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Addendum

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P 222. ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY OF ENDEMIC *SALVIA CHUDAEI* IN ALGERIA

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Keywords: Essential oil;Salvia chudaei; antioxidant activity; antimicrobial activity.

To evaluate antioxidant, antibacterial and antifungal activity of essential oil of *Salvia chudaei*(labiatae). The essential oil of aerial parts of *Salvia chudaei* growing in Sahara central of Algeria was obtained by hydrodistillation. The essential oil was subjected to antioxidant activity using DPPH and β-carotene-linoleic acid assays (Mi-Yae et al, 2003; Braca et al,2002). Antibacterial and antifungal activity were also evaluated against 9 pathogenic bacteria and 5 fungi by the disc diffusion method. The essential oil showed free radical scavenging activity with IC_{50} of 3.25mg/mL in 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay, while in b-carotene-linoleic acid assay the essential oil exhibited 38.6% lipid peroxidation inhibition. In the case of antimicrobial screening, essential oil showed moderate to good inhibition against most of the tested bacteria and fungi strains. Results showed that *Candida albicans* and *Staphylococcus epidermis* were the most sensitive microorganisms(inhibition zone more than 30 mm in diameter). It can be concluded that essential oil of *Salvia chudaei* may become important in the obtainment of a noticeable source of compounds with health protective potential and antimicrobial activity.

Acknowledgements: The authors wish to thank laboratory of Microbiology, ENS, Algeria for providing research facility.

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P 223. Studies oh essentialoil composition and antimicrobial activity of *Santolina chamaecyparissus* L. from Algeria

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Keywords: *Santolina chamaecyparissus* L.; Essential oil; Terpenes; Artemisia ketone; Antimicrobial activity, CMI.

Santolina Chamaecyparissus L. (Asteraceae family) was a small genus, belonging to the Anthemideae tribe. Members of this genus have been of interest due to their excellent medicinal value such as anti-inflammatory, antispasmodic, anthelminthic[1], The present study attempts to examine the essential oil composition as well as the antimicrobial activity of *S. Chamaecyparissus L.* of Algeria. The chemical composition of essential oil of *Santolina chamaecyparissus* L. cultivated in Algeria, isolated by hydro-distillation in a yield of 1.67% from flowering aerial parts of has been characterized by using GC and GC/MS techniques[2]. Thirty-six components accounting more than 82% of the total oil were identified. Oxygenated monoterpenes was the main fraction (54.66%) and represented by artemisia ketone (40.33%) as major component of this oil. The other major constituents were Z-thujone (9.82%), (2Z,6E)-farnesol (7.30%) and limonene (6.87%). Furthermore, the antibacterial activity was done by the diffusion method in double layer [3]. this oil exhibited in vitro the maximum inhibition growth activity against five Gram positive strains(ATTC): *Staphylococcus aureus*, *Enterococcus faecium*, *micrococus luteus*, *Bacillus subtilus* et *Bacillus cereus* and four negative Gram strains(ATTC): *Pseudomonas aeruginosa*, *Echerichia coli*, *Klebsiella pnomoniae* and *Bordetella pronchiseptica* with the lowest MIC value between 0.12% and 0.007%; the antibacterial action of this oil is due to Oxygenated monoterpenes and their height percentage; However, there are some of those bacteria mostly resistant Ex: *Pseudomonas aeruginosa* (MIC Upper 1%).

Acknowledgements: The authors would like to express their sincere gratitude to Thermo Fischer laboratory application Paris and CRD SAIDAL EL Harrache Algeria

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P 224. ESSENTIAL OIL COMPOSITION AND ALLELOPATHIC EFFECT OF CHRYSANTHEMUM CORONARIUM (GARLAND) EXTRACTS ON THE GERMINATION AND ROOT GROWTH OF FOUR PLANT SPECIES

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Keywords: Chrysanthemum coronarium, essential oil composition, cis-chrysanthenyl acetate, allelopathy, germination, bio-herbicide.

The chemical composition of the essential oil of *Chrysanthemum coronarium* (Garland) flowerheads grown in Tunisia (Nabeul) was examined by gas chromatography-mass spectrometry (GC-MS). Forty components were characterized with *cis*-chrysanthenyl acetate (21.82%), *trans*-chrysanthenyl acetate (12.78%), (*E*)-β-farnesene (8.97%), α-methylstyrene (8.92%) and camphor (6.03%) as the major constituents.

