



# **PROCEEDINGS OF INTERNATIONAL CONGRESS ON OIL AND PROTEIN CROPS**

**2-4 NOVEMBER, 2023**

**ANTALYA, TURKEY**

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INTERNATIONAL  
CONGRESS ON OIL AND  
PROTEIN CROPS**

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**Organized by  
Trakya University  
European Association for Research on Plant  
Breeding (EUCARPIA)  
International Researchers Association**

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## WELCOME NOTES

International Congress Oil and Protein Crops Section Conference of EUCARPIA which is organized by Trakya University and the International Researchers Association in cooperation with the European Association for Research on Plant Breeding (EUCARPIA). The congress is held in Megasaray Westbeach Hotel, Antalya, Turkey, on November 2-4, 2023 with supporting of several national and international partners.

The Congress topics covers Oil and Protein Crops: Plant Breeding and Genetics, Molecular Genetics and Biotechnology, Biology and Physiology, Genetic Resources, Plant Protection, Agronomy, Economy, Animal feeding, Food Science and Nutrients, Fats, lipids, and Protein studies.

Oil crops are rich sources of oils, proteins, minerals, vitamins, and dietary fibers for both human and animal feeding and provide the raw material for the production of biodiesel. Oil crops are soybean, cottonseed, sunflower, canola, rapeseed, peanut, safflower, flax, sesame, coconut, castor, copra, etc.

Almost 50% of the global food protein supply comes from cereal seeds. Soybean, peanut, common bean, pea, lupine, chickpea, faba bean, lentil, grass pea, cowpea, pigeon pea, etc. are currently the most important legumes for human consumption and animal feed. Because of the protein content of their seeds; grain legumes, cereals, and other minor crops such as amaranth, quinoa, hemp, caraway, etc. are protein crops growing for plant protein for food and feed.

The Congress is intended that the subjects to be kept broad in order to provide opportunity to the science and research community to present their works as oral or poster presentations. The Congress languages is in English. Researchers, breeders and others with an interest in the genetics and breeding of oil and protein crops are invited to participate. Among the topics to be discussed are directions of breeding for resistance to abiotic and biotic stresses, improved industrial use, and conventional versus organic production.

As there have been many different scientific meetings around the world, we aimed to bring three different communities together, namely science, research and private investment groups considering practical information sharing that is of value for breeders, seed enterprises, researchers and scientists, in a friendly environment of Antalya, Turkey to share their knowledge and experience and benefit from each other.

There are 38 orals and 63 poster presentation in the congress both joining and presenting normal and online with 141 participants from 20 different countries from the world.

The congress gathered scientists from around the world, and present their recent achievements. The organizers will also invite relevant stakeholders to provide a view on the current situation around the world as well as prospects to overcome the limitation for sustainable crop production to feed the world.

We would like to thank all of you for joining this conference and we would like to give also special thanks to our sponsors and collaborators for giving us a big support to organize this event.

Prof Dr Yalcin KAYA  
Head of the Organizing Committee

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## **THE DROUGHT EFFECT ON LEAF SPAD VALUE OF SESAME (SESAMUM INDICUM L.) ACCESSIONS**

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### **ABSTRACT**

Sesame has nutritional value owing to its high-quality oil. It is susceptible to the negative effects of drought in the arid and semi-arid regions of the world. Drought stress reduces chlorophyll content in plants, resulting in lower photosynthesis efficiency and potential damage to plant development and yield. The content of chlorophyll in leaves exhibits a direct correlation with both tolerance and increased productivity in the presence of drought-induced stress. Thus, quantification of chlorophyll content is a crucial characteristic that provides insights into the productivity and physiology of plants and also serves as a valuable tool for assessing their drought tolerance. The present research involves the assessment of chlorophyll concentration in 21 varieties of sesame with the SPAD-502 meter. The SPAD measurements were conducted three times for each accession at different stages of plant development. A comparative analysis was conducted to assess the impact of drought-induced stress on the chlorophyll content of plants exposed to stress and those that were not, serving as the control group. Based on the results, it can be deduced that the occurrence of drought stress tends to result in a reduction of chlorophyll levels in plants. The chlorophyll levels of control plants were consistently observed to be higher in comparison to those of plants exposed to stress. The SPAD data therefore should be used in development of drought tolerant sesame lines.

**Key words:** Abiotic stress, Chlorophyll, Oil crop

## ENHANCING SESAME PRODUCTIVITY FOR LIVELIHOOD AND ECONOMIC IMPROVEMENT IN SUDAN

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### ABSTRACT

Sesame is one of the most important oil crops worldwide, and it is an essential cash crop in Sudan, with the country being one of the world's largest producers, accounting for approximately 20% of global sesame production, according to FAOSTAT. Sesame production in Sudan faces challenges, including biotic and abiotic stresses, which pose significant threats to crop health and productivity. Therefore, we aimed in this study to enhance sesame productivity and resilience to benefit rural communities by utilizing untapped genetic resources and advanced breeding tools. Accordingly, this study adopted participatory and advanced approaches, including collecting sesame landraces and adapted cultivars, participatory selection, conducting field and lab-based phenotyping, and harnessing genomic characterization to accelerate the sesame breeding program. Therefore, we genotyped and phenotyped 207 sesame genotypes for three seasons in three locations. Capsule shattering is one of the vital yield component traits that we targeted in this study. Our phenotypic result reveals several promising genotypes for shattering tolerance. Furthermore, a considerable variation in seed color was detected using a colorimeter device. Moreover, the fatty acids profiling results exhibited a vast variation among the investigated genotypes. The examined traits, including capsule shattering, seed color, and fatty acids profiling, will be employed together with the genotypic data to conduct Genome-Wide Association Study (GWAS) to find associated SNPs, which will be converted to KASP markers for marker-assisted breeding in the crossing scheme. In addition, we interviewed over 200 sesame farmers from different cultivation areas in Sudan, and the obtained result provided valuable insights into production challenges. Participatory field selection with involved farmers revealed an essential contribution to the advanced breeding considerations. The outcomes of this study are expected to improve sesame production and significantly contribute to Gross Domestic Product (GDP) in Sudan.

**Key words:** Sesame productivity, participatory approach, phenotyping, genomic characterization

## POLIMORPHISM OF GRAIN STORAGE PROTEINS IN TRITICALE LINES OF CIMMYT ORIGIN

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### ABSTRACT

A collection of seventy Mexican Triticosecale samples originating from CIMMYT was analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The studied lines are spring forms with high resistance to yellow rust and with high productive potential under the conditions of Bulgaria. Electrophoretic analysis of grain storage proteins encoded by loci Glu-1 (Glu-A1, Glu-B1 and Glu-R1), Glu-3 (Glu-A3 and Glu-B3), Glu-B2 and Gli-R2 showed the presence of eleven alleles encoding the high molecular weight (HMW) subunits (seven for glutenins and four for secalins), six for the low molecular weight (LMW) glutenin subunits and four for 75K  $\gamma$ -secalins. The formed allelic configurations were characterized by higher polymorphism at the Glu-A1 and Glu-B1 loci, where seven alleles were identified. The number of triticale lines possessing subunits ,1' and ,2\*' at the Glu-A1 locus, coded by alleles ,a' and ,b' respectively, is the largest. These alleles are associated with good bread-making qualities of the flour. In the Glu-B1 locus, the fractional pair ,7+18' (allele 'r') was found with the highest frequency, and in the locus Glu-R1 the fractional pair ,6r+13r' (allele ,c') was most often expressed. In the area of low molecular weight glutenins with higher allelic diversity is the Glu-B3 locus. Alleles 'a' and 'b', encoding 75K  $\gamma$ -secalins 'd1' and 'd2', were identified with the highest frequency in the Gli-R2 locus. The obtained results for the allelic composition of the storage proteins of the Mexican triticale lines will find application in the selection program of the Dobrudzha Agricultural Institute (DAI) for the creation of spring forms combining high productive potential, resistance to abiotic and biotic stress and quality.

