ABSTRACTS OF ORAL PRESENTATIONS

EFFECT OF PREIBIOTIC AND HERBAL EXTRACTS (WILD MARJORAM, WILD MINT AND CHAMOMILE) ON SERUM LIPID CONCENTRATIONS OF LAYING HENS

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The study was conducted to evaluate the effect of Prebiotic and herbal extracts wild mint, marjoram and chamomile on serum lipid concentrations (cholesterol, triglyceride, LDL and HDL) in brown TSL laying hens at 80 weeks of age. Trial was performed in a completely randomized design with 5 treatments and 4 replicates (three birds per treatment) for 8 weeks. Diets were formulated according to NRC 1994 nutrient requirements. The ethanolic herbal extracts were added to the drinking water as one to one thousand ratios. The effects of Prebiotic and herbal extracts on serum lipid concentration was significantly different ($P<0.01$). Treatments showed significant differences in terms of triglycerides ($P<0.01$). Triglyceride levels in chamomile and marjoram supplemented groups were the lowest and highest, respectively, indicating a positive effect of chamomile in reducing serum triglyceride. In terms of cholesterol, there was significant difference between chamomile and wild mint with marjoram ($P<0.01$). The birds which received wild mint and chamomile had the lowest cholesterol levels. It has been reported that chamomile extract significantly reduced the lipid levels in rats (1).The results also showed that using medicinal plants has resulted in significant effects on LDL level ($P<0.01$), as wild mint extract treatments had the lowest LDL level. Marjoram extract had significant difference in LDL compared to control and wild mint groups. Prebiotic supplemented group showed the highest HDL and control group had the lowest HDL level. It has been shown that probiotics and prebiotics have been reduced serum cholesterol in humans (2). According to results of this experiment it can be concluded that administration of the above mentioned herbal extracts and prebiotic in laying hens reduce serum cholesterol, LDL and triglyceride.

References

[1] Olfat A. K, *Journal of Health Sciences,* **2012**. *2(5):* 43-48.
[2] Pereira DIA, Gibson GR, *Crit. Rev. Biochem. Mol. Biol*. **2002**; *37*: 259–281.

EVALUATION OF ANTINOCICEPTIVE AND ANTI-INFLAMMATORY ACTIVITY OF TOPICAL USE OF *PLATANUS ORIENTALIS* L. LEAVES IN A RAT MODEL OF OSTEOARTHRITIS (OA)

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Platanus orientalis L. (Platanaceae) is a medicinal tree used in Iranian folklore and traditional medicine as a pain and inflammation reliever. In this study, the total hydro alcoholic extract of *P. orientalis* leaves were prepared and its antinociceptive and anti-inflammatory effects were studied in rats using the MIA (mono sodium iodo acetate) model that induced osteoarthritis. We induced OA via intra-articular mono-iodoacetate (MIA) injection, and evaluated pain and inflammation related behaviors including the volume of inflamed hind paw measured with a cylinder of mercury that is placed on a sensitive digital balance and paw withdrawal threshold in a von Frey hair test. *P. orientalis* extract and diclofenac gel topically administered to decrease MIA-induced effects. An increase in volume of the inflamed of hind paw was noted after intra-articular injection of MIA. *Platanus orientalis* significantly ($P<0.05$) decrease the volume of the inflamed paw. This extract was also effective in suppression of pain behavior by vonfrey test and it had moderately antinociceptive activity in comparison to diclofenac gel. The determination of differences in hind paw volume and paw withdrawal threshold in vonfrey test in the rat MIA model of OA showed the effects of anti-inflammatory and analgesic agents. This study may be useful for the discovery of novel pharmacologic agents in human OA.

References

[1] Tohfe-al-Momenin, Mohammad Momen Tonekaboni , Shahid Beheshti University of Medical Sciences, 1th edition, 2006; 200.
[2] Aghili MH. Makhzanol Advieh, Tehran University of Medical Sciences. 1th edition. 2007; 387.
[3] V. Hajhashemi , A. Ghannadi and S. Mousavi; *Res Pharm Sci*. **2011**; 6(2): 123–128.
[4] Glenn W. Stevenson, Hannah Mercer, Jim Cormier, Catherine Dunbar, Laura Benoit, Chloe Adams, Justin Jezierski, Amy Luginbuhl, and Edward J. Bilsky; *Pharmacol Biochem Behav*. **2011**; *98*(1): 35–42.
[5] M. Fereidonia, A. Ahmadiania, S. Semnanianb, M. Javan , *Journal of Pharmacological and Toxicological Methods* , **2000,** *43,* 11 ±14.

AUDIT OF DEVELOPMENT OF SAFFRON SCIENCE

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Saffron, as the most expensive agricultural and medicinal crop worldwide, has a special position among Iranian industrial and export products. At the present, Iran is the largest producer and exporter of saffron, with more than 80 percent of the global production of this precious crop is dedicated to Iran. Numerous and widespread usages of saffron, the special properties of this valuable medicinal plant, it's given role in the livelihoods of farmers in some provinces, as well as its high value added, all highlight the need for more attention to issues related to saffron. Despite the importance of this crop in the Iran's economy and employment, particularly in its main cultivation area, i.e. the provinces of Southern and Razavi Khorasan, It has received little attention in research and technology. Definitely, world's expectation from a country that considers itself as the master of saffron is very high, and of course, any claim in this regard is defensible only based on research approaches. Audit plan of science is one of the important proceedings performed by Vice-President of Science and Technology, which is hoped its implementation become a major source of changes in the development of science and technology in the country. In this regard, in March 2012, the auditing of the saffron science was assigned to Saffron Research Group, University of Birjand. Implementation procedures of auditing of saffron science include both quantitative and qualitative sections. In the quantitative section, in order to collect the required data, after recognizing related colleges, institutes and research centers, some questionnaires were delivered to the relevant officials. Qualitative data about saffron researches were also collected through a questionnaire. Finally, the analytical results obtained from data collected from questionnaires filled out by farmers, researchers and experts in saffron science are described in detail, and effective trends, training and research requirements, strengths and weaknesses and deficiencies in education and research, opportunities and threats, and future prospects are mentioned, and eventually some recommendations are presented to achieve the major objectives of promoting science and technology in the field of saffron. Among the important challenges ahead are the problem of low yields per unit area and the indiscriminate increase in saffron cultivation area, instability of saffron price in production sector, lack of attention to the required investment and planning to generate saffron science and expanding the frontiers of saffron knowledge, and shortage of experts and specialized, scientific research centers.

References

[1] Abdullaev, FI., Frenked, GD., Saffron in biological and medical research. U.S.A: Harward Academic Publishers; 1999, 103-13.

Arslan, N., Gubruz, B., Đpek, A., Ozcan, S., Sarthan, E., Daeshian, A. M., and Moghadassi, [2] M.S., The effect of corm size and different harvesting times on saffron (*Crocus sativus* L.) regeneration. Proceedings of the 2nd International Symposium on Saffron Biology and Technology. Mashhad, Iran, 28-30 October 2006, p. 113-117.

STUDY ON CANDIDATE GENES EXPRESSION RELATED TO BIOSYNTHESIS PATHWAY OF PHENOLIC MONOTERPENES IN THYME POPULATIONS USING REAL TIME-PCR METHOD

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Medicinal plants are rich sources of natural products used for production of pharmaceutical products. Thymus genus belongs to the Lamiaceae family; it has more than 18 different species distributed in different areas of Iran. Among herbal drugs, thyme has second rank in the world after mint. Two monoterpenes that have antiherbivore, antimicrobial, pharmaceutical and antioxidant activities, thymol and carvacrol, are found in thyme. Carvacrol is the main component of five ecotype and six populations of *T. caramanicus* essential oils [1] but also thymol is the main component of *T. vulgaris* essential oils [3]. A pathway for the formation of thymol and carvacrol in thyme is proposed to start with the formation of γ-terpinene from geranyl diphosphate (GPP) by γ-terpinene synthase (*Tvtps*1). The second step is catalyzed by cytochrome P450s in a two-step oxidation. *CYP71D178*, *CYP71D179* and *CYP71D182* are proposed to be thymol synthases while *CYP71D180* and *CYP71D181* are proposed to be carvacrol synthases. The purpose of the present study is to investigate the expression levels of *Tvtps*1, *CYP71D180* and *CYP71D181* in seven population of thyme which had a much higher variation of the terpene composition. Four plant populations collected from its wild habitat in Kerman province as well as three plant populations provided from Medicinal Plant Gene Bank is located in State Forest Research Institute. Total RNA was isolated from expanding leaves and cDNA synthesized from1 µg total RNA. Then, expression levels of these genes were measured by Real time-PCR method. Results showed that *CYP71D180* and *CYP71D181*in Babgorgy population (*Thymus lancifolius* Celak) and*CYP71D181*in Thyme population of (*Thymus vulgaris* L.) were not amplified. Babzangy population had highest transcript levels for*CYP71D180* and *Tvtps*1, while Babgorgy population had reduced transcript levels of *Tvtps*1.