The aqueous extracts of *C. coronarium* (2.5, 5, 7.5 and 12.5% (w/v)) were tested for their effects on the germination and the root growth of *Triticum durum*, *Zea mays*, *Sinapis arvensis* and *Phalaris canariensis.* Results showed that the extracts reduced the germination and root growth of all tested species in a dose-dependant manner. The phytotoxic effect of the extracts was found to be more pronounced in *S. arvensis* and *P. canariensis.* These results suggest the possible use of *C. coronarium* as environmentally friendly herbicide for the control of weeds and pest management.

P 225. Essential oil composition from the leaf and wood of *Eremanthus erythropappus* (*Candeia*) grown in different areas in Minas Gerais state, Brazil

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Keywords: *Eremanthus erythropappus*; Asteraceace; Compositae; candeia; essential oil

The genus *Eremanthus*, Asteraceae (Compositae), comprises a total of 18 species, of which *Eremanthus erythropappus* (DC.) Macleish, known in Brazil as *candeia*, is one of the species of greater economic importance and occurrence in Minas Gerais state. This species is used not only as a source of wood but also by its highly rated α-bisabolol rich essential oil. This oxygen-containing sesquiterpene finds several applications in the hygiene, cosmetics and pharmaceutical industries, namely due to the anti-inflammatory, antispasmodic, antiflogistic, sedative, antiallergic, and vermifuge properties [1,2]

In the present study the chemical variability of the essential oils isolated from different plant parts, from plant material collected a two locations in Minas Gerais state, was assessed.

Two leaf samples collected at Lavras (LL) and Carrancas (LC) and one wood sample from Carrancas (WC) were evaluated. The essential oil was isolated by hydrodistillation from the different samples, and analysed by Gas Chromatography and Gas Chromatography-Mass Spectrometry, as in [4]. The percentage composition of the volatiles was used to determine the relationship between the different oil samples by cluster analysis, as in [4].

Cluster analysis showed a high correlation ($S_{corr} \geq 0.70$) between the Lavras and Carrancas leaf essential oil samples, which were, respectively, dominated by β-pinene (40% and 14%), β-caryophyllene (17% and 22%), sabinene (1% and 14%), β-myrcene (8 and 5%), α-pinene (6% and 5%), α-copaene (6% and 5%) and germacrene-D (6 and 8%).

No correlation was observed between leaf and wood samples essential oils. Leaf essential oil main components were not detected in the wood essential oil, which was dominated by α-bisabolol (99%).

Acknowledgments: Partially supported by CNPq, CAPES, Fapemig.

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P 226. The best harvesting time of three *Eucalyptus* species leaves to obtain more oil and 1,8-cineole content

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Keywords**:** *Eucalyptus*; oil content; seasonal variation; essential oil composition;1,8-cineole

The seeds of three Eucalyptus species (Myrtaceae) (Origin: Australia) named: Eucalyptus loxophleba, E. microtheca and E. largiflorens were cultivated in the years 1993-1994 in two research stations (Shushtar and Dezful) in Khuzistan province (in the western south regions of Iran) and a research station (Kashan) in Isfahan Province (central regions of Iran). These species have good adaptability with the climatic condision of these area (dry and warm weather). The leaves of these species were collected in the middle of four seasons (spring, summer, autumn and winter) during two concecutive years, in order to find the the best harvesting time for obtaining the highest oil yield and 1,8-cineole percentage. After drying the plant materials in shade, their essential oils were obtained by hydro-distillation. The oils were analysed by Gc and Gc/MS. The results showed that harvesting time had significant effect on the oil yields and 1,8-cineole content of these Eucalyptus species. The main components of all oils were 1,8-cineole and alpha-pinene.

The highest oil yields of E. loxophleba in all lications were found in autumn and winter. For Dezful sample, the highest percentage of 1,8-cineole was found in winter (70.2%) and autumn (63.2%). For Kashan sample, the highest percentage of 1,8-cineole was found in winter (55.5%) and spring (58.1%). For Shushtar sample, the highest percentage of 1,8-cineole was found in summer (53.6% and 49.6%).

The highest oil yields of E. microtheca were obtained in spring for Dezful and Shushtar samples and autumn for Kashan samples. For both Shushtar and Dezful samples, the highest percentage of 1,8-cineole were found in winter and summer. For Kashan sample, the highest percentage of 1,8-cineole was found in summer.

