IHC2018-Symposium 16
International Symposium on Tropical and Subtropical Vegetable Production: Tackling Present and Future Global Biotic and Abiotic Stressors

ORAL PRESENTATIONS

KEYNOTE 1

Botanical ingredient adulteration: How commonly used analytical techniques are fooled

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As the global market for herbal medicines and supplements has increased, so have reports of undisclosed ingredients being added to botanical raw materials, extracts, essential oils, and finished consumer products. Reports include accidental misidentification of botanical materials due to human error. More often, however, adulteration is carried out for financial gain, also referred to as economically motivated adulteration (EMA), where raw materials are intentionally substituted or diluted with undisclosed lower-quality ingredients. This reflects a significant challenge to the global botanical medicine marketplace and, in some cases, impacts consumer safety. The American Botanical Council (ABC), the American Herbal Pharmacopoeia (AHP), and the National Center for Natural Product Research (NCNPR) at the University of Mississippi have initiated the ABC-AHP-NCNPR Botanical Adulterants Program, a large-scale program to educate members of the herbal and dietary supplement industry about ingredient and product adulteration.
The chemically complex nature of herbs and botanically-derived ingredients calls for unique quality control processes of herbal products. One of the universal regulatory requirements in industrialized nations around the world is the appropriate testing for identity and authenticity of botanical materials. However, unscrupulous suppliers often take advantage of a lack of specificity in test methods used to confirm the identity of a botanical ingredient by providing materials that may comply with these identity tests even if they do not correspond to the material declared on the label. Ingredients for which adulteration has been reported include, e.g., extracts of bilberry (*Vaccinium myrtillus*) fruit, black cohosh (*Actaea racemosa*) root/rhizome, cranberry (*Vaccinium macrocarpon*) fruit, ginkgo (*Ginkgo biloba*) leaf, saw palmetto (*Serenoa repens*) fruit, and St. John's wort (*Hypericum perforatum*) herb.
The presentation gives an overview on botanical ingredient adulteration with examples how fraudulent suppliers or manufacturers attempt to fool standard analytical testing. The analytical techniques discussed include macroscopic, microscopic, chemical, and genetic assays.

OS 1:

Differential effect of harvest period and location on the levels of Phytochemicals, Radical Scavenging Activity and Bile Acid Binding Capacity of Dandelion leafy green

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Dandelion (Taraxacum officinale)dark leafy greens have been known to possess vitamins, minerals and phytochemicals that may help prevent the onset of human diseases and illnesses. In this study, dandelion variety, Catalonga, grown in South Texas and New Jersey was separated into whole leaf, leaf and stem components and evaluated for vitamin C, carotenoids, total phenolics, flavonoids, radical scavenging activity, and bile acid binding capacity during an early and late harvested period. Catalonga whole leaf, leaf and stem components were extracted with metaphosphoric acid, acetone and methanol for the quantification of vitamin C and carotenoids using HPLC and DPPH free radical scavenging activity. The Catalonga leaf from both the locations had higher amounts of vitamin C, carotenoids, chlorophyll A and chlorophyll B, and free radical scavenging activity versus the whole leaf and stem components. Catalonga harvested from New Jersey had the highest amount of vitamin C

during the late harvest. Catalonga from Texas had higher amounts of lutein, chlorophyll A and B while Catalonga from New Jersey had higher amounts of violaxanthin and β-carotene all in the leaf components during the late harvest. Free radical scavenging activity and total phenolics was the highest in the leaf component of Catalonga from Texas during the late harvest. Catalonga from New Jersey had a higher percentage of bile acid binding capacity. Results indicate that the growing location, harvest period, and plant components (whole leaf, leaf and stem) had a differential effect on phytochemicals, antioxidant activity, and bile acid binding capacity of Catalonga. This study was supported by USDA-NIFA-2015-121277 and Texas state funding state appropriation.

OS 2:

Mastic Tree: Past, Present, Future. And its Potential Importance for Turkey

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Mastic tree (Pistacia lentiscus var. chia) is known as a dioecious ever green small tree belonging to the Sumac family (Anacardiaceae). It has long been cultivated only in the south part of the Greek island of Chios, in the Aegean Sea. Mastic tree is the unique source of mastic gum, which is obtained by injuring the trunk and branches of the tree. The history of mastic goes back to the 5th century B.C., i.e. to the time of Herodotus. Hippocrates, Dioscorides and Galenus also wrote about the pharmaceutical properties of mastic. Pliny gave detailed information about the mastic in his book of “Naturalis Historiae”. Nowadays, about 120 t mastic is being produced from 2,000,000 trees annually. Mastic production, processing and trade are governed by growers’ association having 4,850 members. Mastic resin and mastic oil are widely used in medicine, pharmaceutical, cosmetic and food industry. The production of mastic gum has long been associated with the island of Chios. But some evidences showed that mastic tree cultivation had also been conducted in the adjacent western Anatolia in the past. Remnants of old plantations, particularly observed in former Greek Orthodox villages on the Çeşme Peninsula, pointed out the growing activities in the past. But probably lost its importance after the 1923 population exchange. Some efforts have been made on protection, rehabilitation and propagation of the current genetic material since 1995. Also, some experimental plots were established by some universities, related ministries and NGOs using different propagation methods in the last 20 years. In this article, history and current status of mastic tree together with its development possibilities in Turkey were presented.

OS 3:

Morphological, phenological and metabolic profiling of Greyia species

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Ethnobotanical studies have documented the usefulness of herbal medicines in the treatment of various dermatological conditions. The genus Greyia has been found to offer dermatological benefits and contains three species namely Greyia flanaganii (GF), Greyia radlkoferi (GR) and Greyia sutherlandii (GS). The variation currently observed in plant material which is obtained and/or sold as GR necessitates that a clear differentiation between the three Greyia species be made in order to prevent adulteration of material and ensure the propagation of chemotypes of each species with high activity. The aim of the research project was thus to investigate morphological, phenological and metabolic differences in cultivated material as there seems to be morphological variation within species with intermediate types in the study population. Leaf material was collected from more than 90 individual trees in a cultivation block at Mothong in Mamelodi. Each tree was morphologically and phenologically described. Initial morphological description indicated different leaf forms and leaf margins. Flowering varies in terms of inflorescence type, density, and flowering time. Distinct evergreen trees were identified, and these are linked to GF whereas GR and GS are deciduous. Initial NMR results indicated that GS and GF separates to some extent but that plants from GR overlaps with both GS and GF indicating that GR might be an intermediate species and stressing the importance of identifying chemotypes with good activity. Variation in anti-tyrosinase activity was evident and genotypes displaying higher activity were identified.

OS 4:

Effect of Explant Type and Plant Growth Regulator on Callus Formation for Potential Production Secondary Metabolites in Cnidium officinale

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Cnidium officinale is a perennial herb of the family Umbelliferae, a medicinal plant of oriental medicine, and believed to have antidiabetic, tumor metastatic, antiplatelet, antimicrobial, and insecticidal properties. This study was conducted to establish an axenic callus culture of C. officinale. Stem and root explants were excised from in vitro-grown plantlets and cultured on the Murashige and Skoog (MS) medium containing different concentrations of 2,4-dichlorophenoxyacetic acid (2,4-D; 0.5-6.0 mg□L-1) alone or in combination with benzyladenine (BA; 0.5 mg□L-1). The cultures were incubated at 16h light and 8h dark, 70% RH, and 24 ℃ (day)/18 ℃ (night) tempe
observed and percent callus induction was recorded. Maximum of 72.7% callus induction was observed from the stem explant on the medium containing 0.5 mg□L-1 2,4-D in combination with 0.5 mg□L-1 BA, while on the same media it was lower (38.7%) for root explants. For root explants, with increase in 2,4-D concentration up to 4.0 mg□L-1, callus induction increased up to 86.6%. Conversely, with increase in 2,4-D concentration, stem explants failed to respond, but turned brown after one week. Maximum callus growth with fresh weight of 10g was observed on the medium containing 0.5 mg□L-1 2,4-D in combination with 0.5 mg□L-1 BA. These results suggest that explant type and concentration of plant growth regulators play significant roles in callus formation and its subsequent growth. These findings could be used for potential production of secondary metabolites in C. officinale.

OS 5:

Chemotypic diversity of Rosmarinus officinalis L. in the collection of the Nikitsky Botanical Gardens

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Rosmarinus officinalis L. is common in the Mediterranean region, widely introduced into culture in England, France, Italy as a spicy and an essential oil plant. Two chemotypes of rosemary are of industrial importance: Tunisian-Moroccan and Spanish. In the Nikitsky Botanical Gardens (NBS-NSC), a high-grade variety Horizon of Rosmarinus officinalis was created. As a raw material, blossoming young shoots are used in the flowering phase. An essential oil refers to the Spanish (cineole-camphor) chemotypes. Mass fraction of essential oil in May is 0,7% of raw weight, in October - 0,8%. The yield of 3-year-old plants is 40 c / ha, 5-year-old plants - up to 80 c / ha. The yield of essential oil in plants during the season is 60-65 kg / ha. Under the conditions of the South Coast, the plantation can be used for more than 20 years. As a result of the expedition to the Caucasus, 2 samples of rosemary were taken to the collection. The purpose of our research is to study the content and the constituent composition of the essential oil of new Rosmarinus officinalis samples. The mass fraction of essential oil was determined by hydrodistillation on Ginzberg apparatus from freshly collected raw materials. Component composition of the essential oil was studied by chromatographic mass spectrometry on the analytical complex "Clarus 600M" of the firm "PerkinElmer" (USA). The main components of the essential oil of the first sample are borneol (23.21-25.71%), camphor (18.0-19.99%), verbenone (5.92-10.15%), linalool (9.47-9 , 93%), 1,8-cineol (3.80-6.81%). It corresponds to an airborne camphor chemotype. The second sample was obtained by cuttings from the Institute of Essential Oil Cultures (Sukhum, Republic of Abkhazia) in 2015. The main components of the second sample essential oil are 1,8-cineole (33.7%), borneol (13.3%), bornyl acetate 8.62), β-Pinene (8.50%), α-pinene (6.10%), camphor (5.80%), camphene (3.65%). It allows it to be attributed to the Tunisian-Moroccan (cineole-borneol) chemotypes. Thus, the collection of the NBS-NSC contains three chemotypes of Rosmarinus officinalis: Spanish, Tunisian-Moroccan, borneol, that gives an opportunity of the wide use of this culture in various industries. This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

OS 6:

Medicinal plants and traditional ethnoveterinary practices by rural community of Lebanon

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Ethnoveterinary care by indigenous plants is a millennia-old cultural practice in the Middle East. This traditional knowledge is presently eroding and there is an urgent need to have it documented. The aim of this study was to identify medicinal plants and traditional practices used in the healthcare and welfare of livestock by rural communities of Lebanon. Using semi-structured questionnaires, personal interviews during field walks with key informants were carried out through 2014-2016. Informants included shepherds, farmers, practitioners, and herbalists.
Findings revealed a list of medicinal plant species popularly used in the treatment and management of various veterinary ailments and health conditions. The cited plants represented a diversity of families including Asteraceae, Apiaceae, Lamiaceae and Malvaceae among others. According to informants, Artemisia herba-alba; Dittrichia viscosa; Foeniculum vulgare; Laurus nobilis; Mentha spicata; Peganum harmala and Salvia fruticosa were reported among other species to have a very high efficacy and use-values. The ailments and conditions reported were gastrointestinal disorders, external parasites, reproduction and lactation, poisoning, fever, respiratory and urinary tracts infections, wounds, bites and stings. Most herbal recipes consisted of plants offered as fodder and oral applications of monospecies or multispecies infusions or decoctions. Cataplasms from fresh or dry powdered plants for topical application in skin conditions were also reported. This study stands as the first report on the veterinary use of medicinal plants in Lebanon. It contributes to the conservation of traditional knowledge of Lebanon and provides good evidence on the importance of medicinal plants in the healthcare and management of livestock. It can also serve as a baseline for future pharmacological investigations and practical applications in veterinary medicine.

OS 7:

Comparative study of essential oil and extracts fromArtemisia herba-albaAsso. Growing Wild in Lebanon

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Artemisia herba-alba Asso. and Achillea fragrantissima Forssk. (Asteraceae) are two native Lebanese plants that are commonly used in traditional medicine to treat diabetes, cardiac and renal and infectious diseases, and as anti-inflammatory analgesic, antispasmodic and to treat arterial hypertension. In this study, the chemical composition of the essential oils of the fresh aerial parts of these two plants growing wild in Lebanon were determined by GC-MS chromatography. Thirty and fifty compounds were identified in the oils, respectively.

