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Sinilal B., Dintu K.P. and Sofia S.

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This book reproduces the Proceedings of the International Seminar on Plant Physiology & Biochemistry conducted on January 19th and 20th of the year 2022. Abstracts of the presentations are given as per the schedule of the conference.

Preface

This book depicts the Proceedings of the International Conference on Plant Physiology and Biochemistry, organized by the Department of Botany, Fatima Mata National College (Autonomous), Kollam, Kerala, India. The conference was conducted on 19-20 of January 2022 online using Zoom platform because of the Covid19 pandemic.

The pandemic had brought about a shift in the course of scientific research by focusing into methods for detection and defending the causative virus. However, many labs remain closed for several months directly hitting research and its output, especially in the field of plant science. Number of publications has reduced drastically. Because of the restrictions in human gathering, many recurrent research conferences/seminars were also postponed. Prior to the pandemic, few innovations in the field of biochemistry and molecular biology have revolutionised biological research. Nanotechnology, next generation sequencing and the genome editing using CrisperCas9 are some of them. But their impact on plant science could not be evaluated on time due to the outbreak of Covid19. The international conference organized by the Department of Botany thus aimed to asses the influence of these technologies in bringing about developments in understanding various processes involved in primary and secondary metabolism in detail.

The conference was inaugurated formally by the Dr. Abhilash Gregory, the Manager of Fatima Mata National College and the function was presided over by Prof. Jojo P.J., the Principal. The whole seminar was conducted as four sessions lead by the invited talks by four internationally admired scientists. Only the abstracts of the oral presentations for the contest are presented in the proceedings.

We would like to appreciate the invited speakers for their excellent presentations and acknowledge the service of the judges who evaluated the oral presentations. Also we thank the staff and the research students of the Department of Botany; Internal Quality Assurance Cell, College management and the Parent-Teacher Association of the college for their support.

Editor in Chief

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IVCPB 01

Investigations of the efficacy of the various diets on diabetes mellitus type 2 patients

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Diabetes mellitus type 2 is a metabolic disease that is characterized by hyperglycemia and insufficiency of secretion or action of insulin. This type of diabetes is very common among middle aged and senior people and is therefore generally called adult-onset diabetes. This disease can be induced in humans by a genetic predisposition coupled with environmental factors and sedentary lifestyle. The food taken by diabetic patients plays a major role in maintaining the glucose level in the blood, thereby making the role of a nutritionist vital. Presently a wide variety of diets containing varying amounts of carbohydrates, fiber, proteins, sugar, and other nutrients are available and known to affect the patients differently. A ketogenic diet aids in glycaemic control and weight loss because of restrictions in carbohydrates. The Mediterranean diet helps in lowering the HbA1c level in blood and also in reducing insulin resistance. Vegetarian and vegan diets appear to improve weight loss and provide better metabolic control in type 2 diabetes patients. Food with a high glycemic index, high carbohydrate content, and added sugars contribute to obesity and in turn may contribute further to diabetes. A rigorous knowledge regarding a diabetic diet and the amount of calories needed is essential to achieve better dietary behavior. Diabetes mellitus type 2 can be controlled by better patients' dietary knowledge, socioeconomic status, attitude, and practices.The presented work rigorously investigates the various types of diets available for diabetic and prediabetic patients in terms of advantages and limitations.

IVCPB 02

Green synthesis of zinc oxide nanoparticles from *Curcuma aromatica* rhizome extract and their evaluation of antioxidant and antibacterial activities

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Nanotechnology is an innovative technology in the field of science and engineering. It has multifaceted with tiny particles constructed in the range of 1~ 100 nm and a high surface and volume ratio. Hence, it is used for various fields electrical, biological, catalyst, and so on. The present study Zinc oxide nanoparticles (ZnO NPs) were synthesized using Curcuma aromatica rhizome extract with zinc nitrate as initiating material. Synthesized nanoparticles shows the Ultra Violet – Visible (UV–Vis) Spectroscopy absorption peak at 340 nm which is one of the distinct features of ZnO NPs. Fourier Transform Infrared (FTIR) Spectrum implies the role of aliphatic amines, alkyl halides and carboxylic acids were responsible for the synthesis of ZnO NPs and its stability. X- Ray Diffraction (XRD) spectrum confirmed that the synthesized zinc oxide particles were in the form of Nano crystals. Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) images showed hexagonal and spherical shapes of synthesized zinc oxide nanoparticles size ranges between 34 – 95 nm. The Energy Dispersive X-Ray Analysis (EDAX) confirmed that the presence of zinc content in the synthesized zinc oxide nanoparticles and asserts the process of biosynthesis of nanoparticles was carried out in accordance. The antioxidant studies revealed significant scavenging activities ranges from minimum 20 % to maximum 80%. Biosynthesized ZnO NPs having efficient biological activities regarding anti-oxidant and antibacterial potential which may be utilized in several biological applications.

Keywords: ZnO NPs; Nano crystals, Antibacterial activity, anti-oxidant, aliphatic amines, alkyl halides, carboxylic acids.

IVCPB 03

Differential growth and metabolite dynamics under osmotic and salinity stress induction patterns in rice (*Oryza sativa* L.) variety Uma

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Rice being a staple food crop demands attention with respect to its productivity constraints. Abiotic stresses pose a serious threat in this context, that is further aggravated by the changing climatic scenario. In this study, an attempt was made to evaluate the in vitro stress induction responses under osmotic and salinity stresses in the popular rice variety Uma. To conduct this experiment, sodium chloride (NaCl) and polyethylene glycol (PEG 6000) at different concentrations were used to impose salinity and osmotic stresses respectively in rice seedlings. The result of in vitro evaluation revealed that the rice variety, Uma could survive or sustain half its normal growth rate at moderate levels of NaCl induced salinity stress (up to 100 mM) and PEG induced osmotic stress (up to -0.4 MPa) under room temperature; ascertained as sublethal induction stress levels. Above these concentrations, the seedlings showed drastic reduction in growth. Gradual stress induction and direct lethal stress exposures under both the stresses revealed that there is a differential pattern for the response to salinity and osmotic stress induction response in rice variety Uma, which also corroborated with the protein contents and heat stable protein fractions. However, under both stresses, the induction treatment provided a better recovery growth response in rice seedlings. GC-MS/MS analysis of tissue extracts of stressed and non-stressed tissues revealed distinct metabolite signatures under osmotic and salinity stress induction, which could probably be the reason for their differential stress induction responses.

IVCPB 04

Distribution and Diversity of Macroalgae from selected stations in the South West Coast of Kanyakumari, Tamil Nadu

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Marine ecosystems are the largest of Earth's aquatic ecosystems and are distinguished by waters that have salt content in contrast to freshwater ecosystems, which have a lower salt content. Marine environment which includes oceans, seas, coastal backwaters, estuaries and bays covers 70.8% of earth surface. It is a wealthy resource of biological and chemical diversity. The present study was explored to enumerate the seaweed resources around five selected stations (Kurumpanai, Manavalakurichi, Muttom, Kovalam and Leepuram) of the Kanyakumari coastal region, Tamil Nadu, during the period from July 2018 to May 2019. Macroalgae collection were made only on the low tidal and sub tidal region. A total of 46 algal species were collected from the selected coasts, among which 12 species belonged to Chlorophyceae, 14 species belonged to Phaeophyceae and 20 species belonged to Rhodophyceae. Among the five coasts, rich vegetation was found at Muttom coast (35 species), followed by 30 species of macroalgae from Kovalam coast. Lower number of macroalgal species were collected from Leepuram (15 species), Manavalakurichi (10 species) and Kurumpanai (7 species). Among the three groups of algae collected, red algae dominated over green and brown algae at the four stations - Manavalakurichi, Muttom, Kovalam and Leepuram - except Kurumpanai.

Keywords : Macroalgae, Kanyakumari coast, Diversity

IVCPB 05

Evaluation of promising Brahmi (*Bacopa monnieri* Linn.) accessions for yield and quality

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Brahmi (*Bacopa monnieri* Linn.), belonging to family Plantaginaceae, is a herb of immense pharmaceutical significance owing to the presence of the saponin 'bacoside'. It is widely distributed in warmer parts of the world and grows in damp or marshy areas near streams or along borders of ponds, being abundant particularly in monsoon. Excessive collection of the species from the wild has put the plant in danger of extinction and has called for the identification of varieties suitable for commercial cultivation, in order to meet the rising demands. Hence our study was conducted with an objective of identifying suitable accessions of brahmi for cultivation, wherein 13 ecotypes selected through the preliminary screening of 52 ecotypes were evaluated for yield and secondary metabolite production. Thirteen promising accessions (11, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 42, 52) identified based on yield index and bacoside content from a preliminary screening of 52 accessions at AMPRS, Odakkali, were evaluated under this study in Randomised Block Design (RBD) with three replications in one square meter plots. Two crops of 60 days duration each were taken in September and December months of 2020. Vegetative parameters were recorded at one-month interval. The crop was harvested at sixty days of planting and fresh and dry yield and quality parameters were compared. Some of the accessions under our experiment have proven to be promising in terms of high herbage and bacoside yield. Moreover, the range of bacoside content observed was comparable with that of improved variety CIM-Jagriti with 2 % bacoside A, released from CIMAP.For the purpose of identification of high yielding, high quality accessions for cultivated conditions on the basis of biomass yield and bacoside content, consistency in yield and quality are to be further evaluated.

IVCPB 06

Hormonal dynamics in the liquid endosperm of immature and mature nuts of West coast tall and Gangabondam dwarf varieties of *Cocos nucifera* L.

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Coconut water (*Cocos nucifera*. L), the semi-clear liquid endosperm obtained from coconut is a refreshing, nutritious beverage having beneficial health properties, used as an important alternative for oral rehydration and even for patient intravenous hydration in remote regions. It contains many PGRs which play vital roles in many processes during seed development such as histo differentiation, reserve accumulation, and germination. In the present study, two varieties; West coast tall and Gangabondam dwarf varieties were screened for the involvement of PGRs at immature (120 days) and mature (360 days) stages of liquid endosperm and the appropriate stages for the extraction of these compounds for industrial purposes by LC-MS/MS method. According to the results, SA was found in an exceptionally high amount in the liquid endosperm of mature nuts (5623.65 ng mL^{-1} and 3861.97 ng mL^{-1}) of both varieties when compared to there immature stage. The liquid endosperm of tender nuts of tall variety had higher amounts of BA (33238 ng mL^{-1}). tZ was found mostly active hormone in both stages of both varieties while tZR was found in insignificant amounts. IAA was the predominant form of auxins in all both cultivars. The results indicate that even though the hormone expression pattern was almost similar in both cultivars, they varied significantly with the level of hormones at different stages of liquid endosperm. The presence of these hormones at higher levels indicating that they are very essential for the histo differentiation and reserve accumulation stages. And elevated hormones shows one more advantages that, it can be extracted for the commercial purposes, So that the elevated hormonal stages are mentioned specifically in this work.

IVCPB 07

Study of induced modification in developmental pattern of cowpea (*Vigna ungiculata* L.) with split dose of POP

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Plant productivity is determined both by the amount of water available and the efficiency by which the water is used by the plant. Available water resources have been found decreasing in recent years for successful crop production. Crop losses due to increasing water shortage will further aggravate its impacts in many regions of world. Cowpea has many mechanisms of response and survival to drought. These include some physiological, biochemical and agro morphological responses. The present programme was an attempt to study induced modification in developmental pattern of cowpea (Vigna Ungiculata L.) with split dose of POP under soil moisture regimes. For a proper supply of nutrients and maximum yields, fertilizer input modifications are essential. Estimates of overall efficiency of applied split dose of fertilizer under stress condition. Treatments like T1M1N1 Control, T2M2N2 (SM30% + 10% POP), T3M3N3 (SM40% + 20%POP), T4M4N4 (SM60% + 30% POP), T5M5N5 (SM70% +40%POP), T6M6N6 (SM80%+50%POP), for each treatment, the germination percentage was noticed. In pots containing a certain treatments as in trays, randomly selected seedlings from each treatment were transplanted. Various growth parameters like root length, Shoot height, plant height, leaves number, total dry weight were recorded for each treatment. In this context, plant should greatly enhance fertilizer use efficiency under different water status.

Key words: Nutrient use Efficiency, Growth, Cowpea, Stomatal frequency, Pigment composition.

IVCPB 08

Bio-Chemical profile of *Solanum violaceum* Ortega subsp. Violaceum and *Solanum violaceum* Ortega subsp. multiflorum (C.B. Clarke) K.M. Matthew

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Solanum violaceum has two subspecies viz. *Solanum violaceum* subsp. violaceum and *Solanum violaceum* subsp. multiflorum. In the present study an attempt has been made to evaluate the biochemical profile of these two taxa, following analysis of the hierarchical status. FTIR spectral data indicates specific fingerprint region for the different ssp. From present analyses, characteristic functional group such as carboxylic acids, alcohols, alkenes and ethers were only detected in the sample of *S. violaceum* ssp. violaceum. and, aldehydes, aromatic amines, alpha-beta unsaturated esters were only present in *S. violaceum* ssp. multiflorum. The total phenol content was measured by means of Folin Ciocalteu method and flavonoids of two ssp. of *S. violaceum*. Moreover, all the concentrations of phenol and flavonoids showed significantly positive correlations with antioxidant activities measured by DPPH and FRAP assays. The DPPH free radical scavenging activity of the *S. violaceum* ssp. violaceum extract showed the relatively high scavenging activity than *S. violaceum* ssp. multiflorum. The heavy metals were determined in fruit samples by means of ICP-MS. Concentration of Cr, Fe, Cu, and Zn in Solanum violaceum ssp. violaceum relatively higher than *S. violaceum* ssp. multiflorum and Li, B, Na, Mg, Al, K, Ca, Mn, Co, and Ni concentration is higher in *S. violaceum* ssp. multiflorum. Two ssp. Of *S. violaceum* samples presented large variability in the chemical compositions from the above bio-chemical studies. The study can be extended along with micromorphology and sequencing of cp genes to get a clearer picture of the taxonomic status.