The highest oil yields of E. largiflorens were obtained in autumn and winter for Dezful and Shushtar samples and summer for Kashan samples. The highest percentage of 1,8-cineole was found in summer and winter for Shushtar sample, spring and winter for Dezful sample and winter for Kashan sample.

P 227. Chemical composition and antioxidant activity of *Eremanthus incanus* wood essential oil

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Keywords: *Eremanthus incanus*; Asteraceace; Compositae; candeia; essential oil

The wood of the tree species *Eremanthus incanus* (Asteraceae) is historically utilized as fence posts, however it is believed to have a nobler use with the extraction of its essential oil, rich in α-bisabolol compound, which has wide application in industry such as pharmaceuticals, cosmetics and food industries. As advantages, *E. incanus* is widely spread in two states of Brazil, Minas Gerais and Bahia. This species occurs in clusters, enabling sustainable management plans, which generate important incomes especially family farmers.

This study aimed to characterize chemically the essential oil of *Eremanthus incanus* wood and assess its antioxidant activity.

The material was collected in Morro do Pilar, Minas Gerais, Brazil. The essential oil was isolated by hydrodistillation from the different samples, and analyzed by Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (MS), as in [1]. The antioxidant activity was evaluated using the ABTS [2,2' azinobis (3-ethylbenzothiazoline-6-sulfonic acid)] method [2].

The analysis of the essential oil from the wood of *Eremanthus incanus* by GC/MS showed a predominance of oxygenated sesquiterpenes with 88% of the total, and displayed α-Bisabolol (86%) as the major component followed by selin-11-en-4-α-ol and α-bisabolol oxide B.

The results obtained in the present study indicate that the essential oil of *E. incanus* wood exhibited antioxidant activity with IC_{50} value of 0,3892 mg mL^{-1}.

The presence of sesquiterpenes like α-Bisabolol can be attributed to the antioxidant property of the
essential oil.

Acknowledgments: Partially supported by CNPq, CAPES, FAPEMIG.

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P 228. Study of volatile fraction by solid-phase micro extraction of different parts of 16 varieties of citron fruit (*Citrus medica* L.)

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Keywords: *Citrus medica*, SPME, GC, GC/MS, citron, volatile fraction

New information about the biological properties of *Citrus* fruit have led us to study the chemical variability of citron varieties from Corsica [1]. To our knowledge, little attention has been paid to assay the variability of citron volatile components [2]. The aim of this work was to characterize the volatile composition of peel, pulp and albedo from 16 varieties of citron. According to our knowledge, the volatile fractions of pulp and albedo from *Citrus medica* are reported for the first time.

Combined analysis by GC and GC/MS of HS-SPME volatile fractions of citron fruits led us to identify 40 components: 13 monoterpene hydrocarbons, 15 oxygenated monoterpenes, 10 sesquiterpene hydrocarbons and 2 non-terpenic oxygenated compounds.

The major component of volatile fractions from peel and pulp of seven cultivars (Fourny, Damas, Ommeyades, Etrog type, Verruqueux, Diamante, Rhobs el Arsa) was limonene (peel: 86.1-96.9%; pulp: 79.0-95.9%). The peel and pulp volatile fractions of eight varieties (Etrog 130, Etrog 131, Etrog 861, Etrog 861-S1, Humpang, Corsican, Poncire, Buddha) were characterised by limonene (peel: 43.3-66.9%; pulp: 46.5-76.5%) and g-terpinene (peel: 19.4-38.9%; pulp: 9.6-29.7%). Furthermore, the albedo volatile fractions of seven (Fourny, Damas, Ommeyades, Etrog type, Verruqueux Diamante, Rhobs el Arsa) and five cultivars (Etrog 130, Etrog 131, Etrog 861, Humpang, Poncire) were also dominated by limonene (88.5-98.1%) and limonene/g-terpinene (46.9-71.9/18.1-29.6%), respectively. The main compounds of albedo from the last three cultivars (Buddha, Corsican, Etrog 861-S1) were limonene (46.7-74.3%) and p-cymene (11.1-42.3%). It appeared that the chemical compositions of these varieties differed drastically to corresponding peel (limonene: 51.7-63.6% / g-terpinene: 21.4-30.7%) and pulp (limonene: 49.6-64.2% / g-terpinene: 9.6-29.2%). Finally, it should be noted that the cultivar 'Florence' showed an atypical chemical composition in comparison with other studied citrons. Indeed, this variety could be distinguished by high amounts of limonene (81.7%) and b-pinene (11.2%) in peel, limonene (62.8%) and sesquiterpene hydrocarbons (23.0%) in pulp and limonene (74.3%) and selina-4(15),5-diene in albedo.