The main components of Artemisia herba-alba oil were α-Pinene (45.89%) followed by Borneol (11.3%), 1,8-Cineole (10.8%), Terpineol (6.45%), Camphene (3.94%), γ-Terpinene (3.2%), α-Terpinene (2.72%), (+)-4-Carene (2.2%). Whereas, the main components in A. fragrantissima were Artemisia ketone (29.97%) followed by α-Thujone (13.34%), Germacrene D (10.35%), α-Cubebene (6.25%), Spathulenol (3.63%), β-sesquiphellandrene (3.52%), γ-Muurolene (3.27%), β-Eudesmol (2.45%). These results of indicate unique chemical profiles despite some similarities in the major groups of compounds of essential oils reported from other countries. This calls for further research to assess the pharmacological activities of these plants and to assess their potential as sources for novel drug discovery.

OS 8:

Optimisation of breeding, cultivation and post-harvest treatments of Artemisia annua L

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Artemisinin, a sesquiterpene lactone endoperoxide, is isolated from the herb Artemisia annua L. and is a highly potent antimalarial compound. The objective was to analyze the benefits of polyploidy for breeding based on the cultivar Apollon, to optimize plant density and harvest stage for high yield and to define the best drying and storage temperatures for A. annua leaves.
In an attempt to increase breeding efficiency, the polyploidy was tested. The use of colchicine at different concentrations and durations resulted in some tetraploid Artemisia annua plants. The crossing of these tetraploid plants was however not very successful. Only one combination of two parental lines produced seeds. The

progenies of both parental lines were tested individually in comparison with the cultivar Apollon. These tests showed no significant differences between the tetraploid plants and the cultivar Apollon with regards to the artemisinin content in the leaves, the leaf yield and the artemisinin yield.
The trials with four plant densities and several harvest stages showed that the most suitable planting density, giving the highest net income were around 20,000 plants per hectare. In addition, the obtained dataset demonstrated that highest artemisinin contents as well as highest possible artemisinin yields for A. annua were obtained just prior to flowering, at about 120-130 days after planting.
The study on the influence of drying and storage temperatures showed that drying temperatures higher than 40°C were problematic for loss of artemisinin. Even short periods of high temperatures (50°C during 1.5 h) reduce the artemisinin content in the leaves. Concerning storage, the best was to store intact leaves. It is not recommended to store raw material after crushing or leaf powder. Temperature and relative humidity (RH) are both important factors for long term storage, as shown by this study. The optimal storage conditions were 20°C with high RH (85 %) or 30°C with low RH (30 – 40 %).

OS 9:

Comparison of LED and HPS illumination effect on cultivation of red pak choi microgreens under indoors and greenhouse conditions

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The objective of our studies was to determine changes of growth, bioactive compounds and mineral elements content in Brassica microgreens depending on different percent of blue light in light-emitting diodes (LED) lighting. Experiments were performed in controlled environment growth chambers. Microgreens of mustard (Brassica juncea L. 'Red Lion'), red pak choi (Brassica rapa var. chinensis 'Rubi F1'), and tatsoi (Brassica rapavar. rosularis), were grown in a peat substrate (pH 5–6) in 0.5 l plastic vessels for 10 days, from sowing to harvest. Day/night temperatures of 21 ± 2/17 ± 2 °C were established with a 16-h photoperiod and relative humidity of 50–60%. A system of five high-power, solid-state lighting modules with standard 445-, 640-, 660-, and 735-nm LEDs was used in the experiments. The spectral composition was changed by adding a blue component – 0, 8, 16, 25 and 33%– changing the PPFD level of red (640 nm) light. ICP-OES method was used for determination of mineral elements, potentiometric method – for nitrate content, spectrophotometric – for total anthocyanins and phenols, ascorbic acid and DPPH. Our results revealed that the formation of leaf area was more effective by lowering the percentage of blue light in the illumination. However, opposite trends were determined for the fresh weight. No common trends were determined on bioactive compounds changes in microgreens. The changes on contents of compounds depended on microgreens species and percentage of blue light. For example, the highest content of total anthocyanins was determined at 8% of blue light in red pak choi and at 25% – in tatsoi, ascorbic acid – at 0% in mustard, at 8% in pak choi and at 16% in tatsoi, total phenols – at 8% in mustard and pak choi, at 33% in tatsoi. An increase of various mineral elements content was mostly caused by higher percentage of blue light.

OS 10:

Different agricultural practices to improve the yield response of Cannabis sativa L. cv. Pilar cultivated for biomedical purposes

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Cannabinoids are the most pharmacologically active compounds of Cannabis sativa L., and are mainly produced in the leaves and female inflorescences, as compounds of the glandular trichomes. Agricultural practices determine the production of these compounds from two different perspectives: 1. In terms of the amount of biomass (inflorescences and leaves) produced by the plants and 2. Based on the cannabinoids content. This work examines the effects of different agricultural practices to maximize the production of biomass in plants of Cannabis Sativa L. cv. Pilar, which is characterized by a cannabidiol (CBD) chemotype. Plants were grown under high-tunnels, and subjected to three irrigation doses: a full irrigation treatment (IR1), which received 100% of crop evapotranspiration (ETC), and two deficit-irrigation treatments (IR2 and IR3), which received 80 and 75% ETC respectively. Moreover, plants were grown under three different plastic films: P1, a film with high

% of diffused light transmission; P2, a film with low % of diffused light transmission, and P3, the same as P2 but modified for obtaining different PAR spectra. Additionally, two kinds of propagation material were used, one of them previously treated with mycorrhizae, and the remaining without being treated. The obtained results evidenced that those plants grown under P1 obtained significant better results in terms of active biomass than those grown under P3. Although no significant differences in terms of yield were obtained by applying different irrigation doses, IR2 evidenced improvements close to 400 kg ha-1 more than IR1. Something similar occurred with those plants previously treated with mycorrhizae, although no significant differences were obtained. According to the results obtained, biomass production can be improved by choosing the best plastic film and irrigation strategy and by using plants treated with mycorrhizae, being necessary to complete this information with the cannabinoids contents for the different treatments.

OS 11:

Investigating of characteristics of two medicinal halophytes of Salsola imbricata and Suaeda fruticosa under different levels of salinity

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One of the largest non-biological stresses affecting the plant is the salinity of water and soil resources, and this problem has increased due to agricultural practices. Considering that the global human population is expected to reach 9.1 billion by 2050, by this time the food production should increase to 70% to match the population growth. Such plants are known as salt-tolerant plants or halophytes. Suaeda fruticose Forssk, a perennial herb, a shrub, with a height of 160 cm and a crown diameter of 3 meters. This native plant of Iran is located in the center and south (Bafq) of this country. The Persian name of this plant is black saltin. Extract of Suaeda fruticosa leaves is used to treat eye pain, it has also been reported to contain antibacterial, antioxidant, and anti-cancer agents, Aqueous extract of Suaeda fruticosa has Glucose lowering effect, also it has fat-reducing effects, like blood cholesterol, the seeds contain 25% oil that can be used as edible oil. Salsola imbricata Forssk, an herbaceous plant with a height up to 120 cm, grows up in saline and sandy places with dispersion in the center and south of Iran (Tabas and Abarkuh). This plant used for traditional medicine in the treatment of dyspepsia, diarrhea, bloody diarrhea, anti-inflammation, colds, dyspnea (asthma), and sinus opacification, Diuretic, reduce blood pressure and women's contraceptives have also been reported. So, in this study the main goal is investigating the effect of different levels of salinity up to 60 ds/m on quality and quantity of these two medicinal halophytes.

OS 12:

Chemical composition of essential oil of Laurus nobilis L

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Bay laurel (Laurus nobilis L.) belongs to the family Lauraceae, which comprises numerous aromatic and medicinal plants. Laurus nobilis L. native to Mediterranean regions is also known as sweet bay, bay laurel, Grecian laurel, true bay, and bay. Bay laurel has been used as a spice since antiquity, primarily because of its oil content. In Turkey, Laurus nobilis L. grows in the Marmara, Aegean and Mediterranean regions. In this study, essential oil content of trees in Urla – İzmir which is western part of Turkey was determined. The samples of two years old leaf were taken in June, July, August and September from 50 different genotypes. After collection samples were dried at room temperature and each sample was subjected to hydro distillation by Clevenger apparatus and analyzed by gas chromatography.
Seventy-six compounds were found in the leaf and 33 compounds of them were found all genotypes. There were not significant differences between genotypes. The major component was 1.8-Cineole. The highest amount of this component was found in September.

OS 13:

Biological and physiological potential of bioactive compounds in Abies Koreana

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An increasing number of studies in recent years have revealed various biological activities—such as memory-enhancing effects as well as anti-bacterial, antioxidant, anti-inflammatory, and anti-cancer functions—of bioactive compounds in the Abies species. While most of those studies described potential applications in medicinal areas using extracts, research on the impact of compounds on biological activities is scant. Therefore, this research aimed to investigate the chemical composition of and the biological and ecophysiological functions in Abies Koreana. The leaf extracts of Abies Koreana were evaporated under vacuum, and further purified by using preparative high-performance liquid chromatography. As a result, different compounds, including benzoic acids, phenylpropanoids, flavonoids, and other flavonoids, were successfully identified in Abies Koreana. In addition, we analyzed the relationship between the plant secondary metabolites and the abiotic environmental conditions such as soil moisture, air temperature, and humidity. These results suggest that the environmental relative humidity and temperature significantly influence the expression level of the identified phenolic. However, further studies are warranted to better understand these findings.

OS 14:

Assessment of Turmeric (Curcuma Spp.) For Production in Alabama, USA

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Turmeric (Curcuma species) is a popular condiment in Asian cuisine and is currently gaining popularity for its anti-inflammatory and anti-cancer properties in the U.S.A. However, the lack of robust, adapted varieties that combine high rhizome yield with high curcumin levels, and production methods are major factors limiting its production in the US. To address this limitation in Alabama, several turmeric genotypes were grown at the Alabama A&M University (AAMU) and Auburn University (AU) in North and Central Alabama, respectively, with the objective of assessing their growth, rhizome yield and quality. The genotypes were planted in a randomized block design with four replications. Three plants from the middle row of each plot were harvested to determine dry rhizome yields and their curcumin, and elemental content. The curcumin and elemental contents were determined using HPLC and Inductively Coupled Plasma Spectrophotometer, respectively. There was a significant genotypic variation for rhizome dry weight, curcuminoids and elemental content at both locations. At AAMU, genotypes CL9 and CL7 were the highest and lowest yielding, respectively, whereas at AU, CL2 and CL6 were respectively, the highest and lowest yielding genotypes. The curcumin content varied from 0.0 mg/g for CZ 1 to 18 mg/g for CL10 at AAMU whereas it ranged from 0.0 mg/g for CZ 1 to 34 mg/g for CL9 at AU. Both rhizome yield and curcumin levels were higher at AU site perhaps because of higher temperatures and longer growing season compared to AAMU location. Elemental content varied between genotypes and locations. In general, potassium was the most dominant element and ranged from 7.4 in CAER1 to 21.72 mg/g in CL3. Turmeric has the potential for commercial production in Alabama and perhaps the southeastern US. The wide variation for both rhizome yield and curcumin content among these genotypes indicates the potential for variety improvement.

