilamide, spectrophotometry, FT-IR etc.

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ABSTRACT 53

Evaluation of secondary metabolites in some tuberous medicinal plants from Sitamata wildlife sanctuary, Pratapgarh (Rajasthan)

Arti Soni and Pawan Kasera

ABSTRACT

Background: The tuberous plants have recently gained a world-wide interest due to their medicinal properties. In the case of tuberous plants, storage organs such as bulbs or tubers are generally regarded as most valuable material for the preparation of medicines. The present study was conducted to investigate phytochemical analyses in three medicinally important tuberous plants, i.e. *Arisaema tortuosum* (Wall.) Schott, *Chlorophytum tuberosum* Baker. and *Curculigo orchioidea* Gaertn. *A. tortuosum* (Whipcord lily; Family: Araceae) tuber paste is applied over the wound caused by snake bite to check poisonous effect. *C. tuberosum* (Adak musali; Family: Liliaceae) tubers are used as aphrodisiac, improve digestion, rejuvenator and immunomodulator. *C. orchioidea* (Kali musali; Family: Amaryllidaceae) tubers are used as aphrodisiac, appetizer, biliousness, fatigue and blood related disorders. Secondary metabolites are organic compounds that are not only known to play a major role in the adaptation of plants to their environment, but also represent an important source of active pharmaceuticals.

Materials and Methods: Leaf samples of selected plants were collected from natural habitat from nearby Sitamata wildlife sanctuary, Pratapgarh District (Rajasthan) during June-October, 2014 and 2015. The leaves were washed with running tap water, oven-dried and ground to evaluate monthly variations in total alkaloids and phenol contents.

Results and Discussion: The total alkaloids in leaves of *A. tortuosum*, *C. tuberosum* and *C. orchioidea* ranged from 2.43 to 5.54%, 2.52 to 5.73% and 5.05 to 6.22%, respectively. In *A. tortuosum* and *C. tuberosum* maximum total alkaloids were observed during August whereas in *C. orchioidea* during September. Higher values of total phenols were observed during October in *A. tortuosum* (15.74 mg/g d. wt.), whereas in *C. orchioidea* (20.87) and *C. tuberosum* (11.27 mg/g d. wt.) during September and July, respectively.

Conclusions: Estimation of secondary metabolites is necessary to find out most suitable month for harvesting of the plant to obtain maximum amount of these chemicals.

Keywords: Sitamata wildlife sanctuary, total alkaloids, total phenols, tuberous medicinal plants

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ABSTRACT 54

Ensuring compliance of quality norms for Indian honey through e-traceability

Ayushi Srivastava and Kavya Dashora

ABSTRACT

The importance of honey has been well documented in the ancient texts. It is known for its high nutritive value and immense contribution in human health. There are primarily three types of honey; monofloral, polyfloral and blended. The physico-chemical properties of honey vary according to the plant species from which nectar is obtained. Scientific research substantiates that honey has antibacterial and antioxidative properties. Obtaining honey from medicinal plants would accentuate its medicinal properties. The composition of honey depends on many factors, including the plant species visited by the honeybees, the environmental conditions, honey processing and storage conditions. India has two biodiversity hotspots and also supports an ideal condition for growth of different flowers and medicinal plants. This offers an opportunity where the honey bee rearing can be taken to rural areas for a secondary income source. Research suggests that medicinal bee flora can be an effective source of honey bee forage. The anti-microbial, anti-oxidant or other properties are transferred from plants into honey, during, rather than after production could be an alternative to the many pharmaceutical products with fewer side effects. To tap the export potential of the monofloral honey, polyfloral honey, specialty honey and blended honey from India, it is vital that the quality parameters are laid down and implemented at the point of production itself. Complying to quality parameter and Codex norms will raise income levels of the locals, increase domestic consumption and accelerate export potential of Indian honey. At the global level, a large volume of Indian Honey is rejected by EU and US primarily. As per statistics from UNIDO, total number of EU rejections of Honey from Third Countries from 2002-08 is 198 MT. The adulteration of honey is a complex problem and has an adverse effect on the economy and health of consumers. Adulterants like corn sugar syrup, jaggery, inverted sugar, beet sugars, and High fructose inulin syrup usually added in honey, deteriorate the quality of honey. The present work being taken up at IIT Delhi for enabling quality parameters in honey processing and introducing e-traceability is an attempt to understand the challenges faced in production and marketing of Indian honey. This will help in exploring the quality and contamination issues related to honey production and aid in exploring all the other factors hindering the production and export of Indian honey.

Keywords: Anti-microbial, honey, inulin, anti-oxidant

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ABSTRACT 55

Biological hardening of *in vitro* derived *Terminalia bellerica* Roxb. plantlets using endophytic root fungus *Piriformospora indica*

R. K. Suthar and S. D. Purohit

ABSTRACT

Background: Micropropagation of plants is generally associated with high mortality rate during *ex vitro* transfer of plantlets. Several strategies have been suggested to improve the process of hardening and acclimatization to reduce mortality of plantlets during transplantation. Priming of micropropagated plants with microbial inoculants has been referred as 'Biopriming' or 'Biological Hardening'. The present study describes potential role of *P. indica* in biological hardening of micropropagated plants of *T. bellerica*.

Materials and Methods: *P. indica*, an endophytic, cultivable fungus was maintained on Kaefers medium on agar-gelled slants or in broth. Fungal inoculation was provided during *in vitro* hardening of plantlets. Mycelium (about 50 mg fresh weight per plant) was mixed with autoclaved Soilrite™. The Soilrite™ - fungus mix (SF) was distributed in culture bottles and in each bottle one rooted shoot was implanted. Thirty-days old treated plantlets were transplanted into poly-bags containing soil, Soilrite™ and farmyard manure (1:1:1) and were allowed to grow under nursery shade conditions. Growth parameters were recorded from treated and untreated plantlets from randomly selected individuals.