**Key words:** SDS-PAGE, grain storage proteins, genetic diversity, polymorphism

## **TOWARD DEVELOPMENT OF CLIMATE RESILIENT VARIETIES: GENOME WIDE ASSOCIATION ANALYSIS FOR HEAT TOLERANCE IN CHICKPEAS**

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### **ABSTRACT**

Chickpeas (*Cicer arietinum* L.) are sensitive to heat stress at their reproductive stage causing significant yield loss at temperatures of 35°C or higher. Increasing global temperature and heatwave frequencies make heat tolerance an important breeding objective in chickpeas. However, chickpeas also suffer from a narrow gene pool. To find novel genetic sources for heat tolerance, we developed an interspecific population of 200 inbred lines by crossing CDC Leader (kabuli cultivar) with 19 accessions of *C. reticulatum*. This population was genotyped using CDC Cicer60K Axiom® SNP chip and was initially tested different seeding dates at three locations (Lucky Lake and Moose Jaw, Saskatchewan, Canada; and Yuma, Arizona, USA) over two years under stress and non-stress conditions. Genome wide association analysis identified SNP loci across different chromosomes associated with multiple stress tolerance indices. The same population is currently being evaluated for its response to heat stress under controlled conditions in growth chambers. Two sets of temperatures were applied to the population. One chamber was set at normal temperature (22°C-16 hr day/14°C-8 hr night) and the other chambers were set at 35°C-16hr day/29°C-8hr night during flowering. Seed weight, seed number, pod number, immature pod number, seeds per pod, harvest index, days to flowering and days to maturity were measured and were used for genome wide association analysis. The results showed that the tolerant lines retain their seed weights under heat stress whereas the sensitive lines had significantly lower seed weight at high temperature compared to control. Further genome wide association analysis identified SNP loci associated with heat tolerance in the population. Further research includes RNA-Sequencing on selected lines under heat stress to identify candidate genes associated with the heat tolerance in chickpea.

**Key words:** Chickpeas, Stress Tolerance, GWAS

## **BREEDING FOR POD-SHATTERING RESISTANCE IN VEGETABLE-TYPE SOYBEAN**

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### **ABSTRACT**

Vegetable-type soybean was introduced to South Africa as a supplementary high quality protein food source that is consumed as a vegetable and is non-genetically modified. Due to poor adaptation, mature pod shattering became one of the major seed production constraints, contributing up to 50% seed yield loss in susceptible cultivars. The aim of this study was to identify and select promising backcross families with pod shattering resistance and high yield potential that can be advanced to the next breeding cycle. Twenty-four BC3F4 families, developed from the vegetable-type breeding programme and their parents, were planted in a field trial during the summer season of 2020/2021. Leaf samples from each plot were collected for DNA extraction and screened for pod shattering resistance quantitative trait loci using three microsatellite markers. The presence of genetic resistance was validated using the dry-oven test, where pod shattering percentage was determined for each plot. At maturity, single plants were harvested and evaluated based on twelve yield-related traits. Using analysis of variance, Pearson's correlations and principal component analysis, families could be categorised into three groups. Group A represented high yield potential families showing positive associations with number of branches per plant, number of pods per branch, total pods per plant, number of seeds per plant, seed mass per plant and plant biomass. Group B represented families that were associated with high plant stature and high number of nodes, while group C comprised families showing pod shattering traits. Using best linear unbiased predictors on fourteen traits altogether, six families with high yield potential and pod shattering resistance have been identified that can be advanced to the next breeding cycle. Family predicted selection gain as a percentage of the mean ranged between 34.85 to 52.19% across the six yield-related traits and the same traits showed high broad-sense heritability estimates ranging from 0.65 to 0.77. Results from this study not only assisted to identify promising families to be advanced to the next generation but also specific yield-related traits that can be used as selection criteria in the breeding programme.

**Key words:** Glycine max, pod shattering, yield, heritability, genetic gain, microsatellite markers



## NOVEL AND SIMPLE CROSSING TECHNIQUE IN OIL SEED CROP SESAME (SESAMUM INDICUM L.)

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### ABSTRACT

Sesame (*Sesamum indicum* L.) popularly known as queen of oil seeds and locally known as til, benni, nuvvulu etc. Sesame is diploid (chromosome no.2n=26), autogamous with 1-42% outcrossing. Sesame is bisexual, ovary is zygomorphic, superior, bicarpellary, stigma-forked. Anthers are epipetalous with four stamens, two long and two short attached to the inner side of the corolla tube, dorsifixed, and higher than the stigma. Flower anthesis happens between 6-9 A.M. The stigma is receptive for 48 hours and pollen is viable for nearly 24 hours. Hybridization plays a key role in creating the variability. Adoption of effective crossing technique plays a major role in creating the variability. Sesame breeders generally adapt soda straw method for crossing or hybridization programme in sesame. In soda straw method, the inserted straws may fall and may contaminate with untargeted or undesirable foreign pollen. In view of the above a new, novel, easy crossing technique Adhesive Bud Method in sesame is developed at Agricultural Research Station, Yellamanchili (Acharya N.G.Ranga Agricultural University ANGRAU), Anakapalle, Andhra Pradesh, India during rabi-summer 2019 and 2020. The detailed procedure of crossing technique, Adhesive Bud Method is given hereunder:

1. Parents are chosen and tagged.
2. Desirable male parents' corolla tubes with the epipetalous anthers of the flower buds to be opened the next day are gathered in a petri plate around 3 to 6 p.m.
3. On the female parents, desirable flower buds to be opened next day are emasculated by removing the corolla tubes around 3-6 p.m.
4. After emasculating the female flower buds, the male corolla tubes are gently put over the stigma at 3-6 p.m. Apply fevicol or glue with a slender stick to the inner surface of the corolla tube's basal section. After applying adhesive, the male corolla tube is delicately put over the stigma of the female parent's emasculated stigma and adhered to the base. It now resembles as if like a real flower bud. Care should be taken that glue or adhesive material should not to stick to the stigma during insertion.
5. A woollen thread is tagged to the flower base and leaf axil of the crossed female flower bud.
6. Capsule development: Male corolla tubes cover stigmas. Next day morning, the epipetalous anthers on the male corolla tube physiologically dehisce, by the time, the stigma is receptive and pollination is successful. The inserted male corolla tube withers and acts as a natural cover restricting the pollen from others, but the epipetalous anthers stay fresh. The pollination is effected and the capsules are developed. Percentage of mature capsules developed ranged from 52 to 68 percentage. The seeds (F<sub>0</sub>) obtained from the capsules germinated effectively with good vigour. The main advantage is that emasculation and pollination procedure is done at the same time 3-6 p.m on day one itself. This is feasible technique which is useful to the sesame breeders.

**Key words:** Sesame, hybridization, flower buds, adhesion

## VARIABILITY OF *AMARANTHUS CRUENTUS* L. CV. PRIBINA PBA AND CDDP PROFILES UNDER THE TREATMENT OF HEAVY METALS

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### ABSTRACT

*Amaranthus cruentus*, cultivated as pseudocereal is known as a heavy metal phytostabilizer. Environmental pollution is becoming an increasingly debated topic. Heavy metals enter the soil through various sources and eliminating their negative impact on all organisms is a challenge. *Amaranthus cruentus* L. cv. Pribina was treated by three different heavy metals Pb, Zn and Mn in this study. Two different marker techniques were used to analyse fingerprinting changes as the effect of Zn, Pb and Mn. Both of them were proved previously to be sensitive for stress marking. Different types of polymorphic variability was found by using the cytochrome P450 Based Analogue (PBA) marker system and methods using conserved DNA-Derived Polymorphism (CDDP) and different ranges of polymorphism was obtained. Three different primer pairs were used for PBA and one for CDDP. Total number of fragments generated by PBA A1 primer variant is 157, by using PBA B6 primer variant it is 136, and with primer PBA C19 it is 76. Total number of fragments generated by primer variant CDDP R1 resulted in 88 fragments. When using the CDDP marker technique, the genetic distance matrix between multiple variants results in values from 0,111 to 1. And when using the PBA marker system, the genetic distance matrix between multiple variants is from 0,048 to 0,857. PBA technique generated fingerprints that were most consistent for Mn treated variant when grouping in dendrograms and CDDP technique generated most consistent fingerprints for Pb. These contrasting outcomes from the two marker techniques indicate the complexity of the plant's genetic response to heavy metal stress. Moreover, the distances calculated within the variants through the distance matrix showed considerable variation. This emphasizes that different heavy metals (Pb, Zn, and Mn) can elicit diverse genetic responses in *Amaranthus cruentus* L. cv. Pribina and some heavy metals might have a more pronounced impact on the plant's genome than others.