OS 15:

Aromatic rose varieties of the Nikitsky Botanical Gardens

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The principal areas of rose cultivation in the Soviet Union were in the Crimea, Moldova and Krasnodar region. The share of the Crimea was 40% of the essential oil rose production in the Soviet Union. In 1926 (91 years ago), in the Nikitsky Botanical Gardens the first-grade essential oil rose “Crimean Red” was planted by method of an individual selection from Rosa gallica. As a result, during 1930s-70s the most active breeding work had been carried out in the Nikitsky Botanical Gardens, and 10 varieties of aromatic roses were created: “Crimean Red” (1926), “Ukraine” (1964), “Taurida” (1964), “Perfume” (1964), “Festival” (1965), “July” (1967), “Dzhalita” (1967), “Vilen” (1969), “Fame” (1979), “Olympia” (1979). Today in Crimea some separate places with varietal rose plantings have been remained: in Alushta, on aromatic rose plantations, in Izobilnoye village; in Sec. Scientific (Bakhchysarai district) - 2,5-3,0 ha; on experimental plots of the Scientific-research Institute of

essential oil cultivars (also called “VNIEMK” and located in Simferopol, Belogorsk region). The collection of essential oil rose varieties of the Nikitsky Botanical Gardens and VNIEMK has been restoring at the present day. The data on the morphology, phenology, yields of essential oil rose varieties has been collecting. “Taurida” (Rosa damascena Mill) is a relatively frost-resistant variety (in winter with a slight snow cover it withstands a temperature of -20-25 ºC), it is also resistant to powdery mildew. A shrub varies in shape from compact to medium spreading, with a height of 140-170 cm. In the brush there are 4-9 flowers, which are pale pink, terry and 5-7 cm in diameter. The weight of a flower is 3-4 g. The yield of flowers is 30-35 c / ha. “Festival” (Rosa damascena Mill x Rosa gallica L.) is a winter hardy variety, which grows well on carbonate soils. It is resistant to chlorosis, rust, and powdery mildew. A shrub is medium-compact, 150-170 cm in height. Flowers are collected in a brush of 8-16 pieces, their average size is 2,5-3,0 cm in diameter, they are terry, with pink-red petals. The average weight of a flower is 3-5 g. The yield of flowers is 20-39 c / ha. This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

OS 16:

Observation Glandular Trichomes and Analysis Volatile Compoundsfor Opisthopappus taihangensis (Ling) Shih and Other Four Kinds of Chrysanthemum Using SPME-GC-MS

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In order to know the volatile compounds of Opisthopappus taihangensis (Ling) Shih and other four Chrysanthemum wild species and explore its relationship with the number of glandular trichomes on leaf, scanning electron microscopy and fluorescence microscopy were used to observe the number of glandular trichomes and head-space soild-phase micro extraction and gas chromatography-mass spectrometry (SPME-GC-MS) were conducted to identify the chemical components .The results showed that there were two morphologically distinct trichome types in these five species’ leaves: One was T-shaped non-glandular hairs without the secretion function, and the other was capitate trichome with the secretion function. Moreover, the distribution and density of trichomes were different in different species. The density of capitate trichomes of Opisthopappus taihangensis (Ling) Shih was greater than other four species, in either upper or lower epidermis. The leaves of Chrysanthemum vestitum have abundant non-glandulars, but the density of glandular trichomes was pretty low. Leaf surface of C. indicum (L.) and C. lavandulifolium had less trichomes, only a small amount concentrated in the veins. Terpenoids were the main volatile compounds of these five species by SPME-GC-MS, and histochemical staining also revealed that the chief volatile compounds were terpenes and the head cells of capitate trichome were the secretory parts of essential oil. The correlation analysis showed that the content of terpenes was related to the density of capitate trichome. The correlation coefficient was 0. 962.The results explain a possible relationship between volatile compounds and capitate trichomes in chrysanthemum.

OS 17:

Bioactive phytometabolite identification through FT-IR and DART-MS in essential oil of African marigold (Tagetes erecta L.)

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Tagetes erecta L. belonging to family Asteraceae, is most widely used as an ornamental plant but has immense cosmeceutical value. Oil extracted from its plant parts is reported to be a rich source of secondary metabolites such as alkaloids, steroids, tannins and phenolic compounds, flavonoids etc. Oil was extracted from flowers, as well as leaves of marigold (Tagetes erecta L.) in fresh form and after processing by solvent extraction method using n-hexane as solvent. Samples were subjected to Fourier infrared spectroscopy (FT-IR) where spectra of sample have shown the presence of major functional group viz. alkanes, aromatic, phenols, aliphatic, nitro compounds and amines etc. at wavelength of 3400 to 3480 cm-1 (alcohol & phenols), 2850 to2990 cm-1 (alkanes), 1050 to 1200 cm-1 (aliphatic amines) and 720 to 890 cm-1 (aromatics). The samples were further validated by DART-MS where peaks at m/z 136 correspond to terpinolene, thujene, sabinene, α-terpinolene, α-pinene, β-ocimene, limonene, 151 to tagetone, 169 to gallic acid, 183 corresponds to mannitol etc. Post-harvest processing of marigold for its oil extracted from its flower as well its plant parts may enhance the value of the crop multifold since it is reported as a rich source of bio color, pigment and bioactive molecules which may be

exploited in the food and pharmaceutical industry, besides the waste management of flowers generally discarded after their use in temples and marriage decorations.

OS 18:

Phytochemical characterization of pumpkin seed extracts with antiparasitic action

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The indiscriminate use of antibiotics, vermifuges and antifungals by individuals has been causing resistance in some parasites and microorganisms. In regions where the population has a low income, people generally use plants, such as pumpkin seeds, as alternative medicine. Pumpkin seeds have been used in traditional medicine because they have action against human parasites. In the agroindustry, these seeds are discarded as by-products, although they present bioactive compounds such as tocopherol, fatty acids (omega oils), carotenoids and amino acids, which make them a promising approach to use as an alternative to treat helminth infections, as well as be used in human feeding to improve the immune system. Thus, the objective of the present study was to determine the chemical composition of Cucurbita maxima seeds and to evaluate in tests in vitro the potential of their extract against Strongyloides venezuelensis larvae. The crude lyophilized extract of C. maxima seeds was obtained after water extraction. Aqueous extracts of pumpkin seeds were prepared, whose chemical composition of the seeds was characterized by AOAC methods. Quantitative and qualitative analyses of bioactive compounds of extracts samples were investigated. Tocopherol and carotenoids were quantified by high-performance liquid chromatography (HPLC), while 1,1-diphenyl-2-picrylhydrazyl (DPPH) has been determined by spectrophotometer methods. The antiparasite action against larvae of S. venezuelensis was evaluated in vitro, where the extract was added into assays tubes varying the concentrations from 0 to 400 µg/mL, containing S. venezuelensis larvae (1500), which tubes were incubated at 25 °C for 48 hours. Samples were withdrawn every 12 hours, centrifuged and the larvae were suspended in aqueous solution and counted by microscopic method. Ivermectin and water have been used as positive and negative control, respectively. Chemical analysis (HPLC) of the seeds revealed a predominant presence of tocopherol and carotenoids. The seed extract showed antioxidant activity, probably due to bioactive substances, mainly tocopherol and fatty acids. After 12 hours, concentrations greater than 100 µg/mL eliminated 92% of the larvae. Increasing the incubation period up to 48h, low concentrations of extract (25 µg/mL) were sufficient to eliminate more than 90% of the larvae, while ivermectin killed 80% and in the water control sample, 80% of the larvae remained alive. This is the first study to evaluate the potential of C. maxima seed extract to eliminate S. venezuelensis larvae in tests in vitro. Our results suggest that the low dose of pumpkin seeds extract has anthelmintic properties to eliminate infective larvae of Strongyloides venezuelensis, being a promising alternative as a medicinal plant and phytotherapeutic product for the elimination of helminths.

OS 19:

Establishing a Juniper (Juniperus communis) production industry in New Zealand

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New Zealand (NZ) spirits exports currently comprise only 2% of total beverage exports and NZ's share of global trade in spirits is only 0.1%. For comparison NZ's share of global trade in wine is 3.4%. Achieving a point of difference, in having 100% NZ origin gin with distinct aromatic flavour profiles derived from locally grown Juniper berries, could create a unique selling point and accelerate export growth for this spirits category, which is one of the stand out beverages for global import growth over the past five years. With no present commercial Juniper production industry in NZ, this paper will describe the opportunity for cropping Juniper as a novel and sustainable local supply chain for berries for both NZ and other southern hemisphere gin manufacturers. Many of the botanical inclusions in gin are available from NZ, but Juniper berries are currently not available in commercial quantities. Juniper (Juniper communis) is an evergreen conifer, related to cedar and cypress grown across Europe, Asia, USA and Canada at latitudes of around 70-28 degrees. Although not native to NZ, it does grow successfully, primarily as an ornamental. Juniper prefers well-drained, slightly acidic, gravelly or rocky soil, to 'chalky/hilly' zones, in eco-zones between forest and grassland, in skeletal soil zones and on poor sandy

soils and stabilized inland sand dunes. Optimum propagation methods, growing and harvesting techniques of commercial Juniper cropping will be outlined in order to achieve high yields and unique volatiles' characteristics. This study includes also consideration of sustainability and social responsibility, both of which may be upheld in new Juniper-producing enterprises. We will discuss and present our feasibility analyses of growing Juniper as a cash crop on medium-to-low class soils in the Taranaki region of North Island, NZ and beyond, as well as potential production and economic constraints of the proposed diversification.

OS 20:

Effects of Mini-Cuttings Length and Medium Substrates on Multiplication of Melicope Ptelefolia

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Melicope ptelefolia is a local herb found in Malaysia and other Asian countries, is believed to be high in nutritional and medicinal values. It is often used as vegetable salad and traditional medicine to address various ailments. Although it is one of the most popular traditional fresh vegetables among the Malays of Malaysian community, the young shoots are normally harvested from plants that naturally grow in the wild. Propagation of *Melicope ptelefolia* is limited by seed viability and inconsistency of germination time. Hence, vegetative propagation is preferred for reliability supply of planting materials. The present study had the objective of evaluating the effects of mini-cuttings length (bi nodal, tri nodal and tetranodal) and media substrates (sand, perlite and peat) on the rooting performance of *Melicope ptelefolia*. The experiment was laid out in a randomized complete block design (RCBD) and replicated three times. The results indicate that perlite medium performed very well by enhanced rooting of mini-cuttings faster than the other medium substrates. Tri nodal micro-cuttings were the most suitable with highest survival percentage and root length.

OS 21:

Quality Control and Standardisation of Medicinal and Aromatic Plants From Field to Pharmacy

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In the recent years with ever-growing commercialization in the field of medicinal plants and herbal medicines, there has been an instant demand for quality control of the drugs used in this system. For this standardization is usually recommended as the solution to the problem.
The challenges are innumerable and enormous, making the global herbal market unsafe. This talk seeks to enlighten physicians, pharmacists, consumers and stakeholders in herbal medicine on the need to establish quality parameters for collection, handling, processing and production of herbal medicine as well; as employ such parameters in ensuring the safety of the global herbal market. The processes of good quality assurance and standardization of herbal medicines and products will also be discussed.
In the present study an attempt has been made to study the medicinal plants in general from Selection of Medicinal Plants, Good Agricultural Practices (GAP), Good Cultivation Practices (GCP), Good Field Collection Practices(GFCP), Technical Planning, population density, Geographical distribution, Topographical maps, collecting techniques & procedures , Source and Period of Collection, Identification, Storage, Chemical Standardization, Assay, Current Good Manufacturing Practices (CGMP), Pre-clinical studies to Clinical Approach, Good Marketing Practice (GMP) with special reference to maintain Standardization at each and every stage and subsequent production of quality raw botanical materials/products.
Different stages, i.e. Quality control studies of raw plant materials, Controlled studies of Method of Processing, Quality Control Studies of the finished product, Standardization procedures at each stage from birth of the plants up to its clinical application & marketing have been described.

OS 22:

Comparison of juvenile and mature Stelechocarpus burahol growth and its leaf bioactive compound using principle component analysis

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Stelechocarpus burahol is one of indigenous species of Java Island that became rare in Indonesia. This tree belonged to Annonacea family and has a long history as traditional medicine and natural cosmetics. Flavonoids from the leaves have antibacterial characteristics. A study of leaf bioactive compound and plant growth at different phases were carried out i.e. juvenile, mature tree on vegetative, flowering, and fruiting phases. Young leaves contain anthocyanin while medium and mature leaves contain anthocyanin and flavonoids. Principle of Component Analysis on mature leaves of juvenile phase, young, medium and mature leaves of vegetative, flowering and fruiting phase with anthocyanin, flavonoids, mature leaf N, P, K, and growth variables showed different closeness and grouping in every phase.