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P 229. Essential oil composition, antioxidant activity and genetic analysis of *Helichrysum italicum* subsp. *italicum* from Corsica

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Keywords: *Helichrysum italicum*, essential oils, genetic markers, antioxidant analysis

Helichrysum italicum subsp. *italicum* (Roth) G. Don Fil., a typically Mediterranean species, is an aromatic shrub with yellow flowers. *H. italicum* oil is widely used in perfume industry and aromatherapy due to their flavouring properties and biological activities (antimicrobial, anti-inflammatory, antioxidant) [1]. The aim of this study was to establish the correlations between essential oil compositions, genetic characteristics and biological activities of *H. italicum* from Corsica.

For this purpose, *H. italicum* samples were collected on 48 localities of Corsica Island and hydrodistilled using Clevenger apparatus. Essential oils were analyzed using GC and GC/MS. The essential oil compositions have been characterized by 43 constituents accounting for 67.8%-94.9% of the total oil. The essential oils were highly variable such as the amount of neryl acetate which varies from 2.4% to 58.3% between samples. The oils were also characterized by unusual b-diketones (named italidione). Data analyses were performed using Principal Component Analysis (PCA) and Cluster Analysis (CA). The plot established according to the first two axes suggests the existence of two groups of essential oils : 24 samples belonged to the group I defined by two variables (linear ketone and monoterpene hydrocarbons). It was characterized by a large content of linear ketones and monoterpene hydrocarbons and low percentages of sesquiterpenes alcohols and b-diketones. 24 samples belonged to the group II defined by three variables (esters, monoterpene alcohols and sesquiterpene alcohols).

The essential oil *H. italicum* exhibited antioxidant properties in respect of DPPH, $ABTS^{\bullet+}$ and Fe^{3+} reducing power. Neryl acetate and hydrocarbons monoterpenes did not exhibit significant antioxidant activity. In contrast, the overall antioxidant activity of essential oil was strongly correlated with the total content of b-diketones.

The genetic diversity of *H. italicum* samples were analysed using the ITS region. This latter was amplified with primers ITS1, and ITS4 and the purified PCR products were sequenced in both directions, following standard methods and using the primers used for amplification. Also the genetic analysis (Mantel test) showed concordance between terpenic and genetic markers and a significant correlation was revealed between these two matrices (volatile composition and ITS markers).

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P 230. Melissopalynological origin determination and volatile analysis of Corsican ´´spring clementine´´ and ´´spring asphodel´´ honeys

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Keywords: Corsican “spring” honey, HS-SPME, volatile fraction

Corsican honey is recognized by “Protected Designation of Origin” denomination, and both marked: “Miel de Corse-Mele di Corsica”. The geographical and botanical origins of these honeys has been characterized by their melissopalynological and sensorial properties and distinguished into six categories: ´´spring maquis´´, ´´spring´´, ´´summer maquis´´, ´´chestnut grove´´, ´´honeydew´´ and ´´automne maquis´´[1]. In Corsica, from april to june, the richness of spring polliniferous and melliferous resources provide the ´´spring´´ honeys. These products showed two predominated origins: ´´spring clementine honey” from cultivated area of oriental plain and ´´spring asphodel honey” from coastal areas [1,2]. The aim of this work was to establish the first typology of volatile fractions of these honeys using HS-SPME, GC and GC-MS.

13 Corsican “spring honeys” were selected according to their geographical distribution. Pollen spectrum and total pollen density had been established [1,3,4] and two distinct types of pollen spectra were demonstrated: six samples could be considered as ´´spring clementine´´ honey and seven were ´´spring asphodel´´ honey. The common melissopalynological characteristic is the ´´under-representation´´ of clementine and asphodel pollen, but they could be distinguished by typical associations of cultivated or non cultivated areas. In addition, low values of color and electrical conductivity and low aromatic intensity with floral and fruit aroma characteristics of the two ranges were quite similar.

