6th World Congress on Medicinal and Aromatic Plants

WOCMAP VI

13-17 November 2019 - Famagusta - N.Cyprus

Congress Programme & Abstract Book

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ABSTRACT BOOK

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SCIENTIFIC PROGRAMME

1st Day – 13th November 2019 (Wednesday)		
Hours	Event / Venues	
09:00-09:30	Registration	
09:30-10:00	Opening Speeches / Room A - K.H.C. Başer WOCMAP 2019 - President	
10:00-10:30	Plenary / Room A - Chairperson: K.H.C. Başer Trends in exploring and sustainable utilization of MAP diversity **Akos Mathe**	
Concurrent Session I (10.30-12.40)		
Room	**Room A**	**Room B**
Chair	**İhsan Çalış**	**İrem Tatlı Çankaya**
10:30-10:50	Plants of South Africa used in the cosmetic industry **Karen Magdalena Swanepoel**	Empowering Tribal Farmers and Aroma Industry through agro-technological interventions: A case study in Anamalai Tiger Reserve, Western Ghats, India **Velusamy Sundaresan**
10.50-11:20	Coffee Break / Main Lounge	
11.20-11.40	The European Phytotherapy Initiative: ESCOP **Funda Yalçın**	Formulation Development and Evaluation of Postprandial Glycemic Effect of Carob Containing Nutraceutical ODT Tablet **Yıldız Özalp, Banu Tuncay, Bilgen Başgut, Filiz Meriçli**
11.40-12.00	Isolation of α-Glucosidase, α-Amylase and Pancreatic Lipase Enzyme Inhibitory Compounds from *Rhus coriaria* L. **Hasya Nazlı Ekin, Didem Deliorman Orhan, Ilhan Gürbüz, Mustafa Aslan**	Pollen morphology of the genus *Valeriana* L. (Caprifoliaceae) in Turkey **Fulya Yüceol, Serap Işık, Zübeyde Uğurlu Aydın, Ali A. Dönmez**
12.00-12.20	Quality assesment of some well-liked herbal medicinal commercial products by validated HPLC methods **Ekrem Murat Gonulalan, Emirhan Nemutlu, Yüksel Kan, Lütfiye Ömür Demirezer**	Effects of *Amaranthus hybridus* L. (Amaranthaceae) Hydroethanol Leaf Extract on Alcohol-induced Hypertension in Rats **Abidemi J. Akindele, Iteoluwakiisi O. Abiodun, Abdullahi A. Adejare, Daniel D. Osiagwu**
12.20-12.40	Towards commercial standardisation of a chemo-genotype of the traditional medicine *Dodonaea viscosa var. angustifolia* (Sapindaceae) – a genomic-metabolomic study of wild and cultivated plants. **M. Hoffman, R. Henriques, N. P. Makunga**	*Cannabis*: The Versatile Plant that Cann **Julie P. Fry**
12.40-14.30	Lunch	
14.30-15.00	Plenary / Room A - Chairperson: Salvador Canigueral A review of African medicinal and aromatic plants **Ben-Erik van Wyk**	
15.00-15.30	Plenary / Room A Genome data to predict the response of cancer patients to medicinal herbs and phytochemicals **Thomas Efferth**	
15.30-16.00	Coffee Break / Main Lounge	

SCIENTIFIC PROGRAMME

1st Day – 13th November 2019 (Wednesday)		
Concurrent Session II (16.00-17.20)		
Room	**Room A**	**Room B**
Chair	**Umesh Patil**	**Kobus Eloff**
16.00-16.20	Middle Eastern Medicine in the Middle Kingdom: Myrrh in the Bencao gangmu **Sean Bradley**	Microbial Transformation and Antimicrobial Evaluation of β-Ionone Derivatives **Özge Özşen Batur, İsmail Kıran, Fatih Demirci**
16.20-16.40	Determination of Traditional Knowledge Based on Biodiversity in Çorum **N. Yağmur Diker, Z. Ceren Arıtuluk, Kadir Ulusoy, Gülçin Alp Avcı, Vahdet Özkoçak, Eyüp Bağcı, İrem Tatlı Çankaya**	Phytochemical screening, antimicrobial activity and cytotoxicity of *Platycarpha glomerata* and *Tulbaghia alliacea* used in the treatment of lymphatic filariasis in the Eastern Cape, South Africa **Tiwani T, Pieters R., Horn S., Thekisoe M.M.O., Komoreng**
16.40-17.00	Imperative system biology tool (Metabolomics) to understand the aroma and chemistry of medicinally important aromatic crops of Indian Western Himalaya **Dinesh Kumar**	A Review of Recent Phytopharmaceutical Investigations and the need for DNA Barcoding of Endemic Medicinal and Aromatic Plants of North Cyprus **Dudu Özkum Yavuz, Mustapha Bulama Modu**
17.00-17.20	Extraction and Identification of Odour Active Molecules from Himalayan Kangra Orthodox Teas **Robin Joshi**	LC-MS/MS Analysis and Biological Activities of *Hypericum androsaemum* L. Leaves and Fruits Extracts **Nurdan Yazıcı Bektaş, Esra Eroğlu Özkan, Mehmet Boğa**
17.20-17.50	**Poster Presentation (All presentations)**	
19.00-19.45	**Welcome Cocktail**	
2nd Day – 14th November 2019 (Thursday)		
09:30-10:00	Plenary / Room A - Chairperson: Akos Mathe Monoterpene Glycosides from Plants of Turkey And Cyprus **İhsan Çalış**	
10:00-10:30	Plenary / Room A Recent advances in the European Pharmacopoeia monographs on herbal drugs and herbal drug preparations **Salvador Canigueral**	
Concurrent Session III (10.30-12.40)		
Room	**Room A**	**Room B**
Chair	**Temel Özek**	**Müberra Koşar**
10.30-10.50	Potential Drug Candidates for Neurodegenerative Diseases from *Corydalis* DC. Species Growing in Turkey **Mehtap Kılıç, Erdal Kaya, Bilge Şener**	Transforming trade in wild collected medicinal and aromatic plants: the FairWild Standard and certification system **Elisabeth Rüegg**
10.50-11.20	Coffee Break / Main Lounge	

SCIENTIFIC PROGRAMME

2nd Day – 14th November 2019 (Thursday)

Concurrent Session III (10.30-12.40)

Room	Room A	Room B
Chair	Temel Özek	Müberra Koşar
11.20-11.40	Safety and efficacy assessment of herbal products: Potential shortcomings **Olaf Kelber, Karen Nieber, Karin Kraft**	Chemical composition and cytotoxic activitiy of *Colchicum polyphyllum* from Turkey **Gizem Gülsoy Toplan, Serpil Demirci Kayıran**
11.40-12.00	Anti-mycobacterial and cytotoxic effects of isolated compounds from *Justicia adhatoda* plant extract **Smita Mishra, Varsha Mehra, Manisha Khatri**	Chemotaxonomic Approach to *Nigella* L. s.l. (Ranunculaceae) in Respect to Fatty Acids **Yasin Kaya, Betül Demirci, Zübeyde Uğurlu Aydın, Emel Oybak Dönmez, K. Hüsnü Can Başer, Ali A. Dönmez**
12.00-12.20	Cytotoxicity screening of secondary metabolites isolated from *Digitalis davisiana* Heywood and *D. grandiflora* Miller **Vahap Murat Kutluay, Iclal Saracoglu**	Cytotaxonomic Evaluation of *Aubrieta* Adans. (Brassicaceae) Taxa **Mustafa Koray Şenova, Metin Tuna, Sırrı Yüzbaşıoğlu, Zübeyde Uğurlu Aydın, Birol Mutlu, Marcus A. Koch, Ali A. Dönmez**
12.20-12.40	Unusual Phenolic Compounds Isolated from *Plantago holosteum* Scop. **Yasin Genç, Iclal Saracoglu**	Effects of different doses of soil humic acid applications and irrigation treatments of the plant and soil nutrient contents of basil (*Ocimum basilicum* L.) **Melike Sayarer, Zehra Aytaç**
12.40-14.30	Lunch	
14.30-15.00	Plenary / Room A - Chairperson: Funda Yalçın Insights from taxonomy and nomenclature for phytochemistry / **Ali A. Dönmez**	
15.00-15.30	Plenary / Room A Additional taxa to Lamiaceae to the Flora of Turkey / **Neriman Özhatay**	
15.30-16.00	Coffee Break / Main Lounge	

Concurrent Session IV (16.00-17.20)

Room	Room A	Room B
Chair	Ömür Demirezer	Olaf Kelber
16.00-16.20	Phenotypic variation among cultivated and wild coriander as genetic resource for breeding and research **Alina Tepikin, Itay Gonda**	Blackthorn (*Prunus spinosa* L.) fruit extract antioxidant activity and cytotoxic effects on various cancer cell lines **Nihal Karakaş, Mehmet Evren Okur, Ayşe Esra Karadağ, Derya Çiçek Polat**
16.20-16.40	Phytochemical investigation of *Terminalia macroptera* leaves extracts having psychopharmacological activity in mice **Stefano Negri,Lydia Ior, Stefania Poletti, Linda Avesani, Atiene Sagay, Flavia Guzzo**	An Investigation on the Anti-inflammatory Potentials of Some Plants Used Against Rheumatism and Hemorrhoids in Turkey **Burcu Sen-Utsukarcı, Britta Diesel, Şükran K. İlhan, Turgut Taskin, Alexandra K. Kiemer, Afife Mat**
16.40-17.00	*Elaeagnus Rhamnoides* Supsp. *Caucasica* and its Active Compounds: Screening for Alpha-Glucosidase Inhibitory Activity **Hafize Yuca, Hilal Ozbek, Cavit Kazaz, Zühal Güvenalp**	Production of Peroxidase by Affinity Chromatography Using Tissue Culture Method from Broccoli and Cauliflower Plants **Şeyma Önlü, Züleyha Almaz, Aykut Öztekin**
17.00-17.20	Quality Control of Dietary Supplements for Metals Available in their Composition **Kamala K. Badalova, Gaibverdi B. Iskandarov**	Potential Role of Rosmarinic Acid on Pulmonary Arterial Hypertension Therapy **Merve Yüzbaşıoğlu Baran, Ayse Kuruuzum-Uz, M. Talat Nasim**
17.20-17.40	Chitosan and N, N, N-trimethyl chitosan nanoparticle encapsulation of Ocimum gratissimum essential oils: optimized synthesis and evaluation of its in vitro release kinetic pattern and bioactivity **Confidence Onyebuchi, Doğa Kavaz**	Comparative studies on phytochemical composition, anti-oxidant and anti-microbial activities of Albizia lebbeck stem bark polar and non-polar extracts **Huzaifa Umar, Hatice Erkurt, Nahit Rizaner**
18.00-18.30	**ICMAP General Assembly**	

SCIENTIFIC PROGRAMME

3rd Day – 15th November 2019 (Friday)		
09:30-10:00	Plenary / Room A - Chairperson: Ali Dönmez Some success stories in using plants to promote animal health / **Kobus Eloff**	
10:00-10:30	Plenary / Room A Challenges, advances in quality control & standardization of herbal products / **Umesh Patil**	
Concurrent Session V (10.30-12.40)		
Room	**Room A**	**Room B**
Chair	**Stefan Gafner**	**Stanislaw Lochinsky**
10.30-10.50	Assessment of Cannabis and its Components by the World Health Organization: Overview of the Implications for Traditional and Complementary Medicine and Research **Kenzi Riboulet-Zemouli**	Phytochemical and biological studies on plants growing wild in Mediterranean Area **Daniela Rigano, Francesca Borrelli, Carmen Formisano, Orazio Taglialatela Scafati, Angelo A. Izzo, Antonio Fiorentino, Severina Pacifico**
10.50-11.20	Coffee Break / Main Lounge	
11.20-11.40	Investigation of bioactive secondary metabolites in industrial (fibre-type) hemps (*Cannabis sativa* L.) cultivated in Lithuania **Jurga Būdienė, Rasa Garjonytė, Aušra Linkevičiūtė, Asta Judžentienė**	Phytochemical study on *Teucrium* species **Sergio Rosselli, , Rossella Gagliano Candela, Maurizio Bruno, Vincenzo Ilardi, Joice G. Nkuimi Wandjou, Filippo Maggi**
11.40-12.00	Seasonal changes of biologically active compounds in bastard balm (*Melittis melisophyllum* L.) **Katarzyna Barbara Bączek,Izabela Szymborska-Sandhu, Jarosław Leon Przybył, Zenon Węglarz**	Potential Therapeutic Role of *Origanum dubium* Boiss. Essential Oil on Neoplastic Transformed Human Telomerase reverse Transcriptase Immortalized Mesenchymal Stem Cells **Merdiye Mavis, Azmi Hanoğlu, Duygu Yiğit Hanoğlu, K. Hüsnü Can Başer, Nedime Serakıncı, Yıldız Özalp, Dudu Özkum Yavuz,**
12.00-12.20	New Approaches for Phytochemical Analysis and Discovery in Natural Product Research **Paula N. Brown**	Oil production from microalgae with new methods **Cemal Kasnak, Recep Palamutoğlu**
12.20-12.40	Willow bark extract STW 33-I in joint and muscle pain: Action well established **Kelber Olaf, Nieber Karen, Khayyal Mohamed T**	RCmiR: A rapid curation tool for plant genomics studies and its application on Actinidia species as medicinal plants **Bihter Avsar, Danial Esmaeili Aliabadi**
12.40-14.30	Lunch	
14.30-15.00	Plenary / Room A - Chairperson: Mark Blumenthal Botanical Ingredient Adulteration – How Commonly Used Analytical Techniques Can Be Fooled / **Stefan Gafner**	
15.00-15.30	Plenary / Room A World Trade and Global Potential of Essential Oils / **K. Hüsnü Can Başer**	
15.30-16.00	Coffee Break / Main Lounge	

SCIENTIFIC PROGRAMME

3rd Day – 15th November 2019 (Friday)

Concurrent Session VI (16.00-17.20)

Room	Room A	Room B
Chair	Anake Kijjoa	Yüksel Kan
16.00-16.20	Enviromental Factors Affecting Morphology, Flowering and Essential Oil of *Origanum dayi* Post. **Gilad Oren, Reena Sharma, Nativ Dudai**	Targeting the cancer epigenome by nutraceuticals: The epigenetic modulation capacity of fatty acids isolated from Sea *buckthorn* oil **Sevinci Pop, Victor Stefan Ionescu, Lucian Albulescu, Maria Dudau, Isabela Tarcomnicu, Cristiana Tanase**
16.20-16.40	STW 1, a herbal combination used in painful complaints in degenerative and inflammatory rheumatic diseases: Mode of action **Kelber Olaf, Nieber Karen, Khayyal Mohamed T**	The Effect of Resveratrol on Epithelial Mesenchymal Transition in Pancreatic Cancer Stem Cell **Mustafa Hoca, Eda Becer, Hilal Kabadayı, Sevinç Yücecan, Seda Vatansever**
16.40-17.00	Bioactivity of plants used against elephantiasis and its secondary infections in South Africa **Ngaka Mzizi, Rialet Pieters, Oriel Thekisoe, Lisa Komoreng**	The Effect of Curcumin in the Treatment of Diseases **Hilal Yıldıran, Merve İnce Palamutoğlu**
17.00-17.20	Biological Active Compounds of Genus *Cephalaria* and *Scabiosa* (Dipsacaceae) from Azerbaijan Flora **E.A.Garayev, I.S.Movsumov, G. Herbette, E.E.Garayev**	The role of probiotic content of kefir in the adipogenic differentiation process of 3T3-L1 cells **Sabiha Gökçen Zeybek, Eda Becer, Tamer Şanlıdağ, Sevinç Yücecan, Seda Vatansever**
17.20-17.40	Increasement of Paclitaxel from Resistant Plant Cell Lines **Onur Özel, Hatice Demiray, Gary Loake**	Optimization and Characterization of Propolis Loaded PEGDMA Hydrogels **Nurten Aşina, Doğa Kavaz**
17.40-18.10	Poster Presentation (All posters)	

4th Day – 16th November 2019 (Saturday)

09:30-10:00	Plenary / Room A - Chairperson: Douglas S. A. Chaves Confirming, Educating, and Preventing Adulteration and Fraud in Botanical Ingredients in the Global Marketplace: The ABC-AHP-NCNPR Botanical Adulterants Prevention Program / **Mark Blumenthal**
10:00-10:30	Plenary / Room A Secondary Metabolites and Their Biological Activities from Tropical Marine-Derived Fungi / **Anake Kijjoa**

Concurrent Session VII (10.30-13.00)

Room	Room A	Room B
Chair	E. Garayev	Nativ Dudai
10.30-10.50	Chemical Composition and Antibacterial Activity of *Tambja stegossauriformis* Nudibranch **Raquel Rennó Braga, Natalia L. P. P. Iorio, Helvécio C. C. Póvoa, Gabriela Cecon Chianca, Piotr Kachlicki, Marcin Ożarowski, Vitória O. da Silva, Hoffgan P. Félix,Isabella C. Lopes, Douglas S. A. Chaves**	Effect of STW 3-VI (*Hypericum perforatum* L.) on the plasticity of hippocampal neurons, the migration of microglia cells oxLDL-induced ROS **Olaf Kelber, O Mierau, J Hofmann, H Abdel-Aziz, A Schwendler, G A Bonaterra R Kinscherf, C Kolb, K Nieber**

SCIENTIFIC PROGRAMME

10.50-11.10	Coffee Break / Main Lounge	
4th Day – 16th November 2019 (Saturday)		
Concurrent Session VII (10.30-13.00)		
Room	**Room A**	**Room B**
Chair	**E. Garayev**	**Nativ Dudai**
11.10-11.30	Marine-derived fungi: a promising source of biological control agents against plant diseases **Tida Dethoup**	*In-vitro* anti-mycobacterial assays of a medicinal plant - *Justicia adhatoda* on *Mycobacterium bovis*. **Smita Mishra, Varsha Mehra, Manisha Khatri**
11.30-11.50	Herbal medicinal products in the public pharmacy: A surveillance study with STW 5 in Irritable Bowel Syndrome (IBS) and other functional GI diseases **Bettina Vinson,Susanne Skeib,Olaf Kelber, Karen Nieber**	The ameliorative effect of the methanolic extract of *Inula glomerata* and *Salacia krausii* on erectile dysfunction **Michael C. Ojo, Foluso O. Osunsanmi, Godfrey E Zharare , Rebamang A. Mosa, Andy R. Opoku**
11.50-12.10	Anticancer Activity from Indonesian Sea Cucumber **Masteria Yunovilsa Putra**	Ethyl Acetate Fraction of *Detarium Microcarpum* (G. & P.) Leaf Attenuates Inflammation Induced in Rat's **Augustina Oduje Akinsanmi**
12.10-12.30	Some Contributions to Natural Product Research **Pawan K. Agrawal**	*In vitro* Antioxidant and Antidiabetic Potential of *Strychnos madagascariensis* ripe fruit. **Michael O. Oboh, Godfrey E. Zharare, Foluso O. Osunsanmi, Rebamang A. Mosa, Andy R. Opoku**
12.30-12.50	Selective inhibitory activities of phytochemicals and their synthetic analogues against intestinal bacteria and cells *in vitro*. A comparison to antibiotics used for infectious diarrhoea. **Tomas Kudera, Ivo Doskocil, Salmonova Hana, Eva Skrivanova, Ladislav Kokoska**	Phytochemical analysis and antioxidant properties from plants used in the treatment of non-filarial elephantiasis in KwaZulu-Natal, South Africa. **Laetitia Voua Otomo, Sa'eed Sabiu, Oriel Thekisoe, Lisa Valencia Buwa- Komoreng**
12.50-13.10	Influence of light intensity and mulch on photosynthesis, yield and essential oil composition of damask rose (*Rosa damascena* Mill.) under acidic conditions of Western Himalayas **Meenakshi Thakur, Vinod Bhatt, Rakesh Kumar**	Morphogenetic variability and yield characters of some *Salvia species* cultivated in a Semiarid Central Anatolian Environment **Zehra Aytaç**
13.10-13.30	Closing Session / Room A	
13.30	Lunch	
20.00-23.30	Gala Dinner	

SCIENTIFIC PROGRAMME

WOCMAP VI Special Session of Frankincense and Myrrh

14th November 2019 (Thursday) - Room C		
Time	Introduction and purpose	Speaker
09.30-10.30	WOCMAP PLENARY SESSIONS - Room A	
10.30-10.45	Introduction to the WOCMAP frankincense and myrrh special session. Present status and critical issues for the future of the species	L. Denzil Phillips Sue Canney Davison
Advances in botany and biochemistry of frankincense and myrrh		
10.45-11.10	Harnessing Frankincense's active components: Gold rush in medicinal chemistry and attempts at Unravelling their biosynthesis	Ahmed Al Harrasi
11.10-11.30	Coffee break	
11.30-12.00	Hybridization and new aromatic profiles of frankincense	Nicolas Baldovini
12.00-12.30	Chloroplast genomics of Frankincense (*Boswellia sacra*) and Myrrh (*Commiphora gileadensis* and *C. foliacea*)	Abdullatif Khan
12.30-12.50	The discovery of a new species of frankincense in Somaliland	Stephen Johnson
12.50-13.10	Introduction and renew the production of the Ancient Apharsemon (*Commiphora gileadensis*) in the Dead Sea basin	Nativ Dudai Guy Erlich
13.10- 14.30	Lunch	
14.30-15.30	WOCMAP PLENARY SESSIONS - Room A	
Sustainability, conservation and trade in frankincense and myrrh		
15.30-15.55	Keeping frankincense resources: what we need to know and do	Frans Bongers
15.55-16.15	A sustainable and ethical way of distilling the essential oil of *Boswellia Sacra*	Ashad Chaudri
16.15-16.30	Coffee break	
16.30-16.55	Frankincense Essential Oils and Sustainability; Lessons Learned from Somaliland/Somalia, Ethiopia and Burkina Faso.	Anjanette de Carlo
16.55-17.15	DoTerra's co-impact sourcing initiative with special reference to frankincense and myrrh	Tim Valentiner
17.15-17.35	Sustainable Production of myrrh in pharmaceutical quality – A medium-sized German pharmaceutical company connects with Ethiopian myrrh collectors	Malik Kleinwaechter
17.35-17.50	Critical aspects of frankincense conservation in Dhofar, Oman	Salahuddin Ajeeb
17.50-18.05	Grading and quality control for high quality incense	Shehbaz Khan
18.05-18.20	Exploring the impact of 'Frankincense' and 'Myrrh' as genus trade names	Sue Canney Davison
The future of frankincense and myrrh – round table discussion		
18.20-19.00	Interactive roundtable discussion, the future of Frankincense and Myrrh including:- Frans Bongers, Mark Blumenthal, Stefan Gafner. Anjanette de Carlo, Sean T Bradley, Stephen Johnson, Denzil Phillips, Tim Valentiner Facilitator: Sue Canney Davison *There will be an informative side display table on different commercial species*	

Welcome to WOCMAP VI

It is my utmost pleasure to invite you to the 6th World Congress on Medicinal and Aromatic Plants for Human and Animal Welfare (WOCMAP VI) which will be held on 13-17 November 2019 in Famagusta, N.Cyprus.

WOCMAP series of congresses have been organized since 1992 in every five years at a different continent. It is the official congress of the International Council for Medicinal and Aromatic Plants (ICMAP). ICMAP was established in a meeting on 8 June 1993 at the Secretariat of the International Union of Biological Sciences (IUBS) in Paris by unanimous decision of the nine international organizations (ISHS, ESCOP, FIP, IUPHAR, UNIDO, FAO, IUCN, WWF, IPGRI) attending the meeting following the recommendation of the 1st World Congress on Medicinal and Aromatic Plants (WOCMAP-I), as an international non-governmental body in order to promote international understanding and cooperation between national and international organizations on the role of medicinal and aromatic plants in science, medicine and industry, and to improve the exchange of information between them. (For more info on ICMAP please visit icmap.org).

WOCMAP I was held on 19-25 July 1992 in Maastricht, the Netherlands [EUROPE]. The following congresses were held as follows: WOCMAP II, 10-15 November 1997 in Mendoza, Argentina [SOUTH AMERICA]; WOCMAP III, 2-7 February 2003 in Chiang Mai, Thailand [ASIA]; WOCMAP IV, 9-14 November 2008 in Cape Town, South Africa [AFRICA]; WOCMAP V, 17-20 August 2014 in Brisbane, Australia [AUSTRALIA].

WOCMAP has been reputed as a congress covering all aspects of medicinal and aromatic plants ranging from ethnobotany, botany, chemistry, pharmacology, biological activity, standardization, adulteration, technology, pharmacy, medicine, cosmetics, food use, flavours and fragrances, regulatory activities to trade and commerce including uses for human and animal welfare. World reknowned experts in the above fields will be invited to give plenary and keynote lectures to enlighten the audience on latest developments in their respected fields. You are cordially invited to attend the congress and contribute with your latest findings in the form of oral and/or poster presentations.

N.Cyprus is an excellent venue for holding congresses thanks to her natural, historical and cultural beauties and for being an attractive touristic spot. Northern Cyprus (Ercan Airport) is easily reachable via any major cities in Turkey and via Larnaca Airport in Cyprus Republic. The congress will be held in 5-star Kaya Artemis Hotel.

We shall do our utmost to make the meeting as fruitful and enjoyable as possible.
I look forward to meeting you on 13-17 November 2019 in Famagusta, N.Cyprus.

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President, WOCMAP VI

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Plenary

6th World Congress on Medicinal and Aromatic Plants
WOCMAP VI
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PL-01 Trends in exploring and sustainable utilization of MAP diversity.

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Globally, an estimated 70000 plant species (including lower plants) are used in medicine: alone in India, Ayurveda utilizes ca. 2000 species, while the Encyclopedia of Traditional Chinese Medicinal Substances mentions 5757 species. According to Akerele (1988) about 80 % of the world population depends on herbal-based alternative systems of medicine. Medicinal plants are valuable sources of herbal products, and globally, they are disappearing at a high speed. This is especially valid for the regions rich in endemic species, as these species dominate the global patterns of extinction. Importantly, crop wild relatives, including wild-harvested medicinal plants and tree species are essential to livelihoods worldwide and to the global economy. Their total trade, according to IUCN, is estimated at USD 115 billion for crop wild relatives, USD 60 billion for plant-based medicines. Ensuring the continued availability of this resource is crucial to sustaining current, and ensuring, future human survival. These species are acknowledged in a number of international conventions as key natural resources that need protection. The Chiang Mai Declaration (1988) called due attention to the imminent dangers caused to medicinal plant diversity and highlighted "the urgent need for international cooperation and coordination to establish programs for the conservation of medicinal plants. These should ensure that adequate quantities are available for future generations. As one of the signs of growing international attention, since its foundation in 1994, the IUCN SSC Medicinal Plant Specialist Group has been active in increasing global awareness to conservation threats of medicinal plants, and promoting sustainable use as well as conservation actions. Importantly, conservation of MAP diversity is one of the focal points of the Global Strategy for Plant Conservation of the Convention on Biological Diversity (CBD). The new initiatives, like Plants for People (P4P) or iNaturalist, etc., can be regarded as useful additions to assess the threat status (using the IUCN Red List Categories and Criteria) of at least 1,500 highest priority species, in each of the following groups: crop wild relatives; medicinal plants; timber trees; and palms (6,000 in total). Bioprospecting is viewed commercially as the exploration of potentially profitable biodiversity and biodiversity-related knowledge (Shiva 2007). Utilization strategies, especially in a sustainable way, rely principally on both in situ and ex situ forms of conservation. Regarding the steadily increasing demand on MAP resources, cultivation deserves a special focus. Sourcing plant material that would meet the requirements for Quality, Safety and Efficacy in modern MAP usage, speak for the sourcing of plant materials from the controlled conditions of cultivation. Cultivation offers several apparent advantages, like the application of good agricultural/collection/manufacturing practices (GAP, GACP, GMP, etc.), organic production and farther sustainable solutions. Besides the generally still time consuming traditional methods, the introduction of multifaceted, innovative approaches that combine botanical, phytochemical, biological, and molecular techniques / methodologies, etc. are promising.

PL-02 A review of African medicinal and aromatic plants

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More than 4500 vascular plant species from about 1600 genera and 192 families are used in traditional medicine in sub-Saharan Africa. Recent inventories have shown that this number is an under-estimate and that many species have hitherto remained unrecorded. Based on available data, the dominant medicinal plant families are (in order of species diversity) the Fabaceae, Rubiaceae, Asteraceae, Malvaceae, Euphorbiaceae, Apocynaceae and Lamiaceae. Species from the Fabaceae (27), Apocynaceae (16), Burseraceae (12) and Rubiaceae (9) are the most common items of international trade. The prominence of Fabaceae and Apocynaceae, and the relatively low numbers of Asteraceae, Lamiaceae, Apiaceae and Rosaceae appear to be characteristic for African medicine. The traditional uses of medicinal and aromatic plants by the San hunter-gatherers of southern Africa (the most ancient of human cultures) are of global significance, because it gives us a glimpse of the original way in which plants were used as medicine and perfume. The ritual, medicinal and deodorant uses of aromatic bushes (known as *buchu*, *san* or *son*) are not only typical of the San people but are indeed also reflected in the name of their culture. *Sanqua* or *Sonqua* directly translates to bushmen, i.e., the men/people (*qua*) who habitually anoint their bodies with aromatic bushes (*son* or *san*)].

PL-03 Genome data to predict the response of cancer patients to medicinal herbs and phytochemicals

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To combat complex systemic diseases that harbor robust biological networks such as cancer, single target intervention is frequently ineffective. In such cases, network pharmacology approaches are highly useful, because they differ from conventional drug discovery by addressing the ability of drugs to target numerous proteins or networks involved in a disease. Pleiotropic natural products are one of the promising strategies due to their multi-targeting and due to lower side effects. Transcriptomics and proteomics became milestones to predict the response of tumors to standard chemotherapy and to identify the multifaceted modes of actions of synthetic and natural new drugs. The extraction of meaningful data from highly complex big data sets is a critical bottleneck, which requires sophisticated bioinformatical tools. The discourse between different disciplines is needed to develop strategies for effective decision making based on expression profiling and mutation analysis for precision oncology and drug discovery. Based on our own results, we discuss the application of network pharmacology for cancer drug discovery. We provide an overview of the current state of knowledge on network pharmacology, focus on different technical approaches and implications for cancer therapy (*e.g.* polypharmacology and synthetic lethality), and illustrate the therapeutic potential with selected examples from herbal mixtures, medicinal herbs and isolated phytochemicals. Finally, we present future perspectives on their plausible applications for diagnosis and therapy of cancer.

PL-04 Monoterpene Glycosides from Plants of Turkey and Cyprus

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Phytochemical studies have been performed on plants registered in the Flora of Turkey, which represents more than 9.000 species and 12.000 taxa [1-3]. In this presentation, a brief summary will be given for the studies showing highlights in the structural diversity of monoterpene glycosides including iridoids and secoiridoids from plant species belonging to the families Caprifoliaceae (*Lonicera* spec., *Viburnum* spec.), Scrophulariacea (*Euphrasia pectinata*, *Lagotis stolonifera*, *Scrophularia* and *Pedicularis* spec.), Plantaginaceae (*Plantago* and *Globularia* spec.), Gentianaceae (*Gentiana* spec.), Oleaceae (*Fraxinus angustifolia, Olea europea*), Rubiacae (*Putoria calabriaca, Wendlandia ligstroides*), Verbenaceae (*Clerodendrum inerme*) and selected plants from various subfamilies of Lamiaceae [*Ajuga* (AJ), *Eremostachys* (LA), *Lamium (LA), Leonurus (LA), Phlomis (LA), Scutellaria (SC), Sideritis (LA), Stachys (LA), Teucrium (TE), Nepeta (NE)*] .

PL-05 Recent advances in the European Pharmacopoeia monographs on herbal drugs and herbal drug preparations

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The European Pharmacopoeia (Ph. Eur.) is a key tool for maintaining high levels of quality of HMP in Europe. It is an updated and transparent regulatory document, harmonized and agreed by 38 countries, which provides a unique collection of monographs and methods for the analysis of herbal drugs and herbal preparations. In January 2020, the 10th Edition of the Ph. Eur. will be implemented. Taking in account the supplement 10.1, already published, the Ph. Eur. contain almost 365 individual monographs related to herbals, mainly corresponding to plant parts (61%), extracts (13%) and essential oils (9%). In addition, the Ph. Eur. contains 6 general monographs related to herbals, and 25 general methods in the field of Pharmacognosy. Three permanent groups (13A, 13B and 13H) and a number of working parties (among them one dealing with the herbal drugs of the Traditional Chinese Medicine) are in charge of developing and revising the monographs. Seventy-eight experts of 22 countries, in addition to EDQM staff, participate in these groups and working parties. The experts come mainly from industry and private sector (40%), followed by university and public research institutions (36%) and Medicines agencies (24%). The general chapter (2.8.25) on High Performance Thin Layer Chromatography analysis of herbal drugs and herbal preparations, which has been published in the 9th edition, introduced detailed description of the methods, including a system suitability test, allowing a better control of chromatographic conditions and a higher reproducibility of the results. The description of the chromatograms has also been improved thanks to the use of intensity markers. Furthermore, the publication of colour pictures of chromatograms of several batches in the Ph. Eur. knowledge database helps the user with the interpretation of the descriptions. The application of the HPTLC for semi-quantitative determinations, in particular for TCM herbal drugs, has been also developed in the last years. The migration from spectrophotometric methods to HPLC methods for the assay of hydroxyanthracene glycosides has significantly progressed in recent years. Completely revised senna leaflets and senna pods monographs, with new HPLC assay methods and new HPTLC identification methods have been published in the supplement 10.1 of the 10th edition of the Ph. Eur. Additionally, the monographs on senna extracts, rhubarb and rhubarb dry extract will be published soon for comments. In comparison with the old spectrophotometric methods, the new HPLC methods reduce the sample manipulation, the time of analysis and the variability of results.

PL-06 Insights from taxonomy and nomenclature for Phytochemistry

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Plant taxonomy is a science dealing with collecting materials from nature, identifying them, discovering and naming the new ones, and classifying all of them for understanding their taxonomic and phylogenetic relationships. To discover and explain the earth biodiversity is the main goal of the taxonomic studies. Taxonomy use the data from morphology, anatomy, palynology, genetics, cytogenetics, phytochemistry, molecular biology and the other relevant areas of life science for understanding biology of the plants. On the other hand, taxonomic data serves for a wide range of the scientific fields, such as conservation biology, ethnobotany, phytochemistry, agriculture, medicine, etc. Based on the extensive usage of taxonomic data, the names of the organisms have to be correct and unique to each taxon. Plant nomenclature is an integral part of plant taxonomy for serving to establish rules of the scientific names. A scientific name for being a correct name has to be effectively published, and it must be valid according to the related rules of the *Code*. Also, the name has to be legitimate under the related Articles of the *Code*. Correct names are only the reliable ones and in use for taxonomists and the other scientists during their any kind of scientific publications. Hence, without nomenclature, taxonomic names are a mass of meaningless words. The plants are the most important natural resources for therapy, preventive healthcare, dietary, well-being and cosmetic industry. To deal with these issues from plants and the other living organisms, their scientific names have to be known for an effective research and sharing the scientific data among researchers. Scientific names of plants are also essential for preventing adulteration. Discovering the plants from nature, naming them and researching all features of them including their chemistry are important and all of the study fields are related to each other. To understand basic rules of taxonomy and nomenclature is also helpful to phytomedicine.

PL-07 Additional taxa to Lamiaceae in the Flora of Turkey

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The diversity of vascular plants of Turkey has been documented in the Flora of Turkey and the Eastern Aegean Islands edited by Prof. Peter H. Davis and published in nine volumes between 1965 and 1985. The identification of additional taxa has necessitated the publication of the supplementary volumes to the Flora of Turkey vol. 10 in 1988, and the second supplemental volume, vol. 11 edited by Turkish scientists (A. Güner, N. Özhatay, T. Ekim and K.H.C. Başer) published in 2000. Lamiaceae is cited in Flora of Turkey vol. 7 as 523 species, with 2 monotypic genera: *Dorystaechas hastata* Boiss. & Heldr. ex Benth. and *Pentapleura subulifera* Hand. -Mazz. endemism percentage is 43.60. In the supplementary volumes: 20 species are added to vol. 10 (1988) and 31 more species are added to the Flora in vol. 11 (2000). In this present study, after publication of vol.11 additional taxa to the Flora of Turkey are given in a systematic order since the year 2000. In eighteen years the number of additional taxa is 79 of which 54 are new taxa for science and 25 of them is new record for Turkish flora. During this period two genera, *Lophantus turcicus* Dirmenci, Yıldız & Hedge from Van, it is *sp. nov.* and *Perilla frutescens* (L.) Britton from Artvin, which is a naturalized species are added. As a result the Lamiaceae in Turkey is represented by 653 species and endemism percentage increased to 47.62 according to recent publications

PL-08 Some success stories in using plants to promote animal health

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There are thousands of research projects and publications on using plant products with the motivation to increase the health and quality of life of people. Many MSc and PhD graduates and research publications are produced, but there are not many examples where commercially useful products have been developed from this research. We have learned a number of lessons in our attempts to develop products from extracts and isolated compounds from plants. One lesson we learned early was that traditional leads are not useful in dealing with antimicrobial activity because water does not extract active compounds from plants. Some examples based on antimicrobial activity will be selected from work that has been done in the Phytomedicine Programme. This includes: a crude plant extract from *Terminalia sericea* with better activity than gentamicin in treating wound infections in rats; a crude extract of *Loxystylis alata* that had better activity than ketoconazole against aspergillosus in poultry; isolation of compounds from plants that can be used to treat diarrhoea, the use of plant extracts to replace antibiotic feed additives in poultry. Other examples based on traditional use of plant extracts include: the use of a leaf extract of *Calpurnia aurea* with pheromones and entomopathogenic fungi to control ticks; a crude acetone bark extract of *Maerea edulis* that had higher activity than the commercial acaricide Amitraz in controlling ticks in a field experiment; because traditional healers do not have acetone available, a mixture of water and a detergent was effective in extracting more non-polar active compounds; extracts of several compounds were active in inhibiting the important helminth *Haemonchus contortus*; a compound was isolated with a different mechanism of activity than the commercial anthelmintics ivermectin and albendazole against this important sheep parasite; the mechanism of activity of *Clausenia anisate* extracts against blowflies was elucidated and the active compound seselin was isolated from *Leucosidea sericea*. A number of patents have arisen out of these attempts but in practically all cases no further commercial development has taken place. The main drivers to change from an academic ivory tower mentality to a product-focused approach are very close collaboration with industry, focussing on the needs of the market and realizing that good academic research is much less important that delivering a cost effective product that the market wants.

PL-09 Challenges and Advances in Quality Control & Standardization of Herbal Products: An Ethnomedicinal Perspective

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The full potentials of the herbal products are mainly not utilized due to the insufficient knowledge of the holistic quality & chemical composition of most herbal products. The growth potentials of the herbal product industry can only be achieved if the composition of herbal product is standardized in order to ensure proper quality control and accountability. In recent years more people throughout world have realized to use herbal products in health care system. Worldwide need of alternative medicine has resulted in growth of herbal product markets and interest in traditional systems of medicine. Herbal drug technology is used for converting botanical materials into medicines, where standardization and quality control with proper integration of modern scientific techniques and traditional knowledge is important. In order to prove constant composition of herbal preparations, adequate analytical methods such as photometric analysis, thin layer chromatography, high performance liquid chromatography, gas chromatography, DNA fingerprinting and metabolomics are used. Phytochemical standardization encompasses all possible information generated with regard to the chemical constituents present in herbal products. In recent years World Health Organization and many herbal industries worldwide have emphasized on the importance of qualitative and quantitative methods for characterizing the samples, quantification of the biomarkers, chemical markers and the fingerprint profiles. If principle active components are known, it is most logical to quantify these compounds. My talk will cover current trends, challenges and advances in quality control and standardization of herbal products with special reference to one ethno-medicinal case study.

PL-10 Botanical Ingredient Adulteration – How Commonly Used Analytical Techniques Can Be Fooled

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The chemically complex nature of botanically-derived ingredients calls for unique quality control processes by suppliers, manufacturers, and producers of herbal products. One of the universal regulatory requirements in industrialized nations is the appropriate testing for identity and authenticity of botanical materials that are to be used in consumer products. Nevertheless, there have been numerous recent cases of accidental or intentional adulteration. Intentional adulteration is also referred to as economically motivated adulteration (EMA), where raw materials are intentionally substituted or diluted with undisclosed lower-quality ingredients for financial gain of the seller. Another concern is the occurrence of extracts "spiked" with various exogenous compounds, including prescription pharmaceutical drugs, to create a false sense of efficacy. This reflects a significant challenge to the global botanical medicine marketplace and, in some cases, affects consumer safety. Suppliers of intentionally adulterated botanical ingredients try to take advantage of the lack of specificity of certain analytical methods used for identification. Examples are currently being compiled by an independent consortium of nonprofit organizations consisting of the American Botanical Council (ABC), the American Herbal Pharmacopoeia (AHP), and the National Center for Natural Product Research (NCNPR) at the University of Mississippi as part of the ABC-AHP-NCNPR Botanical Adulterants Program. Such examples include, e.g., the addition of food dyes to St. John's wort extracts to enhance the UV/Vis absorption at the wavelength used to determine hypericin contents, or the addition of rutin- or quercetin-rich materials from extraneous sources to comply with the required contents for total flavonoids in ginkgo extracts. The limitations of various analytical techniques, such as macroscopic, microscopic, chemical, and genetic assays will be discussed using actual adulteration cases occurring in the dietary supplement and herbal medicine industry. Since most of the available methods focus on the determination of marker/active compounds, the emphasis will be on the chemical analysis.

PL-11 World Trade and Global Potential of Essential Oils

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Essential oils are complex mixture of volatile chemicals mainly found in plants. Animals, liverworts, mosses, microorganisms and marine organisms also bear natural volatiles. Essential oils can be liberated from their matrix by distillation (e.g. water distillation, water and steam distillation, steam distillation) or expression in the case of citrus fruits. Supercritical fluid extraction and solvent extraction are used to extract aromatic extracts which are not technically considered essential oils. Essential oils are ingredients of flavour and fragrance materials for use mainly in food and beverage, perfumery, cosmetics and toiletries, wellness and aromatherapy, spa and relaxation, healthcare, pharmaceutical and chemical industries. They also possess various biological activities and in recent years their use in feeds as antibiotic substitute and growth promoter is on the rise. Global market of essential oils stands at $6.5 billion with a projected rise by 8.4 to 11.3% to $14 to 15.8 billion in 2024-2025. Orange oil tops the list of most globally traded essential oils constituting *ca*. 22% of the global market revenue followed by lemon, lime, peppermint, corn mint, citronella, spearmint, geranium, clove leaf, eucalyptus, jasmine, tea tree, rosemary, lavender oils, etc. Europe dominates the market with Brazil, China, USA, India, Indonesia, Mexico, Morocco, Egypt, Guatemala, etc. as major producing countries. The paper will discuss the importance of essential oils in small and big flavour and fragrance markets.

PL-12 Confirming, Educating, and Preventing Adulteration and Fraud in Botanical Ingredients in the Global Marketplace: The ABC-AHP-NCNPR Botanical Adulterants Prevention Program

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The sales of herbal medicines, dietary and food supplements, and other botanically-based natural products have increased in the international market. Corresponding to this increase are confirmed reports of economically motivated adulteration of botanical raw materials, botanical extracts, and essential oils with undisclosed, lower-cost, non-authentic ingredients. These adulterated ingredients are purchased (often unwittingly) by manufacturers of finished botanical-based consumer products, reducing the activity and expected efficacy of these products, and, in a minority of cases creating potential safety problems. Three United States-based nonprofit research and education organizations have taken on the mission of exploring and educating on this area of international commerce by forming the ABC (American Botanical Council), AHP (American Herbal Pharmacopoeia), NCNPR (National Center for Natural Product Research at the University of Mississippi) Botanical Adulterants Prevention Program (BAPP). To date (September 2019) BAPP has published 53 extensively peer-reviewed and detailed reviews and other publications on adulteration of specific botanical ingredients. BAPP is supported and endorsed by over 200 botanical industry companies, third-party analytical laboratories, U.S. and international nonprofit professional organizations, industry trade associations, research centers, and other parties. BAPP publications include Bulletins confirming adulteration of specific ingredients and Laboratory Guidance Documents in which laboratory analytical methods are evaluated for their fitness for purpose and ability to detect the types of confirmed adulteration currently present in the marketplace. This presentation will give an overview of recent cases of adulteration and BAPP's efforts to help prevent adulteration and fraud by educating the herb industry, researchers, and regulators via documents available on BAPP's free-access website at *http://cms.herbalgram.org/BAP/index.html*

PL-13 Secondary Metabolites and Their Biological Activities from Marine-Derived Fungi from Tropical Waters

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In the past years, there has been an increasing interest on marine-derived fungi as a target source of bioactive marine natural products because many consider them among the world's greatest untapped resources for new biodiversity as well as chemodiversity. Additionally, through established culture methods, they are able to produce quantity of compounds needed for medicinal chemistry development, clinical trials and even marketing. In our ongoing project on the search for bioactive compounds from marine-derived fungi from the tropical seas, we have focused mainly on marine-derived fungi of the genera *Neosartorya*, *Talaromyces*, *Eurotium, Aspergillus*, *Penicillium, Acremonium* and *Sporidesmium,* isolated from sponges, soft coral, sea-fan, macro-algae, and mangrove which were collected from the Gulf of Thailand and Andaman Sea. Several new secondary metabolites, including prenylated indole derivatives, quinazolinone and pyrazinoquinazolinone containing indole derivatives, polyketides, isocoumarins, anthraquinones, meroditerpenes and cyclic peptides have been isolated from these fungi. The structures of the compounds were elucidated by extensive analysis of 1D and 2D NMR while the absolute configurations of their stereogenic carbons were established by X-ray analysis, comparison of the calculated and experimental ECD spectra as well as chiral HPLC. Some of the isolated compounds displayed interesting *in vitro* biological activities such as antibacterial, antibiofilm, anti-obesity, anticholinesterase, antityrosinase and cytotoxicity against a panel of human cancer cell lines.