OS 23:

Effect of pine needle mulch and irrigation frequency on the yield of Origanum Syriacum under open field condition in Lebanon

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Lebanon is one of the natural habitats of Origanum Syriacum. It is grown as a wild subshrub in different areas, especially on west-facing slopes of the Mount Lebanon mountain chain. It is characterized by its multiple benefits and diverse use. Due to the intensive harvest from natural habitat and increasing competition as a source of food, O.Syriacum was introduced into cultivation and soon became one of the promising crops for many farmers in rural areas.
Despite the low agricultural requirements, there is a necessity to adopt advanced agricultural practices to ensure economic feasibility of the cultivation of O.Syriacum. The lack of an appropriate irrigation strategy and weed management are the main problems facing O.Syriacum cultivation. This study was conducted in Lebaa station at the Lebanese Agricultural Research Institute(LARI) to investigate the effect of pine needle mulch and irrigation frequency on the yield under open field conditions. The treatments were organized into randomized complete block design with 3 replicates. The irrigation of 1l/plant/day at 5, 10 and 15 days frequency were assigned to both pine needle mulch and control (not mulched plots).
Average fresh plant weight of both spring and autumn cuts(harvest) was significantly greater in plots mulched with pine needles(121.6g) compared to the control(88.1g) (not mulched). The yield was not affected by irrigation frequency as no significant differences were observed between them neither in the pine mulch nor in the control ones. In a comparison between percent weight contribution of a different plant part, leaves formed the highest proportion(46%) compared to the inflorescence and stem. The fresh and dry weight of weeds/ m2 were significantly less in plots mulched with pine needles compared to the control. Future study should determine the effect of these treatments on the chemical composition of Origanum Syriacum.

OS 24:

Cadmium absorption and accumulation behavior in St .John's Wort (Hypericum perforatum L.) affected by application of zinc and zeolite

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Cadmium is a heavy metal that is very dangerous to the environment, because of its toxicity to humans and animals. The presence of high levels of bioavailable metal concentrations enhances the risk of toxic metal excess in edible and phytotherapeutically effective parts of medicinal and agricultural plants. Hypericum perforatum with anti-depressant properties has the ability to accumulate high levels of cadmium. In the present study the effect of different levels of Cd, Zn and zeolite application on (a) shoot and root dry mass; (b) Cd uptake and content of this element in the plant was investigated. From obtained results it is evident that the content of Cd in roots and shoots increased with the increasing external Cd concentration (20mg.kg-1 soil) and its accumulation in the roots (9.29mg.g-1 dm) was higher than that in the shoots (4.81mg.g-1 dm). When at higher concentrations, the presence of zeolite (10g.kg-1 soil) decreased Cd accumulation in the roots to 0.93mg.g-1 dm. The presence of Zn (50mg.kg-1 soil) decreased Cd content to 0.79mg.g-1 dm in plants that were not also treated with Cd. On the other hand, Cd accumulation in the plants treated with Zn + Cd exceeded than plants treated with Cd alone.

Only the highest Zn concentration (50mg.kg-1 soil) and zeolite level (10g.kg-1soil) positively influenced dry mass.

OS 25:

Nutritional properties and antioxidant capacity of 12 Iranian barberry (Berberis sp.) genotypes

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Barberry, a valuable small fruit in terms of nutritional properties and antioxidant capacity, grows widely in Iran, Turkey and some other countries. Most of this fruit's species has numerous unnamed genotypes. In this study, 12 unique genotypes were chosen among more than 30 genotypes existing in the greatest barberry collection of the Middle East, located in Mashhad, Iran. Their harvested fruits in October-November, 2015 were analyzed for some physico-chemical characteristics and nutritional properties as well as their antioxidant activity. Measured properties includes: fruit cluster length, number of berries/cluster, berry dimensions, juice and moisture content, percentage of pulp and seed, seed set percentage, number of aborted seeds/berry, weight of one hundred fresh and dried berries, volume of one hundred grams of berries, fresh and dried fruit color indexes, antioxidant capacity (by DPPH and FRAP), total phenol, total flavonoid, total anthocyanin, ascorbic acid (by HPLC), titritable acidity (TA), pH, total soluble solids (TSS), TSS/TA, total sugar, Protein, fiber and trace elements (Cu, Fe, Zn and Mg). Results indicated significant between evaluated genotypes. Based on the results, genotype #14-2 had the highest total flavonoid content (22.47 milligram Quercetin equivalent/100g Dry Weight), total anthocyanin content (404.92 mg cyanidin-3-O-glucoside equivalent/100g DW). This genotype also had 22.4 mg/100g DW ascorbic acid and the highest antioxidant activity (DPPH), while the genotype #2-2 had either the lowest amount of antioxidant capacity and total anthocyanin (32.20 mg CGE/100g DW). Result also indicated that seedless barberry genotype had a high amount of total anthocyanin (311.27 mg CGE/100g DW) and its ascorbic acid content was 10.1 mg/100g DW. Among genotypes, the highest and the lowest amounts of phenolic compounds belonged to genotypes #5-1 and #12-1. In all genotypes, the amount of Cu and Fe was higher than Zn and Mg. In conclusion, the barberry genotypes are valuable resources for future domestication, breeding operations and cultivation extensions.

OS 26:

A comparison on the effect of organic and chemical fertilizer on vegetative growth rate and essential oils of Origanum majorana L

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Nowadays in agriculture systems, for decreasing environmental existence pollution and protecting soil, it seems the tendency towards using compost is more than past. Specifically, in the plantation of drug plants for increasing of its operation and security of human health, use of compost is really significant. Therefore, this investigation considers compost effects, domestic animal fertilizer, and chemical fertilizer (NPK), on the range of essence and growth of Orignum majorana plant. It is a member of Lamiae family, a grassy perennial plant that originally is from European country sent to other countries like Iran. This investigation was performed in a CRD design with 3 replications and 6 treatments including soil attendance, compost-soil (50:50), soil-fertilizer (50:50), chemical fertilizer (NPK 20:20:20), soil-compost (70:30) with soluble splash. Finally, the percentage of essential oil, plant height, root length, dry and wet roots and branches weight, and the range of secondary branches were measured. The results showed that treatments which include compost had more significant effect than soil and fertilizer in increasing plant height, root length, dry and wet root and branches weight and the essential oil percentage. Thus, it can be said using compost in cultivating this plant would give more success than other fertilizers.

OS 27:

An investigation on the essential oil compounds of Foeniculum vulgare Mill. in tissue culture in comparison with seeds

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Fennel is a perennial plant from Apiaceae, the essential oil of which is used in pharmaceutical, food, cosmetic and sanitary industries. Most of the medicinal plants are not to be produced using regular methods for such industries, hence tissue culture of these plants is necessary. As a part of this investigation, callus was produced from fennel seedlings and callus ability was studied to produce essential oil components and it was compared with components of seed essential oil. Fennel seeds were cultured on MS media to produce patogene free seedlings. Three parts including cotyledon, hypocotyl and root were cultured on media containing coconut milk (150 mg/l) and NAA (1 mg/l) plus specific concentration of PGRs (kin + 2,4-D) and were kept in controlled condition for callus formation. After producing enough callus, essential oil was extracted. Simultaneously seed essential oil was extracted too. Then those were injected to GC/MS. Results demonstrated that the heaviest callus was produced in media containing 1 mg/l 2,4-D and 0.1 mg/l kin b root explant. The highest essential oil components include trans anethol, alpha fenchon and stragol in seed; trans anethol and Di limonene in callus. Finally, results showed that production of essential oils components in callus depends on various amount of PGRs in the media.

OS 28:

Effects of atmospheric cold plasma on qualitative characteristics of Hyssop (Hyssopus officinalis L.)

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Cold plasma is a non-thermal method for decontamination of medicinal plants, which has been considered in recent years; however, there is not sufficient information about its effects on plant active ingredients. In this study, the influence of atmospheric cold plasma (ACP) treatments (17, 20 and 23 Kilowatts for 1, 5 and 10 minutes) on the essential oil content and composition of Hyssop (Hyssopus officinalis L.) leaves were evaluated on the basis of a completely randomized design with three replications. The essential oil content was determined using hydro-distillation and the constituents of the essential oils were identified and quantified using gas chromatography–mass spectrometry (GC–MS) and gas chromatography (GC), respectively. The results showed that by extending the time of ACP treatment in all samples, EO content was significantly increased. The maximum essential oil content (0. 5 % v/w) was obtained from 23 KW for 10 minutes samples but the lowest one (0.33 % v/w) was determined at 17 KW for 1 minute. Different ACP treatments had considerable effect on essential oil composition, especially cis- pinocamphone, trans-pinocamphone, myrtenol and β- pinene

POSTE PRESENTATIONS

PS 1:

Processing and Use of Edible Petals Grown in Baltic States

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Edible petals of flowers have been traditionally used in many countries for human consumption to improve the appearance, taste and aesthetic value of different food dishes, their nuances and details that consumers appreciate. In Baltic States the use of edible petals in food industry is a new concept. That is why a research study is being carried out at the Latvian University of Agriculture by the author of this paper. This paper focuses on the author's findings of the analysis of chemical composition of edible petals like *Trifolium pratenseL, Borago officinalis L, L.vera , Tropaéolum, Verbascum* and on the identification of substances of petals which have a positive impact on human health. Also, an overview of the available information on diverse edible flowers grown in the Baltic countries is given. The author of this research study has concluded that the valuable properties of edible petals can foster their use in food industry, and that consumers have been looking for functional qualities of food such as anti-inflammatory, antioxidant, antimicrobial, and anti - depression properties because they increase the workability of people. Thus, edible petals offer a considerable contribution to that process

PS 2:

Propagation of Pelargonium sidoides from root cuttings

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Pelargonium sidoides is an important South African traditional medicinal plant used to treat lung infections, tuberculosis, sore throat, fatigue, weakness of the body and dysentery. The roots of P. sidoides are the major plant part used, resulting in destructive harvesting of plant material. This linked to overharvesting of plants from the wild has resulted in localized population decline. Seeds can be used for propagation, but vegetative propagation is advantageous as it results in clonal material with similar genetic and quality properties. The effect of root size and root orientation on the root cutting success of P. sidoides was thus investigated. Root orientation (vertical or horizontal) and three root diameter sizes were tested in a randomized complete block design with three replicates and 5 root cuttings as experimental unit. Smaller root cuttings (0.5-1.0cm diameter) rooted and sprouted better than medium (1.0-1.5cm diameter) and large (1.5-2.0cm diameter) root cuttings although differences were not significant. Horizontally planted root cuttings, however, sprouted and rooted significantly better than vertically planted root cuttings. Interactions between root cutting size and root cutting orientation were also observed. Root cuttings of 0.5-1.0cm in diameter planted in a horizontal orientation can thus be recommended for successful propagation of P. sidoides.

PS 3:

Source of Supplementary Light Affects Growth and Physiology of Plug Seedlings of Three Medicinal Plants,
Adenophora triphylla, Codonopsis lanceolate, and Astragalus membranaceus

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Adenophora triphylla, Codonopsis lanceolate, and Astragalus membranaceus are high-valued herbs or vegetables which have been widely used in traditional medicine or diet. However, optimal protocols for commercial production of medicinal plants such as these are not yet available. In this study, plug seedlings were grown for four weeks in a glasshouse with an average daily maximum light intensity of 490 µmol·m-2·s-1 photosynthetic photon flux density (PPFD) coming from the Sun with 16 h/day of supplemental lighting at a 120 µmol·m-2·s-1 PPFD from either high-pressure sodium (HPS), metal halide (MH), far-red (FR), white LED (LED-w), or mixed (white: red: blue =1: 2: 1) LED (LED-mix). The culture environment had 32°C/25°C day/night temperatures, 85% relative humidity, and a natural photoperiod of 14 h. The results showed that number of leaves and specific leaf weight of all three species were enhanced in the LED-w and LED-mix. The greatest total biomass, stem diameter, and ratio of total weight to total plant length of all three species were found in the LED-mix, leading to more compact seedlings. The root biomass, the ratio of root weight to root length, and root-shoot ratio of all three species were also the greatest in the LED-mix. Furthermore, the contents of starch, soluble sugar, total phenol and flavonoid of all three species were significantly larger in the LED-mix. The accumulation of reactive oxygen species (ROS) and activities of antioxidant enzymes of three species showed no significant differences among the supplementary light sources. The immunoblots of two important photosynthetic proteins PsaA and PsbA of all species showed the largest expression level in the LED-mix. Overall, results suggest that the LED-mix could be an optimal supplementary light source for growth and development of three medicinal plants A. triphylla, C. lanceolata and A. membranaceusin terms of their growth and development.