Results and Discussion: Inoculation of *T. bellerica* plantlets with *P. indica* was beneficial both in terms of overall growth and *ex vitro* survival in comparison to untreated control plantlets. The average total number of leaves (16.5) produced per plantlet was also higher as compared to control (9.5 leaves per plantlet). Such leaves showed an average area of 562.33 mm² per leaf as against 313.33 mm² recorded for untreated control. Significant increase in root length (10.10 cm) and number of laterals in treated plantlets was observed accounting for their improved growth. Highest total fresh (1.55 g) and dry weight (0.150 g) of plantlets was also recorded with treated plantlets. Higher amount of total chlorophyll contents, total carbohydrates, proteins, phenol and ODHP contents recorded for plantlets inoculated with *P. indica*, invariably showed higher values than non-inoculated plantlets. Microscopic examination of stained root samples revealed high colonization in more than 80 per cent plantlets. Root colonized plants on their transplantation showed more than 90 per cent survival as compared to 75 percent survival of untreated control plantlets.

Conclusions: Inoculation of micropropagated plants with *P. indica* proved highly beneficial and was considered an excellent candidate for the biological hardening of micropropagated *T. bellerica*.

Keywords: Biopriming, hardening, baheda, endophytic fungus, micropropagation

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ABSTRACT 56

Factors affecting micropropagation of *Feronia limonia* L. (Swingle) through cotyledonary nodes

Kiran Tak

ABSTRACT

Background: *Feronia limonia* L. (Swingle) (syn: *Limonia acidissima*) (Family: Rutaceae) a rare and endangered tree species of Aravallis in South East Rajasthan is valued for its edible fruits and immense medicinal properties. High rate of seedling mortality and outbreeding nature of this tree species have resulted in to its poor regeneration. Over-exploitation, particularly of superior germplasm has brought this plant in the list of threatened species in South- East Rajasthan. In order to obtain large number of plants, a micropropagation protocol has been developed.

Materials and Methods: Aseptic seedlings were raised on water-agar medium to obtain cotyledonary node explants. Various concentrations and combinations of Kn, BAP, NAA and IAA were tested. After initial establishment of cultures, the subculturing was done every 30 days for shoot multiplication. Two to three centimeter long shoots were placed for rooting on MS medium containing different salt concentrations and auxins (IAA, IBA and NAA). Rooted plantlets were transferred to bottles 1/4th filled with Soilrite™ and 1/4 MS nutrients for hardening in mist house. Hardened plants were transferred to polybags for further growth and finally transplanted into field during monsoon period.

Results and Discussion: Fifteen days-old seedlings were found suitable for nodal explants. Both BAP with kinetin increased the number as well length of shoots. Best shoot multiplication was obtained on MS medium with Kinetin 1.5 mg/l, BAP 0.5 mg/l and NAA 0.01 mg/l. The presence of mother tissue in initial cultures was found necessary for shoot proliferation. The strength of inorganic and organic salts in MS medium played significant role in rooting behavior of shoots *in vitro*. Best rooting was obtained on 1/4 MS salts combined with 1.5 mg/l IBA. Hardening of *in vitro* raised plantlets, prior to transplantation was a crucial step deciding the success of process. Hardening was done by gradual exposure of plants to reduced humidity in a greenhouse. Hardened plants have been successfully transferred to field.

Conclusions: This work has shown tremendous potential for large scale propagation through tissue culture biotechnology. The *in vitro* plants can be used for afforestation programme.

Keywords: *Feronia limonia* L., micropropagation, endangered, Aravallis, South-East Rajasthan

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ABSTRACT 57

Physico-chemical characterization of textile industrial effluent from Bhilwara city, Rajasthan, India

Bhagawatilal Jagetiya and Mahavir Prasad Tripathi

ABSTRACT

In the present study an attempt was made to analyze the physico-chemical properties of dye effluent of the textile industry located in Bhilwara city. The effluent sample was collected from textile industrial site (ES1) in Bhilwara, a textile city of Rajasthan. In this investigation physicochemical parameters such as colour, odour, electrical conductivity (EC), temperature, total suspended solids (TSS), total dissolved solids (TDS), total solids (TS), pH, total alkalinity, total hardness, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), chlorides, sulphates, phosphates, nitrate nitrogen, were determined using standard procedures. The result of this analysis was compared with the water quality standards of BIS (Bureau of Indian Standard). The effluent sample was greenish yellow in colour with average organic and inorganic loading and objectionable odour. The result showed high electrical conductivity ($1876 \mu\text{S cm}^{-1}$), temperature (25.4°C), high TSS (336.8 mg l^{-1}), TDS (2468.4 mg l^{-1}), TS values (2805.2 mg l^{-1}), alkalinity (685 mg l^{-1}), pH (7.8), high BOD (224 mg l^{-1}), COD (4632 mg l^{-1}), and negligible DO, also showed the presence of high amounts of chlorides (6582 mg/l), nitrates (624 mg l^{-1}), and sulphates (94 mg l^{-1}). It was observed that all the parameters studied exceeded the BIS limits. Thus it was concluded that textile effluents are one of the sources of pollution for receiving water which will affect the flora and fauna existing in the surrounding environments. This case study strongly underlines the need for treatment of textile effluent before they are discharged into the surrounding water reservoir.