Oral Presentations

6th World Congress on Medicinal and Aromatic Plants
WOCMAP VI
13-17 November 2019 - Famagusta - N.Cyprus

OP-01 Quality assesment of some well-liked herbal medicinal commercial products by validated HPLC methods

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According to European Food Safety Authority (EFSA), dietary supplements are designed to improve nutritional deficiencies or to support specific physiological functions. They are not to be a medicinal product. However, dietary supplements are often used for medicinal purposes. In order to achieve the desired effect, the plants or products must comply with the quality criteria specified in the pharmacopoeias and in particular the amounts of the marker compounds should be at the desired level. In our study, quantification of the marker compounds (echinacoside, silibinin A and B, rosmarinic acid and chlorogenic acid) in the most preferred plants and their extract containing products, were performed by the validated HPLC methods and their compliance to the European Pharmacopoeia was evaluated. In this context, HPLC method validation studies were performed according to system suitability, linearity, selectivity, sensitivity, accuracy, precision, robustness, stability and recovery. The developed and validated methods were applied to quality control of herbal extracts and dietary supplements of *Echinacea purpurea* (L.) Moench (Asteraceae), *Silybum marianum* L. (Asteraceae) *Mentha piperita* L. (Lamiaceae) and *Salvia officinalis* L. (Lamiaceae) samples. According to results, two of the nine *Echinacea purpurea* (L.) Moench (Asteraceae) samples and two of the eight *Silybum marianum* L. (Asteraceae) samples were found to comply with the standards of pharmacopeia and none of the four *Mentha piperita* L. (Lamiaceae) samples were found to meet the quality criteria. The results obtained in *Salvia officinalis* L. (Lamiaceae) products vary between 1.44% and 14.41%. All these results showed the importance of the quality control of the herbal products.

13-17 November 2019 - Famagusta - N.Cyprus
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6th World Congress on Medicinal and Aromatic Plants
ICMAP

OP-02 Cytotoxicity screening of secondary metabolites isolated from *Digitalis davisiana* Heywood and *D. grandiflora* Miller

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The genus *Digitalis* L. is presented by 9 species in the flora of Turkey (Davis, 1975). In this research, aerial parts and roots of *D. davisiana* Heywood and *D. grandiflora* Miller were studied from the view point of their cytotoxicities. Cytotoxicity of the extracts were tested against HEp2, HepG2 cancer cells and 3Y1, L929 non-cancerous cells by using MTT method (Saracoglu, 1995). Both parts of the plants showed similarly high cytotoxicity on HEp-2 cells than HepG2, 3Y1 and L929 cells. Therefore, the cytotoxicity of the isolated compounds were tested against HEp-2 and L929 cells. The compounds isolated from *D. davisiana* were characterized as ferruginoside B, isolugrandoside, lugrandoside, maxoside, 3''''-*O*- methylmaxoside, digidavisoside B and *trans*-lamiuside E and from *D. grandiflora* as digigrandifloroside, cornoside, rengyoside A and cleroindicin A. Digigrandifloroside and digidavisoside B were isolated for the first time from the nature. Digigrandifloroside showed the highest cytotoxicity against HEp-2 cells (IC_{50} value 10.1 µM) when compared with the positive control, etoposide and other compounds (IC_{50} of etoposide; 39.5 µM). The structure activity relationship of the phenylethanoid glycosides were also evaluated. Compounds with free phenolic *o*-dihydroxyl group showed higher cytotoxicity (isolugrandoside, lugrandoside, maxoside) and subsititution of a methoxyl group decreased the cytotoxicity (3''''-*O*- methylmaxoside, digidavisoside B and *trans*-lamiuside E) (Figure 1). Our results also suggested that the additional glycosidation didn't affect the cytotoxicity.

Compounds	**R_1**	**R_2**	**R_3**
Ferruginoside B	H	H	H
Isolugrandoside	H	Caf	H
Lugrandoside	H	H	Caf
Maxoside	H	Glu	Caf
3''''-*O*-methylmaxoside	H	Glu	Fer
Digidavisoside B	CH_3	Glu	Fer
trans-Lamiuside E	H	Rha	Fer

Figure 1. Structures of the isolated phenylethanoid glycosides

All tested compounds showed concentration dependent cytotoxicity on both cells. Observed cytotoxicity on cancer cells was found to be stronger than non-cancerous cells. This selectivity is important for drug development.

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OP-03 Investigation of bioactive secondary metabolites in industrial (fibre-type) hemps (*Cannabis sativa* L.) cultivated in Lithuania

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Hemp (*Cannabis sativa* L.) is a well known medical plant due to it‘s analgesic, anti-inflammatory, sedative, antidepressant, antimicrobial, muscle relaxant, anti-carcinogenic properties. The plant is used for healing many illnesses, such as diabetes, epilepsy, Tourette syndrome, Alzheimer’s and Huntington’s disease; and others sicknesses. Fibre-type cannabis (hemp with low quantity (0.2-0.3%) of THC) herbal material (Futura cultivar, French origin) was collected at different vegetative stages (10 cm in height (June), during flowering period (August) and seed germination (September)) over several years from local farm (near Vilnius). Total content of phenols was determined in leaves, inflorescences, seeds and roots spectrophotometrically according to the Folin-Ciocalteau method, as a standard reagent was gallic acid. Values of phenols ranged from 215.917±0,005 in leaves (collected in June) to 320.958±0,001 GA mg/g determined in hemp roots (of the plants gathered during flowering in August). Hemp essential oils from different parts of the plants were prepared by hydro-distillation for 2.5h of air-dried material in a Clevenger-type apparatus according to the European *Pharmacopoeia*. The yields of the oils with a strong characteristic odour were up to 0.33% (v/w, on a dry weight basis). GC/MS analyses were performed on chromatograph Shimadzu GC-2010 PLIUS interfaced to MS-QP2010 ULTRA. Three major constituents determined both in inflorescences and leaves essential oils were found as follows: α-pinene (≤ 12.94±0.28 %), b-caryophyllene (≤ 56.64±2.87 %) and α-humulene (≤ 13.78±1.71%). Potential antioxidant activity of the oils was investigated by DPPH· and H_2O_2 scavenging; and electrochemical methods. Values of DPPH·, TEAC mM ranged from 11.144±0.103 (inflorescence oil) to 20.311±0.171 (leaf oil of the hemps at seed stage). Hemp methanolic extracts were analysed by GC/MS and HPLC techniques. Conditions of GC/MS analysis were the same as for essential oils. HPLC-MS analyses were performed on Agilent 1260 Infinity chromatograph coupled with Agilent 6224 TOF-ESI mass spectrometer working in the positive ionization mode. The following major constituents identified by both chromatographic methods: some terpenoids, cannabinoids (such as CBD, CBDA, CBG, CBGA, CBN etc.), salicylic acid, methyl-(Z)-5,11,14,17-eicosatetraenoate and γ-sitosterol. Investigated extracts of cannabis were characterised by large amounts of CBD+CBDA, cannabinoids with strong therapeutic properties.

OP-04 Biological Active Compounds of Genus *Cephalaria* and *Scabiosa* (*Dipsacaceae*) from Azerbaijan Flora

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From 60 species of *Cephalaria* L., distributed in South Europe as well as in West and East Mediterranean area and South Africa, only 20 are present in Caucase, 12 in Azerbaijan. *C. grossheimii Bobr*. – is an endemic species in Azerbaijan. Oleanolic acid, apigenin hyperoside, quercimeritrin, cynaroside and palustroside have been isolated from flowers. *C. grosseimii* is the second species from *Dipsacaceae* family found to contain palustroside. It was determined that flowers contain 20 amino acids, 8 of them are essential. *C.media* Litv. is also an endemic species in Azerbaijan. For the first time iridoids loganoside, sweroside, cantleyoside, ursolic acid and β-sitosterol have been isolated from this species. *C. velutina* Bobr. Is an endemic species in Azerbaijan. β-sitosterol, and alkaloid gencyanine, oleanolic acid and after hydrolysis oleanolic acid and hederagenin have been isolated from roots. Luteolin, quercetin, cynaroside, quercimeritrin, gigantoside A, β-sitosterol, oleanoic acid, and after hydrolysis oleanolic acid and hederagenin have been isolated from flowers. *C. gigantea* (Ledeb.) Bobr. - perennial herb, up to 150-200 cm height. It has grey-yellow flowers. Flavonoids, luteolin, quercetin, cynaroside, quercimeritrin and new compound gigantoside A (quercetin-7-O-[α-L-arabinopyranosil-(1→6)-β-D-glucopyranoside) have been isolated from flowers. β-sitosterol, oleanolic acid, saccharose and oleanolic acid with hederagenin from hydrolysate have been isolated from roots. It was determined that flowers contain 4.21% of amino acids, 8 of them are essential. From flowers of *C. prosera* have been isolated apigenin, luteolin, quercetin, cynaroside, gigantoside A. β-sitosterol, oleanolic acid and hederagenin have been isolated from roots. The alkaloids content in roots is about 0.05% composing of 4 major compounds. In *C. syriaca* roots as above discovered β-sitosterol, ursolic acid, after hydrolysis the amount of triterpenoid saponins - hederagenin and oleanolic acid. From aerial parts isolated β-sitosterol, ursolic acid, hyperoside and cynaroside and after hydrolysis the amount of triterpenoid saponins - oleanolic acid and hederagenin. From flowers of *C. tchihatchewii* have been isolated β-sitosterol, oleanolic acid, luteolin, quercetin, hyperoside, quercimeritrin, cynaroside and after hydrolysis of saponin sum oleanolic acid and hederagenin. From roots alkaloid gencyanine have been isolated. From flowers of *S. caucasica* M.B. have been isolated oleanolic acid, apigenin, cynaroside, quercimeritrin and palustroside. Palustroside was isolated for the first time in the species of *Dipsacaceae* family. Flowers contain 20 amino acids, 8 of which are essential. From flowers of *S. argentea* L. have been isolated hyperoside, cynaroside and quercimeritrin. From leaves and stems have been isolated oleanolic acid, luteolin, hyperoside, cynaroside and quercimeritrin. The raw material contains 20 amino acids, 8 of which are essential. From aerial parts of *S. micrantha* Desf. have been isolated cynaroside and cosmosiin. From saponins sum of roots, as aglycon after hydrolysis, have been isolated oleanolic acid, as sugars were determined D-glucose, L-arabinose and L-rhamnose. From flowers *S. georgica* Sulak. we have isolated flavonoids: luteolin, cynaroside, quercimeritrin and non-identified flavonoids glucoside of luteolin. We have also determined that flowers contain 4 compounds, roots 7 compounds of saponin nature.

OP-05 Phytochemical investigation of *Terminalia macroptera* leaves extracts having psychopharmacological activity in mice

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The genus *Terminalia* (Combretaceae) includes several medicinal species that are widely exploited in traditional folk medicine in many African and Asian countries[1]. Local healers and herbalists from Northern Nigeria rely on the use of different preparations from *Terminalia macroptera* organs to treat the symptoms of various infectious diseases (e.g. hepatitis, malaria and enterocolitis) and CNS-related disorders (e.g. epilepsy, anxiety and depression) together with other minor ailments. In this work we elucidated the phytochemical composition of various fractions of *T. macroptera* leaf extracts, which exhibited *in-vivo* protective and beneficial behavioural effects in mice models for anxiety and depression. The untargeted metabolomics analysis, performed by RP-UPLC coupled to high resolution ESI-qTOF, revealed a notable composition in polyphenols belonging mostly to the classes of gallic acid esters, ellagic acid derivatives, chebulic and non-chebulic ellagitannins and, in minor amounts, flavonoids. Moreover, in order to investigate the mechanism by which *T. macroptera* metabolites could be responsible for the observed biological activities, we performed preliminary *in-vitro* screening for the evaluation of both antioxidant capacity and the ability to inhibit human monoamine oxidases (MAO) enzymes, involved in the homeostasis of neurotransmitters. The high phenolics abundance resulted in great antioxidant activity (expressed as TEAC) of *T. macroptera* leaf extracts tested through ABTS and FRAP *in-vitro* assays. Furthermore, the aqueous extract showed good MAO-A inhibition properties, suggesting a potential relation between specific metabolites of this plant and its ascribed antidepressant and anxiolytic effects.

Abbreviations: ABTS – 2,2-azinobis(3-ethylbenzothiazoline-6-sulfonic acid); CNS – central nervous system; ESI-qTOF – electrospray ionization-quadrupole time of flight; FRAP – Ferric Reducing Ability of Plasma; MAO – monoamine oxidase; RP-UPLC – reverse phase ultrahigh performance liquid chromatography; TEAC – Trolox equivalent antioxidant capacity.

OP-06 Anti-mycobacterial and cytotoxic effects of isolated compounds from *Justicia adhatoda* plant extract

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Tuberculosis remains the world's leading cause of death from infection, responsible for infecting more than 2 billion people. An estimate of 10 million new TB incidents have been reported by WHO, in 2017. Since the treatment of the disease is rigorous and prolonged, the TB bacilli sometimes attain resistance (MDR, XDR, and TDR) to drugs leading to death and subsequent unleashing of new resistant bacilli in the environment. No new drug has been introduced successfully in the market to control the disease. There is an immediate require of a new drug regimen. In this context, the exploration of bioactive compounds from natural sources like plants is making significant strides. Among the many plant sources being currently looked into, *Justicia adhatoda* is an Indian medicinal plant that finds relevance since it has been used to treat TB like conditions in the past. The current study aims to isolate and characterize the bioactive compounds of J. adhatoda extracts and investigate them for their antimycobacterial activity. The isolated fractions were reanalyzed for antimycobacerial activity and cytotoxicity on THP-1 and A549 lung cell lines. Our results showed that Ethanolic extract gave 97.4% and 98.7% of antimycobacterial activity at 100µg/ml against *M. bovis* and *M. smegmatis* respectively. Alkaloids (170.1 ± 5.43 mg/g of Ethanol extract) were extracted and fractionated via Chromatography methods, resulting in 20 different fractions including Vasicine. The antimycobacterial activity and cytotoxicity of three best fractions along with Vasicine were checked and presented in the article. Isolated fractions of *Justicia adhatoda* Ethanolic leaf extracts show promise as antimycobacterial activity and their anti-tubercular activity should also be tested. The compound(s) have very low cytotoxicity, hence its intracellular antimycobacterial activity on stimulated THP-1 cell lines will be checked. Further work on identification, standardization and the mechanism of action of isolated fractions, is underway.

OP-07 An Investigation on the Anti-inflammatory Potentials of Some Plants Used Against Rheumatism and Hemorrhoids in Turkey

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Inflammation is a pathophysiological process, which is classically defined by erythema, edema, heat elevation and pain. Inflammation plays a major role in diseases, such as rheumatism and hemorrhoids. An elevated production of free radicals represents a hallmark in the aetiology and pathophysiology of various diseases, such as inflammatory ones. This is why antioxidants might represent potential anti-inflamatory agents. Because of the adverse effects of drugs and resistance development, natural sources have become an interesting source for finding new therapeutic agents. Therefore, investigations on the anti-inflammatory and antioxidant effects of plants, their extracts, and ingredients has become an increasing focus of research. As an example of this, Aspirin, one of the famous anti-inflammatory drugs, developed by attainment from a plant. For this study, 10 plants (*Acer campestre* subsp. *campestre*, *Clematis vitalba*, *Ecballium elaterium*, *Fraxinus ornus subsp. ornus*, *Hypericum perforatum*, *Juglans regia*, *Paliurus spina-cristi*, *Pteridium aquilinum*, *Sambucus ebulus, and Urtica dioica*) were designated, which are preferred as anti-inflammatory drug for treatment of rheumatism and hemorrhoids in traditional medicine in Thrace-Turkey. The decoctions and infusions, as in its traditional use, also the ethanol extracts were examined by antioxidant methods (DPPH, ABTS, FRAP, CUPRAC, total phenolic content). After this pre-study, the decoctions, infusions, the ethanol extracts as well as subextracts of the ethanol extracts from various parts of these plants were investigated for their anti-inflammatory activity. After controlling for the absence of endotoxins, the extracts were tested in LPS-activated RAW264.7 macrophages by Griess and TNF-α bioassays, on their potential effect on the production of two important inflammatory mediators, i.e. nitric oxide and TNF-α. The extracts from different parts (barks, leaves and fruits) of *Fraxinus ornus* subsp. *ornus* exhibited the highest activity among all samples. Interestingly, the samples of the plants, known with their phenolic content, did not exhibit activity as high as expected. Additionally, the compositions of the plants were also evaluated by preliminary qualitative phytochemical analysis and chromatographical methods. A determination of the *in vitro* activity of traditionally used plants, a comparison between therapeutical potentials of all plants and extracts, and the composition-activity and activity-activity relationships were realized with this study.

OP-08 A Chemotaxonomic Approach to *Nigella* L. s.l. (Ranunculaceae) In Respect to Fatty Acids

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The genus *Nigella* L. s.l. (Ranunculaceae) is one of the most important plants in respect of economic and medicinal usage. Fatty acid compounds have been researched in detail for the taxa of *Nigella* s.l., naturally growing in Turkey. Among them, 19 *Nigella* taxa were researched in respect of 18 fatty acid compounds. These were acquired by the way of quantitative fatty acid analyzes such as GC and GC-MS. Each of the any compound of fatty acids, including polar and apolar forms, has been accepted as a character, and the amounts of them have been accepted as character states. The data have been evaluated in R studio, version 3.5.2, and principal component analysis (PCA), and other basic statistical methods have been applied. The results have been presented as phenogram and correlation matrix for a better understanding of the relationships of the taxa. The generic segregation of the *Nigella* s.l. into small genera has also been supported by 83% accuracy according to the PCA. Moreover, these compounds also support the specific discrimination of many species, such as *N. oxypetala, N. ciliaris, N. nigellastrum, N. orientalis and G. unguicularis.* Beside this, the *N. arvensis* species complex has not been supported as separate taxa.

OP-09 Isolation of α-Glucosidase, α-Amylase and Pancreatic Lipase Enzyme Inhibitory Compounds from *Rhus coriaria* L.

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Rhus coriaria L. (Sicilian sumac), is used as a spice and for treating several disorders for many years. The fruits and leaves of *R. coriaria* are utilized ethnopharmacologically against diabetes mellitus in Turkey. It is demonstrated that the inhibition of α-amylase and α-glucosidase reduces high blood sugar levels in diabetic patients because these enzymes play a key role in the regulation of carbohydrate metabolism. Pancreatic lipase inhibition is important for the diminish the lipid absorption, so the pancreatic lipase inhibitors, such as Orlistat, are used against obesity [1]. The aim of this study is to determine the activities of *R. coriaria* fruit and leaf ethanol (80%) extracts and to isolate effective compounds against α-amylase, α-glucosidase, and pancreatic lipase. Therefore, the bioactivity-guided isolation was conducted from leaf extract since it was more active than fruit extract. As a result, agathisflavone, amentoflavone, and 1,2,3,4,6-penta-*O*-galloyl-β-glucopyranose were isolated and determined as the effective components against α-glucosidase and pancreatic lipase. 1,2,3,4,6-penta-*O*-galloyl-β-glucopyranose also demonstrated more α-amylase inhibitory activity than the reference compound, acarbose. The amounts of these effective compounds in main and subextracts were determined by validated methods using HPLC-UV. The amount of 1,2,3,4,6-penta-*O*-galloyl-β-glucopyranose was determined as 2.67 ± 0.01% and 0.84 ± 0.00% in the leaf and fruit extracts respectively. The amounts of amentoflavone and agathisflavone were 0.08 ± 0.00% and 0.17 ± 0.00% respectively in the leaf extracts; however, any of them were not detected in the fruit extract. The current results support the traditional usage of *R. coriaria* for diabetes mellitus.

OP-10 Blackthorn *(Prunus spinosa* L.*)* fruit extract antioxidant activity and cytotoxic effects on various cancer cell lines

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Prunus spinosa L. belongs to Rosaceae family. Its fruits are consumed as food in Turkey. This study was aimed to evaluate antioxidant activity and cytotoxic effects on cancer cell lines of *P. spinosa* methanol extract. *P. spinosa* fruit methanol extract was evaluated for its *in vitro* cytotoxic activity by using glioblastoma multiform (GBM) brain cancer (LN229, U87 and T98G) and pancreas cancer (PANC-1 and AsPC-1) cell lines. Cell viability assays were performed through measuring the percentage of viable cells using a luminescence system, and the antioxidant activities by ABTS and DPPH radical scavenging spectrophotometrically. Differences were considered as statistically significant at $p^{*}<0.001$ and $p^{**}<0.0005$ according to unpaired student t-test. *P. spinosa* fruit methanol extract showed 2548±17,74 mg GAE/100 g corresponding to the total phenolic content, and moderate antioxidant activity (0,1896 ± 0,1143 and 0,0729 ± 0,0348) by $ABTS^{\cdot}$ and $DPPH^{\cdot}$ assays. To the best of our knowledge, evaluation of the results on brain and pancreas cancer cell lines lead to significant cytotoxic activities. 50-63% cell viability of GBM brain cancer cells were determined while no cytotoxicity was observed on pancreas cancer cell lines, PANC-1; and AsPC-1. The results of this study showed that the *P. spinosa* fruit methanol extract has significant antioxidant capacity and leads to statistically significant decrease on the viability of glioblastoma brain cancer cells.

OP-11 Production of Peroxidase by Affinity Chromatography Using Tissue Culture Method from Broccoli and Cauliflower Plants

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In this study, an effective single step affinity method is presented for purifying plant peroxidase (POD) enzymes from cauliflower and broccoli plants grown with tissue culture method. *Brassica oleracea* 'Botrytis (cauliflower) and *Brassica oleracea* Italica (broccoli) seeds were surface sterilized and germinated on MS medium supplemented B5 vitamins, 3 % sucrose and 0.6 % agar. Sterile seedlings were obtained after 15 days. Leaves, axillary buds and root explants were excised from sterile seedlings. These explants were used for callus production respectively 0.5, 1, 2 mg/L 2,4-D. The best callus obtained from 0.5 mg/L 2,4-D for cauliflower and 1 mg/L 2,4-D for broccoli. 5-amino isophthalohydrazide molecule was synthesized and identified as new competitive POD inhibitors. Then, this molecule was coupled to Sepharose 4B-L-Tyrosine support matrix by diazotization to form the affinity gels. Seedlings and callus of each species were extracted to load into affinity column. Purification factors were recorded as 4.17 % yield - 220-fold from cauliflower seedlings, 5.8% yield - 242-fold from cauliflower callus and 4.2 % yield - 302-fold from broccoli seedlings, 6.7% yield - 420-fold from broccoli callus.

OP-12 Enviromental Factors Affecting Morphology, Flowering and Essential Oil of *Origanum dayi* Post.

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Origanum dayi post is a species of herbaceous perennials and subshrubs in the genus *Origanum*, Lamiaceae which belongs to the Campanulaticalyx section (Ietswaart 1980). It is a desert plant, endemic to the northern Negev area and Southern Hebron mountain regions in Israel. Its' volatiles composition is very unique - the main components are α-terpineol, 1,8-cineole and terpinen-4-ol (Dudai et al. 2003) and has been developed as a new crop. A study of Thoppil et al. (2013) has been made about the plant extract and shows strong evidence of anti-tumor activity. Previous studies on members of the *Origanum* genus showed the effects of environmental factors on the plant's morphology, induction of flowering and the essential oil content and composition (Dudai et al. 1992). In our study we grew the plants in the Pytotron under a combinations of temperature and day length. The results show dramatic effects of temperature and day length on the plant's morphology, induction of flowering and the essential oil content and composition. Such results can explain the dramatic seasonal differences of these parameters and also shed light on a future agro technique or harvesting regime of the plant to optimize its yield and quality.

OP-13 Microbial Transformation and Antimicrobial Evaluation of *β*-Ionone Derivatives

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Biotechnology, especially microbial biotransformations enable the synthesis of many unique structures with various functional groups, allowing a wide variety of odors and flavors (Carroll et al., 2016; Pelosi, 2016). ***β***-ionone and 7,8-dihydro-**β**-ionone are cyclic terpenoids, which key intermediates in the synthesis of vitamins such as A, E, K and derivatives found in some fragrances used in many daily products such as decorative cosmetics, shampoos, toilet soaps and other toiletries (Lopez et al., 2015; Longo and Sanromán, 2006). In this present study, the fungal biotransformations of **β**-Ionone and 7,8-dihydro-**β**-ionone were carried out by different microbial strains with the aim of producing new bioactive and odor/aroma derivatives. Among the tested microorganisms one *Aspergillus niger* strain showed the formation of interesting fragrance compounds. The antibacterial and antifungal activities of **β**-Ionone and 7,8-dihydro-**β**-ionone and its biotransformation derivatives were evaluated comparatively. The results showed that, at the tested concentrations, biotransformation metabolite 2-Hydroxy-7,8-dihydro-**β**-ionone showed relatively moderately to good antimicrobial activity against three of the tested bacterial strains such as methicilline resistant *Staphylococcus aureus* (MRSA, Clinical isolate), *S.s epidermidis* ATCC 12228, *Corynebacterium* sp. *Candida parapsiolosis* NRRL Y-12696 with MIC ranges of 1000-0,25 µg/mL when compared with substrates. The biotransformation and biological evaluation of ionones are ongoing.

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OP-14 *Elaeagnus rhamnoides supsp. caucasica* and its Active Compounds: Screening for Alpha-Glucosidase Inhibitory Activity

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The aim of this study is the scientific investigation of antihyperglycemic effect of *Elaeagnus rhamnoides* (L.) A. Nelson subsp. *caucasica* Rousi (Elaeagnaceae) and determination of its phytopharmaceutical potential for treating of Diabetes Mellitus. *E. rhamnoides* is known as "yalancı iğde, çıçırgan" in Turkey. The fruits of the plant are constipating, strengthening and antiseptic, and used against influenza and colds due to the high vitamin C in Turkish folk medicine. *E. rhamnoides* subsp. *caucasica* which is a subspecies grows in Anatolia (Baytop, 1999). Its fruits are consumed traditionally because of the effects of aphrodisiac and antitussive in Elazığ/Turkey (Cakilcioglu, vd., 2011). In this study, 70% methanol extract and its different polarity fractions (*n*-hexane, dichloromethane, ethyl acetate, *n*-butanol and water) prepared from leaves of the plant were evaluated for *in vitro* α-glucosidase inhibitory activity (Tao, vd., 2013). Then five flavonol glycosides (F/1-5) and a triterpenoid saponin mixture (T-1) isolated from *n*-butanol fraction and were evaluated for inhibitory activity as well. The structures of compounds were determined by 1D-NMR, 2D-NMR spectroscopy and MASS spectrometry. The *n*-butanol fraction showed the best inhibitory activity with 92.6% (IC_{50}=0.049 mg/mL) at 100 µg/mL concentration. Therefore, isolation studies were carried out on this fraction and Isorhamnetin-7-*O*-(4''-α-L-rhamnopyranosyl)-β-D-glucopyranoside (F-1), Isorhamnetin-7-*O*-α-L-rhamnopyranoside (F-2), Isorhamnetin-3-*O*-β-D-glucopyranoside (F-3), Quercetin-3-*O*-β-D-glucopyranoside (F-4), Isorhamnetin-3-*O*-(6''-α-L-rhamnopyranosyl)-β-D-glucopyranoside (F-5) and a triterpenoid saponine mixture (Arjunglucoside I + unknown, T-1) were isolated. They showed inhibitory activities with 50.8% (IC_{50}=1.001 mg/mL), 37.1% (IC_{50}=1.164 mg/mL), 33.4% (IC_{50}=1.199 mg/mL), 37.6% (IC_{50}=1.140 mg/mL), 46.3% (IC_{50}=1.037 mg/mL) and 91.7% (IC_{50}=0.716 mg/mL) at 1 mg/mL concentration, respectively. It was seen that F-1 was isolated for the first time by us when it was searched in the literature. The ranking of the inhibitory activity was as T-1> F-1> F-5> F-4> F-2> F-3> acarbose. **T-1** showed the best α-glucosidase inhibitory activity when compared with standard compound acarbose that displayed 19% inhibitory activity (IC_{50}=2.640 mg/mL) at same concentration.

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OP-15 Chemical composition and cytotoxic activitiy of *Colchicum polyphyllum* from Turkey

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One of the most important medicinal plants are Colchicum species, which have been used for centuries to treat several disorders. The species of genus contain tropolon class alkaloids, colchicine is the most significant one, are used in treatment of FMF, Behcet's disease, cirrhosis, lymphoid leukemia, Hodgkin's, psoriasis and are also essential in inducing polyploidy in plants. Although colchicine and other tropolon alkaloids are used in treatment successfully, they are still obtained from plants due to lack of economic synthesized methods. Turkey is regarded as one of the richest sources of Colchicum species that direct the researchers to investigate the alkaloid content of these species. In the present work, alkaloids and cytotoxic activities from different parts of Colchicum polyphyllum were investigated for the first time. The methanol extracts were investigated for their cytotoxic activity against the A549 cell line using the MTT method. As a result, five alkaloids, namely colchicine, colchifoline, 2-demethylcolchicine, demecolcine, and N-deacetyl-N-formylcolchicine were isolated from different parts of the species. As to cytotoxic activity, the methanol extracts of different parts of C. polyphyllum, showed moderate activity against A549 cell line. This is the first report on the alkaloid contents and cytotoxic activity of C. polyphyllum extracts.

OP-16 LC-MS/MS Analysis and Biological Activities of *Hypericum androsaemum* L. Leaves and Fruits Extracts

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The genus *Hypericum* (Hypericaceae) is represented by 465 species all over the world and 100 taxa in Turkey(1). *Hypericum androsaemum* L. has traditionally been used for diuretic, antihepatotoxic, cholagogue, nephroprotective in Western Europe, and treatment of stomachache and gall bladder in Turkey. Six extracts; dichloromethane, methanol, water extracts of leaves (HD, HM, HW) and dichloromethane, methanol, water extracts of mature fruit (FD, FM, FW) were prepared. Chemical composition of the extracts was identified by LC-MS/MS. HD has hederagenin, FD has herniarin, HM has (-) epicatechin, FM has (-)epigallocatechin gallate, FW has caffeic acid, and HW has caffeic acid as major compounds according to the LC-MS/MS analysis. HM has the highest total phenolic content with 108.51±1.28 µg pyrocatechol equivalent/mg extract, and HD has the highest total flavonoid content with 86.74±2.29 µg quercetin equivalent/mg extract. HM showed strong antioxidant activity in DPPH free and ABTS cation radical scavenging assays with IC_{50}:10.94±0.08 and 9.09±05 µg/mL values, respectively, and better than α-tocopherol used as standard. HM demonstrated significant cupric reducing antioxidant power (2.576±0.095 absorbance value at 100 µg/mL concentration) and metal chelating activity (IC_{50}:96.56±1.29 µg/mL). FW showed better activity among the all extract in metal chelating activity with IC_{50}:77.61±0.79 µg/mL value. FM and HD were more effective than standard cefuroxime on *Staphylococcus epidermidis* in antimicrobial assay; their MIC values were 1.22 and 4.88 µg/mL, respectively. Only HM showed weak antiacetylcholinesterase activity with 21.26±0.82 % ihibition in all extracts. Same extract showed strong butyrylcholinesterase activity better than galanthamine used as standard with 87.90±0.50 % ihibition. HD demonstrated the best activity against butyrylcholinesterase enzyme with 89.13±1.49 % ihibition at 200 µg/mL concentration. HD showed stronger anti-urease activity than the other extracts with 0.029±0.018 mg/mL IC_{50} value. FM showed strongest cytotoxic activity on PC-3 human prostate adenocarcinoma cell line with 7.57 mg/mL IC_{50} value. As a conclusion, *H. androsaemum* can be one of the promising medicinal plants to use for several treatments after further studies.

OP-17 Extraction and Identification of Odour Active Molecules from Himalayan Kangra Orthodox Teas

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More than 900 volatile flavour compounds have also been reported in different teas till date. Simultaneous distillation extraction (SDE), supercritical fluid extraction (SFE) and liquid-liquid extraction (LLE) methods were used to extract volatile flavour compounds from Kangra orthodox teas. Odour quality was determined using gas chromatography-olfactometry-mass spectrometry. Qualitative and quantitative variations among the different tea samples were observed in volatile flavour profiles. Whereas aroma or odour of the active compounds were evaluated through flavour dilution factor using aroma extract dilution analysis (AEDA). Geraniol (sweet), nerol (floral), linalool (fruity, fresh floral), (Z/E)-linalool oxides (floral), phytol (fresh green), (E)-2-hexenal (grassy green), *α*-/*β*-ionone (warm woody, dry floral), methylpyrazine (nutty) and methyl salicylate (wintergreen like) were dominant volatile flaour compounds present in higher quantity in all the teas. Pyrazines (2-ethyl-5- methylpyrazine (nutty), ethylpyrazine (roasted)), dihydroactinidiolide (roasted) and 6,10,14-trimethyl-2-pentadecanone (fresh, floral) were important minor volatile flavour components which provides distinctive aroma character to Kangra orthodox teas. Aroma and taste quality of teas were also judged through tea-tasting panel comprising six professional determining quality attributes including leaf appearance and its shape, infusion colour, taste and aroma. Extracted aroma of SDE was slight burnt odour. But, fresh, flowery and fruity aroma notes were retained in SFE extracts compared to SDE extracts of the teas. The flavour isolated from SFE extracts has superior quality that can be used foods such as bakery, cakes, edible flavour matrices and cosmetics including perfumes and mouthfreshners.

OP-18 A Review of Recent Phytopharmaceutical Investigations and the need for DNA Barcoding of Endemic Medicinal and Aromatic Plants of North Cyprus

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North Cyprus is located in one of the Nicolas Vavilov's Centres of diversity of plants and a home to about 1500 accounting for 79% of the documented plant species of the Island, with 19 are found to be endemic to this part of the island. Been part of the centre of diversity, North Cyprus could provide numerous opportunities for the development of innovative new phytopharmaceutical products. However, only 25% of the endemic plants of North Cyprus were phytopharmaceutically investigated for their medicinal and aromatic potentials, and need to be comprehensively barcoded for proper authentication, detection of adulteration, and quality control – herbal tea misidentification of endemic *Salvia veneris* for *S. officinalis* is well reported. To contribute to this process, available, accessible and published records of phytopharmaceutically investigated endemic plants of the North Cyprus were reviewed. This information would help researchers in the field of pharmacy, phytotherapy, and ethnobotany to ethically explore these plants for their Medicinal and Aromatic virtues.

OP-19 Phytochemical analysis and antimicrobial activity of eight medicinal plants used in the treatment of tuberculosis in the eastern Free State, South Africa

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Tuberculosis (TB), an airborne infectious disease that mainly infects lungs, is caused by *Mycobacterium tuberculosis*. South Africa is one of the countries with the highest TB and multi-drug resistant TB burden. This study was aimed at screening traditional medicinal plants that are frequently used by the herbalists and traditional healers from the eastern part of the Free State Province against TB and other respiratory ailments for the presence of phytochemicals and for antimicrobial activity. Eight medicinal plant species were collected with the help of traditional healers and screened for the presence of phytochemicals using standard procedures. Furthermore, antibacterial, antifungal and antimycobacterial activities of 32 extracts prepared from 8 plant species were determined using standard microplate dilution methods. All plants displayed the presence of tannins and saponins and the absence of alkaloids, anthraquinones and steroids. Extracts prepared from *Hermannia depressa* and *Senecio harveianus* displayed the best antibacterial activity against all test microorganisms with MIC values ranging between 0.098 and 0.781 mg/ml. The acetone and ethanol extracts of *Dicoma anomala* also exhibited the best antibacterial activity with MICs ranging between 0.098 and 0.781 mg/ml. The aqueous and acetone extracts prepared from *Lotononis lanceolata* displayed the best antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* with MIC values of with MIC values ranging between 0.098 and 0.391 mg/ml. Concerning antifungal activity, *Drimia depressa* and *L. lanceolata* extracts displayed the best antifungal activity between 0.049 and 0.781 mg/ml. Good antimycobacterial activity was observed with organic extracts prepared from *D. anomala*, *H. depressa, L. lanceolata* and *S. harveianus* with MIC values ranging between 0.195 and 0.781 mg/ml. The results obtained from this study have validated the use of these plants by the traditional healers. They also suggest that these plants may serve as sources of new antimicrobial agents that could be effective against drug-resistant infections. Further investigations on quantitative analysis of the phytochemicals, anti-inflammatory activity, cytotoxicity and isolation of bioactive compounds are ongoing.

OP-20 Phenotypic variation among cultivated and wild coriander as genetic resource for breeding and research

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Coriander (*Coriandrum sativum* L.), sometimes called cilantro, is a herb and spice growing worldwide. Its leaves, fresh or dry, are being used as in various dishes and salads in many different cuisines. The ripe seeds are the main spice in the Indian Curry powder and are important ingredient in many other foods and food products. It is belong to the *Apiaceae* family and it's originated from the Mediterranean region. Men use it since the Pre-Pottery Neolithic period (~ 5500 BC) with desiccated mericarps found in a couple of sites in Israel, and half of littler were found Tutankhamun's tomb in Egypt (1350 BC) were it does not grow in the wild. We analyzed eight genotypes of wild coriander collected from the wild in Israel in comparison to a large collection of 83 cultivated genotypes. The hardness of the seed coatassisted us to make a clear distinction between wild and cultivated genotypes. While cultivated coriander has a thin seed coat that is breakable by hand, wild coriander seeds are unbreakable by hand and a hard tool is necessary to break them. We characterized the differences between the aroma of the seeds. Linalool was the main compound in both types, but its levels were significantly higher in wild coriander in comparison to cultivated genotypes. Wild genotypes also accumulated higher levels of γ-terpinene and of borneol that was barely present in cultivated coriander. Conversely, *p*-cymene was present in higher levels in cultivated genotypes. Altogether, this work demonstrates the potential in utilizing wild coriander as source for introduction of desired phenotypes, such as higher linalool levels, into commercial cultivars as being done for other important crops such as rice and tomato.

OP-21 Plants of South Africa used in the cosmetic industry

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The Cosmetic industry is a fast growing and changing industry and African plants are now fashionable to be included in new products. Essential oils e.g. *Pelargonium var. rose* and cold pressed oils, plant extracts, and powders of indigenous plants amongst others are the focus areas. *Adansonia digitata* (Baobab) and *Schlerocarya birrea* (Marula) oil, pulp and powder of both are under supplied in a growing market of currently developed products that have already been accepted by most international companies. There is now also extra demand for oils and plant fats to replace or blend with shea butter, argan, almond and olive oil. *Ximenia africana and X. americana, Trichilia emetic* (Mafura), *Citrullus lanatus* (Kalahari Melon) and *Kigelia africana* (Sausage tree) seed oils are now researched for developing market demand and for the requirements in the cosmetic and fragrance industry. Advantages and challenges have been identified with potential of sustainable crop development. Climate change and pressure on natural resources can be managed if careful sustainable measures are taken in time. This study could assist role players of community projects, agricultural and rural development schemes in decisions of choosing alternative crops and for skills and entrepreneurship development and poverty alleviation. The information from the study can also be applied by government departments, small scale and emerging farmers in the feasibility studies of utilization of natural products as new enterprises. This presentation will focus on the potential of sustainable supply of the indigenous species identified to the advantage of the producers of South Africa.

OP-22 Unusual Phenolic Compounds Isolated from *Plantago holosteum* Scop.

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The genus *Plantago* (Plantaginaceae) is represented by 21 species in Turkey and known as an old medicinal plants used for treatment of several disorders as infusion and decoction in Anatolia (1,2). Anti-inflammatory, antitumoral, antifungal, antibacterial, analgesic, antispasmodic, antiviral, cytotoxic and hepatoprotective effects have been shown on different *Plantago* species in previous studies (3,4). The phytochemical investigations on *Plantago* species have revealed that iridoid glucosides, phenylethanoid glycosides, flavonoids, triterpenes and phenolic acids are the main constituents of aerial parts of *Plantago* species (4,5). This phytochemical study is concerning about chemical constituents of the aerial parts of *P. holosteum* and we report here the isolation and structure elucidation of several secondary metabolites, including unusual phenolic compounds. Isolated compounds have been determined as seven phenylethanoid glycosides (acteoside, isoacteoside, leucosceptoside A, martynoside, echinacoside, arenarioside, 4,3”” dimethoxyarenarioside), and one lignan glucoside (dihydrodehydrodiconiferyl alcohol-9’-*O*-*β*-glucopyranoside) by means of advanced spectroscopical methods (1D-, 2D-NMR and MS). Isolation of acteoside is chemotaxonomically important for the genus *Plantago*, moreover isolation of 4,3”” dimethoxyarenarioside, and dihydrodehydrodiconiferyl alcohol-9’-*O*-*β*-glucopyranoside is reported for the first time from a *Plantago* species and also from Plantaginaceae family, while arenarioside is the first reported from *Plantago* genus.

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OP-23 The European Phytotherapy Initiative: ESCOP

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ESCOP is an umbrella organisation of national associations of phytotherapy across Europe. It was founded on June 18th, in 1989 in Cologne with the aim of the enhance of the scientific knowledge of herbal medicinal products and to harmonise their regulatory status in Europe. ESCOP has 14 members from 13 countries. A Scientific Committee was established to produce reference monographs on the therapeutic use of herbal medicines, in particular on their safety, and efficacy. The members of the Scientific Committee are nominated by the national member associations. The ESCOP monographs provide an evidence base for the medicinal use of herbal medicinal products. In October 1990 the first five monographs were published. Between 1996-1999, 60 monographs were compiled, these monographs were revised and expanded to 80 monographs in 2003. In 2009 27 new and 8 revised monographs were published. Since 2011 monographs are published electronically and at the moment more than 50 single monographs are available for download. There is also an ESCOP Herb app on Apple and Android for use by the general public. It summarises the ESCOP monograph conclusions on uses, safety and quality standards for easy home reference.

OP-24 Bioactivity of plants used against elephantiasis and its secondary infections in South Africa

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Elephantiasis is a symptom of a variety of diseases characterised by thickening of the skin and subcutaneous tissue, resulting in grossly enlarged and swollen limbs. The disease could be filarial or non-filarial. Filarial elephantiasis is caused by parasitic nematodes whereas non-filarial elephantiasis is due to a number of cases including tuberculosis, cancer treatment, sexually transmitted diseases and repeated streptococcal infections. This study was aimed at screening plants used by some of the South African traditional healers against elephantiasis and its secondary infection for the presence of phytochemicals, antimicrobial, anti-inflammatory and cytotoxic properties. Medicinal plant species were collected with the help of traditional healers, extracted with water, ethanol and acetone, and screened for the presence of bioactive and cytotoxic properties using standard methods. Extracts prepared from *Cinchona officinalis, Euphorbia clavarioides, Gnidia kraussiana* and *Hermannia geniculata* displayed the presence of tannins. *Hermannia geniculata* displayed the highest tannin content (2.45), followed by *Aptenia cordifolia* (1.78) and *G. kraussiana* (1.00). Concerning saponins, extracts prepared from *C. officinalis*, acetone and water extracts from *E. clavarioides*, acetone and ethanol extracts from *G. kraussiana* and ethanol and water extracts from *Senecio speciosus* tested positive for the presence of the phytochemical. *Euphorbia clavarioides* displayed the highest saponin content (5.1%), followed by *G. kraussiana* (5%) and *A. cordifolia* (3%). All screened extracts displayed some form of activity against the tested microorganisms. Extracts prepared from *E. clavarioides* inhibited all tested bacterial strains with MIC values ranging from 0.098 to 0.781 mg/ml. The organic solvents extracts from *H. geniculate, G. kraussiana, S. speciosus* and *C. officinalis* displayed high activity between 0.098 mg/ml and 1.563 mg/ml. Concerning antifungal activity, *H. geniculata, A. cordifolia, G. kraussiana* and *C. officinalis* extracts displayed the highest activity between 0.098 and 0.781 mg/ml. In antimycobacterial activity, *A. cordifolia, S. speciosus* and *G. kraussiana* extracts inhibited *Mycobacterium tuberculosis* between 0.049 and 0.78 mg/ml. The ethanol extract of *H. geniculata* displayed good inhibitory activity against 5-Lipoxygenase with 0.764± 0.340 µg/ml IC_{50} value. The *Cinchona officinalis* and *A. cordifolia* acetone and ethanol extracts were cytotoxic to the HuTu cells at 24 and 48-hours exposure times. This study has demonstrated that the screened plants possessed significant biological activity and could thus be potential sources of antimicrobial and anti-inflammatory agents. Furthermore, some of these plants should be used with care since they displayed some level of cytotoxicity.

OP-25 Ethyl Acetate Fraction of *Detarium microcarpum* (*G.* &*P.*) Leaf Attenuates Inflammation Induced in Rat's

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Colitis has an increasing incidence and prevalence in most countries and has become a global emerging disease, and this situation is made worse in developing nations because of the high cost and scarce-availability of drugs. This study sought to investigate the anti- inflammatory effect of Ethyl acetate fraction of *Detarium microcarpum* (EfDML) in acetic acid induced colitis using rat model. The anti-inflammatory studies were carried out using Acetic acid (4% in saline) to mimic physiological condition of human colitis. Thirty-six female/male rats weighing 100 – 136g (6 weeks) were separated into six groups based on their sexual orientation. Group A (Control), was administered saline intrarectally, while Groups B –F were induced intrarectally with Acetic acid (4% in Saline). Group B (Acetic acid Control) was not treated, but Groups C – E was treated with 50mg/kg/day, 150mg/kg/day, and 300mg/kg/day respectively. Group F received 0.70mg/kg/day (relative human dose) of Mesalazine standard drug. Administration of extracts and standard drug was done daily for three (3) days. The disease activity index (DAI), haematological, biochemical, histopathological, anti-inflammation assays, and cytokines studies were carried out. The group D (EfDML150 mg/kg/day) results showed an ameliorative effect of EfDML on Acetic acid (4% in saline) induced colitis on the disease activity index, histopathological examination, haematological, biochemical antioxidants activity level, anti-inflammation biomarkers and cytokines levels studied. The result of EfDML 150mg/kg was comparative to the standard drug mesalazine. The ethyl acetate fraction of *Detarium microcarpum* ameliorates colitis condition by tripartite actions; antioxidant, cytokines and inflammatory mediators regulatory mechanism.