PS 4:

Cold water pretreatment enhanced germination of Codonopsis lanceolata seeds

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Codonopsis lanceolate (common name: deodeok) is a flowering plant native to East Asia. As a milder version of ginseng, it has been used to treat and prevent the diseases of bronchitis, cough, inflammation, and diet-induced

obesity. A seed propagation method is normally used in the production. However, still no effective protocol for commercially usable uniform germination is available. In this study, seeds of C. lanceolata were pretreated by imbibing in one of the following solution (250 mL) and conditions: 1) in sterile (autoclaved double distilled) water for one day at 24 °C (TA, control 1), 2) in 100 or 500 mg·L-1 GA3 (TC, GA3-500) for one day at 24 °C, and in sterile
pretreatments, the seeds were soaked first in a Tween 20 solution (3 drops in 100 mL water), and then sterilized in a 2% (w/v) NaClO solution for 5 min, followed by soaking in a 70% ethanol solution for 30 s. The seeds were cultured on the Murashige and Skoog (MS) medium at 24 °C under a dark c
seed germinated in the TA (control 1), TB, or TC, indicating that GA3 is not an effective germination inducible factor for C. lanceolata seeds. Three days after culture initiation, the seeds in the TE showed signs of germination and the germination rate eventually reached to 70% after 8 days in this treatment, while no germination was found in the TD (control 2). Overall, results suggest that imbibition in sterile water for 7 days at 4 °C could be an optimal pretreatment for germination of C. lanceolata seeds.

PS 5:

Effect of level of shading on growth and development of Astragalus membranaceus plug seedlings

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Astragalus membranaceus is an important medicinal plant with a long history of usage in curing liver-related diseases in Korea and China. However, there is still insufficient research on the growth and development of A. membranaceus seedlings as affected by the level of light intensity. In this study, the growth and development of plug seedlings of A. membranaceus were investigated as affected by light intensity by applying different levels of shading to the sunlight. The seedlings were grown for four weeks at 23 °C/13 °C day/nigh
relative humidity, and a natural photoperiod of 11 h in greenhouse with 0, 35 or 55% shading of the sunlight during the day time. Results showed that stem diameter, shoot fresh weight, and number of leaves in the 0 or 35% level of shading were significantly higher than those in the 55% level of shading, respectively. Moreover, root dry weight, root length, ratio of root biomass to root length, ratio of shoot biomass to shoot length, specific leaf weight, and level of root ball formation in the 0% shading were the greatest among the treatments, resulting in higher quality seedlings with more compact shoots and improved roots. A higher root-shoot ratio in 0% level of shading indicates that more photosynthate was allocated and transported to the underground part, contributing to root growth. However, length of the shoot, epicotyl, and internode in the 35 and 55% shading was significantly greater than in those in the 0% shading, showing that shading accelerates the height of seedlings. In conclusion, these medicinal plants do not need any shading during the plug seedling culture, since 0% shading promoted growth and development of roots the most and provided compact and strong seedlings, as compared with slender and weak seedlings produced in the 35 or 55% shading treatment.

PS 6:

Phenotypic Evaluation and Economic Efficiency Concerning a Basil Germplasm Collection from S-E Romania

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In Romania, basil crop is very appreciated from the flavoring, therapeutically, medicinal, ornamental and even religious point of view.
Biodiversity preservation for this species and also creating new varieties represents two of the main research objectives of the vegetable in this country. Vegetable Research and Development Station (V.R.D.S.) Buzau already has 2 basil varieties homologated (V1–"Aromat de Buzau" and V2–"Violet").
From the germplasm collection of this species there were selected eight most representative accessions of basil (Ocimum basilicum L.) and there were compared with 2 varieties already homologated, in order to identify if one of them presents superior characteristics.
Researches were organized in 2017 having the purpose to mark out the main phenotypical and agroproductive characteristics of the biological material taken into study and also to determine the economical efficiency of the yields obtained. The experimental design was a randomized block with 3 replicates. In order to analyze the results there were used analysis of variance and multiple comparison method Duncan's test.

In 2017 weather conditions, plants height varied between 26.43 cm at V5 and 78.67 cm at V1, and plants diameter varied between 36.17 cm at V5 and 89.50 cm at V7. Leaf blade had the lowest values at V5 (1.87 cm length, 1.21 cm width and 0.1083 g weight) and the highest values at V6 (12.62 cm length, 7.62 cm width and 2.6668 g weight). At V2, V8 and V10 there was observed an anthocyanin coloration with different intensity. The yield concerning fresh material/plant varied between 220.60 g at V10 and 760.70 g at V8, and the yield of leaf/plant 68.08 g at V10 and 242.03 g at V6. Dry matter content varied between 11.62% at V5 and 21.63% at V10.
These results dignify a great variability in what it concerns the biological material taken into study and also justify the works concerning the biodiversity preservation for this species. Due to the special characteristics (bush with reduced dimensions) V5 is suitable for flowerpot culture. V6 had the yield of leaf/plant equal to 242.03 g and V8 had the yield of fresh material/plant equal to 760.70 g, both values being superior to V1 and V2.

PS 7:

The potential of using medicinal plants in Haloculture, a case study of Caper (Capparis spinosa L.)

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Salinity stress is a factor that seriously limits the production of agricultural products in arid and semi-arid regions. Considering the increasing trend of salinity and the lack of suitable agricultural lands for agriculture, the identification of saline tolerant plants is very important. Caper (*Capparis spinos*) is a perennial plant of the family (Capparidacea) that has been used as a spice in the traditional medicine for the treatment of rheumatism, liver disease and gout. The purpose of this study was to investigate the effects of salinity stress on morphological and physiological characteristics of Caper. Studies have shown that Caper is tolerant under saline stress conditions, so this medicinal plant can be used as an option for planting and use in arid and semi-arid regions as well as in saline conditions.

PS 8:

A research on Determination of Rooting Performances of Some Origanum spp. Species

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This experiment was conducted with the purpose of determination of rooting performances of Thymus vulgaris, Thymus citrodourus silverqueen, Thymus Citrodorus fredo, Thymus citrodorus mystic lemon, which are grown naturally in our country.
The cuttings, which were used in the experiment, were collected from Medicinal and Aromatic Plants Collection Garden in Bati Akdeniz Agriculture Research Institute and treated with NAA hormone in April 2011. Cuttings were planted in peat+perlite (1:1, v:v) medium in the greenhouse and they were left for rooting for 30 days. After this period, root length and rooting rates were determined.
According to obtained results, Origanum majorona showed the best root length with 8.45 cm and Origanum vulgare showed best rooting rate with 93.33%.

PS 9:

Determining the biochemical contents of black myrtle (Myrtus communis L.) fruits and leaves

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The myrtle (Myrtus communis L.) belonging to the Myrtaceae family grows naturally in forest areas and maquis areas in the Mediterranean region. The myrtle is growing naturally in two types as white and black fruit. Black myrtles are naturally grown in the forests. Because of understanding the benefits of the dark coloured fruits which have higher antioxidant capacities, myrtle is starting to become popular. The content of phenolic substances in black myrtle fruits is higher than in whites. The leaves and fruits of Myrtle have been traditionally widely used for the treatment of various diseases in Mediterranean region by local people. Black myrtle berry is consumed as edible. Myrtle leaves are widely used in pharmacy, perfumery, cosmetic and even as pesticide. The

aim of this study is to determine the total phenolic content, total flavonoid content and antioxidant activity in the fruits and leaves of the black myrtle. Total phenolic content analysis was assessed by the Folin-Ciocalteau assay, total flavonoid content analysis was assessed by a colorimetric method using rutin as standard flavonoid, whereas antioxidant activity analysis was assessed by measuring the ability of the extracts to scavenge DPPH method. As a result, it was found that there are significance differences between fruits and leaves of black myrtle.

PS 10:

Phenolic Acids and Flavonoids in Representatives of Genus Lavandula L. Grown in Southern Russia

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The goal of this investigation was to study changes of the levels of phenolic acids and flavonoids in leaves of Lavandula angustifolia Mill, L. latifolia Medic. and their amphidiploid L. x intermedia Emeric ex Loisel. The levels of phenolics were determined by Uv-Vis spectrophotometry. Phenolic acids and flavonoids were identified and quantified by the HPLC/DAD method. The levels of total phenolics in L. latifolia leaves (29.3-90.2 mg·g-1d.w.) were found to be higher than those in L. angustifolia (27.2-56.3 mg·g-1d.w.) and amphidiploid (27.7-66.1 mg·g-1d.w.). The maximal levels of total phenolics were found during the period of massive flowering. Three phenolic acids were quantified in lavender leaves: neochlorogenic, trans-caffeic and rosmarinic acids. The extracts also contain apigenin-7-O-glucoside, luteolin-7-O-glucoside and coumarin. The maximal levels of rosmarinic acid (4.6 mg·g-1d.w.) and luteolin-7-O-glucoside (0.1 mg·g-1d.w.) were found in L. latifolia leaves at the end of the growing season. The maximal levels of neochlorogenic acid (0.3 mg·g-1d.w.) and apigenin-7-O-glucoside (1.7 mg·g-1d.w.) were found in leaves of L. angustifolia at the beginning of the growing season. Trans-caffeic acid was not found in L. angustifolia. Its content in L. latifolia leaves reached maximum (1.7 mg·g-1d.m.) at the end of the growing season. Apigenin-7-O-glucoside was not found in amphidiploid leaves, and trans-caffeic acid appeared in trace amounts only at the beginning and at the end of the vegetation period.Thus, the levels of the total phenolics and individual components in the amphidiploid L.x intermedia occupy an intermediate position between those in the original parental forms. Our data demonstrate that leaves of L. angustifolia, L. latifolia and their hybrids can be a valuable source of phenolic antioxidants. This study was supported by the research grant No. 14-50-00079 from the Russian Science Foundation.

PS 11:

Relationship between stevia essential oil components and Stevioside, Rebaudioside-A and Stevioside/ Rebaudioside-A

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Stevia rebaudiana (Stevia, sweetleaf, sugarleaf) is the homeland of South America that was discovered in 1887 by a South American natural scientist, Antonio Bertoni. S. rebaudiana is a member of Asteraceae family which likes moist conditions, temperatures average 25 °C, and grows up to 60-90 cm high. Detected in North America, while more than 80 varieties and South America is thought to be more than 200 native species. Native Americans in Paraguay have safely used Stevia for hundreds of years, valuing the herbal sweetener not only for its delicious taste but also for its medicinal healing properties. Stevia has also been used extensively as a sweetener in Japan more than thirty years. Dried form of Stevia leaves is 10-15 times sweeter than sugar. Processed powdered Stevia is 200-300 times sweeter than sugar and non-calorie Stevia plant does not raise blood sugar levels. Some studies show that Stevia has insulin sensitivity and secretion-enhancing effects of the presence. These results lend support to the use in the treatment of diabetes. The main components of Stevia extract are steviosid, rebaudiosid-A and steviol molecules but the molecules that are determinant in quality are stevioside and rebA.
With this research, the relationship between stevia essential oil components and stevioside and rabaudiosideA molecules was tried to be revealed. A correlation matrix was established for determining the relationship between the ratio of rebaudiosideA, stevioside and rebaudiosideA / stevioside with the 15 compounds determined in a great majority of the samples examined. When these values were examined, it was observed that there was a significant correlation between the amount of stevioside and the amount of caryophyllene oxide in the positive direction and the 5% significance level. The amount of RebaudiosideA is significantly positive with beta-farnesene and nerolidol, 13-epi-manool oxide quantities in negative direction and 5% significance level.

There is also a significant positive correlation between the amount of rebaudiosideA and the amount of stevioside at the 5% significance level.

PS 12:

Essential oil yield and compositions of S. stricta from three location in Antalya

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Lamiaceae family is one of the largest flowering plant in the world represented with 224 genera and 5.600 species. Turkey is an important gene center for the family with 45 genera, 565 species and 765 taxa. Sideritis genus contains more than 150 species in the family Lamiaceae, distributed in the world, especially in the Mediterranean basin. 55 taxa Sideritis of which 36 species are endemic to Turkey. Due to this high endemism rate of the genus Sideritis, our country is one of the two main gene centers of this genus. The other gene center is the Iberian Peninsula region in Southwestern Europe, where about 50 species of the Sideritis section are found.
Sideritis stricta is an endemic species distributed in Turkey and consumed intensively as an herbal tea. It is heavily consumed in Europe for this reason the export potential is also high. In this study volatile oil yield and contents of plant samples collected from 3 different locations (Konyaaltı, Saklıkent and Termessos) in Antalya were investigated. The yield of essential oil obtained from Konyaaltı location was %0.042, Saklıkent location %0.043 and Termessos location was %0.041. We identified 6 compounds from Konyaaltı location, 12 compounds from Saklıkent location and 11 compounds from Termessos location. In all locations beta-pinen component with %24.20, %56.60 and %54.03 respectively.