References

[1] Bikdelu, M, M.Sc Thesis. College of Agriculture and Natural Resources, Faculty of Agriculture Sciences and Engineering. 2012.
[2] Crocoll, C., Max Planck Institute for Chemical Ecology, Jena and The Friedrich-Schiller-University, 2011
[3] Nejad Ebrahimi, S.; Hadian, J.; Mirjalili, M.H.; Sonboli, A.; Yousefzadi, M. *Food chemistry*, **2008,** *110*: 927-931.

BIOTRANSFORMATION OF TWO FURANOCOUMARIN COMPOUNDS BY TWO FUNGAL SPECIES *ASPERGILLUS*. SP. PTCC 5266 AND *ASPERGILLUS NIGER*

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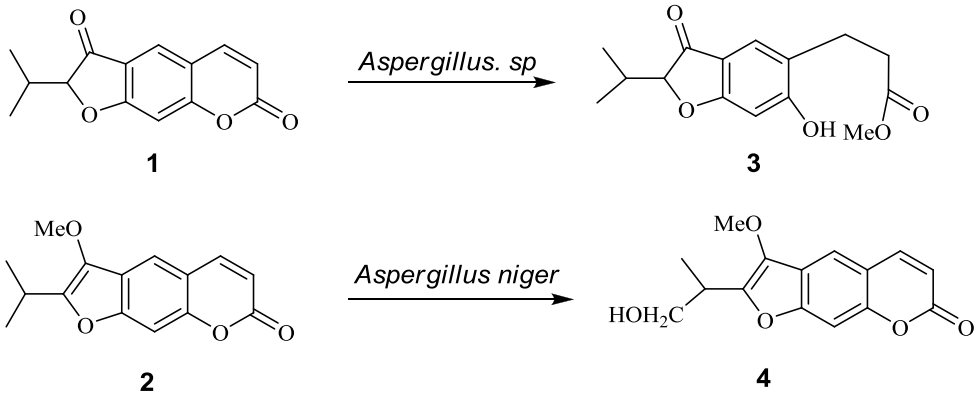
Coumarins are a very large and diverse group of biologically active compounds with widespread pharmacological properties such as anti-inflammatory, anticoagulant, antibacterial, antiviral, anticancer, and antioxidant properties [1- 2]. The linear or angular furanocoumarins are a therapeutically important subclass of coumarins as they have various clinical applications [3]. Biotransformation of two furanocoumarin compounds namely oreoselon (**1**) and pucedanin (**2**) was investigated by two fungal species *Aspergillus. sp*. PTCC 5266 and *Aspergillus niger* for the first time. Microbial transformation of oreoselon using *A. sp* afforded a new metabolite, methyl 3-(2, 3-dihydro-6-hydroxy-2-isopropyl-3-oxobenzofuran-5-yl) propanoate (**3**), with 35% yield. The metabolite produced during pucedanin biotransformation using *A. niger* was 2- (1-hydroxypropan-2-yl)-3-methoxy-7H-furo[3, 2-g] chromen-7-one (**4**) with good yield (45%).



1 **3**

2 **4**

References
[1] Odhav, B. *Biomed. Res. Int*. **2013**, *2013*, 1–4.
[2]. Huang, X. Y., Shan, Z. J., Zhai, H.L., Su, L., Zhang, X. Y. *Chem. Biol. Drug. Des.* **2011**, *78*, 651–658.
[3] Lacy, A., O'Kennedy, R. *Curr. Pharm. Des.* **2004**, *10*, 3797–3811.

THE STUDY OF COLCHICINE APPLICATION ACCOMPAINED WITH IRRIGATION AND TIP MERISTEM ON AUTOTETRAPLOIDY INDUCTION ON TWO *MENTHA MOZAFFARIANII* ECOTYPES

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Ploidy manipulation is considered as a valuable tool in genetic improvement of many plants. Polyploidy often generates variants that may possess useful characteristic. The present study was conducted to polyploidy possibility induction of two Iranian endemic mint ecotypes by colchicines application with two methods. For this purpose, two experiments were done. In the first experiment, colchicine as combined with irrigation was applied. For this purpose, a factorial experiment in randomized complete design with two factors (colchicine concentrations: 0, 0.025, 0.012, 0.006% and two mint ecotypes; ecotype A: Kamarej region and ecotype B: Pirmohlat region) and three replications was conducted. In the second experiment, apical meristem was treated. The factorial experiment based on randomized completely design with two factors and five replications. The factors including different colchicine concentrations (0, 0.035, 0.07, 0.15, 0.3 and 0.7%) and two ecotypes. At the end of all experiments, survival rate and tetraploidy percentage (by morphological change, stomata traits, flow cytometery and chromosome counts) were measured. The results showed that different treatment had significant effects on survival percent on two experiments. In addition, increasing of colchicine concentration caused decreasing plants survival. Treatment of the seedlings with colchicines, combined with irrigation didn't have any effects on ploidy level of the treated plants. These treatments were impressed survival percentage in all ecotypes and increasing colchicine concentrations incur plant survival reduction. In terms of tip meristem treatment, colchicine concentrations had significant effect on damaged shoot apex (due to colchicine treatment) and survival rate on two ecotypes. In two ecotypes, the minimum damaged shoot apex (0%) were observed in control treatment (without colchicines usage) while with addition colchicine concentrations damaged shoot apex were increased and in 0.7% treatment in all ecotypes was reached to 100%. Tip meristem treatment didn't have any effects on elevation of ploidy level. Totally, the results showed that ecotype B is more sensitive than as compared with ecotype A to colchicine concentration.

References

[1] Li, W.; Li, D. N.; Hu, H.; and Chen, X. Y. *Forestry Studies in China*. **2007**. *9 (4):* 283-286.

NEURO-BEHAVIORAL AND PHARMACOLOGICAL EVALUATION OF *ASPERUGO PROCUMBENS* IN USING EXPERIMENTAL MODELS

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Asperugo procumbens (German Madwort; Boraginaceae) has used in Iranian traditional medicine as tonic, sedative and diuretic. Its Persian name is Badranjbuyeh, but it should not be mistaken with *Melissa officinalis*. In this study, we evaluated the hypnotic, anti-depressant, anti-anxiety, and anti-convulsant effects of *A. procumbens*. The samples of *A. procumbens* were purchased from market in Tehran and after identification; ethanol extract (by maceration) was obtained. Pentobarbital induced loss of righting reflex was used for evaluation of hypnotic effect of the extract in mice model. Spontaneous activity in open field was used for evaluation of locomotor activity and the total distance moved by the subjects was analyzed. The extract was tested at doses of 100-800 mg/kg i.p., and diazepam was used as positive control. *A. procumbens* significantly reduced the locomotor activity of the mice in dose dependently manner, but didn't show significant hypnotic effect in pentobarbital induced loss of righting reflex test. The time spent in center of the cage by mice was significantly increased by *A. procumbens* indicating possible anti-anxiety effects of the plant. These findings show that *A. procumbens* reduce the locomotor activity and this might be because of sedative effect of the extract. Anti-depressant effect of *A. procumbens* has been assayed by use of forced swim test, on Swiss Webster male mice. The ethanolic extract of *A. procumbens* has injected intra-priotoneally to mice, have anti-depressant effect in 75, 150 and 300 mg/kg doses. Pentylentetrazole (PTZ) and maximal electroshock (MES) models were used for anticonvulsant activity of the extract. *A. procumbens* showed significant anticonvulsant activity at doses of 20-320mg/kg in MES model (ED_{50}= 173.9mg/kg), but at doses up to 320 mg/kg show no effect in PTZ model. Total extract of *A. procumbens* was fractionated by 3 solvents including petroleum ether, chloroform and ethyl acetate, and their anticonvulsant activity was evaluated. Chloroform fraction showed anticonvulsant activity in MES model (ED_{50}= 202.92 mg/kg). Two experimental methods, elevated plus maze (EPM) and light-dark box, were used to evaluate the anti-anxiety effects of the extract. The extract did not show statistically significant effect in EPM test. The extract did not show any significant anti-anxiety effect in light-dark box test. *Asperugo procumbens*, elevated plus maze, light-dark box, anti-anxiety effects, Pentylen tetrazole, maximal electroshock model, anticonvulsant activity, forced swim test, anti-depressant effect, hypnotic effect, righting reflex test, open field, locomotor activity, sedative effect, anti-anxiety.