OP-26 Phytochemical study on *Teucrium* species

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The genus *Teucrium*, belonging to Lamiaceae family, includes 300 species widespread all around the world. *Teucrium* species are a rich source of secondary metabolites, such as neoclerodane diterpenoids which can be used as chemotaxonomic markers of the genus (Ulubelen et al., 2000; Piozzi et al., 2005). These plants are used in the folk medicine in many countries of the Mediterranean area. Phytochemical investigations of the species belonging to this genus revealed also the presence of triterpenes, steroids, iridoids, saponins, flavonoids, polyphenols and essential oils (Bedir et al., 1999; Tumbas et al., 2004). *Teucrium* species are used as alimentary plants and some of them are employed in the production of flavored wines, beers, herbal teas and bitter liqueurs. An interesting biological property of neoclerodane is the antifeedant activity against some pest insects and previously investigation on *T. fruticans* reported the occurrence of quite potent metabolites (Bruno et al., 1999). In this communication a review of the phytochemicals, and their most relevant biological activities, occurring in *T. fruticans* and *T. scordium* subsp. *scordioides* species will be provided as well as new researches on their essential oil. A comparative study on the profiles of metabolic contents of these species collected in different places will be discussed.

OP-27 Phytochemical and biological studies on plants growing wild in Mediterranean Area

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Plants are a source of compounds with antioxidant, antiinflammatory and spasmolytic activities. In continuation with our previous work on biological properties of medicinal and food plants, some culinary and officinal herbs have been collected from different zones of Mediterranean Area and extracted at room temperature with ethanol. These plants included *Achillea millefolium* L.*, Artemisia vulgaris* L.*, Foeniculum vulgare* Mill.*, Hyssopus officinalis* L., *Laurus nobilis* L.*, Mentha longifolia* (L.) Hudson, *Myrtus communis* L.*, Satureja montana* L.*, Helichrysum italicum* (Roth) Don ssp. *italicum* and others. Crude ethanolic extracts of the plants were first screened for their antioxidant and radical scavenging activities, using chemical (DPPH and FRAP) assays and other test (TBARS and ROS) based on Caco-2 cell line, which mimics, after differentiation, the intestinal epithelium. The extracts were also screened for their antiinflammatory and spasmolytic activities, both *in vitro* and *in vivo*. A chromatographic separation of those showing the most interesting biological activities was also carried out. In this communication, the results of our study will be discussed.

OP-28 Potential Drug Candidates for Neurodegenerative Diseases from *Corydalis* DC. Species Growing in Turkey

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Our continuing research for the determination of bioactive secondary metabolites from Turkish geophytes as therapeutic agents for neurodegenerative diseases is mainly based on the need for drug candidates affected to brain areas. The neurodegeneration related to Alzheimer's Disease (AD) is directly related to cognitive function. The degeneration of cholinergic neurons in AD promotes cholinergic hypofunction that can result in decreased of choline acetyl transferase and acetylcholinesterase (AChE) activity in the hippocampus. All therapeutic drugs (donepezil, rivastigmine, galanthamine) elevate acetylcholine levels in the synaptic cleft through the inhibition of cholinesterases-enzymes involved in acetylcholine degradation. Nitrogene-containing compounds were suggested as potential lead structures for inhibition of cholinesterases and in management of dementia. Among the geophytes, the genus *Corydalis* DC. (Papaveraceae) comprises of 470 species distributed mainly in temperate regions of the Northern Hemisphere, mostly in Eurasia; represented by one species in the subarctic Russia and North America, one species in the mountains of eastern Africa, 3 species in the subtropical Indo-China, and 17 species with 23 taxa in the Flora of Turkey. Members of the genus are also a rich source of isoquinoline alkaloids with various biological properties and have long been used for the treatment of different ailments traditionally. In the Traditional Chinese (TCM), tubers of herb *Corydalis yanhusuo, C. ternata* have been used and they contain isoquinoline alkaloids. The present study was aimed at exploring the effect of extracts prepared from 17 *Corydalis* species collected from Turkey on cholinergic neurotransmission and the analysis of their alkaloidal content by LC-Q-TOF-MS/MS. *In vitro* studies revealed the inhibition of AChE and BChE inhibitory activity. The results indicated that the alkaloidal extracts of the tubers of *Corydalis* species were exerted high to AchE and BuChE inhibition between 70,979 ± 2,155 and 98,425 ± 0,827, 70,871 ± 0,687 and 94,417 ± 1,022, respectively (galanthamine 98,795 ± 0,643 and 74,951 ± 1,204) at 200 mg/ml. In conclusion, this study is highlighted that *Corydalis* DC. species are rich in potential cholinesterase inhibitors that can provide lead structures for further development of therapeutic drugs.

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OP-29 *Cannabis*: The Versatile Plant that Cann

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Cannabis sativa L. is a remarkable plant in that not only does it bioremediate soil, but it grows synergistically with surrounding plants and wild life, thereby contributing to biodiversity in an environment and thus, can and should be used in permaculture methods. The fabulous part about using Cannabis in permaculture methods would be that other MAPS grow synergistically with it, thereby consolidating the raw materials for essential oil extraction and for use in formulating ethnopharmacological products. As the Cannabis market is ever-expanding, so too is the need for humans to examine the way we are forcing the production of this plant - in sterile, isolated, energy-intensive, high waste-producing, plant prisons. It is time we face the fact that this type of agriculture is not only not sustainable, but unnecessary. Furthermore, the root of the name *Cannabis ruderalis* (about which there is some contention as to whether that is an actual subspecies of *Cannabis sativa L.* or not), ruderal, describes the primary succession of plants to inhabit an environment after the soil has been destroyed. Cannabis can not only help heal dead soil, but it can remediate it, then contribute to a biodiverse permaculture agricultural structure.

OP-30 Effects of *Amaranthus hybridus* L. (Amaranthaceae) Hydroethanol Leaf Extract on Alcohol-induced Hypertension in Rats

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Hypertension is one of the leading causes of morbidity and mortality worldwide. There is the need for the discovery and development of new antihypertensive drugs with better efficacy and safety profile than existing agents. Natural agents, including plants, have been reliable sources of new drugs and/or lead compounds. *Amaranthus hybridus* L. (Amaranthaceae) is an herbaceous plant widely distributed in the tropics, including the various sub-regions of Africa. In West Africa, it is found in countries like Côte d'Ivoire, Ghana, Guinea, Mali, Sierra Leone and Nigeria with ascribed culinary role as vegetable. It is commonly called green amaranth, slim amaranth or smooth pigweed. Extract of the plant has been reported to have strong in-vitro antioxidant activity. This study investigated the antihypertensive effect of the hydroethanolic leaf extract of *Amaranthus hybridus* L. (Amaranthaceae) (AH) on alcohol-induced hypertension in rats. Different groups of rats orally received distilled water 10 ml/kg; 35% ethanol (3 g/kg/day); ethanol + AH (50, 100 and 200 mg/kg respectively); and ethanol + nifedipine (10 mg/kg) for 4 weeks. At the end, blood pressure and other relevant parameters were assessed. Acute toxicity test was carried out. Ethanol caused marked increase in systolic, diastolic and mean arterial blood pressure relative to the control. AH (200 mg/kg) and nifedipine caused reduction in the blood pressure parameters relative to the ethanol group. Ethanol reduced kidney level of reduced glutathione with AH (100 and 200 mg/kg) and nifedipine reversing this trend. Same trend of effect was produced in respect of kidney levels of superoxide dismutase and catalase, and aorta level of catalase. AH reversed the increase in malondialdehyde induced by ethanol in respect of aorta (200 mg/kg) and liver (50-200 mg/kg). AH (100 mg/kg) reversed the effect of ethanol on kidney level of glutathione S-transferase. Histopathological assessment of the selected organs confirmed the results of beneficial effect of AH. In respect of acute toxicity test, AH did not cause any mortality administered at 2000 mg/kg. The findings in this study suggest that AH possess antihypertensive effect possibly due to enhancement of in-vivo antioxidant activities.

OP-31 Potential Role of Rosmarinic Acid on Pulmonary Arterial Hypertension Therapy

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Pulmonary arterial hypertension (PAH) is a devastating and incurable cardiovascular disorder caused by extensive vascular remodelling of the blood vessels in the lung. The prevalence of the PAH is 9.6 per million and 12250 PAH patients are registered in Turkey (Pektas et al., 2015). The germline mutations in the bone morphogenetic protein type II receptor (*BMPR*2), which belongs to the transforming growth factor beta (TGF-β) family underlie in majority of the familial forms of PAH (>80%). Modulation of BMP and TGF-β signalling pathways is a novel therapeutic approach for the resolution of inherited PAH (Nasim et al., 2011, Nasim et al., 2012; Ogo et al., 2013). In this study, rosmarinic acid yielded from the aerial parts of *Arnebia purpurea* was investigated for its effects on BMP signaling using a cell-based reporter, western blotting and qPCR assays. Our results exhibited that RA increased BMP signalling through BMPRII mediated reporter assay in HEK 293T, enhanced the phosphorylation of SMAD1/5 proteins and increased the expression of *Id1* transcripts. All these results showed that RA elicits pro-BMP effects and it could be a potential drug candidate for further *in vivo* and

OP-32 Herbal medicinal products in the public pharmacy: A surveillance study with STW 5 in Irritable Bowel Syndrome (IBS) and other functional GI diseases

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Pharmacy-based surveys on everyday life therapeutic use and patient perceived satisfaction are tools to gain real life evidence and understanding of patient needs for over-the-counter (OTC) medicinal products. The herbal combination preparation STW 5 has been available in the German market for more than 58 years. Its scientific evidence for treatment of functional gastrointestinal diseases like irritable bowel syndrome and functional dyspepsia includes a multitude of clinical, pharmacological and toxicological studies. Up to now, few data on self-assessed usage behavior, perception of effectiveness and tolerability for STW 5 are available. To assess these factors was the aim of this study. Pharmacy customers with product desire or recommendation for STW 5 were asked whether they would participate in a survey on the product. Patients received a questionnaire regarding demographic data, gastrointestinal complaints, effectiveness, tolerability and satisfaction with the product. They were asked to answer it during the next few days and send it back to a contract research institute within a week. Data from 843 patients were evaluated. 29.4 % were male and 70.6 % female. The majority was in the 30-49 age range. In 384 patients, complaints were related to the upper, in 139 to the lower abdomen, in 311 patients to both regions. In 7.3 % of the 384 patients a functional dyspepsia had been diagnosed, in 16.9 % of the 139 patients an irritable bowel syndrome. Up to 64% of the patients specified a good or very good improvement of the respectively predominant symptom with treatment of STW 5. Symptom relief with was perceived as fast and covered the comprehensive spectrum of complaints. Tolerability was rated good to very good in 97.4 % of all patients and did not differ between patient groups. Correspondingly 93.2 % of the users were „very satisfied“ or „satisfied“. 91 % of the customers would recommend STW 5 to others for treating their complaints. Overall, it can be concluded that this pharmacy-based survey gives a reliable picture of the view of patients on STW 5 as an OTC herbal medicinal product, with high satisfaction values as well in irritable stomach as in irritable bowel syndrome. The ratings are well in accordance to the favorable ratings of tolerability and patient perceived satisfaction from the clinical studies on the product.

OP-33 Safety and efficacy assessment of herbal products: Potential shortcomings

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The interest in herbal products is increasing, but not the quality of the respective efficacy and safety assessments. A main reason for this, while the amount of available data is even increasing, is the lack of awareness of the limitations of these data. To address this issue, a classification of sources of bias and ways out is aimed to. A systematic data base search for reviews in this field, combined with hand searching in text books, was conducted. Sources of bias were classified according to data types involved. Depending from the data involved, different sources of bias were identified: Data on quality: Often the great differences of the composition of herbal products prepared from the same plant are neglected, so leading to flaws when transferring data to other products. Non-clinical data: Common pitfalls are the transfer of data from in vitro studies to the clinical setting, without taking into account the influence of ADME. Often also effects from sublethal high-dose settings are used without sufficiently taking into account dose dependency of effects or, especially e.g. in carcinogenicity studies, methodological ambiguities. Data from clinical studies and post marketing surveillance: Referring to studies conducted with products of a different composition can lead to misleading attribution of efficacy to inefficient products and vice versa. Lack of differentiation between negative studies and failed studies can lead to wrong conclusions on inefficacy. Finally, the evaluation of safety data is often flawed by neglecting background incidences, as e.g. in case of hepatotoxicity by protopathic bias, and by the awareness and views of authors of case reports. A higher awareness of potential shortcomings in the assessment of safety data on herbal products is needed, e.g. in case of hepatotoxic risks, if we want to avoid that methodological artefacts and misperceptions of the generalizability of data continue to influence our view of the safety and efficacy of herbal products, both by neglecting risks, as, more abundant, by exaggerating non-existing risks.

OP-34 New Approaches for Phytochemical Analysis and Discovery in Natural Product Research

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In response to their environment, plants produce a phytochemical arsenal in order to communicate and to withstand abiotic and biotic pressures. The average plant tissue contains upwards of 30,000 phytochemicals, consequently the vast majority of approaches used to study plant chemistry are reductionist, only targeting specific classes of compounds, often are selected for ease of detection or isolation. Metabolomics is the qualitative and quantitative analysis of all metabolites present in a biological sample and this phytochemical snapshot has allowed researchers to study plant primary and secondary metabolism in ways that were never done before. A standard metabolomics data set contains vast amounts of information and key factors in using the data effectively are experimental design, availability of reference materials, sample preparation and selection of statistical analyses performed. This presentation will discuss and demonstrate how chemometric analyses of metabolomics data can lead new approaches for authentication of botanicals, improving the safety and efficacy of products and discovery of new metabolites and pathways. Together these tools represent an entirely new approach to both quality control and phytochemical discovery.

OP-35 Willow bark extract STW 33-I in joint and muscle pain: Action well established

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Willow bark extracts are used e.g. in joint and muscle pain. They contain a large number of polar constituents. Among these, the salicylates are the basis of the standardization of the extracts, so that their relevance for the mode of action is a matter of interest, especially with regard to the use of aqueous willow bark extracts as STW 33-I. Therefore a literature review was conducted, focused on the mode of action of willow bark extracts and fractions thereof. This review revealed a considerable number of pharmacological studies, including in vitro- and in vivo studies in different pharmacological models, supporting the assumption that especially the polar fractions of the extract contribute to the action. Salicylic acid derivatives and their metabolites, together with different other polyphenols, were identified as relevant for the mechanisms of action, as was also confirmed by gene expression analyses. Accordingly, the studies on the mode of action of the aqueous willow bark extract STW 33-I show, that its action is based on more than just tradition, given the broad available evidence on willow bark and the salicylates, and can be well explained even on a molecular level.

OP-36 STW 1, a herbal combination used in painful complaints in degenerative and inflammatory rheumatic diseases: Mode of action

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In painful complaints caused by degenerative and inflammatory rheumatic diseases, herbal medicinal products such as STW 1, a combination product containing extracts of trembling poplar leaves and bark, golden rod herb and common ash bark, are an important, evidence-based treatment option. Therefore, the question is which mechanisms of action contribute to this therapeutic effect? Accordingly, a review was conducted with the aim to identify data on the pharmacology of this product. As could be shown, the action of the combination product as well as those of its components included anti-inflammatory, anti-oedematous, anti-oxidative and analgesic properties. These modes of action are even broader than those of synthetic anti-rheumatics. Accordingly, these data can explain the action and efficacy of STW 1 in randomised, placebo- or verum-controlled double-blind trials, as well as in non-interventional studies, which have been performed in different subtypes of rheumatic diseases and even documented as a successful combination therapy with non-steroidal anti-inflammatory drugs (NSAIDs). As these data show, STW 1 can complement NSAIDs and cyclooxygenase 2 (COX-2) inhibitors in particular in these indications.

OP-37 Morphogenetic variability and yield characters of some *Salvia* species cultivated in a Semiarid Central Anatolian Environment

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A field experiment was carried out during 2017 at the Faculty of Agriculture of Eskişehir Osmangazi University, Turkey. The experimental design was a randomized completely block design with three replications. Three *Salvia* species (*Salvia officinalis, Salvia triloba* and *Salvia sclarea*) were used as material to determine the essential oil content of different plant parts (fresh and dry top leaves, fresh and dry bottom leaves, fresh and dry top stalks, fresh and dry bottom stalks, fresh and dry flowers) of the above given *Salvia* species. Yield characters *viz.* plant height, number of leaves, flower length, fresh herba yield, dried herba yield, dried flower yield and dried leaf yield were studied. Correlation studies were performed between the essential oil content and yield characters of the species and significant differences were found among the essential oil contents of different plant parts within the *Salvia* species.

OP-38 Effects of different doses of soil humic acid applications and irrigation treatments of the plant and soil nutrient contents of basil (*Ocimum basilicum* L.)

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Humic acid has beneficial effects on nutrient uptake by plants and is useful for the transport and availability of micronutrients from soil (Bohme and Thiua, 1997). A field experiment was carried out during 2016 and 2017 at the Faculty of Agriculture of Eskisehir Osmangazi University, Turkey. One *Ocimum basilicum* L. population was used as material to study the effect of different doses of soil humic acid (0 -2500-5000-7500 g ha^{-1}) with the incorporation of irrigation treatments (I_{100}:%100; I_{75}: %75, I_{50}: %50, I_{25}: %25). According to the results, significant differences were found between soil humic acid applications with the irrigation treatments of some soil characteristics (organic matter, P_2O_5, K_2O, Fe, Zn, Mn, Cu) and plant N contents. Soil characteristics and N contents of plant differed significantly both year.

OP-39 Seasonal changes of biologically active compounds in bastard balm (*Melittis melisophyllum* L.)

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Bastard balm (*Melittis melissophyllum* L.) is a perennial growing wild in mixed forests and bright woodlands of Western, Central and Southern Europe. The plant is about 50 cm high, with large, dark leaves and pink flowers gathered in whorls in the leaf axis. Specific, sweet aroma of its herb depends on the presence of coumarin and essential oils. The raw material is also rich in flavonoids and phenolic acids. The herb is used in folk medicine as antispasmodic in digestive problems, as urinary antiseptic and diuretic, as well as in some sleeping disorders. Water extracts are applied in eye inflammations or in wound and skin infections. In Poland, bastard balm herb is mainly used for aromatization of alcohol and tobacco products. Since 2001 the plant has been taken under legal protection, however, the raw material is still collected exclusively from wild growing plant. The introduction into cultivation of such species ensure the raw material for the herbal industry and gives the chance for their survival in natural habitat. The aim of this study was to evaluate the accumulation of biologically active compounds during four years of bastard balm cultivation. Seasonal changes among populations has been observed, as well. The plants were cultivated under shading nets simulating natural light conditions in which bastard balm grows. The highest mass of herb was obtained in fourth year of plant vegetation (20.7 g DW per plant). In these organs three coumarin compounds (coumarin, 3,4-dihydrocoumarin and o-coumaric acid), three flavonoids (verbascoside, luteolin-7-O-glucoside, apigenin-7-apioglucoside), and five phenolic acids (chlorogenic, caffeic, 4-hydroxycinnamic, ferulic, cichoric acids) were determined using HPLC. Among identified compounds luteolin-7-O-glucoside, verbascoside, chlorogenic acid and coumarin were the dominants. The highest content of flavonoids and phenolic acids was observed in two-year-old plants, while coumarin in four-year-old ones (272.06 mg 100^{-1} DW). When considering seasonal changes, the highest content of luteolin-7-O-glucoside was observed at the full flowering while verbascoside and chlorogenic acid - at the beginning of seed setting. The content of coumarin was similar at the beginning and at the full flowering and distinctly lower at the seed setting. The obtained results show that the cultivation of bastard balm under shading nets may be a promising method to obtain relatively high yield of good quality raw material.

OP-40 Empowering Tribal Farmers and Aroma Industry through agro-technological interventions: A case study in Anamalai Tiger Reserve, Western Ghats, India

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CSIR-Aroma Mission was launched in India with the aim of developing and disseminating the aroma technologies to reach the end users viz. the farmers, the industry and the society leading to business opportunities, rural development and life-quality enhancement. Also, to bring about 5550 ha of additional area under captive cultivation of aromatic crops particularly targeting the plains, coastal, hills, rain-fed and degraded land across the country. Most of the agro and processing technologies of aromatic crops are unreachable to the tribal farming communities throughout the world. Even small scientific interventions will help for their economical upliftment. Anamalai Tiger Reserve (ATR) is carved out of the Tamil Nadu portion of the Anamalais in Western Ghats, a region designated as one of 25 Global Biodiversity Hotspots in India. It lies South of the Palakkad gap in the Southern Western Ghats and is located between the longitudes 76^{o} and 77^{o} E and latitudes 10^{o} and 10^{o} N. Eight tribal settlement families are living in this forest area. The farmers are cultivating local variety of lemongrass which is yielding less oil (0.3%) with a primitive distillation method as a result of poor oil recovery. The lemongrass oil is the major source of their livelihood. The successful interventions made under the CSIR-Aroma Mission in the tribal areas has benefitted the tribal farmers through introduction of a high yielding variety and improved processing units which have resulted in enhancing the total essential oil yields to about four times and their farm incomes by more than 400%. The various interventions made, industrial assistance toward this success will be presented in detail.

OP-41 Transforming trade in wild collected medicinal and aromatic plants: the FairWild Standard and certification system

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The FairWild Standard (www.fairwild.org) is a set of eleven principles guiding the sustainable collection and fair trade of wild harvested plants, fungi and lichen. It is maintained by the FairWild Foundation, a non-profit entity established with the aim to provide "a worldwide framework for implementing a sustainable, fair and value-adding management and trading system for wild-collected natural ingredients and products thereof." This session will introduce the latest developments with the FairWild Standard and its certification system, including our experience with establishing an accreditation system and training programme for auditors, industry actors and other stakeholders interested to benchmark the sustainability of wild harvesting operations against the FairWild performance indicators. It will provide an update on the companies and other organisations currently engaged with the FairWild initiative, and share perspectives on our future plans including new partnerships and collaborations, revision of the Standard, and efforts to expand industry involvement through the certification system and beyond.

13-17 November 2019 - Famagusta - N.Cyprus
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OP-42 Influence of light intensity and mulch on photosynthesis, yield and essential oil composition of damask rose (*Rosa damascena* Mill.) under acidic conditions of Western Himalayas

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Damask rose (*Rosa damascena* Mill.) is one of the important essential oil bearing plant, which is being used in cosmetic, flavors, perfumery and pharmaceutical industries. It is largely cultivated in Turkey, Bulgaria, Iran, Morocco, France, Egypt, India and China. About 2500-3000 hectares land is under commercial cultivation of *R. damascena* in India. Major products obtained from damask rose are rose essential oil, rose concrete and rose absolute. The quality of essential oil is measured by secondary metabolites with high percentage of monoterpene alcohols including citronellol, nerol, trans-geraniol, linalool, and phenyl ethyl alcohol and hydrocarbons such as nonadecene and nonadecane. Light intensity significantly affect the yield and components of medicinal and aromatic plants. A field experiment was conducted during 2017-2018 at CSIR-Institute of Himalayan Bioresource Technology, Palampur (HP), India to study the effect of light intensity and mulch on photosynthesis, yield, oil content and composition of *R. damascena*. The experiment was laid out in a split plot design (SPD) with four replications. The experiment comprised of nine treatments; three light intensities *viz.*, control (100% sunlight), 25% shade and 50% shade in the main plots and three mulch types *viz*., control (without mulch), organic mulch (poplar leaf mulch5 t/ha) and black polyethylene mulch (25/30 micron size) in sub plots. Yield attributes *viz.,* numbers of flowers plant^{-1}, fresh flower weight plant^{-1}, fresh flower yield, and essential oil yield were significantly higher under 100% sun light due to higher photosynthesis as compared to 25% and 50% shade. Similarly, black polyethylene mulch recorded significantly higher yield attributes, fresh flower yield and essential oil content as compared to other mulches. Damask rose planted under open sunny conditions and applied with black polyethylene mulch recorded significantly higher number of flowers, number of petals, fresh flower weight and fresh flower yield as compared to other treatments. Decreasing light intensity led to decrease in stomatal density whereas reverse trend was found for trichome length. Light intensity did not affect essential oil content but the oil yield was significantly higher under open conditions. A total of twenty-five essential oil compounds were identified which accounted for a total of 87.4 to 88.5%. Plants grown under 25% shade applied with black polyethylene mulch produced significantly higher concentration of citronellol+nerol (37.5%), whereas trans-geraniol was significantly higher in 25% shade applied with organic mulch (30.0%). In conclusion, 100% sunlight along with black polyethylene mulch is good for the cultivation of *R. damascena* under western Himalayas

OP-43 Pollen morphology of the genus *Valeriana* L. (Caprifoliaceae) in Turkey

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According to phylogenetic analyses based on morphological and molecular characters the genus *Valeriana* L. has been positioned as a genus derived from *Caprifoliaceae*. It has been used for 2000 years for medical purposes in producing phytomedicines to reduce anxiety and insomnia, and to improve sleep quality. Many species of the genus *Valeriana* are used as sedatives in various nervous system problems in traditional medicine, and their effects are supported by clinical studies. In this paper, pollen morphological features of 13 species in the genus *Valeriana* in Turkey were examined by light and scanning electron microscopy to evaluate their taxonomic significance. Pollen slides were prepared according to the method of Wodehouse(1935). As a result of our morphological observation of the pollen grains with a light microscope, pollen grains of the genus are radially symmetrical, isopolar; small to medium in size; di, tri, and tetracolpate; triangular to circular in polar view; suboblate-oblate, oblate-spheroidal to suboblate in shape. Pollen exine ornamentations of the taxa have been observed by scanning electron microscopy and their microphotographies were taken. In terms of pollen size, *V. speluncaria* and *V. phu* have been found to have the largest pollen grains, while *V. dioscoridis* and *V. oligantha* have the smallest pollen grains.In addition, the largest halo was observed in *V. officinalis* and *V. dioscoridis* at different locations. The results revealed that the exine ornamentations and the sizes can be diagnostic characters useful for the classification.

OP-44 Cytotaxonomic Evaluation of *Aubrieta* Adans. (Brassicaceae) Taxa

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Cytological and chromosomal data are important and often provide significant information for inferring taxonomic relationships and evolutionary processes. Very often cytogenetic data follow geographic patterns, and thereby contribute to the phylogeography of the taxa. In this study, nuclear DNA contents and chromosome numbers of some *Aubrieta* Adans. taxa have been studied. As part of an ongoing project focusing on the systematics, taxonomy and evolutionary history of the genus, a large seed sample sets of various taxa have been collected throughout Turkey. Cytological preparations were made by using root tip meristem tissues. Nuclear DNA content analyses were made by flow cytometer using propidium iodide as fluorochrome and tomato (*Lycopersicum esculentum* Mill., 1Cx = 1 pg) as internal standard. The mean 2C nuclear DNA content of four species were determined as means of three different plants per populations and three populations per species. Among the studied species (*A. alshehbazii* Dönmez, Uğurlu & M.A.Koch, *A. pinardii* Boiss., *A. deltoidea* (L.) DC. , *A. olympica* Boiss., *A. parviflora* Boiss., *A. canescens* (Boiss.) Bornm.) all of them are diploid with 2n=2x=16. However, the mean 2C nuclear DNA content of the species varied between 0.79 pg (*A. alshehbazii*) and 0.97 pg (*A. parviflora*), and the differences were statistically significant. In conclusion, although all the species are diploid, there are important nuclear DNA content differences among *Aubrieta* taxa. Therefore, nuclear DNA content information can be useful in taxonomic identification and classification of the *Aubrieta* taxa.

OP-45 Determination of Traditional Knowledge Based on Biodiversity in Çorum

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This study was carried out with the aim of identifying and recording the traditional knowledge based on the use of all the elements that compose biodiversity in Çorum within the scope of project for Recording of Local and Traditional Knowledge Based on Biological Diversity. Field studies were carried out in 51 villages of 14 districts of Çorum province (Alaca, Bayat, Boğazkale, Dodurga, İskilip, Kargı, Laçin, Mecitözü, Merkez, Oğuzlar, Ortaköy, Osmancık, Sungurlu, Uğurludağ) between November 2017 and November 2018. Interviews (face-to-face) were conducted with the local people and the plants, which were found to be traditionally used, were collected with the persons who were informed. After identification of plants, herbarium materials were removed to Hacettepe University Faculty of Pharmacy (HUEF). We also collected samples representing the traditional knowledge during the fieldwork, which could be used for promotion and exhibition purposes. The findings obtained from the field study were evaluated by comparing with the literature in Çorum. As a result of the identification and evaluation of the plants, 125 taxa belonging to 44 families and 95 genera were collected during the field study, as well as 78 data about traditional information belonging to 36 species were reported. It was determined that among traditional information data 61 were used in health category, 15 were in nutrition category and 2 were in other categories. Traditionally the most commonly used species were *Rosa canina*, *Malva neglecta, Polygonum cognatum, Portulaca oleracea*, *Prunus divaricata*, and these species were mostly used for nutritional and health purposes. Nowadays, when nature is on an irreversible path by human beings, the importance of these projects is increasing. Humanity should prevent this accumulation from disappearing for its own future. It is no longer in the neighborhoods / villages of the province of Çorum to live in a continuous and sustainable way away from the opportunities that modern life will provide to keep the traditional knowledge fresh. With this study, the observations and the results obtained, it is shown once again that this valuable information that we lost day by day should be recorded and collected in a center.

OP-46 Chemical Composition and Antibacterial Activity of *Tambja stegossauriformis* Nudibranch

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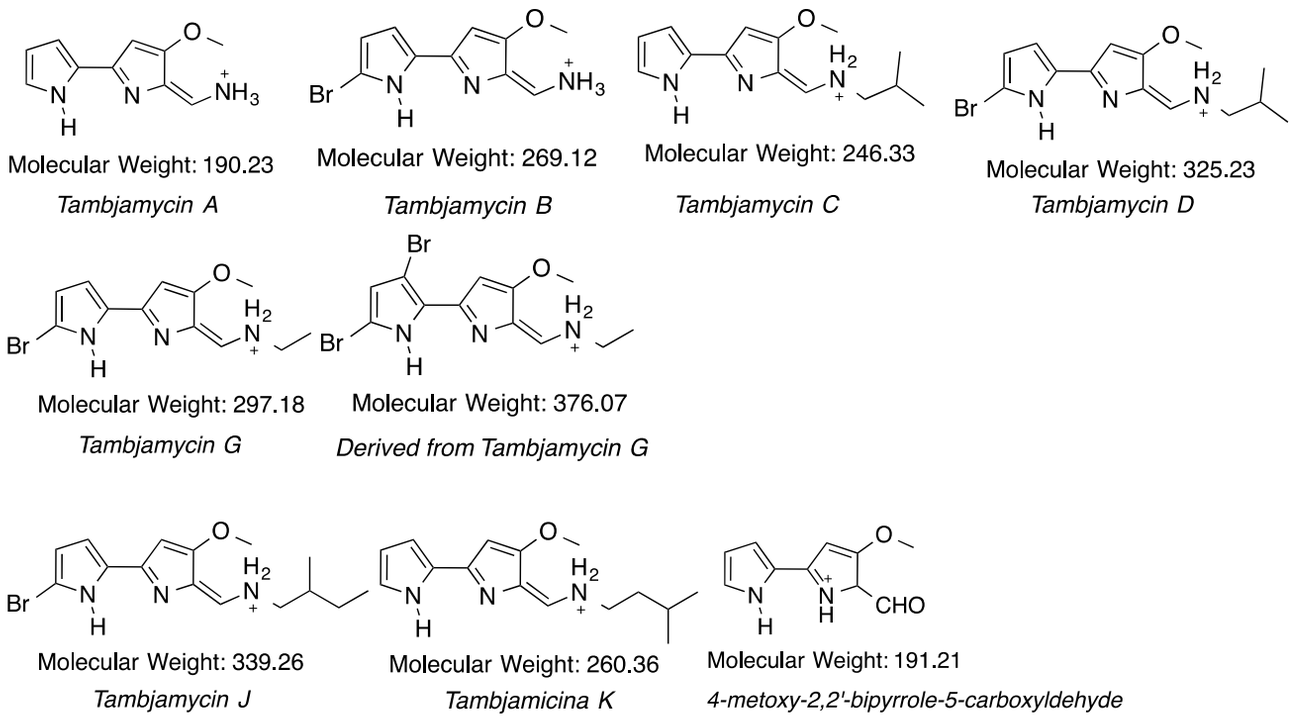
Several compounds with biological activity may be found in nudibranchs, which with the indole alkaloids as a particularly group. The aim of this study was to identify indole alkaloids from ethanolic and methanolic extracts of *T. stegosauriformis* (TS) from the Brazilian coast. Ten individuals were collected on the coast of Cabo Frio/Rio de Janeiro/Brazil, preserved in ethanol followed by methanol extraction, and rotary evaporator drying. The extracts were solubilized in methanol (1mg mL^{-1}) and analyses were performed using HPLC-DAD-MSn with a PDA detector and an ion trap mass spectrometer (operating in the positive ion mode) using the X-Bridge C18 column (2.1 × 150 mm). Nine TS pyrrolic alkaloids (Figure 1) were identified between 13-22 min retention time. All alkaloids are derived from the base structure with two interconnected pyrrolic rings. Tambjamycin A (*m/z* 189), B (*m/z* 267 and 269), C (*m/z* 246), D (*m/z* 324 and 326), G (*m/z* 297), J (*m/z* 260), and 4-methoxy-2,2'-bipyrrole-5-carboxaldehyde (*m/z* 191) were previously identified and reported in the literature. A new alkaloid, derived from tambjamycin G, has been identified (*m/z* 376 and 378) for the first time during this study. This compound has two bromine atoms in its structure, which could be confirmed by their loss (m/z 216 [M-2Br]). Other new compound from tambjamycin G and C is proposed by identification of m/z 595.



This is the first report of two new pyrrolic alkaloids isolated from the *Tambja* genus. The antibacterial activity of the extracts was tested on *Streptococcus mutans* ATCC (American Type Culture Collection) 25175 and *Lactobacillus casei* ATCC 393 samples, determining the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of the extract against these bacteria. The cytotoxic activity against *Artemia salina* was detected in the *T. stegossauriformis* extract with antibacterial activity. The *T. stegossauriformis* extract presented bacteriostatic activity against *S. mutans* (MIC = 1.175mg / mL) and *L. casei* (MIC= 0.5875 mg / mL) (Table 1). The results indicate a potential anticariogenic effect of substances isolated from *T. stegossauriformis* nudibranch.

Table 1: Minimal Inhibitory Concentration (MIC) and Minimal Bactericidal Concentration (MBC) of *T. stegossauriformis* extract (mg/mL) against *S. mutant* and *L. casei*, in two separate experiments

Bacteria	1st experiment		2nd experiment		Mode	
	MIC	MBC	MIC	MBC	MIC	MBC
S. mutans ATCC 25175	1.175	> 2.35	1.175	> 2.35	1.175	> 2.35
L. casei ATCC 393	0.5875	> 2.35	0.5875	> 2.35	0.5875	> 2.35

OP-47 Oil production from microalgae with new methods

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Urban people who are away from nature as a result of industrialization and technological progress, turn to natural resources in search of healthy foods. Algae is one of the natural resources that are favoured by people due to the important nutrients it contains. Biologically important metabolites such as fatty oils and fatty acids, carbohydrates, proteins, minerals, vitamins, pigments, polyphenols and antioxidant phytochemicals can be produced by algae that show quickly biomass growth due to their rapid multiplication. One of the most important of these metabolites produced by algae is omega-3 polyunsaturated fatty acids (PUFA). The most important are alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Since it cannot be synthesized by humans, omega-3 needs to be met by food consumption. Therefore, extraction and purification of oil from algae is important. In this study, microalgae with high oil content were examined, and conventional methods and new extraction methods with obtain high oil yield were investigated.

OP-48 Marine-derived fungi: a promising source of biological control agents against plant diseases

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Marine-derived fungi were evaluated for their antagonistic activities against economically important plant pathogenic fungi and investigated for their halotolerance on potato dextrose agar amended with 1%-25% NaCl. The results of dual culture tests showed that the marine *Trichoderma* species, *T. asperellum* and *T. harzianum* exhibited higher antagonistic effects against all plant pathogens than the other tested fungi, causing percentages of mycelial growth inhibition ranging from 59.31-100%. The results of dilution plate assays revealed that crude extracts of marine-derived fungi in the genera *Emericella*, *Myrothecium*, *Neocosmospora*, *Penicillium* and *Talaromyces* displayed great antifungal activity against plant pathogenic fungi at a low concentration of 1 g/L. However, the crude extract of *Myrothecium verrucaria* showed the best antifungal activity, more than 52% inhibition of five of the tested species of plant pathogenic fungi and complete mycelial growth inhibition of *Bipolaris oryzae* and *Lasiodiplodia theobromae* at 1 g/L *in vitro*. All of the tested marine-derived fungi were tolerant to NaCl at concentrations up to 7%. Under greenhouse conditions, the crude extract at 5 g/L and spore suspension of *Talaromyces tratensis* at 10^6 spores/mL exhibited the highest reductions in the incidences brown spot and dirty panicle of rice by 56.74% and 60%, respectively. Under field conditions, the greatest reduction in the incidence of dirty panicle was 50–60% when treated with spore suspension of *T. tratensis*. The highest yield weight was obtained when crude extract of *T. tratensis* was applied twice at 10 g/L. These results revealed marine-derived fungi possess exploitable antagonistic activities against plant pathogenic fungi through antibiosis, competition for nutrients and space and halotolerance. Moreover, the results from this study showed their potential as novel BCAs for supporting crop production under climatic changes in the future.

OP-49 RCmiR: A rapid curation tool for plant genomics studies and its application on Actinidia species as medicinal plants

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Medicinal plants including wild and cultivated have important nutraceutical and pharmaceutical health benefits. Although the little research has been conducted because of the lack of commercial importance, these plants are excellent sources of important chemical compounds including phenolic phytochemicals, antioxidants for functions in the defense system against various diseases, insects and fungi. In this study, we investigate microRNA genes, their functions and targets using genomics tools and sequencing information from *Actinidia chinensis cv Hongyang*, *Actinidia chinensis cv Red5* and *Actinidia eriantha cv White*. By using homology conservation method with miRBase version 22, we identified 75, 71 and 67 different miRNA families on *A.chinensis cv Hongyang*, *A.chinensis cv Red5* and *A.eriantha cv White*, respectively. The three high copy number of miRNA gene families are identified for all Actinidia species. Among all miRNA repertoire, for all Actinidia species, miR156, miR396, and miR7696 families are the highest representative miRNA families on the genome. We also detect the miRNA targets on their transcriptomes and categorize them as biological processes, molecular functions, and cellular components. According to our results, miRNA targets are mostly found as transcription factors and various proteins including MLO-like proteins, PPR proteins, and elicitor-responsive proteins. The targets of identified miRNA families are located at cellular compartments and organelles. To accelerate the detection process, we developed a rapid curation software tool (RCmiR), which filters out unwanted microRNA genes on the target genomes, based on three significant criteria: 1.) the pre-miRNA sequence does not consist of multi-branched loops, 2.) no more than six mismatches between the miRNA-miRNA* strand are allowed 3.) no mismatches at DICER cut points are permitted on the mature miRNA strand. Plant miRNAs are critical regulators; so, our findings will assist to gain insights into understanding their important functions on the pathways in medicinal plants. Identification of these key players may also help scientific society in breeding programs to use them efficiently for biotechnological purposes.

OP-50 Anticancer Activity from Indonesian Sea Cucumber

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Sea Cucumber Holothuria scabra is the most widely consumed marine organisms in Asian countries. H. scabra has been used as a new source of novel bioactive compounds for several therapeutic measure including anticancer. This study aimed to determine the active fractions of H. scabra which have anticancer activity. H. scabra was extracted using methanol and dichloromethane (1:1). The crude extract was partitioned using n-hexane, ethyl acetate, butanol-water fraction. Cytotoxicity test was conducted using HeLa (cervic cancer) cell line and MCF-7 (breast cancer) cell line based on the MTT assay. The crude extract of H. scabra displayed the best cytotoxic activity against HeLa cells (IC_{50} = 13. 67 µg/mL) and MCF-7 cells (IC_{50} = 16.40 µg/mL). The toxicity tests showed the IC_{50} value of the n-hexane fraction, ethyl acetate fraction, and methanol-water fraction against HeLa cells HeLa (IC50 = 66.35 µg/mL; 57.10 µg/mL; 13.89 µg/mL) and MCF-7 cells (IC_{50} = 48.80 µg/mL; 79.34 µg/mL; 12.43 µg/mL).

OP-51 Potential Therapeutic Role of *Origanum dubium* Boiss. Essential Oil on Neoplastic Transformed Human Telomerase reverse Transcriptase Immortalized Mesenchymal Stem Cells

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Plant essential oils have several biological effects such as antioxidant, antimicrobial and antifungal. In addition to these they have cytotoxic and potential anticancer activities. In our study, oregano (*Origanum dubium* Boiss) essential oil analyzed by GC and GC/MS showed high content of carcacrol and p-cymene. A potential anti-cancer activity of *Origanum dubium* Boiss. essential oil (EO) is investigated by using human telomerase reverse transcriptase immortalized mesenchymal stem cells (hMSC-telo1) and their tumorigenic counterpart; hMSC-telo1 cells which were irradiated with 2.5 Gy of γ-rays and showed neoplastic transformation. To study the genotoxicity of *Origanum dubium* essential hMSC-telo1 and their counterpart irraditated hMSC –TERT cell lines were treated with increasing concentrations. The cells were treated with 0.5% (v/v), 1% (v/v) and 2% (v/v) oregano essential oil. The morphology of the cells has been investigated at different time points. Cells were followed up for 20 days and at the end of this period the strongest toxic activity was observed at the concentration of 0.5% (v/v) both on hMSC- telo1 and irradiated hMSC (TERT) cell lines. When the concentration of the *Origanum dubium* EO has been increased, a no decline in the cell survival observed, and the 1% (v/v) *Origanum dubium* EO led into greater level of cell death compared to 2% (v/v). Additionally cell viability determined by MTT assay, beta –gal staining used to investigate senescent cells and TUNEL assay used to detect apoptotic cells. All of these experiments were performed by using 0.5% (v/v) *Origanum dubium* EO. These preliminary results showed promising genotoxic effect of *Origanum dubium* EO on hMSAC telo1 and their counterpart tumoricanic hMSC-telo1 cells.

OP-52 Selective inhibitory activities of phytochemicals and their synthetic analogues against intestinal bacteria and cells *in vitro*. A comparison to antibiotics used for infectious diarrhoea.

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The absence of proper form for effective and safe antimicrobial therapy of intestinal infections caused by diarrheagenic bacteria (DB) prevails a global issue, whereas impairment of human gut microbiota (GM) as one of the side-effects is suspected to increase the risk of intestinal cancer. Phytochemicals and their synthetic analogues (P&SA) possess a high potential to alternate commercial antibiotics (ATBs) from the point of view of strong inhibitory activity against DB and safety to normal intestinal cells (NC). Moreover, their selective antiproliferative effect as a supportive therapy trait is also considered. A comprehensive *in vitro* study of selectively antibacterial and cytotoxic effects of P&SA from various chemical classes on DB/CC with respect to GM/NC, compared to ATBs commonly used for diarrhoea is therefore needed. In present study, ten P&SA (berberine chloride, sanguinarine, 8-hydroxyquinoline, chloroxine, nitroxoline, ferron, zinc pyrithione, salicylic acid, bismuth subsalicylate, tannic acid) and six ATBs (ceftriaxone, ciprofloxacin, chloramphenicol, metronidazole, tetracycline, vancomycin) were tested using broth microdilution method and MTT assay. Minimum inhibitory concentrations (MIC) against standard cultures of 12 DB (*Bacillus cereus, Clostridium difficile, Clostridium perfringens, Enterococcus faecalis, Escherichia coli, E. coli* 0175:H7*, Listeria monocytogenes, Shigella flexneri, Salmonella enterica, Salmonella yyphimurium, Vibrio parahaemolyticus, Yersinia enterocolitica*) and 9 BB (*Bacteroides fragilis, Bifidobacterium adolescentis, Bifidobacterium animalis spp. lactis, Bifidobacterium bifidum, Bifidobacterium breve, Bifidobacterium longum, Lactobacillus casei, Lactobacillus reuteri, Lactobacillus rhamnosus*) strains, and the half maximal inhibitory concentrations (IC_{50}) against NC (FHS 74 Int) and CC (Caco-2, HT29) were determined. Selectivity indices (SIs) were calculated between HC/DB, BB/DB and NC/CC from average values, whereas IC_{50}s were recalculated to IC_{80} to be used as equivalent to MIC_{80}. Ciprofloxacin, tetracycline, zinc pyrithione, nitroxoline, chloramphenicol, and chloroxine showed the strongest anti-DB activity (MICs = 1.8 – 24 µg/mL). Together with 8-hydroxyquinoline and ceftriaxone, these compounds also exhibited selective inhibition of DB with respect to both or at least one of the intestinal ecosystem substances (NC: SIs = 1.2 – 1.9; BB: SIs = 0.2 – 1.1). 8-hydroxyquinoline (SI = 1.1) and sanguinarine (SI = 0.1) were only the drugs exhibiting selective cytotoxicity against CC. In conclusion, 8-hydroxyquinoline and pyridine alkaloids generally showed attributes comparable to most active ATBs (ciprofloxacin, tetracycline, chloramphenicol and ceftriaxone) from the point of view of their strong antibacterial effect and relative safety to indigenous gut ecosystem. Further studies dealing with these and related phytochemicals will be helpful in identifying a convenient alternative antimicrobial drugs for the treatment of intestinal infections caused by DB.

OP-53 Some Contributions to Natural Product Research

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The fascinating field of natural products began with collection of plant, fungal, marine organisms etc., isolation and characterization of chemical constituents, many being found to have utility as medicinal/ bioactive compounds, flavor/fragrances and the like. The chemical investigation on Indian medicinal plants (*Aesculus indica*, *Agave cantala*, *Callicarpa macrophylla*, *Cedrus deodara*, *Solanum torvum* and *Phyllanthus niruri*) has led to isolation of several new and many known compounds. The aim of this presentation is to share "highlights from the past" and our contributions by introducing "Natural Product Communications (NPC)" to serve community of natural product researchers.