The volatile compositions of ´´spring clementine´´ and ´´spring asphodel´´ honeys were characterized by 42 and 33 components, respectively. The chromatographic profiles showed that these honeys could be distinguished by their volatile fraction: the main compounds of ´´spring clementine´´ honey were three lilacaldehyde isomers whereas phenylacetaldehyde, benzaldehyde and toluene were identified as the main components of ´´spring asphodel´´ honey. In accordance with our previous results [3,4], it appeared that the analysis of volatile components could be considered as an interesting supplementary method for the characterisation of botanical origin of Corsican honeys.

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P 231. Composition and chemical variability of *Senecio vulgaris* essential oils

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Keywords: Essential oil; *Senecio vulgaris*; GC; GC/MS

The genus *Senecio* is one of the largest of the Asteraceae family that includes more than 1500 species all around the world [1]. In Corsica Island 10 species are reported [2]. Among them *S. vulgaris* are an annual plant 5-40 cm high, commonly widespread, from February to October, on ruderal fields and sometimes on coastal sands [3]. Only one study described the composition of the essential oil from Netherland in which *(E)-β*-caryophyllene, caryophyllene oxide, anhydro-oplopenone and α-bisabolol were identified as main components [4].

The aim of the work was to investigate the chemical composition of *S. vulgaris* essential oil and to characterize the intraspecies variations in essential oils from 25 sample locations. The strategy carried out required the pooling of all Corsican oils in a mixture called ”Corsican collective oil”, then the oil investigation using Column Chromatography and a combination of techniques including GC/RI, GC-MS. Principal component analysis and cluster analysis were performed to identify correlations between the chemical composition and possible environmental factors.

Analysis of *S. vulgaris* oils allowed the identification of 54 components accounting for (91.6-99.2 %) of the total samples oils. Among them, the main components were a-humulene (47.6-59.7 %), *(E)-β*-caryophyllene (1.3-8.9 %), terpinolene (3.0-6.80 %), ar-curcumene (1.2-6.9 %) and geranyllinalool (1.0-4.1 %). Statistical analyses allowed determining two main groups GI (20 samples) and GII (5 samples) differentiated by the amount of ar-curcumene always superior to 5% for samples of GII against (0.9-3.1%) respectively for the samples of GI. The results seem to match the nature of the grounds on which the plant grows up. Indeed, GI cluster includes the samples harvested on ruderal habitats while cluster GII displayed samples grown on sand areas.

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P 232. CHEMICAL COMPOSITION OF ESSENTIAL OILS FROM LEAVES, FLOWERS AND ROOTS OF STEVIA SERRATA CAV

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Key words: *Stevia*; GC-MS; essential oils; chamazulene; germacrene D; α-longipinene

The genus *Stevia* (Asteraceae), includes more than 230 species, which are widely distributed from the southwestern part of the United States through Mexico, Central and South America Andean mountains, to central Argentina. This genus have been extensively investigated from a phytochemical viewpoint and its potential to produce secondary metabolites such as longipinane derivatives, sesquiterpene lactones, flavonoids and kaurane diterpenes is well documented [1]. There are also some essential oil studies on *Stevia* species in which the presence of monoterpenoid, sesquiterpenoid and phenylpropanoid volatile components has been reported [2-4]. In this communication, the chemical composition of essential oils from leaves, flowers and roots of *S. serrata* Cav. is analyzed.

Freshly harvested vegetable material [leaves (*lv*), inflorescences (*fw*) and roots (*rt*)] was crushed, and then separately subjected to hydrodistillation in a Clevenger-type apparatus for 4 h. The obtained essential oils [*lv*: 5.8 mL (0.30 % w/v); *fw*: 4.0 mL (0.25 % w/v); *rt*: 1.3 mL (0.26 % w/v)] were analysed using a Hewlett Packard-5973 gas chromatograph-mass spectrometer (GC/MS) equipped with a capillary HP-5MS column (30 m x 0.25 mm, 0.25 µm film thickness) and a FID detector operated at 280 °C.

The volatile components of each oil [11 (*lv*), 15 (*fw*) and 20 (*rt*)] were identified from their retention indices and by comparison of their mass spectra with those in the Wiley GC-MS Library data base (6Th Ed). The major compounds were chamazulene [80.41 % (*lv*); 71.20 % (*fw*); < 1.0 % (*rt*)], germacrene D [11.66 % (*lv*); 11.42 % (*fw*); 37.43 % (*rt*)], β-caryophyllene [1.64 % (*lv*); 3.53 % (*fw*); 20.77 % (*rt*)] and α-longipinene [10.70 % (only in *rt*)].The identification of these compounds was confirmed by NMR studies. A comparative detailed discussion on composition percentages in leaves-, flowers- and roots-oil is presented. Studies on pharmacological properties of these oils are in progress.