NEW STEROIDAL SAPONINS FROM PERSIAN LEEK

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In this Study, seeds of Persian Leek (*Allium ampeloprasum* Subsp. Persicum) that is known as Tareh in persian was investigated. This plant is used as vegetables and food in Iranian dishes widely. The seeds were air dried, powdered and extracted with hexane, CHCl3, $CHCl_3$–MeOH (9:1), and MeOH. The MeOH extracts were partitioned between butanol and water phases. The $CHCl_3$–MeOH (9:1) and butanolic extracts were chromatographed by CC or MPLC on a RP18 Silica gel, using a linear gradient solvent system from H_2O to MeOH as mobile phases. Interested fractions with saponins contents were selected, base on preliminary 1H NMR analysis. The selected fractions were purified by preparative HPLC with the suitable mobile phases (mixture of MeOH–H_2O). 1H NMR, 13C NMR, 2D NMR, FABMS and IR, techniques were used to elucidate of isolated compounds. The study afforded the isolation of two new spirostane glycosides, persicosides A (1) and B (2), together with ceposides A1/A2, C1/C2 (6a/6b, 7a/7b), tropeosides A1/A2, B1/B2 (8a/8b, 9a/9b), and ascalonicosides A1/A2 (10a/10b)), previously found in the related species, white onion, red Tropea onion and shallot, respectively. Structure elucidation of the compounds was carried out by comprehensive spectroscopic analyses, including 2D NMR spectroscopy and MS spectrometry, and by chemical evidences. The chemical structure of new compounds were identified as (25S)-spirostan-2α, 3β,6 β -triol 3-O- [β -D-glucopyranosyl-(1→3)] [β -D-xylopyranosyl-(1→2)]- β -D-glucopyranosyl-(1→4)- β -D-galactopyranoside (1), (25S)-spirostan-2α,3 β,6 β -triol 3-O-[β -D-xylopyranosyl-(1→3)] [α-L-rhamnopyranosyl-(1→2)]- β -D-glucopyranosyl-(1→4)-O- β -D-galactopyranoside (2).

ANTIPLASMODIAL ACTIVITY OF SOME SELECTED MEDICINAL PLANTS FROM THE NORTHWEST OF IRAN

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The effectiveness of antimalarial drugs is declining at an ever accelerating rate, with consequent increase in malaria-related morbidity and mortality. The newest antiplasmodial drug from plants is needed to overcome this problem. The aim of this study was to assess antimalarial activity of the ethanolic extracts of 10 different medicinal plants from eight families against *Plasmodium falciparum* chloroquine-sensitive 3D7 strain. The selection of the hereby studied plants was based on the existing information on their local ethnobotanic history. Plants were dried, powdered, and macerated in a hydroalcoholic solution. Resulting extracts have been assessed for *in vitro* and *in vivo* antimalarial and brine shrimp toxicity activities. Of 10 plant species tested, four plants: *Althea officinalis* L. (Malvaceae), *Myrtus communis* Linn (Myrtaceae), *Plantago major* (Plantaginaceae), and *Glycyrrhiza glabra* L. (Papilionaceae) displayed promising antimalarial activity *in vitro* (50% inhibitory concentration values of 62.77, 42.18, 40.00, and 13.56 μg/mL, respectively) with no toxicity against brine shrimp larvae. The crude extracts of three active plants, *G. glabra*, *M. communis*, and *A. officinalis*, also significantly reduced parasitemia *in vivo* in female Swiss albino mice at a dose of 400 mg/kg compared to no treatment. Antiplasmodial activities of extracts of *A. officinalis* and *M. communis* are reported for the first time [1].

References

[1] Sangian H, Faramarzi H, Yazdinezhad A, Mousavi SJ, Zamani Z, Noubarani M, Ramazani A. *Parasitol Res.* **2013**; *112(11)*: *3697-701*. doi: 10.1007/s00436-013-3555-4.

LABELING OF COLCHICINE FROM *COLCHICUM AUTUMNALE* FOR SINGLE PHOTON IMAGING OF TUMOR

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Colchicine is an alkaloid derived from the plant of the Lily family *Colchicum autumnale*. Plant extracts containing colchicines have been used to treat gout for more than 2000 years, and pseudogout and familial Mediterranean fever (FMF) for several decades [1, 2]. Each colchicine molecule binds to a tubulin molecule, preventing it from incorporating into the polymer. Microtubule elongation stops, the mitotic spindle is disrupted, and cell division cannot proceed. This effect makes colchicines one of the oldest identified antimitotic drugs [3]. Colchicine and its analogues are of interest for tumor therapy by radiolabeling with a therapeutic radioisotope, and their conjugation to an imaging agent offer the facility to monitor their physiological distribution and effectiveness as antimitotic agents. ^{99m}Tc-based conjugates of colchicine and its derivatives are attractive due to the availability of low cost ^{99}Mo/^{99m}Tc generator, favorable physical characteristics of ^{99m}Tc ($t_{1/2}$ of 6 h, γ 140 keV 89% abundance) and high specific activity of radionuclide. Colchicine labeled with ^{99m}Tc was investigated further. Labeling with ^{99m}Tc was performed at 100 °C for 10 min and radiochemical analysis included thin layer chromatography method. The stability of labeled colchicine was checked in the presence of human serum and biodistribution studies were carried out in mice. Labeling yield of >90% was obtained corresponding to a high specific activity. Labeled colchicine showed good stability in the presence of human serum. Biodistribution studies in mice showed that labeled colchicine was accumulated in tumor and was cleaned fast from normal organs and showed clearance through urinary and hepatobiliary systems. Labeled with a gamma emitter radionuclide such as ^{99m}Tc, this natural compound extracted from medicinal plant may be useful to assess of tumor by single photon imaging.

References

[1] Lidar, M.; Livneh, A. *Neth. J. Med*. **2007,** *65*, 318-324.
[2] Niel, E.; Scherrmann, J. M. Joint. *Bone. Spine*. **2006,** *73*, 672-678.

GENETIC AND PHYTOCHEMICAL ANALYSIS OF IMPORTANT MEDICINAL PLANT, *WITHANIA COAGULANS* (STOCKS) DUNAL ACCESSIONS GROWING WILD IN IRAN

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The genus *Withania* (fam. Solanaceae) comprises 23 species. This genus in the flora of Iran is represented by the 2 species *W. somnifera* and *W. coagulans.* They are not cultivated, but are only available in the wild. Distribution of *W. coagulans* in Iran is limited and located only in the southeastern sections of the Sistan and Baluchestan province. In this investigation, genetic diversity and phytochemical components of twenty *W. coagulans* (fam. Solanaceae) accessions were assessed. Six EcoRI/MseI AFLP primer combinations produced 410 scorable bands of size 43- 1127 bp, out of which 339 (82.6%) were polymorphic across the twenty one accessions. On average, 56.5 polymorphic bands were amplified by each primer combination. The highest and lowest number of polymorphic bands was generated by AFLP primer combinations E-ACC+M-CAA and E-ACG+M-CAT, respectively. The mean of polymorphism information content was 0.18 and the coefficients of genetic similarity vary from 0.79 to 0.95. The results indicated high level of genetic variation in *W. coagulans* accessions. The phytochemical investigation showed the presence of Withaferin A (14.80-70.38 µg/g D.W), flavonoids (6.90-7.60 %), proteins (0.76-4.23 mg/g D.W), carotenoids (0.24-0.49 (mg/g F.W) and anthocyanins (6.07-11.21µmol/g) that varied among accessions. The evidence from this study suggests that USB019 has the highest values of withaferin A, carotenoids, and anthocyanins compared to the other accessions. Therefore, the USB019 accession can be selected as the candidate accession for breeding programs and the development of locally-suited genotypes in Iran. Also, the findings revealed that the total phenolic contents of the roots ranged from 14.9 to 23.8 µg/mg of Gallic acid equivalent and that the USB008, USB024 and USB025 have higher phenolics content. Antioxidant activity indicated that IC_{50} was 3.61-40.50 µg/ml, that USB 008, USB 024, USB 025 and USB0158 had greater DPPH scavenging ability (IC_{50}; 3.61-3.89 µg/ml) in comparison with ascorbic acid (IC_{50}; 4.85 µg/ml). This investigation clearly revealed that polyphenols in *W. coagulans* roots were largely responsible for the antioxidant activity (R^2= 0.823). The results demonstrated that *W. coagulans* possesses valuable antioxidant properties for the pharmaceutical and food industries. This finding has important implications for devising strategies for conservation and employing them in breeding programs of *W. coagulans.*

STEREOCHEMICAL CHARACTERIZATION OF TAXOIDS FROM *TAXUS BACCATA* BY COMPUTATIONAL ELECTRONIC CIRCULAR DICHROISM AND IN VITRO ANTIPROTOZOAL ACTIVITY