13-17 November 2019 - Famagusta - N.Cyprus
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OP-54 Effect of STW 3-VI (*Hypericum perforatum* L.) on the plasticity of hippocampal neurons, the migration of microglia cells oxLDL-induced ROS

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Depressive symptoms may be induced by chronic stressful life events, which affect the neuronal and microglia function. Microglia activation and remodeling of dendrites in the hippocampus are apparently relating to depression development and healing, but the molecular mechanism is not fully understood. Extracts of *Hypericum perforatum* L., like STW 3-VI, have been recommended for the treatment of depression. The aim of our investigation was to determine in vitro the effects of STW 3-VI on neuronal plasticity and microglia functions. Mouse microglia SIM-A9 cells and differentiated hippocampal HT-22 neurons were treated with different concentrations of STW 3-VI or desipramine. Neurite outgrowth and morphological changes were microscopically analyzed and quantified. After treatment with different concentrations of STW3-VI or desipramine viability/cytotoxicity and migration were measured. Additionally, TNF-α was measured by ELISA, as well as ROS production by using the cell permeant reagent 2',7'-dichlorofluorescin-diacetate. Neither STW 3-VI nor desipramine showed cytotoxic effects on neurons or microglia cells. Differentiation of mouse hippocampal HT-22 neurons induced the expression of the NMDA receptor. After treatment with 5 µg/ml STW 3-VI the neurite outgrowth was increased 25% ($p \leq 0.05$) compared to the control (medium alone). Furthermore, STW 3-VI increased the viability of microglia cells. Activation of microglia cells with lipopolysaccharides (LPS) (0.25 µg/ml), but not STW 3-VI itself, 2.4-fold increased the TNF-α release compared to the control. Incubation of microglia cells with 100µg/ml oxidized low-density lipoprotein (OxLDL) increased the ROS production 7.5-fold, which thereafter could be significantly inhibited 1.8-fold by treatment with 10 µg/ml STW 3-VI. Moreover, STW 3-VI (10µg/ml) stimulated 2.2-fold the migration compared to control, whereas LPS inhibited it. Our results indicate that the Hypericum perforatum L. extract STW 3-VI improves the plasticity of hippocampal neurons, protects from oxLDL-induced ROS production and stimulates the migratory capacity of microglia cells. These reparative/protective properties may support the therapeutic use in neurodegenerative diseases like depression.

OP-55 Lipid lowering and weight loss effects of methanol extracts of *Vernonia colorata* in high fat diet fed albino rats.

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The study evaluated the effect of concomitant administration of methanol extracts of *Vernonia colorata* (MEVC) and feeding of high fat diet (HFD) on lipid profile and body weight changes in albino rats. Thirty male albino rats aged between 10 and 12 weeks were separated into six groups of five rats each (I- fed basal diet only, II-HFD + 1000mg/kg body MEVC , III-HFD + 200mg/kg body weight MEVC, IV-HFD + DMSO, V-HFD + Orlistat which served as drug control, VI-HFD only). Animals were fed *ad libitum* while extracts were administered 5 times a week for ten weeks. Animals were sacrificed at the end of the study period and blood collected for lipid profile analysis. Concomitant feeding of high fat diet and administration of methanol extracts of *Vernonia colorata* resulted in significantly ($p<0.05$) lower Serum Triacylglycerol, cholesterol and LDL-Cholesterol but higher HDL-cholesterol concentrations relative to groups fed high fat diet only and high fat diet + DMSO the vehicle in which the extracts were dissolved. The serum lipid lowering effects of methanol extracts of *Vernonia colorata* were comparable to effect of the standard drug orlistat. Decreases in body weight in groups administered the extract were also comparable weight loss observed in groups administered the standard drug orlistat. The findings in this study suggest that methanol extracts of *Vernonia colorata* possess hypolipidaemic, cardio-protective and anti-obesity effects. The plant therefore may be useful in not only weight management but could be possible drug lead in the search for natural products for treatment of diseases associated with dyslipidaemia.

OP-56 Quality Control of Dietary Supplements for Metals Available in Their Composition

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In general, biologically active additives are natural or identical natural biologically active substances derived from plant, animal or minerals, as well, but much less frequently by chemical or microbiological synthesis. Among the pollutants of the biosphere, which are of the greatest interest for various quality control services, metals (primarily heavy, that having an atomic weight greater than 50) are the most important. Aluminium, copper, chromium, and etc. in very small quantities are part of the biologically active substances that are necessary for the normal life of plants and humans; they are present in the air, in the water which we drink, in the soil, where are absorbed by the plants and are involved in food chains cosmetics, etc. Especially a lot of aluminum in yeast, dyes and food additives, without which sausage, canned food, bread (especially white) and other products are not complete. In Europe, such additives included substances with coding E173 (aluminum metal powder used for decorative decoration of culinary products), 520, 521, 522, 523 (aluminum sulfates, which are well absorbed by the intestines), 541 (sodium aluminophosphate, used as emulsifier), 554, 555 and 556 (sodium aluminosilicate and calcium aluminosilicate, which were added as a powder to instant coffee, baking compositions, and batch soups to prevent sticking and caking of the granules). Many heavy metals, such as copper, is involved in biological processes and in certain quantities are essential for the functioning of plants, animals and humans. Chromium is widely distributed in foods. Chromium supplements are available as chromium chloride, chromium nicotinate, chromium picolinate, high-chromium yeast, and chromium citrate. On the other hand, heavy metals and their compounds can have a harmful effect on the human body, and can accumulate in tissues, causing a number of diseases. From the above data it is clearly seen that the up mentioned metals can get into the composition of food additives by different ways. Therefore, quality control of these biological additives can be carried out by the presence of metals in their composition. Therefore, the proposal of effective, accurate, sensitive methods for the determination of these metals in biological additives is an important task. In our experiments, we used the formation of intracomplex compounds of these metals with various organic ligands, obtaining mixed-ligand complexes that have the necessary stability for photometric measurement. Considering the chemical nature of the metal and the ligand, to determine each metal, we approached this issue individually, facing all the physicochemical parameters of the mixed-ligand complexes synthesized by us. Photometry was performed on a spectrophotometer (UV-VİS UV 752D) in the UV and visible regions of the spectrum. The results of the analysis were subjected to statistical processing by a known method. Obtained reliable results, which allows to use this method if necessary for the intended purpose.

OP-57 Formulation Development and Evaluation of Postprandial Glycemic Effect of Carob Containing Nutraceutical ODT Tablet

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Functional excipients were formulated as an orally dispersible tablet (ODT) with cinnamon *(Cinnamomum cassia)* and carob fruits *(Ceratonia siliqua)* powder which is produced in Northern Cyprus. Direct compressible tableting method was used for various formulations containing different pharmaceutical compositions. All powder compounds were accurately weight and blended in cubic mixer and compressed with 16 mm single punch as 600 mg chewable tablet. The prepared tablet controls were evaluated according to EP Pharmacopeia. Clinical part of this study was approved by the local ethical committee. This study was performed in 10 nondiabetic subjects with age 27.4 ± 2.0 years and body mass index (BMI) 24.9±4.0 kg/m^2. Inclusion criteria was age 20-35 years and exclusion criteria were diabetes, acute or chronic disease, chronic medication and alcohol use. Study results showed that formulations had more pleasant mouthfeel in oral cavity. Formulations containing cinnamon, carob and combinations and placebo ODT tablets were used. It was found that Carob reduced postprandial glycemia as well as cinnamon in nondiabetic subjects. Combination of carob or cinnamon has no synergistic effect on postprandial blood glucose levels.

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OP-58 The Effect of Resveratrol on Epithelial Mesenchymal Transition in Pancreatic Cancer Stem Cell

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Pancreatic cancer is a fatal disease that has minimum survival with regard to any another cancer types. In pancreatic cancer, metastasis occurs in association with epithelial mesenchymal transition (EMT). Resveratrol is one of the polyphenolic compounds found that in many plant species such as grapes, peanuts and berries. Resveratrol can suppress EMT-related factors (ACTA-2, N-cadherin, vimentin, etc.). It can also inhibit stem cell activity in pancreatic cancer. The aim of this study was to investigate the effect of resveratrol on metastasis in pancreatic cancer stem cell. Human pancreatic cancer stem cells were isolated by MiniMACS system using CD133 antibody. Furthermore, cell cytotoxicity was measured by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) cell viability test. After administration of 5 µM resveratrol to CD133+ and CD133- cells for 24 hours, staining of ACTA2, N-cadherin and vimentin was graded semi quantitatively using the H-SCORE. Mann-Whitney U and Kruskal-Wallis tests (whichever appropriate) were used for differences among groups. A p value of <0.05 was considered as statistically significant. ACTA-2 immunoreactivity was higher in control group than resveratrol-treated CD133+ cells ($p>0,05$). However, the H-SCORE for N-cadherin was significantly higher in control group than resveratrol-treated CD133+ cells ($p<0,05$). CD133+ control group had increase in H-SCORE for vimentin when compared with resveratrol-treated CD133+ cells, but not significant ($p>0,05$). ACTA-2 and N-cadherin immunoreactivities were significantly lower in resveratrol-treated CD133+ cells than resveratrol-treated CD133- cells ($p<0.05$). When compared to resveratrol-treated CD133- cells, H-SCORE of vimentin was lower in resveratrol-treated CD133+ cells, but not significant ($p>0.05$). After resveratrol treatment; the ACTA-2, N-cadherin and vimentin immunoreactivities were decreased in CD133+ cells. Therefore, epithelial mesenchymal transition of pancreatic cancer stem cells was inhibited by resveratrol. Thus, it was concluded that resveratrol may decrease the potential of these cells to metastasize. Resveratrol may reduce the mesenchymal cell property of cancer cells.

OP-59 The role of probiotic content of kefir in the adipogenic differentiation process of 3T3-L1 cells

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Kefir is a fermented probiotic milk product. It has various health benefits such as preventing obesity. The aim of this study was to investigate the effect of kefir on lipid accumulation and cell differentiation in adipocytes. Kefir was prepared by fermenting kefir grains with milk. Then mature 3T3-L1 cells were incubated for 24 and 48 hours with kefir supernatant and kefir pellet fractions. The MTT assay was used to measured the cytotoxic effect of kefir. Lipid accumulation in adipocytes was determined by oil red-o staining. Anti-adipogenic activities of kefir fractions were investigated distribution of ANGPTL-4, leptin and PPAR- γ in mature 3T3-L1 adipocytes using indirect immunoperoxidase technique. The MTT assay showed that 0.1 mg/dl of kefir supernatant and kefir pellet dilutions were effective on the adipocytes growth and differentiation after both 24 h and 48 h incubations. Kefir supernatant and pellet treated 3T3-L1 adipocytes showed less intracellular lipid accumulation decreased versus control cells. The H-SCOREs of ANGPTL-4, leptin, PPAR-Ɣ intensities in 3T3-L1 adipocytes treated with kefir supernatant and pellet for 24 h are given in Table 1. As a result of immunohistochemical staining, ANGPTL-4 immunoreactivity was significantly increased, and leptin immunoreactivity was significantly decreased in 3T3-L1 cells. There were no differences in expression of PPAR- γ in all groups. Kefir fractions inhibit lipid accumulation in adipocytes and prevents weight gain by increasing expression of ANGPTL-4 and reducing leptin expression. Therefore, this study will guide us to explain the role of kefir in obesity.

OP-60 The Effect of Curcumin In The Treatment of Diseases

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Curcumin, which is stated to be useful in the prevention and treatment of many diseases in traditional Chinese and Indian (Ayurvedic) medicine, is a yellow/orange powder which is used as a spice and colorant obtained from crushed rhizomes of *Curcuma longa* known as turmeric. It has a bitter taste and used as a component of the curry powder and many sauces in Indian cuisine. The characteristic yellow/orange color of turmeric originates from polyphenolic components which are containing curcuminoids. Major curcuminoids in turmeric are curcumin, demethoxycurcumin, bisdemethoxycurcumin, and cyclocurcumin. The spice contains 2 to 5% of curcumin, which is the most active component of turmeric. The chemical name of curcumin is 1,7-bis (4-hydroxy-3-methoxyphenyl) -1,6-heptadiene-3,5-dione and its chemical formula is $C_{21}H_{20}O_6$ and also called diferuloylmethane. Although curcumin is a lipophilic compound which is insoluble in water and ether at acidic and neutral pH, it is a phenolic compound soluble in organic solvents such as acetone, ethanol, chloroform, and dimethylsulfoxide. It is sensitive to light so it is stated that biological samples containing curcumin should be protected from light. Curcumin has long been used as a drug in traditional medicine, which has a protective and preventive effect against various diseases such as cancer, neurological, metabolic, lung, and liver. The studies mostly focus on anti-oxidant and anti-cancer properties of curcumin. Also, curcumin is effective in the treatment of wound healing, psoriasis, chronic anterior uveitis, sepsis and asthma, and in reducing the severity of premenstrual syndrome symptoms and gall bladder contraction. Most studies on curcumin were in-vitro and animal studies; clinical studies have shown that curcumin is safety, tolerability, and non-toxicity, these results have been recorded on a small number of patients and its efficacy in humans is currently questionable.

Acknowledgements: This study aims to review the chemical structure of curcumin and its effects on human health.

OP-61 Targeting the cancer epigenome by nutraceuticals: the epigenetic modulation capacity of fatty acids isolated from Sea buckthorn oil

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Nutriepigenomics is an emerging field of research that is focussed on the interaction between nutrition and the epigenome. The human epigenome exhibit plasticity throughout the life time, albeit to varying degrees, and can be modified by environmental factors including diet. Therefore the nutritional interventions or dietary choices may modify the epigenome of individuals. One major implication of the interaction between the diet and the epigenome is that it may be possible to reverse the epigenetic alterations that are associated with increased disease risk, like malignancy, by nutritional or lifestyle interventions. The induction and maintenance of epigenetic marks, in particular DNA methylation and covalent modifications of histones, are strongly associated with metabolic pathways and hence the dietary intakes of nutraceuticals involved in these pathways might affect the epigenetic regulation of genes. Dietary fatty acids can alter cell function through membrane fluidity, by providing substrates for synthesis of second messengers and by activation or repression of transcription factors. Recent studies show that many of the biological activities of fatty acids underline their capacity to target the epigenome and to modulate epigenetic processes. Here we present our preliminary data of *in vitro* studying the biological activity of fatty acids fractions isolated from the *Sea buckthorn* oil on tumor and normal fibroblast cell lines. Cytotoxicity profile of purified fatty acids on cells was assessed by end-point assays (MTS, LDH). The anti-proliferative effect of fatty acid treatment on tumor fibroblast cell line was real-time monitored by measuring the cellular impedance (xcellingence platform). DNA methylation level and DNA methyltransferases (DNMTs) activity was quantified by ELISA. The pattern of global DNA methylation and DNMTs expression levels were measured by immunofluorescence and qRT-PCR was used for DNMTs mRNA quantification. The unsaturated fatty acids fractions (alpha linolenic acid and linoleic) treatment on tumor cells decreased DNA methylation level correlated with decreased DNMTs expression and enzymatic activity. No significant modifications were observed on normal fibroblast cells. By understanding the nature of epigenetic modifications induced by every fatty acid of *Sea buckthorn* oil we can evaluate the chemoprevention potential of these nutraceuticals.

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OP-62 *In vitro* Antioxidant and Antidiabetic Potential of *Strychnos madagascariensis* ripe fruit.

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Diabetes remains a global cause of several disease complications and death despite the availability of pharmacotherapeutic drugs. This research aimed at investigating the *in vitro* antioxidant and antidiabetic efficacy of *Strychnos madagascariensis* ripe fruit, an indigenous medicinal plant used by the people living in the Northern coast region of Kwazulu Natal, South Africa to curb diabetes and hypertension. The plant samples were screened for their phytochemical components. Different crude extracts were prepared by maceration using methanol, hexane, ethyl acetate and water. The antioxidant potential of crude extracts was investigated using ABTS and DPPH radicals. Furthermore, the *in vitro* antidiabetic activity of the plant extracts was evaluated against some carbohydrates (α-amylase and α-glucosidase) and lipids (pancreatic lipase) digestive enzymes. The phytochemical screening revealed that the seed coat and fruit pulp contain terpenoids, alkaloids and cardiac glycosides. The crude extracts exhibited different degree of ABTS and DPPH radical scavenging activity. The aqueous and methanolic extract of the seed coat and fruit pulp possessed the highest scavenging ability on ABTS and DPPH respectively when compared to the rest of the extracts. In addition, the crude extracts exhibited antidiabetic property by inhibiting amylase and alpha-glucosidase activities in a concentration dependent fashion with the methanolic extract showing the highest efficacy. Similarly, the crude extracts also reduced the activity of pancreatic lipase with the methanolic extract displaying the most efficacy. In conclusion, this plant can be used as a scaffold for treating diabetes however, the *in vivo* antidiabetic mechanism and safety profile study is recommended for future studies.

OP-63 *In-vitro* anti-mycobacterial assays of a medicinal plant - *Justicia adhatoda* on *Mycobacterium bovis.*

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Tuberculosis (TB) has always been a major health concern as it's treatment includes a range of drug regimes, for 6 months at least. This rigorous treatment causes heavy side effects and also leads to bacterial resistance (MDR, XDR and TDR). After Delamanid and Bedaquiline, for which patients developed resistance long ago, no new regime has been introduced for TB therapy. There is an urgent need for a new drug/therapy for TB treatment. *Justicia adhatoda* is an Indian medicinal plant, which is used frequently in Ayurveda for respiratory ailments. Some studies have reported its anti-mycobacterial activity. Apart from Vasicine, which is an alkaloid, no other important bioactive compound has been discovered yet. Hence, no definite medicine has been derived from the plant. In this study, a brief evaluation of the plant leaf extract has been done on *Mycobacterium bovis* (BCG), which is a known model organism for TB. *In-vitro* anti-mycobacterial activity of *J. adhatoda* plant leaf extracts on *M. bovis* was assessed. Further fractionation of the best extract was done via Prep-TLC and HPLC. Fractions were further studied for anti-mycobacterial activity and cytotoxic effect on THP-1 and A549 cell lines. Characterization of these fractions, via NMR and MALDI-TOF MS, is under process. Ethanolic extract of *J. adhatoda* leaf showed the best activity, hence further evaluated by isolating the most abundant phytochemical, *i.e*, alkaloids present in it. Various fractions were obtained, which were compared with the standard alkaloid Vasicine as well as the first line drugs of TB; Streptomycin and Isoniazide. Various fractions were found to be very active against *M. bovis* and had very low cytotoxic effect for THP-1 and A549 cell lines. Out of all, three of them have been presented in the article. *Justicia adhatoda* shows promise for TB treatment. The isolated fractions were found to be very active. Some of them showed better results than the first line drugs. The fractions are being pursued for Nutrient starved *M. bovis*, Synergistic effect with first line drugs, and also for Intracellular phage infection. Study will be further taken for In-silico analysis after characterization and if required, animal testing will be done.

OP-64 Phytochemical screening, antimicrobial activity and cytotoxicity of *Platycarpha glomerata* and *Tulbaghia alliacea* used in the treatment of lymphatic filariasis in the Eastern Cape, South Africa

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Lymphatic filariasis is a disease caused by filarial nematodes *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*, spread by vector mosquito species of *Culex* and *Aedes*. Treating lymphatic filariasis remains a huge problem in South Africa as some South African public hospitals turn away patients due to lack of treatment. This study was aimed at screening the collected plants for the presence of phytochemicals, antimicrobial properties and cytotoxicity assays. Medicinal plants, *Platycarpha glomerata* and *Tulbaghia alliacea* were collected from the Intsika Yethu and Nkonkobe municipal areas in the Eastern Cape Province of South Africa. Extracts from the dried plant material were screened for the presence of phytochemicals, antimicrobial and cytotoxic properties towards mammalian cell lines. *P. glomerata* was found to possess tannins, saponins, flavonoids, terpenoids as well as cardiac glycosides while *T. alliacea* contained tannins, saponins, flavonoids, terpenoids, cardiac glycosides and alkaloids. The organic solvent extracts from the two plants showed antibacterial activity against *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus pumilus* and *Staphylococcus aureus* with minimum inhibitory concentration (MIC) values ranging between 0.098 mg/ml and 0.78 mg/ml. The organic solvents of *T. alliacea* had the highest antifungal activity against *Candida albicans* with MIC values between 0.098 mg/ml and 1.563 mg/ml. The methanol and acetone extracts of *T. alliacea* and the water extracts of *P. glomerata* were the most effective against *Mycobacterium tuberculosis* with MIC values ranging from 0.391–0.78 mg/ml. The ethanol extracts of both plants were more cytotoxic than the water and acetone extracts of the respective plants in both human intestinal cells (HuTu cell line) and the rat hepatoma cells (H4IIE-*luc*). Cell viability declined with increase in exposure time for all solvents, both plants, and both cell lines. The plants *P. glomerata* and *T. alliacea* have been identified as plants that need extensive study for the purpose of developing novel drugs for the treatment of lymphatic filariasis and the related ailments.

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OP-65 Phytochemical analysis and antioxidant properties from plants used in the treatment of non-filarial elephantiasis in KwaZulu-Natal, South Africa.

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Non-filarial elephantiasis is an advanced form of lymphedema. It is caused by complications from injury, infections or cancer. The disease is present in South Africa, however, it is not well documented, patients have been dismissed from hospitals because of the inexistence of treatment. In the province of KwaZulu-Natal (KZN) plants have been used by healers to treat the disease. To investigate the phytochemical compounds and antioxidant properties of the traditional medicinal plants used against elephantiasis and its ailments in KZN. Five plants were collected with the assistance of traditional healers and tested for the presence of phytochemicals and antioxidant properties using standard techniques. *Qualitative phytochemical analysis:* Steroids, flavonoids, tannins and cardiac glycosides were present in all the plant extracts. All the extracts tested negatives for alkaloids. Saponins were present in most of the extracts except in the ethanol and the acetone extracts of *Chenopodium ambrosioides*, and in the acetone extract of *Senecio speciosus*. Anthraquinones were only present in the ethanol extract of *Cheilanthes sp.* Terpenoids were present in all extracts except in the 50% acetone extracts of *Cheilanthes sp., Pentanisia prunelloides,* and *S. speciosus.* Extracts from *Cheilanthes sp.* and *S. speciosus* displayed the highest total tannin content. *C. ambrosioides* displayed the highest flavonoid content (78.49 and 82.37 mg/g quercetin equivalent), and the extract from *H. geniculata* displayed the highest total phenol content (7.13 mg/g gallic acid equivalent). Among the 10 extracts tested, the ethanol extract of *C. ambrosioides,* with the lowest IC_{50} value (54.65 µg/ml), was the most potent and effective inhibitor of DPPH radicals. Our findings suggest that those plants are likely to give an alternative to patients suffering from elephantiasis and from oxidative stress caused by the patient immune response.

OP-66 Towards commercial standardisation of a chemo-genotype of the traditional medicine *Dodonaea viscosa var. angustifolia* (Sapindaceae) – a genomic-metabolomic study of wild and cultivated plants.

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In the Western Cape of South Africa, *Dodonaea viscosa var. angustifolia* (L.f.) Benth. is medicinally used as a traditional Khoi and Cape Dutch remedy to treat influenza and inflammation. Pharmacological studies demonstrate that *D. viscosa* exhibits anti-HIV-1 and anti-cancer bioactivity. *D. viscosa var. angustifolia* contains a suite of secondary metabolites, mainly, flavonoids and di- and triterpenoids which contribute to the plant's medicinal value. When considering the consumption of medicinal plants such as *D. viscosa*, it becomes imperative to identify underlying biosynthetic pathways of the phytochemicals and their regulation as this may establish chemotypical variation across different growth landscapes. This information can be incorporated into standardisation and quality control protocols for commercial purposes. The aim of this study was to, firstly, assess the chemical differences of *D. viscosa var. angustifolia* plants from different localities across the Western Cape (Stellenbosch, Cederberg, and De Hoop) and to identify chemical signatures that were important as features to resolve biogeographical relationships. Secondly, different chemotypes were cultivated in a common garden experiment prior to metabolomic profiling. The final aim of this study was to correlate metabolomic profiles to genetic data obtained using microsatellite analysis across populations. Both wild and cultivated *D. viscosa* plant extracts were interrogated using a non-targeted metabolomics approach, with liquid chromatography mass spectrometry as the metabolite fingerprinting tool. A total of 24 chemicals were tentatively identified of which 15 represented flavonoids and four were terpenes. Some of the main compounds found in *D. viscosa var. angustifolia* samples, included pinocembrin, hautriwaic acid and santin. Principal component analysis indicated that both wild and cultivated plants from the Cederberg are chemically separated from De Hoop and Stellenbosch, containing significantly higher levels of pinocembrin than the other populations ($p < 0.05$). Cultivated plants from the Cederberg had a significantly lower photosynthesis output compared to Stellenbosch ($p = 0.0068$) and De Hoop ($p = 0.017$) as well as lower stomatal water use efficiency than De Hoop ($p = 0.0093$). Microsatellite primer sequences specific to *D. viscosa* were used for PCR analysis. The amplified loci were genotyped and genetic variation between plants from all three localities was assessed. The microsatellite data showed genetic differentiation, suggesting a break in gene flow between Cederberg and the other populations, it would be recommended however to do a follow up study using more markers. Over all our dataset suggests that these plants are chemotypes that are possibly genetically distinct.

OP-67 The ameliorative effect of the methanolic extract of *Inula glomerata* and *Salacia krausii* on erectile dysfunction

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Erectile dysfunction (ED) is a common but multifaceted sexual disorder suffered by men with adverse effect on their self-esteem and quality of life. Globally, the prevalence of ED has markedly increased as revealed by epidemiological studies. The use of conventional drugs has been reported to have side effects in addition to being unaffordable especially to rural dwellers. Traditional healers use extracts of medicinal plants to manage ED and the leaves of *Inula glomerata* (Ig) and roots of *Salacia krausii* (Sk) are among those used by traditional healers to reverse impotence. The study aimed at determining the erectile dysfunction ameliorative effect of the methanolic crude extracts of Ig and Sk. The plant materials were screened for their phytochemical's composition. The crude extract was prepared by maceration using methanol. The *in vitro* antioxidant efficacy of the crude extracts was tested against DPPH and ABTS. Furthermore, evaluation of the *in-vivo* antioxidant enhancing capacity, inhibitory propensities on arginase, acetylcholinesterase and angiotensin converting enzyme were done using a rat model. The cytotoxicity of the crude extracts was also determined. The phytochemical screening shows that they possess tannins, flavonoids, terpenoids and alkaloids. The crude extracts were able to (at varying degree of efficiency) scavenge ABTS and DPPH radicals with Sk (IC_{50} 0.00658 mg/ml) possessing a better scavenging potency than ascorbic acid (IC_{50} 0.0127 mg/ml). The results indicated that the plants were able to boost catalase, SOD activities and the level of glutathione. The plants also exhibited the ability to inhibit arginase and acetylcholinesterase when compared to the untreated. Similarly, at low concentrations the plants' extracts were able to increase the level of testosterone while SK enhanced the activity of angiotensin (II) converting enzymes at higher concentration. In conclusion, both plants have the potential to correct erectile dysfunction by inhibiting arginase and acetylcholinesterase as well as boost libido. Nonetheless, the increase in uric acid and level of the liver enzyme biomarkers (ALT and AST) indicate that the plants' extracts could be toxic to the kidney and liver respectively.

OP-68 Middle Eastern Medicine in the Middle Kingdom: Myrrh in the *Bencao gangmu*

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Myrrh *(Commiphora spp./mo yao*) was transferred along the Silk Road from the Arabic peninsula into China from as early as the 4th century. Its gradual incorporation into traditional Chinese Medicine practices spanned centuries and made its way into historical records, formularies, and *materia medica*. Arguably the most well known Chinese *materia medica* is the *Bencao gangmu* (*Systematic Materia Medica*) by Li Shizhen *(1518-1593 CE)* from the Ming Dynasty *(1368-1644 CE*). A close examination of the entry on myrrh in the *Bencao gangmu* can shed light on how myrrh carried medical knowledge along the Silk Road and that eventually became part of the standard Chinese medical system.

OP-69 Assessment of Cannabis and its Components by the World Health Organization: Overview of the Implications for Traditional and Complementary Medicine and Research

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The World Health Organization (WHO) is the leading standardization entity and public health referent globally in relation with Traditional and Complementary Medicines (TCM). Beside this role, WHO is also directly mandated by the International Drug Control Conventions (IDCC) as the provider of official scientific and independent assessments of drugs, including herbal materials, for the purpose of scheduling (i.e., determining the extent of use-related harms and the scope of therapeutic properties of psychoactive plants, fungi, products or substances in order to categorize and hierarchically list them) within the IDCC. Different categories of products and substances derived from *Cannabis sativa* L. (*C.*) are currently scheduled within the IDCC, although having never been assessed by the WHO nor its preceding international organizations with similar mandate. For this reason, the WHO has been undertaking since 2016 a process of review and assessment of these *C.*-related products and substances, recommending important changes in their level and status of scheduling within the IDCC. We comprehensively followed the WHO assessment processes since its inception and reviewed the contents submitted to its independent Expert Committee in charge of the assessment at all stages. We analysed the outcome, and estimated the impacts and consequences of the changes in IDCC scheduling status of *C.*-related products and substances for the medical and research fields. We also analysed the consequences of the linked reintegration of *C.* within the scope of TCM and in the stream of work of the WHO's relevant departments in charge of TCM and other herbal health products. WHO's new official position acknowledges that *C.* is legitimate in medicine, considers herbal formulations less liable to abuse than isolated compounds, encourages governments to provide access to a variety of formulations while leaving them flexibility in the choice of products and policies to implement. It also shows a needed renewed conceptual address of *C.* and other potentially harmful scheduled herbal materials, that include methodologies and practical approaches from the field of Medicinal and Aromatic Plant studies. The presentation will relate the history of that assessment, its main findings, and present our own research conclusions explaining how the international policy landscape surrounding *C.* in medicine has evolved, while assessing the impact on the involvement of other academic disciplines, and policy frameworks needed to ensure a safe and compliant access to phytotherapeutical *C.*

OP-70 Harnessing Frankincense Active Components: Gold Rush in Medicinal Chemistry and Attempts at Unravelling their Biosynthesis

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Frankincense has been used since ancient times for cultural, religious, medicinal and economical purposes. *Boswellia* (*Burseraceae* family) comprises 20 species, widely distributed across African, Arabian and Indian continents. Frankincense resin is produced constitutively or *de novo* via induced in response to tapping the tree outer bark. The diverse terpene content of the resins has attracted a wide interest from biologists, chemists, pharmacologists and medicinal chemists due to their fascinating structural diversity, interesting structures and exceptional biological activities. More than 300 volatile constituents in the essential oils of *Boswellia* and more than 100 diterpenes and triterpenes have been reported from this genus. Numerous studies on bio-guided isolation, synthetic modifications and structure-activity relationship of active compounds from frankincense were extended to various derivatives from the 20 known *Boswellia* species and a "frankincense gold rush" was on. More than 600 publications have been published on frankincense demonstrating its medicinal importance and reviving its historical role in treating many chronic diseases. In spite of the high momentum in frankincense medicinal activities, the biosynthesis of its active terpenic acids remained enigma and it is of utmost importance to understand their biosynthetic pathways.

OP-71 Sustainable Production of myrrh in pharmaceutical quality - A medium-sized German pharmaceutical company connects with Ethiopian myrrh collectors

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The resin of the true myrrh tree (*Commiphora myrrha*) is a highly demanded resource. It has not only been used as incense for thousands of years but also serves as a key raw material for the production of modern cosmetics and pharmaceutical products. The foundational materials of pharmaceutical products require very high quality standards with respect to product purity, active ingredient content and microbial load. Unfortunately, during the last decade the availability of myrrh matching the required quality standards has decreased steadily. In order to tackle this issue, the medium-sized company Repha, which distributes the myrrh-containing medicament Myrrhinil-Intest®, initiated a develoPPP project in cooperation with the Biodiversity and Forestry Program of German Corporation for International Cooperation (GIZ). The project is named "Sustainable Production of myrrh in pharmaceutical quality." The main objective of this project is to connect pastoralist myrrh collectors from the Somali region of Ethiopia with the German pharmaceutical company via direct trade relations. With this approach, the company seeks to influence the quality of myrrh acquired and aims to secure its future myrrh supply by sustainable forest management, while the myrrh collectors will benefit from both equitable long-term trade relations and secure sales. This lecture provides a short overview of the background and conception of this project and outlines the developments, from the project implementation approximately 3 years ago until today. At the beginning, a baseline study analyzed the local myrrh value chain and identified suitable project implementation sites on the availability basis of natural resources. Further into the project, myrrh collectors were organized in registered cooperatives. Meanwhile, processing facilities were constructed, and both local experts and Repha offered teachings on practical works and Good Collection Practices, respectively. Current Nagoya legislation restrains the progression of the project and has turned out to be a serious obstacle. Nonetheless, this project has the potential to act as a role model for the sustainable sourcing of diverse forestry products.

OP-72 A Frankincense Resin Grading System

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The Frankincense Store's grading system is one of the most unique methods of sorting and classifying the Frankincense resins. The grading involves separating every piece of resin and removing all the powder from the Frankincense by hand. Shehbaz grades 1 sack of Frankincense which is 40kg in one 8 hour day. The dedication to the grading has allowed us to discover a deeper meaning behind the many varieties of Frankincense. Each of the grades we have discovered of the one species namely Boswellia sacra has a different smell, feeling and also a frequency which can be measured. As Frankincense has been used more so for its many spiritual and healing benefits, when one works deeper with the individual pieces then one gets to delve deeper into the world of Frankincense. We have discovered about 11 grades from the Boswellia species and there are a few more too. There is a method and timing to use each of the grades. The burning of Frankincense can have a powerful effect on the mind. Working with our energetic field Frankincense has the ability to clear old energetic attachments to the body and soul and as well as enhance the minds clarity and thought process. In this demonstration Shehbaz will discuss what each of the Frankincense resins has the ability to do, whilst burning each grade o you can experience the smell and feeling each. He will also discuss how to handle and manage Frankincense and most importantly how it must be treated with intent.

OP-73 Chloroplast genomics of Frankincense (*Boswellia sacra*) and Myrrh (*Commiphora gileadensis* and *C. foliacea*)

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Frankincense and myrrh are famous for fragrant producing resins that are obtained through tapping the tree's bark. The solidified resin possesses strong cultural, economic, religious and medicinal importance since ancient histories. However, there are least understanding on the genomics of both the tree kinds. We have recently sequence, annotated and elucidated the gene content, structure, and phylogenetic disposition of a species *Boswellia* (sacra) and two species of Commiphora (*gileadensis* and *foliacea*) for their plastid (cp) genomes. The results showed that *B. sacra*, a keystone species in Oman, revealed a circular genome of 160,543 bp size with 37.61% GC content. The cp genome is a typical quadripartite chloroplast structure with inverted repeats (IRs 26,763 bp) separated by small single copy (SSC; 18,962 bp) and large single copy (LSC; 88,055 bp) regions and the presence of 114 unique genes with 83 protein-coding regions. Similarly, in case of results revealed that the cp genome sizes of *C. gileadensis* and *C. foliacea*, are 160,268 and 160,249 bp, respectively, with classic quadripartite structures that comprises of inverted repeat's pair. Comparison of these complete cp genomes with *C. wightii and B. sacra* revealed significant sequence resemblance and comparatively highest deviation in intergenic spacers. The phylo-genomic comparison showed that *C. gileadensis* and *C. foliacea* form a single clade with previously reported *C. wightii* and *B. sacra* from family *Burseraceae*. The results of this study reported for the first time the cp genomics of species from *Commiphora* and *Boswellia*, which could be helpful in understanding genetic diversity, taxanomy and phylogeny of these species. Further research is underway on both the genus to understand the whole genome sequencing, polyploidization, chromosomal structure, gene organization and content, and transcriptome characterizations to understand the resin synthesis mechanisms and genes involved in resin synthesis.

OP-74 *Boswellia sacra*

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It is the well internationally known economical tree dominating Dhofar region / S. of Oman, since the ancient times, of the most famous great civilizations of the World. These trees grow in fairly restricted habitat,in the arid zone behind Dhofar mountains ,and beyond the reach of the Monsoon rains , but within the Scope of the cool Foggy winds which blow steadily from the south west to the north east during this season (21st. June to 21st. September every year), although it is found in some humid zones as the coastal plains of (Jofa , Raysot , Fazaeh). The current condition of Frankincense lands require the efforts of Miscellaneous national Institutions to advise and participate in the conservation of this sector. The Ministry of Agric. & Fish. Started some basic and essential programs & applications regarding (Nursery ,,, seedling production & distribution to local people, farmers and other agencies freely to encourage the planting Awareness among the local communities, as these are the main target groups who actually use these lands. Also there are some small scale experimental applications & some plantation programs in protected sites (+ 20,000 Fr. Trees planted in different sites, some of these Trees are big enough &ready for tapping). This is a Brief of the presentation which will tackle some other performances with elaborations .

OP-75 Frankincense Essential Oils and Sustainability; Lessons Learned from Somaliland/Somalia, Ethiopia and Burkina Faso

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To conserve major Boswellia species popular for essential oils, research and ecological supply chain analysis must be done in coordination for several species in the genus at the same time. Using a trans-disciplinary approach is also necessary to understand the complex factors that either lead to decline of species or the sustainable management. In depth field work efforts in Somaliland/Somalia, Ethiopia and Burkina Faso, includes bringing together critically important traditional knowledge, stakeholder analysis, semi-structured interviews, forest surveys, GPS tagging/mapping, botanical species identification, individual tree resin sampling, identification of chemotypes, yields and factors that effect resin quality. Overarching themes from several recent publications and ongoing research will be discussed on *Boswellia Frereana, carteri* and occulta, *Boswellia papyrifera*, and *Boswellia dalzelli*. Where science informs we are compelled to act, thus the projects to conserve Boswellia, in places it already grows, will be highlighted including; training in country tree monitors/researchers, best practices for sustainable tapping and production of high quality resin, nurseries/ cultivation trials, community education for livelihood empowerment and the importance of partnership.

OP-76 Introduction and renew the production of the Ancient Apharsemon (*Commiphora gileadensis*) in the Dead Sea basin

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The Ancient Apharsemon, known also as the Judean Balsam, grew in the Dead sea basin for fragrance and medicinal uses, but has been extinct in this area for many centuries. Its resin was very famous and expensive. Today the Apharsemon identified as *Commiphora gileadensis*. Germplasm of this crop re-introduced to this area and currently it under agro -technical development and investigation. The pilot sites of the modern production are in Almog and the oasis Ein Gedi. The volatiles composition was recently analyzed. The bio-activity of the essential oil and the resin have investigated, mainly against cancer and preventing damages caused by UV radiation. The pilot orchard, the chemical and bioactivity results will be present and discussed.

OP-77 The discovery of a new species of frankincense in Somaliland

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Methoxyalkanes, extremely rare as natural products, have been detected in commercial *Boswellia carteri* (syn. *B. sacra*) essential oils in recent years. Further investigation has uncovered a previously undescribed species of *Boswellia* growing in the Sanaag region of Somaliland; it was named *Boswellia occulta*, and resin samples taken directly from individual trees showed high levels of alkyl methyl ethers as well as the diterpene alcohol serratol and sesquiterpene alcohol 4,10-di-*epi*-guaiol. This chemistry is dramatically different from other *Boswellia*, which are typically dominated by terpenes or aliphatic esters; methoxyalkanes have previously only been described from arthropods, microbes, and a single species of peony. Analysis of commercial samples of essential oil sold as pure *Boswellia carteri* found the majority to be contaminated with alkyl methyl ethers, indicating that the resin distilled was a mixture of *B. carteri* and *B. occulta*. Additionally, the majority of certified organic samples contained *B. occulta* essential oil, showing that organic certification has in this case been ineffective at preventing biological contamination of a wild-harvested species. This also suggests that organic certification alone is insufficient to guarantee sustainable harvesting of a wild species, as it is unable to distinguish source trees. However, this discovery also provides exciting new source material for fragrance, aromatherapy, and natural medicine.

OP-78 Exploring the impact of 'Frankincense' and 'Myrrh' as genus trade names

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The aim of this session is to stimulate an open discussion on the impact of using the terms Frankincense and Myrrh as overarching trade names for Boswellia and Commiphora resins and essential oils respectively. Frankincense is commonly accepted as a terms for all 20 Boswellia species of resin and oil, despite their quite different aromatic, chemical and medicinal characteristics. Some large scale essential oil companies currently blend 3 or 4 main commercial species into a 'standard Frankincense blend'. Other smaller organisations sell and promote at least 3 to 4 species-specific resins and oils. Does this avail these companies of greater transparent and ethical sourcing? Does it also limit their commercial scope? There is also the case of 'Frankincense like Commiphoras' such as the work done on *C. confusa*. Traditionally Myrrh was sourced from *Commiphora myrrha*. Nevertheless *Commiphora wightii* is called Mulmul or ' Indian myrrh' in India and Pakistan, *Commiphora wildii* "Namibian Myrrh', *C. guidotti* can be called 'Sweet myrrh' or opoponax, and while *C. holtziana* can be called 'Kenyan myrrh' or hagar. What is the impact for consumers? In areas of mixed forests, where different Boswellia and Commiphora species grow together, local and scientific naming are seldom aligned. 'Hagar' in local communities in Ethiopia can cover a range of Commiphora species, just as 'mirafur' can cover *Boswellia rivae* and/or a mix of several Commiphora species, often changing from one local area and language to another. Intense hands on community involvement is needed to source pure and clean species- specific resins and oils. Does species specific harvesting yield greater returns for the communities? Are enough customers interested in species-specific traceable certified sourcing and can it be funded by a higher buying and selling price? The discussion will openly explore what effects these different realities and approaches have on the sourcing communities, harvesting, traceability, sustainability, pricing, and consumer understanding of the resins and essential oils from different species.

OP-79 Pursuit of an Integrated Ethical and Sustainable Sourcing Program for Frankincense and Myrrh resins: Successes, Failures/Lessons Learned, and Recommendations for Improvement in Somalia, Ethiopia, and Oman

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doTERRA International is a U.S.-based integrative health and wellness company and now the world's largest aromatherapy and essential oils company, sourcing significant levels of essential oils globally including Frankincense and Myrrh. During the last 6+ years, doTERRA has been integrating an ethical and sustainable sourcing program known as Co-Impact Sourcing™ which aims to create shared value for all stakeholders in the supply chain by being at the source and intentionally implementing environmental stewardship and/or poverty solutions. To measure the impact of Co-Impact Sourcing initiatives, dōTERRA gathers data annually from each supplier. Data is then aggregated and compared to Key Performance Indicators (KPIs) that measure progress toward accomplishing the program's objectives. Examples from its Co-Impact Sourcing program for Frankincense and Myrrh sourcing will be discussed and appraised. doTERRA is committed to support research and sustainability initiatives and enhance the harvesters' knowledge of tree health and longevity. The company is also developing nurseries for propagation to help ensure the long-term viability and sustainability of the *Boswellia* species, while also implementing tree education and training to help mitigate overharvesting and to promote a healthy *Boswellia* biome. This presentation will review and discuss the successes, failures/lessons learned, and recommendations for improvement from these efforts, drawing upon experience in Somalia, Ethiopia and Oman.

OP-80 Chitosan and N, N, N-trimethyl chitosan nanoparticle encapsulation of *Ocimum gratissimum* essential oils: optimized synthesis and evaluation of its in vitro release kinetic pattern and bioactivity

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The use of polymeric materials for the encapsulation of essential oils (EOs) from plants and further reduction of the polymeric matrix into their Nano sizes have shown wide applications both in the food and pharmaceutical industry. This study reported a novel approach for the synthesis of Ocimum gratissimum essential oil-loaded chitosan (CS) and N, N, N-trimethyl chitosan (TMC) nanoparticles as well as evaluation of their physiochemical and bioactive properties. Chemical qualitative analysis of *Ocimum gratissimum* methanolic extract (OG-MeOH) and EOs was evinced with GC-MS. Total phenolic content (TPC) of OGEO and OG-MeOH was determined using the Folin-Ciocalteu method. Different methods and optimized techniques were adopted for the successful synthesis of OGEO-loaded Chitosan Nanoparticles (OGEO-CSNPs) and OGEO-loaded Trimethyl Chitosan Nanoparticle (OGEO-TMCNPs). The synthesized nanoparticle was characterized with UV-Vis, FTIR and SEM. *In vitro* drug release kinetic pattern was ascertained by membrane dialysis, while antioxidant activity was determined by the DPPH free radical scavenging method. The disc diffusion method was used for antibacterial activity evaluation, while MTT and a trypan blue dye exclusion assay were used to assess cytotoxic activity on MDA-MB-231 breast cancer cells. GC-MS results showed newly found compounds not previously reported for OGEO and OG-MeOH. *In vitro*-release kinetics of OGEO release revealed higher ($P < 0.05$) OGEO release efficiency from OGEO-TMCNPs over long period of time compared to the OGEO-CSNPs. The antioxidant activity assay showed that, OGEO-CSNPs and OGEO-TMCNPs never reached a steady state after 75 h. OGEO-TMCNPs exhibited antibacterial activity at lower concentration notably 40 mg mL^{-1} for E. coli, 20 mg mL^{-1} for B. cereus, 20 mg mL^{-1} for S. aureus and 80 mg mL^{-1} for S. typhimurium. *In vitro* cytotoxicity on MDA-MB-231 breast cancer cell lines revealed that OGEO-TMCNPs exhibited higher toxicity ($P < 0.05$). The physiochemical properties of OGEO-TMCNPs and OGEO-CSNPs have shown more promising application in pharmaceutical and food industries.