Key words: Taxonomy, Spectral bands, Chemotaxonomy

IVCPB 09

Morphological, anatomical and preliminary phytochemical analysis of *Aristolochia krisagathra* Sivar. & Pradeep

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Aristolochia krisagathra Sivar. & Pradeep, an ethanobotanically important medicinal plant belonging to the family Aristolochiaceae. In this context the morphological, microscopic and phytochemical evaluation of the plant was observed. The morphological details revealed that the plant was a twining herb. Leaves were simple, glabrous alternate, petiolate, exstipulate, entire, multicostate divergent venation. Flowers were bisexual, epigynous and zygomorphic and gynostemium was present. The plant shows all the typical morphological characteristic features of the family Aristolochiaceae. The anatomical knowledge of plant helps in the taxonomy as a diagnostic key. It was noticed that A. krisagathra had an anomalous secondary growth. Fascicular cambium cuts secondary xylem towards inner side and secondary phloem towards outer side. Interfascicular cambium produces parenchyma to both outer and inner sides. Stomata were anomocytic surrounded by guard cells. Phytochemical screening was done using the aqueous extract of the leaves of A. krisagathra. The results revealed the presence of alkaloids, flavanoids, steroids, terpenoids, tannins, fixed oils, phenols, glycosides and cardiac glycosides. But phlobatannins were absent.

Keyword: Aristolochiaceae, anomalous, anomocytic, phytochemical analysis

IVCPB 10

Epigenetic mechanism in distinct molecular subtype of breast cancer

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Breast cancer is the most commonly diagnosed multiple sub-type heterogeneous disease in women. It has become a global burden owing to an alarming increase in its incidence worldwide. Disastrously it is also associated with high mortality rates warranting novel healthcare strategies and improvements in the existing ones to combat the disease. Being multifactorial in nature it is associated with numerous genetic and epigenetic alterations during the course of its development and progression. Presence of disparate subtypes and heterogeneity in their drug resistance capabilities makes its treatment even more complex with the pre-existing chemotherapeutic or anticancer drugs. Several risk factors are also associated with the disease including child bearing age, tobacco consumption, obesity, reproductive factors and dietary habits. Recent research suggests the significance of targeting a combination of epigenetic modifications for the efficacious treatment of breast cancer, as targeting only one type of epigenetic alteration cannot offer any solution. Demethylating agents increase the expression of tumor suppressor genes, but they also possess risk of demethylating oncogenes leading to their increased expression. The complex interplay associated with epigenetic alterations, their clonal evolution and environmental factors in the pathogenesis of breast cancer makes it more challenging to treat, necessitating further research of such alterations. In depth molecular and genetic analysis of such alterations has greatly contributed to early diagnosis, favorable prognosis and novel therapeutic approaches. In this review, we attempt to highlight and explore the epigenetic modifications and environmental factors that converge in the development of different molecular subtypes of breast cancer.

IVCPB 11

Cytological and morphological effects of synthetic and natural food colours on root tips of *Allium shoenoprassum* L.

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Food has always been accepted as an emotion from centuries ago and food colours have been used to bring out these emotions. Initially natural colours were used but with the onset modern technological advancements, artificial food colours have come into play. Rampant use and misuse of these colours have led to the development of serious debilitating side effects and diseases. The objective of the study was to evaluate cytological and morphological effect of artificial and Natural food colours on root tips *Allium shoenoprassum*. Orange red, Lemon Yellow (Artificial), Curcumin, Annatto, Betanin (Natural) dyes were evaluated at doses 0.01% 0.025%, 0.05%, 0.1% at exposure times of 6 hours. Cells and the presence of chromosomal aberrations were analyzed throughout the whole cell cycle. The mitotic index and percentage of abnormality was calculated. From the obtained results, it was verified that the natural food colours were not cytologically and morphologically toxic to the cells of the test system. However, the artificial colours at the four evaluated doses used in this bioassay have promoted significant reduction in cell division and induced the emergence of anaphasic bridge, chromosome clumping aberrations and binucleate cells, and also it inhibits the root and leaf growth of *A. shoenoprassum*. The result of the present study clearly establishes the cytotoxic behavior of Orange Red and Lemon Yellow food colours. Additional studies should conducted to add information to these and other previously obtained results in order to evaluate, with property, the action of these colours on a cellular level.

IVCPB 12

Photocatalytic degradation of methylene blue by green synthesized silver nanoparticles of *Callistemon citrinus* (Curtis.) skeels.

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Nanotechnology deals with the synthesis of nanoparticles with controlled size, shape and dispersity of materials at the nanometer scale length and their potential use for human well-being. The purpose of the present study was to assess the degrading property of the synthesized silver nanoparticles from *Callistemon citrinus* (Curtis.) skeels. leaf extract towards methylene blue. In this analysis, eco-friendly silver nanoparticles synthesized from the leaf extracts of *C. citrinus* are employed in the photocatalytic degradation of the commonly used textile dye; methylene blue. The leaf extract reduces Ag+ to metallic silver. No stabilizing agents were used in this experiment and hence dye degradation was carried out before agglomeration. The synthesized silver nanoparticles were characterized using UV-Visible spectroscopy. UV-Visible spectrophotometer was used to study and analyse the degradation performance of green silver nanoparticles on methylene blue. The results showed that 63% of methylene blue degraded after two hour of photocatalytic degradation. Leaf extract of *C. citrinus* proved to be an effective reducing agent for the synthesis of silver nanoparticles and exhibits excellent photocatalytic degradation activity against methylene blue. This is cost-effective, simple and non-toxic process addresses the modern day pollution problem.

IVCPB 13

Leaf anatomy of Nymphaea L species in Kerala

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Flowering plants show great diversity in the arrangement and structure of tissues in their roots, stem and leaves. It is mainly used in the identification of plants and their relationship with different genera, families, orders and taxa. The present study was done to investigate the similarity and differences among the Nymphaea species cultivated in Kerala. The anatomical characters of *Nymphaea rubra*, *Nymphaea omarana*, *Nymphaea micrantha*, *Nymphaea nouchali*, *Nymphaea marliaceae* and *Nymphaea mexicana* were analysed. Fresh leaf and petiole samples of the plants were collected from different localities and prepared for microscopic observation using standard protocol and photographed. Anatomical studies show that all the species show almost all characters similar. Presence of non-glandular trichomes on the epidermis of the petiole in *N. malabarica*, *N.mexicana, N.rubra* which are absent in other species taken for study. Some of the distinguishing characters were the presence of angular and lacunar type of epidermal layers. All species contains asterosclerids present in the lacunae of arenchyma. Tubular and elonagaed sclereids were found in the midrib of *N. malabarica, N. marliaceaea* and *N. nouchali*. Except in *N. marliaceae* all the species posses columnar sclerids. 2-6 bicollateral vascular bundles were present in the evaluated species. Collateral vascular bundles with protoxylem lacunae are present in all species except in *N. omarana*. Except in *N.malabarica* and *N.mexicana* all the species possess collateral vascular bundles without protoxylem lacunae. The plants show few typical characters which helps to differentiate it from others. The anatomical differences in the leaves helps to differentiate the taxa and can make it as identification key.

IVCPB 14

Phytochemical investigation on nutritional composition of 'Microgreens' produced from selected wild forage legumes profusely growing in Northern Kerala

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Many legumes have been identified as edible greens and as potential forage/fodder crops. This implies the nutritional value of the 'microgreens' they generate in addition to their protein rich seeds and pods. Microgreens are vegetable greens harvested just after the cotyledon leaves have emerged; or they are the young plantlets harvested approximately after completing their growth of one week. Microgreens are getting attention recently because of their easiness in management and nutritional qualities as well. The present study is to evaluate the significant changes in the chemical composition of three pairs of wild under exploited legume seeds and their microgreens. The selected species are *Canavalia rosea*, *Calopogonium mucunoides* and *Peuraria phaseoloide*s. The specimens were subjected to dry weight determination, qualitative as well as quantitative biochemical analysis. Moisture, fiber, pectin, total carbohydrate, total starch, reducing sugar, soluble sugar, total protein, free amino acid content, total antioxidant activity and some anti-nutritional components were also estimated quantitatively. The compounds such as carbohydrate, sugar, starch and protein were found higher in seeds whereas fiber content and antioxidant composition were found increasing on germination. Studies depicts that anti-oxidant components have the potential to lower the risk of several disease. So that both enzymatic as well as non-enzymatic antioxidants were also analysed for all the seeds and microgreens. All the interesting results obtained from this study were explained, analysed and interpreted in detail.

Key words: Legume, Microgreen, Phytochemicals, Antioxidants.

IVCPB 15

Comparative study on the presence of phytochemicals in the leaves and rhizome extracts of *Theiophonum infaustum* N.E.Br. : An endemic Aroid

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Theriophonum infaustum N.E.Br. is a seasonally dormant tuberous herbaceous plant belonging to the Araceae family, endemic to India and Sri Lanka. This is a medicinal plant, keeping this information in view, an endeavor has been made to determine presence of some biochemical constituents of the T*heriophonum infaustum* by preliminary phytochemical screening. Three different solvent extracts of leaf and rhizome were compared, by standard qualitative screening procedure of phytochemicals. Results obtained that, presence of phytochemical is higher in methanolic leaf extract and less in acetonic extracts of rhizome. Hence methanolic extract can be further investigated for more study.

IVCPB 16

Comparative metabolite profiling of high antioxidant potential fractions of *Dendrophthoe falcata* and *Macrosolen capitellatus* infesting jack (*Artocarpus heterophyllus*)

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Plants are thought to be one of the most important sources for discovering and developing pharmaceuticals that are both effective and safe compared to currently available synthetic drugs. Mistletoes are a diverse collection of semi-parasitic plants that are found all over the world. Loranthaceae and Viscaceae are the two main groups of mistletoes. *Dendrophthoe falcata* and *Macrosolen capitellatus* belonging to the family Loranthaceae are widely distributed in India, commonly inhabiting the host jackfruit (*Artocarpus heterophyllus*) and are considered among nature's many plants with medicinal characteristics. Aqueous extracts of *M. capitellatus* and *D. falcata* exhibited higher extract efficiencies and correspondingly higher antioxidant potentials. This suggested that polar inorganic extraction could be advantageous for eluting out the antioxidant fractions. Among the two, *M. capitellatus* extracts exhibited higher free radical scavenging activity. Qualitative phytochemical screening revealed the presence of alkaloids, saponins and phenols in case of *M. capitellatus* and alkaloids and phenols in *D. falcata*. There was a differential display in possession of different classes of phytochemicals by both the parasites on jack, which is probably a phenomenon across different host-parasite associations. The aqueous extracts of the two parasites inhabiting jack were further characterized by GC-MS/MS analysis, unravelling distinct candidates from each host-parasite interaction. Both *M. capitellatus* and *D. falcata* extracted in water revealed the differential abundance of some of bioactive compounds such as Benzopyran-4-one and phytol in the former and lupeol and diphenyl sulfone in the latter, which possesses anti-microbial, anti-inflammatory, anticancer and diuretic properties.

IVCPB 17

Impact of nutrients and biofertilizers on flowering in tomato under elevated CO_2 induced high temperature condition

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The study aimed at investigating the effect of elevated CO_2 induced high temperature on flowering in tomato variety Vellayani Vijay and it's improvement through the application of various nutrients and biofertilizers. A pot culture study was done with treatments - 50 ppm B + 50 ppm Zn + water spray (T1), 75 ppm B + 75 ppm Zn (T2), POP 150% N + 125 % P+ 125% K (T3), Azolla (Soil application) (T4), Azolla biofertilizer extract (20%) (foliar application) (T5), Azolla biofertilizer extract (20%) (seed treatment) (T6), POP, KAU + PGPR1(T7), Control (water spray) (T8), Absolute control(T9). The flowering was delayed and number of flower clusters were improved under elevated CO_2 condition. The foliar application of 50 ppm Boron + 50 ppm Zinc + water spray, application of 50% extra N and 25% extra phosphorus and potassium each than the recommended doses as per package of practices (Kerala Agricultural University) and foliar application of 20% Azolla biofertilizer extract were found to be improved the number of flower clusters and number of flowers per cluster under elevated CO_2 condition.

IVCPB 18

Priming mediated biotic stress tolerance in *Curcuma longa* L.

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Seed priming is an effective method to enhance germination and growth under stressful conditions. The effects of different rhizome priming techniques namely Hydropriming, Halopriming and Chemical priming on the emergence, growth, and resistance in *Curcuma longa* L. were investigated in this study. In this study, the most effective reagents were used, together with pre-optimized concentrations based on early studies. Three different turmeric varieties, namely Prabha, Prathibha, and Pragati were primed and allowed to grow in grow bags along with the control rhizomes. Rhizomes were treated with 250Mm NaCl for 12 hours during halopriming. Rhizomes were hydro-primed for 12 hours using distilled water. Chemical priming involves treating the rhizome with different concentrations of potassium nitrate [50Mm, 100Mm, 150Mm, 200Mm, 250Mm, 300Mm]. Rhizome primed with 200Mm KNO_3 showed the highest growth rate. They also showed the highest chlorophyll content. Moreover, the overall growth of plants is enhanced due to the seed-priming treatments. Proline concentration was significantly higher in KNO_3 primed plants and MDA content was higher in the halo primed variety. Proline levels increase in the turmeric leaves in response to increased stress conditions and help in stress tolerance. Most halo and hydro-primed plants are disease-prone however, no disease has been found in the KNO_3 primed plants. As a result, chemical priming provides greater disease resistance than other primed plants. The present study suggested that chemical priming with potassium nitrate is an alternative and more effective method to increase tolerance in turmeric varieties when exposed to different biotic stress conditions.