**Key words:** *Amaranthus cruentus*, PBA, CDDP, heavy metals

## TESTS FOR THE CULTIVATION OF SUNFLOWER IN THE AGRO-CLIMATIC CONDITIONS OF LATVIA

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### ABSTRACT

Sunflower is one of the most useful in its fatty acid composition and in demand oilseeds in the world. Statistics show that in 2022, 51,948 million tons of sunflower seeds were produced in the world. The largest producers are the Russian Federation - 17,000 million tons, Ukraine - 10,500 million tons, which together account for 52.9% of the world sunflower market. The EU produced a total of 9,475 million tons of sunflower seeds, with the largest producing countries being France, Bulgaria, Romania, Hungary, Spain (USDA). In 2022, sunflowers were sown in many Latvian farms as a sign of support and solidarity with Ukraine and its farmers affected by the war unleashed by the Russian Federation (Sunflower map in Latvia). At the end of 2022, the scientists-breeders in AREI set the task of using the world experience in cultivation and try to adapt sunflower by creating varieties and hybrids. Having collected and analyzed the obtained data on the agro-climatic conditions of Latvia over the past 50 years, where we observe a temperature increasing trend and longer vegetation period, in the same way we took experience from few farms and collect their results, where this crop was cultivated. Of particular satisfaction is the Salenieki farm in Preiļi district, which is not the most suitable region and has been successfully growing sunflower for three years already without applying fertilizers for biological needs, reaching a seed yield of 1,5 tha, using non-specialized equipment for sowing and harvesting. To achieve our tasks, the germplasm of sunflower paternal components was purchased from the largest breeding and genetic bank NDSU (USA), which, according to our estimates, can be propagated, adapted and show excellent results. In 2023, more than 20 types of paternal components and some local varieties found by us were sown at the STENDE Research center for testing in the agro-climatic zone of Latvia and possible breeding.

**Key words:** sunflower, agro-climatic conditions, breeding, Latvia

## **DEVELOPMENT OF SOUTH AFRICAN SOYBEAN LINES WITH RESISTANCE TO SUDDEN DEATH SYNDROME**

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### **ABSTRACT**

Sudden death syndrome (SDS), a yield-limiting soilborne disease of soybean, is causing havoc in soybean production areas worldwide including South Africa. Breeding for genetic resistance is key to containing the impact of SDS. This study aimed to identify South African soybean cultivars with potential SDS resistance and incorporate it into elite soybean lines. Forty-eight soybean cultivars from the South African germplasm were genotyped using 20 microsatellite markers associated with SDS resistance covering 12 soybean linkage groups. Disease resistance was evaluated using both seedling and soil inoculation methods for phenotypic validation. Several quantitative trait loci (QTL) linked to SDS resistance were identified across the 48 evaluated cultivars. These QTL were found in linkage groups C2, D2, F, G, H and I. Different combinations of these QTL in the different cultivars, expressed diverse levels of resistance to SDS when subjected to phenotypic validation. Eight commercial cultivars with potential SDS resistance were identified from the germplasm and subjected to a pre-breeding programme. The cultivars with the best QTL combinations that expressed the highest level of resistance as well as dual resistance (to both root rot and leaf-scorch) were crossed to develop three cross populations where F<sub>2</sub>-derived lines were subjected to genotypic and phenotypic evaluation of SDS symptoms. These populations segregated for resistant and susceptible QTL alleles. The quantitative nature of disease resistance suggests that SDS resistant cultivars will have to contain multiple resistant genes/QTL. Therefore, combining QTL linked to SDS resistance in the best possible combination, will improve SDS resistance. However, it's challenging, because each breeder's objective is to create a resistant cultivar adapted to their region with significant and stable yield and quality.

**Key words:** Soybean, sudden death syndrome, genotyping, resistance, QTL

## CHARACTERISATION OF THE *SCLEROTINIA SCLEROTIORUM* POPULATION ON SOYBEAN AND SUNFLOWER IN SOUTH AFRICA TO IMPROVE RESISTANCE BREEDING STRATEGIES

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### ABSTRACT

*Sclerotinia sclerotiorum* (Lib.) de Bary is a destructive necrotrophic soilborne pathogen known for its diverse host range and worldwide distribution. This study aimed to investigate the population structure of *S. sclerotiorum* from soybean and sunflower focusing on the geographic distribution and genetic diversity. Understanding the pathogen population structure is crucial for implementing effective management strategies as well as to develop cultivars/hybrids with resistance. A total of 535 *S. sclerotiorum* isolates were collected from infected soybean and sunflower fields across multiple provinces in South Africa. Population genetic diversity and structure was determined using 11 SSR markers. The dendrogram indicated that isolates grouped into 3 clusters and a total of 58 clonal groups was identified. A low level of genetic variation was observed among populations and 98% genetic variation was observed within populations. No evidence of isolates to host/crop correlation was observed within the cluster however isolates cluster together based on their geographic area. Twenty of the clonal groups consisted of isolates from the eastern Free State province. In other groups, isolates from different provinces were included indicating the distribution of the pathogen to new areas. Most of these areas are situated next to the Vaal River, also forming part of the bigger Orange River basin which serves as a crucial water source for overhead irrigation and might contribute to the distribution of the pathogen to new areas explaining the increase in genetic diversity within field populations rather than between different populations. The clonal nature of the population will simplify the development of resistant lines not limited to a specific area. Information from this study could help improve resistance breeding strategies against *Sclerotinia* diseases in soybean and sunflower and provide an incentive to producers to increase production and reduce risk factors.

**Key words:** Soybean, sunflower, genetic diversity, population structure, resistance breeding

## OVERVIEW ON THE ROMANIAN SOYBEAN QUALITY

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### ABSTRACT

Soybean crop is becoming more and more interesting to farmers and consumers due to its high quality protein and oil, being also essential for food security. In the past 50 years, Romanian breeding programs developed modern high yielding genotypes that have been grown in different agricultural areas. Soybean is a basic food, with a high nutritional value, being used both as a raw material in the food industry and in animal feed. Seeds contains macro and micro-minerals, being considered a source of energy, vitamins and minerals. The main objective of soybean breeding program from Research and Development Station (RDSA) Turda, Romania is to increase the yield potential and also quality features of new varieties. At Turda, the 1969, was the starting point in developing Romanian new soybean genetics, being registered varieties from different maturity groups that meet the requirements of soybean food industry. The variability within the Turda germplasm allowed the creation of soybean varieties with a high ecological plasticity, adapted to different crop technologies and with different destinations. The aim of the present study is to evaluate the quality traits of Romanian soybean genotypes. The experiment was conducted in three years (2020-2022), in the experimental field of Soybean Breeding Laboratory from Research and Development Station (RDSA) Turda, Romania, and included 20 soybean genotypes registered at Turda between 1994- 2022. PERLA, EUGEN, ONIX, FELIX, CRISTINA TD, MALINA TD, CARLA TD, LARISA, CARO TD, ILINCA TD, BIA TD, ADA TD, TEO TD, MIRUNA TD, NICOLA TD, FELICIA TD, RALUCA TD, ISA TD, IRIS TD and ZIANA TD soybean varieties were used as biological material. Seed unground samples from each experimental plot were analyzed using NIR spectroscopy (Tango, Bruker Optik GmbH, Ettingen, Germany) determining protein content, oil content, and four fatty acids (stearic, oleic, linoleic, and linolenic acid). The results obtained revealed that soybean quality was very high influenced by the genotype. Iris TD, Ziana TD and Perla were identified with higher than 40% protein content while Isa TD had the greatest oil content (22.24%). The correlations established between traits can help future breeding directives such as developing varieties for specific purposes (food industry, animal feed and biodiesel). Almost an ideal ratio of fatty acids was obtained in some varieties. The maximum values for studied traits were identified for: Ziana TD (linolenic acid), Miruna TD (oleic acid), Nicola TD (linoleic acid) and Ilinca TD (stearic acid). A high diversity was revealed based on cluster analysis method using the "shortest distance", indicating that simultaneous or separate improvement of the analyzed quality indices can be achieved. In order to improve the quality of soybeans, first step consist in the evaluation of the existing biological material. Using conventional hybridization and selection methods, along with chemical and biochemical analyzes we can improve soybean genetics through registration of superior varieties.