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OP-81 Comparative studies on phytochemical composition, anti-oxidant and anti-microbial activities of *Albizia lebbeck* stem bark polar and non-polar extracts

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Alibizia lebbeck is otherwise known as 'flea' or 'siris' tree and is *a valuable plant that have medicinal properties and it's cultivated in different part of the world mainly subtropical and tropical region. The present study compared the antioxidant, antimicrobial potential of A. lebbeck extracts and report the extract with best activity.* Fresh stem barks of *A. lebbeck* were obtained from Tabuli town of Gaya Local Government Area, Kano State, Nigeria, dried in shade at a temperature range between 25-30 °C and pulverized into coarse powder using clean and sterilized mortar and pestle. Methanolic (ALME), Ethanolic (ALEE), Aqueous (ALAE), Ethyl acetate (ALEAE) and hexanolic extracts (ALHE) were prepared and antioxidant and antimicrobial activity were evaluated using standard methods respectively. Anti-oxidant potential of the extracts were ascertained by 2,2-diphenyl-1-picryl hydrazyl (DPPH) and hydrogen peroxide (HP) free radical scavenging activity. Anti-microbial activity of the extracts were determined using the methods of Semenah *et al.* with slight modification. Total phenolic and total flavonoid contents of the extract were also determined using the method of Bagchi and Singleton respectively. Anti-oxidant activity carried out using DPPH and HP radical scavenging assay revealed best activity with lowest IC_{50} of 121.95 µg/mL and 82.37 µg/mL with ALME. The *A. lebbeck* extracts anti-oxidant activity were found to be reduced in the following order; ALME > ALEE > ALAE > ALAEE > ALHE. Best anti-oxidant activity from our studies was shown by ALME. Antiomicrobial activity of various *A. lebbeck* extracts revealed strong activity against *E. coli, B. cereus, S. aureus, K. pneumonia and S. typhi.* ALME revealed the highest anti-microbial activity against all the tested organism followed by ALEAE. Additionally, *A. lebbeck* extract showed a net MIC and MBC of 12.5 µg/mL and 25 µg/mL respectively. ALME contain the highest TPC amount upto 8177.88 GAE µg/g, followed by ALEE. ALAE and ALEAE have moderate TPC of 3989.18 and 3396.63 GAE µg/g compared to lowest amount revealed by ALHE. Similarly, ALEAE have the highest TFC, followed by ALME and ALEE. ALAE have moderate TFC of 1680.56 QE µg/g compared to lowest amount showed ALHE. TPC and TFC revealed from the extracts might be responsible for antioxidant an antimicrobial activity of the plant, and it could be a potential antibiotics drug candidate.

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OP-82 Increasement of Paclitaxel from Resistant Plant Cell Lines

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Taxus baccata is a very important tree that comprise paclitaxel (Taxol) which is one of the diterpene alkaloids. We chose PFP (p- Fluorophenylalanine) as a analog of paclitaxel and, by optimizing the concentration of the PFP, rapid accumulation of paclitaxel in a plant cell culture is aimed. In accordance with this purpose, a plating system for cell suspensions of *Taxus baccata* was developed using feeder cells. Employing the plating system, mutant resistance to PFP was isolated in 3 weeks.

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OP-83 Optimization and Characterization of Propolis Loaded PEGDMA Hydrogels

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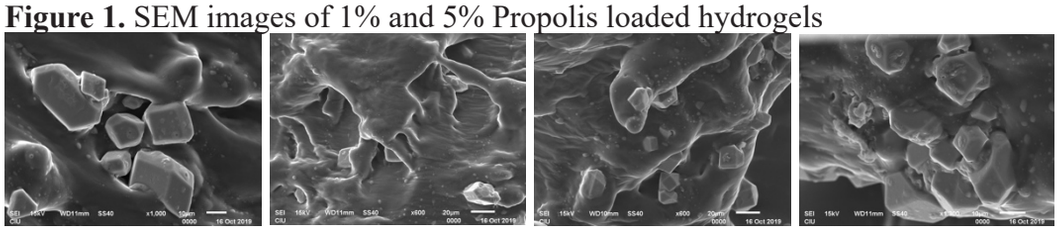
Polymers, composed of two or more monomers has a network chains which contains a huge amount of water in their system. Polymeric hydrogels have a porous surface caused by their hydrophilic behavior procure almost the same tissue with natural (human) tissue. Hydrogels as a drug carrying vehicle, is the center of attraction in the biomaterials field (Zhang et al., 2017). The transport of the active drug to the targeted area has become one of the major problems, for this reason the hydrogel applications are the most popular and the interesting application in drug delivery system. The propolis (*Apis Mellifera L.*) has been used as a drug because of its anti-inflammatory, anti-cancer and anti-microbial effects. In recent studies, the researchers have been focused on the antioxidant activity of the propolis (*in vitro*) (Cauich-Kumul et al., 2019). The biological properties of propolis known as an antimicrobial, anticancer, anti-inflammatory, antiviral, and anti-parasitic properties (De Lima et al., 2016). It is aimed to find the perfect version of hydrogels and load propolis. It is expected to focus on anti-cancer effect of propolis extract on cancer cells specially brain and lung cancer in the future analysis. In this study, synthetic polymer called PEGDMA used as polymer solution and Irgacure 2959 used as a photo-initiator in the system. The system stabilized as 20% of polymer and 0.2% of photo-initiator in 5mL of PBS solution and called as “Standard Method Hydrogels”. The hydrogel samples exposed to UV light in different time periods to crosslink. Three different combination of hydrogels compared and analyzed by FTIR, SEM and Swelling analysis. The characterization of propolis samples have been made by GC-MS analysis. The best swelling results have been chosen from each three combination and best propolis sample added to the system as 1% and 5% (w/w). SEM, FTIR and Swelling tests have been applied to the samples and the results discussed. The surface morphology of the Propolis loaded hydrogels represented below (Figure 1);

Figure 1. SEM images of 1% and 5% Propolis loaded hydrogels



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OP-84 Imperative system biology tool (Metabolomics) to understand the aroma and chemistry of medicinally important aromatic crops of Indian Western Himalaya

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Medicinally important aromatic crop based food, pharmaceutical, cosmeceuticals, laundry and house hold products are available over the counter at world trade market. Aromatic crops species are enriched in aroma phytochemicals and claimed to treat various disorders such as anxiety, depression, pain, inflammation and skin related problems. The detailed study to understand the aroma and chemistry within the plant tissues are need of current time. Thus, GC-MS, HPTLC and NMR based metabolomics of different aromatic crops of Western Himalaya collected at different conditions were carried out. A different class of compounds were unambiguously identified and quantified using GC-MS and 1 & 2D-NMR techniques (1H, 13C, DEPT 135, COSY, HSQC, HMBC) using relative quantification method. Moreover, HPTLC also help to identify and profile the important constituents. Concentration-dependent stacked chart, HCA, and PCA showed the differences and similarities among different samples. The chemical compounds were identified as authentication markers for respective aromatic crops. The aromatic crops contain a significant mixture of aroma molecules within time intervals. Trends of metabolites alteration, up and down regulation in plant tissues were noticed which highlights the responses of the plant at different conditions. NMR based comprehensive metabolite-information developed the chemical signature, quality control chemical markers and strategies to understand chemical diversity and biochemical synthesis in aromatic crops. Chemo information of aromatic crops will also provide an idea about the extensive utilization in the global market.

Poster Presentations

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PP-01 Phytochemical Constituents of *Origanum sipyleum* L.

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Origanum sipyleum L., belonging to the Lamiaceae family, is an endemic species in Turkey (1). It is commonly known as "Bayırçayı, Güve otu, Mor mercan (2-3).The main components of essential oil are carvacrol, thymol, γ- terpinene and p-cymene (2). In the present work, chemical composition of the essential oil (EO), methanolic extract (ME) and infusion (INF) of *O. sipyleum* were investigated. The aerial parts of *O. sipyleum* were collected in July 2018 from Muğla,Turkey. The EO was obtained by hydrodistillation using a Clevenger type apparatus for 3 h. A small amount of EO trapped in *n*-hexane was analyzed by GC/MS and GC/FID, simultaneously. The extract of ME and 5% INF of *O. sipyleum* were prepared. After evaporation of the methanol parts dry extract was used for LC-MS/MS analysis. Phenolic compound determinations were performed using a Shimadzu 20A HPLC system coupled to an Applied Biosystems 3200 Q-Trap LC- MS/MS instrument equipped with an ESI ion source was used in the negative ionization mode. Separations were performed on a ODS 150 x 4,6 mm, i.d., 3 µm particle size, octadecyl silica gel analytical column operating at 40ºC at a flow rate of 0.5 mL/min.Rosmarinic acid and 4-[[(2',5'Dihydroxybenzoyl)oxy]methyl]phenyl O-β-D-glucopyranoside were determined in the LC-MS/MS analysis. Germacrene (15.4%), β-caryophyllene (16.7%), γ-terpinene (14.0%) and caryophyllene oxide (5.5%) were determined as major components by GC/MS and GC/FID.

PP-02 The use of HPLC for determination of stability - isolation and identification of secondary metabolites from *Rumex crispus* L.

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Stability of medicinal plants is an important quality control criterion because it indicates that whether it contains sufficient amounts active compounds. According to the FDA, 95% of the composition needs to be maintained to ensure that a product or drug retains its stability (1). *Rumex* (Polygonaceae) genus has more than 800 species and are rich in active secondary metabolites (2-4). They are used in regions of Turkey for their laxative, purgative and tonic properties (5). In this study, isolation and identification of potential active compounds and the physical-chemical stability tests of *Rumex crispus* L. were carried out. The isolated compounds from roots and leaves were identified as chrysophanol (92.7 mg), physcion (55.2 mg), emodin (46,2 mg), aloe-emodin (9.5 mg), emodin-8-*O*-*β*-glucopyranoside (63 mg), emodin-6-*O*-*β*-glucopyranoside (25.9 mg), chrysophanol-8-*O*-*β*-glucopyranoside (52.7 mg), emodin-1-*O*-*β*-glucopyranoside (50.8 mg), and nepodin-8-*O*-*β*-glucopyranoside (20.9 mg) based on comparisons with data in the literature. The chemical profiles of the ethanolic root, leaf and fruit extracts were evaluated by HPLC using the isolated pure compounds as reference. Extracts were subjected to accelerated stability tests at conditions of 40ºC±2ºC, 75±5% RH and 6,000 lux±10%. After 3 months and 6 months, it has been found that all extracts maintain a chemical content of 95%. The change in the amount of the compounds is much less in the extracts that stored in closed vials. The change in the amount of the substances in the fruit extracts is almost insignificant. Considering the quantitative results of all reference compounds, it appears that the *Rumex crispus* L. ethanolic extracts retained their stability for 6 months. In addition, all extracts protected physical stability and photostability.

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PP-03 The Effect of Different Harvest Times on Quality in Lavender (*Lavandula x intermedia* var. Super A.)

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This study was carried out with the aim of determining the effects on the yield and quality of the essential oil in the different flowering periods of the lavender (*Lavandula x intermedia* var. Super A.) plant, which is of economic importance worldwide and which has great benefit to human health and grown in Adana in recent years. For this purpose, chemical components in the oils from the 5 kg wet flowers in different harvest times were determined by GC-MS. In the lavender collected at different harvest times, physical and chemical analyzes such as water content (%), leaf rate (%), flower color, essential oil yield and essential oil components were determined. It was found that different harvest times showed differences in the lavender plant.

PP-04 Post-Harvest Treatment in Some Medicinal and Aromatic Plants

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In this study, collection, drying, packaging, storage conditions and consumption patterns of some natural medicinal plants grown naturally in Adana and surroundings were investigated. For this purpose, plants such as rosemary, thyme, lavender, mint, basil, sideritis, terebinth, sumac and laurel leaf were investigated. These plants are collected in appropriate season, dried in the shade, packaged and stored in suitable conditions and then used as spice, herbal tea and therapeutic.

PP-05 Evaluation of the antioxidant potential and phenolic content of different *Digitalis* species growing Turkey

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In the Flora of Turkey, the genus *Digitalis* is represented by nine species (Davis, 1978). As well known, *Digitalis* species contain compounds such as cardenolides, anthraquinones and phenolic compounds. This study was performed on three different *Digitalis* species growing in Turkey. *D. davisiana* Heywood is an endemic plant for Turkey and *D. grandiflora* Miller, *D. viridiflora* Lindley are endemic plants for the Balkan region. Aerial parts of the plants were extracted with methanol. Dried methanolic extracts were dissolved in distilled water and partitioned with petroleum ether. Aqueous fraction of methanolic extracts were tested for radical scavenging effects on 2,2-diphenyl-1-picrylhydrazil (DPPH), nitric oxide (NO), superoxide (SO) radicals (Jensen, 2010). Total phenolic content of the extracts were also defined using Folin Ciocalteu method. However, the extracts showed high free radical scavenging activity against DPPH and SO radicals, their activities are not stronger than that of reference antioxidants, 3-*t*-butyl-4-hydroxyanizole, quercetin and ascorbic acid. Results showed that all extracts have concentration dependent radical scavenging activity. Among the extracts, *D. davisiana* and *D. viridiflora* were found to show higher activity on DPPH radicals with an IC_{50} value of 133.8 and 134.5 µg/ml respectively while *D. grandiflora* has an IC_{50} value of 161.4 µg/ml. NO radical scavenging activity of extracts were found to be low with a IC_{50} value in a range of 1.28-2.22 x 10^3 µg/ml. *D. viridiflora* showed higher activity on SO radicals (IC_{50} value; 144.0 µg/ml) while *D. davisiana* and *D. grandiflora* showed similar activity (IC_{50} value; 158.5 and157.0 µg/ml, respectively). Total phenolic content of the extracts was expressed as gallic acid equivalent in mg/g dry extract as 83.0, 81.6 and 63.0 for *D. viridiflora, D. grandiflora* and *D. davisiana* respectively. Although the radical scavenging activities of all extracts were found similar against DPPH and SO radicals, *D. viridiflora* with the highest phenolic content showed stronger activity. These findings supported the relation with the phenolic content and radical scavenging activity.

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PP-06 Isolation and characterization of two new compounds from *Scutellaria salviifolia* Benth.

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Genus Scutellaria (Lamiaceae) includes about 360 species worldwide (Paton, 1990). Scutellaria is represented by 32 taxa and 14 of them are endemic in the flora of Turkey (Cicek, 2008). Scutellaria species are the most popular herbs in traditional Chinese medicine and used in the treatment of gastrointestinal disorders, inflammation, cardiovascular diseases, cancer (Shang et al., 2010). Scutellaria salviifolia Benth. is an endemic species growing in Turkey. As a result of phytochemical study on aerial parts of S. salviifolia, two new and 10 known compounds were isolated from aqueous fraction of methanolic extract. Their structures were elucidated by advanced spectroscopic methods as UV, ^{1}H NMR, ^{13}C NMR, 2D NMR and HR-ESI-MS analyses. The new compounds were determined as two a-pyrone glucosides (scusalvioside A) and its caffeic acid derivative (scusalvioside B) with new skeletal structure. Along with them, 3 phloroglusinol glucosides (phlorin, tadehaginoside, 6″-O-Z-p-coumaroyl phloroglusinol-1-O-β-glucopyranoside), 6 flavonoids (apigenin, apigenin 5-O-β-glucopyranoside, isoschaftoside, luteolin 7-O-β-glucuronide, luteolin 4'-O-β-glucopyranoside, hispidulin) and one phenylethanoid glycoside (martynoside) were also isolated as known compounds. Tadehaginoside, 6″-O-Z-p-coumaroyl phloroglusinol-1-O-β-glucopyranoside and luteolin 4'-O-β-glucopyranoside were reported for the first time from a Scutellaria species.

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PP-07 Evaluation of Cytotoxicity of Anthranoids on Leukemia Cells with regard to Structure-Activity Relationships (SARs)

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Anthranoids are secondary metabolites occurring in fungi, lichens, insects, and plants (1). The structural similarity of anthraquinone aglycones to anthracyclines which are well established anticancer drugs, allows to speculate on their possible activities against cancer. Anthranoids comprise anthrone and anthraquinone structures, generally occurring in their glycosidic forms in the entire plant (2). In this study, cytotoxicities of some anthranoids were investigated towards drug sensitive CCRF-CEM and drug resistant P-gp-overexpressing CEM/ADR5000 leukemia cells by resazurin reduction assay (3). The anthranoids tested against the cell lines were emodin, aloe-emodin, rhein, physcion and emodin-8-glucoside. Furthermore, preliminary cytotoxicity researches of diastereomeric mixture of rumejaposide G and H as well as mixture of chrysophanol-8-glucoside and physcion-8-glucoside at 10 µg/mL were conducted on those cell lines. Preliminary tested anthranoids did not execute notable cytotoxicity to be needed further researches. The IC_{50} values of emodin, aloe-emodin, rhein, physcion and emodin-8-glucoside were 35.62, 9.872, 34.42, 123.5 and 69.05 µM, respectively for CCRF-CEM cells and 35.27, 12.85, 46.87, 74.79 and 104.51 µM, respectively for CEM/ADR 5000 cells. Cytotoxicities of those compounds were compared and interpreted based on structure-activity relationships (SARs) of those compounds. When we evaluate SARs of tested anthraquinones based on their cytotoxicities, we can generally assume that a distinctive decrease or loss of cytotoxicity occurs when the structure contains sugar molecule. Furthermore, extremely decline in cytotoxicity due to substitution of 6th position with $-OCH_3$ instead of -OH indicated importance of the 6th position of 1,8-dihydroxyanthraquinone structure. Aloe-emodin in comparison rhein displaying outstanding cytotoxicity, emphasized significance of the 3rd position of that structure. Determination of (SAR)s is a remarkable perception in the development of drugs. The study allows us to have a knowledge on cytotoxicity of a class of anthracyclines and prescribe drug candidate molecules effective in those leukemia cells.

PP-08 Chemotaxonomic aspects of new acylated iridoid glucosides from endemic *Scutellaria glaphyrostachys* Rech. f.

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Scutellaria L. is a large, widely distributed genus of the Labiatae (Lamiaceae) family with nearly 360 species (Paton, 1990). The genus Scutellaria L. is grown worldwide in Europe, the South-Western USA, North Mexico, and East Asia (Cicek, 2008, Paton, 1990). Scutellaria genus has two subgenus, Scutellaria and Apeltanthus (Paton, 1990). In Turkey, there are taxa from three section of the genus Scutellaria. While sect. Scutellaria and sect. Salviifoliae are belonging to subgen. Scutellaria, sect. Lupulinaria is belonging to subgen. Apeltanthus. Scutellaria glaphyrostachys Rech. f. is a member of sect. Scutellaria (Cicek, 2008). As a result of phytochemical study, two new acylated iridoid glucosides, 6'-O-E-caffeoyl geniposidic acid and 6'-O-E-caffeoyl 8-epi-loganic acid with 8 known compounds were isolated from the methanolic extract of aerial parts. Known compounds were identified as 6'-O-E-p-coumaroyl 8-epi-loganic acid , catalpol, scutellarioside I (globularin, 5), scutellarioside II, 6'-O-E-caffeoyl mussaenosidic acid, albidoside, scutelloside, 6'-O-E-p-coumaroyl gardoside. Structures of the isolated compounds were elucidated using 1D, 2D NMR and HR-ESI-MS spectra. Iridoid character of plants are important in plant classification and chemotaxonomy (Sampaio-Santos and Kaplan, 2001). The presence of catalpol in the Scutellaria species has an important role in the classification of genus (Paton, 1990, Cole et al., 1991). Iridoid isolation from Scutellaria genus was performed only on sect. Scutellaria. There isn't any information on the isolation of iridoids from sect. Salviifoliae or subgenus Apeltanthus. Isolation of iridoids from S. glaphyrostachys belonging to sect. Scutellaria is significant for classification.

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PP-09 Volatiles characterization of honey with dominance of *Bupleurum spinosum* pollen

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Previous studies on Moroccan honey with *Bupleurum spinosum* (Apiaceae / Umbelliferae) as main pollen source have addressed its melissopalynological, physicochemical and microbiological quality. Known locally as Zantaz honey, no previous study addressed the volatiles / pollen relationship. In the present work, the volatiles from 18 honeys of this type were isolated by hydrodistillation for 1 h and analysed by Gas Chromatography and Gas Chromatography-Mass Spectrometry, for volatiles quantification and identification, respectively. The percentage composition of the volatiles was used to determine the relationship between the different samples by cluster analysis as in. Cluster analysis defined two poorly correlated clusters. Cluster I, with 17 out of the 18 samples analyzed, included four subgroups, A1, A2, A3 and A4, dominated by straight-chain hydrocarbons and fatty acids in variable proportions. Cluster II included just one sample, with two yet unidentified components as main components. Mono- and sesquiterpene hydrocarbons, as well as oxygen-containing mono- and sesquiterpenes occurred always <1%. Principal component analysis (PCA) of the volatile profile, showed two groups with significantly different means in terms of their *B. spinosum* pollen contents (60±13% against 46±14%) considering the second PC which explained 21% of the given data. This suggests the importance of *B. spinosum* plant in determining the final volatile profile of Zantaz honey, while no significant correlation was seen with specific compounds. Further experiments should evaluate the volatiles from *B. spinosum* flowers and pollen, in order to evaluate how they contribute to the volatile profile of this type of honey.

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PP-10 Evaluation the effects of *Polygonum equisetiforme* Sibth. & Sm. on *in vitro* carbohydrate-hydrolyzing and pancreatic lipase enzymes and glucose uptake in 3T3-L1 pre-adipocytes

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Type 2 diabetes is still a main chronic ~~le~~ health problem around the world. Nowadays, insulin and oral antidiabetics are used for the treatment of diabetes but some limitations such as providing convenient transportation and storage conditions, administration difficulties and side effects of these drugs lead to seek new and natural alternatives to these antidiabetic compounds. The genus *Polygonum* (Polygonaceae) has nearly 300 species in the worldwide. It consists of 41 species as 7 of them endemic in Turkey (1). Some species possess antioxidant, antitumor and antidiabetic effects and numerous *Polygonum* species are frequently used as food, as well as in traditional medicine (2). In this study potential anti-diabetic effects of *P. equisetiforme* extracts and fractions were investigated by measurement of their α-glucosidase, α-amylase and pancreatic lipase enzymes, in addition to their glucose uptake data with the presence/non-presence of 50nM insulin in 3T3-L1 mouse pre-adipocytes. According to our results, Fr. 1 demonstrated the strongest inhibitory activity on α-glucosidase and α-amylase enzymes (IC_{50} values are 224 µg/ml and 114 µg/ml, respectively). Fr 3 and 4 have the substantial inhibitory effects on pancreatic lipase enzyme (IC_{50} values are 352.73 µg/ml and 363.98 µg/ml). Also aqueous and Fr. 4 exhibited the significant results at 100 µg/ml concentration by enhancing the glucose uptake in 3T3-L1 mouse pre-adipocytes in the presence of 50 nM insulin. Our results suggested that, *P. equisetiforme* is an important drug candidate source for the researches on the treatment of type 2 diabetes and its complications. Our researches on its active constituents are continue.

PP-11 Pharmacoepidemiological research on herbal medicinal products in the paediatric population: Children data from the PhytoVIS study, a NIS in overall 20,870 patients

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Pharmacoepidemiological research can be an important source of information on the use of medicinal products in the broad range of patients attending the practice of internists and general practitioners. This applies even more to the pediatric patient group and to herbal medicinal products, where clinical study data often leave questions open. To address this gap, data from the PhytoVIS study, presumably the world's largest pharmacoepidemiological study on the use of herbal medicinal products, were evaluated with the view on the pediatric population. The PhytoVIS data set contains information on the epidemiology of the patients and the therapeutic indication, the efficacy and tolerability of the medicinal products used by them, which have been captured in pharmacies and in doctor´s practices, in compliance to the ENCePP Code of Conduct. When screening it for pediatric data, information on indications, treatments, co-medication and tolerability was evaluated.Overall, 2203 data sets from the pediatric population could be evaluated, thereof 297 for patients below 2 years, 505 from patients aged 2-5 years, 578 from age 6-11 years, and 823 from age 12-17 years. Of those, 67.7 % were treated because of common cold and fever, 13.6% due to digestive complaints, 4.9% because of skin diseases, 3.5% due to sleep disturbances and anxiety and 10.3% because of other complaints. A co-medication was documented in 25.0% of the patients. The efficacy of the therapy was rated very good in 48.8% of the patients, good to moderate in 36.3%, modest in 10.7% and missing in 4.1%. Tolerability was good in 93.6% and moderate in 5.5% of patients. The data sheds light to a field of pharmacotherapy in which up to now data have been rare, and gives a picture of the use of herbal medicines in an unselected cohort of pediatric patients. The information gives a better understanding on the way these medicinal products are used in this age group and are also good background information for therapeutic decisions for these patients and their perception. Further age- and indication specific evaluations are desirable.

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PP-12 Ethanol in common foods and in herbal medicines: Safety in children

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Herbal medicines are important therapeutic options in children. This is especially true for liquid dosage forms in which the dosage can be well adapted to different age groups. Although the products are generally considered safe, the ethanol content has raised questions about child safety. The aim of the study was to present data on the extent to which children ingest ethanol when using these herbal medicines and how this is related to the intake of ethanol common foods. Data from studies with herbal paediatric medicinal products were evaluated with regard to the side effects encountered. Based on these findings, the exposure for a 6-year-old child (20 kg BW) was determined to provide a better insight into the relative contribution to total ethanol exposure by measuring the ethanol content in common foods and estimating exposure values. 17 non-interventional studies were analysed with 10 herbal medicines containing 0.03 to 0.23 g/ethanol per single dose. They included 50,316 children from 0-12 years. As shown by the example of a 6-year-old child, between 70 and 180 mg of ethanol per single dose are taken up with conventional herbal medicines. At a body weight of 20 kg, this is 3.5 – 9.0 mg/kg and eliminated within 1-3 min. The studies and, in addition, spontaneous reports from more than 3 million children taking such herbal medicines showed no evidence of ethanol-related side effects. Gas chromatographic analysis of the ethanol content of children's foods showed that orange juice, apple juice and grape juice contained significant amounts of ethanol (up to 0.77g/l). Also certain packaged baked goods contained more than 1.2 g ethanol/100 g. An extrapolation for mean ethanol intake in a 6-year-old child derived from these data revealed an ethanol exposure of up to 12.5-23.3 mg/kg. This amount is almost 2 times (average) or up to 4 times (high) higher than the exposure to herbal medicines (6 mg/kg BW) for which warnings for use in children is prescribed. In summary, our data suggest that in common foods consumed by pre-schoolers contain low, but measurable amounts of ethanol. The intake of ethanol with herbal medicines in these children is in an order of magnitude comparable to the daily exposure to foods, or even lower. Therefore, there is no specific risk associated with the ethanol content in herbal medicines. It therefore has no relevant impact on the benefit-risk assessment of these medicines in children.

PP-13 Natural products and the liver: Hepatoprotective properties often neglected

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While in Europe the scientific awareness in the field of liver and natural products is presently mainly focused on herb induced liver injury (HILI), in Asia, the focus of a number of recently published reviews is on hepatoprotective effects of herbs. But also in Europe, there is a high prevalence of hepatic disturbances due to different causes, so that an overview of the often neglected hepatoprotective potential of herbs in use in Europe would be of therapeutic relevance, e.g. in herbs used in the therapy of gastrointestinal diseases. Providing such an overview was the aim of this survey. For identifying these plants, the HMPC monographs of the European drug agency EMA and in addition leading textbooks were evaluated, followed by a systematic literature search on hepatoprotective effects. There are HMPC monographs describing a use in gastrointestinal diseases for 50 medicinal herbs, others are described in textbooks. For the majority of these plants there are published data on hepatoprotective effects. In most cases these are data from pharmacological models of different types of liver diseases, as are e.g. for caraway, peppermint, lemon balm, liquorice, gentian, angelica root, but also fennel and greater celandine. In specific cases there exist also data from clinical trials, as is the case for artichoke and milk thistle. In addition, there are data on herbal constituents as e.g. quercetin und sulforaphane available, which point to hepatoprotective effects of further plants, as e.g. bitter candytuft or horseradish. Phytomedicines in Europe have in many cases a hepatoprotective action, as can be shown e.g. in herbs used in gastrointestinal diseases. It would be desirable to conduct pharmacoepidemiological studies to evaluate whether this action is reflected also in a lower incidence of hepatitis of different origin.

PP-14 Herbals at the forefront of the treatment of functional GI diseases in children: A systematic review

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Herbal medicinal products play an important role in the treatment of functional GI diseases. These diseases, which include functional dyspepsia (FD) and irritable bowel syndrome (IBS), are characterised by symptoms like abdominal pain, nausea, fullness and stool irregularities, leading to a severely impaired quality of life. Given the high medical need in these indications especially in children, there is the question, which treatment options are applicable also in this age group. To address this question, a systematic review was conducted. Focus was set on FD and IBS in children, searching for clinical studies and reviews via PubMed-Medline in compliance to the PRISMA statement. This search was complemented by hand searching and cross-referencing. The search gained 79 hits for FD in children, thereof 27 on pharmacological treatment options, of which 2 were herbals. For IBS, it gained 321 hits, thereof 90 on pharmacological treatments, thereof 5 herbals. Herbal treatments mentioned for IBS were Psyllium, Peppermint oil and STW 5 (Iberogast) as well as Turmeric, Cannabis, Aloe vera and Ginger, with clinical studies in children mentioned only for Psyllium, STW 5 and Peppermint oil (1, 2, 3, 4, 5). For FD Hippophae rhamnoides and STW 5 were identified, with clinical evidence on both (1, 6). Only Iberogast was mentioned for both diseases. A closer look into the evidence for this preparation showed a number of studies supporting therapeutic usefulness in children of all ages, retrospectively (7, 8) as well as prospectively (9-14). These NIS included 44.315 children, showing an excellent safety profile with only few mild side effects in this age group, and a convincing rating of the therapeutic usefulness. Functional GI diseases are an important indication especially in children, where herbal preparations provide effective treatment options with a low risk profile and therefore play a prominent role in their management. Grades of evidence are different and most convincing for Iberogast likewise in FD and IBS, while Psyllium and Peppermint oil as well as Hippophae rhamnoides show evidence only for IBS or FD respectively.

PP-15 Mechanisms of action – keys to the efficacy of herbal medicinal products in irritable bowel syndrome

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Herbal treatment options are increasingly used in functional gastroenterological disorders (FGID) like irritable bowel syndrome (IBS), while an understanding of their mechanisms of action is often lacking. Therefore, on the example of STW 5, a combination product of nine herbal extracts, which an evidence-based treatment option in IBS according to recent national and international therapeutic guidelines (e.g., 1, 2, 3), the mechanisms of action involved in IBS were reviewed. To warrant completeness, a systematic search according to the PRISMA statement was conducted in order to retrieve all data on STW 5 or its trade name (Iberogast), using PubMed, Toxlit and BIOSIS. Identification of data on the mechanisms of action was then done manually. In addition hand searching was done and text books were screened, to get a complete picture. The search identified more than 450 publications. A considerable number of publications on spasmolytic as well as prokinetic activities could be identified, as well as on prosecretory effects. Also data showing that the product can counteract inflammatory changes as well as an intestinal hypersenstitivity and hyperpermeability were found. Even a beneficial effect on the microbiota was described. Accordingly, the product has a multitude of mechanisms of action. In IBS, a number of herbal therapeutic options with different mechanisms of action is used. On the example of STW 5, it could be shown, that a multitude of mechanisms of action is involved, so underlining the clinical evidence and confirming the multi-target action of this product.

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PP-16 Epidemiological data from 1515 patients with functional GI diseases treated with an herbal medicinal product, STW 5

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Data on patients with functional GI diseases from unselected patient cohorts can improve the understanding of patients' needs in daily practice. Therefore data on patients treated with an herbal medicinal product for this indication, STW 5, were selected from PhytoVIS, a non-interventional study in 20,870 patients who had used herbal products within the last 8 weeks before the survey. The aim was to describe the epidemiology, the medical needs, and the perceived effectiveness of the therapy by this patient group. The database contained 24,056 patient questionnaires. They had been documented in physicians' practices and pharmacies by respectively trained medical or pharmaceutical students who acted as interviewers, in compliance to the ENCePP Code of Conduct. Questionnaires related to STW 5 were evaluated regarding data on gender, age and disease state as well as on the use of the product and its perception. 1515 datasets were retrieved containing STW 5. They include patients from young to old age. The majority was female, with a broad range of functional GI symptoms. Effectiveness was predominantly rated as very good or good, also by the 71 children. Tolerability in all age groups was predominantly very good, being in accordance to published data from more than 50,000 patients treated with this herbal product. PhytoVIS is a suitable tool to study the epidemiology of patients with functional GI diseases treated with STW 5, showing tolerability, safety and perceived effectiveness based on the ratings of the patients. Due to the high number of participants, special patient groups such as children and elderly were also covered. This example demonstrates that the PhytoVIS database is an excellent source for information on patients using herbal medicinal products.

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PP-17 Data on St. John´s wort in an epidemiological study on the use of herbal medicines in Germany

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The PhytoVIS study, a non-interventional study (NIS) in 20,870 patients, is presumably the largest study worldwide on herbal medicines, with the aim to describe the epidemiology, medical needs, and perceived effectiveness of the therapy with these products. It was conducted in pharmacies and physician´s practices in Germany. The inclusion criterion was a use of herbal medicinal products within the last 8 weeks before the survey. Most of these products are non-prescription drugs, many of them are even available outside of pharmacies. However, St. John´s wort preparations authorized for the use in moderate depression are a special case, as they have RX-status due to the severity of the disease. In this setting, it is of special interest to evaluate the respective data on the hypericum preparations to identify potential specific patterns of its therapeutic use. The total database of 24,056 patient questionnaires was screened for the use of the leading product in this indication, Laif 900. This product contains 900 mg St. John´s wort extract, allowing to apply the dose recommended by the monograph of the European Medicinal Agency with a single tablet a day. Epidemiological data on gender, age and disease state as well as on the use of the herbal product and its perception by the patient were evaluated. 80 reports were revealed, which describe the use of the product in predominantly female patients, their reasons for its use and their rating of its perceived effectiveness and tolerability. Their evaluation confirmed the positive rating of its use already described in previous non-interventional and interventional studies in altogether more than 5000 patients. Due to the provenience of the present data from a large non product-specific survey, they augment, despite of the rather small sample size, the already available evidence, and the knowledge on the specificities of the use of hypericum products in moderate depression.

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PP-18 Marshmallow root: A medicinal plant with a great tradition

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There is an increasing popularity of natural treatment options in patients and consumers worldwide. This is not only true e.g. for Chinese and Indian traditions, but also for European traditions, leading to an increasing use of such products all around the globe. This is also true for root extracts from Marshmallow (*Althaea officinalis* L.), which are successfully used for maintaining respiratory health resp. in mucosal irritations of the respiratory tract and irritative cough, as new study data show. Therefore a search for documents of its history of use was conducted. Based on textbooks and monographs, cross referencing and hand searching, also via internet, a survey was conducted to retrieve historical texts on its medicinal use. *Althea officinalis* L. has a wide spread natural range in Eurasia, and nowadays occurs worldwide in temperate climates. While from the early advanced civilizations of the middle east no evidence of its use could be found, it is mentioned in the Greco-Roman literature by Hippokrates of Kos and, among others, the Cilician physician Dioskurides, who mentions its use in anuria, diarrhoea, lithiasis, internal injuries, nerve pain etc.. The first clear evidence for its use for the treatment of the respiratory tract is Plinius's Naturalis historia (ca. 77 AD). The plant is then also mentioned in European medieval texts. Paracelsus describes its use as abscess emollient and cleanser. The plant is also mentioned in the pharmacopoeias of the 19th and 20th century, e.g. Deutsches Arzneibuch 1926, British Pharmaceutical Codex 1949 and in medical and pharmaceutical textbooks from that time on, e.g. Madaus 1938, Hänsel et al. 1993, Blaschek 2015. In these textbooks also its traditional preparations, i.e. aqueous root macerates, are described, with the cough syrup STW 42 as a typical example complying to this tradition. This is in line with its descriptions of use in modern European herbal monographs, as those of commission E, ESCOP and HMPC, which are accepted today as references for its use, also in many non-European countries worldwide. Recent research has proven that this preparation has not only immediate protective physical effects, but also beneficial pharmacological effects on the irritated pharyngeal mucosa. For Marshmallow root, a great tradition could be proven, which well supports its use in patients and consumers worldwide, and is an adequate base for its positive image as a plant well supporting respiratory health and offering fast relief in respiratory complaints.

PP-19 Use of STW 42 in PhytoVIS, a NIS in 20,870 users of herbal medicinal products

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STW 42 is a marshmallow extract used as syrup and lozenges (trade name Phytohustil) for the treatment of pharyngeal irritation with dry cough, a condition frequently occurring in the cold season. Due to its exclusively local action, it has very low side effects compared to various other systemic acting therapeutic options, which thereby have a higher potential of side effects. PhytoVIS, a pharmacoepidemiological database on the use of herbal medicinal products, contains data from 20,870 users of herbal medicinal products, which have been captured in pharmacies and doctors' practices in compliance to the ENCePP Code of Conduct. This large database is a potential source of data on the use of STW 42. The database was screened for users of STW 42 and information on indications, treatments, co-medication and tolerability was evaluated. Data sets from 141 users of STW 42 syrup or lozenges could be retrieved, including 43 children. All patients rated the perceived effectiveness of the treatment predominantly very good or good to moderate, with excellent tolerability. Together with data from more than thousand patients documented in previous surveys, the present data underline the perceived effectiveness and the tolerability of the marshmallow product, supporting its use not only in adults, but also in pediatric patients.

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PP-20 Pyrrolizidine alkaloids accidentally present in food and herbal medicinal products have different toxic potency: Cytotoxicity data in primary rat hepatocytes and HepG2 cells

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Pyrrolizidine alkaloids (PAs) are secondary metabolites occurring in a wide range of plant species. Some 1,2-unsaturated PAs exert toxic effects through metabolic activation which form the corresponding dehydropyrrolizidine derivatives, primarily in the liver, catalyzed by cytochrome P450 monooxygenases. Due to their hepatotoxicity, genotoxicity and carcinogenicity, the accidental presence of PAs in food, feed and herbal medicinal products can be, depending on the dose, a cause for safety concerns. In order to assess potential risks and confirm the connection between structure and in vitro toxicity, we generate data firstly concerning cytotoxicity of some food-relevant PAs. In addition, we also wanted to test in vitro the role CYP3A plays in metabolic activation of PA-induced cytotoxicity. After 24 h and 48 h exposure, cytotoxicity of the selected PAs was determined at concentrations ranging from 1 to 300 µM by the Alamar blue assay in primary rat hepatocytes and in the human HepG2 cell line. A kinetic assay analyzing 7-benzyloxyresorufin-O-dealkylation (BROD) was used for measuring the activity of CYP3A enzymes. A structure dependent cytotoxicity was demonstrated with rat hepatocytes in primary culture. Lasiocarpine, an open-chained di-ester with 7S-structure, proved to be the most cytotoxic followed by the other di-esters echimidine, retrorsine, seneciphylline and senecionine. The mono-esters heliotrine, indicine, europine and lycopsamine were much less cytotoxic. On the contrary, failure to detect cytotoxicity in HepG2 cells is possibly due to the lack of CYP3As. In primary rat hepatocytes, the CYP3A activity decreased rapidly during the culture, therefore, the time to incubation significantly affects the cytotoxicity. These data confirm that CYP3A plays a critical role in PA-induced toxicity. Pyrrolizidine alkaloids (PAs) have different toxic potencies, so that relative potency factors would allow a more adequate risk management of traces of these substances accidentally present in food and herbal medicinal products.

PP-21 Synergistic effects of the components of herbal medicinal products: The example of the functional gastrointestinal diseases

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Herbal medicines are now an integral part of the modern healthcare system. The number of patients and health care professionals relying on herbal medicines for the treatment of functional gastro-intestinal (GI) diseases as functional dyspepsia (FD) and irritable bowel syndrome (IBS) has been increasing over recent years. Due to the complex control of the GI motility, herbal medicines can have multiple actions in the same region of the GI. On the other hand, it has always been claimed that herbal combination medicines have superior effects over their single components. Therefore, STW 5, an herbal combination medicine with clinically proven efficacy in FD and IBS and its components were investigated for synergistic effects in models representative for GI disorders. Studies were conducted in small intestinal smooth muscle preparations from rats and guinea pigs, after stimulation with ACh as a spasmolytic, or incubation with TNBS for inducing an inflammatory reaction. STW 5 and its components, both as single compounds or in different combinations, were tested. The smooth muscle-relaxing effects of STW 5 introduced a supra-additive effect in the model of ACh-induced contraction in comparison to the effect of the single components. To elucidate whether this was based on synergistic effects, combinations of two components in different concentrations were tested in small intestinal preparations after preincubation with TNBS. A mathematical evaluation indicated additive, syn- and antagonistic effects, depending on the combination tested. Further evidence for this is also generated by modern gene expression profiling methods. In the complex control of motility in the small intestine with its multiple pharmacological targets, combinations of active substances, as e.g. STW 5, have actions, which might be superior to those of the single components. Our results allow greater insight into the interactions between individual herbal constituents of combination products and confirm the concept of multi-target actions. This gives a rationale for the good therapeutic effect of combinations of herbal actives.

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PP-22 Study of innovative drying and ozonization techniques in aromatic herb processing

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This research is part of Interreg V France-Italy, ALCOTRA 2014-2020 projects and is focused on the study of innovative techniques for the drying and sanitization of aromatic herbs (ESSICA project). Different French and Italian herb producers are involved in the project and they provide herbs grown in areas located in Provence-Alpes-Côte d'Azur French region and in the Italian provinces of Cuneo and Torino. For the experimentation, eight herbs were initially selected, 4 produced in France (savory, oregano, lemon balm and thyme) and 4 in Italy (savory, mint, lemon balm and mallow). The main objective of the project was to improve the quality of aromatic herbs by applying and optimizing innovative processing techniques. More precisely, a cold drier was provided by Northwest Technology (Boves, Cuneo, Italy) and the effects of cold drying on herb quality was evaluated in terms of Total Phenolic Content (TPC), Radical Scavenging Activity (RSA) and sensorial analysis. Moreover, gaseous ozone treatments were tested to reduce microbial herb contamination and against main insect pests. Cold drying technique, with temperatures ranging from 10 °C to 30 °C, was compared with traditional drying (temperatures about 40 °C). As expected, TPC and RSA decreased in both traditional and cold dried Italian herbs compared to the fresh ones but not significant differences were detected between herbs submitted to the two methodology [with the exception of savory samples]. Moreover, sensory analysis did not highlight differences between cold and traditionally dried samples. Regarding herb sanitization, two different concentrations of ozone were used, precisely 5 ppm and 10 ppm for 30 min, and compared with the control at 0 ppm. Ozone treatments were occasionally effective on *Enterobacteriaceae* and fungi but did not lead to a significant reduction of the total microbial load. Thus, new trials were planned and performed by treating herbs using 10 ppm ozone throughout the whole cold drying process. Preliminary results are quite encouraging, showing a decrease of about 2 log for total microbial count, *Enterobacteriaceae*, xerophile moulds and yeasts, and will be enriched with further analyses. Concerning the effects of sanitization on insect pests, ozone treatments, at the 3 tested concentrations (0, 5 and 10 ppm), were not effective on *Tribolium castaneum* (Coleoptera: Tenebrionidae), a species chosen among noxious pest of dried herbs from bibliography. Since ozone concentrations did not cause a significant insect pest mortality, concentration values and exposition times should be augmented in summer-autumn 2019.

PP-23 Isolation and characterization of iridoid glucosides from *Veronica crista-galli* Stev.

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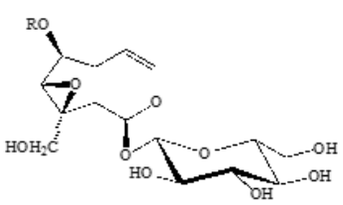
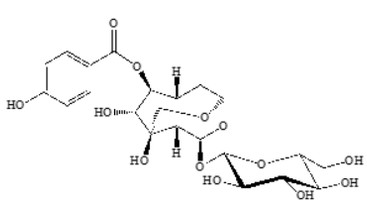
The genus *Veronica* L. (Plantaginaceae) includes about 200 species in worldwide. In the flora of Azerbaijan, *Veronica* is represented by 40 species and three of them are endemic (Karjagin., 1957). Veronica has a long history of use in European traditional medicine, mainly in central eastern Europe and the Balkans (Raclariu et al., 2017). Some *Veronica* species are used for the treatment of different inflammatory diseases and cancer in traditional medicine (Saracoglu et al., 2011). *Veronica crista-galli* Stev. is one of the species growing in Azerbaijan. The herb of *Veronica crista-galli* includes flavonoids, iridoids, hydroxycinnamic acids, coumarins and other compounds (Suleymanov et al., 2018). The MeOH extract of *V. crista-galli* was suspended in water and partitioned with petroleum ether. The water fraction of the MeOH extract was subjected to polyamide column chromatography to afford 11 main fractions. Repeated column chromatographies (RP, silica gel, Sephadex LH-20) of the fraction which was eluted with water from the polyamide column, resulted in the isolation of four compounds in pure form as colorless amorphous powders. Their TLC characteristics, UV and NMR spectra were characteristic for iridoid glucosides. They were compared by HPLC analysis with authentic compounds isolated from another *Veronica* species in our previous studies (Saracoglu et al., 2011). Their structures were determined exactly by advanced spectroscopic methods such as UV, ^{1}H NMR, ^{13}C NMR and 2D NMR analyses as catalposide (1), verproside (2), veronicoside (3) and 6-*O*-*p*-hydroxybenzoyl scutelloside (4).

Acknowledgements: Authors are grateful to Prof. Dr. Makoto Inoue and Dr. Kenichi Nakashima (Aichi Gakuin University, College of Pharmacy, Nagoya, Japan) for recording NMR spectra of isolated compounds.





Catalposide (1)	R: *p*-hydroxybenzoyl	6-*O*-*p*-hydroxybenzoyl scutelloside (4)
Verproside (2)	R: Protocatechuoyl	
Veronicoside (3)	R: Benzoyl	

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PP-24 The mechanism of thyme (*Thymus vulgaris* L.) essential oil in an endotoxin-induced acute airway inflammation

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Inflammatory lung diseases affect a large population worldwide. Essential oils can easily reach the respiratory tract via inhalation. The anti-inflammatory effect of essential oils is poorly studied *in vivo*. Transient Receptor Potential Vanilloid1 (TRPV1) and Ankyrin1 (TRPA1) ion channels are expressed on the sensory neurons and epithelial cells of the airways and play a role in sensory-immune interactions. Therefore, we aimed to examine the chemical composition and effects of thyme oil (TO) inhalation in the model of lipopolysaccharide (LPS)-induced airway inflammation and the potential role of TRPA1/V1 ion channels in mediating TO effect. The essential oil was selected on the basis of its potent antibacterial activity. The chemical composition of TO was determined by GC-MS. Lung inflammation was evoked by the intratracheal administration of 60 µL LPS (*E. coli* 083: LPS) in female TRPA1/V1$^{+/+}$ (WT) and TRPA1/V1$^{-/-}$ (KO) mice. TO or the control oil was inhaled 3 times for 30 min during the 24-h period of the experiments. Airway function was measured in awake, spontaneously breathing animals by unrestrained whole body plethysmography. Lung myeloperoxidase (MPO) activity was determined by spectrophotometry. The histopathological alterations were evaluated from hematoxylin-eosin stained lung sections by semiquantitative scoring. Thymol (46.3%) and p-cymene (22.1%) were the two main components of TO. TO inhalation significantly alleviated airway hyperreactivity in WT, but aggravated it in KO mice. Histological parameters were not affected significantly by TO inhalation in either WT or KO mice. LPS treatment induced a remarkably increased MPO activity, which was significantly reduced by TO inhalation in WT, but not in KO mice. Therefore, thyme oil can be considered as a potential treatment in airway inflammation, and its protective effect is potentially mediated by TRPA1/V1 ion channels.