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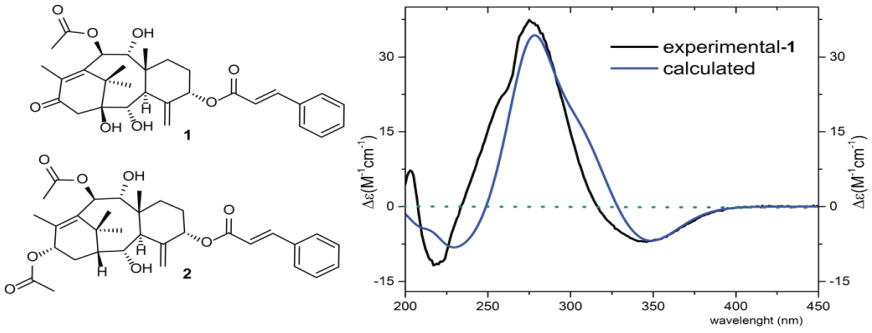
The complete structure elucidation of a new secondary metabolite involves determination of constitution, assignment of relative and, finally, absolute configuration. Chiroptical methods such as electronic circular dichroism (ECD) has been used for assignment of absolute configuration since several decades, but were limited in their applicability. Recent progress in the areas of conformational analysis and time dependent density function theory (TDTDF) calculation allows prediction of CD spectra by quantum chemical calculations [1]. This is especially valuable for the analysis of new molecular entities when chemical synthesis of the reference compound is not an alternative. Two taxanes diterpenoids namely 5-Cinnamoyl-10-acetyltaxicin-I (1) and 10-Deacethyl taxezopidine G (2) isolated from aerial parts of *Taxus baccta* L. The complete structure elucidation and relative configuration was done by combination of 1D, 2D NMR, and NOESY spectroscopy. The assignment of absolute configuration compound **1** and **2** was achieved by comparison of experimental ECD spectra with simulated ECD data, by using time dependent density function theory (TDDFT) and MeOH as solvent. The calculated ECD spectra showed excellent fit with the experimental data. *In vitro* biological activity against *Plasmodium falciparum* and *Trypanosoma bruceirhodesiense* STIB 900 strain and cytotoxicity in rat myoblast (L6) cells were determined. The IC_{50} values of the compound **1** and **2** respectively were 17.6 and 3.1 µM against *P. falciparum*, and *T. brucei rhodesiense* 10.4 and 3.6 µM. The cytotoxic IC_{50} values were 85.2 and 3.2 µM. Selectivity indices for *P. falciparum* were 4.90 to 1.04, and 8.19 to 0.89 for *T. brucei rhodesiense*.



ANTITRYPANOSOMAL ISOTHIOCYANATE AND THIOCARBAMATE GLYCOSIDES FROM *MORINGA PEREGRINA*

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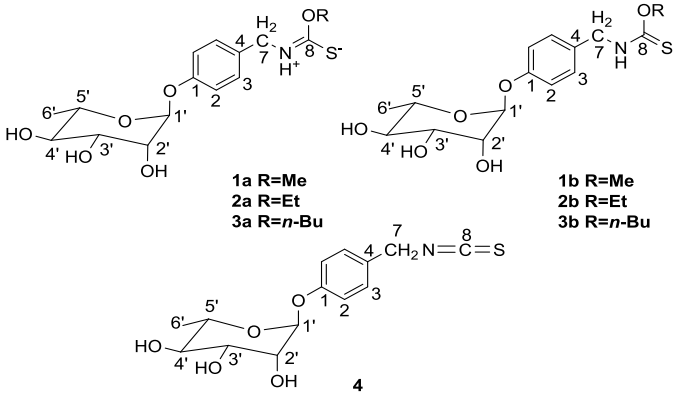
O-Methyl (**1**), *O*-ethyl (**2**), and *O*-butyl (**3**) 4-[(α-L-rhamnosyloxy) benzyl] thiocarbamate (*E*), along with 4-(α-L-rhamnosyloxy) benzyl isothiocyanate (**4**) have been isolated with preparative HPLC from the aerial parts of *Moringa peregrina* (Forssk.) Fiori. The compounds were elucidated by 1D and 2D NMR spectroscopy and HRESI mass spectrometry. The thiocarbamates are in two resonance hybrid forms. The isolated compounds were tested for *in vitro* activity against *Trypanosoma brucei rhodesiense*, and cytotoxicity in rat skeletal myoblasts (L6 cells). The most potent compound was **4** with an IC_{50} of 0.10 µM against *T. b. rhodesiense* and a selectivity index of 73, while the thiocarbamate glycosides **1**, **2,** and **3** showed only moderate activity. Intraperitoneal administration of 50 and 10 mg/kg body weight/day of **4** in the *T. b. rhodesiense* STIB 900 acute mouse model finally revealed significant *in vivo* toxicity and did not cure the animals. Because of its high *in vitro* activity and its ability to irreversibly inhibit trypanothione reductase, an attractive parasite-specific target enzyme, 4-[(α-L-rhamnosyloxy) benzyl] isothiocyanate (**4**) can be considered as a lead structure for the development and characterization of novel antitrypanosomal drugs [1].



References

[1] Ayyari, M.; Salehi, P.; Ebrahimi, S. N.; Zimmermann, S.; Portmann, L.; Krauth-Siegel, R. L.; Kaiser, M.; Brun, R.; Rezadoost, H.; Rezazadeh, S.; Hamburger, M., *Planta Med* (EFirst).

ISOLATION, STRUCTURE ELUCIDATION AND BIOLOGICAL ACTIVITIES OF THE CHEMICAL CONSTITUENTS OF SOME ENDEMIC *SALVIA* SPECIES

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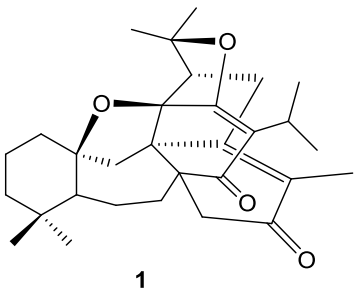
A huge diversity of molecular skeletons found in natural products enables finding better lead compounds to develop clinically useful entities. Plants of the *Salvia* genus have a rich history in traditional medicine. Indeed, the name *Salvia* is derived from the Latin "salvare" meaning "to heal or to be safe and unharmed", which sums up the folkloric belief of its "magical" therapeutic properties for many kinds of ailments and it popularity in traditional medicine. This genus is a rich source of structurally diverse terpenoids with a broad spectrum of bioactivities, such as cardiotonic, antibacterial, antioxidant, antitumor, and antimalarial properties. One of the most distinguishing features of *Salvia* species is their ability to synthesize isoprenoids with unusual scaffolds [1]. The genus *Salvia* is represented in the Iranian flora by 61 species, of which 17 are endemic [2]. Our recent studies, aimed at identifying structurally interesting and bioactive metabolites from the Iranian *Salvia* species, resulted in the isolation of several new compounds; some of them possess unusual and unique structures (**1**-**3**). The structures were elucidated by a combination of 1D and 2D NMR, HRESIMS, and X-ray crystallographic analyses. Plausible biosynthetic pathways toward these new skeletons were proposed. Biological properties of the new compounds were also investigated. Some of these compounds showed good *in vitro* antiplasmodial and anticancer activities at submicromolar concentrations.



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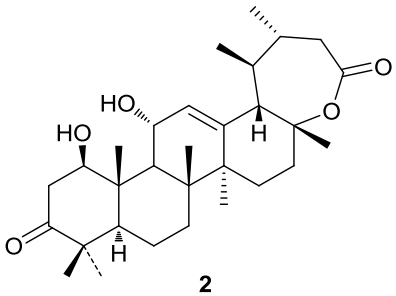

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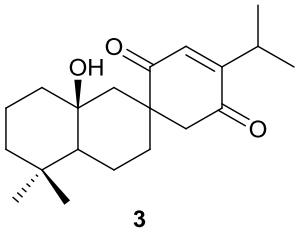

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References
[1] Wu, Y.-B.; Ni, Z.-Y.; Shi, Q.-W.; et al. *Chem. Rev*. **2012**, *112*, 5967−6026.
[2] Jamzad, Z. Lamiaceae. In *Flora of Iran*; Assadi, M., Maassoumi, A., Mozaffarian, V., Eds.; Research Institute of Forest and Rangelands: Tehran, Iran. 2012; Vol. 76.

PLANT DISTRIBUTION IN IRAN WITH EMPHASIS ON ENDEMIC, THE COMMON AND TRADITIONAL MEDICINAL PLANTS

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Today with the development of human sciences in modern Botany and many investigations that have been down from 1664 to 2013 by different scientists in Iran, offer quite attributable knowledge in Botanical Science and Plant taxonomy. Iran is located in south-west Asia and is a vast country with a total area of about 1,648,000 Km^2. Because of variable, climatically condition (Considerable variation of, temperature, rainfall and edaphically conditions) Iran has the most varied and most fascinating vegetation and naturally great diversity and richness in the plant life in Southwestern Asia. According to Boissier *(Flora Orientals*, 1867-1888), and K. H. Rechinger (*Flora Iranica* 1963-2013) and tremendous efforts of Iranian botanists at recent decades have lead to recognition of around 150 spontaneous families of Angiosperms including 124 Dicotyledonous and 22 Monocotyledonous and 4 Gymnosperms families, containing about 1450 genera. Totally ca. 8000 species are recognized in Iran of which around 1700 species (excluding *Astragalus*) are Endemic. Beside of them around 36 Cultivated families grows in Iran that not mentioned in *Flora Iranica*. With a careful review of complete list of Iranian plant species and genera, listed in Dictionary of Iranian Plants Name (Mozaffarian, 1996) showed about 130 families containing 569 genus of medicinal and odorant plants. This comprises about 2300 species of spontaneous and exotic medicinal and aromatic plants which of them about 850 species are medicinal, but according to a precise research not more than 400-450 species used as common and traditionally medicinal plants. About the distribution patterns of plant species several earlier authors have considered aspects of plant distribution and phytogeography of Iran. Based on Geobotanical researches most of Iran belongs to the Holarctic kingdom; the coastal areas of the Persian Gulf and their foothills belong to Paleotropic kingdom. The present author as a botanist have tried to merge studies of earlier authors and based on endemic species given a new aspect about plant distribution in Iran and discus about each of subdivisions, beside of endemic species to show how many of the common and traditional medicinal plants grow in these geographical divisions.