**Key words:** fatty acids, protein content, oil content, soybean, varieties



## GENETIC STRUCTURE AND VARIABILITY PARAMETERS OF LATHYRUS SATIVUS L. EUROPEAN COLLECTION

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### ABSTRACT

Grass pea (*Lathyrus sativus* L.) is a self-pollinating legume that is well adapted to changing climatic conditions. In our study, the collection of 25 accessions from different parts of Europe (7 from BiH, 2 from Romania, 4 from Portugal, 8 from Serbia, 2 from Bulgaria, 1 from Greece and 1 from Slovenia) was genetically assessed by 15 species-specific nSSR markers (Simple Sequence Repeat). Extraction of gDNA was performed from 3 to 10 individual young plants/genotypes of each accession using an automated magnetic procedure. PCR reaction mixtures and amplification were optimized for each primer pair under two-step touch-down PCR conditions. Fragment analysis was performed on a genetic analyzer (ABI 3130XL) together with the internal standard ROX500. Accurate allele lengths were recorded from the electropherograms in GeneMapper6.0 software. The diversity parameters and genetic structure of the *Lathyrus* collection was observed using various population genetic programmes such as Arlequin, MSToolkit, GenAlEx, Populations, TreeView, and Structure. The selected set of SSR markers (*G* loci) was highly informative with an average polymorphic information content of 0.76. The high level of overall genetic diversity among 15 loci was calculated within the collection ( $H_e=0.79$ ), while deviations from Hardy-Weinberg equilibrium were statistically significant ( $p < 0.01$ ) at loci G18200 and G17922 for all studied accessions. The Bayesian approach divided the collection into three genetically distinct groups with high average genetic distances ( $H_e=0.751$ ;  $F_{st}=0.092$ ). Considering Shannon information index ( $I=1.55$ ) and average number of private alleles (1.33), accession KL2 from Serbia was genetically most diverse. The strongest genetic relatedness was found between accessions from BiH (GB01001, GB00954 and GB01002). Analysis of molecular variability revealed 12% of variability between accessions, 49% between genotypes within accessions and 39% of total variability between genotypes. The obtained results will give us an insight into promising *Lathyrus* germplasm and enable its use for breeding purposes.

**Key words:** grass pea, genotyping, SSR markers, genetic background, breeding

## THE STUDY ON THE VARIABILITY OF PRODUCTIVE AND QUALITATIVE COMPONENTS OF SOME MUSTARD GENOTYPES

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### ABSTRACT

Mustard is an important crop for man's food, for food industry, and for pharmaceutical industry. The increased interest for the cultivation of this species in Romania, proved by the significant increase of mustard cultivate areas these years, made us carry on a series of investigations important both scientifically and technologically. The aim of the research was to study an assortment of mustard genotypes in terms of the variability of some quantitative and qualitative characters. The tested biological material was represented by a collection made up of 9 mustard varieties of different genetic origin, to which 6 perspective mustard lines were added. Based on the results obtained in the comparative culture, the work presents the performances of the mustard genotypes from both a quantitative and qualitative point of view. The research was carried out in several experimental years under field conditions. The data obtained after the biometric measurements were statistically processed, determining the mean, the standard deviation of the mean and the coefficient of variability. In mustard, most of the quantitative characters of productivity and quality are determined by actions and interactions of the entire genetic system, specific to the hereditary base of the organism as well as the influence of environmental conditions. Biometric analysis clearly demonstrates the existence of a wide variability at the level of certain characters. The number of branches per plant in most varieties showed a medium variability. Regarding the number of siliques per plant, the studied varieties presented values between 694.4 and 1310.4 with an amplitude of 614. The number of grains in the silique recorded values between 4.20 and 6.67, with a variation amplitude of 2.47. Variability within cultivars for this character was generally low. Regarding the length of the silique, the varieties studied achieved values between 2.70 cm and 3.06 cm with a variation amplitude of 0.36 cm. Regarding the weight of the grains per plant, the varieties studied achieved values of this character between 14.13 g and 31.02 g, respectively a variation amplitude of 16.89 g. The variability within the varieties was medium. The number of grains per plant in the studied mustard varieties recorded values between 1571 and 3768.6, with a variation amplitude of 1192.4. Taking into consideration the mass of 1000 seeds, it is observed that the varieties studied achieved values between 5.72 g and 7.68 g, with a variability of 1.86 g. Within the varieties, the variability of this character was reduce. The obtained results facilitated the characterization of the mustard genotypes considered in the study and the highlighting of valuable genotypes for mustard breeding programs, but also for agricultural practice.

**Key words:** Breeding programs, mustard genotypes, quality, yield



## USING OF HETEROSIS SELECTION IN PEANUTS (*ARACHIS HYPOGAEA* L.)

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### ABSTRACT

Heterosis is the most frequently applied biological phenomenon in plant selection and seed production. It is typical for the hybrids in F1 and is expressed in increasing the power, vitality and productivity of the hybrids in comparison with the same characters in parent forms. Four peanut (*Arachis hipogaeae* L.) hybrid combinations are observed with Bulgarian and introduced origin from the collection of IPGR – Sadovo, their F1 populations and the selected in F2 progenies. The height and width of the plant, mass of the fruits and seeds per plant are recorded and the randeman has been calculated. Defined are: 1. The overall level of the mean parent (MPH) and heterosis (BPH) to clarify whether this is an appropriate model when investigating the molecular basis of heterosis in peanut; 2. The change in the amount of MPH and BPH among different hybrids was measured; 3. The level of genotypic variance ( $\sigma^2G$ ) through its components, the levels of additive variance ( $\sigma^2A$ ), dominance variance ( $\sigma^2D$ ) and epistasis variance ( $\sigma^2E$ ). The coefficients of inheritance in a broad ( $H^2$ ) and narrow ( $h^2$ ) sense, with the possibility of comparing them; 4. Selection success ( $R$ ) via selection differential ( $S$ ) and heritability in the broad sense.

**Key words:** peanuts, heterosis, gene and phenotype variance, selection differential

## USING OF HETEROSIS SELECTION IN SESAME (*SESAMUM INDICUM* L.)

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### ABSTRACT

The phenomenon of heterosis has opened wide perspectives in a number of crops and continues to play a crucial role in the genetic improvement of plants. The heterosis effect is most expressed in cross-pollinated plants, however, they are also the most sensitive to inbreeding depression. Heterosis is less expressed in self-pollinating species, but inbreeding depression is less. The crosses in sesame were made in an incomplete diallel pattern. Biometric measurements of major yield elements were made on the parental forms from the working collection of IRGR - Sadovo and the hybrid progeny. Seed mass per plant, height of the main stem, number and average height of the branches, total number of boxes per plant were recorded. The mean total parent height (MPH) and heterosis (BPH) were determined. The variation in MPH and BPH among different hybrids was measured. The level of genotypic variance ( $\sigma^2_G$ ) was determined by its components, the levels of additive variance ( $\sigma^2_A$ ), dominance variance ( $\sigma^2_D$ ) and epistasis variance ( $\sigma^2_E$ ). The inheritance coefficients are determined in the broad ( $H^2$ ) and narrow ( $h^2$ ) sense, as a possibility to compare them. Selection success ( $R$ ) is accounted for by the selection differential ( $S$ ) and heritability in the broad sense.