Keywords: Physico-chemical parameters, BOD, COD, TDS, BIS

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ABSTRACT 58

Comparative fingerprint and extraction yield of *Prosopis cineraria* (Lin.) Druce. leaves with phenol compounds (Gallic acid), as determined by UV and FT-IR spectroscopy

Ram Singh Bishnoi, Ajay Kumar Shukla, Manish Kumar Goyal and C.P. Jain

ABSTRACT

Objective: To analyse the comparative fingerprint and extraction yield of *Prosopis cineraria* leaf with phenolic compound gallic acid as determined by UV spectroscopy and FTIR spectroscopy.

Materials and Methods: The UV spectroscopy and FTIR spectroscopy are adequate technique to fingerprint comparatively and to evaluate the extraction yield of *Prosopis cineraria* leaf extract. The higher extraction yield was recorded in ethanol comparatively superior and richer in phenols (Gallic acid). Gallic acid has therapeutic for antimicrobial activity. Fingerprint region was recorded between 500-3500 cm^{-1} for each extract and functional groups were identified and compared with standard. **Results and Discussion:** The extraction factor was superior in ethanol (270 nm) rich in polar molecule. The FTIR signal at 900, 1500, 1714, 3000, 3100 cm^{-1} as a good indicator of phenol (Gallic acid). The functional groups of each extract were identified.

Conclusions: The UV and FTIR method was validated as a good tool to investigate the finger print and to predict the composition of leaf extracts of *Prosopis cineraria*.

Keywords: Antimicrobial, UV spectroscopy, FTIR spectroscopy, ethanolic extract, gallic acid, *Prosopis cineraria*.

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ABSTRACT 59

Molecular characterization of diversity among natural populations of *Boswellia serrata* using molecular markers

Sharma, P., Nagori, R. and S. D. Purohit

ABSTRACT

Background: *Boswellia serrata* Roxb. (Family: Bursaraceae) commonly known as 'Salar' is a principal tree of Aravallis in Rajasthan, India. The tree is of great medicinal and economic value. The aim of this study was to determine the genetic diversity among populations spread across districts of Udaipur, Rajsamand and Sirohi falling within Aravallis in Rajasthan.

Materials and Methods: For this study, DNA isolation was done using a new improving method involving CTAB based extraction with selective binding of DNA to a silica matrix of diatomite in the presence of chaotrope. For molecular characterization, various parameters of PCR, like concentration of genomic DNA, primers, dNTP, Taq polymerase, $MgCl_2$, annealing temperature, and number of cycles were optimized using different concentrations. After the optimization of PCR conditions, all 24 populations were identified and subjected to molecular evaluation using RAPD and ISSR Markers.

Results and Discussion: A total of 98 primers (50 RAPD and 48 ISSR) were initially screened, out of which 33 primers (18 RAPD and 15 ISSR) that resulted in discrete bands were used for further molecular analysis. The cumulative analysis carried out on the basis of RAPD and ISSR data sets revealed 61.50% polymorphism. The pair-wise distance matrix calculated by Dice's co-efficient showed a distance range of 0.69 to 0.97 when computed using cumulative data set. The average observed number of alleles per locus (N_e) was 1.1911 and 1.3745 at the population and species level. The partitioning of genetic diversity revealed that more variations existed among populations with H_{sp} of 0.33 than within populations where the estimated H_{pop} value was 0.15. The UPGMA dendrogram resolved all the 24 populations representing three districts into various clusters according to their genetic distances. The principal component analysis [PCA] supported the UPGMA results and justified the relationship among populations.

Conclusions: The RAPD and ISSR markers, showed low level of genetic diversity within populations of groups and significant genetic differentiation among groups of *B. serrata*. This study created a better understanding of genetic variation and population structure of *B. serrata* in Aravalli hill region helping formulation of efficient programs for the preservation of biodiversity.

Keywords: *Boswellia serrata*, RAPD, ISSR, Genetic diversity, PCA

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ABSTRACT 60

Protective effect of *Asparagus racemosus* root extract in acute restraint stress-induced behavioral and biochemical alterations in mice

Komal Sharma

ABSTRACT

Background: A stressful stimulus is a crucial determinant of health and disease. Antidepressants are used to manage stress and their related effects. The present study was designed to investigate the effect of *Asparagus racemosus* root extract (ARRE) in restraint stress-induced behavioral and biochemical alterations in mice.

Methods: Animals were immobilized for a period of 6 hr. *Asparagus racemosus* (50 and 100 mg/kg) was administered for 5 days, on 5th day, 30 minutes after ARRE administration, the animals were subjected to acute immobilized stress. Animals of control group received vehicle and were subjected to stress and subsequent tests in similar manner as that of treatment groups. Various behavioral tests for anxiety, locomotor activity and nociceptive threshold were assessed, followed by oxidative parameter tests (malondialdehyde, glutathione, catalase, nitrite and protein), subsequently.

Results: Acute restraint stress for 6-hr caused severe anxiety like behavior, antinociception and impaired locomotor activity as compared to unstressed animals. Biochemical analyses revealed an increase in malondialdehyde, nitrites concentration, depletion of reduced glutathione and catalase activity as compared to unstressed animal brain. Five days *Asparagus racemosus* treatment in a dose of 50 mg/kg and 100 mg/kg significantly attenuated restraint stress-induced behavioral (improved locomotor activity, reduced tail flick latency and antianxiety like effect) alterations and oxidative damage as compared to control (restraint stress).

Conclusion: Present study highlights the significant protective effect of *Asparagus racemosus* roots against acute restraint stress induced alterations.