1- **Holarctic Kingdom** in Iran comprises two region:

1-1. Euro – Siberian region extends into northern Iran in the Caucasian – Euxino –Hyrcanian Province (Senso lato) or Hyrcanian Province (Senso stricto). The Hyrcanian Province includes the south Caspian coastal plain and the northern slope of the Elburz Mountains up to 2500 m., the Western parts extends to Arasbaran and from Eastern boundary runs West of Bujnurd. Dominant feature of Hyrcanian province is deciduous broadleaves trees and Shrubs and many herbaceous plants that grow there, in the forests or in the higher Altitudes of forestless areas. This Province in Iran comprises ca. 251 endemic and 160 wild and cultivable medicinal species.

1-2.Irano – Turanian region includes three well known Provinces: Armeno – Iranian, Kurdo – Zagrosian and Central Iranian Province.

- Armeno –Iranian Province in Iran comprises 3 subprovince named: Atropatanian, extends from northwest of Iran to Sefidrud valley. There are at least 132 Endemic and 170 wild and cultivable medicinal plant species in this subprovince.

- Elburzian subprovince extends from Sefidrud valley in the West to Khooshyeilagh valley in the East and includes high mountains like Damavand and other high mountains in central Elburz .This subprovince comprises ca. 250 Endemic and 208 wild and cultivable medicinal plant species.

- North Khorassanian subprovince extends from West of Bujnurd to East of Khorassan and included high mountains in Khorassan like Hezarmasjed, Binalud and etc. Number of the endemic and wild and cultivable medicinal plant species reach to 75 and 162 respectively.

- Kurdo – zagrosian province includes the extensive areas of Northwest of Iran to Southeast and comprises many high mountains and Zagrosian dry resistance *Quercus brantii* forests together with *Pistacia -Amygdalus* community of southern part of Zagros. By having special features and some endemic species can be divided into 3 subprovince: North, South and East of Zagros. In this province grows at least 560 endemic and 155 wild and cultivable medicinal plant species.

- Central – Iranian Province has not any subdivisions, includes the extensive areas of desert and steppe between high mountain of Armeno-Iranian (Elburzian subprovince) and high mountain of East Zagros and South Zagros subprovince and limited in the Southeast of Iran with Nobo-Sindian province. Central-Iranian province characterized by high fluctuations between temperatures of night and day, very low precipitation which occurs mainly in winter and spring and a long dry period in summer and autumn. This province covered by vast area of sand dunes, salt marshes and salty soil together with more or less Gypsum-calcareous sterile soils ,very rare trees and shrub species and vast area covered by Goose foot family species with Artemisia spp. In this area grows about 230 endemic and 120 wild and cultivable medicinal plant species.

2- **Paleotropic Kingdom** in Iran comprises Saharo-Sindian region and Nobo-Sindian (South- Iranian) province including lowland of coastal areas on the Persian Gulf and Oman Sea. From west it reaches to Ghasre Shirin in Southwest and by the East runs to border of Pakistan in Guater sinus. The flora of Nobo-Sindian province is Xerophytic and very Thermophilous. It requires very high summer temperatures, high humidity and frost-free winter. The most characteristic species of this area is *Phoenix dactylifera*. This province in Iran can be divided into 2 subprovinces: Persian Gulf (Sino- Persian) and Omanian subprovince. It characterized by more or less evergreen trees and shrubs which grow here. Endemic and wild and cultivable medicinal plant species of this subprovince is ca.130 and 115 respectively.

CHEMICAL COMPOSITION AND ANTIBACTERIAL ACTIVITY OF ESSENTIAL OIL OF *TANACETUM POLYCEPHALUM* SUBP. *AZERBAIJANICUM* (ASTERACEAE) FROM NORTHWEST OF IRAN

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Tanacetum L. belongs to the family Asteraceae and tribe Anthemideae. In Flora Iranica area, this genus was considered to have 54 species and in Iran, comprised 25 species and altogether 34 taxa. In this research, the essential oil composition of *Tanacetum polycephalum* subsp. *azerbaijanicum* collected from West Azerbaijan province of Iran was investigated for the first time. The essential oil was isolated by hydrodistillation from the aerial flowering parts and analyzed by GC and GC-MS. Sixteen compounds were characterized accounting for 96.8% of the total oil. Monoterpene hydrocarbons (32.9%) were found to be the principal compounds group, of which α-pinene (25.8%) and β-pinene (6.5%) identified as the main constituents. Oxygenated monoterpenes comprised 30.1% of the total oil with 1,8-cineole (19.7%) as the major component. Among the oxygenated sesquiterpenes (26.4%) allo-hedycaryol (26.4%) was identified as the main constituent. The essential oil exhibited moderate antibacterial activity against the *Escherichia coli* and *Staphylococcus aureus* with MIC values of 16 mg/mL.

CHICORY AS A POTENTIAL NEW CROP IN IRAN

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In an effort to increase agricultural diversification opportunities for small scale farmers in Iran, new alternative crops that have market demand have to be explored. One of the more promising alternative crops is chicory. Chicory (*Cichorium* sp.) is an annual, biannual or perennial herb from Asteraceae plant family. In ancient system of medicine, chicory is used as a Hepatoprotective. Chicory consists of a dietary fiber called as Inulin, which is useful in treating diabetes and constipation and it is an industrial plant and the leaves are usually consumed freshly. Recent studies have found some of the important constituents in chicory such as caffeic acid derivatives, fructooligosaccharides, flavonoids and polyphenol. On the other hand, chicory could be used as forage for livestock because it has high digestibility, low fiber and moreover, it has proper tolerance to drought stress. Study on morphological characters of 18 native races of Iranian chicory showed that in genus *Cichorium* consists of three species in Iran. Results of experiments on seeds of native dwarf chicory (*Cichorium pumilum*) showed that its optimum thermal range is 15- 25^{o}C. The research on spring planting dates of dwarf chicory with the aim of forage production showed that in spring plantings of dwarf chicory, at least to cuts in stalking phase is possible. Delay in planting causes an increase in phenolics rate. 25 seed samples of native races of Iranian chicory along with introduced root and salad cultivars of chicory were planted in cropping year of 2012-2013 in the research farm of RIFST in Mashhad as spring and autumn plantings. Results showed that commercial pubescent native races and introduced salad cultivars are suitable for spring planting and introduced root and native dwarf chicories are planted as spring and autumn under Mashhad conditions. Industrial cultivars and native genotypes of chicory were studied in 2012-2013 in Karaj for inulin production. With respect to climatic conditions of our country and water deficiency for irrigation in Iran, potential of autumn planting of chicory as an alternative crop of sugar beet is important in some areas of Iran. However, extensive studies should be done to provide information about all the essential cultural practices under different Iran's environmental conditions.

References

[1] Bais, H. P. and Ravishankar, GA. *J. Sci. Food Agric*. **2001**. *81*: 467- 484.

MACRO- AND MICRONUTRIENTS UPTAKE AND THEIR EFFECTS ON FLOWER QUANTITY AND QUALITY OF *ROSA DAMASCENA* MILL

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This research was conducted in Alborz research station, dependent of Research Institute of Forests and Rangelands, due to determine the best fertilization and feeding system and Macro- and micronutrients uptake of *Rosa damascena* Mill in 2011-12. As well as their effects on flower quantity and quality of *Rosa damascena* Mill. The research performed in two separate experiments as split plot with 3 replications based on randomized complete block design. The main-plots were NPK, Manure and combined fertilizers which were used in 2005. Sub-plots were Chelated iron fertilizer (soil application and foliar spray), sub factors of first and second experiment were foliar spray times (0, 1, 2 & 3 times) and the amount of micronutrients usagein soil (0, 8 & 12g/plant).The results showed that the max growth and number of main branches belonged to two times of foliar application (227.36cm and 58.91n/plant). Also, one and three times foliar application had the superlative height and number of sub branches with 65.05cm and 75.16n, respectively. Mean comparison of foliar spray numbers illustrates that two times foliar spray treatment had the uttermost growth & number of main branches with 55.36cm and 26.46n. As well as, the maximum growth & number of sub branches observed in one time foliar spray treatment by 20.32 Cm and 18.40n. The interaction effect of soil usage combined fertilizer exhibits that 4*8g treatment had the highest flower numbers and yield per bush & per hectare with 3.98 n/plant, 4425.11n/ha, 5.38kg/plant and 5981.84kg/ha, respectively; Furthermore, 4*12g treatment had the superlative essential oil yield (5595g/ha) and average percent (0/105%). The result of essential oil compounds analysis pointes that there was significant difference between main and sub plots on citronelol. According to the results, the highest flower number and yield were obtained by foliar spray method. The most essential oil percent and yield belonged to soil applied method.