**Key words:** sesame, heterosis, gene and phenotype variance, selection differential

## EVALUATION OF HYBRID FORMS, ORIGINATED FROM WILD HELIANTHUS SPECIES ON SOME BIOCHEMICAL CHARACTERISTICS

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### ABSTRACT

The study presents the evaluation of hybrid forms, obtained as a result of interspecific hybridization between two sunflower inbred lines and accessions from wild annual species *H. annuus* and perennials *H. smithii* and *H. strumosus* from the collection of wild *Helianthus* species at Dobrudzha Agricultural Institute, on oil and protein concentration and fatty acids composition of seeds. Interspecific F1 plants were obtained by applying classical breeding methods and *embryo rescue* techniques. Those, that originated from perennials were characterized by a weak perennial growth habit and had a linoleic type of oil. The saturated fatty acid composition of achene oil was lower than that observed in oil of cultivated sunflower line. F1 plants were self-pollinated to obtain F2 achenes, and backcrossed in the field with cultivated lines to produce BC1F1 achenes. Preliminary results showed that saturated acid levels in sunflower oil could be lowered by the introgression of genes from wild populations and higher level of unsaturated acids in progenies were preserved.

**Key words:** fatty acids, *Helianthus annuus*, *H. smithii*, *H. strumosus*, interspecific hybridization; seed oil content

## **SAFFLOWER: A SOURCE OF BENEFICIAL FLORAL TEA**

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### **ABSTRACT**

The study was conducted in the Aktobe region, situated in western Kazakhstan. The region experiences a sharply continental and arid climate, which influences the moisture supply of crops, amounting to 30-35%. Safflower (*Carthamus Tinctorius*), an annual plant from the aster family (Compositae), is renowned for its powerful tap root system and high concentration of cell sap. These unique characteristics enable safflower to produce a bountiful harvest of flower petals even in extremely dry years. These petals are abundant in essential nutrients and boast a valuable compound called carthamine. They are primarily utilized in the production of safflower floral tea, which offers numerous health benefits. Through meticulous breeding efforts, two late-ripening safflower varieties, namely "Akhrum" and "Qyzyl Akhrum" have been developed. These varieties boast the highest number of flower baskets per plant, while also demonstrating remarkable ecological adaptability and impressive petal yield. The vegetation season of the selected varieties is 125-135 days; the number of flower baskets on one plant is 35-45 pcs. The weight of flower petals per plant is 0.0666-0.12869 grams, while the weight of petals collected from 1 hectare is 2.6-5.1 hwt. The flower mass is harvested at the beginning of seed ripening and until they are fully ripe.

**Key words:** safflower, oil crop, floral tea, petals, flower mass, carthamine

## YIELD ENHANCEMENT OF WATER STRESS CHICKPEA GENOTYPES BY INOCULATION WITH RHIZOBIUM STRAINS

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### ABSTRACT

**ABSTRACT-** Chickpea (*Cicer arietinum* L.) is one of the most ancient Eurasian crops. Their ability to grow in hot and dry climates and the nutritional value of seeds allowed the fast spread of their cultivation from the respective domestication areas to the western side of Mediterranean basin, and successively to all continents. The selection of improved varieties characterized by higher yields and resistance to biotic and abiotic stress was important. As part of a multilateral project (PRIMA), two local Algerian genotypes of chickpea displaying contrasted drought resilience were evaluated under water stress regime. After sowing the stressed plants received only 25% quantity of water depending on the field capacity of each pot, with or without the inoculation with 2 different rhizobium strains (CC4 and SMA2). Control he received 75%. Morpho- physiological parameters were measured as following: shoot length (SL) (cm), chlorophyll index (CI)(SPAD units), Relative Water Content (RWC %), root Dry Matter (DM %) and yield component (number and weight of seeds). The data showed that chickpea plants inoculated with *Rhizobium spp* strains increase in the biomass. Stressed plants in association with the different strain give better results in comparison with the control. It seems that the native strains of rhizobium used have positive effects on the resilience of plants impacted by water stress.

**Key words:** Drought stress, chickpea genotypes, rhizobium

## GENOME-WIDE ASSOCIATION STUDIES OF SALINITY TOLERANCE IN MUNGBEAN AT THE VEGETATIVE AND REPRODUCTIVE STAGE

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### ABSTRACT

Mungbean is a short duration sub-tropical grain legume mainly grown in South and Southeast Asia but recently expanded to such regions as Southern Europe, United States and Australia. Salinity stress severely limits mungbean growth and yield with cultivars differing widely in susceptibility. Identifying the sources of salinity tolerance and the genetic loci associated with salinity tolerance at different growth stages is crucial for the improvement of salt tolerance. However, there is very limited information about the genetic basis of salinity tolerance in mungbean. In this study, the salt tolerance of 130 genotypes from a mini-core germplasm collection was evaluated based on 15 tolerance indices at early vegetative and reproductive stages under control (non-saline) and 75 mM NaCl treatments grown in pot-soil system in a temperature controlled glasshouse. Mungbean genotypes exhibited high phenotypic variation for all the traits at both stages and salinity stress considerably reduced growth, seed yield and its related traits. The variation in reduction of shoot dry mass (% of control) varied from 48-90% at early vegetative stage and seed yield reduction varied from 0-100% at reproductive stage. Genome-wide association studies were performed using two set of genetic data: low density 5991 SNPs from DArT sequencing and high density 198474 SNPs from Illumina whole genome resequencing (data from World Vegetable Center). DArT SNPs enhanced the precision of association mapping by tagging the causal polymorphisms. A total of 19 significant SNPs harbouring 408 candidate genes associated with salinity tolerance at the early vegetative stage and 22 significant SNPs harbouring 233 candidate genes at the reproductive stage were identified. Genes related to many functional categories were highly enriched at both stages, but genes related to lipid-metabolic process and signal transduction activity were highly expressed at early vegetative stage and genes related to nitrogen compound metabolic process and transcription factor activity were highly expressed at the reproductive stage. SNPs located in the promising genetic loci and candidate genes should be validated for future use in marker assisted selection.

**Key words:** GWAS, Mungbean, Phenotypic variation, Reproductive stage, Salinity Tolerance, Vegetative stage

## EXPANDING GENETIC VARIABILITY AND TRAIT IMPROVEMENT OF STAPLE CROPS: INSIGHTS FROM IFVCNS SUNFLOWER, WHEAT AND BRASSICAS PROGRAMS

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### ABSTRACT

Induced mutations are useful tool to broaden the genetic diversity of crops. By using this meticulously orchestrated process, the intention is to harness induced genetic variability to identify and develop new crop varieties that exhibit improved and desirable traits and that are better adapted to changing climate. Within framework of previous IAEA projects, fifteen superior IFVCNS sunflower genotypes, were exposed to gamma rays, fast neutrons, and EMS, altering seedling height. Damage indices (D50 and D30) were calculated for each genotype. Bulk irradiation targeting 30-50% growth reduction will be applied, followed by M1 field cultivation. Promising mutants, that are currently in M6 stage, are currently undergoing selection based on traits like early flowering, reduced stature, leaf and head changes, branching, head angle, sterility, and oil yield. This controlled evolution aims to develop new improved sunflower varieties. Through the activities of the project RER5024, supported by IAEA, mutation breeding is introduced into IFVCNS wheat and barley improvement programs by production and exploitation of three mutant populations. Two wheat and one barley cultivar, all of them widely spread in the production, were exposed to different doses of the gamma irradiation and mutant populations were obtained. The populations are sown in the field trials and first cycle of selection was performed. The chosen mutants will be phenotyped and genotyped in order to select the best possible candidates for new and improved small grains cultivars. Based on previous experiences, further research plans will include mutations of the species of the Brassicaceae family. The aim of this activity will be to alter traits compared to the parental genotype including oil content, quality, protein composition, metabolites, disease and parasite resistance, herbicide resistance, and tolerance to abiotic stress, especially soil salinity. By working on different mutation breeding programs, and through activities of its Centre of Excellence for innovations in Breeding of Climate-Resilient Crops – Climate Crops, IFVCNS aims to accelerate creation of the new crop varieties and more efficiently respond to changing climate, thus ensuring sustainability of agricultural production in Serbia and the region.