Keywords: Turmeric; Hydropriming, Halopriming, Chemical priming, growth parameters, Disease resistance

IVCPB 19

Selection of a plant best suited for plant-mediated gold nanoparticle synthesis

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Gold nanoparticles are of immense utilities to mankind because of their unique physical and chemical characteristics. At present they are prepared commercially by chemical synthesis which is hazardous to the environment. Search for a green protocol lead to the discovery of the property in plants and plant products. Since the invention of the technique, numerous plants are being reported to be having the capability. But none of them came up as successful for using as an alternate to chemical synthesis. It is mainly because of the difficulty in regulating size and shape of the particles. The present investigation was done for standardizing an extraction medium. Being a widely used one in biological experiments, phosphate buffer was employed for extraction of leaves from ten different plants and the effect on nanoparticle synthesis was analyzed using spectrophotometry and testing catalytic activity of the particles. Results show that almost all plants are having the property; but showed differences in results probably due to the differences in size, shape and concentration of the particles produced.

Key words: Gold nanoparticles, Green synthesis, catalysis

IVCPB 20

Physiological Adaptations in Selected Species of *Anisochilus* Wall. Ex Benth.

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Anisochilus is one of the medicinally important genus of Lamiaceae. *Anisochilus* species is rich in active secondary metabolites and very important for economic, agricultural and pharmaceutical point of view. Some of the species such as *A. scaber* Benth., *A. carnosus* Wall., and *A. kanyakumariensis* are distributed in rocky areas of Kerala and Tamilnadu. Xylem vessels of all these species possess numerous helical (spiral) thickening. It is a mechanism for increasing the surface area, thickening of vessel wall and narrowing the lumen of the vessel. According to Carlquist (1982) it helps in hydration and facilitates tolerance of a higher tension of water column without rupture of the column. It also prevents the incidence and spreading of cavitation. These vessels are valuable for safety when larger vessels are embolised (Huber, 1935). Apart from the increase of mechanical strength, the anatomy of xylem vessels revealed the physiological performance which is in connection with the fitness of the plant. Occurrence of helical thickening is a common feature of wood from xeric habitat. However, helical sculpture may not be able to evolve in all groups in xeric habitats. There can be little doubt that presence of helical sculpture in vessels of *Anisochilus* species related in general with dryness (low soil moisture, low humidity, and physiological drought) of habitat, as in Asteraceae.

Key words: Anisochilus , Xylem, helical thickening, Asteraceae.

IVCPB 21

Assessment of the various iodine detection methods in biological samples

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Iodine is a vital component of human nutrition which needs to be investigated in all aspects to get a better understanding of the situations, where it is related to deteriorating health or illness. Thyroid hormones essentially require iodine for their synthesis. Milk, vegetables, fruits, cereals, eggs, meat, and marine foods are all-natural sources of iodine. Further consumption of iodized salt is a good way to provide enough iodine. There are several methods available to estimate blood Iodine to diagnose iodine deficiency or excess, iodine-induced hyperthyroidism, hypothyroidism, and autoimmune thyroid diseases like Graves' disease and Hashimoto's thyroiditis & to monitor iodine exposure.For biological assessment of iodine incorporation in vivo thyroid monitors or whole-body counters are used to quantify iodine radioisotope within the body. In case the in vivo measurements can't be done,Urine is the recommended sample for in vitro iodine tests, while other sample types such as faeces, tissue, blood, serum, and hair can also be used on a limited basis with good detection sensitivities. Majority of the urinary iodine concentration analysis procedures are based on manual spectrophotometric measurements of the Sandell-Kolthoff reduction process catalyzed by iodine in the early digestion stage using various oxidising reagents. Moreover semi-quantitative approaches, microplate method, automated methods, and technologically sophisticated methods, such as the inductively coupled plasma mass-spectrometer method are also available. Because of its precision, simplicity, and low cost, the iodine titration method is a choice all around the world. Rapid test kits, preferably with titration back-up, are suited for qualitative application in circumstances where iodised and non-iodised salt must be separated.

IVCPB 22

Imprints of mycorrhizal association on the Cadmium-induced structural and functional modifications in leaves of *Oryza sativa* and *Zea mays*

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Cadmium (Cd), a divalent cation, is one of the most toxic heavy metals introduced to the agricultural fields due to the extensive application of agrochemicals. Association of arbuscular mycorrhizae with crop plants is an appropriate strategy to augment the metals tolerance of the plants. The major objective of this study was to determine the structural and functional modifications in the leaves of mycorrhizal and non-mycorrhizal *O. sativa* and *Z. mays* plants exposed to $CdCl_2$. In the present study, 45 d old *Z. mays* (var. CoHM6) and *O. sativa* (var. Varsha) plants inoculated with AM fungi (*Claroideoglomus claroideum)* were exposed to 0.45 g Cd Kg−1 soil. Cadmium toxicity inhibited the photosynthetic machinery, which implicates in the extensive degradation of photosynthetic pigments and the functional impairment of the photosystem activity. At the same time, mycorrhization alleviated the degradation of pigments and the reduction in photosystem activities than non-mycorrhizal plants exposed to Cd stress. Moreover, Cd restricted the stomatal opening that causes reduction in the gaseous exchange, and the impact on stomatal opening was prominently observed in *Z. mays*. In addition, the shape of induction curves of chlorophyll fluorescence (OJIP) of *Z. mays* and *O. sativa* was modified under Cd stress. Cd did not significantly affect the standard shape of OJIP curve in *O. sativa*; however, OJIP curve of *Z. mays* was significantly modified as compared to the control plants. At the same time, mycorrhization aid to maintain the standard shape of OJIP curves in *Z. mays* and *O. sativa* under Cd stress. Mycorrhization maintained the photosynthetic efficiency of *O. sativa* and *Z. mays* by improving the pigment content, functionality of PSII, efficiency of electron transport, and by preventing stomatal closure even under the extreme metal stress.

IVCPB 23

Estimation on the bioactivity of Secondary metabolites and Antioxidant analysis of *Syzygium cumini* (L.) skeels

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Medicinal plants, also called as medicinal herbs are used in traditional medicine practices since prehistoric times. Healing with medicinal plants is as old as mankind itself. The purpose of the study was the collection and authentication of plant material and the estimation of primary and secondary metabolites and antioxidant effect of *Syzygium cumini.* The plant samples were collected from two different geographical regions like Trivandrum and Kollam, Kerala. The leaf and bark extracts were analyzed for the presence of the major classes of phytochemicals namely phenols, flavonoids, steroids, amino acids, tannins, terpenoids, glycosides, saponins, alkaloids in addition to the primary metabolites namely carbohydrates, proteins and lipids. The quantitative estimation was the analysis of primary metabolites such as Proteins, Carbohydrates, Lipids and Amino acids. It also involved the antioxidant analysis of DPPH free Radical Scavenging Assay, Nitric Oxide Scavenging Activity and Superoxide Dismutase Activity. Stem showed high value of flavonoids, lipids and amino acids. It was found that a maximum composition of most biochemicals were present in the leaf of *S. cumini* from Asramam. The stem of *S. cumini* from Asramam showed higher amount of certain biochemicals. Intermediate amount of composition was found in the stem and leaf of *S. cumini* from Neyyattinkara. The three antioxidant analysis indicated a result of higher and lower percentage of inhibition in the leaf and stem of *S. cumin* collected from Asramam, Kollam than those collected from Neyyattinkara, Trivandrum.

IVCPB 24

A study on germination percentage of *Syzygium caryophyllatum* (l.) Alston seeds stored at different conditions

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Recalcitrant seeds are short lived and also termed as dessication sensitive seeds. They are dessication intolerant and are highly sensitive in nature. It is mainly due to insufficient maturation drying on mother plant since they shed with high moisture content. Seed viability mainly depends on nature of species, seed processing and conditions at storage. It plays a crucial role in enhancing the viability. In storage, moisture content, temperature and environmental conditions promotes seed deterioration which makes difficulty in maintaining the viability period during storage. It also depends on the quality of seeds and also the condition in which it is stored. *Syzygium caryophyllatum* is an evergreen shrub or tree growing 3-5 metres tall and it belongs to family Myrtaceae and has recalcitrant seeds. The plant is classified as Endangered in the IUCN Red list of Threatened Species. The present study deals with the evaluation of seed viability, germination percentage and moisture content of seeds stored at different storage conditions and to find a suitable storage medium. The above mentioned factors were noted at regular intervals and found that refrigerator is the most suitable medium for storage. These factors plays an important role in storage.

Keywords: . Syzygium caryophyllatum, dessication, deterioration

IVCPB 25

Morphological and anatomical alterations in *Artemisia nilagirica* (Clarke) Pamp. upon copper toxicity

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Plants have always been an excellent and suitable source of pharmaceutical agents. *Artemisia nilagirica* (Clarke) Pamp. Commonly known as Indian wormwood, is an important medicinal plant with good therapeutic values. Before using plants for medicinal purposes it is mandatory to evaluate their growing habitat. Copper is an essential metal for normal plant growth and development, although it is also potentially toxic. Excess copper inhibits plant growth and impairs important cellular processes. Toxic effects of copper was studied in *A. nilagirica.* Rooted propagules were grown in Hoagland nutrient medium contaminated with known concentration of copper sulphate. Concentration of $CuSO_4$ to impart about 50% growth retardation symptoms maintaining survival of the plant was 50µM. Toxicity symptoms are expressed morphological changes as growth retardation. Growth rate in terms of Shoot length, Root length, Leaf area and Tolerance index exhibited significant changes between control and treated plants. In addition to imparting morphological alterations Cu can also affects anatomy of the plant. Histochemical study of plant cuttings were done using toluidine blue stain. Accumulation of Cu was observed in the form of stained masses in root, stem and leaf, indicating the uptake of Cu to the plant body. Findings of the present study contribute a lot to the existing knowledge and better understanding with regard to the impact of copper on normal physiology of *Artemisia nilagirica* (Clarke) Pamp.

IVCPB 26

Phytochemical screening and anti-inflammatory properties of *Thottea siliquosa* rhizome extract

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Thotttea siliquosa, commonly known as 'alpam', is a medicinal undershrub, used by tribal groups in the Western Ghats for curing various ailments. The traditional health practices involving *T. siliquosa* are not scientifically validated till now. The present study mainly focused on the documentation of the ethnobotanical knowledge with regard to *T. siliquosa* and the pharmacological evaluation of the ethnobotanical claims. Ethnobotanical documentation was done by survey method. Ethnic people claim the anti-inflammatory potentials of the rhizome of *T. siliquosa*. The plant extract was prepared by the tribal protocol. In vitro anti-inflammatory potentials of *T. siliquosa* rhizome was analyzed by conducting in vitro assays which includes Protein denaturation inhibition assay, Anti proteinase assay and, HRBC (Human Red Blood Cell) Membrane stabilization assays. In each of the assay the plant extract exhibited dose dependent anti-inflammation. Phytochemical screening of the rhizome extract revealed the presence of alkaloids, glycosoides, phenols, flavonoids, saponins, reducing sugar and starch.

Keywords: Thottea siliquosa, Anti-inflammation, HRBC Membrane stabilization

IVCPB 27

Total antioxidant assay of *Gnidia glauca* (Fresen.) Gilg leaf and bark extracts using Phosphomolybdate method.

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*Gnidia glauca (*Fresen.) Gilg, belonging to the family Thymelaeaceae, is native to India, Sri Lanka and South Africa. It is a very little known plant shrub available the southern part of the Western Ghats. *G. glauca* was used in traditional medicine for cancer, sore throat, wounds, burns and snakebites. Leaves are used to treat contusions, swelling, back ache and joint aches. The aim of the present study was to evaluate the antioxidant and free radical scavenging activity of *G. glauca* leaf and bark extracts. Plant parts like leaf and bark were washed, shade dried, grinded and sequentially extracted by hot solvent extraction method with Soxhlet apparatus. The extracts were subjected to qualitative phytochemical screening using 5 different solvents Viz. petroleum ether, chloroform, acetone, methanol and aqueous. The qualitative and quantitative phytochemical analysis revealed the presence of secondary metabolites such as phenols, tannin, flavonoid, alkaloid in different extracts. Antioxidants play an important role in protecting cellular damage caused by reactive oxygen species. Total Antioxidant potential of different extract of *G. glauca* was studied using Phosphomolybdate assay. The results obtained from the assay shows that Acetone, Methanol and Aqueous extracts has strong ability to reduce Mo(VI) to Mo(V) by donating electrons than petroleum ether and chloroform extracts. This study demonstrates that the extract of *G. glauca* exhibit significant antioxidant activity.

Keywords: *Gnidia glauca,* Total antioxidant activity, Thymelaeaceae.

IVCPB 28

Effect of divalent cations (Zn^{2+}, Pb^{2+}, Co^{2+}, Ca^{2+}) on the enzyme activity of Acid Phosphatase in *Murraya koenigii*

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Among the various reasons that cause plant toxicity and environmental degradation is the presence of certain metal ions in the soil environment which inhibit the proper functioning of plants and thus causing deterioration in plant quality. This further leads to bio magnification which hinders the various biochemical mechanisms in higher organisms. However, scarce information is available currently with regard to the effect of heavy metals on the activity of plant enzymes. Acid phosphatases are a group of enzymes that are widely distributed in plants , which non-specifically catalyse the hydrolysis of a variety of phosphate esters in an acidic environment . The hydrolysis of phosphate esters is an important process in energy metabolism, metabolic regulation and a wide variety of cellular signal transduction pathways of plant cells. The main objective of our study was to understand the effect of divalent metal ions like copper, zinc, calcium and lead on the activity of enzyme acid phosphatase. From the inhibition assays we saw that zinc has the maximum capacity for inhibition while calcium at low concentrations activates the enzyme and at higher concentrations has the ability to inhibit as well. We therefore infer that even at normal permissible concentrations of the above ions, the enzyme acid phosphatase would be inhibited. To a certain extent the plant as well the enzyme can handle the excess metal ions but, after that it would definitely lead to metal toxicity.

IVCPB 29

Preliminary phytochemical studies on the leaves and roots of *Canthium angustifolium* Roxb.