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P 233. Evaluation of antioxidant potential of Tunisian *Lavandula dentata* L.

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Keywords: *Lavandula dentata* extracts, flavonoids, tannins, polyphenols, DPPH, antioxidant activity.

Tunisian *Lavandula dentata* (Lamiaceae) was studied for the flavonoids and total tannins, as well as total polyphenols content, in the flowering tops methanolic, acetonic and aqueous extracts. Antioxidant potentials on this plant part extracts were assessed by the DPPH free radical scavenging activity. The preliminary results of our study, showed that the methanol extract has the highest concentration of total polyphenols and total flavonoids. However, the aqueous extract was the richest in condensed tannins. The highest total antioxidant activity of *L. dentata* flowering tops extracts was registered in the acetone extract. However the most interesting activity of inhibiting synthetic radical (DPPH) was recorded in the methanolic extract. A good correlation was found between the polyphenol contents and antioxidant activities of the three extracts.

P 234. CHEMICAL COMPOSITION AND EVALUATION OF SOME BIOLOGICAL EFFECTS OF ESSENTIAL OIL EXTRACTED FROM NIGELLA SATIVA (L.) SEEDS

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Keywords**:** Inflammation; essential oil; phenols; Nigella sativa; neutrophil; elastase

The *Nigella sativa (L.)* seeds and its purified constituents have been shown beneficial therapeutic potentials for many diseases such as COPD and emphysema. The aim of this study is to investigate the anti-inflammatory effect of essential oil (EO) and its main components on human neutrophil (HN) functions, HNs chemotaxis, the activity and secretion of human neutrophil elastase (HNE). Hydrodistillation was used to extract the EO from the seeds of *N. sativa (L.)*. The yield of EO obtained was 0.4 %. Results of GC-MS analysis revealed that main components comprise 65% of EO and identified are monoterpens; p-cymene, thymoquinone, carvone, thymol and carvacrole. The control movement and chemotactic responses of HNs and HNE secretion were reduced at a dose dependent manner. The results of these studies revealed clearly that components of EO are potent inhibitors for HNs movement, chemotactic responses, the activity and secretion of HNE.The observed inhibition of HNs functions may occur via intracellular pathways.

P 235. Antibacterial activity of ginger essential oil

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Keywords: Antibacterial activity; essential oil; *Zingiber officinale*

Our study is to evaluate a medicinal plant, *Zingiber officinale* whose rhizomes are used as a remedy against several diseases.

A study of the antibacterial activity of essential oil extracted, from dried rhizomes, by a Clevenger hydro distillation for 4 hours, was carried out on 5 pathogenic strains (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Enterococcus faecium*, *Enterococcus faecalis*) and *Candida albicans*.

The well diffusion method was used and it gave clear zones of inhibition.

The preliminarily results indicate that the essential oil diluted in methanol has a capacity of inhibited growth of three strains (*Staph. aureus*, *E. coli*, *Pseudomonas aeruginosa*) of five and *Candida*, causing inhibition zones of up to some millimeters.

P 236. ANTIOXIDANT ACTIVITY OF ESSENTIAL OILS OF *ORIGANUM VULGARE* L. SUBSP. *GLANDULOSUM* (DESF.) IETSWAART FROM TUNISIA

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Keywords**:** *Origanum*; essential oil; phenols; antioxidant activity

Origanum vulgare L. subsp. *glandulosum* (Desf.) Ietswaart is an endemic plant of North African area used as medicinal and aromatic plant. In this study, its antioxidant activity is evaluated.

The essential oils from *Origanum glandulosum* collected from two localities of Tunisia, Krib and Zaghaouan, were obtained in yields of 2.0 and 3.2% (v/w), respectively. The essential oils were analyzed by GC and GC/MS and assayed for their total phenolics content, by the Folin-Ciocalteu method, and antioxidant effectiveness, using the 2,2-diphenyl-1-picrylhydrazil (DPPH) radical scavenging assay. The main components, from Krib and Zaghaouan, were thymol (26.99% and 40.7%), *p*-cymene (27.29% and 28.7%), *γ*-terpinene (23.52% and 17.1%) and carvacrol (7.74% and 2.7%), respectively. The abilities to scavenge the DPPH radicals, expressed by IC50, are 151.85 ± 12.27 and 111.70 ± 13.72 mg L^{-1}. It is very strong compared to the effects of other medicinal plants. The total phenolic content, expressed in gallic acid equivalent (GAE) g kg^{-1} dry weight, are 4.08 ± 0.13 and 6.71 ± 0.28 from Krib and Zaghaouan respectively .