Keywords: *Asparagus racemosus*, catalase, locomotor activity, restraint stress

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ABSTRACT 61

Plumbago zeylanica Linn: A medicinal herb

Suresh Kumar Dev and Pratim Kumar Choudhury

ABSTRACT

Herbs are staging a comeback as the alternative solution to insidious and debilitating effects of synthetic drugs. *Plumbago zeylanica* is one such important medicinal plant which is rambling sub scandent perennial herb or under shrub with green branches, stems somewhat woody, spreading, terate, striate, glabrous, and belongs to family Plumbaginaceae. It is commonly known as Chitrak, Chitramol, Ceylon leadwort, Doctorbush or Wild leadwort. Traditionally *P. zeylanica* have various applications as a stimulant digestant, expectorant, laxative and in the treatment of muscular pain, rheumatic, dermatitis, scabies, leprosy, acne, sores, ulcers and intestinal worm infections viz. ringworm, hookworm. The plant has numerous pharmacological activities like anti-microbial, anti-oxidant, anti-inflammatory, anti-fertility, blood coagulation, wound healing, memory enhancer, anti-cancer, antibacterial, antiviral, antiplasmodial and antiaging. The plant has been attributed to the presence of number of bioactive compounds, such as elliptinone, zeylanone, sistosterol and plumbagin. Present review deals with chemical constituents, medicinal and biological properties and pharmacological effects of *P. zeylanica* for the assessment of anti-inflammatory and wound healing activity particularly for future product development in treatment of cuts, wounds, burns.

Keywords: *Plumbago zeylanica*, Plumbagin, Bioactive compounds, wound healing, anti-inflammatory

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ABSTRACT 62

Quality issues of herbal formulations and nutraceuticals: An urgent call for safety

Princy Agarwal, Rajat Vaishnav and Anju Goyal

ABSTRACT

In recent years, there has been a huge demand for plant-derived products worldwide. The Indian systems of medicine, namely Ayurveda, Siddha and Unani (ASU drugs), mainly consists of medicinal herbs and various herbo-mineral formulations. These products are increasingly sought out due to their medicinal value, and are also used as nutraceuticals as well as herbal cosmetics. They are in great demand in almost all health problems due to their effectiveness, safety and minor side effects. Many consumers have misconception that these drugs are intrinsically safe, which is the main reason why quality control of herbal medicines is harder than that of western drugs. The main quality problems are adulteration, through artificially manufactured, lower quality, harmful or fictitious substances; faulty collection, improper storage, gross substitution with plant material, replacement with exhausted drugs and inappropriate preparation methods. Another problem is the contamination of herbs with micro-organisms, fungal toxins like aflatoxin, and with pesticides and heavy metals. It has also been discovered that many herbal medicines are adulterated by synthetic drugs that continue to be a serious problem for regulatory agencies. Examples include products that claim to have acquired vigor and vitality, have been found to contain steroids and other potent drugs like Sildenafil and Tadalafil. Lastly, nutraceuticals like many marketed Chyawanprash, having label claims of inclusion of expensive Swarna bhasma and Rajat bhasma in their formulations, but even traces of these elements are not found on Lab analysis. All of these factors are contributing to the harmful toxic effects of these "so-called safe" preparations. Although the safety assessment of herbal medicines has become an important issue for consumers, regulators and health professionals, the analysis of adverse events related to the use of these products is much more complex than in the case of conventional pharmaceuticals. Even the problems associated with adverse reactions have become more vivid in recent times, they are not discussed openly. Therefore, regulatory policies should be made such that the herbal medicines should be standardized and strengthened on a global scale to control the high sustainable quality and to exclude contaminations that seriously affect patients. Relevant regulatory authorities of our country should be proactive and continue to implement appropriate measures to protect public health. They should ensure that all herbal medicines approved for sale are safe and are of adequate quality.

Keywords: Herbal medicinal products, adulteration, synthetic drugs, toxicity, quality assurance, standardization

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ABSTRACT 63

Development and evaluation of herbal shampoo

Rimjhim Arora, Kamal Singh Rathore and Meenakshi Bharkatiya

ABSTRACT

Background: The aim of the present investigation was to formulate and evaluate herbal shampoo containing natural ingredients with an emphasis on safety and efficacy, which will avoid the risk posed by chemical ingredients. The main objective of this study was to eliminate harmful synthetic ingredient from shampoo formulation and substitute them with safe natural ingredients. An attempt has been made to combine modern formulation technology into a formula based on natural ingredients. It clears sebum, dirt, dandruff, promotes hair growth, strengthens, and darkens the hair. Moreover, it also acts as a conditioning agent and performs all these actions without affecting or damaging hair.

Materials and Methods: The shampoo was prepared by taking the extracts of *Aloe vera*, *Hibiscus rosa-sinensis*, *Phyllanthus emblica*, *Acacia concinna*, *Azadirachta indica*, *Sapindus mukorossi*, *Glycyrrhiza glabra* and *Eclipta prostrata*. Evaluation of organoleptic properties, physicochemical and performance test were carried out.

Results and Discussion: A herbal shampoo was formulated, which avoid the risk posed by chemicals. The results indicated that this can be used as a potential alternative for cleaning and managing hair in a natural and effective way instead of synthetic source. The findings of this investigation reveal that chemicals have sometimes been the cause of adverse effects among consumers. The main objective of this study was to eliminate harmful synthetic ingredient from shampoo formulation and substitute them with safe natural ingredients.

Conclusions: The present work confirmed the successful preparation of herbal shampoo using natural ingredients. The results indicated that this can be used as a potential alternative for cleaning and managing hair in a natural and effective way instead of synthetic source. All the ingredients used to formulate shampoo are safer and the physicochemical evaluation showed ideal results.