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Medicinal plants are rich sources of bioactive phytochemicals which are essential for preventing various disorders causing degenerative diseases. *Canthium angustifolium* Roxb., belonging to the family Rubiaceae is a traditional medicinal plant that occurs in the African and Asian tropics. Hence, the objective of the present study was to investigate the preliminary phytochemicals and to screen the anti-oxidant activities of the ethanolic leaf and roots extracts of *C. angustifolium.* The antioxidant activity was evaluated based on Hydroxyl Scavenging and NO Scavenging Assays. The preliminary screening showed the presence of carbohydrates, terpenoids, alkaloids, flavonoids in the leaves and the roots and steroids were present in the leaves but were absent in the root extract. But, proteins, aminoacids and tannins were absent both in the leaves and roots. The antioxidant activities of the leaf and root extracts revealed that the activity showed increase in the percentage of inhibition with increase in the concentration of the leaf sample from 12.2%, 37.9% and 52.8%, and root sample from 24.8%, 48.51% and 62.7% in NO scavenging assay, and in Hydroxyl radical scavenging assay with 37.7%, 46.6% and 56.1% in leaf and 31.29%, 42.11% and 54.32% in root sample. The IC_{50} values were also calculated. Both the leaves and the roots showed significant antioxidant activity compared to the standard ascorbic acid.

IVCPB 30

Copper oxide nanoparticles mediated photocatalytic degradation of Thiabendazole, antimycotic potential of CuONP-TBZ complex and its *In silico* docking analysis

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Nanomaterials are substances with superior physiochemical properties. The antimycotic applicability of the nanocomplex (CuONP-TBZ) was evaluated to determine the antifungal activity against *Asperigillus niger*. Fabricated complex exhibited elevated anti-fungal activity when compared with its free form ie, Thiabendazole alone. This was evident by the observations obtained from the poisoned food technique assay performed in *A. niger* wherein the maximum activity was observed in a dose-dependent manner. The UV-Spectroscopy analysis was used to confirm the degradation of Thiabendazole by Copper oxide nanoparticles in the presence of UV light. In silico molecular docking was performed to identify the property of Copper oxide nanoparticles to inhibit the growth and proliferation of the plant pathogenic fungus. Thus fabricated nanocomplex prepared in an inexpensive, simple and fast means could be constructively used as an antifungal agent.

IVCPB 31

Effect of seaweed extracts on in vitro rhizogenesis and growth of *Stevia rebaudiana* (Bert.) Bertoni.

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Stevia reboudiana is a well-known plant for its capability to synthesise a group of chemicals with sweet taste, steviol glycosides. The effect of seaweed extract on in vitro culture of S. rebaudiana was studied using S*argassum wightii* (Phaeophycea) and *Gracilaria edulis* (Rhodophyceae). From the studies, it was found that the Sargassum extracts have rhizogenesis ability and also induce multiple shoot formation. Those cultures grown in 4ml. of *S. wightii* extract in half Murashige and Skoog (HMS) medium found to produce a mean value of 7.25 roots within 30 days of inoculation and 12.25 after 60 days. *G. edulis* extracts showed an average of 0.825 roots after 30 days of inoculation and 1 root after 60 days. *S. wightii* extract found root initiation after 7 days of inoculation in half Murashige and Skoog (HMS) medium. This was found earlier than those inoculated in HMS medium supplemented with Indole-3- butyric acid (IBA) as plant growth hormone. The plants regenerated from the medium supplemented with *S.wightti* shows a 95 % acclimatization and this is an effective in the case of *S. rebaudiana*. In vitro grown plants with S. wightii extracts also found to produce higher inter nodal elongation that is with higher shoot length compared to other medium. *G. edulis* do not show any significant result.

IVCPB 32

Toxicological impacts of synthetic dye on plants and phytoremediation potential

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Synthetic dye-containing wastewater is hazardous to ecosystem flora and affects aquatic and terrestrial habitats when deposited into diverse environmental systems. Fish, crustaceans, algae, and bacteria have been characterized as acutely poisonous to several acid, basic, and direct azo dyes. Non-ionic azo dyes are considered as harmful or potentially dangerous substances in most cases. The existence of untreated dyes in water bodies poses the greatest harm to the environment since many of these reactive dyes obstruct the photosynthetic activity of hydrophytes by obstructing light penetration, resulting in the creation of hazardous chemicals. These are micro pollutants that are found in extremely small amounts in the aquatic environment and are resistant to degradation. However, aromatic amines, which are chemicals of concern due to their potential carcinogenicity, are among their breakdown products and contaminants. These are genotoxic, mutagenic, and carcinogenic, and they have found their way into the food chain, posing a serious threat to biota health. The global community has pushed for the development of effective and resourceful wastewater treatment technology that does not further harm the ecology. For the elimination of synthetic dye, several microbes and plants have been considered. For the destruction, elimination, and detoxification of dye, phytoremediation and its related metabolic processes have been recognized as environmentally benign and valuable techniques. Therefore, this highlights the toxicological impact of dyes on aquatic and terrestrial plants. It also emphasizes the functional characteristics of various plant species and their metabolic capacities which facilitate them to deal with dyes successfully.

IVCPB 33

A study on stomatal ontogeny and stomatal clustering of *Dendrophthoe falcata* (L.f.) Ettingsh. (Loranthaceae) from Eastern Ghats, Tamil Nadu, India.

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Dendrophthoe falcata (L.f.) Ettingsh. an perennial climbing parasitic plant of family Loranthaceae. It is widely distributed in tropical regions, including India. The whole plant is used for astringent, aphrodiasic, narcotic, diuretic, and is useful in pulmonary tuberculosis, asthma, menstrual disorders, swelling wounds and ulcers. It showed antifertility, antilithiatic, immunomodulatory and anticancer properties also. It is one of the hemi-parasitic plants, so the anatomical study will help to support the analysis the physiological properties of the plant. In this regards, a detailed stomatal ontogeny and stomatal clustering of this species were carried out. The objectives of the study were, to document the leaf micro-morphological features and to assess the clustering pattern of the stomata in *D. falcata*. Leaf samples were collected from the Eastern Ghats and analysed by selected qualitative and quantitative characters. In the present study, paracytic stomata were observed on both sides, which indicate *D. falcata* has an amphistomatic type. Epidermal cell surface smooth and anticlinal walls straight to curved on both sides. In epidermis, tetragonal to polygonal cell shapes were observed. The observed data were statistically evaluated. In clustering, non-contiguous stomatal cluster was observed in *D. falcata*. Stomatal clustering was first time studied in this species. The present study documented the detail stomatal ontogeny, clustering of stomata and ecological significance of *D. falcata* from Eastern Ghats.

IVCPB 34

Bioactive macromolecules coated silver nanoparticles synthesized from *Curcuma zanthorrhiza* Roxb., its antifungal activity supported with *In silico* docking studies

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The study focuses on a facile, rapid, and eco - benign synthesis of silver nanoparticles (AgNPs) using aqueous rhizome extract of *Curcuma zanthorrhiza* Roxb. (CZ). HR – LCMS was used for the simultaneous identification of organic compounds in the CZ rhizome extract and its biosynthesized nanoparticles. The presence of eleven phytoconstituents in the rhizome extract acts as reducing and capping agents during the synthesis of AgNPs. The analytical techniques used for the nanoparticle characterization included UV – Visible spectral analysis, which displayed SPR band at 409 nm; FTIR spectrum depicted the active biomolecules involved in capping and reduction of silver ions to silver nanoparticles; XRD pattern attributed to fcc structure of CZAgNPs with an average size of 39.7 nm; HR-TEM and FESEM confirmed the size and spherical morphology of CZAgNPs. The chemical nature of phytoconstituents bound to AgNPs revealed by HR – LCMS was in agreement with FTIR spectral data. The antifungal property of the CZAgNPs determined from the poisoned food technique inhibited 86 % of *Aspergillus niger*. *In silico* molecular docking performed using the five ligands (biomolecules bound on the as synthesized silver nanoparticles) against the protein isocitrate lyase (1DQU) further substantiated the antifungal activity of the synthesized silver nanoparticles. Therefore these findings could contribute to the upgraded utilization of CZAgNPs to effectively deter plant pathogenic fungi.

IVCPB 35

Elite screening of superior germplasm of *Garcinia gummi- gutta* (L.) Roxb. across southern Kerala

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Garcinia gummi-gutta (L.) Roxb. an evergreen tree species of the Clusiaceae family, is known for its eye-catching fruit. The tree is distributed in restricted pockets of Southern Western Ghats. *G. gummi-gutta* shows high rate of endemism. The dried fruit rind or pericarp is commonly known as 'Malabar tamarind'. It is one of the important condiments in Kerala, which has been in use for centuries as a souring agent in dishes. Genetic Resources of Indian Garcinia species have been neglected thus facing threat of extinction. Greater emphasis on management of Indian genetic resources of Garcinia is required by collection, characterization and conservation to safe guard and for sustainable utilization. There is an urgent need to identify superior genotypes. In view of this molecular screening was done to identify superior *G. gummi-gutta* candidates from southern Kerala. Candidate Plus trees (CPTs) were selected and they were investigated for 10 quantitative characters. Principal component analysis revealed that fruit length, weight, diameter, nipple length, are the morphologically superior traits existing among different accessions.Scatter plot placed G11 separately, which may be due to superior morphological traits. Based on superiority on various yield parameters evaluated, CPT G11 was selected as 'elite' among the 14 Candidate trees compared. DNA was isolated from the leaves of CPTs using modified Dellaporta method. PCR reaction master mix composition and temperature conditions were standardized for ISSR markers. A total of 21 ISSR primers were used for evaluating genetic diversity. Out of these 21, 11 primers produced reproducible fragments and recorded 186 fragments, ranging from 123bp to 1499 bp. Among the 186 bands 184 were polymorphic (98.78%). Primer UBC 835 produced maximum unique bands. Molecular characterization indicates relatively high degree of polymorphism within the restricted area of study. The binary data of 186 fragments were used to analyze genetic relationship between 14 selected accessions and Jaccard's similarity coefficient (JC) was calculated. Pair wise similarity matrix values using Jaccard's coefficient ranged from 0.62 (between G1 and

G6) to 0.82 (between G3 and G4).The low JC value between these two accessions indicates their significant genetic differences. The highest JC value noticed between G4 and G3 suggested their genetic similarity. Cluster diagram constructed on UPGMA based similarity matrix of ISSR data were divided into 2 major principal cluster. The major cluster I consisted of G1, G2, G12 and G13. The cluster II consisted of two subclusters, comprised of 10 accessions. The molecular characterization of *G. gummi-gutta* collected from southern parts of Kerala showed significant genetic diversity. Superior germplasm screened through the present study can be used as genetic stock to improvement program of *G. gummi-gutta*.

IVCPB 36

Evaluation of bioactive compounds and mosquitocidal activity in *Cnidoscolus aconitifolius* (mill.) I.m.johnst.

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Phytochemicals are the bioactive compounds in plants, helps in the metabolic and defensive functions. Current study is to reveal the types of phytochemicals and mosquitocidal activity of the leaves and petioles in *Cnidoscolus aconitifolius*. There will have maximum treatment affect by the leaves dry powder against mosquito activity.

IVCPB 37

Effect of phosphate solubilising bacteria on vegetative growth, yield and metabolism of Butter Beans (*Phaselous lunatus*.L) cultivated in Kodai Hills

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Butter beans (*Phaseolus lunatus* L.) is one of the Kodai Hills crop belongs to the family Fabaceae and consumed as high protein food. Typically the soil is well treated with phosphatic chemical fertilizers for phosphorous insufficiency. Inadequate fertilization leading to low productivity of butter beans crops. Massive usage of chemical fertilizers will brings havoc to the environment and the price was said too steep by farmers. Hence, it is essential to reduce the use of chemical fertilizers by substituting with organic fertilizers preferably of microbial biomes such as phosphate solubilising bacteria (PSB). In order to study the effect of PSB on growth, yield and metabolic attributes of butter beans, the experiment consisting 15 treatments combination with phosphate solubilising bacteria with three levels (control, tricalcium phosphate and PSB) in randomized complete block design with three replications. This study showed that the application of PSB on butter beans crop resulted in better performance in growth, yield and metabolic parameters and thereby produced greater seed yield with a potential crop yield increase.

IVCPB 38

Physiological impact of CO_2 enrichment and associated high temperature on photosynthetic efficiency of Tomato (*Solanum lycopersicum* L.) and their improvement through certain mitigation strategies.

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Sustaining food security is a daunting challenge constantly faced by our nation and the world at large under the changing climatic scenario. The rising CO_2 levels and associated global warming has become an issue of concern as it greatly influences crop production. In this background, the proposed research was aimed to evaluate the effect of elevated CO_2 and associated high- temperature on photosynthetic efficiency in a popular tomato variety of Kerala namely Vellayani Vijay and its improvement through the application of certain promising mitigation strategies including growth regulators and additional dose of nutrients. A pot culture study was undertaken in two conditions namely open top chamber system (OTC) for CO_2 enrichment and control conditions with foliar spray treatments of NAA (50 ppm), SA (50 ppm), Boron (50 ppm) and Boron (50 ppm) + Zinc (50 ppm) at 40, 55 and 70 DAS, and additional nutrient treatments of POP 125% N: 100% P: 100 % K and POP 125% N: 125% P: 125 % K in equal splits, water spray and a control without any sprays. CO_2 enrichment resulted in a significant increase in photosynthetic parameters such as total chlorophyll content, total carbohydrate, photosynthetic rate, water use efficiency, chlorophyll fluorescence, and chlorophyll stability index and significant decrease were noted in transpiration rate and total soluble protein content. Foliar spray with 50 ppm B+ 50 ppm Zn at 40, 55 and 75 DAS and an additional application of 25% nitrogen resulted in better plant performance under the elevated CO_2 conditions by increasing the overall photosynthetic efficiency.

IVCPB 39

Association between water and electrolyte leakage in the recalcitrant seeds of *Humboldtia vahliana* Wight.