PS 13:

Quality of boldo (Peumus boldus Molina) commercialized in Conselheiro Lafaiete, southeastern Brazil

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Boldus-de-Chile (Monimiaceae), commonly known as Boldo (Brazil, Portugal) boldus (Chile, Europe) is a shrub or small tree, originating in Chile, which can reach up to six meters high. Its leaves are simple, with short petiole, whole coriaceous, elliptic or oval-elliptic, mucronate with leaf blade of 3-7 cm long and 1-5 cm wide. Pharmacologically, its leaves are used as eupeptic, choleretic and diuretic. In Brazil, the plant drug of P. boldus is adulterated with other species popularly known as boldo and are marketed in popular fairs, markets and herbalists. The aim of this study was to evaluate the quality of boldo samples marketed in Conselheiro Lafaiete, Brazil. Commercial samples were purchased at local open fairs, totaling 4 treatments (T1 to T4). All treatments were submitted to the quartet and submitted to macroscopic, biometric, morphological and organoleptic characterization (color, odor and flavor). In the physical-chemical parameters, tests were carried out to determine the moisture content, ashes and foreign material. The experimental design was in completely randomized blocks, the analyzes performed in quadruplicate and the treatments were compared to each other and described parametrically. The packages of the treatments were of the primary type, plastic (200-micron film), flexible, thermo-wrapped, allowing the passage of light and susceptible to temperature. Morphologically in all treatments, rough, brittle leaves with rough surface, elliptic contour, acute apex, rounded base, split limb, penni-veined, whole margin, with a mean width of 2.40 ± 0.19 cm and average length of 4.20 ± 0.33 cm, within acceptable values for commercialization. Of the analyzed treatments, T1 and T2 preserved the greyish green coloration and intense camphor odor. According to the Brazilian Pharmacopoeia V (2010) the dried drug of P. boldus has characteristic aromatic odor, camphoraceous and slightly acrid, which is accentuated by crushing and bitter and acrid taste. In the treatments, the organoleptic characteristics were altered indicating failure in the drying process, storage or of the vegetal drug packaging. From T1 to T4, treatment T2 was superior to the others in leaf integrity. The average values were of a strange material of 7.21 ± 0.25% and of total ash of 23.55 ± 1.23% higher than those allowed for commercialization of vegetal drug (foreign material = 3%, ash = 10%), according to Braz. Pharm. V (2010). Moisture contents were 0.99 ± 1.03%, which may be considered unsuitable for preserving plant drug stability (10% expressed as wet basis). In all treatments, the analyzed plant drugs were of the described species, however, they did not comply with the determinations regarding the organoleptic characteristics, ash content and foreign matter. The lack of quality of the plant drug compromises the stability of the active principle and the therapeutic effects. It is important to educate marketers regarding the handling, storage, validity, stability of plant material to preserve shelf life and provide a preserved quality product.

PS 14:

Indoor living green walls of aromatic plants illuminated with LEDs

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The LED technology for indoor lighting is promising because LEDs have a high-energy conversion efficiency, wide range of specific wavelengths, durability, cool emitting temperature and small size. In addition to providing photosynthetic light (400-700 nm), the spectral quality of LED light may influence plant morphology, enhance the production of bioactive health compounds, control pests and diseases and create an interesting lighting ambiance and design which can be timely modulated. In addition, LED lighting may be used to overcome the most important limiting growing factor of indoor living green walls, which is the amount of available photosynthetic light to support plant growth.
Our hypothesis was that LED lamps are appropriate for lighting domestic vertical green wall modules containing various edible aromatic plants. Our objective in this study was to evaluate the performance of different LED lighting regimes for green wall plants grown under low PPFD, normally observed inside a building. Plant growth and product quality were evaluated on eight species of herbs (Mentha citrata, Mentha piperita, Mentha spicata, Origanum vulgare, Rosmarinus officinalis, Salvia officinalis, Stevia rebodiana, Thymus vulgare) exposed to six LED light treatments consisting of three sets of LEDs with two intensities (100% and 50%).
The three sets of LEDs were white (W), blue:red (BR) and blue:red + far-red (BR+F) with respectively peak wavelengths of 318 and 594 nm, 342 and 598 nm, and 342, 598 and 690 nm. At 100% intensity, the PPFD were 91 µmol m-2 s-1 (W), 94 µmol m-2 s-1 (BR) and 173 µmol m-2 s-1 (BR+F) for a 12-h photoperiod.
Dimensions of vertical green wall plastic modules were 100 (H) x 50 (W) x 7.5 (D) cm filled with rockwool slab in which the herb plugs were planted 3 weeks prior to the beginning of the experiment. In growth chamber, plants were irrigated and fertigated with a conventional nutrient solution (1.33 g of 15-0-15 per L water) in order to maintain adequate humidity of the walls. The experiment was a randomized complete design replicated twice with three modules per replicate.
LED light treatment effects on growth parameters (height, width, biomass), photosynthetic performance, leaf chlorophyll and phenol contents of the different species and their visual quality will be discussed.

PS 15:

Determining Pomological and Biochemical Features of Some Pecan Nuts Varieties which are Grown in Gap Region

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Pecan nut is hard-shelled fruit and belongs to family of Carya varieties. İt is grown in different parts of the world. It is grown on the slopes of the Aegean and Mediterranean regions facing the sea. İn addition, positive results were obtained in the studies on the pecan walnut which was grown in GAP region.
In this study, five different types of pecan nuts were analyzed. The types - Süper, Mahan, Schley, and Mohawk are ideal. These types have been analyzed for pomological features such as Fruit Weight (9.096;10.722;5.910;5.425;10.845) mm, Fruit Length (42.702; 44.177; 51.833; 34.514; 38.539) mm, Fruit Width (21.995; 24.026; 22.439; 23.950; 26.224) mm, Fruit Height (23.795; 24.280; 23.660; 23.209; 25.412) mm, Fruit Crust Thickness (1.101; 0.833; 0.584; 0.739; 0.826) mm, and Fruit Internal Weight (4.093; 6.106; 2.941; 2.323; 5.857) mm, in addition to total fat (45,41, 50.74, 45.27, 46.18; 58.69), percent moisture (6.260, 4.421, 11.560, 2.700, 2.068), ash (9.61, 11.89, 13.56, 12.40, 10.53). Also, it has been analyzed for fruit oil acids such as saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, trans fat, omega-3, omega-6, omega-9.
İn this study, similar results were obtained with the literature. Due to its pomological and chemical properties, it has been determined that ahan and ideal varieties are most suitable for GAP region.

PS 16:

Equisetum hyemale L.: phenolic compounds, flavonoids and antioxidant activity

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In the post-harvest process and subsequent commercialization of the vegetal drug (dry plant), the drying and storage are of fundamental importance for obtaining the phytotherapic. In Brazil, most plants are commercialized "in natura" or dried inadequately. Among these species whose use reflects a cultural fad, marketing associated with false welfare, and consequent, irrational use by the population, is Equisetum hyemale L., known as Horsetail and employed for fast weight loss and inhibition of appetite. Thus, the aim of this study was to evaluate the preservation of bioactive compounds of E. hyemale (dried plant) in relation to natural drying (sun drying, SDE and thin layer drying, TLE) and artificial drying process (conventional oven drying, COE). Dry plant obtained from aerial parts of E. hyemale were evaluated in relation to the efficiency and yield of extract, phenolic compounds, flavonoids and antioxidant activity and compared to the "in natura" aerial parts extract (APE). The highest phenolics and flavonoids contents were in TLE, which were 38.70% and 65.65% lower than in APE (193,1037 g.100g-1 dry mass e 37,3963 g.100g-1 dry mass). In E. hyemale, the effectiveness of the drying processes when confronted with "in natura" extract (fresh plant) allowed us to conclude that although TLE has higher contents of phenolic compounds and flavonoids this process was inefficient in the preservation of the antioxidant activity and that COE was more efficient to preserve antioxidants.

PS 17:

Light conditions for increasing growth and glucosinolates contents of watercress(Nasturtium officinale) in a plant factory system

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Watercress (Nasturtium officinale) is a perennial aquatic plant belonged to brassicacea, which contains a large amount of the functional component glucosinolates. Glucosinolates act as a natural antioxidant in human body with an anticancer activity and an activity to reduce active oxygen that attacks DNA. The aim of this study was conducted to analyze the effects of 1) light quality, 2) light intensity and photoperiod, 3) UV-B radiation on growth and glucosinolates contents of watercress. Nasturtium officinale seeds were sown on the soil then grown for 2 weeks. The first study examined the effect of light quality. Watercress was subjected to the following light conditions: R10 (R:B:G = 10:0:0), R9B1 (R:B:G = 9:1:0), R8B2 (R:B:G = 8:2:0), R7B3 (R:B:G = 7:3:0), R6B4 (R:B:G = 6:4:0), R1B1G1 (R:B:G = 1:1:1) with 200±10 µmol·m-2·s-1 PPFD, a light/darkness ratio of 16 h/8 h. The R7B3 condition was considered to be the most suitable for the growth and glucosinolates contents. The second study examined the effect of photoperiod and light intensity which were set to 12 h-266, 16 h-200, 20 h-160, and 24 h-133 µmol·m-2·s-1. All plants were subjected to same daily light integral (DLI) during the experiment. The optimal light intensity and photoperiod of 12 h-266 µmol·m-2·s-1 treatment was considered to be the most suitable for the growth and glucosinolates contents. To increase glucosinolates concentration, the UV-B irradiation intensity adjusted to 1.55 W·m-2 from UV-B lamps at the canopy level was irradiated for 0 (control), 0.25, 0.5, 1, 2, 4, 8, 16, and 24 h. Although glucosinolates contents of watercress irradiated by UV-B for over 0.5 h was significantly higher than that of the control, there was no significant difference in the glucosinolates contents among the watercress irradiated by UV-B for 0.5 h to 16 h. Thus, these results indicated that the glucosinolates content of watercress per plant in a plant factory system can be increased to about 30% through optimal light quality of the RBG ratio of 7:3:0, light intensity and photoperiod of 266 µmol·m-2·s-1 and 12 h, and UV-B irradiation for 0.5 h, respectively.

PS 18:

Effect of rosemary extract on postharvest conservation of cabbage leaves (Brassica oleracea)

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The present work aims to investigate the effect of the rosemary (Rosmarinum Officinalis) extract on the post-harvest conservation of cabbage leaves (Brassica oleracea), seeking a better shelf life. Freshly harvested leaves

were treated with aqueous, hydroethanolic or ethanolic extract of Rosemary. Subsequently the leaves were stored in the laboratory for a pre-established period of 9 days at room temperature in standard plastic containers simulating shelf life. Each package received 5 cabbage leaves, properly washed, treated and dried with paper towel. The analyzes were performed visually with notes from 1 to 3, note 1 being attributed to leaves with consumption conditions, being green and tender. Note 2 was attributed to more yellowed leaves but still in acceptable condition for consumption. Note 3 was attributed to leaves completely yellow or showing visible rot, being unfit for consumption. We also evaluated chlorophyll a, b and total, antioxidant capacity and total phenolics. The results indicate that cabbage leaves treated with rosemary aqueous extract presents better conservation at 9 days of shelf life showing visually better results. Chlorophyll a, b and total, antioxidants and total phenolics were also higher in the leaves treated with Rosemary aqueous extract. Our results show that aqueous extract of Rosemary has potential to be used in the postharvest conservation of green leaves as cabbage leaves.