Keywords: Herbal shampoo, organoleptic properties, *Aloe vera*, cosmetics

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ABSTRACT 64

Evaluation of anti-oxidising property of *Aloe vera*: a source of wonder drug for various illnesses

Sunil Ashrani

ABSTRACT

Scientifically, *Aloe vera* is known as *Aloe barbadensis* miller. It belongs to the family of Liliaceae, and is a shrub, perennial, xerophytic, succulent, pea-green color plant. It grows around the world but mainly in dry region. *Aloe vera* has been used for various medicinal purposes in different parts of the world since a long time. The *Aloe* genus has been used for thousands of years in the treatment of burns, wounds, skin irritations and constipation. *Aloe* has broad range of pharmacological properties, including anti-inflammatory, antiviral, antioxidative actions, antibacterial, immune-stimulant, antifungal, analgesic, antitumor, antidiabetic and inhibition of tumor cells activation and proliferation. There is a growing trend of using anti-oxidant in the foods as preservative but synthetic antioxidants have least health benefits so natural antioxidants are being used such as *Aloe vera*. It was of interest to determine effects of antioxidant activity *in vitro* and *in vivo* in whole a *Aloe vera* leaf extracts and their physiological effects in biological system. A potent anti-oxidative compound was isolated from a methanolic extract of *A. vera barbadensis* miller. Then to compare and quantify the amount of antioxidants in *Aloe vera* at different stages of their life span a comparative study against BHT and a tocopherol was done by the DPPH radical scavenging method and the linoleic acid system at 100µg of the soluble solids per mL of ethanol. The results showed that three- year old *Aloe vera* contained significantly higher levels of polysaccharides and flavonoids than two- and four year old *Aloe vera*. All the aloe extracts showed significant antioxidant activity. The anti-oxidant activity of *Aloe vera* extracts and reference compounds followed the order: three year old *Aloe vera* > BHT > four year old *Aloe vera* > a tocopherol > two year old *Aloe vera*. The three year old extract exhibited the strongest radical scavenging activity of 72.19%, which is significantly higher than that of BHT at 70.52% and a tocopherol at 65.20%. These data suggest that the growth stage plays a vital role in the composition and antioxidant activity of *Aloe vera*.

Keywords: *Aloe barbadensis*, immune-stimulant, DPPH

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ABSTRACT 65

Medicinal and cosmoceutical importance of *Commiphora wightii*

Aayushi Bhatnagar

ABSTRACT

Commiphora wightii, with common names such as Indian bdellium tree, guggul, gugal, is a flowering plant in the family Burseraceae. The guggul plant is found in northern Africa to Central Asia, but is most common in northern India. It is a shrub or small tree with thin papery bark. Guggul is used to prepare as base to prepare fumigation. It is a method of disinfection. Over a hundred metabolites of various chemical compositions were reported from the leaves, stem, latex and root. When used for medicinal purposes, the resin harvested from stem in winter is traditionally processed to purify and rendered. The extract of gum guggul, called gugulipid, has been used in unani and ayurvedic medicine. These steroidal components have fat reducing activities. Many other components are also extracted from the resin. The triterpenoids like myrrhahone and myrrhanol are anti-inflammatory, so it is helpful to relieve pain in muscles, joints, ligaments and bones. Guggul is useful in quick bone healing during fracture and dislocation. The component sesquiterpenoids, is responsible for thinning of blood and reduction in chest pain. Many volatile oil like limonene and eugenol are extracted from guggul including flavanoids like quercetin which shows neuroprotective activities and alter nerve damage and reduces memory loss effect. It relieves rheumatoid arthritis. It is anti-cancerous and kills cancer cell reducing cell growth. Recently, it has been recommended for use in treatment of thyroid, as it increases thyroid hormone and iodine uptake. Bile acid has direct effect on respiratory functions as guggul is a suppressor of this receptor activity. Guggul stimulates insulin secretion via bile acid activation. Therefore, it is beneficial for type 2 diabetes. In cosmoceutical industries it is used in making creams and lotion effective on treatment of acne. Guggul increases TYPT1 collagen production, which gives strength to human skin and is key component of anti-wrinkle and anti-ageing products. Guggul also acts as anti-oxidant, by inhibiting production of oxygen-free radical and prevent skin tissue damage.

Keywords: *Commiphora wightii*, guggul, medicinal properties, cosmoceutical importance

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ABSTRACT 66

Pumpkin seeds: An emerging nutraceutical

Kiranbala Jain

ABSTRACT

Society is now focused on finding an optimal diet that seeks to promote the consumption of foods that have a favorable effect on health. This is the context in which the concept of “functional foods” appeared. Pumpkin seeds (*Cucurbita pepo*) have received considerable attention in recent years due to their protective and nutritional health benefits. Pumpkin is widely used as food and folk medicine all over the world. Pumpkin seeds are rich in oil and nutrients. Pumpkin seeds have generally been considered as agricultural waste and discarded despite having high nutritional value and medicinal benefits. Pumpkin seeds contain many proteins, fatty acids, a significant amount of micronutrients such as P, K, Mg, Mn and Ca and are a good source of calories, proteins, carotenoids, minerals, fiber and phytosterols that contribute to the regulation of cholesterol. They also have omega 3 and omega 6 fatty acids necessary for hormone balance, brain function and skin health. Tryptophan present in these seeds helps milk production in nursing mothers and is used to reduce postpartum swelling of the hands and feet. A review of the literature shows that *C. pepo*, is known for its usefulness in benign prostatic hyperplasia (BPH) and urinary dysfunction. The seeds have also been found useful in cancer treatment due to its considerable cytotoxic and antioxidant properties. These have also been used as a hypoglycemic agent since ancient times. Many pharmacological studies have supported the traditional uses of these seeds as hepatoprotective, antioxidant, antitumor, antimicrobial, anti-inflammatory, anti-diabetic and antiulcer. The conversion of these agro-wastes into value-added ingredients is likely to be an important step towards global sustainability efforts; therefore, it deserves more investigation. Till now many people are unaware of its therapeutic importance and discard them due to lack of awareness. This review provides an updated account of this emerging nutraceutical and will also help in making the society aware about the nutritive and medicinal importance of Pumpkin seeds.