PP-25 Essential oils of roots of *Heracleum sphondylium* subsp. *ternatum* (Velen.) Brummit. (Apiaceae) growing in Turkey

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Heracleum sphondylium subsp. *ternatum* Boiss. belongs to the family Apiaceae. The plant is known as "hogweed" throughout the world and with the name "devesil" in Turkey [1, 2]. Plant species was collected from Tekirdağ, a city found in the Thrace region of Turkey. Mostly essential oil content of fruits of the species have been studied by different researchers, however some methanol and ethyl acetate of the taxon has also been studied [1, 3-4]. In this study we investigated the essential oil composition of the roots and aerial parts of the species and identified myristicin (21.1%), octyl acetate (20.2%), β-pinene (15.5%) β-bisabolene (12.5%) as the major constituents for the aerial parts and β-pinene (56%), myristicin (20%) and terpinolene (8.3%) for the roots.

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PP-26 Determination of Antioxidant Activity and Antioxidant Compounds of *Elaeagnus rhamnoides supsp. caucasica*

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The aim of this study is investigation of antioxidant effect of *Elaeagnus rhamnoides* (L.) A. Nelson subsp. *caucasica* Rousi. (Elaeagnaceae). *E. rhamnoides* is known as "yalancı iğde, çıçırgan" in Turkey. The fruits of the plant are constipating, strengthening and antiseptic. Also fruits are used against influenza and colds in Turkish folk medicine (Baytop, 1999). *E. rhamnoides* has been found to have anticancer, antimutagenic, antioxidant and antibacterial effects in previous studies (Zeb, 2004). *E. rhamnoides* subsp. *caucasica* which is a subspecies grows in Anatolia (Baytop, 1999). Its fruit is consumed traditionally because of the effects of aphrodisiac and antitussive in Elazığ/Turkey (Cakilcioglu et al., 2011). In this study, 70% methanol extract and its different polarity fractions (*n*-hexane, dichloromethane, ethyl acetate, *n*-butanol and water) prepared from leaves of the plant were evaluated for *in vitro* antioxidant activity by using DPPH and ABTS radical scavenging effect assays (Blois, 1958; Re et al., 1999). Then five flavonol glycosides (F/1-5) and a triterpenoid saponin mixture (T-1) isolated from *n*-butanol fraction and were evaluated for antioxidant activity as well. It was found that the most effective fractions were ethyl acetate (96.52% for $ABTS^{\bullet+}$ at 10 µg/mL and 69.84% for $DPPH^{\bullet}$ at 40 µg/mL) and *n*-butanol (76.33% for $ABTS^{\bullet+}$ at 10 µg/mL and 53.46% for $DPPH^{\bullet}$ at 40 µg/mL). Five flavonol glycosides (F-1, F-2, F-3, F-4 ve F-5) and a triterpenoid saponine mixture (T-1) were isolated from *n*-butanol fraction. In the antioxidant activity assays, the most effective compound was found as F-4 (96.27% for $ABTS^{\bullet+}$ at 15 µg/mL, IC_{50}= 0.0049 mg/mL and 46.15% for $DPPH^{\bullet}$ at 25 µg/mL, IC_{50}= 0.0290 mg/mL) when compared with trolox and α-tocopherol. F-1-5 were effective especially against $ABTS^{\bullet+}$, but T-1 wasn't effective on both assays.

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PP-27 Composition and Biological Activities of *Pimpinella anisetum* Boiss. & Bal. Essential Oil

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The aim of the present work is to investigate *in vitro* antioxidant, anti-inflammation, antimicrobial activities, acetylcholinesterase (AChE), butyrylcholinesterase (BuChE) and α-glucosidase inhibition of the essential oil of *Pimpinella anisetum* Boiss. & Bal. in addition to its chemical compositions. *P. anisetum* of the family Apiaceae is one of the 23 Turkey species of the genus *Pimpinella* and is an endemic species scattered in Inner Anatolia (Cappadocia, Amasya, Erzincan and Erzurum Areas). The aerial parts of *P. anisetum* was hydro-distilled to produce oil in the yields of 3.7% (v/w). The chemical compositions of essential oil was determined by GC-FID and GC-MS techniques. According to chemical analysis, (E)-anethole (78.6%), methyl chavicol (14.1%) and anisaldehyde (5.1%) were found as main compounds. The essential oil was screened for its possible antioxidant activities by the photometric 1,1-Diphenyl-2-picrylhydrazyl (DPPH), cupric reducing antioxidant capacities (CUPRAC) and ABTS cation radical scavenging methods. The anti-inflammatory activity was performed by *in vitro* lipoxygenase (LOX) enzyme inhibition test, as spectrophotometrically. In results of enzyme activity assays, essential oil showed weak anti-inflammatory activity and 12.06 % LOX inhibition value was calculated at 100 µg/mL while IC_{50}=9.01 µg/mL for standard nordihydroguaiaretic acid (NDGA) were calculated. The essential oil was also screened for their antimicrobial activities against *Streptococcus pneumoniae* ATCC 49619, *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213, *Acinetobacter lwoffii* ATCC 19002, *Klebsiella pneumoniae* ATCC 700603, *Pseudomonas aeuroginosa* ATCC 27853 *Escherichia coli* ATCC 25912 and *Escherichia coli* ATCC 85218 bacteria by disc diffusion method. Antimicrobial activities result; The essential oil have not shown antimicrobial activity against all microorganisms tested. In addition, *P. anisetum* essential oil inhibitory effects on acetylcholinesterase (AChE), butyrylcholinesterase (BuChE) and α-glucosidase inhibition were evaluated. As a result, the essential oil showed low inhibitory activity in both AChE and BuChE. The IC_{50} value against AChE and BuChE is 337.34, µg/mL and 114.44 µg/mL, respectively. It also showed a low rate of α-glucosidase inhibition (IC_{50} value of 523.25 µg/mL) and almost no antioxidant effect.

PP-28 Cytotoxic effect of chrysophanol and chrysophanol-8-*O*-β-glucopyranoside on human ovarian and breast cancer cell lines

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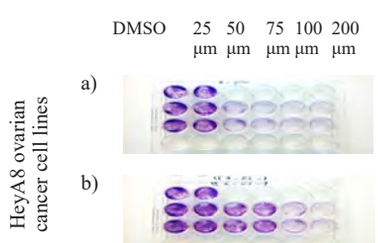
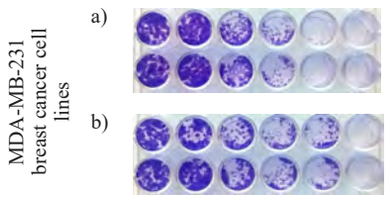
Breast and ovarian cancer constitutes one-third of all cancers occurring in women and is responsible for about a quarter of cancer-related deaths in women. Rumex (Polygonaceae) species are grown throughout the world and includes 32 genus and more than 800 species. This genus is a rich source of anthranoids. There are lots of unknown biological activities of anthranoids and they have not studied in detail so far. In this study we isolated chrysophanol and chrysophanol-8-*O*-β-glucopyranoside from *Rumex crispus* L. roots and aimed to investigate cytotoxic effects of these anthraquinones on HeyA8 ovarian and MDA-MB-231 breast cancer cell lines. The MTS proliferation assay was used to detect the viability of cancer cells. Cytotoxic activities of compounds tested against HeyA8 and MDA-MB-231 cancer cell lines at the concentrations between 1-100 µm. All experiments were performed in triplicate. According to results, HeyA8 cells viability decreased moderately by chrysophanol (>100µm). For chrysophanol-8-*O*-β-glucopyranoside, HeyA8 cell viability was 50 % when at 100 µg/ml. On MDA-231 breast cancer cells, the same results were obtained, compounds have concentration dependent cytotoxic activity against breast cancer cell lines. Chrysophanol-8-*O*-β-glucopyranoside was more effective on cell killing, MDA-MB-231 cell viability was 50 % when at 20 µm concentration. For clonogenic survival assay; cells were transfected with control or chrysophanol and chrysophanol-8-*O*-β-glucopyranoside every week and grown for 2 to 3 weeks. Cells were stained with crystal violet and colonies were counted. Each experiment was performed in duplicate. According to results both of two compounds inhibited cell proliferation and colony formation of HeyA8 ovarian and MDA-MB-231 breast cancer cells. (Fig. 1).




MDA-MB-231
breast cancer cell
lines
a)
b)

PP-29 Screening of the anti-*Haemophilus* activity of different lavender oils using TLC-bioautography

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Essential oils (EO) have a long tradition in pharmaceutical sciences as natural products with pharmacological, cosmetic, agrochemical and nutritional applications. EOs can easily reach the upper and lower parts of the human respiratory tract via inhalation because of their volatile character. Respiratory tract diseases associated with bacterial infection affect a large number of people from every age group worldwide. Some EOs are used as anxiolytic remedies. One of the most popular EOs for mental disorders and anxiety is lavender (Lavandula angustifolia Miller). However, there are low number of studies, which highlight the antibacterial effect of lavender oil against respiratory tract pathogens. Therefore, the aim of this study was the screening of the antibacterial activity of lavender oil against *Haemophilus influenzae* (DSM 4690) and *H. parainfluenzae* (DSM 8978) with TLC-direct bioautography (TLC-DB). The plant materials were collected in three phenophases (before blooming, in full bloom, end of bloom) in 2018 and the lavender oils were obtained by water distillation from fresh and dried plant materials. The chemical composition of the oils was performed by GC-MS. Our results showed that linalool was the main compound in all of the lavender oils. The antibacterial effect of the EOs and the main component was proved by TLC-DB. Lavender oils isolated from fresh samples showed higher activity (0.4-0.6 mm) than oils isolated from dried plant materials (0.3-0.5 mm). The fresh plant material collected before blooming produced the highest inhibitory zones (0.63 mm) against *H. influenzae*. Plant materials collected in full bloom and end of bloom did not produce different inhibitory effect against the bacteria. We conclude that the phenophase of *Lavandula angustifolia* and the drying procedure influenced the anti-*Haemophilus* activity of this EO.

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PP-30 Possible interactions between essential oil components and antibiotics in the case of resistant pathogens

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The growing appearance and difficult treatment of the antibiotic-resistant bacterial strains producing a serious problem in the medical health-care all around the world. Due to the misuse or overuse of antibiotics in most cases, classic antibiotic protocols are not sufficient in these infections. Therefore, the discovery of new antibiotics which can support medical therapy is an urgent challenge nowadays. Besides, the combination of antibiotics and other bioactive substances could be one of the alternatives as well. The antibacterial activity of essential oils (EOs), as well as the action of their components, have been known for ages. Based on their effectiveness, the combination of volatile components and antibiotics against food-borne and human pathogens was one of the most promising areas during the last decades. Thus, the aims of our study were the combination of the most effective components of cinnamon bark, thyme, clove, peppermint, and citronella oil with antibiotics (amikacin and vancomycin). Direct bioautography (DB) method was used in the detection of interaction profiles of *trans*-cinnamaldehyde, eugenol, thymol, menthol, and geraniol (Sigma Aldrich Kft.) against MRSA (4262), resistant *P. aeruginosa* (RPA, 34205). After the detection of active compounds, and antibiotics their minimal detectable dose (MDD) was determined. According to the MDD values combined samples as well as the individual compounds, and antibiotics were applied to the TLC plates. The diameter of inhibition zones was measured with Motic Images Plus 2.0 program. The statistical analysis of the data was performed with a Mann-Whitney-Wilcoxon test of R Studio 1.1.383 program. As a result, in the case of RPA, the combination of *trans*-cinnamaldehyde and amikacin was the most effective. In contrast, thymol and eugenol did not show any enhanced activity in combination. In comparison with the activity of the single compounds, all of our combinations produced better inhibition against MRSA. We presume that among the mixtures the vancomycin with *trans*-cinnamaldehyde, thymol, menthol, and geraniol were the most promising combinations. According to our knowledge, we applied TLC-DB to detect interactions firstly. We concluded that in combination with statistical analysis, it could be a cost-effective, and quick screening analysis. We hope that our results may contribute to the therapeutical application of EOs in the case of antibiotic-resistant infections. In the future, we would also like to test the activity of our combinations with other methods. Furthermore, we would like to focus on the mode of action of our combinations as well.

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PP-31 Anticancer effects of *Sclerocarya birrea* extracts in colon adenocarcinoma cell lines

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Sclerocarya birrea is a popular African wild tree that the leaves, stem bark, root, and fruits are used in traditional medicine in Nigeria. It is widely studied with regard to its antidiabetic, anti inflammatory, analgesic and antimicrobial activities. The aim of this study was to investigate the cytotoxicity and in vitro anticancer activity of *Sclerocarya birrea* leaves and barks ethanolic extracts on Colo-320 primer and Colo-741 metastatic colon adenocarcinoma cell lines. *Sclerocarya birrea* leaves and stem barks were collected from Bayo University, Nigeria. Dried and ground leaves and stem barks were extracted with ethanol. Different concentrations of leaves and bark extracts were incubated for 24 h and 48 h with Colo-320 andColo-741 cells. Cell growth and cytotoxicity were measured by MTT assays. Anticancer and antiproliferative activities of *Sclerocarya birrea* extracts were investigated by immunocytochemistry using antibodies directed against toβ-catenin, BMP-2, CD133, Indian hedgehog, jagged1, Ki-67 and LGR-5 in Colo-320 and Colo-741 cells. *Sclerocarya birrea* leave sand bark extracts at 50 µg/ml concentration were more effective at inhibiting Colo-320 and Colo-741 cell growth when compared with other dilutions. As a result of immunohistochemical staining β-catenin and Ki-67 immuno reactivities were significantly increased in both *Sclerocarya birrea* bark extract treated Colo-320 and Colo-741 cells. However, *Sclerocarya birrea* leaves extract significantly decreased LGR-5 and Indian hedgehog immuno reactivity in Colo-320 celllines. We conclude that *Sclerocarya birrea* leaves extract may have anticancer effects on colon cancer cells through molecular signalling pathways. Interestingly, *Sclerocarya birrea* bark extract increased signaling molecule which is assumed to play important role during carcinogenesis.

PP-32 The Effect of Anthocyanin-Rich Wheat on Biochemical and Antioxidant Parameters, Liver Microsomal Drug-Metabolizing Cytochromes P450 in Rabbits *in Vivo*

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Wheat is one of the most important agricultural crops worldwide; the genotypes of anthocyanin-rich wheat were introduced to the market as a food with added value. The effect of 15 % of PS Karkulka, purple grain wheat, in pelleted feed on HYLA female rabbits was studied. The aim of the investigation was to determine whether two months intake of anthocyanin-rich wheat can influence i) routine biochemical parameters in rabbit´s blood, ii) antioxidant status of the blood and erythrocytes, iii) the drug-metabolizing microsomal cytochromes P450 (CYPs), which indicated the ability of the rabbits´ liver to metabolize drugs or xenobiotics. The health status of rabbits was good over all experiment. Routine biochemical parameters and the antioxidant power of plasma were not affected in the test group; the antioxidant parameters in erythrocytes remained unaffected, except for a slight decrease of GST – glutathione S-transferase activity in test group *vs* control group, $P < 0.05$. Consumption of an anthocyanin-rich diet did not change the activities of the studied CYPs (equivalent to human CYP1A1/2, 2A6, 2B6, 2D6, 2E1 a 3A4); only nonsignificant inhibition of human CYP2C19 equivalent activity was observed. Based on these observations, there will be no significant influence of the consumption of anthocyanin-rich wheat on the metabolism of xenobiotics and drugs in rabbits.

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PP-33 Antiinflammatory and Wound Healing Effects of Some *Acanthus* L. Species Growing in Turkey

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Acanthus L. species are used as expectorant, for healing wounds and relieving constipation in Turkish traditional medicine (Baytop, 1999). They are used to relieve pain in chest, for gastrointestinal system problems, urinary system diseases, hepatitis, lymphomas and rheumatism in different countries (Phisalaphong, 2006). In the present study, aqueous extracts of the aerial parts of *A. dioscoridis* L. var. *dioscoridis* L. (AD) and *A. spinosus* L.(AS), polyamide column fractions [AD fraction B, AD fraction C, AD fraction D, AD fraction F, AS fraction A, AS fraction B, AS fraction C] with two pure compounds [leucoseptoside A and benzoxazole-2(3*H*)-one (BOA)] were studied for their antiinflammatory effects on nitric oxide (NO) and prostaglandin E_2 (PGE_2) cytokine levels in LPS-stimulated RAW 264.7 cells. Wound healing activities of the extracts on L929 cells were also tested via scratch method. The results showed that *A. dioscoridis* var. *dioscoridis* and *A. spinosus* aqueous extracts inhibited the nitric oxide production % 38.2 and % 47.9 in 800 mg/ml, respectively. AD fraction C and AS fraction B are the most effective fractions on NO inhibition with EC_{50} values 43.64 and 42.99 mg/ml, respectively. Benzoxazole-2(3*H*)-one (BOA) exhibited % 32.9 nitric oxide production inhibition in 100 mg/ml. PGE_2 production in positive control LPS (+) was found to be 1837 pg/ml, while in negative control LPS (-) was 35 pg/ml. The aqueous extracts of *A. dioscoridis* var. *dioscoridis* and *A. spinosus* decreased the PGE_2 levels to 466 and 728 pg/ml in 10 mg/ml. While AD fraction C decreased PGE_2 levels to 165 pg/ml in 5 mg/ml, AS fraction A to 363 pg/ml in 100 mg/ml. PGE_2 levels were determined as 304 and 347 pg/ml by treatment with benzoxazole-2(3*H*)-one (BOA) and leucoseptoside A in 20 mg/ml. Cell damage in L929 cells was improved completely in 48 hours for the extracts.

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PP-34 Phytochemical Studies on Some *Acanthus* L. Species Growing in Turkey

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The genus *Acanthus* (Acanthaceae), which includes about 30 species in worldwide, is widespread in Asia, Europe, Africa and Australia (Capanlar et al., 2010). It is represented by 8 taxa, 3 of them are endemic in Turkish Flora (Davis, 1982). The chemical constituents isolated from *Acanthus* sp. include phenylethanoid and phenypropanoid glycosides, benzoxazinoids, lignan glycosides, alkaloids, megastigmanes, flavones and aliphatic alcohols, triterpen and steroidal glycosides (Huo et al., 2005, Amer et al., 2004, Kanchanapoom et al., 2001, Winrow et al., 1993). In the present study, the aerial parts of two *Acanthus* species (*A. dioscoridis* L. var. *dioscoridis* L. and *A. spinosus* L.) were investigated for their chemical compositions by isolation studies. As a result of a serial chromatographical studies 8 compounds isolated from two plants. The structures of isolated compounds were elucidated by advanced spectroscopical methods as β-hydroxy acteoside, benzoxazole-2(3*H*)-one (BOA), 2,4-dihydroxy-1,4-benzoxazine-3 (2*H*)-one (DIBOA), 2-*O*-β-glucopyranoside-4-hydroxy-1,4-benzoxazine-3(2*H*)-one (DIBOA-Glu), acanthaminoside, naringenin 7-(3”-acetyl-6”-*E*-*p*-coumaroyl) glucoside, naringenin 7-(6”-*E*-*p*-coumaroyl) glucoside and pinoresinol-4-*O*-β-glucopyranoside. Acylated flavanon glucosides, naringenin 7-(3”-acetyl-6”-*E*-*p*-coumaroyl) glucoside and naringenin 7-(6”-*E*- *p*-coumaroyl) glucoside were isolated for the first time from *Acanthus* genus.

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PP-35 A Comparative Study of the Essential Oils and Fruit Anatomy of Naturally Distributed *Daucus* L. Species in Turkey

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In this study, the fruit anatomy and essential oils of naturally grown *Daucus* L. species in Turkey were examined. The genus of *Daucus* belongs to the Apiaceae family, which contains plant groups of economic importance in the world. In the Flora of Turkey and the East Islands, including *D. carota* L., *D. broteri* Ten., *D. guttatus* Sibth. & Sm., *D. littoralis* Sm., *D. involucratus* Sm. and *D. conchitae* W. Greuter (endemic) 6 species are registered. In order to examine the anatomical features of the fruits, cross sections were taken from the mericarp. The sections were taken from the middle of the mericarps by hand with the help of razor blade and examined in the Sartur reagent. Photographs of the sections were taken with the imaging system consisting of microscope and camera and various measurements were taken. At the same time, drawings of fruit anatomy were made for the purpose of showing all species anatomical features. In anatomical studies, it was determined that the most distinctive features were the vallecular vitta and endocarp shapes. Additionally fruits of *Daucus* species were subjected to hydrodistillation in Clevenger apparatus for 3 hours. The obtained essential oils were analysed by GC-FID and GC-MS systems, simultaneously. The main volatile compounds were found in *D. carota, D. broteri, D. guttatus, D. involucratus, D. littoralis*, *D. conchitae* as 1αH-himachal-4-en-1β-ol (49.4%), β-sinensal (30.4%), methyl eugenol (30.5%), methyl eugenol (40.9%), α-humulene (29.4%), methyl eugenol (29.6%), respectively. As a result of the determined differences and measurements, a diagnostic key was formed with anatomical features of the fruit. Differences of essential oils chemical compositions are supported these situation.

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PP-36 Comparative Study on Some *Hypericum* L. Species in the *Drosanthe* Section of Turkey

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Hypericum species in Turkey were collected under 19 sections and consists of 100 taxa. 45 of these taxa are endemic (Eroğlu et al. 2013; Robson 1988; Güner et al. 2000). Studies on the genus *Hypericum* concentrated on *H. perforatum* L. In this study *H. scabrum* L., *H. thymopsis* Boiss., *H. spectabile* Jaub & Spach species belonging to the Drosanthe section collected from the Sivas and Erzincan provinces were compared in terms of pharmaceutical botany. Morphological and anatomical features are considered in comparison of species. The sections were taken from leaves, stems and roots by hand with the help of razor blade. Then examined in the sartur reagent. Photographs of the sections were taken with help of camera attachment microscope and their measurement were taken at the same time. Morphological and anatomical similarities and differences of species were revealed as a result of these investigations. Although these species are included in the same section, it is foreseen to be an indicator for the diagnosis and grouping of the new species.

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PP-37 Investigation of Chemistry and Biological Activities of Turkish sweetgum balsam (Styrax liquidus) Essential Oil

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In this present study, the essential oil of sweetgum balsam (Styrax liquidus) was obtained by hydrodistillation. Styrax liquidus is a resinous exudate obtained from the wounded trunk of *Liquidambar orientalis* Miller from Altingiaceae family (Hamamelidaceae). Composition of the essential oil was determined by using Gas Chromatography (GC) and Gas Chromatography/Mass Spectrometry (GC/MS). The essential oil has been used in pharmaceutical and cosmetic industry particularly in perfumery. The styrax liquidus has been used for treatment of various ailments in Turkish folk medicine. It is used to treat of wounds, asthma, bronchitis, upper respiratory tract diseases, such as fumigation and an expectorant in the form of powder and pastille, skin diseases like scabies and fungal in the form of pomade and plaster. In result of GC and GC/MS analysis of the essential oil, the main compounds were determined as styrene (92.6 %) and α-pinene (2.2 %). This study was aimed to investigate *in vitro* antioxidant, antimicrobial activities, anticholinesterase and α-glucosidase inhibition of the essential oil. The essential oil was also screened for their antimicrobial activities against *Streptococcus pneumoniae* ATCC 49619, *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213, *Acinetobacter lwoffii* ATCC 19002, *Klebsiella pneumoniae* ATCC 700603, *Pseudomonas aeuroginosa* ATCC 27853 *Escherichia coli* ATCC 25912 and *Escherichia coli* ATCC 85218 bacteria by disc diffusion method. Antimicrobial activities result; The essential oil showed weak antimicrobial activity against only *Klebsiella pneumoniae*. The others microorganisms have not effectivite. Antioxidant, anticholinesterase and α-glucosidase activities results; the essential oil showed moderate inhibitory activity in both AChE and BuChE. The IC_{50} value against AChE and BuChE is 36.5 µg/mL and 69.5 µg/mL, respectively. It also showed a low rate of α-glucosidase inhibition (IC_{50} value of 637.2 µg/mL) and similar antioxidant effect on CUPRAC and ABTS method ($A_{0,5}$ value of 637.2 µg/mL and IC_{50} value of 632.2 µg/mL, respectively).

PP-38 Sources and doses of organic fertilizers as factor to improvement the biomass and essential oil production of *Cymbopogon flexuosus*

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Cymbopogon flexuosus is a medicinal species with relevant commercial value and widely used in flavors, fragrances, toiletries, cosmetics, soaps, detergents, and pharmaceutical products. The objective of this study was evaluate the effects of different doses and sources of two manures and one compost on plant growth, leaf nutrient accumulation, content, yield, and chemical composition of the essential oil. The sources were cattle manure, quail manure, and organic compost applied in four doses and control treatment. The species increased the growth and productions of secondary metabolites by use the manures and organic compost. The highest weight gain was obtained with fertilization between 300 and 450 g pot-1 of quail manure, but the yield of essential oil in the doses from 150 to 300 g pot-1. Overall, lemon grass plants fertilized with quail manure accumulated greater concentrations of nutrients in leaf tissue than cattle manure and compost. The neral content in the essential oil was increased with the use of quail manure compared to compost and cattle manure. The results from this study demonstrated that dose and source can alter dry weight, leaf nutrients accumulation, and essential oil content and yield.

PP-39 Growth and essential oil production under intercropped cultivation with lemon balm and yarrow

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The purpose of this study was to assess the influence of lemon balm intercropping with yarrow on the vegetative growth, photosynthetic pigments and essential oil contents as well as the chemical composition of essential oils. Accordingly, the lemon balm and yarrow monocroppings were compared to the intercropping of both species. The plants were cultivated for 120 days under Field conditions. The experimental design followed randomized blocks with seven repetitions. Growth was assessed through the accumulation of shoot dry matter and through the leaf area. The photosynthetic pigment content was set based on the fully expanded leaves from five plants in each treatment. The essential oil was extracted through the hydrodistillation of the lemon balm leaves and yarrow leaflets dehydrated in a forced ventilation oven at 40°C. The chemical analyses of the essential oils were performed using GC-FID and GC-MS. Intercropping showed a reduction of vegetative growth. However, intercropping increased the lemon balm essential oil content. On the other hand, these parameters did not change in yarrow. There were variations in the level of chemical constituents in lemon balm and yarrow essential oils, which were more evident in the major constituents.

PP-40 New Trends for Suncare Healing Herbal Cosmeceuticals Formulation

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UV Radiations cause various harmful and damaging effects on skin such as hyperpigmentation, photo ageing, sunburn, skin irritation and skin cancer. Herbal cosmeceuticals possess property to protect skin from damaging effects of sun rays. Active constituents extracted from herbals having potent UV shielding effect. Basically, herb with Vitamin (A, C, E) flavonoids, polyphenols, carotenoids (Lycopene, β carotene), and phenolic acids enhance photo protection as they posses antioxidant action. These herbal ingredients inhibit free radical formation and neutralize reactive oxygen species (ROS) and enhance skin protection from harmful UV rays. Cosmeceuticals are topical agents that are lying in a broad spectrum, between cosmetics and drugs. Not only they are thermodynamically unstable, but also the rheology of the formulations should be controlled accurately for optimizing spreadability and feel. To answer all the requirements of the customers, new delivery systems were developed for cosmetic products. The systems came in all shapes and sizes. The cosmetic delivery systems can be divided into four broad types as; Emulsion systems (classic, micro and multiple emulsion),Vesicular systems (liposomes, niozomes etc.), Particulate systems (microcapsules, micro particles and porous polymeric systems) and molecular systems (cyclodextrins). Encapsulation techniques are most widely used in the development and production of improved delivery systems. The present review focuses on scientific account of herbals in cosmetics and new formulation trends using Cosmetics Delivery Systems.

PP-41 Osmoprotectant regulation of *Sceletium varians* (syn. Mesembryanthemum) in response to salinity stress

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Sceletium species (syn. *Mesembryanthemum*; Aizoaceae) are amongst the most promising medicinal plants in South Africa based on their pharmacological properties. The plant's wide usage in traditional medicine is linked to neurologically acting novel mesembrine alkaloids. Advancements made thus far on *Sceletium* research have seen the introduction of *Sceletium tortuosum* into commercial markets. However, much of the attention on *S. tortuosum* commercialization has resulted in other *Sceletium* species being overlooked, including *S. varians* (Haw.). In this study, aimed to elucidate the role of salt stress, we chose the succulent *S. varians* as a study tool, where compatible solutes were assessed in six week-old *in vitro* plantlets propagated in different NaCl concentrations (0, 150, 300, 450 mM) using Murashige and Skoog (1962) media. Apart from growth measurements, a quantitative profile of mesembrine alkaloids using LC-MS, amino acids using UPLC-MS and sugars including sugar alcohols, was obtained using GC-MS technology. Interestingly, 150 mM NaCl levels (414 mg/FW) significantly increased plantlet fresh weight as compared to the control (0 mM) treatment (260 mg/FW), with no observable differences in plantlet growth between 300 mM NaCl and the control, and significantly reduced growth at 450 mM NaCl (87 mg/FW). Mesembrine alkaloids were not detected in six-week old plantlets. In total, 19 amino acids were recorded in *S. varians*, with methionine present in abundance (14 175 – 17 982 mg/l DW). Cumulative salt levels in plantlets increased serine, aspartate, proline and methionine production, with an excessive decline in other quantified amino acids, including tyrosine, phenylalanine, putresine and spermidine. Soluble sugars (D-fructose, glucose and mannose) also decreased due to salt stress in *S. varians*. On the contrary, 450 mM NaCl stimulated minor sucrose concentration, with no detection of sugar derivative at 0, 150 and 300 mM NaCl treatments. D-fructose and glucose were constituted in reasonably high levels in plantlets, with the highest concentrations determined at 450 mM NaCl treatment. This study reports for the first time the important role osmoprotectants plays towards salt-tolerance in *S. varians* plantlets. The excessive decline in majority of amino acids, particularly phenylalanine and tyrosine, known to be mesembrine precursors needs to be elucidated in details, once we have determined the stages of mesembrine synthesis in plants. Since secondary metabolites are well-known to be highly regulated by plant age, growth conditions and abiotic stress.

PP-42 Evaluation of the stability and antimicrobial activity of propolis from Bosnia and Herzegovina

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Propolis is the most researched bee product. Numerous studies have shown that effective against bacteria, fungi, viruses and inflammation and has anesthetic, antioxidant and anticancer effect, prevents the growth of plants and seed germination, stimulates tissue regeneration and strengthens the immune system. The analysis of propolis was done to establish chemical characteristics of propolis, its importance for human health and antibacterial activity. For analysis, four samples were used: two raw propolis samples (the samples 1. and 4.) and two commercial samples, water extract of extra pure propolis and glycerin – aerosol for children (sample 2.) and non-alcoholic water sample of 10% propolis (sample 3.). The samples 1., 2. and 3. was prepared by weighing 7.35 g of sample in test tube of 40 mL and adding 26 mL 70% ethanol. Test tube was closed with plug and solution was mixed every hour 15 minutes for next 24 h. The sample 4. was prepared by dissolving 400 g of propolis in 1 L of 90% ethanol. Solution was leave for 40 days and then was filtrated. The determination was done on three bacterial species: *Micrococcus luteus, Staphylococcus aureus and Staphylococcus epidermidis*. During the preparation of samples, we used the filtration method and during the determination of antibacterial activity we used the agar well diffusion method with automated inhibition zone reading using the Scan 4000 Ultra-HD zone reader. The inhibition zones values of bacterial strains were shown in Table 1.

Storage location Refrigerator 2-8^{0}C	Sample 1. Period (days)			Sample 2. Period (days)			Sample 3. Period (days)			Sample 4. Period (days)		
	1	**50**	**365**	**1**	**50**	**365**	**1**	**50**	**365**	**1**	**50**	**365**
Micrococcus luteus	21.0	20.1	25.8	8.9	7.2	0	14.7	13.8	10.9	20.5	23.3	21.5
Staphylococcus aureus	21.0	22.7	28.2	9.8	6.2	0	15.4	12.3	10.3	20.1	31.7	23.2
Staphylococcus epidermidis	18.5	20.5	30.0	5.9	6.2	0	10.6	11.0	12.7	26.8	21.0	27.8

Table 1. Zone of inhibition (mm) of three bacterial strains against four propolis samples.

As Tables 1. clearly indicated that the inhibition zone values of these samples were significantly different from each other.

From the results we can realize that the propolis is “natural antibiotic” number one in world for many scientist and scientific studies. Homemade propolis in 70% or 90% ethanol had the best inhibition zones so he had the best qualities. Non-alcoholic propolis samples had the minimal inhibition zones and sensitivity on the tested strain of bacteria, and sample 2. (water extract of propolis) had very small

inhibition zone and big resistance of bacteria.

PP-43 Antimicrobial activity of natural garlic vs commercial garlic supplements

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Garlic (*Allium sativum* L.) is a plant that traditionally has been used both as spice and medicinal product for centuries. Its beneficial medical properties have been proved in many studies. Some of these are: antimicrobial, antifungal, antiparasitic properties, effect on cardiovascular disorders and antioxidant properties. Therefore, its antimicrobial activity is well known. The antimicrobial activity of garlic is mainly attributed to allicin, the compound of garlic which originates from allicin. The analysis was done on the three samples of natural garlic raised in the different cities and countries (Bosnia and Herzegovina (Bihac and Travnik regions) and China) and on the four commercial garlic supplements: essential oil, oil macerate, garlic powder and garlic extract. Due to the fact that these supplements have different chemical composition, the purpose of this study was the assaying their antimicrobial properties and comparing that results with results of natural garlic antimicrobial properties.The assaying of antimicrobial properties of the samples was done on three bacterial strain (*Micrococcus luteus*, *Staphylococcus aureus* and *Staphylococcus epidermidis*) by the agar well diffusion method with automated inhibition zone reading. The inhibition zones values of bacterial strains were shown in Table 1.

	Sample 1.	Sample 2.	Sample 3.	Sample 4.	Sample 5.	Sample 6.	Sample 7.
	Natural garlic samples			Commercial garlic supplements			
Micrococcus luteus	15.5	14.8	0	10.9	0	0	0
Staphylococcus aureus	17.4	15.4	0	12.4	0	0	0
Staphylococcus epidermidis	16.1	12.1	0	12.3	0	0	0

Table 1. Zone of inhibition (mm) of three bacterial strains against seven garlic samples

The results of assaying commercial supplements have revealed that only one supplement, the garlic essential oil (sample 4.), shows weak antimicrobial activity. The rest of the supplements didn't show any antimicrobial activity. The results of the natural garlic showed the antimicrobial activity of two from three samples on all three bacteria. The best action he had was from a garlic cultivated in Bihac region, Bosnia and Herzegovina (sample 1.).

PP-44 Biologically active substances of wild *Valeriana officinalis* L. roots from different regions of Latvia

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Valerian (*Valeriana officinalis* L.) plant root is an herb which is used worldwide over centuries. It belongs to Valerianaceae family. There are about 300 species in the family Valerianaceae. The plant of *Valeriana officinalis* is native to Europe and Asia and in addition has naturalized in eastern North America. The roots of *V. officinalis* known as valerian, since long are taken as sedative medicine in Europe. Valerian is an agent with mild sedative and sleep-promoting properties that is often used as a milder substitute or a possible alternate for stronger synthetic sedatives, such as the benzodiazepines, in the treatment of nervous states and anxiety-induced sleep disturbances. Valerian is also a component of many herbal mixtures, which are widely used to treat sleeping disorders. Nowadays, valerian extracts are available as dietary supplements, which primarily involve dried root or extracts from the root, formulated into tablets or soft gelatin capsules. According to European Pharmacopeia one of the most important quality parameter in *Valeriana officinalis* root samples is the total content of essential oil. Therefore the aim of this research was to determine the amount and composition of the essential oil from wild *Valeriana officinalis* samples collected in different regions of Latvia. The fifteen wild *Valeriana officinalis* samples were collected from different local provinces of Latvia during the period from August to September 2017 and four authentic *Valeriana officinalis* samples were collected in April 2018. Collected roots were dried at temperature 45 °C. Essential oil of the dried Valerian root was extracted by hydro-distillation using the Clevenger-type apparatus. Ten grams of the dried root was hydro-distilled for 4 h and the oil obtained stored in lightproof bottle until analysis. Separation of the constituents was determined by gas chromatography-mass spectrometry (GC/MS). The chemical compositions of the essential oil were determined according to their retention time and spectrometric electronic library (NIST). The identity of the constituents of the oils was established using GC retention indices (RI). According to European Pharmacopeia essential oil content should be more than 4 mL kg^{-1} expressed on a dry root weight. Hydro-distillation of the valerian root yielded pale yellow, pungent and unpleasant smelling essential oil. Concentration of essential oils from samples harvested in 2017 varies from 1.2 till 12.18 mL kg^{-1}, however concentration of essential oils from samples harvested in 2018 varies from 9.9 till 15.8 kg^{-1}. All samples meet European Pharmacopeia requirements except two samples. Analyses of Valerian have reported over 150 chemical constituents with various biological activities. Like other medicinal plants, there is substantial variation in the chemical constituents of this plant species from different regions due to climatic conditions, processing and storage conditions, etc. GC/MS analyses of the essential oil revealed the presence of thirty-eight components. The major compounds identified in the oil were bornyl acetate (18.44-37.57%), valerianol (8.69-22.89%), valeranone (7.17-17.96%), intermedeol (n.d-11.84%), camphene (1.04-11.18%), myrtenyl acetate (3.38-6.77%), agarospirol (3.5-8.71%) and γ-eudesmol (1.17-5.37%). In all investigated samples the most dominant compound was bornyl acetate.

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PP-45 Growing Technology for Dandelion (*Taraxacum officinale* L.) Under Organic Croping System

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Dandelion (*Taraxacum officinale* L.) has been used as medicinal herb for centuries. Roots of dandelion could be used in pharma for several health promoting benefits (for example, diuretic, laxative, cholagogue, anti-rheumatic and hypoglycemic activities (Schütz, Carle, & Schieber, 2006)). Dandelion roots also are usable as food for herbal teas, liquors or marmalades, food supplement (Martinez et al., 2015), coffee substitutes as well as in cosmetics for skin depuration or scalp cleansing. The content of active substances of the wild MAPs is not a constant and varies by geographic region and other factors. Therefore, the pharma and cosmetics industries in the World lack reliable and stable supply of MAPs. Field cultivation under controlled and documented conditions is a step towards improving drug safety and pharmaceutical quality. Germany, Poland and Hungary are growing dandelion at farm level, mostly for leaf production. Root are grown in France, Austria and Italy. In Latvia there is a lack of technical knowledge for dandelion cultivation as well how this is reflected on the quality of the product and its commercial value. The aim of this research was to determine the most promising growing technology for dandelion under organic conditions, adapted to techniques, available in LTD 'Field and Forest' (Latvia). Field trials on organically certified fields (57°19'29.4"N 25°19'20.6"E, 110 m altitude)' were set up close to industrial production conditions. The objectives of agrotechnical field trials for dandelion was: identify the most promising commercially available varieties and optimal plant density; to found optimal harvesting time. Fields were cultivated with agro-machinery used by the company on usual basis for planting, sowing, cultivation to evaluate growing technology close to commercial fields. In each trail variant 25 roots were randomly picked. Median was used for yield calculations. No significant differences between evaluated varieties 'Nouvelle' (Pharmasaat) and 'Nesuuna varieta specificata' (Jelitto) in terms of yield were found. 'Nesunna' had higher yield. Opposite was observed on content of chlorogenic acid and chicoric acid. Their content was higher in variety 'Nouvelle', but statistically significant differences were not found. Three different distances between plants in rows were evaluated - 22, 31 and 75 cm (distance between rows – 75 cm). Distance between plants (22 un 30 cm) did not affect neither yield nor quality. With distance increasing to 75 cm root yield per area was significantly lower, but quality parameters did not change. Four harvesting data were evaluated – 18.09.2018., 26.09.2018., 04.10.2018. and 15.10.2018. Yield per harvest date was fluctuating and it had significant effect on quality and yield of both tested varieties. The highest yield and root quality were obtained in harvest date 04.10.2018.

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PP-46 Effects of gamma irradiation and comparison of different extraction methods on sesquiterpene lactone yields from the medicinal plant *Thapsia garganica* L. (Apiaceae)

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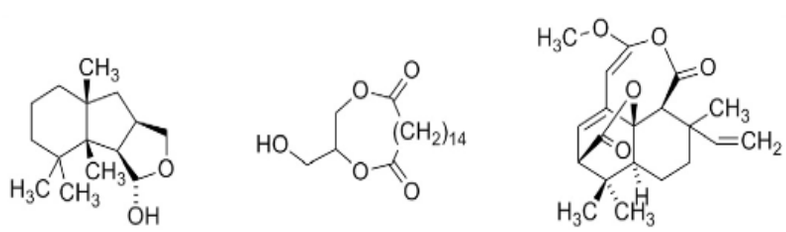
The objective of this study was to evaluate the combined effect of microwave assisted extraction and gamma irradiation on the highly bioactive compounds found in o Algerian *T. Garganica* extracts. Quantification of the compounds of interest was carried out using an HPLC. The antioxidant activity extracts was determined using the two free radical scavenging assays: the 2,2-diphenyl-picryl-hydrazyl (DPPH) and the 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) diammonium salt (ABTS). It was found that location and extraction method had significant impact on the phytochemical composition of extracts. Gamma irradiation was found to have no significant effect on the phytochemical composition (Thapsigargin (Tg), nortrilobolide (Nb) and thapsigargicin (Tc)) of the plant extracts as well as on their antioxidant properties.It has been shown that microwave assisted extraction is an effective method for investigating the chemical constituents of *T. garganica* and the results support the fact that the gamma sterilization by do not alter the chemical composition.



.....Nb Tg Tc

Figure 1: Thpsigargins molecules in *T. Garganica* extract

PP-47 Cytotoxic and Anticancer Activity of Petroleum ether extract of Algerian Propolis

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It is well established that bee propolis obtained from different sources showed different chemical nature and possess various biological activities including cytotoxic and anti-carcinogenic. Therefore, studies about propolis and its activities have increased considerably in recent years. In this regard, cytotoxic and anti-carcinogenic activities of Algerian propolis extract was explored in MDA-MB-231 (human breast cancer), cell line. Propolis was collected in Mila, Algeria. Propolis extract was obtained by maceration of ground sample (10 g) using petroleum ether as a solvent. For evaluation of cytotoxicity, MTT assay throughout in this study. Petroleum ether extract of propolis showed a concentration dependent cytotoxic effect. EC50 concentration was calculated as 104 ug/ml. Apoptosis was evaluated by Arthur image based cytometer. The results showed that apoptosis was induced by propolis extract in breast cancer cells. All of these results were confirmed that induction of apoptosis is one of the main reasons for anticancer and cytotoxic activity of Algerian propolis. Further experiments were required to explain other mechanisms for anticancer activity of that extract.

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PP-48 Determination of Anticholinesterase Inhibitory Activity of *Arum rupicola* Boiss. *var. rupicola*

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The *Arum* L. in the Araceae family, is represented in Turkey by at least 18 taxa. *Arum rupicola* Boiss. var. *rupicola* is one of them. It is native to Greece (Lesbos), Turkey, Iraq, Iran, Syria, Lebanon, Israel, Jordan, Cyprus and Belorussia as a wild plant. This study was set up to determine different extracts of *A. rupicola* var. *rupicola* tubers' (hexane, ethyl acetate, 70% methanol and water) anticholinesterase activity on acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) enzymes by *in vitro* Ellman method at 1 mg/ml and 2 mg/ml concentrations. The hexane extract had the highest inhibitory activity against AChE in 1 mg/ml concentration 16.58±0.31 % and 2 mg\ml concentration 22.54±0.37 %. The ethyl acetate extract showed the highest inhibitory activity against BChE in 1mg\ml concentration 17.55±*0.007% and 2mg\ml concentration 21.79±0.02%.*

PP-49 The Thyme oil pickering emulsion for the biological cleaning of historical stone surfaces

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The *Thymus* genus is one of the most taxonomically complex genera in the Lamiaceae family and includes 250–350 taxa (species and varieties) of wild growing evergreen species of herbaceous perennials and subshrubs, native to Southern Europe, Africa and Asia. Thyme is a largely used medicinal plant for its expectorant, spasmolytic and antiseptic properties and infusions are employed for treating ulcers, dermatitis and rheumatic pains. The essential oil of *Thymus* ssp. shows a broad spectrum of bioactivities. In fact, its application as food preservative, as antioxidant, and as additive to enhance organoleptic characteristics has been reported. *Thymus capitatus* (L.) Hoffmanns. & Link. [syn. *Coridothymus capitatus* (L.) Reichenb. fil; *Thymbra capitata* (L.) Cav.; *Satureja capitata* L.] (Lamiaceae) is a Mediterranean endemic plant commonly used as a condiment for typical Mediterranean cuisine in Portugal, Spain, Italy, Cyprus, and Greece (Facciola, 1990). It is very rich in the terpenes thymol, carvacrol, and *p*-cymene. Chemotypes thymol, thymol-carvacrol, and carvacrol have been described, the latter being the most abundant (Bounatirou et al., 2007).Several heterotrophic microorganisms (bacteria and fungi) have the ability to interact with historical material such as textile, leather, paper, paintings, wood, papyri. Species of bacteria, fungi and algas can cause deep deteriorations of the items. Also stone monuments, in moderate and humid climates, can be colonized by fungal communities. The surfaces of stone monuments can be altered by fungal activity via hyphal penetration through the porous stone matrix and by production of organic acids and pigments (Stupar et al., 2014). Herein we reports on Maltese accession of *Thymus capitatus* essential oil as anti-microbial agent against several microorganism, infesting historical stone surfaces.