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Innovations in Breeding of Climate-Resilient Crops - Climate Crops, Institute of Field and Vegetable Crops, Novi Sad, Serbia

**Key words:** Induced mutations, breeding, Climate Crops



## CYTOGENETIC STUDY OF SOME SPECIES OF MEDICAGO GENUS

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### ABSTRACT

The karyological study of four diploids species witch comprises the Intertextae section of the genus Medicago has been carried on the basis of classical cytogenetic (method of orcein, Cbanding, AgNO<sub>3</sub> nucleolus staining ) and fluochrom banding (chromomycin A3 witch map repeated sequences GC). Coloration with orcein revealed that all species were found to have  $2n = 2x = 16$  chromosomes. This karyotyps are composed of metacentrics pairs and submetacentrics pairs. We also observed the presence of B chromosomes and connections interchromosomes. Coloration with Geimsa (c-banding) has revealed the existence of constitutive heterochromatin localized in regions centromeric, telomeres and intercalated. The coloration with the chromomycin A3 at M. intertexta and M. muricoleptis has revealed bands rich in GC, localised essentially in the centromères and at the telomeres. Regions of the NORs shows signals CMA +. The nitrates coloration allowed to detect a number of nucleolus vary from 1 to 2 with a majority of 1 nucleolus by cell what indicates that there is an active site

**Key words:** Medicago, Heterochromatin, Orcein staining, C-banding, ChromomycinA3

## BREEDING AND AGRONOMIC COMPARISON BETWEEN SPRING AND WINTER VARIETIES OF *CAMELINA SATIVA* IN ITALY

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### ABSTRACT

Climate change is one of the most pressing global challenges, necessitating the urgent development and adoption of sustainable solutions. In this context, *Camelina sativa*, commonly known as camelina or false flax, has emerged as a promising cover crop with significant potential for mitigating climate change. Camelina is an oilseed crop belonging to the Brassicaceae family, native to Europe and Central Asia. It is known for its resilience to diverse climatic conditions, including arid and semi-arid regions, making it suitable for cultivation in a range of environments. Camelina's ability to thrive with limited water resources and in poor-quality soils makes it a sustainable alternative to traditional oilseed crops. In fact, given the strong interest camelina is nowadays studied as a biofuel crop and a new source of protein and oil, the seed oil content is about 40%, with a high level of polyunsaturated fatty acids (30–40%  $\alpha$ -linolenic acid, 15–25% linoleic acid, 15% oleic acid and about 15% eicosenoic acid). The cake deriving from the seed pressing can be introduced into the animal diet as a source of proteins and oils. However, its use in feed and food is limited by the presence of glucosinolates (GLS), sulfur molecules involved in plant defense. In this work a breeding program started from a study of the most used commercial varieties in Europe, characterized by molecular markers (SSRs) and subsequently by GBS (Genotyping by Sequencing) technique. Furthermore, bromatological and chemical analyzes were carried out to better characterize the initial commercial germplasm. Merging the genetic and chemical data we selected the best parents for the crosses. The progenies were evaluated and compared in open field with the initial commercial varieties under study using quality parameters for DUS examination (CPVO Technical Protocols). Molecular analyses performed by SSRs markers and confirmed by GBS showed that two main genetic clusters are present in camelina germplasm: i) winter varieties ii) spring varieties. On the base of bromatological and antinutritional compound (i.e., GLS) analyses, we selected the best parents by “bulk selection method” the new variety C1205. The results confirmed that in North Italy, camelina has higher yields if cultivated in the autumn–winter period (about 2 t/ha vs. 0.6 t/ha) and a negative correlation was found between spring and winter yields, indicating that varieties that produce more in winter cultivation produce less in spring cultivation. The new selected variety showed a compromise among the best traits present in winter and spring genotypes such as high yield, early flowering, moderate GLS content and low height representing a promising genetic material for further breeding programs.

**Key words:** *Camelina sativa*, breeding, oilseed, glucosinolates, molecular markers

## IMPROVEMENT OF BEAN PLANT TRAITS BY INDUCED MUTAGENESIS

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### ABSTRACT

*Fasola vulgaris* is a leguminous plant with very high nutritional values and widely spread in Albania. Climatic changes have affected this plant to reduce its production, and during high temperatures the flowering phase cause the flowers to abort and as a result, bean flowers may fail to set bean pods. The experiment was designed to shorten the flowering time of bean plants. The bean seeds belong to Shijak variety, collected in Central Albania. We used as physical mutagens Cs-137 gamma radiation and we irradiated with 50 Gy, 100 Gy and 150 Gy in the IANP facility in Tirana. Also, we choose as chemical mutagens dES (Diethyl Sulphate), and we treated seeds with three concentrations: 0.0025M, 0.005M and 0.010M. The irradiated seeds were planted in the experimental field in Fieri district and in the greenhouse in Tirana suburban area during two consecutive years 2021 and 2022. The effect of physical and chemical mutagens on bean plants and pods was compared with untreated parental materials. Diverse traits were analyzed in different growing phases: germination ability, pigment change, chlorophyll content, pod characteristics, root system development etc. The best performance for pod length and width, seeds number and weight were taken for the 50 Gy gamma radiation dose. This dose has increased production and the weight per unit. The measurement of chlorophyll content in M1 and M2 generation has evident differences according to doses. Photosynthetic pigments differ from one generation to another due to the action of physical mutagen, and we compared the photosynthesis pigments between M1 and M2 generations. Since the chlorophyll content is an indicator of plant health, we observed that 100 Gy irradiation dose improves the condition of plants in the experimental field. For the first two dES concentrations the plants have a better development of the root system than the control.

**Key words:** Induced mutagenesis, gamma radiation, dES, white bean

## EXPLORATION, EVALUATION AND EXPLOITATION OF WILD SPECIES OF COOL SEASON FOOD LEGUMES

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### ABSTRACT

Legumes (Fabaceae Lindl.) are ranked in the second rank after Poaceae Barnhart family in terms of human and animal nutrition, and 3rd in terms of species richness with approximately 800 genera and 20 K species. Edible legumes are divided into two groups as cool and warm season food legumes, depending on the climate in their natural areas, especially the temperature requirements. Chickpeas (*Cicer* L.), lentils (*Lentil* Mill.), peas (*Pisum* L.), and broad beans (*Vicia* L.) are the most important genera of cool season food legumes. The aim of this review is to introduce wild cool season legumes that grow naturally in their habitats and to share the last exploration, collection, multiplication and evaluation studies in Turkey. *C. arietinum* L. is the only cultivated species among the 50 taxa and *C. reticulatum* Ladiz, which is only found in the Southeastern and Eastern Anatolia regions today, is considered to be progenitor. *L. culinaris* Medik. is the cultivated species among the 7 lentil taxa, naturally grown in Asia minor, and its progenitor, *L. orientalis* (Boiss.) Ponert, is some parts of Turkiye. Although there is no consensus on the number of species in pea, there are 7 taxa and 3 taxa are cultivated such as *P. sativum* L. (garden pea), *P. arvense* (L.) Poiret. (field or forage pea) and *P. abyssinicum* A. Braun. (dekoko or Abyssinian pea). It is assumed that these three pea plants were derived from two different species. Despite their morphological differences, *Vavilovia formosa* (Stev.) A. Fed. is still questioned whether it is a pea or a monotypic genus. The genus *Vicia* L. includes approximately 200 species, and faba or broad bean (*V. faba* L.) is a typical species and is represented by 2 taxa within the species (*V. faba* subsp. *faba* and *V. faba* subsp. *paucijuga* Moratov). Its progenitor has not been found to date, and how it is cultured has not been fully elucidated. A new species of chickpea, *C. turcicum* Toker, Berger & Gokturk was discovered in an exploration, collection and evaluation studies. Wild species of these species were produced to share their seeds in some genebanks and evaluated for phenological, morphological and agronomical traits. After that, wild species were screened for resistance to abiotic stresses including heat, drought, cold etc. and biotic stresses consisting of seed beetle (*Callosobruchus chinensis* L.), and leaf miner (*Liriomyza cicerina* Rondani). Some of these wild species, crossable with the cultigens, are also important for introgression resistant genes from wild relatives into the cultigens. In chickpea, the following reciprocal interspecific crosses between *C. arietinum* × *C. reticulatum* and *C. arietinum* × *C. echinospermum* were advanced recombinant inbred lines (RILs) and assessed for agro-morphological traits, while *C. arietinum* × *C. turcicum* crosses were advanced F1 plants. In pea, the following interspecific crosses between *P. sativum* × *P. elatius* and *P. sativum* × *P. fulvum* were reciprocally advanced recombinant inbred lines (RILs) and assessed for agro-morphological traits. Intergeneric crosses between *P. elatius* × *V. formosa* were made in this year and some pods were obtained. RILs derived from interspecific crosses created transgressive segregations for agro-morphological traits and resistance to a/biotic stresses with their unveiled specific genes. The progenitors of these cool season food legumes in Asia minor or Anatolia, as well as the old carbonized remains of transitional forms from progenitor to cultigen, species richness and wide variation in cultigens indicate that Anatolia including Fertile Crescent is both the center of origin and the cradle of these species. Some of the endemic species in this region are under