CURRENT ISSUES IN MANUFACTURING OF HERBAL PHARMACEUTICAL PRODUCTS AND FOOD SUPPLEMENTS IN IRAN

Mahmoud Falamarzian

The most important issues in manufacturing of herbal medicinal products are clear understanding of definitions, regulations and GMP requirements governing these products." Herbal Medicine" is use of plants for medicinal purposes and the written record the use of herbs dates back to 5000 years. "Herbalism" is one of the core disciplines of traditional medicine. According to WHO "traditional medicines are based on the sum of the knowledge, skills and practices based of theories, beliefs and experiences", while modern pharmaceutical products are based on the evedeised scientific informations. Food supplement (or dietary supplements) includes vitamins, minerals, fiber, fatty acids, and are not intended to prevent or treat any disease. Documentation and licensing of modem pharmaceuticals, herbal medicines and food supplements are different and not necessarily alike in all countries. For example U.S. authorities define dietary supplement as foods, while elsewhere they may be classified as drugs or other products. Another important issue is the concept of OTC (over the counter) drugs. Regulations detailing the establishments, where drugs may be sold, who is arithorized to dispense then, and whether a prescription is required vary considerably from country to country. In Canada, in addition to prescription only medicine (POM) and OTC, an intermediate category exist: nonprescription items that must be kept behind the counter. In Netherlands there are four categories: UR (prescription only); UA (pharmacist only) and AV (can be sold in general stores). In UK, there are 3 categories: "POM", "Genal sales list" (GSL) which they can be sold anywhere and "pharmacy medicines" (P) which can be sold from a registered pharmacy but should not be available for self-selection. The most important issue is that authorization and licensing for manufacture and sales of food, drug products, and active pharmaceutical products should conform with good manufacturing practices (GMP) guidelines. These guidelines provide minimum requirements that a pharmaceutical or food manufacturer must meet while manufacturing drugs or food products, in order to assure that products are of high quality and do not risk the consumer or public. All GMP guidelines follow a few basic principles among which are: hygiene, controlled environmental conditions, defined and controlled manufacturing processes, writhen instructions and procedures , training of operators, detailed records so that the quality and quantity should be as expected and that enable the firm that the complete history of a batch to be traced, the distribution of the batch which minimizes any risk to their quality and a system of recalling. In conclusion, the regulations governing herbal medicinal products should be more clarified and harmonized with the international systems. OTC drugs need to be overviewed frequently and in regards with herbal products regulations need to be more specific. Most importantly, GMP requirements should be observed by all the manufacturers and distributors of herbal medicinal products and food supplements.

EFFECT OF DUAL INOCULATION WITH ARBUSCULAR MYCORRHIZAL FUNGI AND BACTERIA ON GROWTH, MINERAL NUTRITION, ESSENTIAL OIL YIELD AND QUALITY OF *THYMUS DAENENSIS* CELAK.

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In sustainable production of medicinal plant, the arbuscular mycorrhizal symbiosis is a crucial component for improving the biological equilibrium between microorganisms in the mycorrhizosphere and to increase nutrient uptake efficiency (Tommerup, 1992). Other important and beneficial root-interactive microbes are the plant growth promoting rhizobacteria (PGPR) (Perotto and Bonfante, 1997). Researchers have stated that PGPR can have some stimulatory effects on AM growth (Linderman, 1997). The objective of our present research was to evaluate, the effect of inoculation with a mixture of AMF and rhizosphere bacteria on root colonization, plant growth, essential oil yield and quality on *Thymus daenensis* plants. In order to study the effects of interactions between the AM fungi and PGPR on the dry matter yield, root colonization, essential oil yield and quality in organic cultivation of *T. daenensis* an experiment was conducted at semnan natural resource research greenhoue, in 2011-2012. Treatments included: A: the fungus of *Glomus moseae* (1- inoculated (AM) and 2- no inoculated) and B: PGPR inoculums (1-: *Bacillus subtilis* 2- *Pseudomonas fluorescens* 3- control). A split plot experimental design was applied in a randomized complete blocks with six treatments and three replications. Our results showed that the Co-inoculation with *G. moseae* and *B. subtilis* resulted 75% increase in shoot /root dry weight, increased (plant yield) by about 117% and stimulated essential oil yield by 93 % compared to uninoculated controls or to plants single inoculated. All microbial inoculation treatments significantly increased the concentration of Thymol in *T .daenensis* plants with respect to the control plants. Results showed that the foliar K contents and root colonisation increased significantly with the *G. moseae* inoculation and the foliar P contents increased significantly with the *B. subtilis* inoculation alone. The combination of *P. fluorescens* and *G. moseae* caused an antagonistic effect on the plant growth and essential oil in *T. daenensis*. Our findings confirm that plants Co-inoculated with *G. moseae* and *B. subtilis* during the nursery stage, can produce the highest quality transplants that have a better survival chance compare to control plants.

References

[1] Linderman RG.1997i. In: Caroll GC, Tudzynski P (eds) The Mycota. Springer- Verlag, Berlin, pp 117–128
[2] Perotto S, Bonfante P. *Trends Microbiol*. **1997**. *5*:496-501.
[3] Tommerup I C. *Mycorrhiza*, **1992**. *1*: 123-125.

CARUM COPTICUM, A HERBAL MEDICINE WITH RESPIRATORY PHARMACOLOGICAL EFFECTS

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Carum copticum (*C. copticum*) commonly known as "Ajvan" has been used traditionally in the past for various therapeutic effects including: respiratory distress. The followinf respiratory pharmacological effects were showen in a series of studies for this plant in tracheal smooth muscle: (1) a significant relaxant effect aqueous and extract ethanol as wellas essential oil extract of the plant ($p<0.001$) but the abscence of this effect for thymol the main constituent of the plant, (2) a non parallel rightward shift in methacholine concentration response curve and significantly greater EC_{50} methacholine obtained in the presence of extracts ($p<0.05$ to $p<0.001$), The extracts caused, (3) parallel right ward shifts in histamine concentration response curves and significantly greater EC_{50} histamine in the presence of extracts ($p<0.05$ to $p<0.001$) and (4) leftward shift in isoprenaline concentration response curve in the presence of ethanol extract all compared to the effect of saline. In addition (5) different extracts showed significant relaxant effect on tracheal smooth muscle incubated with atropine, chlorpheniramine and propranolol, contracted by KCl ($p<0.001$) as well as significant positive correlation between the relaxant effect of increment concentrations of essential oil of the plant with the effect of theophylline ($P<0.001$). (6) Fractions 3 and specially 2 which is suggested to be carvacrol showed concentration dependent relaxant effects of ($p<0.05$ to $p<0.002$) on tracheal smooth muscle. (7) The concentration dependemt relaxant effect of carvacrol, one of the main constituents of the plant was also observed ($p<0.05$ to $p<0.001$). Bronchodilator effect of *C. copticum* extract in presence of high K+(50 mM) and carbachol on guinea-pig tracheal preparation demonstrated a dose-dependent relaxation with a possible mechanism of calcium channel blocking effect. (9) Significant effect on cough number of various concentrations of extracts of the *C. copticum* was showed ($p<0.001$ for all cases) which were significantly greater than the effect of codeine ($p<0.05$ to $P<.001$). (10) Bronchodilatory effect of *C. copticum* boiled extract on asthmatic airways comparable with the effect of theophylline at concentrations used was also shown. The results of this study suggest that this plant could be of therapeutic value as a brochdilatory drug in patients with obstructive airway diseases. A potent relaxant effect of *C. copticom* on tracheal smooth muscle with a possible muscarinc and histamine receptor inhibitory, β-receptor stimulatory and xanthine like activity was shown. The mainn constituent of the plant responsible for its relaxant effect suggested to be carvacrol. A relatively potent anttussive effect and a bronch dilatory effect on asthmatic airways were also observed for the plant.

ASSESSING THE POTENTIAL OF MEDICINAL PLANTS- WHERE TO START

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Although there are over 350 000 plant species, fewer than 20 `major' crop species provide for most human food needs. Within the rest of the plant kingdom there remain many hundreds of underutilized crops that have been grown locally for centuries and which contribute to the food security of the world's poorest people. In poor and impoverished regions of the world there are plants that have survived despite various harsh environment conditions. This is our chance to find out what those plants would be like as crops for the future — in climates of the future. With focused scientific efforts applied to unconventional crops we can do things that will make them more valuable, more useful and more popular. Many of these crops are cultivated in hostile, tropical environments by small-scale farmers without access to irrigation or fertilizers and with little guidance on improved practices. There are few examples of a multidisciplinary research effort on an underutilized crop and no methodological framework that can be applied across a range of underutilized species. Simulation models are robust tools to guide our understanding of how a system responds to a given set of conditions. Crop simulation models are increasingly being used in agriculture to estimate production potentials, design plant ideotypes, transfer agrotechnologies, assist strategic and tactical decisions, forecast real time yields and establish research priorities. Although there are growth simulation models for a range of major crops, there have been few attempts to develop models for medicinal species for which the factors controlling growth and development are not well understood and the general literature is sparse. Identifying novel approaches require for expansion of medicinal crops. A first step can be developing a CROPBASE considering all available and subsequently required data. Such an effort can help to provide a platform for decision support knowledge.