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Humboltia vahliana is an endangered evergreen tree species belonging to the subfamily Caesalpinioideae, under the family Fabaceae and it's an over- exploited species due to its medicinal uses. Seed infestation and poor natural regeneration of seedlings are the major hindering factors for the declining population. Hence there is an urgent need to conserve the species at any cost and for this the nature of the seed should be familiarized. *H. vahliana* seed takes 120 DAA (Days After Anthesis) to attain maturity. The mature seeds are shed from the mother plant at high moisture content of 57.23% which is a characteristic feature of recalcitrant seeds. The freshly fallen seeds had 83.2% germination rate. After 360 h of natural drying, the viability of seeds were lost and the moisture content at this stage was formed to be below 26.89%. Electrolyte leakage progressed gradually during prolonged natural drying and it leads to seed deterioration. There have been no extensive reports on seed physiology of *H. vahliana* yet. The present work is focussed on the moisture content status during the embryogeny and embryo desiccation and the relation between moisture content and electrolyte leakage during natural drying. The research might aid in the long-term preservation and conservation of the seeds of *H. vahliana*.

IVCPB 40

Effect of elevated blood pressure and circulating iodine levels in blood on thyroid functioning

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Nearly every third Indian suffers from one or other kind of thyroid disorder. The purpose of this study is to understand the effect of elevated blood pressure levels and circulating iodine levels in blood on thyroid gland. Thyroid hormones (T3 and T4) produced in the thyroid gland have many functions to execute. One of the most important functions of thyroid hormone is to maintain the basal metabolic rate(BMR) of virtually all the cells of the body. It also has an important role in growth, especially skeletal growth. Iodine is an element that is needed for the production of thyroid hormone. The body does not make iodine, so it is an essential part of our diet. Total body contains 25–30 mg of iodine. Iodine accounts for 65% of the molecular weight of T4 and 59% of T3. All cells do contain iodine, but 80% of the total is stored in the thyroid gland. When our body does not get enough iodine the body cannot produce thyroid hormones, disrupting the basic metabolic processes.Iodine fortification is one way to overcome the deficiency of iodine in a common Indian household. Although thyroid hormone has got its receptors on virtually every cell of the body but it has very well established effects on cardiovascular system, in this article we try to explore the effects of blood pressure on thyroid hormone by affecting cardiac output. How Thyroid homeostasis plays an important role in maintaining the overall homeostasis of the body remains our main objective.

IVCPB 41

Phytochemical profiling of *Cocos nucifera* L. haustorium

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Cocos nucifera L. commonly known as the coconut tree belongs to the family Arecaceae. It is referred to as ‘ kalpavriksha’ (the all - giving tree) in Indian classics because of its multifarious utility. The various products of coconut include tender coconut water, copra, coconut oil, raw kernel, coconut cake, coconut toddy, coconut leaves, coir pith, coconut shell and wood-based products. One of the lesser - known edible products of the coconut palm is the coconut haustorium. Coconut haustorium is a nutrient-rich spongy tissue formed during coconut germination. The present study was conducted to determine the phytochemical constituents of the haustorium of Chowghat Orange Dwarf variety of coconut. The phytochemical analysis was carried out on the haustorium in soxhlet, and cold percolation method. Saponin is the only phytochemical present in the different solvents of soxhlet extracts. The cold extract showed the presence of phenols, alkaloids, terpenoids and saponins in different solvents such as petroleum ether, chloroform, ethyl acetate, methanol and distilled water. Flavonoids were absent in all extracts. The total phenol content was maximum in methanolic extract (98.85 µg/mg) and alkaloid was found to be more in chloroform extract (115.5µg/mg). Saponin content was estimated in both cold and soxhlet extract. In soxhlet extract, maximum saponin content was found in chloroform and ethyl acetate (83.3 µg/mg) but in the case of cold extract, maximum saponin content was found in distilled water (34.15 µg/mg). The study revealed that coconut haustorium is rich in phytoconstituents such as phenols, flavonoids, alkaloids, and saponin. Coconut haustorium has been used in the diet as healthy food and in addition to being a good source of basic nutrients; they also have important phytoconstituents with disease prevention and health-promoting properties.

Keywords : Coconut haustorium, phytoconstituents

IVCPB 42

Early-stage water-logging in pea induced reduction in grain filling capacity and Chlorophyll fluorescence at maturity stage

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Frequent water-logging events have serious effects on regional ecology, food safety, and socioeconomic sustainable development. Early monitoring of waterlogging stress levels is vital for accurate production, input management, and reduction of crop production-related risks. In this study, a pot experiment on pea plants was designed to determine the physiological responses of pea under waterlogging and the effect of these stressed conditions on the grain filling capacity. Longer water-logging treatments increased the severity of yield losses in the experiments. The water-logging treatments initially caused reductions in pod number and then in average pod weight. The reductions in pod number resulted from reduced flowering number. The reductions in average pod weight may have been triggered by multiple factors, including reductions in soil nutrients, reduced nutrient uptake due to hypoxia, and reductions in the photosynthetic rate. Many studies revealed the effect of water-logging on grain filling capacity but physiological responses have received little attention. Therefore, the kinetics of the OJIP transient transition was used to recognize the physiological responses of a pea at early and mature stages. The early-stage water-logging ultimately impacts on grain filling capacity of pea and reduced photosynthetic performance at the maturity stage. A wide variation in chlorophyll fluorescence (Fm- maximum fluorescence) was observed between control and waterlogged pea plant leaves. The control plant leaves showed a high value of fluorescence, whereas low fluorescence was detected in waterlogged pea leaves. It may be due to the low concentration of chlorophyll molecules. A significant variation in all parameters of photosynthesis was observed in control and waterlogged leaves. Leaf models clearly show a low concentration of chlorophyll pigments and PS II reactions in waterlogged pea leaves. The aim of this study is to increase the productivity of peas and their responses to water-logging and to produce water-logging resistant pea varieties.

IVCPB 43

The inflorescence variations of the genus Echinochloa P. Beauv. (Poaceae, Panicoideae, Paniceae) in Kerala.

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The family Poaceae, alternatively Graminae and commonly called as grasses is represented globally by about 780 genera and 12000 species. Grasses are considered as one of largest angiospermic families, It provide a wide adaptations of different habitat.The aim of the paper is to describe with the inflorescence and to discuss the actual significant relationship of the genus Echinochloa. In Kerala the Genus includes four species such as *Echinochloa colonum (*L.) Link, *Echinochloa crus-galli* (L.) P. Beauv. E*chinochloa frumentaceae* Link, *Echinochloa stagnina* (Retz.) P.Beauv. The Inflorescence of Echinochloa are composed of short spikes in an alternate arrangement on the main axis, erect contracted panicle. Spikes long, Spikelet ovate , Lower floret male or sometime barren, Upper floret bisexual, and also directions of glume,lemma, palea and the pattern of the floret development, shape of Gynoecium and Stamens development etc will be studied by stereomicroscope.The present study allowed us to define a morphological characteristics of the Inflorescence and the variations of the four species of Echinochloa in Kerala.

Keywords: Poaceae, Paniceae, Echinochloa, Angiosperm, Inflorescence.

IVCPB 44

Phytochemical screening, GC/MS and pharmacological analysis of *Rivina humilis* L.

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Many of the weeds have important medicinal values. One such example is the members of the Phytolaccaceae family. *Rivina humilis* L. (Pigeon berry) is a species of Phytolaccaceae, which is indigenous to America, traditionally been used to cure epilepsy, jaundice, infertility and also as a blood purifier. The present study was intended to screen the phytochemical constituents, potential bioactive compound identification and pharmacological effect of the aqueous, ethanol, methanol and chloroform extracts of *R. humilis*. leaves. The preliminary phytochemical screening of the fresh and dried leaf extracts revealed the presence of various bioactive compounds and the ethanol extract of fresh leaves showed the highest antibacterial and potent in vitro antioxidant activity. The cytotoxic effect of ethanol extract of fresh leaves of *R. humilis* on MCF 7 Cell line was tested by MTT cell viability assay and the high percentage of viability at 200 µg/ml of the sample showed 36.76% of viable cells. The bioactive components present in the *R. humilis*. leaves extract was identified by GC-MS Analysis. 3 compounds such as 3-Carbethoxyethyl-4H-pyrido[1,2-a]pyrimidin-4-one (98%), Citronellyl n-proprionate (1%) and Dipentyl Disulfide (0.08%) were detected in ethanol extract of *R. humilis* leaves. Thus the results of the present study revealed the potential of the *R. humilis* as a source for natural antibacterial and antioxidant agents.

IVCPB 45

Changes in endogenous ABA levels during embryogenesis and the recalcitrant behaviour of *Syzygium zeylanicum* (L.) DC seeds

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Syzygium zeylanicum (L.) DC is a small tree species belongs to the family Myrtaceae indigenous to Western Ghats. The leaves and fruits of the plant possess medicinal property. The species is less distributed in their habitat due to poor natural regeneration. ABA is an important plant growth regulator that plays critical role in seed development, dormancy and seed germination. Accumulation of high quantities of ABA during cell expansion phase of seed development is a strategy of recalcitrant seeds to prevent precocious germination. The present work mainly focus on understanding the recalcitrant behaviour and desiccation tolerance of *S. zeylanicum* seeds as well as the detailed analysis of dynamics of hormone ABA during seed development.

IVCPB 46

A comparative study on the biochemical and nutritional values of selected leafy vegetables

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Natural products derived from plants used for the treatment of disease have proved that nature stands as a golden mark to show the interrelationship between man and environment. In addition to medicinal properties, plants also show nutritional, antioxidant and anticancer properties. The present study elucidated the estimation of primary and seconadary metabolites, quantification of antioxidants and vitamins from Amaranthus species and *Talium portulacifolium* (Forssk.) Asch. ex Schweinf. The study evaluated the phytochemicals and nutrient qualities of *A. dubius*, Mart.ex Thell., *A. spinosus*, L., *A. tricolor*, L. and *T. portulacifolium*, (Forssk.) Asch. ex Schweinf. Out of all these species, it was indicated that polyphenolic level was higher in *A. spinosus*, L. and *A. tricolor,* L. Flavonoid content was higher in A. spinosus, L. *T. portulcifolium*, (Forssk.) Asch. ex Schweinf. belongs to the family portulacaeae showed tremendous nutritional and antioxidant properties. The results demonstrated that collected plants were rich in carbohydrates, proteins, and lipid contents. Vitamin A and vitamin C were also found in considerable amount. Antioxidant activity was found to be higher in leaves of *A. spinosus*, L.and *T. portulacifolium*, (Forssk.) Asch. ex Schweinf. Their root and leaf contain considerable amount of antioxidant activity. From these plant different photochemical such as flavonoids, alkaloids, tannins, terpenoids, steroids and saponins can be isolated. The nutritional evaluation of plant possess high amount of carbohydrates, proteins and lipids. The study showed that all the selected leafy vegetables can contribute immensely to nutrition, food security, health and therapeutic benefits. So these plants can be used as potent nutraceutical agents for further generation.

IVCPB 47

Expression and phylogenetic analysis of PISTILLATA (PI) gene in *Coccinia grandis* (L) Voigt (Cucurbitaceae)

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The expression and phylogenetic studies of B function gene PISTILLATA (PI), was examined in different stages of floral morphogenesis and floral whorls of both male and female *Coccinia grandis*, a dioecious plant belongs to the family Cucurbitaceae. Regulation of PI floral morphogenesis in male, specified during the development of anther and pollen grains. While in females, regulation of PI gene was up-regulated in early phase of stigma and ovule development, suggesting a chance to alter the development of female reproductive whorls to male (anther or rudimentary anther). The PI was up-regulated in the petal and anther in male, while in female, its expression was limited to the petals, pointed out the role of PI as B- class floral homeotic gene for petal and anther identity in *C. grandis*. Neighbor Joining tree based on BLAST result of PI query sequence of *C. grandis*, included in the MADS-box family of transcription factor, and closely related to the PISTILLATA/GLOBOSA (PI/GLO) clade of MADS-box family encodes MIKC-type transcription factor. Apart from the similarity of aligned sequences, many single nucleotide shifts were obtained at several regions of PI. At the amino acid level, PI exhibited more homology to PI homologues of other members of the family Cucurbitaceae, that aid strong evidence to the conserved regions present in the nucleotide sequences. The single amino acid replacement (Alanine by Valine) observed in the PI *C. grandis* may be due to a point mutation or single nucleotide shift of the nucleotide sequence "C". Phylogenetic analysis revealed consensus reconstructions with strong posterior probability support (>0.90) for most of the branches in the tree, indicating several independent events of gene duplication within and between species. All of the aligned species in the tree are eudicots, and represented by two major clades of angiosperms, the 'Asterids' and 'Rosids'. It was evident that, the PISTILLATA and GLOBOSA had been derived from a common ancestor, probably an 'Asterids', and the MADS-box genes in the MIKC- type lineage was derived during the early period of evolution indicating a pre-dated split between the two B-class floral homeotic genes with functional similarities.

IVCPB 48

Standardization of light conditions for the artificial culture of *Azolla pinnata*

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Azolla pinnata is a free floating pteridophyte which can be grown artificially in suitable medium with optimum conditions. In this study *A. pinnata* was grown in H-40 medium and IRRI2 medium with different range of light intensities (Lux). Both cultures were grown in different range of light intensities of 1700-1900, 1900-2100, 2100-2300 and 2300-2500 lux and estimated total biomass at 7th, 10th and 14th days. The Azolla culture grown in 2100-2300 lux range have relatively greater value of total biomass than other light intensity ranges in both the medium. In both mediums, the relative growth rate of the *A. pinnata* was higher at the 10th day. The study have also showed that, H-40 medium supports the growth of *A. pinnata* more than IRRI-2 medium.

IVCPB 49

GC-MS analysis of the essential oil from the leaves of *Eugenia sphaerocarpa* Vadhyar, Sujana, J.H.F.Benj & Murthy.