threat and it is imperative to take protection measures to transfer these relics to future generations.

**Key words:** Chickpea, Cicer, lentil, Lentil, pea Pisum, faba bean, Vicia, interspecific crosses, intergeneric crosses

## DEVELOPMENT OF CHLORSULFURON RESISTANCE SOYBEANS BY EMS MUTAGENESIS

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### ABSTRACT

This study aimed to develop herbicide-resistant soybeans through the application of ethyl methanesulfonate (EMS) mutagenesis. The study involved applying 0.1% EMS mutagen to soybean seeds (*Glycine max* (L.) cv Arisoy). Among the M2 population assessed in field and greenhouse conditions, a single herbicide-resistant mutant was identified. The investigation involved mapping the AHAS gene regions in the progeny of this resistant mutant, elucidating the nucleotide changes responsible for conferring herbicide resistance. Sequence analysis of the AHAS gene revealed three notable nucleotide substitutions at positions 407 (C/T), 532 (C/T), and 1790 (C/T). Comparative analysis with the AHAS gene protein sequence of *Arabidopsis thaliana* unveiled amino acid alterations in the progeny of the resistant mutant, including Ala155Val, Pro197Ser, and Thr616Met. It is noteworthy that the Pro197Ser alteration was consistently present in all progenies, while the others exhibited diversity. Over consecutive two years, a comparative assessment was conducted between wild-type and mutant plants in terms of seed yield, number of pods per plant, stem height to the first pod, 1000-seed weight, and physiological maturity days. The results show no statistically significant differences between the mutant and wild-type plants concerning seed yield and its associated components. This suggests that EMS-induced mutagenesis provided target-site resistance to sulfonylureas (SU) without compromising yield components, underscoring the potential for effective herbicide resistance development in soybeans.

**Key words:** AHAS gene; EMS mutagenesis; herbicide resistance; chlorsulfuron

## THE CHALLENGE OF BREEDING FOR REDUCED OFF-FLAVOUR IN FABA BEAN INGREDIENTS

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### ABSTRACT

The growing interest in plant protein sources, such as pulses, is driven by the necessity for sustainable food production and climate change mitigation strategies. Faba bean (*Vicia faba L.*) is a promising protein crop for temperate climates, owing to its remarkable yield potential (up to 8 tonnes ha<sup>-1</sup> in favourable growing conditions) and high protein content (~29% dry matter basis). Nevertheless, the adoption of faba bean protein in plant-based products that aim to resemble animal-derived counterparts is hindered by its distinctive taste and aroma, regarded as "off-flavours". In this poster, we propose to introduce off-flavour as a trait in breeding programs by identifying molecules involved in sensory perception and defining key breeding targets. We discuss the role of lipid oxidation in producing volatile and non-volatile compounds responsible for the beany aroma and bitter taste, respectively. We further investigate the contribution of saponin, tannin, and other polyphenols to bitterness and astringency. To develop faba bean varieties with diminished off-flavours, we suggest targeting genes to reduce lipid oxidation, such as *lipoxygenases (lox)* and *fatty acid desaturases (fad)*, and genes involved in phenylpropanoid and saponin biosynthesis, such as *zero-tannin (zt)*, *chalcone isomerase (chi)*, *chalcone synthase (chs)*, *β-amyrin (bas1)*. Additionally, we address potential challenges, including the need for high-throughput phenotyping and possible limitations that could arise during the genetic improvement process. The breeding approach can facilitate the use of faba bean protein in plant-based food such as meat and dairy analogues more extensively, fostering a transition toward more sustainable and climate-resilient diets.

**Key words:** plant-based; off-flavour; faba bean; breeding; tannins; saponins, lipoxygenase

## POLIMORPHISM OF GRAIN STORAGE PROTEINS IN TRITICALE LINES OF CIMMYT ORIGIN

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### ABSTRACT

A collection of seventy Mexican Triticosecale samples originating from CIMMYT was analyzed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The studied lines are spring forms with high resistance to yellow rust and with high productive potential under the conditions of Bulgaria. Electrophoretic analysis of grain storage proteins encoded by loci Glu-1 (Glu-A1, Glu-B1 and Glu-R1), Glu-3 (Glu-A3 and Glu-B3), Glu-B2 and Gli-R2 showed the presence of eleven alleles encoding the high molecular weight (HMW) subunits (seven for glutenins and four for secalins), six for the low molecular weight (LMW) glutenin subunits and four for 75K  $\gamma$  - secalins. The formed allelic configurations were characterized by higher polymorphism at the Glu-A1 and Glu-B1 loci, where seven alleles were identified. The number of triticale lines possessing subunits ,1' and ,2\*' at the Glu-A1 locus, coded by alleles ,a' and ,b' respectively, is the largest. These alleles are associated with good bread-making qualities of the flour. In the Glu-B1 locus, the fractional pair ,7+18' (allele 'r') was found with the highest frequency, and in the locus Glu-R1 the fractional pair ,6r+13r' (allele ,c') was most often expressed. In the area of low molecular weight glutenins with higher allelic diversity is the Glu-B3 locus. Alleles 'a' and 'b', encoding 75K  $\gamma$  - secalins 'd1' and 'd2', were identified with the highest frequency in the Gli-R2 locus. The obtained results for the allelic composition of the storage proteins of the Mexican triticale lines will find application in the selection program of the Dobrudzha Agricultural Institute (DAI) for the creation of spring forms combining high productive potential, resistance to abiotic and biotic stress and quality.

**Key words:** SDS-PAGE, Grain storage proteins, Genetic diversity, Polymorphism



## **MODIFIED METHOD OF MICROSPORE ISOLATION FOR DH TECHNOLOGY FOR THE BRASSICACEAE FAMILY**

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### **ABSTRACT**

Increasing the efficiency of DH-technology for a number of crops of the Brassicaceae family will increase the potential for the development of new hybrids of this family, which includes oilseed rape. The efficiency of DH-technology is influenced by the method of microspore isolation. Embryogenicity of cell culture depends on the stage of microspores development, the degree of their responsiveness to embryogenesis, purity of the preparation, etc. In standard DH protocols, isolation of microspore is based on mechanical destruction of buds followed by filtration of the suspension, which is suitable for cultures/genotypes with high responsiveness to embryogenesis, but for weakly responsive cultures this step should be modernized. We have developed a method of microspore isolation (individual dissection of buds with a scalpel and their subsequent mixing in nutrient medium on a rotary shaker), in which the mechanical impact on bud tissues is minimal, so somatic tissues are not destroyed and do not get into the preparation, and not destroyed anthers play the role of a "sieve" for microspores, which increases the concentration of embryogenic microspores in the preparation. The efficiency of DH-technology for low-reactive Brassicaceae crops increases by several times if you using a new method of microspore isolation.