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PP-50 Glycosides from a Sicilian accession of *Urginea pancration* (Steinh.) Speta and its biological activity against *Stegobium paniceum*

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Urginea pancration (Steinh.) Speta [syn.: *Charybdis pancration* (Steinh.) Speta, *Urginea maritima* (L.) Baker, *Drimia maritima* (L.) Stearn] belongs to the family Hyacinthaceae within the order of the Asparagales. The most commonly used name is Scilla, from the Greek σκυλλω = torment, allusion to the poisonous properties of the bulb, from Σκύλλα = Scilla, the beautiful nymph transformed by Circe into a sea monster because she is in love with Glaucus, or from σκέλλω = wither, because the plant is born and grows in dry places; pancratium comes from the Greek παν (pan, "all") and κρατυς (cratys, "powerful") in allusion to the supposed medicinal virtues. The Scilla is one of the oldest remedies. It was described by Theophrastus and recommended by Dioscorides describing the preparation of the scillitic wine, while later the Arabs introduced the scillitic honey, a galenic preparation used until 1960.The species of the family Hyacinthaceae are perennial bulbous herbaceous plants that grow in the coastal and inland areas in the whole Mediterranean region. *Urginea pancration* can easily grow in dry and arid areas up to three hundred meters above sea level, but populations have been found even at 680 meters in a national park in Puglia and at altitudes up to 900 meters in Sicily. Previous phytochemical investigations indicated the occurrence of bufadienolides, flavonoids, mucilage, triterpenes, ecc. (Bradley, 1992; Kopp et al. 1990).In the present communication we report on the extraction, with different solvents, of the bulbs of a Sicilian accession *U. pancration* Furthermore several glycosidate metabolites were isolated and chemically characterized. The extracts were also tested for their insecticidal activity against *Stegobium paniceum*, a pest also known as "biscuit beetle". It is capable of causing substantial damage and enormous economic losses since it attacks cereals, post-harvest, and all packaged and stored derivatives.

PP-51 Solvent Effects by The Microwave Extraction of *Alhagi pseudalhagi* Bioactive Compounds

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The effect of solvent type by the microwave extraction of bioactive compounds from *A. pseudalhagi* was studied. Microwave extraction was carried out on a monomode Discover-S-Class microwave reactor operating at a frequency of 2.45 GHz with an adjustable power of microwave energy in the interval from zero to 300 W with 1 W discreteness. The bioactive compounds was observed using GC/MS method (Baisalova et al., 2014). The extracting media included hexane, chloroform, ethyl acetate, ethyl alcohol. The extracting power of the media was presented by the yields of extractive substances and main compounds in the extracts obtained. Seeds of *A. pseudalhagi* was subjected for this investigation. According to the value of extractive substances, the solvents can be placed in the following row: ethyl alcohol (1.9%) > chloroform (1.5%) > ethyl acetate (1.1%) > hexane (0.9%). Palmitic and linoleic acids were the compounds of interest (Baisalova et al., 2011). For palmitic and linoleic acid, hexane and ethyl acetate as extracting medium showed the highest yield.

PP-52 Antioxidant Activity of Various Extracts from *Scutellaria orientalis* subsp. *sosnowskyi* from Ağrı, Turkey

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The genus *Scutellaria* is one of the important members of the Lamiaceae (Labiatae) family. There are approximately 350 species of the genus *Scutellaria* which are called skullcaps all around the world. The species of *Scutellaria* are used as a folk medicine for the treatment of several diseases due to possess with anticancer, antiviral, antibacterial, anti-oxidant, antipyretic, neuroprotective and anti-inflammatory properties. In the present study, *Scutellaria orientalis* subsp. *sosnowskyi* was collected from Ağrı, Turkey and the aerial part of the species was extracted with different solvents such as hexane, chloroform, methanol. Infusion of plant was also prepared. The antioxidant activity was determined by CUPRAC and FRAP assay and free radical scavenging activity (by DPPH•). Besides, the phenolic content of extracts were determined and the results showed that infusion extract contains the highest amounts of total polyphenolics, expressed as gallic acid equivalents (59±1.2 mg/g extract). According to three antioxidant tests, all extracts showed moderate to strong antioxidant activity.

PP-53 Efficacy of Green Tea Catechins on the Treatment of Cancer

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Green tea is the leaves of *Camellia sinensis*, is a widely consumed beverage around the world. The consumption ratios of teas are 78% black tea, 20% green tea and 2% oolong form all over the world. Green tea contains more catechins than black and oolong teas. Catechin derivatives which obtained from green tea leaves are; epigallocatechin-3-gallate (EGCG), epigallocatechin (EGC), epicatechin-3-gallate and epicatechin.The anticancer effect of green tea is thought to be due to polyphenolic compounds which called catechin. The EGCG have an anticancer effect among these catechin derivatives. This compound is effective in many cells, which can be triggered by apoptosis or necrosis in the cells, or as a pause in the life cycle of cells. Studies have shown that EGCG inhibits the growth and angiogenic spread of breast, bladder, prostate, and skin cancer cells.In this study, it is aimed to review the effects of green tea on various types of cancer.

PP-54 The Effect of Caffeine on Exercise Performance

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Caffeine is a widely consumed pharmacologically active food component in the world. Most people take caffeine from coffee and tea. Caffeine is a psychostimulant purine-like herbal alkaloid that is present in more than 60 plant species in coffee and tea in a high proportion, low in naturally occurring cocoa beans (chocolate and cocoa) guarana, yerba mate and cola nuts. 1,3,7-trimethylxanthine, also known as caffeine, is widely used for alertness, improving performance by reducing physical stagnation, and increasing attention. Caffeine contributes to endurance performance by increasing the breakdown of fatty acids, thus protecting glycogen stores. It also acts as a facilitating agent for the transport of calcium, affects muscle contraction, as well as decreasing fatigue, as well as increasing plasma potassium levels accompanying the fatigue. Caffeine, which is widely used by athletes, the consumption and researches has been increased from 2004 to these days because of the removal of catechin from the ban list of the World Anti-Doping Agency (WADA). In this study, it was aimed to review the studies examining the effect of caffeine on exercise performance.

PP-55 Comparison of free fatty acid profile of different *Carthamus tinctorius* L. genotypes determined by Ultra Performance Convergence Chromatography

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In this study, comparison of free fatty acid (FFA) content of seed oils obtained from several genotypes of *Carthamus tinctorius* L. was performed. The seeds of thirty three genotypes of *Carthamus* species were extracted with Soxhlet apparatus, in addition two seed samples were subjected to supercritical fluid extraction (SFE-CO_2). The qualitative and quantitative analyses of FFA of the oils were carried out with Ultra Performance Convergence Chromatography (UPC^2) technique coupled with a mass detector. The main goal of the work was to evaluate the actual quantities of the FFA in the seed oils without any derivatization for subsequent comparison of the genotypes in terms of their fatty acids profile. It has been determined that linoleic acid was in abundance in all the genotypes examined. However, α-linolenic acid was found at trace level. Other free fatty acids detected in noteworthy amounts were palmitic, stearic and oleic acids.

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PP-56 *Phlomis brevibracteata* Turrill. decreased the motility and ROS accumulation at liver adenocarcinoma cell line

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Phlomis brevibracteata Turrill. is an endemic plant of North Cyprus belonging to Lamiaceae, a family known for its antioxidant and anticancer properties. Due to its endemism, there is not any detailed study available in the literature regarding this species. In our previous study, the anticancer and *in vitro* antioxidant activity of aqueous methanolic (70%) extract (PBM) of *Phlomis brevibracteata* has been observed to be high upon cytotoxicity and $ABTS^{+\bullet}$/$DPPH^{\bullet}$ radical scavenging assays, respectively. For a better understanding of the biological activities of PBM, the motility and *ex vivo* antiradical potency of PBM has been analyzed by 2-dimensional wound healing assay and H_2DCFDA assay, a well-known cellular antioxidant assay, respectively. Additionally, the ability of PBM in inhibiting the motility and morphological change upon induced oxidative stress has also been analyzed. Our results revealed that PBM, significantly decreases the motility of SK-HEP1 cell line at concentrations more than 1000µg/ml. PBM has also shown an extensive decrease in both basal and induced oxidative stress on SK-HEP1 cell line. No morphological change has been observed at H_2O_2 or PBM exposed cells.

PP-57 Cytotoxic effects of *Phlomis brevibracteata* Turrill. on Hep3B Hepatocellular Carcinoma Cell Line†

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Phlomis brevibracteata Turrill., an endemic plant of Northern Cyprus, is a member of Lamiaceae family. In-virtue of its endemism, studies are required to understand the characteristics of this unexplored plant. In a previous study 70% methanolic extract of *Phlomis brevibracteata* has been found to significantly decreasing the cell viability of SK-HEP-1 adenocarcinoma cell line at concentrations ≥1000µg/mL. For a better understanding of the cytotoxic potency of PBM in different HCC cell lines, the current study has been carried out with the goal of investigating the cytotoxic potency of PBM in Hep3B hepatocellular carcinoma cell line, by the means of MTT assay. Our results showed that Hep3B and SK-HEP-1 cell line shared similarity regarding methanolic extract of herb part (PBM) effect on the viability. Interestingly both cell lines show a significant proliferation decreasing with PBM treatment over ≥1000µg/mL. However, on a scale of sensitivity to PBM treatment, Hep3B with an IC_{50} value of 569.2µg/mL is more sensitive than SK-HEP-1 cell line with an IC_{50} value of 1056µg/mL.

PP-58 The cytotoxic potency of different plant parts of *Lycium ferocissimum* Miers. on SK-HEP-1 adenocarcinoma cell line

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Hepatocellular carcinoma is a major liver malignancy, currently reported as the fifth most commonly occurring cancer in men and the ninth most commonly occurring cancer in women. After the discovery of the first-ever plant origin anticancer agent of podophyllotoxin in the late 1960, various studies have notably focused on finding new plant lead molecule in cancer management since compared to conventional chemotherapeutic agents these are more biologically friendly and less toxic to normal cells. *Lycium ferocissimum* Miers. commonly known as African boxthorn or boxthorn is a shrub belonging to Solanaceae, a family mostly recognized by its high alkaloid content. This species is native to Cape Province and Orange Free State in South Africa, however this plant has also been geographically adapted to Cyprus. For a better understanding of the cytotoxic activity of this unexplored plant, SK-HEP-1 adenocarcinoma cell line have been treated with different concentrations (10µg/mL-1000µg/mL) of 70% aqueous methanolic extract of *Lycium ferocissimum* from leaves (LFL) and fruits (LFF) together with its juice extract (LFJ) for 48-hrs, independently. Our results show that, among all analyzed samples only the 70% methanolic extract of *Lycium ferocissimum* leaf extract caused a significant decreased in the cell viability of SK-HEP-1 adenocarcinoma cell line. Interestingly, LFJ and LFL not only did not affect the viability but rather stimulated the proliferation of SK-HEP-1 adenocarcinoma cell line. Even though both LFJ and LFL caused a concentration dependent increase in the proliferation of SK-HEP-1 adenocarcinoma cell line, only the stimulating effect of LFL was considered to be statistically significant.

PP-59 Cytotoxic effects of *Phlomis brevibracteata* Turril on Neuroblastoma Cell Line

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The American National Cancer Institute reported that 22910 adults have suffered from brain and other nervous system tumors in 2012. From those 13700 resulted with death. Neuroblastoma is a kind of cancer which is most common in children under one year old. This cancer originates from neuroblasts, mostly non-invasive which grow slowly. It accounts for about 6% of all cancers in children. Nowadays scientists focus on new and effective therapeutic pathways to discover a treatment of neuronal derived cancers. Plant extracts are good candidates as natural source of therapeutic agents for different types of cancer. In our study we focused on one of the endemic plants of North Cyprus *Phlomis brevibracteata* Turrill (PBT) belonging to Lamiaceae, a family known for its antioxidant and anticancer properties. To the best of our knowledge, there is not any study available in the literature regarding the neuroprotective or anticancerogenic effect of this species. In this study we try to understand the anticancerogenic effect of aqueous methanol extract (70%) on neuroblastoma cell line SH-SY5Y. MTT assay carried out to assess the antiproliferative effect of different concentrations of extract (100-2000 µg/ml) on the SH-SY5Y cell line and we used One-way ANOVA analysis to understand the statistical significance. Our results showed that extract concentrations over 1500 µg/ml ($p<0.0001$) caused significant anticancerogenic activity on this cell line. The half maximum inhibitory concentration (IC_{50}) for extract is calculated as 1335 mg/ml. In future studies we are planning to analyze other biological activities and molecular effects of this plant in details.

PP-60 Effects of some *Plantago* species on enzymes related with wound healing

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Plantago species (Plantaginaceae) have been used as medicinal plants in Turkey and many other countries for centuries. Previous studies revealed that species belonging to *Plantago* genus have anti-inflammatory, wound healing, antifungal, antibacterial, antiviral, cytotoxic, and hepatoprotective effects; moreover, iridoid glucosides, phenylethanoid and flavonoid glycosides, caffeic acid derivatives, and polysaccharides are the main constituents responsible for these biological effects. Current study is concerned about potential inhibitory activities of the aqueous extracts of aerial parts of *P. major* subsp. *major* L., *P. major* subsp. *intermedia* (Gilib.) Lange, *P. lagopus* L., *P. scabra* Moench., aerial parts and roots of *P. holosteum* Scop. against hyaluronidase, collagenase, and elastase enzymes which have crucial roles in wound pathogenesis. Inhibition of hyaluronidase, collagenase and elastase, which break down the structural proteins constituting the main components of tissue, could be useful for the wound healing process (6). Results of the current study exhibited that aqueous extracts of *P. holosteum* Scop. and *P. major* subsp. *major* L. showed significant inhibition on the activities of hyaluronidase and collagenase enzymes among all tested extracts. However, none of the extracts exerted remarkable inhibition against elastase enzyme. Thus, phytopharmaceuticals including the extracts of *P. holosteum* Scop. and *P. major* subsp. *major* L. may be useful for the treatment of wounds.

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PP-61 Scientific rational for the traditional use of *Pittosporum viridiflorum* Sims in African traditional medicine

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Pittosporum viridiflorum finds use in African traditional medicine (ATM) for treatment of several diseases and conditions including tuberculosis, cancer, and inflammatory disorders. This study aimed to provide credence for the traditional use of this plant in ATM. Acetone, 80% ethanol, and water (cold and hot) extracts from the bark and leaves were evaluated for antimycobacterial activity against 5 non-pathogenic and 3 pathogenic *Mycobacterium* strains. Four human cancer and two normal cells were used to determined cytotoxicity, *Salmonella typhimurium* TA98 and TA100 for genotoxicity, and 15-lipoxygenase (LOX) enzyme for antiinflammatory activities of the prepared extracts. The acetone leaf extract demonstrated the best antimycobacterial (with MIC value=160 µg/ml against pathogenic *M. bovis*), anticancer (LC_{50} values ranging from 3.16-26.87 µg/ml against A549, HeLa, Caco-2, and MCF-7 cells), and antiinflammatory (LC_{50} value=5.01 against LOX enzyme) activities. All the tested extracts were not cytotoxic towards Vero African green Monkey kidney and bovine dermis cells, and were negative in the Ames test against *Salmonella* strains. *P. viridiflorum* acetone leaf extract can be considered as a source for isolation, identification and development of either anticancer, antimycobacterial and antiinflammatory agents.

PP-62 Inhibitory activities of different parts of *Prunus mahaleb* extracts on tyrosinase

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Among medicinal plants in Turkey, *Prunus mahaleb* L. (syn. *Cerasus mahaleb* L. Mill.) commonly known as mahlep, mehlep, idris agac, pis ağaç and belongs to the family Rosaceae. It is important for Turkey because of export potential. Its kernels, seeds and fruits are used for medicinal and nutritional purposes. Many studies on *Prunus* species have shown that these species have cosmetic potential. In this study, we investigated on tyrosinase inhibitory activity in methanol extract and its ethyl acetate, n-butanol and aqueous fractions from twigs, flos, leaves, seeds, fruits and kernels of *Prunus mahaleb*. While the lowest tyrosinase inhibitory activity was observed in aqueous fractions, the highest activity was found in ethyl acetate fractions of all parts. In the study using kojic acid (%94.2) as standard, ethyl acetate fractions of parts showed potent activity with %82.1-90.1 inhibition at 200 µg/ml. According to the results *P. mahaleb* can be used as a natural cosmetic agent.

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PP-63 Investigation of phytochemical and antioxidant properties of *Salvia officinalis* extracts obtained by different methods

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Salvia officinalis L. (Sage) is a valuable aromatic and medicinal plant from the family Lamiaceae with the highest commercial value. Although there are over 900 species of *Salvia* in the world, the common known species are sage (*Salvia officinalis* L.), Anatolian sage (*S. fruticosa* Mill., syn. *S. triloba* L.), apple sage (*S. pomifera* L .), Spanish sage (*S. lavandulaefolia* Vahl.) and musk sage (*S. sclarea* L.). In Anatolia, most of the sage types are used as dry leaves, mainly tea and spices. Biological activities of sage such as antimicrobial and antioxidant effect are stated to be mostly due to components of essential oil (1,8-cineole, α-thujone, β-thujone and camphor) as well as phenolics acids, carnosol derivatives, and flavonoids. In the present work, the leaves of *S. officinalis* were collected during flowering period from cultivation area near to Eskişehir province. The dried leaves were extracted with four techniques. Namely, accelerated solvent extraction (ASE) with hexane (HE), methanol (ME) and water (AqE), subsequently, at 70°C and 100°C, 103 bar and 18 min; supercritical fluid extraction (SFE-CO_2) at 40°C, 100 bar and 45 min; and hydrodistillation (EssOil) methods were applied. The yield values were obtained as 3.31% for HE, 12.94% for ME, 16.10% for AqE, 2.49% for SFE extract and 1.25% for EssOil. The main constituents of EssOil were α-thujone (34.7%), camphor (16.5%), 1,8-cineole (10.1%), manool (4.1%) and β-thujone (3.3%). In SFE were detected a-thujone (23.3%), manool (18.4%), hentriacontane (7.8%), camphor (6.9%) and viridiflorol (5.1%). The free radical scavenging activity was evaluated using DPPH and TEAC assays. The highest antioxidant activity was detected for AqE (IC_{50} 0.04±0.001 mg/mL) and ME (IC_{50} 0.06±0.002 mg/mL) extracts. Noteworthy activity was detected in HE (IC_{50} 0.1±0.005 mg/mL) and SFE (IC_{50} 0.21±0.12 mg/mL) extracts. However, EssOil showed low inhibition (Inh. 38.38±0.08%). The highest values of trolox equivalent antioxidant capacity (TEAC) were found for SFE and AqE extracts (1.95±0.02 mM and 1.79±0.14 mM, respectively).

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PP-64 Essential oil composition of *Juniperus* species Growing Wild in West Mediterranean region of Turkey

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Essential oil of *Juniperus* species is used in medicine, cosmetic and food industry because of antimicrobial, antifungal, antioxidant activities. In this study was aimed to determine the essential oil content and components of wild *Juniperus* species collected from two different locations in the west Mediterranean region of Turkey. The essential oil contents were determined by hydro-distillation method with Clevenger type apparatus. The essential oil composition of each sample was analysed by GC-MS/FID. The highest essential oil yields were found for *Juniperus excelsa* (4,00%) followed by *Juniperus oxycedrus* (2,25%), and *Juniperus drupacea* (0,13%). The essential oil of each species has significantly different composition. The principal components for *Juniperus excelsa* were α-pinene, myrcene, cedrol, *trans*-pinocarveol, β-pinene, and ranged between 84,65-89,88%, 1,40-2,03%, 0,87-3,26%, 0,92-2,25%, 0,93-1,29%, respectively. On the other hand, the major components of *Juniperus oxycedrus* were myrcene, α-pinene, Germacrene D, limonene, and varied between 56,47-65,13%, 10,82-15,61%, 8,06-16,61%, 3,65-3,78%, respectively. The third species, *Juniperus drupacea*, has the lowest essential oil content, and its main components were α-pinene (31,28-39,50%), limonene (25,65-28,61%), γ-muurolene (3,80-7,21%), δ-cadinene (3,30-6,17%).

PP-65 Cytotoxic and Antimicrobial Activities of *Prunus mahaleb* L. Kernels

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Prunus mahaleb L. a wild member of the Rosaceae family, is an important rootstock for cherry and sour cherry cultivars. Specifically the seeds and fruits have been used as a flavouring agent. In this study, we investigated cytotoxic and antimicrobial activity of methanol extract and its fractions from kernels of *P. mahaleb*. Cytotoxicity was determined with 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay against healthy cells of L929 and HeLa cancer cells. Antimicrobial activities were determined using broth microdilutions against the bacteria (*Escherichia coli* ATCC 25922, *Enterococcus faecalis* ATCC 29212, *Pseudomonas aeruginosa* ATCC 27853, *Staphylococcus aureus* ATCC 29213) and fungi (*Candida albicans* ATCC 90028, *Candida krusei* ATCC 6258, *Candida parapsilosis* ATCC 90018). *n* Buthanol and hexane fractions showed moderate antimicrobial activity against *Candida krusei* with 64 µg/mL MIK value. While none of the extract and fractions showed cytotoxic effects against healthy L929 cells, ethyl acetate fraction showed slightly cytotoxic effect against HeLa cancer cells at high concentrations.

PP-66 Isolation and identification of four alkaloids from the seeds of *Peganum harmala* L. collected in Turkey

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In traditional medicine, *Peganum harmala* L. has been used for treatment of a wide range of conditions such as asthma, rheumatic pain, hypertension, diabetes, hemorrhoids etc. Harmala seeds used as incense due to their hallucinogenic properties since ancient times. All the parts of the plant are used in folk medicine. Particularly, the seeds are reported to be utilized as powder, decoction, maceration or infusion in etnhnobotanical surveys. Numerous studies revealed that *P. harmala* and its alkaloids possess inhibitory effects on cholinesterase, monoamine oxidase and angiotensin converting enzyme. Also hypotensive, antispasmodic, antihistaminic, immunomodulatory, anticoagulant, analgesic, antimicrobial, emetic, hypoglycemic and antiproliferative effects of the plant have been presented. In this study, dried and grinded seeds of *P. harmala* (A voucher specimen has been deposited in the Herbarium of Faculty of Pharmacy, Hacettepe University, Ankara, Turkey HUEF:17003) extracted three times with Methanol: Water (3:1) at 40°C under reflux. The extracts were combined and concentrated under vacuum. The extract was further partitioned with n-Hexane, Ethyl acetate and n-Butanol, respectively. Among them, n-Butanol extract (22g) was subjected to various separation techniques including normal and reverse phase chromatographies, Sephadex column chromatography as well as preparative TLC to obtain three β-carboline alkaloids and one piperidine alkaloid. Their structures were elucidated by spectroscopic analyses including ESI-MS, 1D and 2D NMR, additionally by comparison of the data with those in the literature. Thereby, β-carboline alkaloids were identified as Harmine, Harmaline and Harmalol meanwhile piperidin alkaloid was described as Pegaline.

PP-67 Cytotoxic coumarins from the Apiaceae plants

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Cytotoxic activities of 14'-acetoxybadrakemin, 14'-hydroxybadrakemin, marmesin, smyrnioridin, deltoin, colladonin isolated from *Petroedmondia syriaca* (Boiss.) Tamamsch. as well as bergapten and 4'-senecioiloxyosthol isolated from *Neocryptodiscus papillaris* (Boiss.) Herrnst. & Heyn were investigated on the MCF-7 mammalian cancer cell line using the MTT assay. Amongst the tested compounds 14'-acetoxybadrakemin and colladonin showed the highest activity with IC_{50} values of 27 and 29 µM, respectively. Deltoin was moderately active against the MCF-7 cell line with IC_{50} values of 88 µM.

PP-68 Antioxidant activity of ethanol extracts of leaves and flowers from *Prunus spinosa* L. from Bosnia and Herzegovina"

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Prunus spinosa L. (blackthorn or sloe) which belongs to the rose family *Rosaceae* is a perennial plant which grows as a shrub on slopes of wild uncultivated areas. Because of medicinal characteristics of sloe's fruits, flowers and leaves, it is commonly used in food industry and phytotherapy. Leaves and flowers were collected from three different areas in Bosnia and Herzegovina. Ethanolic extracts were obtained by using two methods: microwave extraction and ultrasound assisted maceration. Total phenolic content was determined in comparison with standard Gallic acid, and the results were expressed as mg GAE/g dry sample. Total phenolic content for leaves and flowers was in range 17,78±0,10 to 27,45±0,12 and 36,81±0,06 to 54,45±0,115 mg GAE/g of ethanolic extracts obtained by microwave-assisted extraction and 8,31±0,03 to 13,12±0,03 and 19,67±0,23 to 24,41±0,03 by ultrasound-assisted maceration using the Folin–Ciocalteu method, respectively. Total flavonoid content was expressed as mg quercetin equivalents/g of dry leaves and flowers (mg QE/g) spectrophotometrically. The content of total flavonoids is very low and ranges from 0,39±0,001 to 0,56±0,001 mg QE/g of dry leaves and 1,13±0,001 to 1,55±0,001 mg QE/g of dry flowers for microwave extracts and 0,19±0,003 to 0,28±0,001 mg QE/g of dry leaves and 0,50±0,001 to 0,85±0,0005 mg QE/g of dry flowers for macerated extracts. The extracts obtained by microwave-assisted extraction show higher content of total phenols and total flavonoids than extracts obtained by ultrasonic assisted maceration as expected. Total anthocyanin content was analysed by using the pH differential spectrophotometric method at 525 and 700 nm. The total content of anthocyanin was not detected in all samples as was expected due to the type of samples being analysed. Content of anthocyanins as antioxidants lies between 0,75±0,07 to 4,02±0,04 mg cyanidin 3-glucoside/g of dry sample for leaves and 0,06±0,03 to 0,72±0,06 mg cyanidin 3-glucoside/g of dry sample for flower extracts. In order to detect antioxidant activity of extracts, a method based on the reduction of DPPH was carried out. DPPH scavenging activity was higher for flower extracts (62,04±0,0006 to 75,53±0,0006 %) than leaves extracts (7,28±0,0006 to 30,69±0,0006). In conclusion, leaf and flower extracts of sloe exhibit a phenolic content and a high antioxidant activity, and can be used as an antioxidant in food and pharmaceutical industries. The differences in the measurement results for different ethanolic extracts are because leaves and flowers originate from different areas and were processed in two different manners.

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PP-69 Chemical Characterization of *Prunus spinosa* L. fruit Volatiles

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Prunus spinosa L (blackthorn or sloe) is known in traditional medicine in Bosnia and Herzegovina for different purposes. Usually extracts of fruit as well as other parts of plants have shown astringent, depurative, diaphoretic, diuretic, febrifuge, laxative and stomachic properties. However, their essential oils were not used. This part will present the investigation of phytochemical composition of essential oil samples present in *Prunus spinose*. The fruits of the *Prunus spinosa* picked at different locations in Bosnia and Herzegovina were exposed to headspace solid-phase micro-extraction using PDMS/DVB fibre and to hydro-distillation using a modified Clevenger apparatus with pentane as a trap. Investigation by direct GC and GS-MS analysis identified wide range of phytochemical compounds, 59 of volatile organic compounds obtained by 1) HS-SPME and 34 in the essential oil fractions obtained by 2) hydro-distillation. The major constituents in fractions obtained by method 1 were: benzaldehyde (%), benzyl alcohol (10,5-47,1%), nonanal (7,7-13,2%), decanal (%), 2-phenylethanol (5,6%), (*E*,*E*)-α-farnesene (4,2-4,7%) and were followed by *trans*-linalool oxide (3,9%), lilial (3,2%), p-cymene (3,1%), *trans*-β-Ionone (2,1-2,8%), benzophenone (1,7-2,6%), α-terpineol (1,4-2,4%), 1-(4-Isopropylphenyl)-2-methylpropyl acetate*(2,2%), 2-phenoxyethanol (1,9%), ethyl phthalate (1,5%), (E)-geranylacetone (1,5%), ar-Curcumene (1,3%), undecanal and undecan-2-one (1,3% each), dodecanal (1,1%), α-ionone and dihydro-β-ionone (1% and 0,5%), linalool (0,6-1,2%), β-cyclocitral (0,4-0,9%), (E)-2-Hexyl-cinnamaldehyde (0,8%), and other compounds with content less than 1% , such as limonene (0,5%) or eugenol (0,3%). Saturated long chain hydrocarbons such as nonadecane (2,3%) as well as chains with 18, 17, 16, 15 and 14 C atoms, in an amount less than 1% each were detected. The most represented chemical compounds in essential oils obtained by hydro-distillation (method 2) are: ethyl linoleate (28,7-57%), nonadecane (36%), docosane (17,2%), tricosane (3,8-6,3%) methyl linoleate (3,2-8,7%), ethyl palmitate (6,4-7,5%), methyl palmitate (1,8%), benzaldehyde (8,6%), α-terpineol (4,9%), methyl (Z)-dihydro jasmonate (2-2,2%), phytol (4,9-6,5%), (E,E)-farnesylacetone (2,4%),1-hexadecanol (3,8-4,8%), nonanal (1,6%), phenylacetaldehyde (0,2-1,2%), eugenol (0,4-0,5%), geraniol (0,2%), *trans*-linalool oxide and linalool (0,4% both), α-terpinolene (0,2-0,9%), methyl salicylate (0,2%), and many others in an amount less than 1%. According to the literature, identified compounds have different biological activities, and can be concluded that essential oils of *Prunus spinosa* L. have promising bioactive potential. Discovering the scale of that potential is the goal of our further research. In the end, as for our best knowledge, no *Prunus spinosa*. essential oil analysis of any kind was reported.

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PP-70 Mineral and Metal content in Wild and Cultivated *Mentha* species from Bosnia and Herzegovina

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Medicinal plants are raw materials used for many herbal formulations. Mentha species are widely consumed in traditional medicine in Bosnia and Herzegovina because of their antispasmodic, antiseptic effects. *Mentha longifolia* L. and *Mentha x piperita* L. are an important herbal drug since ancient times used to cure a variety of illnesses. It is very important to determine heavy metals because of their great tendency to accumulate in human organs. The presence of heavy metals above the permissible limits can cause various metabolic disturbances. The aim of this study was to estimate essential and heavy metal concentrations such as Na, K, Ca, Mg, Cu, Cr, Mn, Ni, Fe, Pb, Zn and Cd in the leaves of *Mentha longifolia* L. and *Mentha × piperita* L. The plant samples were collected from six different locations in Bosnia and Herzegovina. They were wild and cultivated in regions that were far from heavy metal pollution source. Wet digestion was applied for the dissolution of the samples, and essential and heavy metals concentration was analysed by Atomic Emission Spectrometry (AES) and Atomic Absorption Spectrometry (AAS). Metals were found to be present in varied concentrations in the plant samples. The concentration ranges were obtained as follow: Na 2,08±0,36-4,12±2,01; K 14,85±0,40-22,54±0,02; Ca 9,06±0,27-15,53±0,35; Mg 1,93±0,03-3,12±0,03; Cu 0,01±0,00-0,05±0,06; Cr 0,0007±0,00-0,0009±0,0002; Mn 0,02±0,00-0,09±0,00; Ni 0,0007±0,00-0,0066±0,01; Fe 0,06±0,00-1,11±0,16; Pb 0,0001±0,0002-0,0009±0,0001; Zn 0,01±0,00-0,04±0,01. Cd was not detected by AAS. The results showed that concentrations of essential and heavy metals were higher in cultivated *Mentha x piperita* L. than *Mentha longifolia* L species. In addition, chromium was not detected in wild Mentha samples. Interestingly, in all tested samples cadmium was not detected which is important because of its toxicity. Cadmium is a non-essential element that induces various toxic responses in plants when accumulated above the threshold level. The assimilation of heavy metals in plants depends on geo-climatic conditions, growing and harvesting plants as well as processing and production of herbal drugs. In conclusion, *Mentha longifolia* L. and *Mentha × piperita* L. can be used in daily consumption without any consequence for human health considering the content of essential and heavy metals.

PP-71 Phytochemical analysis, cytotoxicity and *in vitro* evaluation of antidiabetic activity of bioactive compounds from *Anchusa officinalis* polyphenolic-rich extract

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The utilization of natural resources to develop nutraceuticals, drugs, pharmaceuticals and cosmetics is of growing interest. Nowadays, ultrasonic-assisted extraction (UAE) and membrane technology have become the most important and efficient technique for extraction, separation and concentration of the phenolic compounds from various plant sources. *Anchusa officinalis* (family: Boraginaceae) is a wild plant native to Europe, scarcely studied to date. In this study we have examined the polyphenolic compounds, cytotoxicity and also was investigated *in vitro* the antidiabetic activity of *A. officinalis* polyphenolic-rich extract. Hydro-alcoholic extract of the medicinal herbs was processed by microfiltration and nanofiltration for concentrating the polyphenolic compounds. Polyphenols composition were evaluated by HPLC-MS, among which chlorogenic acid and rosmarinic acid were the most abundant phenolic acids and luteolin was representative for flavonoids. The studies on cell line of mouse fibroblast (NCTC clone 929) demonstrated that *A. officinalis* polyphenolic-rich extract possess the cytotoxic effect at the concentration higher than 500 µg/mL The polyphenolic-rich extract from *A. officinalis* showed a high α-glucosidase inhibition activity (IC_{50} 99.15±5.2 µg/mL), compared to the acarbose (IC_{50} 486.16±20.4 µg/mL) and mild inhibition over α-amylase (IC_{50} 283.75±15.8 µg/mL). The results of this study could be beneficial to develop medicinal preparations or functional foods for diabetes.

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PP-72 *In vitro* biological and phytochemical evaluation of *Phlomis pungens* Willd.

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The genus *Phlomis* L. is represented by more than 100 species in the world, where 46 species are in Turkey. The herbal parts are used as herbal tea among other folk medicinal uses in Turkey. In the present study, *Phlomis pungens* Willd. of Lamiaceae was collected from the Eastern Turkey. The air-dried plant material was macerated initially with methanol for 24 hours. The extract was evaluated for its *in vitro* antimicrobial activity by broth microdilution against selected human pathogens such as *Escherichia coli* NRRL B-3008, *Staphylococcus aureus* ATCC 6538, *S. epidermidis* ATCC 14990, *Pseudomonas aeruginosa* ATCC 10145, *Helicobacter pylori* ATCC 43504, *Candida albicans* ATCC 90028. In addition, in vitro lipoxygenase inhibition activity was evaluated spectroscopically. The phytochemical composition of the extracts were analyzed by LC-MS resulting in the identification of rosmarinic acid, quercetin, luteolin, and apigenin, respectively. Among the tested microorganisms in the present study, *C. albicans* was the more sensitive to the extract (MIC: 2.5 mg/mL), while *E. coli* appeared to be the most resistant in tested concentrations (10 mg/mL). The LOX inhibitory activity of *P. pungens* was 27.7%. Also, the inhibition of LOX by isolated compounds rosmarinic acid (58%) and luteolin (10%) were reported. The preliminary results suggested moderate anti-inflammatory and antimicrobial potential.

PP-73 Micropropagation *in vitro* of maqui (*Aristotelia chilensis*) by autotrophics conditions

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Aristotelia chilensis (maqui) is a tree native to Chile with an increasing demand for its fruit. Maqui-berry, considered as a "superfruit", is a rich source of antioxidants. For sustainable production domestication of the species is required to produce homogeneous and standardized quality of the raw material. The variety 'Luna Nueva' with high anthocyanin concentrations (1.5% dry weight) is being propagated by rooting cuttings or micropropagation. The *in vitro* propagation in mixotrophic conditions contains sucrose in the medium, whereas the autotrophic culture, without sucrose, is based on CO_2 as the only carbon source. This technique is expected to optimize plant development, prevent morphologic and physiologic disorders, as well as to improve adaptation *ex vitro*. In the present study maqui explants were exposed to treatments with enriched (1500 ppm) and environmental CO_2 concentrations. After three weeks explants were evaluated for morphologic characteristics (root and shoot growth; disorders such as hyperhydricity), physiologic characteristics (net photosynthesis) and adaptation to *ex vitro* conditions.

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PP-74 The essential oil composition and antimicrobial screening of *Salvia albimaculata* Hedge & Hub.-Mor.

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Salvia albimaculata Hedge & Hub.-Mor (Lamiaceae) is a plant in the subfamily of Nepetoideae, tribe Mentheae. *Salvia* genus contains about 1000 species, and can be found in Europe, Mediterranean region, Southeast Asia, and Central and South America. According to latest studies, 99 species (107 taxa) of the genus *Salvia* have been identified in Turkey and 52 (52%) of them are endemic to Turkey. Apart from aqueous infusion or solvent extracts of the sage, many studies have demonstrated the bioactivity of the essential oils including antimicrobial, antioxidant, anti-cholinesterase, improvement of cognitive performance and mood, reducing work-related stress, antimutagenic, anticancer, anti-inflammatory and choleretic. The present study, hydrodistilled essential oil of *Salvia albimaculata* were analysed by GC-FID and GC/MS systems. The major compounds were determined as sabinene 13.5%, α-pinene 12.0%, borneol 7.2%, terpinen-4-ol 4.1% and *p*-cymene 3.8%. In order to determine the anticandidal and antibacterial effects, the oil was screened against 6 *Candida* and 10 bacteria species by using standard micro-broth dilution methods. The oil showed anticandidal effect between the concentration of 250-1000 µg/mL. Moreover, tested bacteria were inhibited by the oil in the range of 125 to 1000 µg/mL. This is the first study on *S. albimaculata* essential oil and its antibacterial and anticandidal effects.

PP-75 An ethnobotanical review of the Gilaburu (*Viburnum opulus* L.) plant

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Viburnum opulus L. is a plant belonging to the family Caprifoliaceae. In Turkey, it mostly grows in the mountainous and marshy parts of Central Anatolia and the Black Sea. Especially in Kayseri and surrounding area its use is widespread. Also in this region it is known as Gilaburu. Gilaburu plant is used as a laxative, antispasmodic, anti-inflammatory, antiallergic, sedative and diuretic in the world. Due to the particularly effective compound of Gilaburu fruits it is regarded as an important dietary fruit. Active substances are colorants, tannin and organic acids. It is used for the treatment of kidney stones, bile and liver diseases and stomach pain. Fruit juice is anticancer and antioxidant because of its acids. Due to its antioxidant properties, it has been proven to have anti-aging, anti-mutation, anti-cancer and cholesterol-lowering properties. This plant is also very rich in vitamin C. *Viburnum opulus* L. is among the phytotherapy plants with its natural, easy to use and therapeutic properties. The study will comprise a review of previously conducted ethnobotanical, chemical, pharmacological studies.

PP-76 Improving Oxidative Stability of Flaxseed Oil by Microemulsified Polar Antioxidants

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Omega-3 fatty acids are important nutrients for human health. The richest source for omega-3 fatty acids is fish oil whereas some plant seeds such as flaxseed, chia seed or walnut also contain omega-3 fatty acids mostly as the form of α-linolenic acid (ALA). Flaxseed is one of the main sources for omega-3 fatty acids among oil bearing plants. The main problem with omega-3 rich oils is oxidative instability during handling and storage. In this study, the effect of different polar extracts on oxidative stability of flaxseed oil microemulsions was studied. Aqueous extracts were obtained from grape seed, rosemary and pomegranate peels and incorporated to cold pressed flaxseed oil. Microemulsification was managed in the presence of Polyglycerol polyricinoleate (PGPR) via ultrasonication. Obtained water-in-oil microemulsions were subjected to thermal oxidation at 50 °C for 20 days. Gallic acid and α-tocopherol were used as standard antioxidants for comparison. Oils containing; just PGPR, PGPR+water and no additive were also subjected to oxidation. At intervals, emulsion/oil samples were taken and oxidation degree was monitored by measuring peroxide value (PV) and thiobarbutiric acid reactive substances (TBARS). Free fatty acid content and changes in antioxidant capacity were also assessed during oven oxidation. According to the results, it was observed that PV and TBARS of gallic acid and plant extracts incorporated microemulsified flaxseed oil samples were lower compared to the control sample which contains water without antioxidants. Among extracts, grape seed was the superior one and it was followed by rosemary and pomegranate peel. Results have also shown that PGPR and α-tocopherol was acted as pro-oxidants in these conditions. Parallel to the oxidative stability tests, the remaining antioxidant capacity was measured as the highest for grape seed sample at the end of the oxidation period. The initial free fatty acids content was about 0.8% in microemulsions and during oven test it increased for all samples while the lowest increase was observed in grape seed incorporated sample.

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PP-77 Chemical Composition and Antibacterial Activity of *Calamintha nepeta* L. Savi subsp. *glandulosa* Essential Oil

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Calamintha nepeta (L.) Savi subsp. *glandulosa* is a natural perennial grass belonging to the Lamiaceae family, growing spontaneously in the Mediterranean region. This aromatic plant is used as a mint-like spice in food preparations and in the composition of some recipes during religious feasts. In folk medicine, it is known as stimulant, antiseptic and antispasmodic. Aerial parts of *C. nepeta* were collected from Bilecik in July 2017, and was air dried and hydrodistilled for 3 h using a Clevenger-type apparatus and the composition of the essential oil was analyzed by GC-FID and GC-MS, simultaneously. Piperitenone oxide (47.8%), limonene (18.6%) and piperitone oxide II (13.6%) were found as a major components for the essential oil. In addition, antibacterial activity of the essential oil was tested against *Escherichia coli* NRRLB-3008, *Pseudomonas aeruginosa* ATCC 27853, *Salmonella typhimurium* ATCC 13311, *Bacillus cereus* NRRL-B3711 and *Streptococcus sanguinis* ATCC 10556 were used by broth microdilution method. Ciprofloxacin was used as control and Minimal Inhibitory Concentrations (MIC) were determined. The lowest activities were determined against *E. coli* (5 mg/mL) and *P. aeruginosa* (10 mg/mL). The essential oil is more effective against *B. cereus* (2.5 mg/mL), *S. sanguinis* (2.5 mg/mL) and *S. typhimurium* (1.25 mg/mL).

PP-78 Identification of Fatty Acids and Volatile Compounds of Bergamot Fruits

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Bergamot fruits are very important for cosmetic, perfumery, food and drug industries. well characterized bergamot essential oil is used extensively in many flavors and perfumes. In the present study, the bergamot fruits cultivated in Adana were collected in December, 2017. The fresh pericarps of the fruits subjected to microdistillation were analyzed by GC and GC/MS systems, simultaneously. Also, to trap volatile compounds in the fresh pericarps HS-SPME technique was employed. The fiber was then inserted immediately into the injection port of the GC/MS for desorption of the absorbed volatiles for analysis. The seeds separated from the fruits were subjected to Soxhlet extraction by *n*-hexane for 8 h. The fatty acids were then methylated by BF_3 in methanol. The methyl esters of the fatty acids were identified by GC and GC/MS, simultenously. Limonene (32.9, 36.8%), linalool (37.3, 16.6%) and linalyl acetate (7.8, 30.2%) were the major compounds in the pericarps obtained by microdistillation and HS-SPME, respectively. In the seeds, linoleic acid (30.8%), oleic acid (28.4%), palmitic acid (21.2%) and linolenic acid (13%) were the main fatty acids.

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PP-79 Evaluation of antityrosinase potentials of kumquat, limequat and lime fruits extracts by HPTLC-bioautographic and spectrophotometric methods

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Mature fruits of kumquat, limequat and lime were collected in Adana, Turkey, December, 2017. The fresh fruits directly lyophilized or firstly treated hot air in the oven then freezed-dried were extracted by hot water (90ºC). The yield of the each extract was calculated. The fingerprint analysis of the extracts were evaluated by a suitable High Performance Thin Layer Chromatography (HPTLC) method. A simple and effective HPTLC coupled with antityrosinase assay method was employed for the bioactivity-based quality control of the fruits extracts. White/yellow spots on the HPTLC plate showed tyrosinase inhibitory properties whereas spots darker than the plate background were interpreted as tyrosinase activators. Also, the antityrosinase activities of the extracts were measured spectrophotometrically by using L-DOPA as substrate. The results were critically discussed and compared with the positive control, kojic acid. To the best of our knowledge this is the first study of its kind.

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PP-80 Understanding the Mechanism Conferring Resistance for Fusarium Wilt of Sweet Basil

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Sweet basil (*Ocimum basilicum* L.) is one of the most economically important herbs in the world. A major limitation for basil growers is Fusarium wilt of basil (FOB), a destructive defoliation disease caused by *Fusarium oxysporum* f. sp. *Basilicum*. Fortunately, the control of FOB was achieved by the development of resistant cultivars. Previously, it was shown that the resistance is inherited by a single dominant gene, but the mechanism has not been discovered. To understand this mechanism, we phenotyped disease response in 173 individuals of an F_2 population which segregates for the trait. We used genotyping-by-sequencing to identify major QTLs that can explain the observed phenotypic variation. Our results indicated a primary classification to 128 resistant and 45 susceptible individuals, with a 3:1 ratio that confers a single dominant gene. In a finer phenotyping, out of the surviving individuals, 45 did not exhibit disease symptoms and were defined as resistant, and 83 showed symptoms but recovered and classified as intermediate. This fits a 1:2:1 ratio conferring a gene model of incomplete dominance. We have mapped one major and one minor QTLs harboring two candidate genes that are homologous to a known gene responsible for Fusarium wilt resistance in tomato. They are trans-membrane leucine-rich repeats proteins known to act in primary plant immune response, and we hypothesize they are responsible for FOB resistance. These findings shed light on the resistance mechanisms of plants to *Fusarium oxysporum* and will help to better understand the sub-species specificity of this fungus to its host.