PS 19:

Level of Shading Affects Growth and Development of Codonopsis lanceolata Plug Seedlings

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Codonopsis lanceolata, belonging to the Campanulaceae family, is a high-valued herb and vegetable. Large expectation of market demand and unavailable standard protocols for commercial production make it necessary to carry out more research on propagation and cultivation of C. lanceolata. In this study, the growth and development of plug seedlings of C. lanceolata were investigated as affected by light intensity by applying different levels of shading to the sunlight during the period of October 10 to October 28, 2017. The seedlings were grown for two weeks at 23 ℃/13℃day/nigh
of about 11 h in greenhouse with 0, 35 or 55% shading of the sunlight (average light intensity of 600 µmol·m-2·s-1 PPFD) during the day time in late autumn. Results showed that the total length of the plant was the greatest in the 0% level of shading with significantly greater root length and shorter shoot length than the other two shading levels, showing shading partly inhibited root elongation and accelerated shoot elongation. Besides, the average lengths of internode and hypocotyl were also the smallest in the 0% level of shading. No significant differences were found in the number of leaves and chlorophyll content in seedlings under three levels of shading. Furthermore, biomass, ratio of shoot biomass to shoot length, specific leaf weight, ratio of root biomass to root length, ratio of root biomass to shoot biomass, and level of root ball formation in the 0% shading were the greatest among the treatments, resulting in higher quality seedlings with more compact shoots and improved roots. In conclusions, the plug seedlings of C. lanceolata need to be grown under not shaded conditions in late autumn for the better seedling quality.

PS 20:

Quality properties of roselle (Hibiscus sabdariffa) calyxes as affected by three drying methods

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Roselle (Hibiscus sabdariffa L.) calyxes have been used worldwide as a food, in hot and cold beverages, as a flavoring agent and as an herbal medicine. Traditionally, the calyxes are dehydrated by exposure to direct sunlight, despite the limitations implied, such as the lack of control of drying conditions and the eventual loss of quality properties. The aim of the present study was to evaluate the effect of three drying methods on nutraceutical and physicochemical characteristics of roselle calyxes from México. Roselle calyxes from “Criolla” and “China” samples were subjected to different drying methods: direct sunlight drying, solar oven drying and forced air drying (at temperatures of 45, 55 and 65 °C), followed by the evaluation of quality parameters such as the physicochemical properties (pH, total acidity and color) and nutraceutical properties (monomeric anthocyanins, polymeric anthocyanins, phenolic compounds, flavonoids compounds, and ABTS and DPPH antioxidant capacity). Drying curves showed both a constant drying period and a decreasing falling rate period. To determine kinetic parameters, the drying data were fitted to a 4P Gompertz model. The results reflect that the drying treatment has significant statistical effect ($p \leq 0.05$) on the “Criolla” roselle calyxes for total flavonoid content (3.75-24.31 mg ECAT/g MS), antioxidant capacity by DPPH method (40.18-48.91% TROLOX inhibition) and antioxidant capacity by ABTS method (80.78-85.61% TROLOX inhibition). Similarly,

a significant statistical effect ($p \leq 0.05$) was observed on "China" sample for total phenolic content (55.36-85.98 mg EAG/g MS), flavonoids content (4.94-10.85 mg ECAT/g MS), antioxidant capacity by DPPH method (46.79-57.86% TROLOX inhibition) and antioxidant capacity by ABTS method (82.45-86.78% TROLOX inhibition). The results reflect that the treatments evaluated have no significant statistical effect on physicochemical properties. Furthermore, a moisture sorption isotherm was elaborated at 35°C using seven water activities from 0.11 until 0.90 and was adjusted to a GAB model.

PS 21:

Effects of abscisic acid and methyl jasmonate on the recovery of hail damaged rose geranium (Pelargonium graveolens L.) plants

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Hail has been identified as one of the natural hazards that causes yield loss in crops. The level of hail damage varies across plant species depending on the stage of development, plant height, and leaf and stem morphology. In South Africa, essential oil plants are not covered under any agricultural crop insurance cover options, and farmers can usually not afford the use of costly alternative mitigating strategies, due to production area size. The use of phytohormones as an alternative biological mitigating strategy against hail damaged essential oil crops has not received much attention in South Africa. Rose geranium is a native indeterminate plant species to South Africa. This study was set up in a randomized complete block design (RCBD), containing a 3x3x2 factorial treatment design. Plants were grown under a temperature controlled environment. Treatments were different levels of abscisic acid (0, 75 and 150 µM L-1), methyl jasmonate (0, 10 and 20 mL L-1) and application frequency (7 and 14 days). Hail simulation was conducted by 100% defoliation of rose geranium plants. Herbage and essential oil yield parameters were analyzed to determine the recovery response mechanisms after hail damage simulation during the 2016 season. Tukey's Studentized Range test was used to determine significant difference between the means. Preliminary results for 2016 production season showed that an interaction between abscisic acid (150 µM L-1), methyl jasmonate (0 mL L-1) and the application frequency (14 days) increased the leaf area index significantly. Furthermore, an application of methyl jasmonate at 10 mL L-1 significantly increased the leaf area index and foliar fresh mass of rose geranium plants. Based on the preliminary results obtained in the first trial; hail damaged rose geranium plants have to be applied with an abscisic acid at 150 µM L-1) for 14 days without any methyl jasmonate administration (0 mL L-1).

PS 22:

Effects of different watering frequencies and absucular mycorrhiza on the the growth, leaf cholorophyll and nutrient uptake of Perlargonium reniforme Curtis

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Pelargonium reniforme Curtis. is an indigenous herbaceous groundcover form the Western Cape of South Africa with great economic importance as a traditional medicinal species. This study aimed to measure the effects of different watering frequencies with and without the addition of arbuscular mycorrhiza on plant growth, leaf chlorophyll and nutrient uptake of P. reniforme. The study was conducted over a period of 15 weeks with a total of ten treatments applied to ten replicates. Irrigation supplied at 320 mls were applied at five watering frequencies varing from once a day to every twenty four days. These treatments were inoculated with 30 g of arbuscular mycorrhiza and repeated with no arbuscular mycorrhiza. Results of the water frequency tests showed statistical significant variance in all variables but the wet root weight. A significant difference was observed in the mycorrhiza inoculation in only the total wet weight. More significance was observed in the water frequency with mycorrhiza treatment in the wet root weight. Results on measuring C, K, Mg, N and P were all significant in the watering frequency treatments without mycorrhiza but only significant with mycorrhiza in Mg uptake. Similarly, there was also a higher interaction between the watering frequency without and with mycorrhiza in the availability of Mg. Total dry weight and chlorophyll readings were obtained in the highest watering frequency for P. reniforme. The addition of arbuscular mycorrhiza generally increased growth parameters, photosynthesis and water assimilation.

PS 23:

Essential Oil and Biomass Of Basil, Cv. Cinnamon In Function of Types Of Fertilization and Protected Cultivation

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Basil stands out among medicinal plants due to the wide range of its compounds, useful to various branches of science. The study of the varieties of this species against the amplitude of Brazilian climatic conditions, as well as other techniques of management are important to give the producers guidelines for better conduction of the crops. The objective of this study was to evaluate the cultivation of Cinnamon basil under cultivation systems and fertilization, in the conditions of Uberlândia-MG, Brazil in the spring-summer period. The experiment was conducted in a randomized complete block design in a 2 x 4 factorial scheme, with the following factors: open field system and protected environment (greenhouse), and sources of fertilization (organic, mineral, organomineral and absence of fertilization). The amount of nutrients was according to soil analysis and crop requirements. The cultivation was carried out in beds covered by mulching and drip irrigation. The plots consisted of 15 plants, spaced 0.6 m between rows and 0.5 m between plants. The analyzes were carried out in the three central plants. Plants fertilized with organic fertilizer in protected environment presented fresh leaf and flower mass and total dry mass 33 and 36% superior to the cultivation in the open field, respectively. For total dry mass, in greenhouse, organic and organomineral fertilization stood out. The SPAD index, plant height, crown diameter and essential oils content did not differ between crops and fertilization. Leaf length and width were respectively 16 and 12% higher in protected culture. In greenhouse, the organic fertilization favored the yield of oil. In the field, the yield was not altered between the fertilizations. Plants fertilized with organic source, presented 75% higher yield of oil in protected culture. The main compounds found in the essential oils of Cinnamon were: (E) cianamato de metila, linalool e methyl chavicol.

PS 24:

PS 25:

Cannabinoids and terpenoids yields of the ornamental Cannabis sativa L. variety Divina characterized by a variegated foliage as morphological marker

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The ornamental variety “Divina” is the first Cannabis variety that has obtained a provisional protection of plant breeder's rights at the Community Plant Variety Office (CPVO) and being characterized by a variegated foliage as morphological marker. The variegated foliage allows the visual identification of the variety, and the distinction from the medicinal variety "Pilar" where the spontaneous mutated type chimera was detected and isolated. Both varieties are characterized for having the not psychotropic compound cannabidiol (CBD) as predominant cannabinoid. Plants of the variety “Divina” have a significant lower content of chlorophyll in their leaves than plants of the variety “Pilar”. A slower growth rate and less total biomass production have been generally observed when mother plants of both varieties are grown at similar conditions under long daylength, supposedly due to the inability to synthesize chlorophyll in portions of the photosynthetic organs. A comparative production trial between plants of the mutated variety “Divina” and plants of the not mutated variety “Pilar” was set in the same trial location for evaluating yield losses or gains in vegetal raw material components (stalks, leaves and inflorescences), as well as cannabinoids and terpenoids yields and possible changes on specific secondary metabolites due to genomic mutation. Results shown that in artificial growing conditions the variety “Pilar” achieved significantly higher cannabinoids and terpenoids yields than the variety “Divina”. Slight differences on terpenoids composition were detected. The potential extensive exploitation of an ornamental variegated Cannabis variety as starting material could be eventually considered for obtaining essential oil and CBD-enriched extracts with deprived residues of chlorophyll, as well as pure forms of CBD, especially when

production of vegetable raw material take place in countries with restrictive rules on exploiting this plant species and where a morphological marker could make a difference on permitting its cultivation.

PS 26:

Laurus nobilis L.: comparative chemical composition and antimicrobial activity of essential oils from leaves, flowers and fruits.

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The present study deals with the investigation of the chemical composition and antimicrobial activity of the essential oils of Laurus nobilis L. growing wild in Lebanon.
Essential oils from fresh leaves, flowers and fruits were extracted using hydrodistillation method (HD) and were analyzed by GC/GC-MS. The chemical composition of the oils from the three plant parts were compared to each other and to literature data. Twenty compounds accounting for 97.2% of the total oil, with 1% oil yield were identified in the essential oil of the leaves, the major components were 1,8-Cineol (55%), α-Pinene (10.4%) and γ-Terpinene (4.5%). Twenty-four compounds, accounting for 91.7% with 0.32% oil yield were identified in the essential oil of the flowers, their major components were 1,8-Cineol (28.3%) and Trans-β-Ocimene (5.2%). Twenty-two compounds accounting for 90.3% with 0.26% oil yield were identified in the essential oil of the fruits, their major components were Trans-β-Ocimene (31.9%), α-Phellandrene (14.3%), 1,8-Cineol (12.3%) and α-Pinene (7.4%)
Essential oil was also subject to a screening for potential antimicrobial activity in vitro against three strains of pathogenic bacteria and one species of Candida albicans yeast certified using the disk diffusion method. Essential oil reacted positively against three microorganisms except against the resistant strain of Pseudomonas aeruginosa tested. Essential oil showed almost identical activities and MICs were determined from the most active essential oil on agar medium.
Our results clearly demonstrate that the essential oils of L. nobilis can well present an interesting alternative natural and may be useful as antibacterial and antifungal.

PS 27:

The determination of the flavour profile of Apium graveolens through biochemical analysis

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Apium graveolens, better known as celery, is a widespread crop grown and consumed across the globe. Consumption is prevalent due to distinct aromatic flavours and rich nutritional quality; possessing vitamins A, B, C and K and micronutrients such as potassium, calcium and magnesium. Volatile and non-volatile compounds contribute to the flavour profile and differ considerably throughout varieties as well as growth, harvest and storage conditions. The project aim is to determine and quantify flavour compounds within celery using biochemical techniques, allowing associations to be drawn between the biochemistry of the plant and how human consumers perceive the flavour profile. The information will aid the development of new celery hybrid lines with distinct flavour characteristics based on the metabolite profiles of parental selections.
Identification of flavour compounds was accomplished through a series of experiments on 24 parental lines of celery. Volatile compounds were analysed by Solid-Phase MicroExtraction Gas Chromatography Mass Spectrometry (SPME-GC-MS) and compounds identified included terpenes such as limonene and b-caryophyllene and phthalides such as butylphthalide and senkyunolide; these contribute significantly to the organoleptic properties of celery. Non-volatile compounds including sugars (fructose, glucose and mannitol) and also phenolic acids (p-coumaric acid, caffeic acid) and flavonols (apigenin and luteolin) were analysed by High-Performance Liquid Chromatography (HPLC) and Liquid Chromatography Mass Spectrometry (LC-MS) respectively. Analysis of these different compounds has enabled distinctions to be made between the 24 parental lines, such that work will now continue with a reduced subset of 10 lines that represent the extreme chemical profiles. These will be carried forward to a trained sensory panel where flavour profile can be assessed and further compared to consumer preference.