IBN AL-BAYTÂR AL-MÂLEQI AND HIS EXPENSIVE PHARMACOPOEIA AL- JÂME LE MOFRADÂT AL-ADWIYAH WA AL-AGHZIYAH

Seyyed Ahmad Emami

Zia al-Din Abu Mohammad Abdullah ibn Ahmad ibn al-Baytâr al-Mâleqi (died in 646 A.H. /1248 A.D.) was one of the great physicians of Andalusia, who lived in the seventh century. He collected and studied botany under ibn Romiah, ibn al Hajâj Ashbili and Abdollâh ibn Sâleh Kotâmi. He traveled for many years to Morocco, Algeria, Tunisia, Egypt, and Asia Minor, Greece, Byzantium, Libya, Iran, Iraq, Shâm (Syria), during which he acquired valuble information on medicinal herbs. He was appointed master of pharmacist (Imam al-Ashâbin) of al-Malek al-Kâmel, the Ayyubi (Jobean) king. He spent the final round of his life in Egypt and Syria. He trained great students. The famous students of ibn al-Baytâr were ibn Abi Ossaybah and ibn al-Soweydi. He leaved some books in the field of medicine and pharmacology. Ibn al-Baytâr masterwork is al- Jâme le Mofradât al-Adwiyah wa al-Aghziyah (Comprehensive Book in Simple Drugs and Foods). The book contains the names, properties, indications, and contraindications of 1422 mineral, herbal, and animal medicinal substances in alphabetical order.

The book has been translated into French, Germany, and Latin. The text of the book has been also published. Ibn al-Manzoor author of Lisan al-Arab summarized the al-Jâme le Mofradât al- Adwiyah wa al-Aghziyah. Among other medical works of ibn al-Baytâr one may mention the following: Al Moghni fi al-Adwiyah al-Mofradah (The Enriched Book of Simple Drugs) in 20 chapters in which he well-arranged the disease according the various organs; al-Ebânah wa al- Elâm be Mâ fi Menhâj Men al-Khalal wa al-Awhâm (Criticism on Menhaj al-Bayân) in which he criticized the ibn Jazlah; Tafsir Ketâb Diosqorides (An Interpretation of Dioscorides' Book) which he explained 553 Greek names in the al-Maqâlât (Treatises) of Dioscorides. The later has been recently revised and published by Dr. Ibrahim ben Marad. Some of his lost books are: al-Afâl al-Ajibah wa al-Khawâs al-Gharibah (The Tremendous Actions and Wonderful Properties).

A REVIEW OF VOLATILE SULFUR-CONTAINING COMPOUNDS FROM TERRESTRIAL PLANTS: BIOSYNTHESIS, DISTRIBUTION AND ANALYTICAL METHODS

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This review includes 554 volatile sulfur-containing compounds (VSCs) that have been reported from 43 terrestrial plant families until the year and including 2010. This review deals with extraction and analytical methods for VSCs, distribution of VSCs among plants, biosynthesis and other important aspects of this class of natural products. It has been shown that some classes of VSCs, specifically those in certain plant families, may have chemotaxonomic significance. This review also presents the retention indices of VSCs in different types of GC columns, as reported to date.

DIFFERENT STRATEGIES OF BIOLOGICAL TECHNOLOGY IN INCREASING OF PRODUCTION AND PRODUCTIVITY OF MEDICINAL PLANTS

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Medicinal plants have been man's best friend for a long time. Early civilizations relied exclusively on the medicinal plants for treating their various ailments and slowly what started as primitive herbal medicine around the world evolved into full- fledged systems.Though earth has been bestowed with a rich biodiversity, over exploitation of medicinal plants has led many of them to the verge of extinction. On the other hand, medicinal plants often have to tolerate extreme milieu; they are vulnerable to bacterial- fungal- viral infections themselves and in order to survive continuously evolve and develop mechanisms to synthesize secondary metabolites. However, the yield of secondary metabolites in plants grown in the field is often low at times to be able to meet the burgeoning demand. It has been realized over the years that plant improvement is essential, especially for obtaining higher yields of high-value, low-volume medicinally useful compounds. Conventional genetic approaches have helped in a lot of ways by improving plant strains and productivity of secondary metabolites. None the less, the need has been felt for improved procedures and protocols for medicinal plant improvement and it is here that plant biotechnology has carved a niche for itself. The cytogenetic, genetic investigation and biotechnological tools are important to select, multiply and conserve the critical genotypes of medicinal plants. Polyploidy motivation in Medicinal and aromatic plants (MAPs) whit effect on the morphological and physiological characteristics, in addition to the variation in plant populations, in many cases, improve the traits. In a lot of plant species, polyploidy motivation increases the cell size and the subsequent enhance flower size, inflorescence and leaves and the vegetative and reproductive organs and generally, organs containing effective substances larger than diploid Plants parents, and ultimately increase the production of important pharmaceutical compounds. In-vitro regeneration holds tremendous potential for the production of high-quality plant-based medicine. Cryopreservation is long-term conservation method in liquid nitrogen and provides an opportunity for conservation of endangered medicinal plants. In-vitro production of secondary metabolites in plant cell suspension cultures has been reported from various medicinal plants. Bioreactors are the key step towards commercial production of secondary metabolites by plant biotechnology. Genetic transformation may be a powerful tool for enhancing the productivity of novel secondary metabolites; especially by Agrobacterium rhizogenes induced hairy roots. DNA-based molecular markers have utility in the fields like taxonomy, physiology, embryology, genetics, etc. DNA-based techniques have been widely used for authentication of plant species of medicinal importance. DNA profiling techniques like DNA microarrays save as suitable high throughput tools for the simultaneous analysis of multiple genes and analysis of gene expression that becomes necessary for providing clues about regulatory mechanism, biochemical pathways and broader cellular functions.

SAFFRON: BASIC VERSUS APPLIED RESEARCH

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Crocus sativus L. commonly known as saffron is a perennial stemless herb of the Iridaceae family and widely cultivated in Iran. Compounds considered pharmacologically active and important in saffron are volatile agents (e.g. safranal), bitter principles (e.g. picrocrocin) and dye materials (e.g. crocetin and its glycoside, crocin). Different activities of saffron such as antidepressant, hypnotic, anti-inflammatory, hepatoprotective, bronchodilatory, aphrodisiac and anti-appetite have been reported. Unlike basic research, there are few applied research projects concerning saffron. In this review, pharmacological findings about saffron and its challenges with applied research will disscused.

NANOPARTICLES AS AN ALTERNATIVE DELIVERY SYSTEM FOR LOW WATER SOLUBLE NATURAL COMPOUNDS

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It is estimated that 40% of the new chemical entities in drug discovery stages are poorly water soluble which is a key property in dissolution, absorption and thus the in vivo efficacy. Therefore, enhancing the solubility, dissolution rate and bioavailability of a drug candidate is a very challenging task in drug development [1]. In recent years nanotechnology has provided an alternative approach for delivery of low water soluble drugs. It has many advantages for drug delivery including controllable release of drugs on target tissues and long ciculation of nanoparticle within the size range 50-200 nm [2]. The present work deals in detail about two approaches used for delivery of poorly water soluble drugs. In one approach, Paclitaxel and Curcumin-loaded HSA nanoparticles within the size range 90 and 250 nm were prepared. Surface morphology of the loaded nanoparticle were investigated by scanning electron microscopy (SEM) and average particle size and size distribution by differential light scattering (DLS) technique. The paclitaxel and curcumin-loaded nanoparticles were examined for drug loading by high performance liquid chromatography (HPLC). SEM of pictures showed that nanoparticles were spherical and mono dispersed. In another approach, nanoemulsions of essntial oils (EO), including *Salvia officinalis* EO were prepared and the impact on the antibacterial activity was investigated. The results showed that nanoemulsions with mean particle size of 200 nm could be prepared, which loaded up to 99% of the added EO. The antibacterial studies were then carried out in the liquid and vapor phase against various bacteria. Interestingly, a MBC value of 2 mg/mL for pure EO was reduced to 0.0312 mg/mL using nanoemulsified EO against *Streptococcus pneumonia*. Moreover, the MIC for the EO in vapor phase against *Streptococcus pneumonia* was 689.65 µL/L, while this value was reduced to 270.34 µL/L for nanoemulsion. A higher activity observed for the nanoemulsion could be explained by slow release of active components from the nanoemulsion droplets.

References

[1] Mohanachandran P. S; Sindhumol P. G.; Kiran T. S. *Int. J. Comp. Pharm.*, **2010**, *4*, 1-10.
[2] Langer, k.; Balthasar. S.;Vogel, V. *Int. J. Pharm*.**2003**, *25*, 169–180.