A high scavenging effect is generally due to high content of phenolic compounds, but also, it can due to other constituents like flavonoids. The results suggest that *O. glandulosum* possesses high antioxidant activity and may play an important role in the prevention of free radical induced diseases.

P 237. ANTIFUNGAL ACTIVITIES OF ESSENTIAL OILS AGAINST *BOTRYTIS CINEREA*

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Keywords**:** Oregano; Monarda; thyme oil; *Botrytis*; strawberry; fungicide

Increasing concern for food safety and environmental protection has brought about the need for the development of new and safe plant disease control strategies. The study was therefore aimed at finding alternative to synthetic fungicides currently used in the control of the devastating fungal pathogen like *Botrytis cinerea* Pers, the causal agent of grey mold disease of strawberry (*Fragaria ananassa* Duch). Antifungal activities of essential oil from *Origanum vulgare* L, *Monarda didyma* L and a commercial formulation of thyme oil (Gloves Off) vs control were investigated against *B. cinerea*. Contact phase effects of different concentrations of the essential oil and the commercial formulation were found to inhibit the growth of *B. cinerea* in a dose dependent manner. Complete growth inhibition of the pathogen was recorded at 150 µg/ml of Gloves Off. Reduced pathogen growth was recorded at the highest concentration of the essential oil of *O. vulgare* and *M. didyma* tested at 12.8 µg/ml. Spore germination and germ tube elongation were also inhibited by the essential oil and Gloves Off. Light microscopic observations revealed that the essential oils caused morphological degenerations such as cytoplasmic coagulation, hyphal shrivelling and protoplast leakage of the fungal hyphae. It seems that essential oil of *Origanum vulgare* L and *Monarda didyma* L have potential and promising antifungal activity against *B. cinerea* similar to the commercial formulation "Gloves Off".

P 238. Antimicrobial effect of vapours of essential orange oil, essential fir cone oil and (+/-)-limonene on airborne microbes.

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Key words: orange oil; fir cone oil; (+/-)-limonene; antimicrobial effect; airborne microbes

Airborne microbes are a still underestimated cause of risk for human health. Since all currently used air disinfectants have disadvantages such as a potential for skin irritation, pollution of environment and unpleasant smell, it seems to be worthwhile to investigate new, eco friendly and safe agents with high potential to serve as air-disinfectants.

In the presented study the potential of two essential oils (orange oil and fir cone oil) as well as their main compounds (+/-) limonene, both substances and essential oils with known antimicrobial activity [1-3] but still not investigated for their antimicrobial activity against airborne microbes, were tested to serve as innovative air-disinfectants. The essential oils and the single compounds were evaluated for their influence on airborne microbes when vaporized in salesrooms of pharmacies. In the present investigation orange oil (95.7% (+)-limonene) and fir cone oil (67.9% (-)-limonene) as well as (+)-limonene and (-)-limonene, respectively, were distributed continuously by using a room diffuser throughout the opening hours of the pharmacies. The total microbial count in the testing rooms were determined by using an RCS Air Sampler at 8:00, 11:00, 14:00 and 17:00. For blank values, the same procedure was performed without distributing the aromachemicals or essential oils. The airborne microbes in the testing rooms were identified as *Micrococcus* sp., *Staphylococcus* sp., *Bacillus* sp., *Aspergillus* sp., *Penicillium* sp, *Acinetobacter* and *Pseudomonas,* employing microscopical analysis, gram straining, motility checking (hanging drop) and API-analysis.

There was a continuous rise of microbial count throughout the day for the blank values, whereas with each of the tested substances/essential oils a significant reduction of total microbial count in the air was achieved. In our study the most effective antimicrobial agent was (+)-limonene, followed by orange oil, fir cone oil and (-)-limonene [4]. In conclusion, it can be stated, that the essential oils/aroma chemicals investigated in this work have the potential to be used as an alternative or supporting agent to established air disinfectants.

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