Keywords: *Cucurbita pepo*, fatty acids, hyperplasia, antioxidant

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ABSTRACT 67

Prosopis gum: A prospective additive for pharmaceutical formulations

Anirudh Khatri and C. P. Jain

ABSTRACT

Prosopis cineraria is one of the most important leguminous trees of the Indian desert because of their ability to fix nitrogen and tolerate aridity. The hot and dry weather of Thar desert offers ideal conditions for *Prosopis* species to exude gum. The gum of *Prosopis cineraria* is exuded in the form of round spherical balls resembling tear drops or angular fragments, during May and June by mechanical injury to the vascular cambium, resulting in the formation of schizolysigenously gum cavities in the inner secondary phloem of the stem. Gum *Prosopis* together with gum Arabic is unique among the natural hydrocolloids because of its extremely high solubility in water, which can yield solutions above 50% (w/w) concentration. Chemically, it is arabinogalactan protein having the capability to form a compact globular structure in solution and act as an emulsifying agent because of its ability to form visible viscoelastic films at the oil-water interface. *Prosopis* gum has been used as a binder in tablet dosage forms and as a suspending agent at par with gum Acacia and superior to tragacanth gum. This gum is not recommended as food additive due to its higher tannin content, but if processed for removal of tannins, it may have prospects for use as food additives.

Keywords: Emulsifying agent, hydrocolloids, schizolysigenously, suspending agent.

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ABSTRACT 68

***Musa*: A banana species effective in dissolving kidney stones**

Priyambada Pandey

ABSTRACT

In Stone Age people used to survive on raw fruits and flowers. They had a vast knowledge of benefits of the naturally available food. Still we can find the tribal population dwelling in forest and remote areas of our country using the natural therapy for treating several illnesses. Banana plants (*Musa* species) of the family Musaceae are known to human civilization since ages. It is a fruit having several health benefits. *Musa* species are grouped according to ploidy the number of chromosomes sets they contain, and the relative proportion of *Musa acuminata* (A) and *Musa balisiana* (B) in their genome. Most familiar seedless cultivated varieties (cultivars) of banana are triploid hybrids say, Robusta (AAA), Nendran (AAB), (ABB). *Musa* has some chemical constituents that have been proven of treating kidney stones through several *in vitro* and *in vivo* studies. Kidney stones are formed when there is high level of calcium (hypercalciuria), oxalate (hyperoxaluria) in the urine; a lack of citrate in the urine or insufficient water in the kidneys to dissolve waste products. The present poster is a compilation of various researches done for knowing the potential of *Musa* species in dissolving kidney stones. The juice extracted from the fruit is used as a home remedy for kidney stones along with honey. There has been UV analysis of the juice extract for confirmation of presence of sodium, magnesium and potassium in the species *Musa*. These are known for their role in dissolving kidney stones according to an *in vitro* study. One more study on animal specimen shows the *in vivo* utility of *Musa* ABB on rats which reports of dissolving calcium, oxalate and phosphate, the main constituents of forming renal stones. An ICP- MS technique has been used for quantification of sodium and potassium and based on the results it has been concluded that the diuretic and urolithiatic activity of *Musa* shoot juice is due to the presence of higher percentage of sodium and potassium. Thus, traditionally, medicine practitioners prescribed the *Musa* shoot juice to the patients suffering with kidney stones to increase the urine flow in the patients thereby, reducing further deposition of kidney.

Keywords: *Musa acuminata*, hypercalciuria, ICP- MS

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ABSTRACT 69

Phytoremedial management of textile effluent: A review

Bhagwatilal Jagetiya and Sunil Rai Porwal

ABSTRACT

Increasing population of world and its facilitated life style has influenced the biosphere adversely. Rapid growth in industrialization and technological advances has created the pollution problems. Textile industry plays a major role in the economy of developing countries like India. These industries use large amount of chemicals-dyes and generate enormous quantity of effluent. Textile effluent has displeasing smell due to dyeing operation and alkaline in nature. Many heavy metals like cadmium, copper, aluminum, chromium, zinc, boron, mercury, iron etc. are found in effluent and causes poisonous effect. The textile processing units discharge untreated or semi-treated effluents in to the ecosystem and create problem in many ways and damage or affect the living beings. Many traditional methods such as incineration, excavation and landfill, vitrification, soil washing, solidification, reburial of soil, soil flushing, stabilization of electro kinetic systems as well as pump and treat systems for water are used to remediate such hazardous substances but these methods are not safe, cost effective and have limited aspect. The use of microorganism to control and destroy contamination is of increasing interest to minimize some of these pollution problems called, 'bioremediation'. When green plants are used to remove toxic substances from the soil, bioremediation is known as 'phytoremediation'. It involves the use of green plants for *in situ* treatment of contaminated soils, sediments and water where plants degrade, assimilate, metabolize or detoxify inorganic or organic pollutants. It is an aesthetically pleasing mechanism that can reduce remedial costs, restore habits and clean-up contamination in place rather than entombing it in place or transporting the problem to another site. Each of textile industry utilizes large amount of water, which will finally become wastewater. The most significant sources of pollution among various process stages are pre-treatment, dyeing, printing, and finishing of textile materials, these stages have been designated as 'sacrifice zones'. The residual wastewater and other textile effluents, heavy metals and chemicals contribute to an elevated environmental contamination. Phytoremediation technology has been used successfully in abating textile related pollution problems at many places across the globe. This review paper is a comprehensive and vast report on various issues and impact of pollution caused by textile industries and success stories of mitigating the challenge with botanical remediation technology.