POSSIBILITY OF SAFFRON PRODUCTION UNDER DRYLAND FARMING CONDITION

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Restriction of water available leads farmers to dryfarming systems. Medicinal plants are the suitable option for dryfarming due to their adaptability and tolerance upon water deficit, and producing economic yield. Dryland farming of saffron (*Crocus sativus*) as a medicinal plants with low water requirement, vegetative growing in autumn and winter, could be introduced in waste low fertile drylands of Iran. Performance of several treatments were carried out in dryland farming of Damavand as a semi arid climate, such as plant nutrition, weed control by plastic mulch, planting depth, corm density, plantation orient, corm size, etc... In several investigations. The results showed increasing in flower number and stigma yield (more than 1 Kg/ha) by nutrition treatments, weed control and corm size. Also the results showed that in the initial years of experiment max number of flower and stigma yield was belonged to the low depth of corm and high depth of corm produced the significant increasing in all traits in the further years. Thus it could be concluded that *Crocus sativus* successfully produced economic yield and adapted well under dryfarming condition.

MEDICINAL PLANTS USED TO TREAT DERMATOLOGIC DISEASES

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The skin is central organ of the human body, with a surface area of around 2 m^2 and weight of nearly 4 Kg. It is the largest organ systems and one of the most diverses. Phytotherapy is a welcome addition to chemical useful drugs, such as glucocosticoids, antibiotics and antimyctics. Various herbal drugs are be used successfully to treat skin diseases. The most researched and recommended herbs for dermatologic diseases are as the follow:

1. For Dermatitis and Eczema
   - Mallow, Malva silvestris
   - Oak Bark, Quercus Cortex
   - Pine Tar, Pix liquida, Beach Tar
   - Walnut, Juglans regia
   - Wild Pansy, Viola tricolor
2. For Atopic Eczema
   - Fumitory, Fumaria officinalis
   - Evening Primrose, Oenothera biennis
3. For Pesorasis
   - Olibanum, Boswellia serrata
   - Bishop,s Weed, Ammi majus
   - Sarsaparilla, Smilax aristolochiaefolia
4. For Wounds, Contusions, Sprains
   - Comfrey, Symphytum officinalis
   - Arnica, Arnica Montana
   - St. John’s Wart, Hypericum perforatum
   - Marigold, Calendula officinals
   - Chamomile, Matricaria recutia
   - Echinacea, Echinacea purpurea
5. For Hair Loss
   - Birch, Betula pendula
   - Wormwood, Artemisia absinthium
   - Nettle, Urtica dioica
   - Tribulus, Tribulus terrestris
6. For Vitiligo
   - White Hellebore, Veratrum album
   - Bishop’s Weed, Ammi majus

- Bergamot oil, Oleum bergamottae

7. For Lymphoderma
   - Horse Chesnut, Aesculus hippocstanum
8. For Warts
   - Fig, Ficus carica
   - Celandine, Chelidonium majus
   - Garlic, Allium sativm

The most important Licensed Herbal Drugs used for Dermatologic Disease in Iran are: Calendula cream, Arnica Cream, Dermagol Lotion, Camillogol Solution, Bernagol Ointment, Golitch Lotion, Melissan Gel, Salvisan Gel, Iralvex Drop, Mycozin Vaginal Cream, Venogol Cream, Hemorro-herb Cream, Mamogol Cream, Calendit-E Cream, Mintagel Gel, Mycoderm Drop, Zexon Ointment, Dermatin Lotion.

THE CHEMICAL STRUCTURE OF HERBAL MEDICINE

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The topic of this lecture is “The chemical structure of herbal medicine”. The effective ingredients in the herbal medicines, obtained from medicinal herbs, have different chemical formations. The name of a number of these materials are: Glycosides, Flavonoids, Volatile oils, Steroids, Alkaloids, polysaccharides. The details of which are described in numerous available specialized books, and in this lecture the entity of herbal medicines, taking note of all the molecules existing in their effective ingredients, will be considered, in such a way that all the audience could gain more acquaintance of a herbal medicine and some of their questions could be responded.

EVIDENCE BASED CLINICAL TRIALS FOR SAME HERBAL DRAGS

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Boswellia is known to have anti-inflammatory properties. It blocks the chemical, that contribute to inflammation and many clinical trials show its effects in different diseases such as osteoarthritis, rheumatoid arthritis, IBD, chrohn's disease, ulcerative colitis, collagenous colitis, asthma, multiple sclerosis and Malignant glioma. Estragole drop has been evaluated in patients with angina pectoris. The results showed that this herbal compound effectively lowers, LDL, cholesterol and triglyceride in serum of the patients. Curcumin can stimulate macrophages in destruction of amyloid proteins in Alzheimer patients. Curcumin has a strong anti inflammatory effects in patients with osteoarthritis. Silymarin from silybum marianum has been shown to help the liver health and clinical trials have proved its efficacy in the treatment of fatty liver, hepatitis C and liver citrhosis. Many chinical trials have shown that ginger is active against morning sickness, and vomiting, also, it shows a good anti – inflammatory effect. Vitex (Agnus- cactus) has a dopamine agonist namely "acubin" which is very effective in alleviating menopausal symptoms, and menstrual irregularities .In conclusion the evidence based clinical trials for herbal drugs can prove the efficacy and therapeutic effects of these products.

WHO GUIDELINE ON TRACEABILITY OF HERBAL RAW MATERIAL: A CHANCE FOR THE AMELIORATION OF QUALITY AND SAFETY OF MEDICINAL PALNT RAW MATERIAL

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Nowaday herbal products are more and more present in our life. Pharmceutical, cosmetic and food industries are depending to herbal raw materials which are still harvested or wild crafted under uncontrollable conditions. The WHO guidline “Good Agricultural and Collection Practice” (GACP) should lead to total transparency of the whole chaine of herbal production, from the plant, down to the finished product.

STUDY THE EFFECTS OF DIFFERENT FERTILIZING SYSTEMS INCLUDE BIOLOGICAL, ORGANIC AND CHEMICAL ON GROWTH AND ESSENTIAL OIL IN CULTIVATION OF *THYMUS DAENENSIS* SUB SPP. DAENENSIS

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The Iranian *Thymus daenensis* Sub spp. Daenensis may be a potential thymol rich source (about 75% of oil compounds) for commercial cultivation. Availability of nutrients and providing them in soil through chemical, organic or biological sources should be considered in the cultivation of endemic species. As in a fertilizing system integrated use of different fertilizing sources include chemical, biological and organic, camper to individual, is more efficient and sustainable for providing nutrients, therefore we tried in our investigations to first study the photochemical, physiological and morphological responses of *Thymus daenensis* Sub spp. Daenensis to different biological, organic and chemical fertilizer levels in order to choose the best level of each one; and second, comparing these fertilizing sources in an integrated fertilizing system. Our studies are divided in to three parts. In part 1, the PGPR strains were selected according to two methods. First, by conducting a laboratory study where the effects of rhizobacteria strains which isolated from rhizosphere of *Thymus daenensis* on *Thymus daenensis* seed germination rate (SGR) and seedling vigor index (VI) were determined; and second, by physiological assays include IAA (Auxin) production, phosphate solubilization, and siderophore compounds production. Then, these PGPRs (include the strain with highest SGR and VI, and strains with IAA production, phosphate solubilization, and siderophore compounds production abilities) were used individually or integrated in an one year green house study with 7 treatments and 3 replications in a complete randomized block (CRB) design where their effects on growth and essential oil of *Thymus daenensis* were investigated. The best PGPR treatment was selected as biofertilizer. In part 2, for determining the most suitable levels of chemical (N-P-K) and manure (organic) fertilizers, a two year field study was conducted in a CRB design with 6 treatments [three chemical (N-P-K) + three manure] and three replications. The treatments which produced the highest essential oil yield of *Thymus daenensis* were selected as suitable chemical and organic fertilizers. Finally In part 3, the biological, chemical and organic fertilizer treatments resulted from previous studies were used individually or integrated in a two year field study which conducted in a CRB design with 8 treatments and three replications. According to the results of part 3, the fertilizing system of biofertilizer (*Brevibacterium frigoritolerans*) + %50 chemical fertilizer (20 kg ha^{-1} P, 220 kg ha^{-1} N, 200 kg ha^{-1} K) produced the highest dry mater, essential oil, Thymol and Carvacrol yields ($p<0.01$), camper to control.

SUSTAINABLE UTILIZATION OF EXUDATE SPECIES IN KOHRASAN PROVINCE

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The worldwide use and international market of medicinal and aromatic plants and their products grows yearly and the wild collection of materials can not support the high demand and also high specifications of pharmaceutical and food industries. Also the unsustainable collection and more-harvesting of these species cause to degradation of their habitats and endangering these high valued genetic recourses. Domestication and cultivation of these species can support row materials with unique quality for industries and in the other way conserve the species and their habitats from distribution.

Exudate species play an enormous role in economy of local people in Khorasan province but the unsustainable harvesting of the materials endangered these species. Researches showed that plants like *Ferula assa foetida*, *Ferula gummosa* and *Dorema ammoniacum* can successfully cultivated and harvested in marginal lands in dryland farming systems. This manuscript review continuous researches on domestication, cultivation and sustainable harvesting methods of exudates species in Khorasan.