PS 28:

Micropropagation of Rosa damascena using different treatments of plant growth regulator

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Rosa damascena is one of the important medicinal plants of Iran and one of the important species of Rosaceae family. The aim of this study was to investigate the micropropagation of this plant in modified MS (Murashige and Skoog) medium with different concentrations of cytokinin (BAP, KIN) for proliferation and different concentrations of auxin (IBA, NAA) for rooting. Single node was used as an explant. Sterilization of the explants was done with 70% ethanol for 30s and then immersed in laundry bleach (5.25 % Hypochlorite sodium) for 10 min and finally washed three times with distilled water. At the stage of establishment, the explants were placed in culture medium without plant growth regulator and then transferred to proliferation stage after one week. Results revealed that the culture medium containing BAP (1.5 mg.l-1) and KIN (0.5 mg.l-1) produced the highest number of shoots/explant and was selected as the best treatment for proliferation. The regenerated shoots then were sub-cultured to the rooting medium. After four weeks, the modified MS supplemented with 0.2 mg.l-1 IBA was the best rooting treatment. For acclimatization, the rooted plantlets were transplanted into the common growth chamber and then in to the greenhouse successfully.

PS 29:

Enhancement of root production and alkaloids accumulation in in vitro roots of Stemona curtisii Hook. f. by adding with indole-3-butyric acid (IBA) as elicitor

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Enhancement of alkaloids accumulation in in vitro roots of Stemona curtisii Hook. f. by adding with indole-3-butyric acid (IBA) as elicitors were investigated. Seedlings were cultured on MS supplemented with 0, 0.2, 0.4, 0.6, 0.8 and 1.0 mg/l Roots were harvested after culturing for 2 months. Roots were dried in hot air oven and extracted with 95% ethanol and stemona alkaloids were analyzed by UV-Vis spectrophotometer. The result found adding with IBA as elicitor in vitro enhanced the production of root and stemona alkaloids accumulation in S.curtisii Hook.f. The roots in 0.6 mg/l IBA treatment had the maximum fresh weight at 1.59 g while 0.8 mg/L IBA treatment had the highest percentage of dry weight, total alkaloid and stemocurtisine contents at 0.40 g, 13.48 %, 186.97 10-3mg/gDW และ 340.14 x 10-6 mg /gDW, respectively.

PS 30:

Rose Geranium as a commercial crop in rural areas of South Africa

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The genus Pelargonium comprises about 270 distinct species of which a large number are indigenous to the Western and Eastern Cape Provinces of South Africa. Rose geranium is a hybrid (Pelargonium capitatum and P. radens) which was developed for the production of essential oils. This initiative seeks to develop successful commercial growers of rose geranium in rural areas of South Africa. Essential oil crops have not traditionally been produced in South Africa and the development of essential oil agribusinesses which incorporates both primary production of plant material, extraction of the oils and value adding utilizing the essential oil, offer opportunities for further economic development in rural areas.
In introducing rose geranium three important steps were deemed necessary as in essential oil production, the end product quality is of critical importance for successful marketing and profitability and this is strongly influenced by the intrinsic characteristics of the planting stock, soil and climatic conditions and cultural practices. A feasibility study was completed to determine the suitability of the areas, this included determining the agricultural potential and technical suitability, social and farmer skills, infrastructure and identification of gaps. A trial stage was completed where the crop was evaluated under local conditions. Skill development and capacity were addressed intensively during this stage. Scaling up where production is systematically moved from the trial stage to commercial volumes is currently being implemented. Ongoing technical training is undertaken on all aspects necessary to ensure that farmers are capacitated to produce rose geranium as a sustainable economic enterprise. Small successful agri-businesses have been developed and seven groups are producing

glycerine soap and candles utilizing essential oils extracted from herbs grown in the village. Products are currently sold to local guesthouses and in villages. The successful development and implementation of this model can assist other rural areas to introduce sustainable production of essential oil crops.

PS 31:

Studies for the propagation by seed of Clinopodium mexicanum (Poleo), a native Mexican traditional medicinal plant

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Clinopodium mexicanum is a species of the family Lamiaceae, endemic to the central region of Mexico, commonly known as “menta”, “poleo”, “toronjil de Monte” “chipito” and “hierba del borracho”. It is used in traditional medicine as an appetizer, a digestive, to relieve gastrointestinal disorders (pain and upset stomach), to relieve the symptoms of a hangover, as a sedative and analgesic remedy. The infusion of its leaves is used to induce sleep. Phytochemical studies of the species have already shown that it contains secondary compounds with depressive effects on the central nervous system. Despite its wide traditional use, the species does not have studies for its propagation and management, so the objectives of this study were: 1) Document its phenology, its strategies for propagation in wild populations and the characteristics of its habitat, and 2) Characterize the seeds of Clinopodium mexicanum for agronomic purposes. Considering the natural distribution of the species in the state of Querétaro, central Mexico, field trips were carried out and a population was selected to be monitored over a year, collecting information on flowering and fruiting intervals, reproduction strategies in the wild and specific habitat characteristics. Seeds were collected and characterized morphologically. Scanning microscopy was used to obtain photographs of mature and immature seeds, which were observed in fresh in variable pressure mode. As results, it was found that wild populations of Clinopodium mexicanum are frequently distributed in limestone rock mountain ranges at altitudes of 1700 to 2600 masl. It is found mainly in regions of sub humid temperate climate and to a lesser extent in sub humid semi-warm climates. It is distributed in a range of precipitation of 400 to 1500 mm with average annual temperature that ranges from 14 to 20 ° C. It was found in flowering stage throughout the year. In a plant, floral buds, anthesis flowers, immature fruits and ripe fruits can be found at the same time. The floral visitors observed were butterflies and hummingbirds. Its propagation in the wild is mainly by seed. The seeds have reticulated cover and can measure from 5 to 11 mm wide by 1 to 2 mm long, they are brown to black. It was also determined that in a gram there may be between 2507 and 2866 seeds.

PS 32:

Studies for the propagation by seed of Turnera diffusa, a native Mexican traditional medicinal plant

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Turnera diffusa, commonly known as Damiana, is a shrub that is naturally distributed in the arid and semi-arid regions of Mexico and has a wide distribution in America. It is used in traditional Mexican medicine for the treatment of male impotence, to treat depression, chronic fatigue, nervous disorders and venereal diseases. The high commercial demand of Turnera diffusa, both nationally and internationally, has generated different problems related to over exploitation and biological conservation. The species already has asexual propagation protocols and tissue culture, however there is still no protocol for seed propagation. The objectives of this study were to:1) Document their phenology form of propagation in the wild populations and characteristics of their habitat and 2) Characterize Turnera diffusa seeds for agronomic purposes. Field trips were carried out and a population was selected to be monitored over a year, collecting information on flowering and fruiting intervals. Seeds were collected and characterized morphologically considering color, shape, length, width and weight. A scanning microscope was used to obtain photographs of mature and immature seeds. As result, it was found that the wild populations of Turnera diffusa are frequently distributed in high mountain ranges, plains and canyons, in limestone regions, at altitudes of 1000 to 2100 meters above sea level. It is distributed in regions with a rainfall range of 500 to 1000 mm, average annual temperature that ranges from 14 to 24 ° C. It was found to be flowering from February to November. Its propagation in the wild is mainly by seed. The mature seeds of Turnera diffusa have an average size of 0.19 cm long and 0.11 cm wide. Mature seeds have a dark brown color, which are suitable for sowing; while the immature seeds have a yellowish-white color. Both seeds have reticulated appearance. The immature capsules have a green color.

PS 33:

Effects of agronomic practices on yield and composition of ginger and turmeric

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Ginger (Zingiber officinale Roscoe) and Turmeric (Curcuma longa L.) are plants that produce edible rhizomes that are increasing in demand all over the world due to their health-related properties especially in traditional and modern medicine. Increasing demand for ginger and turmeric in Australia has resulted in industry expansion, and a requirement for growers to meet size, weight and rhizome composition standards to access some markets. Experiments were conducted to assess the effects of a broad range of crop management practices used by commercial growers in Queensland, Australia on the yield and quality of harvested rhizomes. Rhizome development patterns were documented and variability in composition within rhizomes during crop development were documented.

PS 34:

Human gut health relevant antibacterial activity of blessed thistle (Cnicus benedictus L.)

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The most common chronic bacterial infection in human gut is due to Helicobacter pylori, a gram-negative microaerophilic organism. Infection of H pylori is commonly associated with many stomach related diseases such as chronic atrophic gastritis, peptic ulceration, and mucosa-associated lymphoid tissue lymphomas. Currently, common antibiotic treatments with synthetic drugs for gastritis and peptic ulcer have many harmful side effects and often lead to the development of antibiotic resistance. In this context, medicinal plants with antimicrobial properties are safe and can be targeted against H pylori infection. Blessed thistle (Cnicus benedictus L) is an annual hairy thistle-like plant in the family Asteraceae, native to the Mediterranean region. Blessed thistle contain lignans, essential oil, tannins and other bioactive compounds, and can be used in traditional medicines. The objective of this study was to determine anti-bacterial property of aqueous extracts of blessed thistle from different maturity stages (H1= the elongation of plant, H2= inflorescence emergence, H3= 50% of inflorescence, H4=100% flowering and H5= Mature seed formation) against H. pylori. One of the side effects of common synthetic antibiotic drug treatment is to have inhibitory activity against beneficial probiotic gut bacteria which leads to the diarrhea and other gastrointestinal discomforts. Therefore the activity of blessed thistle against probiotic gut bacteria such as Bifidobacterium longum has been targeted in this study. In this study, high inhibitory activity (2-6 mm zone inhibition) of aqueous extract of blessed thistle against H. pylori was observed. However, same extract did not have any inhibitory activity against B. longum, the beneficial probiotic bacteria. The findings of this study indicate that blessed thistle is a promising medicinal plant that can be targeted against H. pylori infection and for the remedy of related stomach diseases without having any harmful side effects against beneficial gut bacteria.

PS 35:

Atmospheric pressure cold plasma affects color parameters of Hyssop (Hyssopus officinalis L.)

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This research was conducted to evaluate the effects of cold atmospheric plasma on the color of Hyssop. The experiments were conducted at different levels of operating conditions. The conditions were the treatment time with the levels of 1, 5, and 10 minutes and the voltage values of 17, 20, and 23 kilovolts. The values of Lightness (L^*), redness (a^*),and yellowness (b^*) of the samples were obtained by HunterLab colorimeter. The results indicated that the plasma treatment had a significant effect on the color of Hyssop and the values of L^* and b^* of the treated Hyssop samples had been increased with increasing the treatment time and voltage compared with the control sample. The lightest green color was acquired at 10 minutes and 23 kilovolts.

PS 36:

Basil (Ocimum basilicum) Phenotypic Difference for Beverage Industry

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Beverages and beverage crops have a massive impact on our world population in terms of employment, income, nutrition, lifestyle and for their therapeutic (relaxation) and social role. This study assesses Basil's genetic phenotypic differences for beverage supply chain acceptance interventions. Basil germplasm evaluation and characterization was carried out at the National Horticultural Research Institute (NIHORT) experimental fields, Ibadan, Nigeria. The experimental layout was completely randomized design with four replications. Treatments were: *O. basilicum*, *O. gratissimum* and the local basil. Treatments were randomly allocated per replication. Significant phenotypic differences observed in the *O. basilicum* variety ranges from deep to light purple colouration of stem, leaf, leaf vein and petiole. Our observations also revealed significant (LSD 5%) differences in the purple coloured compared to the green *O. basilicum* in the early stages of growth till 50% anthesis. This is the first report of this coulouration observation in the African continent that could be explored for beverage supply chain acceptability. We concluded therefore that inducement of purplish coloration in Basil through breeding might improve further beverages acceptability and profitability in supply chain and thereby increase market value of Basil with these sustainable interventions.