PP-81 Chemical and Behavioral Analysis of the Whitefly *Bemisia tabaci* Attraction to Rosemary (*Rosmarinus officinalis*)

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The whitefly Bemisia tabaci of the Aleyrodidae is a cosmopolitan pest that causes immense economic damages to many agricultural crops. Commercial field Observations revealed differences in the B. tabaci preference for various varieties of rosemary. In 1984 a live genetic collection established at the Newe Ya'ar Research Center for selection and breeding rosemary for growing for various uses. A sample of 33 chemotypes from the collection were characterized according to their 18 main volatiles (1%>) in an EOs obtained by distillation and by extraction. The EO compositions from the sampled plants from summer and winter found stable, and used as an index that split them to four representative types: (i) 1,8-cineole & borneol type; (ii) verbenone type; (iii) camphor type; and (iv) 1,8-cineole & camphor type. Deep insight showed that camphor and 1,8-cineole contents increased in water distillation compared to solvent extraction; and that these volatile contents in hydrosol, following steam distillation, were high, as were borneol and verbenone contents. However, α-pinene content was higher in solvent extraction compared with water distillation and lower in the hydrosol. Differences in B. tabaci preferences to these chemotypes pointed out their reliance on volatile compositions and/or on their proportions, separately or synergistically, in "choice" olfactometer tests, in GC-MS analyses of EOs and in SPME atmosphere sampling. These findings suggest that (i) five significant preference types were present among the sampled chemotypes (high preference, medium-high preference, medium preference, medium-low preference and low preference). (ii) B. tabaci's preference for β-caryophyllene and for limonene exhibited a bell curve shape, according their dependency on volatile concentrations (optimal attraction for medium concentration, and low attraction for high and low concentration levels). (iii) 43% of the volatiles in the oil fractions of two representative varieties found to be involved in repelling B. tabaci. Additionally (iv), negative correlations were found between B. tabaci's preferences for the main volatiles: camphor, 1.8 cineole, bornyl acetate, verbenone, linalool and borneol. The results shown above suggest ecological complexity in the interrelationships between B. tabaci and rosemary, which are based mainly on a repellency effect. In practical terms, the live rosemary plants collection at Newe Ya'ar characterized by chemotype stability, which constitutes a breeding basis, for industrial needs, and especially for the development of a sustainable management system for coping with B. tabaci.

PP-82 Antimicrobial activity and cell viability assay to determine the cytotoxic effects of eight medicinal plants used in the treatment of elephantiasis in the Eastern Cape, South Africa

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Ethnopharmacological relevance: Elephantiasis, medically known as lymphatic filariasis is a condition where the skin thickens and hardens after excessive swelling associated with lymph accumulation (lymphoedema). Filarial elephantiasis is caused by filarial worms and non-filarial elephantiasis is caused by tuberculosis, certain sexually transmitted diseases and podoconsiasis. South Africa is one of the countries burdened by the disease. The study was aimed at screening traditional medicinal plants that are frequently used by the herbalists and traditional healers from the Eastern Cape Province against elephantiasis and related ailments for the presence of antimicrobial activity and to determine their cytotoxic potential using standard procedures. The medicinal plant species were collected with the help of traditional healers and screened for the presence of antimicrobial activity. Furthermore, the MTT cell viability assay on H4IIE-*luc* cells was determined. Extracts of water, acetone, ethanol and ethyl acetate prepared from *Curtisia dentata and Kniphofia drepanophylla* displayed the best antibacterial, antifungal and antimycobacterial activity between 0.098 to 0.39 mg/ml and *Rapanea melanophloes* inhibited the microorganisms between 0.098 to 3.125 mg/ml. Extracts were tested against the bacterial strains *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterococcus faecalis, Staphylococcus faecalis*, *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, *and Proteus vulgaris*. The fungal strains were *Candida albicans, Candida vulgaris and Trichophyton mucoides. M. tuberculosis* was tested for antimycobacterial activity. Between *C. dentata*, *K. drepanophylla* and *Rapanea melanophloes*, water and acetone extracts of *K. drepanophylla* at concentrations between 1 mg/mL to 0.0625 mL displayed the best % cell viability greater than 100%, the values were statistically significant to the differences between the solvent control and MeOH treated samples (negative control) after 48 hours on H4IIE-*luc* cells. The results obtained from this study have validated the use of these plants by the traditional healers for the treatment of elephantiasis. The study also indicates that these plants may serve as sources of new antimicrobial drugs that could be effective against drug-resistant strains. Further investigations on their anti-inflammatory activity, qualitative phytochemical analysis, antioxidant activity and isolation of bioactive compounds are ongoing.

PP-83 Rosemary's biological activity

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Rosmarinus officinalis is a generally straight evergreen shrub. It's leaves are aromatic with needle-like shape, its flowers are pale blue to white. Native habitat of rosemary is Mediterranean areas of southern Europe to western Asia with rocky, scrub soil. Two most important substances present in rosemary are rosemary acid and rosemary essential oil. First is the most characteristic among phenolic compounds and due to its ability to absorb in human skin found many applications in cosmetology. Main ingredients of rosemary essential oil are 1,8-cineole (0,2-67,0%), α-pinene (7,6-26,2%), borneol (2,0-20%), β-pinene (0,7-8,3%), (±)-campher (1,0-29,7%), camphen (1,5-12,8%), limonene (0,3-14,9%), β-caryophyllene (0,5-2,7%), α-terpineol (1,7-12%) and verbenone (0,2-8,7%) and a slight presence of tannins (5-8%). Therepeutic properties of rosemary are antimicrobial, anti-inflammatory, vision protective, cardioprotective and soothing in atopic dermatitis. Moreover, rosemary is an excellent food additive as antioxidant and, consequently, preservative to protect food against degradation processes.

PP-84 *In vitro* Evaluation of Rosemary and Coriander Essential Oil Combination Nanoemulsions targeting the Cholinesterase and Lipoxygenase

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In recent years, there are many studies on the effects of essential oils on the central nervous system (CNS). However, low water solubility of essential oils, their high volatility and instability limit their application on formulations. Nanoemulsion preparations of essential oils are therefore a feasible approach. In the present study, it was aimed to reduce volatility, increase the stability and biological activity of essential oils by nanoemulsion preparations. For this purpose, *in vitro* anticholinesterase and anti-inflammatory effects of nanoemulsion formulations containing rosemary and coriander essential oils and their combinations were evaluated. *Rosmarinus officinalis* L. (Rosemary, Lamiaceae) and *Coriandrum sativum* L. (Coriander, Apicaeae) essential oils were obtained from commercial sources and their chemical contents were confirmed by GC-FID and GC/MS methods. Oil-in-water (O/W) emulsions were obtained by the self-emulsification method of the oils and their respective combinations. The essential oil/tween 20 ratio of the prepared emulsions were 1:9, 2:8, and 3:7 (w:w), respectively. Thereafter the droplet size, polydispersity index, zeta potential and turbidity of emulsions were measured within the scope of characterization studies. Resistance to centrifugation, freezing and heating were determined as rapid stabilization tests. *In vitro* 5-lipoxygenase inhibition (LOX) effects of the emulsions before and after the stability tests were determined, and the results were evaluated by comparing with droplet sizes and pure essential oils. The *in vitro* acetylcholinesterase and butyrylcholinesterase (AChE– BuChE) effects of stable nanoemulsion formulations were determined. The Pharmacopoeia complying rosemary (44.1% 1,8-cineol) and coriander (74.9% linalool) essential oils, and their resulting nanoemulsion formulations obtained were successfully. As an overall result, no changes were observed in 5 different nanoemulsions after stability tests. In addition, the anti-inflammatory effect of coriander essential oil was increased by nanoemulsion. However, there was no significant difference in the cholinesterase inhibition effects of the oil formulations. These studies demonstrate that nanoemulsification is a promising method for the formulation and enhancement of the solubility of essential oils on potential CNS effects, supported by further studies associated to stability, imaging and *in vivo* biological activity.

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PP-85 The essential oil composition of *Lagoecia cuminoides* L. growing wild in Cyprus

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Lagoecia cuminoides L. [Apiaceae (Umbelliferae)] is an aromatic plant growing wild in Cyprus. Essential oil was obtained by hydrodistillation from aerial parts and analysed by GC-FID and GC-MS, simultaneously. Oil yield was 1% (v/w). 29 compounds were characterized with thymol being the main component (74.1%) followed by γ-terpinene (15.2%) and *p*-cymene (7.5%). There is only one report in the literature on the essential oil composition of *L. cuminoides* from Turkey.

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PP-86 Composition of the essential oils of two *Dittrichia* species growing wild in Cyprus

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*Dittrichia (*family Asteraceae), formerly a section of the genus Inula, is a small genus with two species: *D. graveolens* (L.) Greuter (syn. *Inula graveolens* (L.) Desf.) and *D. viscosa* (L.) Greuter (syn. *Inula viscosa* (L.) Ait.) Both of them grow in Cyprus. Essential oils of aerial parts of the plant materials were obtained by hydrodistillation and simultaneously analysed by GC-FID and GC-MS. The essential oil yields (v/w) were 0.06% for *D. viscosa* and 1.14% for *D. graveolens.* 36 compounds were characterized representing 99.5% of the oil of *D. graveolens* with bornyl acetate (73.2%) and borneol (11.6%) as main constituents. 51 compounds were determined representing 78.5% of the oil of *D. viscosa,* main components being *(E)*-nerolidol (23.5%), fokienol (12.5%), 12-carboxy eudesma-3,11(13)-diene (= α-costic acid) (8.5%) and β-eudesmol (6.4%).

PP-87 Essential oil composition of the rhizomes of *Rhaponticum acaule*

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Essential oi of Rhaponticum acaule rhizomes was analyzed by GC-FID and GC-MS. Aplotaxene (1,8,11,14-heptadecatetraene) (34.6%), carvacrol (11.1%), amylfurane (6%), limonene (4.5%) were the main constituent of rhizomes of Rhaponticum acaule

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PP-88 Reversed-Dispersive Liquid-Liquid Microextraction (RDLLME) prior to HPLC-DADfor Quantitation of Bioactive Flavonoids in *Crataegus azarolus* and *Crataegus pallasi*

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Bioactive flavonoids of C. azarolus collected from Northern Cyprus and C. pallasii collected from Libya were investigated in comparison with Crataegutt®Tropfen (well known Crataegus preparation) using a novel approach termed as "reversed-dispersive liquid-liquid microextraction, RDLLME" prior to high-performance liquid chromatography with diode-array detection (HPLC-DAD). HPLC is one of the most commonly applied analytical techniques for the analysis of phytochemical fingerprints of medicinal plant extracts. However, sample preparation prior to HPLC analysis is a critical step for preconcentration of analytes with low concentrations and for sample clean-up in order to suppress matrix effect. Conventional DLLME, which is mostly applicable for non-polar analytes, has been extensively applied for extracting the analytes from an aqueous solution into an organic phase.In this study, RDLLME was exclusively used as an efficient sample clean-up method to lower the high baseline in the initial chromatogram obtained for the analytes after Soxhlet extraction due to matrix effect. The interferences were extracted into the organic phase (i.e., chloroform), while the analytes remained in the aqueous phase, due to their polar nature to obtain quantitative results with minimum matrix effect. A high baseline is well known to cause error in quantitation, especially since some of the analytes were present at low concentrations which were close to limit of quantitation (LOQ). To the best of our knowledge, this mode of DLLME termed as RDLLME has not been reported in the literature. Analytical performance parameters were calculated as follows: Limit of detection (LOD) ranged from 0.4 to 2.2 mg g^{-1},intraday and interday precision expressed as %RSD ranged from 1.0 to 3.20 and 1.5 to 10.3, respectively. Coefficient of determination (R^2) values were above 0.9950 for all analytes. Four predominate peaks were identified using certified standards as vitexin-2-O-rhamnoside, vitexin, rutin and hyperoside, with mass concentration (%w/w) in *C. azarolus* as 4.4, 2.9, 1.7 and 4.6% and in *C. pallasii* as 4.4, 2.6, 1.4 and 5.3% and in Crataegutt®Tropfen as 1.6, 1.1, 0.6 and 0.4% respectively. Thus, the values met the criteria of the United States Pharmacopeia (USP) and the European Pharmacopeia (EP) monographs. Our investigations postulate that *C. azarolus* and *C. pallasii* could be a good source for the production of *Crataegus* phytomedicines.

PP-89 Volatile and Non-Volatile Compositions of *Sideritis albiflora* Hub.- Mor

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One of the most commonly used plants for herbal tea is the genus *Sideritis* (Lamiaceae) which is widespread particularly in Aegean and Mediterranian areas, and represented by 46 species and 53 taxa in Turkey, 39 taxa being endemic. *Sideritis* species are widely used in Turkey due to their antimicrobial, antiinflammatory, antirheumatic, antispasmodic, digestive and diuretic activities.In the present work, chemical composition of the essential oil (EO), methanolic extract (ME) and infusion (INF) of *Sideritis albiflora* Hub.-Mor. (endemic) were investigated. *S. albiflora* were collected in July 2018 from Muğla, Turkey. The EO from the aerial parts of *S. albiflora* was isolated by hydrodistillation using a Clevenger type apparatus for 3 h. A small amount of EO trapped in *n*-hexane was analyzed by GC/MS and GC/FID, simultaneously. The ME and 5% INF of *S. albiflora* were prepared. After evaporation of the methanol parts dry extract was used for LC-MS/MS analysis. Phenolic compound determinations were performed using a Shimadzu 20A HPLC system coupled to an Applied Biosystems 3200 Q-Trap LC- MS/MS instrument equipped with an ESI ion source was used in the negative ionization mode. Separations were performed on a ODS 150 x 4,6 mm, i.d., 3 μm particle size, octadecyl silica gel analytical column operating at 40ºC at a flow rate of 0.5 mL/min. The main components of the EO were found as germacrene D (23.5%), β-caryophyllene (13.6%), caryophyllene oxide (8.0%) and hexadecanoic acid (3.8%). Chlorogenic acid, verbascoside, forsythoside, apigenin glucoside, isoscutellarein derivatives were determined in the LC-MS/MS analysis.

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PP-90 Evaluation of essential oils association (GAE®) and natural extract alone or in combination in an *in vitro* model of human rhinovirus infection

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Bronchitis (infection of the main airways of the lungs) and rhinopharyngitis (*aka* common cold) are acute or chronic inflammatory diseases of the upper respiratory tract. These pathologies are often related to viral infection by rhinovirus. Several plants extract can be used alone or combined with essential oils to decrease the severity of the inflammatory symptoms related to these pathologies. However, their mechanisms of action or efficiency remain not fully elucidated yet. An *in vitro* model of bronchial epithelial cells (HBEpC) was used to evaluate the ability of a commercial essential oils association (GAE®) and 4 natural extracts (Elderberry, Eucalyptus, Thyme and Propolis) to decrease the severity of viral inflammation related to bronchitis or rhinopharyngitis. A specific agonist of Toll Like Receptor 3, polyinosinic:polycytidylic acid (Poly (I:C), a synthetic dsRNA and molecular pattern associated with viral infection), was used to mimic rhinovirus infection. The effects of the compounds against Poly(I:C) were evaluated at the gene expression level by Real Time quantitative PCR. Bafilomycin A1, an inhibitor of vacuolar-type H+ ATPase was used as a positive inhibitory reference compound against Poly(I:C)._Functional TLR3 was indeed expressed since Poly (I:C) was able to modulate gene expression of the HBEpC. It effectively mimicked rhinovirus-induced inflammation by stimulating the expression of inflammatory genes (IL8, IL6, CCL5, TNF, IL1A, PTGS2) and a cell-cell interaction gene (ICAM1). Bafilomycin A1 completely inhibited the effect of Poly (I:C). Every natural extract displayed an anti-inflammatory effect with a down regulation of at least one of tested gene. GAE®, Elderberry and Eucalyptus displayed clear anti-inflammatory properties with a down regulation of at least 3 inflammatory genes. When tested in association with GAE®, natural extracts anti-inflammatory properties were better than when tested alone for at least one of the tested inflammatory gene demonstrating a superiority of the association. Poly(I:C) induced an inflammatory phenotype in HBEpC by stimulating ICAM1, CCL5, IL8, IL6, TNF and IL1A, thus recapitulating some features of rhinovirus infection. This experimental model confirmed the mechanism involved in the anti-inflammatory and demonstrate the anti-inflammatory properties of the commercial essential association GAE® and natural extracts (*i.e.*: Eucalyptus, Elderberry, Thyme and Propolis) when tested alone. Moreover, this study demonstrates the superiority of anti-inflammatory properties when natural extracts and essential oils are tested in association.

PP-91 Antimicrobial evaluation of *Prunus spinosa* L. ethanol fruit extracts

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Prunus spinosa L. also known as blackthorn or sloe is a plant from the *Rosaceae* family. It grows as a shrub on slopes of wild uncultivated areas in various regions in Bosnia and Herzegovina. Fresh fruits were collected from three different areas from Bosnia and Herzegovina (Trnovo, Vareš and Borije). The aim of this study was to determine antimicrobial activity of ethanol extracts from dried fruits of blackthorn. The collected fruits were dried and extracted with 96% ethanol. Extracts were obtained using two methods: microwave-assisted extraction and ultrasound assisted maceration. The *in vitro* antimicrobial activity of ethanol extracts was tested by agar well diffusion method against Gram positive bacterial strains (*Staphylococcus aureus* ATCC 25923, *Bacillus subtilis* ATCC 6633, *Enterococcus foecalis* ATCC 29212), Gram negative bacterial strains (*Salmonella enterica* ATCC 31194, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 9027) and fungi *Candida albicans* ATCC 1023. Antibiotic streptomycin (10 µg, Oxoid) and antimycotic nystatin (10 µg, Oxoid) were used as a positive control, and 96% ethanol as a negative control. The investigated extracts exhibit antimicrobial activity in various degrees. The highest values of inhibition zones were recorded in dried fruits extract from Trnovo, extracted using microwave-assisted extraction, against Gram positive bacteria *Enterococcus foecalis* and Gram negative bacteria *Salmonella enterica*. The least effective was ethanol extract from Vareš obtained by microwave-assisted extraction, which was not active against five out of seven tested microorganisms. Three of six investigated extracts exhibit antifungal activity against *Candida albicans*. In general, the inhibition zones of microorganisms ranged from 10.00 mm to 38.00 mm. The extracts obtained by microwave-assisted extraction show better results compared to the extracts obtained by ultrasound-assisted maceration. Based on obtained results, one can conclude that the investigated blackthorn fruit extracts have significant antimicrobial activity.

PP-92 Assessment of *Laserpitium hispidum* M.Bieb. for antioxidant and anti-acetylcholinesterase activities

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In this study, *Laserpitium hispidum* M. Bieb (Apiaceae) has been subjected to investigation for chemical and biological activity profiles. The folk name in Turkey of this species is "saçlienguban". The plant material collected from Mihalgazi - Eskişehir was hydrodistilled in a Clevenger type apparatus to obtain essential oils from the flower, fruit, leaf, root, and stem separately. The fruit methanol extract was obtained with maceration method. Sabinene (21.7- 54.1%) was found as the main constituent of the fruit, leaf, flower and root oils, while terpinene-4-ol (33.4%) was the main component in the stem oil. Five essential oils as well as the fruit extract were evaluated for free radical scavenging activities with DPPH and TEAC assays. The same samples were also tested for anti-neurodegenerative effect through inhibition of acetylcholinesterase (AChE) enzyme. The root oil demonstrated noteworthy (IC_{50}: 2.33 mg/mL) anti-AChE effect among the samples examined. However, the essential oils were found to be weak (Inh. % 29-59) antioxidant. To the best of our knowledge, this is the first approach to the *Laserpitium hispidum* species in the point of chemical and biological profiles.

PP-93 Biological activities of the extracts obtained by different methods from *Satureja cuneifolia* Ten.

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Satureja cuneifolia Ten. (Lamiaceae) is known as "dağ kekiği or kaya kekiği" and commonly used as a spice in Turkish cuisine. It is well-known aromatic plant used for producing essential oil and hydrosol in the mountain regions of the Aegean and Mediterranean parts of Turkey. Infusion of *S. cuneifolia* is reported to be effective as a carminative and against diabetes. In the present study, the leaves of *S. cuneifolia* collected in Eskişehir between Gökçeyayla and Yapildak villages were subjected to accelerated solvent extraction (ASE) to get sequentially non-polar and polar extracts: *n*-hexane (AHE), methanol (AME) and water (AWE) extracts. The yields of AHE, AME and AWE extracts were found to be as 0.76%, 9.4% and 9.9%, respectively. The supercritical fluid extraction with CO_2 carried out at 100 bar and 250 bar resulted with 0.62% and 0.08% yields extracts (SFE-100 and SFE-250, respectively). On the other hand, hydrodistillation in Clevenger-type apparatus resulted with 0.79% oil yield. Assessment of the free radical scavenging activity (DPPH test) of the extracts revealed the highest activity for AWE (IC_{50} 0.04±0.005 mg/mL) and AME (IC_{50} 0.09±0.006 mg/mL). The essential oil and AHE demonstrated moderate activities (IC_{50}0.56±0.06 mg/mL and 0.40±0.07 mg/mL), while SFE-100 and SFE-250 extracts showed weak activities (IC_{50} 0.94±0.008 and 1.32±0.04 mg/mL). AWE indicated the highest value of trolox equivalent antioxidant capacity (1.93±0.02 mM) among the examined extracts.

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PP-94 Biological and Phytochemical Profiles of *Hieracium pannosum* Boiss. Extracts Obtained by Supercritical Fluid Extraction (SFE) and Accelerated Solvent Extraction (ASE) Methods

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The genus *Hieracium* L. belonging to Asteraceae family has more than 1000 species all over the world. In Turkey, the genus is represented by nearly 100 taxa. In traditional European medicine *Hieracium* species are used as diuretic and antiinflammatory agents, for treatment of bronchial asthma, diuretic and wound healing properties. *Hieracium* species contain phenolic acids, flavonoids, coumarins and terpenic compounds. *H. pannosum* Boiss. is known with the folk name "acikanak". In this study, the leaves of *H. pannosum* were sequentially subjected to accelerated solvent extraction (ASE) to get non-polar and polar extracts: *n*-hexane extract (AHE), methanol (AME) and water (AWE) extracts. The yields of the extracts AHE, AME and AWE were found to be as 2.1%, 6.6% and 9.6%, respectively. Also, supercritical fluid extraction (SFE) with CO_2 and hydrodistillation were separately applied to the leaves. SFE was carried out for 45 min at 40 °C and 100 bar to get extract SE with 0.03% yield. Hydrodistillation of the leaves resulted with EssOil (0.03% yield). The antioxidant activity of all the extracts was evaluated through free radical scavenging activity tests, DPPH and TEAC. Aqueous extract WSE demonstrated the highest antioxidative activity (IC_{50} 0.07±0.004). Noteworthy activity values were also detected for AME (IC_{50} 0.09±0.0003 mg/mL). However, SE showed very low inhibition (Inh. 10.3±1.2%), while EssOil and AHE were inactive. In TEAC assay, the highest trolox equivalent antioxidant capacity was found for AWE (0.95±0.05 mM) and for AME (0.69±0.03 mM). The present work is the first report about biological activity of *Hieracium pannosum* Boiss.

PP-95 Investigation of antioxidant activity of the flower and leaf oils of *Seseli tortuosum* L. from Turkey

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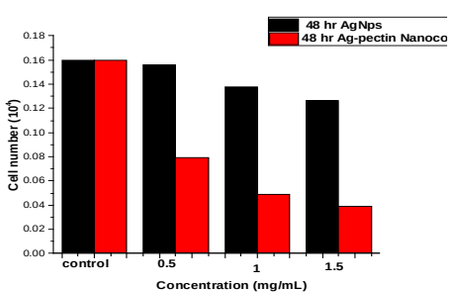
The genus *Seseli* L. (Apiaceae) is represented by 11 species and 1 subspecies, 4 of which are endemic. *Seseli tortuosum* L. is known as 'horozgözü' in Turkey. Traditionally, the fruits of *S. tortuosum* are used as emmenagogue and anti-flatulence. Antifungal and cytotoxicity of *S. tortuosum* essential oil have earlier been reported. In this work, the plant material (flowers and leaves) of *S. tortuosum* were collected in Doğanoğlu village near to Eskişehir province in July 2018. The flowers and leaves were separately subjected to hydrodistillation to get essential oils (FEO and LEO, respectively). FEO contained α-pinene (38.1%), (*E*)-sesquilavandulol (24.9%), β-pinene (7.5%), sabinene (6.9%) as main constituents, while in LEO α-pinene (36.5%), β-pinene (11.4%), camphene (6.3%), spathulenol (6.1%) and limonene (5.7%) were detected. The free radical scavenging activity of the oils was evaluated using DPPH and TEAC assays. LEO demonstrated noteworthy antioxidant activity (Inh. % 46.4±3.1), while FEO demonstrated weak activity (≤5%). The trolox equivalent antioxidant capacity values were determined to be as 0.07±0.05 mM for FEO, and 0.17 ± 0.05 mM for LEO.



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PP-96 Microwave assisted hydrodistillation and extraction of *Eucalyptus camaldulensis* Dehnh. and *E. grandis* W.Hill ex Maiden leaves

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The main goal of the present work was to comparatively study the essential oils and extracts obtained with conventional (CHD, 180 min) and microwave assisted (MAHD, 44 min) hydrodistillation and extraction (CM and MAE) methods from *Eucalyptus camaldulensis* and *E. grandis* leaves. In CHD procedure, the leaves were hydrodistilled using Clevenger type apparatus (3 hours). For MAHD, the leaves were hydrodistilled in the microwave oven operated for 3 min at 800 W, and then kept for 40 min at 400 W followed by 1 min of ventilation. Conventional maceration (CM) of the leaves was carried out with methanol under room temperature (24 hours). For MAE, the leaves were extracted in the microwave oven operated for 1 min at 800 W, and then kept for 25 min at 300 W followed by 1 min of ventilation. Comparatively study of the essential oils and extracts was carried out on basis of their yields, chemical compositions and antioxidant activities. GC-MS/FID and LC-MS/MS techniques have been used for analysis of the essential oils and extracts. Free radical scavenging activities of the oils and extracts were tested against $DPPH^{\bullet}$ and $ABTS^{\bullet+}$ radicals *via* microtiter plate assays using spectrophotometric evaluation. Application of microwaves to *E. camaldulensis* and *E. grandis* led to obtain the extracts with significantly higher yields (27.8% and 34.2%, resp.) than conventional maceration (26.40% and 29.6%, resp.). The leaf extracts demonstrated significantly higher free radical scavenging (DPPH assay) potential than the oils. The highest activities were determined for CM extracts (IC_{50} 0.04mg/mL) obtained from both of the plants. Microwave irradiation did not increased inhibitory potential of the extracts from both of the samples (IC_{50} 0.06mg/mL) in comparison with conventional maceration. The same pattern was noticed for both essential oils obtained with MAHD method in comparison with CHD. Trolox equivalent antioxidant capacity values obtained for the extracts (TEAC 0.94-0.61 mM) were significantly higher than values were for the oils (0.26-0.45 mM), with exception of *E. grandis* essential oil obtained with CHD (TEAC 0.71 mM). It should be noticed, that microwave irradiation did not increased the antioxidant capacity of the oils and extracts in comparison with conventional heating with exception of *E. camaldulensis* essential oil.

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PP-97 Application of microwaves for hydrodistillation of essential oil and extraction of phenols from *Salvia officinalis*

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Salvia officinalis L. (Lamiaceae) is a worldwide cultivated aromatic herb. In the recent years, anticancer, anti-inflammatory, antioxidant, antimicrobial, antidementia, hypoglycemic and hypolipidemic activities have been frequently reported for *S. officinalis*. The aim of the present study was to investigate the effect of microwaves on the yield, chemical composition and antioxidant activities of *S. officinalis*. In the present work, conventional (CHD, 180 min) and microwave assisted hydrodistillation (MAHD, 44 min) methods have been applied to get essential oils from *Salvia officinalis*. The microwave oven was operated for 4 min at 900 W, and then kept for 40 min at 350 W followed by 1 min of ventilation. In addition, ultrasound assisted extraction (UAE) and microwave assisted extraction (MAE) have been applied to *S. officinalis* to get phenols rich extracts. The microwave oven was operated for 1 min at 800 W, and then kept for 40 min at 400 W followed by 1 min of ventilation. As a solvent we used aqueous ethanol (30%). Comparatively study of the essential oils and extracts was carried out on basis of their yields, chemical compositions and antioxidant activities. GC-MS/FID and LC-MS/MS techniques have been used for analysis of the chemical compositions of the oils and extracts. Free radical scavenging activities of the oils and extracts were tested against $DPPH^{\bullet}$ and $ABTS^{\bullet+}$ radicals *via* microtiter plate assays using spectrophotometric evaluation. Conventional hydrodistillation procedure resulted with the oil yield higher (0.65%) than MAHD (0.52%). Application of microwaves led to obtain the extract with significantly higher yield (9.03%) than using of ultrasounds (6.50%). The free radical scavenging activity of the extracts was found to be higher than the essential oils. UAE and MAE extracts demonstrated significant free radical scavenging activities with IC_{50} 0.13±0.01 mg/mL and IC_{50} 0.086±0.002 mg/mL, respectively. However, the essential oils obtained with CHD and MAHD methods demonstrated moderate free radical scavenging properties (Inh. 31.5±2.2% and 26.1±2.4%, respectively). Trolox equivalent antioxidant capacity values of the essential oils were found as 0.4 mM and 0.3 mM, respectively, while both of the extracts have significantly higher TEAC values (3.0 mM).

PP-98 Antimicrobial activity of constitutional water from aromatic herbs against technological, alterative and pathogenic microorganisms

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This study is part of a wider Interreg V France-Italy project focused on the study of process innovation in aromatic dried herb chain. A new low-temperature drying technique has been tested, in the project, to improve herb quality, and constitutional waters obtained from the drying have been studied, in the present research, for their antimicrobial properties. Constitutional waters were obtained from thyme, mint, savory, lemon balm, oregano and mallow and their antimicrobial activity was tested by performing semi-quantitative trials on traditional plates. The microorganisms used for evaluating the activity belonged to *Lactobacillus* spp., *Lactococcus* spp. and *Streptococcus* spp. genera, *Saccharomyces cerevisiae* and *Candida humilis* species related to fermented food transformation, and to *Penicillum* spp. and *Aspergillus* spp., alterative strains affecting the shelf-life of different food products. Finally, water properties were tested against the pathogens *Listeria monocytogenes*, *Yersinia enterocolitica* and *Salmonella thyphimurium*. The results did not highlight any inhibition against pathogenic species while a partial inhibition was found against alterative moulds. In particular, the best results were obtained by using constitutional water obtained from thyme drying that showed inhibition towards *Penicillum citrinum* and *Penicillium aurantiogriseum.* Those results will be further investigated; in fact, constitutional water could be considered a by-product of interest, in food manufacturing, as natural preservative.

PP-99 ESSICA project: process innovation in aromatic dried herb chain

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ESSICA is part of Interreg V France-Italy, ALCOTRA 2014-2020 projects and is focused on the study of process innovation in aromatic dried herb chain, with the aim of obtaining high quality products and, thus, increasing the competitiveness of producers. The partnership includes four members: TERRE di SAVOIA Association, DISAFA (Department of Agricultural, Forest and Food Science, University of Turin), FRANCEAGRIMER (Etablissement National des Produits de l'Agriculture et de la Mer), CRIEPPAM (Centre Régionalisé Interprofessionnel d'Expérimentation en Plantes à Parfum, Aromatiques et Médicinales). Different French and Italian herb producers are involved in the project. They provide herbs grown in areas located in Provence-Alpes-Côte d'Azur French region and in the Italian provinces of Cuneo and Torino. For the experimentation, eight herbs were initially selected, 4 produced in France (savory, oregano, lemon balm and thyme) and 4 in Italy (savory, mint, lemon balm and mallow). The main objective is to improve the quality of the herbs by studying and optimizing innovative techniques to be applied in their processing and throughout the whole herb chain. More precisely, a new low-temperature drying technique is used for a better quality of the herbs, and ozone treatments is tested to sanitize herbs. Finally, part of the experimentation concerns packaging aspects with a major interest towards techniques with low environmental impact. As regards drying technique, the plan is comparing the quality (organoleptic properties, polyphenol content, antioxidant activity, essential oil profile) of the herbs obtained at low temperatures (ranging from 10 °C to 30 °C) by Northwest Technology, with those obtained by traditional drying (temperatures around 40 °C). Regarding herb sanitization, ozone treatment is used to reduce or eliminate the main alterative and pathogenic microorganisms and insects. Different parameter combinations, in terms of ozone concentration and treatment duration, are tested. The study and optimisation of these techniques are thought to make easier, also for small producers, the production of good quality and safe aromatic herbs, and to increase their competitiveness. Last but not least, the project leader Terre dei Savoia, will play a fundamental role also after the project: it will spread the results of the experiments and set up permanent laboratory in Savigliano (Italy) with all the relevant equipments which will be made available to small and medium producers.

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PP-100 Biochemical and Morphological Changes Caused by Zinc Oxide Nanoparticles Synthesized using *Albizia lebbeck* Stem Back Extract in Rats

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Nanotechnology is an advance area of studies that utilizes technologies that are environmentally friendly for the purpose of synthesizing nanoparticles, which are chemically stable, nontoxic, biocompatible, and can be used for biomedical application. The study reports the effect of oral administration of Zinc oxide nanoparticles (ZnO NPs) synthesized using *A. lebbeck* stem extract on rats metabolic profiles and tissue morphology. The ZnO NPs were biologically synthesized under ambient conditions from an aqueous stem bark extract of *Albizia lebbeck* with 0.1, 0.05 and 0.01 M zinc nitrate ($Zn(NO_3)_2 \cdot 6H_2O$) solutions. Wistar rats with an average weight of 1705 g were randomly assigned in eight groups. Animal in group A serve as control and received distilled water for 28 days, while those in group B-E were administered with 40 and 80 mg/kg body weight of 0.1, 0.05 and 0.01 ZnO NPs. The rats were sacrifice under anaesthesia, 24 hours after the final treatment and there blood, heart, liver and kidney were collected for the biochemical and histopathological evaluations. Synthesized ZnO NPs exposure in rats caused significant increase in creatinine and urea serum levels with increase concentration of the nanoparticles ($P < 0.05$; $n \geq 3$). The activities of alanine amino transaminase, aspartate aminotransferase and alkaline phosphatase in rat serum and tissue were also altered with increase concentration. Similarly, total protein, total cholesterol and albumin level in rat serum were also altered with increased concentrations of the nanoparticles ($P < 0.05$; $n \geq 3$). Additionally, histophatological examination of the renal and liver tissues following exposure to 0.05 and 0.1 M ZnO NPs revealed vascular congestion, inflammation, tubular necrosis, fibrosis and cytoplasmic vacuolation when compare with the control group. Synthesized ZnO NPs showed significant alteration in biochemical parameters and tissue morphology with increase concentrations of the nanoparticles.

Acknowledgments: We acknowledged the Bayero University Kano Biotechnology Research Laboratory for given us the opportunity to use their animal laboratory for our studies.

PP-101 Application of AgNP in Carob (*Cerratonia Siliqua*) Fruit Extract; Ag-Pectin Nanocomposite Beads as Drug Delivery Vehicle System for Breast Cancer Cells.

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It is worthy of note to elaborate the applications of biogenic and biocompatible nanoparticles in general and anti-cancerous property in particular. The present study was aimed to investigate the *in vitro* cytotoxicity effect of biogenic silver nanoparticles (AgNPs) in comparison to the Ag-pectin nanocomposite against human breast cancer cells MDA-MB-231 towards the development of anticancer agent. The silver nanoparticles was obtained from Carob (Cerratonnia siliqua) and further characterized by a range of techniques like SEM, XRD, FTIR and UV- Vis spectroscopy. Antimicrobial activity, antioxidant activity and anticancer activity was observed.

The mean sizes distribution of this particle was between 50nm-90nm**.** Antioxidant activity was remarkable for the AgNPs comparative with the carob pod extract and the L-ascorbic acid according to the DPPH scavenging assay, overall antimicrobial observation suggests that Ag-pectin nanocomposite increased potency to inhibit growth among the tested microorganisms in comparison to AgNPs. There was a significant difference in the proliferation of target cancer cells which were treated for 48hrs with equal concentration of AgNPs and Ag-pectin nanocomposite respectively. Keen observation indicated in the MTT assay was that as equal concentration of the AgNPs and Ag-pectin nanocomposite was added to same concentration of cells, the was more observable cell number decrease after 24hr and 48hr, with the Ag-pectin composite than was with the Ag-NPs.

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PP-102 *In vitro* anticancer activity of *Allium sativum* L. against MCF-7 and MDA-MB-231 human breast cancer cell lines via caspase-3 and caspase-9 mediated pathway

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Garlic (*Allium sativum* L. fam. Alliaceae) is among the most widely studied plant species, with therapeutic effects on various diseases ranging from hypertension and cancer to infections (Mantawy et al., 2011). Garlic's effect on stimulating the immune system against several diseases including cancer has been well established (Schäfer and Kaschula 2014). In this study, we aimed to explore *in vitro* antitumoral effects of *Allium sativum* L. (ASB) on human breast cancer (BCa) cell lines , MCF-7 and MDA-MB-231 at the molecular level. Trypan Blue Assay and LDH assays were used to quantitatively demonstrate the levels of cytotoxicity exerted on breast cancer cells by ASB extract which revealed a significantly increased ($p<0.05$) cytotoxicity on both MCF-7 and MDA-MB-231. Cytotoxicity experiments were followed up by caspase-3 and -9 activity assays which has been used to demonstrate the apoptotic activity exerted by the extract on the breast cancer cell lines. ASB extract induced significant activation in caspase-9 upon 24h incubations on both tested cell lines ($p<0.05$). MTT assay was utilized to observe proliferation of the cancer cell lines upon exposure to the garlic extract. Consequently, MTT assay revealed the antiproliferative nature of ASB where proliferation of both MCF-7 and MDA-MB-231 cancer cell lines were significantly reduced upon incubation at all tested time points. Lateral motility is an important determinant of metastatic potential of cancer cells. We have used lateral motility experiments in order to evaluate antimetastatic properties of ASB. Lateral motility assays have demonstrated a significant reduction in the motility of in MCF-7 and MDA-MB-231 suggesting an antimetastatic property associated with garlic. In order to delineate the biologically important molecules included within the ASB extract, Gas chromatography-mass spectroscopy (GC-MS) analysis has been utilized. GC-MS studies demonstrated several bioactive molecules obtained from ethanolic extraction of ASB many of which are well-known compounds associated with anticancer activities. In summary, our study has once again demonstrated *Allium sativum* as a potent anti cancer agent, further revealing the molecular mechanisms exerted directly on the cancer cells as the basis of its anticancer functions. Our study further emphasizes the potential for development of de-novo anti-breast cancer therapeutics using garlic and the biologically active anticancer compounds within its bulb.

Keywords:*Allium sativum* L., anticancer, apoptosis, antimetastatic activity, proliferation, cytotoxicity.

PP-103 *Allium willeanum* Holmboe exhibits *in vitro* antimetastatic, antiproliferative activities in a caspase-3 and caspase- 9 mediated manner on human breast cancer cell lines

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Allium species including garlic are historically used, medically important plants with antitumoral properties (Bayan et al., 2014). These species are used widely by the locals of Cyprus for medicinal purposes and food. This study is the first to document the molecular mechanisms associated with the medicinal uses of an endemic Allium species of Cyprus, Allium willeanum Holmboe.Aim of the study In this study, we aimed to investigate the anticancer effects of Allium willeanum Holmboe (AWB), an endemic Allium species of the island of Cyprus, on MCF-7 and MDA-MB-231 human breast cancer (BCa) cell lines. Fresh forms of *Allium willeanum Holmboe* were collected from North Cyprus at flowering season. Dried plant material were macerated with ethanol and extracts were obtained through Rotary Evaporator. Typan Blue Exclusion assay and LDH Cytotoxicity assays were used to evaluate cytotoxicity effects of extract, Caspase-3 and -9 Colorimetric assays were used to determine induction apoptosis through extract applications. MTT assay were used to evaluate antiproliferative effects and Motility assay were used to determine antimetastatic effects of AWB extract. Gas chromatography-mass spectroscopy (GC-MS) analysis was used to determine bioactive compounds in AWB extracts (Isbilen et al, 208). We demonstrated the apoptotic activity of AWB on tested BCa cells, revealed by caspase-3 and -9 activation. Similarly, the viability and LDH assays revealed significant cytotoxicity of AWB on both cell lines at all time points. Lateral motility of both cell lines were significantly reduced upon AWB treatment demonstrating the extract's antimetastatic effects. We also reveal the significant antiproliferative activity exerted by the extract on both tested cell lines. Several antitumoral compounds were identified in AWB extracts by GC-MS analysis, providing an explanatory mechanism towards the observed antitumoral effects.Overall, our results demonstrate for the first time, the significant anticancer, antiproliferative, apoptotic and antimetastatic activities of AWB on both MCF-7 and MDA-MB-231 Bca cell lines revealing, Allium willeanum Holmboe as a potential candidate for further investigation as a potent anticancer agent for direct or integrative anticancer therapies.

PP-104 Antimicrobial and Biofilm Inhibitory Activities of *Allium orientale* Boiss on *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli*

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The continued extensive use of the same group of antibiotics in hospitals has resulted in the development of antibiotic resistance which has reached epidemic magnitudes worldwide (Ventola 2015). The commercial antibiotic front is slowly losing the war against bacteria. Ethnomedicine may deliver solutions to this epidemic but the lack of science based evidence of efficacy makes it invisible to most healthcare-systems. In this study, we aimed to investigate the antibacterial effects of *Allium orientale* Boiss bulb extracts (Amaryllidaceae family), on pathogenic Gram positive and Gram negative *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli*. Potential antibiotic effects of the *Allium* extract on the bacterial species was tested using the Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC), Disc diffusion and the Biofilm inhibition assays (Shetty et al., 2013). *Allium sativum* with known antimicrobial activities was used as a positive control whenever applicable. All experiments were done in triplicate and statistical analysis was conducted using the INSTAT3 software. The overall effect of extract towards gram positive and gram negative bacteria was analyzed using the same software. The minimum inhibitory concentration tests demonstrated that the bulb extracts of *A. orientale* Boiss had anti-bacterial effect on all three tested species; *P.aeruginosa*, *E.coli and S.aureus*. The biofilm assay showed statistically significant reduction in the biofilm formation with AOB on all tested bacteria. The largest inhibition of biofilm formation with AOB was seen with *E.coli* (76.41%). Overall, the study demonstrated the antibacterial effects associated with *Allium orientale* bulb extracts, on three pathogenic bacterial species encompassing both Gram positive and Gram negative species. *Allium orientale* showed inhibition of pathogenic bacteria both in their planktonic and biofilm states. Our study, along with several others, reveal *Allium orientale* Boiss as a lucrative research field to be further.

PP-105 Alkaloids found in Some Papaver Species Growing in Northern Iraq and their antimicrobial effects on *Escherichia coli*

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The genus *Papaver* is represented by 15 species in Iraq belonging to 4 sections namely *P. glaucum, P. decaisnei,* (sect.Papaver), *P. macrostomum, P. bornmulleri* (sect. Carinata), *P.rhoeas, P. dubium*(sect. Rhoeadium*), P. argemone, P. hybridum* (sect. Argemonerhoeades) *P. persicum, P. fugax, P. acrochaetum, P. cylindricum, P. curviscapum, P. armeniacum* (sect. Miltantha) (Cullen 1965, Kadereit 1987). In this study we sought to investigate the alkaloids of P. *glaucum* (PG 1) and *P. decaisnei* (PG 2) collected from Northern Iraq, (Kurdistan) region. Papaverine has been isolated from *P. glaucum* as most abundant alkaloid among all together with palaudine and N-methylasimilobine as minor ones. Presence of roemerine and mecambrine has been shown in *P. decaisnei*. Bioactivity tests have been performed to show the antimicrobial effects of extracts obtained from selected papaver species on *E. coli*.

Plant material. *P. glaucum* was collected from Rowanduz Gorge region and *P. decaisnei* Hawraman - Tawela at the flowering stage. Extraction of Alkaloids. Dried powdered material was first percolated with methanol (Sigma Aldrich). Tertiary alkaloids were then extracted and separated as previously done by Coban *et al.* 2017. Preparative thin layer chromatography on precoated silica gel were applied for the isolation of alkaloids. The structure of alkaloids were identified by means of 1H-NMR spectroscopy and comparing their Rf values with those of reference alkaloids. Alkaloids of Papaver species of Iraqi origin including P. glaucumwere previously studied on the extracts obtained from herbarium samples (Phillipson *et al*. 1981). Existing of liriodenine, roemerine dihydroroemerine and rhoeagenine has been reported (Phillipson et al. 1981) In this study papaverine was isolated as a major alkaloid whereas palaudine and N-methylasimilobine were obtained as minor ones. This is the first report the presence of papaverineas a major alkaloid in this species. Palaudine was previously isolated only from *P. somniferum. P. glaucum* has been found as a second species which contain this alkaloid. The alkaloid content of *P. decaisnei* of Iraqi origin has been studied for the first time. Roemerine and mecambrine were isolated from *P.decaisnei*. Although these two alkaloids are very common in many Papaveraceae species this is the first time the isolation of these alkaloids from *P. decaisnei*. Present work confirmed the existence of chemotypes of *P. glaucum* in Iraq. Minimum inhibitory concentration (MIC) experiments results showed that PG1 and PG2 has significant antimicrobial effect on *E. coli.*

PP-106 Anatomical, Morphological and Ethnobotanical Studies of *Chelidonium majus* L. (Papaveraceae) Growing in Turkey

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Chelidonium majus L. (Papaveraceae) is perennial herbaceous plant distributed from Europe to East Asia and Northern Africa. This species is a Euro-Siberian element and growing in Northern part of Turkey[1]. This plant is well known for its orange sap that stains on the skin strongly and has powerfully irritant effect[2]. It called with different names such as greater celandine, swallow-wort, or bai-qu-cai in Chinese[3] and "Kırlangıç out" in Turkey. Beside these, this plant has long history of therapeutic use in medicines from western phytotherapy to Traditional Chinese Medicine. For the therapeutic purposes, dried aerial parts, roots and juice are used[4]. In Europe it has been used to treat liver diseases, gastric ulcer, oral infections, pain, skin eruptions, and tuberculosis, in Traditional Chinese Medicine, to treat blood stasis and jaundice, relieve pain and cough as well as promote diuresis in oedema[3-5]. Different parts of this plant contain numerous therapeutically important alkaloids such as chelidonine, chelerythrine, sanguinarine, berberine, which exhibit a wide range of pharmacological activities[3]. In this study, we investigated ethnobotanical properties of *C. majus* naturally growing in Turkey, as well as provided a detailed morphological and anatomical description of this species. *C. majus* juice is used externally skin diseases, warts, wounds, abscess, eczema, fungal disease and blood-relieving. The infusion or decoction of leaves/aerial parts is used internally in bronchitis, jaundice, gallbladder disorders and as diuretic. It is also used externally in elimination of sciatic pain and rheumatic pain in Turkey[6]. Additionally, we did extensive research on morphology and anatomy of this species for correct identification of this taxa.

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