Keywords: Effluent, textile industry, bioremediation, phytoremediation

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ABSTRACT 70

Re-embodiment of traditional medicinal system with new approaches in phytotherapeutics

Sumit Sharma, Sakshi and Subash Upadhyay

ABSTRACT

The Mother Nature has always been dedicated to her children (including every species) in many ways. Plants have been the basis for medical treatments through much of human history, and such traditional medicine is still widely practiced today. The traditional medicine is the sum total of knowledge, skills, and practices based on the theories, beliefs and experience indigenous to different cultures used in maintenance of health as well as in prevention, diagnosis and treatment of physical and mental illness. The system includes *Ayurveda*, *Siddha*, *Unani*, Naturopathy, Homeopathy, Chinese medicinal system, Aromatherapy, Herbalism prevalent in western culture, who indulges in herbal preparations for treatment. *Ayurveda* is the oldest medicinal science since vedic period which offers different customs to live a healthy life and its prevention from diseases. Herbs and related products have been commonly used for several thousands of years. Herbal medicine are making a magnificent comeback and regenerating trust in the traditional medicinal system. According to different studies of WHO, the population living in rural areas, any specific tribal communities are more dependent on plants (herbal medicine) for curing common ailments. The traditional medicinal system includes herbs, metallic preparations, and diet- life style regime in preventing diseases. The re-embodiment of such a system is due to its efficacy, cost-effectiveness, drug resistance. The use of such traditional system is basically concerned with the chronic diseases like diabetes, respiratory disorders, skin infections, etc. The herbal preparation or plant based formulations can be taken as tea, decoction, tinctures, essential oils (aromatherapy). Even spices are one of best instances among the traditional medicinal system. The daily use of spices in food or as home remedy is part and parcel of the system. Thus, this work emphasizes on the betterment of phytotherapy in association to a medical system.

Keywords: Herbalism, phytotherapy, traditions, community, medicinal system, formulations

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ABSTRACT 71

Beauty and Herbal Cosmetics

Yashwant Singh, N.S. Chundawat, Sunayana Asha and Sachin

ABSTRACT

Beauty consciousness and the knowledge of application of herbs, minerals and animals products are as old phenomena as the human existence. Beauty of person gives perceptual experience of pleasure or satisfaction. Ayurveda never isolate the involvement of mental and spiritual well being from the concept of beauty. Ayurveda determined beauty by *prakriti* (Body constitution), *sara* (structural predominance), *sanhanan* (compactness of body), *twak* (skin complexion), *Praman* (Measurement) and *dirghayu lakshyana* (symptom of long life). Ayurveda cosmetology started from mother wombs, *dinacharya*, *ratricharya*, *ritucharya* with the practice of medicinal herbs and minerals. Ayurveda physician believe that toxic materials inside our body make a person ugly and disease and *Sodhana* (Purification) is the best therapeutic intervention to eliminate body toxins. *Charak samhita* classified cosmetics drugs as *Varnya*, *Kustagna*, *Kandugna*, *bayasthapak*, *udardaprasamana*, etc and many *alepam* (poultice) are described in *Susruta Samhita* and *astanga hrudaya*. Some medicinal plants like- *Haridra*, *Manjistha*, *Chandana*, *Amalaki*, *Gritkumari*, *Sikakai*, *Brinaraj* etc has been prescribed for beautification of skin, hair, teeth, nails etc. *Panchakarma* procedures are employed for beatification of skin. There are significant evidences already generated for Ayurveda skin care in vitiligo, psoriasis, and eczema and acne vulgaris. Consumer trends suggest a gradual shift from chemical-based products to Ayurvedic beauty products. India could emerge as a major contributor to the global cosmetic industry. This will possible, as one of the strengths of India is Ayurvedic tradition.

Keywords: Ayurvedic cosmetics, beauty, herbo-cosmoceutical, panchakarma

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ABSTRACT 72

Preliminary phytochemical analysis and HPTLC fingerprinting of *Pueraria tuberosa* (Roxb. ex Willd.) DC. – An important medicinal plant

Nirali Tank and Illa Patel

ABSTRACT

Background: A medicinal plant possesses curative properties due to the existence of various complex chemical substances of different composition known as secondary metabolites/ phytochemicals. *Pueraria tuberosa* (ROXB. Ex Willd.) DC belongs to family Fabaceae, large herbaceous perennial twiner with tuberous root. *Pueraria* used in indigenous system of Indian medicine as antirheumatic, aphrodisiac, tonic for strength, diuretic and galactagogue. Tubers are consumed as supplementary food and for birth control by assured Indian tribes.

Materials and Methods: The present investigation was carried to the presence of different phytochemical compounds of *Pueraria tuberosa* (ROXB. Ex Willd.) DC plants parts viz. stem, leaf, tuber pulp and tuber bark.

Results and Discussion: Qualitative phytochemical analysis showed the presence of carbohydrates, glycosides, tannins and phenolic compound, flavonoids, steroid, alkaloid, protein, amino acids, gums and mucilage etc. Phytochemical analysis was carried out by using series of solvents such as petroleum ether, chloroform, methanol water and acetone by soxhlet extractor. Methanol extract showed presence of maximum phytochemicals in it. Although all the part of *Pueraria tuberosa* have some phytochemicals in it but the tuber pulp and tuber bark have maximum amount of carbohydrates, phenolic compound, flavonoids, alkaloids and glycosides. HPTLC fingerprinting showed presence number of phytochemicals in UV and fluorescent spectra.