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The genus Eugenia (Family: Myrtaceae), was originally described by Carl Linneaaus in 1753, based on the single species *Eugenia uniflora*. Eugenia species are mostly aromatic, evergreen shrubs or small trees, leaves are opposite; the flowers are solitary or in small clusters. Genus Eugenia is one of the largest Genera in the family Myrtaceae with 1204 taxa distributed mainly in tropical region of the world (WCSP 2020). *E. sphaerocarpa* is a new species reported from the Western Ghats region of Kerala, India. It is a large shrub with elliptic-ovate leaves; acuminate at apex, lateral inflorescence with one or two flowers in cluster and globose fruit. The present work reports the GC-MS analysis of leaf's essential in *E. sphaerocarpa* collected from Kakkayam Wild Life Sanctuary, Calicut. The leaves essential oil was isolated by hydrodistilation method and analyzed through GC-MS technique. Thirty six compounds were identified from the oil. The major compound identified in the oil were Caryophyllene (37.48%), Trans-cadinol(6)-4-diene(19.18%), α-Guianene (10.53%),α-Himachelene(8.38%). This is the first report of analysis of the essential oil from the leaves of *E. sphaerocarpa.*

Key words: Myrtaceae, Eugenia sphaerocarapa, GC-MS.

IVCPB 50

Phytochemical screening and biochemical quantification of a medicinal mangrove fern *Acrostichum aureum* L.

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Though economic and medicinal values of angiosperms have been investigated, Pteridophytes have been unfortunately ignored. Ethnobotanically, fern plants have great economic value as folk medicine and have been successfully used in the different system of medicine. *Acrosticum aureum* L is a large mangrove fern species of Pteridaceae common in mangrove swamps, salt marshes, canal margins of Kerala and so on. Aim of the present study is to evaluate the Phytochemical screening and Biochemical quantification of a medicinal mangrove fern *A. aureum* L. Preliminary phytochemical screening revealed the presence of phytochemicals such as alkaloids, flavonoids, terpenoids, glycosides ,phenols, tannins, saponins, anthraquinones, hydroxy anthraquinons, quinones and steroids.During quantitative analysis it was found that high amount of phenols and terpenoids were found. Extract of the fern is used as a herbal medicine to treat various human ailments like haemorrhage, asthma, constipation, elephantiasis, chest pain, gastric, colon and breast cancer, wound healing, peptic ulcers and boils, anti-inflammatory, anthelmintic and analgesic. From all these analysis the extract is found to be a potent source of drug to various ailments.

Key words: *Acrosticum aureum* L, Mangrove fern, phytochemicals

IVCPB 51

Antibacterial study on green synthesized Manganese dioxide nanoparticles

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We are focussing on developing cost effective, environmentally friendly, hazardless, reusable materials for human needs. Inorganic metal oxide nanoparticles find various applications in biological, medical, chemical fields etc. The presence of various bio molecules in the leaf extract acts as reducing agents during nanoparticle synthesis which helps in the easy reduction of metal oxide nanoparticles. Thus, we blending the advantages of biosynthesized nanoparticles with antibacterial performance of the sample for flourishing a suitable material for future use. Antibacterial, catalytic properties of metal oxide nanoparticles help to react with microbial membrane sites and rate of chemical reaction gets enhanced. It's a great challenge for us to develop stable metal oxide nanoparticles with good antibacterial performance against different antibiotic resistant bacteria. Thus, for evaluating the antibacterial performance of green synthesized manganese dioxide nanoparticles, in this study, we prepared MnO_2 nanoparticles using leaf extract of *Justicia plumbaginifolia* which act as the reducing agent. It's a cost effective and eco-friendly way to develop manganese dioxide nanoparticles, which is an efficient candidate for various needs including photocatalysis, energy storage, antibacterial applications. Antibacterial activity of biosynthesized MnO_2 nanoparticles against different bacteria were investigated after various characterization techniques such as XRD, SEM, UV for confirming the formation of nanosized particles.

IVCPB 52

Conservation of *Madhuca neriifolia* (Moon) H.J.Lam through plant tissue culture

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Madhuca neriifolia (Moon) H.J.Lam is an endangered plant species distributed in the Southern Western Ghats of India . Conventional method of propagation of madhuca is sexual that is through seed germination. But plant is beset with many problems that restrict their multiplication on a large scale. Propagation through seed is unreliable because of short viability and heavy rains during the seedling season in the natural habitat. In vitro techniques have great potential for mass propagation of elite genotypes of this important forest species for reforestation programs. This paper describes the in vitro propagation of *M. neriifolia* from embryo and cotyledonary nodes. The embryo was cultured in full strength MS medium fortified with different concentrations of BAP (benzyl aminopurine) and callus was produced. The callus production was found to be maximum in 0.5 mgL^{-1} BAP. The cotyledonary nodes of 4-5 days old seedling of *M. neriifolia* were placed in full strength MS medium supplemented with 0.5, 1.5 and 2.5 mgL^{-1} concentrations of BAP and IBA (indole-3-butyric acid) for the activation and proliferation of axillary buds and roots. Rooting was observed best in 1.5 mgL^{-1} concentration of IBA and shooting was maximum in 0.5 mgL^{-1} BAP. Thus, the present work was carried out to develop a protocol for the conservation of *M. neriifolia* through micropropagation.

IVCPB 53

An appraisal on the biochemical characteristics and antioxidant status of *Rhynchospora corymbosa* (L.) Britton in Aruvikkara reservoir, South India

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The potential of oxygen free radicals and other reactive oxygen species (ROS) to damage tissues and cellular components is called oxidative stress. The present study aims to assess the biochemical characteristics and antioxidant status of *Rhynchospora corymbosa* (L.)Britton, and to analyze the major physico-chemical parameters of water in the Aruvikkara Reservoir in Kerala, South India. The Pearson correlation analysis was carried out between the important water quality parameters and the biochemical and antioxidant status of the plant in Aruvikkara reservoir. It was observed that water quality parameters such as EC, TDS and sulphates have strong positive correlation with plant parameters such as MDA, Proline and Glutathione. The study shows that changes in the water quality parameters of reservoir have a strong impact on the biochemical constituents and antioxidant status of the aquatic vegetation. Therefore malondialdehyde, total chlorophyll and the antioxidants, catalase, peroxidase, ascorbic acid, proline can be considered as the biomarkers of water pollution induced oxidative stress in aquatic plants.

Key words: *Rhynchospora corymbosa* (L) Britton, Aruvikkara Reservoir, Biochemical characteristics, Antioxidants.

IVCPB 54

Identification, charcterization and comparison of seasonal calcium oxalate crystal load in *Amaranthus dubius*

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Calcium oxalate is a very important antinutrient present generally in all plant parts from embryo to mature plant, which reaches the human body through food and raw plant-based drugs. Though calcium oxalate crystals in plants are useful for them in many ways, it can contribute to an increase in the oxalate levels in humans and animals consuming them raw as food or drugs, which can in turn precipitate nephrolithiasis and renal failure. Hence the identification, characterization and comparison of CaOx load in vegetables consumed as food and herbal drugs are crucial in managing a low oxalate diet for patients suffering from renal ailments and to those prone to hyperoxaluria. The present study aims at generating new knowledge on the seasonal oxalate load of common leafy vegetable purple Amaranthus at its various stages of maturity such as young leaf and mature leaf, in its life cycle. Young leaves exhibit a greater number of small druse crystals whereas mature leaves show a lesser number of big druse crystals in *Amaranthus dubius*. The crystal load can be plotted as mature leaf>young leaf. The crystal load in young leaves is 6% less than that of mature leaves. The future prospect of the study lies on the biotechnological intervention to genetically engineered plants with less oxalate content by identifying the genes responsible for ergastic crystal formation in plants.

IVCPB 55

Preliminary phytochemical and pharmacognostical studies in *Jasminum cordifolium*, Wall.ex G.Don

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Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been derived from natural sources, many of these were based on the uses of the agents in the traditional medicines. Jasminum L. is the largest genus of the family Oleaceae and the plants have been used as tradional medicine. The antioxidant and antimicrobial potential of plants have attracted the attention of scientific community from ancient times. Hence, the objective of the present study was to investigate the phytochemicals and to screen the anti-oxidant and anti-bacterial activities of the methanolic leaf extract of *J. cordifolium*, Wall.ex G.Don. The antioxidant activity was evaluated based on DPPH Scavenging and NO Scavenging Assays. The antibacterial activity was examined using Micro Titer Plate Method, using three different bacterial strains. The preliminary screening revealed the presence of carbohydrates, proteins, aminoacids, steroids, alkaloids, flavanoids, cardiac glycosides, terpenoids and phenols. Saponins tested were found to be absent in the leaf extract. The concentration of flavonoids were high (12.35 mg/g), followed by alkaloids (3.98 mg/g) and terpenoids (2.80 mg/g). The results of the anti-oxidant activity in DPPH assay, showed an inhibition of 47% at 500mg/ml of the extract, whereas in NO assay, the inhibition was 51% at 500mg/ml, against the standard ascorbic acid. Pronounced effect of antibacterial activity was noted in all the microbial strains studied. The leaf extract exhibited maximum anti-microbial activity against bacterial strains *E.coli* and *Salmonella typhi*. The antibacterial activity was found to be more in *Escherichia coli* (90%), followed by *Klebsiella pneumoniae* (85%), and *Salmonella typhii* (80%). The results of antioxidant and antibacterial activities revealed that the methanolic leaf extract of *J. cordifolium* possesses significant bioactive compounds.

IVCPB 56

Effect of type 2 diabetes on cardiovascular disease

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Type 2 diabetes mellitus (DM) is a chronic metabolic disorder, usually characterized by hyperglycemia (high blood sugar). This chronic condition occurs due to insulin insensitivity and eventually pancreatic beta-cell failure. Individuals with type 2 diabetes show a two to four-fold rise in the occurrence of coronary artery disease and stroke, and a two to eight-fold increase in the risk of heart failure. Excessive blood sugar level reduces the elasticity of blood vessels and makes them confined, impeding blood flow which subsequently results in the reduced supply of blood and oxygen in heart and increases the chances of hypertension and damages to the blood vessels. Subsequently this results in the development of diabetic neuropathy and hyperlipidemia. This condition further results in diabetic patients having atherosclerosis, which is a buildup of cholesterol in blood vessels and when these cholesterol plaques rupture, the body tries to repair the rupture by sending platelets to seal it up. As the area of the artery is small, the platelets block the flow of blood and a heart attack develops which results in loss of blood in the brain, stroke and other diseases. The immoderate rise in the risk of coronary events in diabetic patients can be attributed to multiple factors, including glycation and oxidation of proteins and the increased incidence of classic jeopardy of coronary disease, like hypertension, obesity, and dyslipidemia. As the longer the person has diabetes, increases the risk of heart diseases and other complications.The presented work reflects the biochemical correlations which are responsible for the increased risk of cardiovascular disorder in diabetic patients.

IVCPB 57

Phytochemical, histochemical and anti-microbial Screening of *Murraya koenigii* L.

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The discovery of revitalizing molecules with the capacity to stop or reduce the pathogens will be considered as the major breakthrough of the present time. The side effects and health issues due to the usage of available synthetic compounds heightens the need of molecules from plants and other natural resources. *Murrayya koeinigii* from Rutaceae family is commonly used as a medicinally important herb. It has been scientifically proven that the leaves, roots, and bark of this plant are rich sources of carbazole alkaloids, which produce potent biological activities and pharmacological effects which include antioxidant, antidiabetic, anti-inflammatory, antitumor, and neuro-protective activities. The present study provides an insight into the major components of *M. koenigii* and their pharmacological activities against various pathological conditions. Morphological and microscopic characters were observed by pharmacognostic study. Quantitative analysis of carbohydrate, alkaloid, sterol, tannin, volatile oil, saponins, anthraquinone, glycosides and flavonoids were also the part of study. The organoleptic characteristics of bark of M. koenigii were noted. The protein estimation of leaves of M. koenigii exhibited comparable results. Based on the diameter of zone of inhibition, the organic extracts exhibited inhibitory activity against Staphylococcus aureus, *Escherichia coli* and P*seudomonas aeruginos*a. *Klebsiella pneumoniae* and *Salmonella paratyphi* were found to be resistant except for chloroform extract which showed a very faint zone of inhibition. The organic extracts presented a good potential of antibacterial activity against *E.coli* and *Pseudomonas aeruginosa* with the zones of inhibition well above standard antibiotic. Ethyl alcohol extract displayed highest inhibitory activity when compared to hexane and chloroform extracts. The results were comparable to that of previous studies in which the researchers reported that various organic extracts of *M. koenigii* exhibited significant antimicrobial activity against both gram positive and gram negative bacteria.

IVCPB 58

Study on the diversity of parmelioid lichens in Thiruvananthapuram hills of Kerala, India

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Parmelioid lichens are the most diverse group of macrolichens in the world with about 1854 species classified in 27 accepted genera which belonged to family Parmeliaceae. These foliose lichens flourish in high altitude areas with cold weather and unpolluted environmental conditions. The present study deals with the parmelioid lichen distribution in Ponmudi, Bonacaude, Pandipathu, Varayadu motta, Brimore, Mankayam area of Thiruvananthapuram, which yielded about 26 species with 10 genera. The collected and identified specimens have been classified based on recent generic concepts. Distribution of saxicolous and corticolous species of parmelioid lichens in each area were analysed and conservation aspects were also mentioned.

IVCPB 59

Lasiodiplodia theobromae infection on *Myristica malabarica* seeds: Threat in artificial regeneration

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Lasiodiplodia theobromae (Pat.) Griffon and Maubl. was found associated with seeds of several tropical tree species, which eventually proved decline in regeneration potential in many forest tree species. Germination studies on seeds of *Myristica malabarica* for artificial regeneration recorded incidence of the ascomycetic fungal pathogen in stored Myristica seeds. Seeds were collected from the natural stands during the months of February - March for four consecutive years of study 2018 to 2021, from Mullaringad forest range in South India with coordinates of 10°1'4" N and 76°47'10" E. Seeds stored in containers detected fungal infection after one month of storage. Mean incidence percentage of 28.75% was recorded in stored seeds collected during 2018. Infection appeared as fluffy, cottony, grayish white patches. Germination characteristics of fresh and stored seeds were evaluated by ANOVA. Fresh seeds recorded a mean germination percentage of 31% and that of infected seed lot was 4.5%. Seed borne fungi *L. theobromae* is a threat in plantation practices of *M. malabarica*. The disease incidence is random in seed lots but has a significant impact in reducing germination. Since *M. malabarica* is listed as vulnerable in IUCN, its propagation requires high consideration.