Conclusions: Presence of different phytochemicals confirms its use as antirheumatic, aphrodisiac, tonic for strength, diuretic and galactagogue properties and as a supplementary food for Indian tribes.

Keywords: Phytochemicals, HPTLC, *Pueraria tuberosa* DC.

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ABSTRACT 73

Discovery and development of antidiabetic agents from natural products

Himani Tiwari and Pradeep Kumar Goel

ABSTRACT

The term natural product has also been extended for commercial purposes to refer to cosmetics, dietary supplements, and foods produced from natural sources without added artificial ingredients. Natural products sometimes have therapeutic benefit as traditional medicines for treating diseases, yielding knowledge to derive active components as lead compounds for drug discovery. Although natural products have inspired numerous U.S. Food and Drug Administration-approved drugs, drug development from natural sources has received declining attention by pharmaceutical companies, partly due to unreliable access and supply, intellectual property concerns, seasonal or environmental variability of composition, and loss of sources due to rising extinction rates. Drugs used in diabetes treat diabetes mellitus by lowering glucose levels in the blood. There are different classes of anti-diabetic drugs, and their selection depends on the nature of the diabetes, age and situation of the person, as well as other factors. Discovery and development of anti-diabetic agents from natural products brings together global research on the medicinal chemistry of active agents from natural sources for the prevention and treatment of diabetes and associated disorders. Bioactive chemical compounds from plants with anti-diabetic properties, the identification and extraction of anti-diabetic agents and antioxidants from natural sources. It then explores anti-diabetic plants from specific regions before looking more closely at the background, isolation, and synthesis of key therapeutic compounds and their derivatives, including mangiferin, resveratrol, natural saponins, and alpha-glucosidase enzyme inhibitors. This article reviews the properties of available anti-diabetic medications and highlights potential targets for developing newer and safer drugs.

Keywords: Traditional medicines, oral hypoglycemic agents, anti-diabetic drugs, natural sources

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ABSTRACT 74

Phytonanoceticals: an innovative step in phytotherapeutics

Sayeed Shaziya Yasmeen and Anju Goyal

ABSTRACT

Since ancient time, herbal remedies and natural products are being utilized to cure the diseases. Unlike to broadly utilized allopathic system, the herbal remedies have a huge number of constituents that all work simultaneously against the diseases. The action of herbal medicines relies upon overall function of a variety of active components, as all the constituents offer synergistic activity and therefore improve the therapeutic value. Each active constituent plays an important role and they are all related to each other. The development of nanotechnology is considered as a point of reference in the medicine world. In case of herbals, nanotechnology turns into a great solution to beat the issues emerging now-a-days. In phyto-formulation research, developing nano dosage forms has large number of advantages for herbal drugs, including enhancement of solubility and bioavailability, protection from toxicity, enhancement of pharmacological activity, enhancement of stability, improving tissue macrophages distribution, sustained delivery, protection from physical and chemical degradation, etc. Various techniques are involved in preparing nanoherbal extract such as nanoparticles, nanocapsules, liposomes, phytosomes, nanoemulsion, microspheres, tranferosomes and ethosomes. These techniques give the robust strength to herbal products against physical, chemical and environmental degradation, which in turn increase the safety and pharmacological activity of drugs.

Keywords: Herbal nanotechnology, nanofiber, nanoparticles, dendrimers, herbal pharmaceuticals, herbal nanomedicines

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ABSTRACT 75

Electrochemical study of Cobalt(II)-Hydroxytriazenes complexes at DME

Girdhar Pal Singh, N.S Chundawat, Pathan Sultan Ismail, Shahnawaaz Khan, R.S. Chauhan and A.K. Goswami

ABSTRACT

Background: Cobalt is an important naturally occurring trace element its small part of our environment and very small amounts are needed for many animals and humans to stay healthy a vital role in human metabolic system. Cobalt is an integral part of vitamin B₁₂ which is needed by humans. The aim of this study was to develop a facile, rapid, robust, sensitive and selective methodology for the determination of cobalt(II).

Material and Method: Synthesis: Hydroxytriazenes has been synthesized by tree step method in which first step Nitrobenzene reduced to phenylhydroxylamine. Second step involved the diazotization of sulphanilamide and the third step coupling of step - I Step- II at 0-5°C in the pH range 4.5-6 with addition of sodium acetate buffer solution.

Instrumentation: The current-voltage curves are recorded using a D.C.polarographic. A systronics polarograph 1632 was used. All pH measurements are made by using pen pH meter(Hanna) with pH range 0-13.Standard solution of cobalt(II)Nitrate [1.0 µg ml⁻¹] and Stock solutions of hydroxytriazenes prepared in deionized double distilled water. Citric acid and Na₂HPO₄ solution were used as buffer to maintain pH. Ionic strength was kept constant by using KCl as supporting electrolyte, gelatin (.002%) was use as maximum suppressor.

Result and Discuss: The method was based on chelation of cobalt(II) with hydroxytriazenes in water and ethanol (40:60) at pH 7.5 - 8 to produce catalytic hydrogen currents at -1.29 V and -1.38 V vs SCE respectively and prior detected by D.C polarography. Diffusion controlled nature of each wave and the reversible nature of reduction process was verified. The plot of half wave potential E_{1/2} vs log C_x (where C_x = concentration of complex in m mole lit⁻¹-) have been found to be a straight line showing the formation of most stable complex. The number of transferred electrons(n) and coordination no. (j) of the metal complex is determined. The value of n and j was found to be 2 and 6.

Conclusion: This technique is successfully applied for the analysis of cobalt(II) in different matrices and the results obtained were comparable with the differential pulse polarography (DPP).

Keywords: D.C Polarography, Differential pulse polarography (DPP), Hydroxytriazenes.

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