IVCPB 60

Evaluation of bioactive compounds in speciality land races of rice for nutraceutical potential through *In silico* analysis

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Modern society is under high risk of lifestyle related diseases. Rice is a major crop feeding global population. Several bioactive compounds present in speciality land races of rice have various nutraceutical potential to combat these diseases. We selected twenty five speciality land races of rice for analysis of bioactive compounds and their validation for nutraceutical potential through molecular docking studies. Previous reports showed that land races such as Black jasmine, Njavara, Rakthasali, etc. contain bioactive compounds in a range of 27.16, 32.80 and 30.10 mg of gallic acid/g respectively. We selected three receptor proteins for cancer, inflammation and diabetes viz. DPP 4 (Dipeptidyl Peptidase-4), CoX-2 (Cyclo oxygenase-2) and PTP 1B (Protein tyrosine phosphatase 1B) respectively. The ligands selected are major sub compounds such as Cyanidine 3-glucoside (anthocyanin), Campesteryl ferulate (gamma oryzanol), Alpha tocopherol (tocopherols), and Luteolin 7-o- glucoside (flavonoids). *In silico* validation of these compounds was done using software discovery studio. For cancer, DPP 4 were docked with ligands and indicated docking score of -8.6, -9.6, -7.3 and -9.1 kcal/mol which showed high interaction. For diabetes, PTP 1B docked with ligands and indicated docking score of -7.5, -7.8, -6.8 and -8.6 kcal/mol. For inflammation, CoX 2 docked with ligands and indicated docking score of -10.5, -10.9, -8.6 and -10.4 kcal/mol. There were numerous hydrogen bonds for all the docking poses, which indicates strong interaction. The docking study dictates the nutraceutical potential of these bioactive compounds present in speciality land races.

IVCPB 61

Effect of various auxins and cytokinins on shoot multiplication of *Aristolochia bracteata* Retz.

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Aristolochia bracteata Retz. belongs to the family Aristolochiaceae is a climbing or prostrate perennial herb with an unpleasant smell. The leaves are ovate, flowers are dark purple with trumpet shaped mouth. It is also known as 'worm killer' due to its anthelminthic activity and its trypanocidal effect. The plant is important in traditional medicine in Africa, India and the Middle East. The plant was used for the treatment of skin disease, inflammation and purgative. It is used in traditional medicine as a gastric stimulant and in the treatment of cancer, lung inflammation, dysentery and snakebites. Due to its medicinal value, ethnobotanically importance and rarity, conservation of *A. bracteata* is needed. The present study was undertaken to identify the effect of various auxins and cytokinins for the micropropagation through shoot multiplication of *A. bracteata*. Varying concentration of IAA, NAA & IBA were the auxins and BA, TDZ and Kinetin were the cytokinins used for in vitro propagation. The plant showed maximum shoot when MS medium fortified with TDZ (100 µ) was used for culturing. Lower concentration of IAA produced multiple shoots and roots. Lower concentration of BA (0.7 mg/l) also induced multiple shoots (3.71±0.77). Higher concentration of kinetin was needed for shoot multiplication. A combination of NAA (1 mg/l) and BA (0.7 mg/l) showed multiple shoots along with rooting.

Key words: Aristolochia bracteata, micropropagation, Aristolochiaceae

IVCPB 62

Study of different nutrient application for sustainable and production in radish (*Raphanus Sativus*) with different soil moisture.

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The efficiency of the plants is determined either by amount of water required or the productivity of the use of water by the plant. The present programme was an attempt to Study of different Nutrient application for sustainable and productive agriculture on Radish (*Raphanus Sativus*) with different soil moisture. Treatments like Treatments like T0S0 Control, T1S1 (SM40%), T2S2 (SM60%), T3S3 (SM80%) and T4S4 (SM90%). Biochemical chemical parameters such as composition of the chlorophyll pigment, stomatal frequency, relative humidity, pH, and electrical conductivity (EC) (EC). For each procedure, the germination percentage has been found. The seedlings randomly selected from each treatment were transplanted, as in trays, into pots containing a certain treatment. For each procedure, various growth parameters were recorded, such as root length, shoot height, plant height, number of leaves, total plant biomass and total dry weight. In this context, substantial radish plant growth should greatly improve under moderate stress followed by low moisture condition.

Key word: Water use Efficiency, Growth, Radish, Moisture stress.

IVCPB 63

Data generation and analysis for biodiversity screening of endophytic bacterial communities from medicinal plant *Emilia sonchifolia* (Linn.) DC. metagenomics through illumine MiSeq

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The data generated for the analysis of endophytic bacterial community composition evaluation from medicinal plant *Emilia sonchifolia* (Linn.)DC. Metagenomic DNA extraction and amplicon sequencing of V3-V4 region of 16SrRNA gene enables complete screening of endophytic communities. Illumina MiSeq method was used to identify the taxonomic diversity of endophytes associated with E. sonchifolia. The raw sequence data generated was deposited at NCBI under Sequence Read Archive (SRA) with BioProject accession No. PRJNA542222.Different softwares were used to analyse the data and quality optimization. The generated sequence reads were classified and operational taxonomic units were identified which indicated the wide diversity of bacterial endophyte in the host plant.

IVCPB 64

Moisture content dynamics and FT-IR spectral analysis of seeds of *Spondias pinnata* (L. f.) Kurz

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Seeds are classified into orthodox (desiccation-tolerant) and recalcitrant (desiccation-sensitive) on the basis of their response to desiccation. Orthodox seeds can be dried to low water content (< 7%) with little effect on viability whereas, recalcitrant seeds are shed at high water content (> 30%) and are metabolically active on shedding. *Spondias pinnata* (L. f.) Kurz is an underutilized ethnobotanically important deciduous tree species, belonging to the family Anacardiaceae and whose natural regeneration is problematic. The present study is taken up to understand the seed physiology behavioural pattern of *S. pinnata* by analysing the embryo moisture content during different stages of embryo development. The FT-IR spectral analysis of the methanol, 50% methanol and chloroform extracts of the embryo at different developmental stages were also analysed to understand the differential occurrence of different classes of compounds. The moisture content analysis showed that *S. pinnata* seeds have more resemblance to recalcitrant behaviour during the development where the embryo water content gradually decreases from 65.99% at the stage of early embryogeny to 23.53% at the time of shedding. The FT-IR spectrum confirmed the presence of functional groups such as hydroxyl (-0H), amine (N-H), alkane (C-H), aldehyde (C-H), nitro compounds (N-O), oxime (C=N), carbonyl (C=O), carboxylic acids (O-H) and halo compounds (C-Br/ C-Cl/ C-I). The present work is thus aimed at understanding the seed physiology and consequently, the better utilisation and conservation of *S. pinnata*.

IVCPB 65

A study on factors influencing seed viability in *Artocarpus hirsutus* Lam.

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Artocarpus hirsutus. Lam (Common names-Ayni, Anjili, Wild jack etc,) is a tall, evergreen, keystone tree species endemic to the Western Ghats. The tree is valuable for its timber, edible fruits and seeds and is medicinally important. Based on the nature of the viability of seeds, it was reported as a recalcitrant species. The seeds showed a loss of viability within two weeks of natural drying. The ripened seeds shed at a moisture content of 43.3%. At this stage the seed shows 100% viability. Electrolyte leakage at this stage was found to be 35.07% and the TDS content was 14.9%. When the mature seeds were subjected to natural desiccation under ambient environmental conditions, a sharp decline in the water content was observed. The gradual reduction of water content showed a connection with the seed viability, electrolyte leakage and TDS. When the moisture content drops during natural desiccation the seed viability also got decreased, which indicates the desiccation sensitivity of the seeds. The critical moisture content and the viability of the seeds at this stage were found to be 26.6% and 58% respectively. A sharp increase in the percentage of electrolyte leakage and TDS at the critical moisture content level was observed, which reflects the damage to cellular membranes. The amount of electrolyte leakage indicates an increase in membrane permeability and reduced cell tolerance to desiccation. The physiology of this endemic species should be given due importance, since many such tropical species facing this problem of desiccation sensitivity, short life span and need some special procedures for cryopreservation. So the recalcitrant seeds like *A. hirsutus*. Lam cannot be stored like orthodox seeds since it cannot tolerate desiccation.

IVCPB 66

Diversity analysis of endophytic fungi in the roots of *Eclipta prostrata* (L.) L using metagenomic approach

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Plants can host a number of endophytic fungi and bacteria within their tissue. They can be found in leaves, stem, roots, flowers and seeds of plants. Fungal endophytes are one such highly diverse groups that have a profound impact on the biotic and abiotic tolerance of plants. They play a significant role in plant growth promotion, secondary metabolite production etc. The present study is an attempt to understand the endophytic fungal diversity in the roots of *Eclipta prostrata* (L.) L through metagenomic approach using illumina MiSeq platform. Metagenomic diversity analysis were based on the sequencing of ITS region of endophytic fungi. OTU analysis at different taxonomic level clearly catalogues two phyla viz. Ascomycota and Basidiomycota. Basidiobolomycetes, Dothideomycetes, Mortierellomycetes, Tremellomycetes, Wallemiomycetes were the most abundant classes. In these classes three orders such as Tremellales, Cystofilobasidiales and Wallemiales were identified. Among these, three families viz. Tremellaceae, Wallemiaceae and Trichosporonaceae were represented predominantly whereas Rhynchogastremataceae, Sirobasidiaceae, Carcinomycetaceae, Cystofiobasidiaceae were less represented. Wallemia was the most abundantly seen endophytic genus while Vishniacozyma, Cladosporium, Pyrenochaeta, Verticillium, Pichia, Cryptococcus, Acremonium, Neopyrenochaeta and Gibellulopsis showed decreasing relative abundance in the root sample. The diversity analysis of the endophytic fungi in the roots of *E. prostrata* can help in the identification and further characterisation of prominent fungal species that plays an important role in plant growth promotion, stress tolerance and involvement in metabolic pathways.

Keywords: Metagenome, Illumina Miseq, OTU, diversity analysis, relative abundance

IVCPB 67

Anti-oxidant activity studies of leaf and stem bark of *Syzygium palodense*

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Plants are the source of various bioactive compounds, the study of which is termed as Phytochemistry. Phytochemicals accumulate in various plant parts such as leaf, stem, root, bark, flower, fruit, seed etc. Antioxidants have the ability to neutralize free radicals without becoming one among them. They are free radical scavengers which prevent and repair damage. Many Syzygium species such as *S. cumini*, *S. densiflorum*, etc. were reported to have antioxidant properties. The present plant, S. palodense is one of the unexplored species of Syzygium. The leaf and stem bark of the plant were shade dried, powdered and extracted with the help of soxhlet extractor. DPPH radical scavenging assay (Brand-William et al., 1995) and reducing power assay (Ozaizu, 1986) of all the extracts were determined. The methanol and distilled water extracts of both leaf and stem bark showed significant radical scavenging capacity compared to other extracts. But the reducing power of the extracts was not so significant. The radical scavenging activity of the plant revealed the potential use of the plant. This is the first report on the antioxidant activities of the present plant, endemic to southern Western Ghats.

IVCPB 68

A comparative study on the heavy metal phytoremediation potential of some common ornamental plants.

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Contamination of environment by heavy metals has become a major issue of concern due to their detrimental effects on living organisms and ecosystem. Conventional remediation techniques like soil washing, burning etc. are costly and affect the original nature and composition of soil negatively. Phytoremediation is an environment friendly technology that exploits the ability of plants to absorb and accumulate pollutants in their biomass from their growth matrix(soil/water) thereby cleaning up the contaminated sites. In this context, the present study investigates the Pb and Zn removal efficiency of some common ornamental plants, *Begonia sarmentacea* Brilmayer, *Cosmos sulphureus* Sch. Bip., E*piscia cupreata* Hanst., *Impatiens walleriana* Hook.f., *Kalanchoe blossfeldiana* Poelln,, *Tagetes erecta* L., *Tradescantia spathacea* Sw. and *Turnera subulata* Sm. 1000mg Pb/kg and 1000 mg Zn/kg soil was provided to the selected plants. After a period of one month of treatment, heavy metal concentrations of plants were analysed by atomic absorption spectrophotometry (AAS). Bioaccumulation factor values (BAF value) were calculated. It was found that with the highest BAF values, *Tradescantia spathacea* showed high capacity to remove both Pb and Zn from lead and zinc spiked soil. It was also found that all the treated plants exhibited decreased fresh and dry weights as compared to the control plants. The present study revealed that *T. spathacea* is an effective candidate for the remediation of lead and zinc contaminated soil.

Keywords: Soil pollution, Bioaccumulation factor, Phytoextraction, Atomic absorption spectrophotometry

IVCPB 69

SEM-EDX Study to evaluate the absorption and translocation of copper in *Plectranthus Amboinicus* (Lour.) Spreng.

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Plectranthus amboinicus is a semi-succulent perennial plant belongs to the family Lamiaceae. This plant is extensively used in Indian traditional Ayurvedic system as well as tribal medicines for different treatments. Copper (Cu) is an essential element for normal plant growth when present in lesser quantity, while in excessive amount it exerts toxicity in plants. It also serves as a structural and functional element of numerous macromolecules and takes part in various biochemical processes. Studies related to Cu toxicity are very scanty particularly in medicinal plants. Therefore, the present study was carried out to evaluate the absorption and translocation of Cu in *P. amboinicus* with respect to Cu toxicity using SEM and EDX for the first time. One set of rooted propagules in half diluted Hoagland nutrient medium supplied with different concentrations of $CuSO_4$ were taken as experimental and another set without $CuSO_4$ as control. Out of these, at 80 µM $CuSO_4$, the plant exhibited about 50% growth retardation and this concentration is taken for further experiments. After 20 days of $CuSO_4$ exposure, samples were collected, free hand sections of root, stem and leaf were taken and used for SEM –EDX studies. The SEM results revealed that, the enhanced uptake of Cu was observed in the stem. Therefore, it can be stated that stems are the site of Cu localization and that is confirmed by the EDX. Degradation of vascular bundles in stem was found to be a mechanism adopted by the plant to avoid the metal absorption to some extent and thereby preventing the toxic effects of Cu. An interesting observation was the localization of oil globules in the control stem, which was completely vanished in plants exposed to Cu stress. The results are explained and interpreted in terms of the physiological dynamics of nutrition in general and that of Cu in particular.

Keywords: Copper toxicity; heavy metal; localization; Plectranthus amboinicus; SEM-EDX.

IVCPB 70

Effect of heavy metal stress (Cadmium) on morphological physiological activity and anatomy of cow pea plant (*Vigna uncuigulata*).

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This study was done to examine the effect of heavy metal on the growth, lipid peroxidation, antioxidant enzyme activity and some key physio-biochemical attributes in cowpea (*Vigna unguiculata* [L]. In this study 21 days old seedlings of Cow pea plant were subject to different heavy metal stress levels (0g, 0.1g and 0.2g Cd) at germination and early seedling growth stage of plant development. Data were analysed for growth parameters such as plant height, fresh and dry weight, leaf water content (LWC), and length of radicle and plumule during germination period, and biochemical parameters such as proline content, membrane stability index (MSI), malondealdehyde (MDA) content, chlorophyll content, and antioxidant enzyme activity Catalase (CAT) and Peroxidase (POD). It was seen that the effect of heavy metal stress reduced plant height, fresh and dry weight, LWC, radical and plumule length. Heavy metal stress reduced the biochemical activities and also chlorophyll a, chlorophyll b and total pigment content. The decrease was 0.03 and 0.003 respectively. The result showed an increase in the activity of CAT enzyme in leaves and root with increasing salt concentration. An increase CAT activity were found with 0.1g, 0.2g Cd treatment which represented values of relative increasing of 15.88 and 18.5 g/L in leaves and 9.48 g/L and 12.44 g/L in root respectively. There was increase in the activity of POD enzyme in leaves and root with increasing heavy metal cadmium concentration. The level of POD activity was found with 0.1g,0.2g Cd treatment, which represented relative reduction80.55 g/L and 86.46g/L in leave and root 81.2 g/L and 85.3g/L.

Keywords: Heavy metal, plant stress, Cadmium, Cow pea

IVCPB 71

Preliminary physiological studies on improved seed shelf life of *Machilus macrantha* Nees.

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Recalcitrance or nature of rapid loss in seed viability among forest seeds is being a great challenge in tropical forestry. This seed behaviour is more common to the plants which grow in evergreen and riparian ecosystems where atmospheric humidity is higher to maintain seed viability for a reasonable period from one week to few months. However, the erratic weather changes, seed pest incidence, fruit/seed predation, etc. were found constraints for optimum harvest of these seeds and subsequent storage practices. Physiological maturity is a lesser explored scientific area encompasses the identification of biochemical, morphological and germination behavior to predict maturity of seeds rather solely depending on morphological cues. Knowledge on physiological maturity of seeds will equip the conservationists/ forest managers for timely fruit management practices. Extension of shelf life, based on physiological maturity had wide practice in horticultural crops, however seldom studied in wild species. Present study aims at optimum fruit harvesting of *Machilus macrantha* Nees. after analyzing seed development, maturation pattern and biochemical components as the species displayed high fruit predation, seed pest along with short seed viability period. Seeds attained physiological maturity at 90% of fruit maturity exhibited 43% germination at 53% moisture content. Along with a peak in components such as total phenols, amino acid, total soluble sugars and starch. On fruit ripeness (100%), seed germination was decreased to 36% against 44% moisture content along with quantitative reduction of biomolecules. The baseline data generated could be facilitated for the improved germplasm storage practices of the species.

IVCPB 72

Influence of stress signals on vegetative growth, yield and secondary metabolite production in turmeric

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Turmeric (*Curcuma longa* L.), a herbaceous plant belongs to Zingiberaceae family, is one of the most precious plants due to its extreme biological properties. As a good spice, food preservative, and a colouring agent this plant is very close to human dietary practices. The medicinal properties of turmeric also had been identified and utilised by human beings from time immemorial. The biological properties and pharmacological uses of turmeric are mainly due to its bioactive compounds, curcuminoids, which are produced as secondary metabolites of these plants.

Farm based cultivation of Alleppey supreme variety of turmeric is expanded in different parts of India due to its high yield and curcumin content. As a crop plant turmeric is exposed to several chemical and other nutritional substances during its cultivation. A balanced supply of nutrients is necessary for sustainable production of rhizomes and secondary metabolites in turmeric. Nutrient supply may become eustress (beneficial to plant growth) or distress (detrimental to plant growth) during the period of its growth and development. Present study aim to evaluate the role of six nutrients, soil application of fish waste compost and sea shell powder, foliar application of coconut water, cow urine, salicylic acid and zinc sulphate as stress signals in vegetative growth, leaf chlorophyll, rhizome anatomy and yield in turmeric.

IVCPB 73

Study of biochemical and biophysical adjustments during the transition from desiccation-to-fully-hydrated states in *Riccia gangetica* and *Semibarbula orientalis*

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Liverworts are considered as the earliest-divergent clade of land plants, while in phylogenetics mosses are the more advanced sister group to a clade that existed between hornworts and tracheophytes. In the present studies, a comparative analysis was done to understand the biochemical and physiological changes during watering in desiccated thalli of *Semibarbula orientalis* (moss) and *Riccia gangatica* (Liverwort). In a dehydrated state, resurrection plants enter in quiescent phase and stop all molecular, biochemical and physiological processes until the following rehydration. Biochemical (chl content, proline accumulation, expression of antioxidant enzymes) and biophysical (fluorescence values, density of active reaction centers, specific and phenomenological fluxes, and performance of PSII) studies were done to unravel the physiological mechanism of reactivation during the transition from desiccation-to-hydration. It was observed that SOD, CAT and POD remain in an inactive form in the fully desiccated thalii and become actively performed as antioxidants upon the availability of water in *S. oreintalis.* Proline accumulation conserves the photosynthetic machinery in both plants. The study also demonstrates the quick conversion of PS-II reaction centers which develops the high potential to grow the *S. oreintalis* in desiccation during the evolution as compared with *R. gangetica*.

IVCPB 74

Activity of extracts from Sargassum, Gracillaria and Padina as growth promoters of *Withania somnifera* (L.) Dunal.

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Withania sominifera is an endangered medicinal herb, with thoughtful therapeutic significance in both traditional and modern systems of medicine. The roots and leaves are mainly utilised for drug preparation. Seaweed extract contains growth promoting hormones like auxins, cytokinins, gibberellins, abscisic acid, ethylene, betaine, polyamines, trace elements, vitamins, amino acids, antibiotics and micronutrients. In the current study, effect of sea weed extract from *Gracillaria edulis, Sargassum wightii* and *Padina tetrastromatica* on in vitro plant culture was examined. Different concentrations of seaweed extract, IBA are compared with MS medium alone. The effect of seaweed extract was evaluated on in vitro micropropagation of *Withania sominifera* by assessing the root initiation and root length. Maximum rooting was observed in MS medium supplemented with Sargassum as compared to Gracillaria and Padina. The endogenous plant growth regulators present in the sea weed extracts thought to have growth rhizogenesis activity. This study demonstrated that seaweed extract media show comparable result and proved to be economically alternative to phytohormones as they were easy to extract and gave quick result. The plantlets were transferred to the growth chamber and maintained in it for a week, then they are transferred to a green house.

Keywords: Seaweed extract, Withania sominifera, Gracillaria edulis, Sargassum wightii, Padina tetrastromatica, phytohormones.

IVCPB 75

The effect of music on plants growth

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The plants are considered as living entities. Are they really hearing something? Are they give response to music/sound? To answer these questions, several research have been initiated in last two decades. The growth, phytochemical contents, and stress responses of plants are reported to be affected by music as revealed in recent researches. Sound waves of specific wavelength and green music were reported to exert positive impact on the plants by regulating gene expression. From sprouts to the full-grown plants are susceptible to specific sound waves or music. These induce physiological changes in plants which further affect the level of different metabolites, flavonoids etc. In some cases, these are also reported to improve nutritional quality, plant's defence to pests or insects etc. However, there is room of research in the sound wave treatment in order to find out the suitable frequencies, the suitable doses and time of exposure and their effect on growth hormones. This will help the implementation of sound wave treatment for the growth of healthy plants.

IVCPB 76

Molecular regulation of the oxidative damages during drought stress in *Momordica charantia* L.

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Drought is one of the most severe environmental stresses currently affecting agriculture, and it has a significant negative impact on crop plant growth and development. *Momordica charantia* is one of the most important vegetable crops belonging to family Cucurbitaceae with potential medicinal values. The present study analyzed physiological and molecular regulation of reactive oxygen species (ROS) during drought stress in the two varieties *M. charantia v*iz, *M. charantia* var. charantia (cultivar) and *M. charantia* var. muricata (wild)). The drought tolerance capacity of plant during different intervals of water stress (3 days, 5days, 7days, 9days and 11 days) by antioxidant genes including peroxidase (POD), ascorbate peroxidase (APX), PAL and the osmoregulator gene proline dehydrogenase (PDH) were studied with quantitative reverse transcription PCR methods. Results showed that in cultivar, the antioxidant genes APX, PAL, and the osmoregulator PDH were down regulated during 3day and 7days stressed plants, while it was up-regulated during the prolonged periods of stress (9 days, and 11 days water stress). In the wild variety, a gradual up-regulation was observed when the period of stress increased. The gene POD showed up-regulation in wild during increase in drought stress, whereas that was down-regulated in cultivar. The study pointed out the role of antioxidant enzymes in the regulation of oxidative damage and in defence response. It is also suggested that these antioxidant genes could be viable targets to determine the level of drought tolerance.

Keywords: Drought, Momordica charantia, gene expression

IVCPB 77

Antibacterial activity of green synthesized nanoparticles

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Phytonanotechnology is a novel field of research dealing with the production of plant-based nanoparticles. A nanoparticle is a microscopic particle with at least a dimension less than 100nm. Now we are focused on ecofriendly product production, the plant-based synthesis of nanoparticles accepted in the modern biological science world. Also, the experimental studies prove that the importance of nanomaterials in the growing research world, especially in drug delivery, medicine, and agricultural field because of their environmental friendly nature and the possibility to extract them under non-toxic chemicals. This is because of their ability to convert metals into nanoparticles by using plant extracts. In this paper, an aqueous extract of flowers of *Gmelina arborea* L. was used for the synthesis of silver (Ag) nanoparticles. Different biological methods are gaining recognition for the production of silver nanoparticles (AgNPs) due to their multiple application. Different plant parts of *G. arborea* L. widely used in many medicinal preparations in Ayurveda and Siddha. The biosynthesis of silver nanoparticles from *G.arborea* will explore valuable knowledge regarding its medicinal properties. Characterization of nanoparticles was done using different methods, which include; ultraviolet-visible spectroscopy, Fourier transform infrared, powder X-ray diffraction . Antibacterial activity of the synthesized AgNPs was studied by the standard disc diffusion method. The overnightgrew bacterial suspensions of Escherichia sp., Klebsiella sp., Enterococci sp., Pseudomonas sp., Proteus sp. Staphylococcus sp. And Serratia sp. were standardized using McFarland standard. The antibacterial activity of AgNPs against generally found bacteria was assessed to find their potential use in silver-containing antibacterial products.

IVCPB 78

Study on nutritional composition in five varieties of cassava (*Manihot esculenta* Crantz) tubers

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Cassava (*Manihot esculenta* Crantz) tubers are one of the most important sources of carbohydrate. They are the third largest source of food carbohydrate in the tropics. The research was intended to investigate the nutritional composition such as moisture, total carbohydrate, crude fibre, protein and minerals (calcium, phosphorous and iron) present in selected five varieties of cassava tuber. Malayan, Mulluvadi, Sree Jaya, Sree Vijaya and Swarna are the selected cassava tubers in this study. The result accomplished that there is only a narrow variation in composition of nutritional content in the selected varieties of cassava tubers. The result of the work shows high amount of moisture content is observed in Sree Vijaya (69.81%), whereas Sree Jaya, Malayan, Swarna and Mulluvadi contains 69.36%, 69.04%, 68.07% and 68.64% .respectively. The carbohydrate content was found as 298.1±2.10mg/g in Sree Vijaya, which is high among the other cassava varieties. The total carbohydrate content of Mulluvadi, Malayan, Sree Jaya and Swarna are 271.4 ±1.76 mg/g, 284.4±0.80 mg/g 266.0±1.41 mg/g and 276.2±1.15mg/g respectively. In case of crude fibre, Mulluvadi contains 2.5%, Sree Vijaya contains 3%, Sree Jaya contains 2.6%, Malayan contains 2.8% and Swarna of 2.7%. The protein content is high in Malayan (0.038±0.002 mg/gm) and low in Mulluvadi (0.025±0.004 mg/g), the Sree Vijaya contains 0.031±0.003 mg/g, Sree Jaya contains 0.033±0.003 mg/g, Swarna includes 0.032±0.006mg/g of protein. The minerals calcium, phosphorous and iron content in Mulluvadi is 0.04%, 0.09% and 6.3ppm respectively. In Sree Vijaya the amount of calcium is 0.06%, phosphorous is 0.142% and iron is 18.5 ppm. Sree Jaya contains 0.06% of Ca, 0.073% of P and 6 ppm of Fe. The Ca in Malayan is 0.1%, the P content is 0.1% and the Fe is 9.4 ppm. In Swarna the quantity of Ca, P and Fe is 0.04%, 0.104% 13.7 ppm respectively.

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