**Key words:** DH-technology, microspore culture, oilseed rape

## IMPROVEMENT OF BEAN PLANT TRAITS BY INDUCED MUTAGENESIS

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### ABSTRACT

*Phaseolus vulgaris* is a leguminous plant with very high nutritional values and widely spread in Albania. Climatic changes have affected this plant to reduce its production and this experiment was designed to shorten the flowering time of Shijak variety bean plants, collected in Central Albania. We used as physical mutagens Cs-137 gamma radiation and we irradiated with 50 Gy, 100 Gy and 150 Gy. Also, we choose as chemical mutagens dES (Diethyl Sulphate), and we treated seeds with three concentrations: 0.0025M, 0.005M and 0.010M. The irradiated seeds were planted in the experimental field and the greenhouse during two consecutive years 2021 and 2022. The effect of physical and chemical mutagens on bean plants and pods was compared with untreated parental materials. Diverse traits were analyzed as germination ability, pigment change, chlorophyll content, pod characteristics, root system development etc. The best performance for pod length and width, seeds number and weight were taken for the 50 Gy gamma radiation dose. This dose has increased production and the weight per unit. The chlorophyll content in M1 and M2 generation had evident differences according to irradiation doses. Photosynthetic pigments differ from one generation to another due to the action of physical mutagen. Since the chlorophyll content is an indicator of plant health, we observed that 100 Gy irradiation dose improves the condition of plants in the experimental field. For the first two dES concentrations the plants had a better development of the root system than the control.

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**Key words:** Induced mutagenesis, gamma radiation, dES, white bean

## PREPARATION OF CUO-TiO<sub>2</sub> BINARY NANOCOMPOSITES FOR THE SUPERIOR PHOTOCATALYTIC DEGRADATION OF RHODAMINE B: MORPHOLOGICAL AND STRUCTURAL PROPERTIES

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### ABSTRACT

Rhodamine B (RhB) belongs to the xanthene dye family that is commonly used in textiles and various applications, including photosensitizers, paper dyeing, and laser dye production, as well as biological staining and a fluorescent marker. This toxic cationic dye can be carcinogenic and mutagenic with high potential antagonistic results on all living organisms [1]. Consequently, the elimination of hazardous RhB is paramount before discharging into water streams to protect the environment and ecosystem. Semiconductor photocatalysis as a wastewater treatment technology can be promising for RhB high-efficiency removal. The coupling of semiconductors between p-type CuO and n-type TiO<sub>2</sub> semiconductors is expected to produce effective photoactive particles with advanced properties. The formed p-n heterojunctions can lead to enhanced degradation of organic pollutants that are persistent in the environment. The study was focused on the preparation, characterization, and photocatalytic evaluation of CuO-TiO<sub>2</sub> binary nanocomposites in the photo-assisted degradation of RhB under UV irradiation. CuO-TiO<sub>2</sub> binary nanocomposites were synthesized via a simple solid-state dispersion method. The structure and surface morphology of CuO-TiO<sub>2</sub> binary nanocomposites were determined using FT-IR, XRD, SEM, and Raman spectroscopy. The SEM image revealed the morphologies of both CuO and TiO<sub>2</sub> catalysts. The XRD diffractogram of CuO-TiO<sub>2</sub> binary nanocomposites clarified the characteristic monoclinic structure of the CuO phase and the anatase and rutile phases of TiO<sub>2</sub>. The results could be beneficial for designing CuO-TiO<sub>2</sub> binary nanocomposites with superior photocatalytic degradation in wastewater management technologies.

**Key words:** Binary nanocomposites, CuO-TiO<sub>2</sub>, decolorization, Rhodamine B, semiconductor photocatalysis

## PHYTOPATHOLOGY AND MOLECULAR INVESTIGATION OF RESISTANCES TO BACTERIAL AND FUNGAL PATOGENS IN COMMON BEAN MUTANT AND BREEDING LINES

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### ABSTRACT

Common bean (*Phaseolus vulgaris*) has several important diseases that can affect its growth and productivity. Bacterial and fungal diseases can have a significant impact on common bean crops, leading to reduced and losses yield, poor seed quality, and economic losses. The aim of the study was to analyze Bulgarian bean accessions, including EMS-induced mutant lines, local forms and breeding lines, and evaluate their resistance for pathogens through phytopathological and molecular studies. We focused on three economically important pathogens for Bulgaria - *Colletotrichum lindemuthianum* (races 6,8, 81,320); *Pseudomonas savastanoi* pv. *phaseolicola* (races 1, 6); *Xanthomonas phaseoli* pv. *phaseoli* (XB96221; XB99132). By the phytopathological screening of 104 bean accessions for resistance to Halo blight, all 84 mutant lines showed resistance to both races in leaves, and in pods - resistance and immune response. In the mutant lines, we reported resistance and medium resistance to Bacterial blight in the leaves. In pods, the response to stress varied from resistance to sensitivity. In the local forms, variety and breeding lines in leaves and pods, we observed a different response to biotic stress – from complete resistance to susceptibility to *Pseudomonas savastanoi* pv. *phaseolicola*; *Xanthomonas phaseoli* pv. *phaseoli*. Most of the accessions are sensitive to *Colletotrichum lindemuthianum*. We conducted the molecular studies with SCAR markers, determining the resistance of bean to the pathogens, as well as by qRT-PCR analysis. The contribution of molecular studies carried out in parallel with phytopathological screening confirmed the presence of genes in breeding lines and varieties developed to introduce resistance to pathogens into their genomes. On the other hand, this allowed us to identify which are the alleles and/or loci that determine the available resistance in local accessions of unknown origin.

**Acknowledgement:** RER/5/024 funded by FAO/IAEA; ERA-NET CORE Organic (DIVERSILIENCE) (MOH—KП06ДO-02/7).

**Key words:** phytopathology, molecular investigation, common bean, mutant, breeding lines

## **DROUGHT STRESS TOLERANCE IN COMMON BEAN MUTANT AND BREEDING LINES: PHYSIOLOGY AND PROTEOMICS RESPONSE**

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### **ABSTRACT**

Drought stress significantly reduces the yield of common bean (*Phaseolus vulgaris* L.) by affecting different stages of plant development. In the present study, we aimed to investigate drought tolerance in Bulgarian bean accessions, including mutant and breeding lines, varieties, as well as local forms. We performed pre-screening in pots on 41 Bulgarian accessions by treatment with PEG 6000, and as a result, we reported that drought stress resulted in a significant reduction in fresh and dry leaf and root weights and relative water content (RWC %). The proline content of the studied accessions increased when plants were subjected to water deficit and they underwent a series of physiological and biochemical changes. The accessions showing the highest proline levels were selected to be studied under drought stress field conditions. In the physiological studies we conducted, we found data from the PSA activity confirming the results of prescreening by proline concentrations, as well as from the field analysis for tolerant accessions. The application of proteomic technologies, such as two-dimensional gel electrophoresis (2D-DIGE/Maldi Toff) and mass spectrometry (LC-MS/MS) allowed us to investigate changes in protein regulation under drought stress and identify as well as to quantify specific proteins that have an important role in plant response to drought stress. Using bioinformatics tools and databases, we annotated and classified the identified bean proteins according to their potential roles in plant stress tolerance mechanisms. The function of a large part of them is related to photosynthesis and primary metabolism.

**Acknowledgment:** RER/5/024 funded by FAO/IAEA; ERA-NET CORE Organic (DIVERSILIENCE) (MOH—KП06ДO-02/7).

**Key words:** drought stress, common bean, physiology, proteomics

## PROTEOME EFFECT OF DROUGHT STRESS IN PEPPER MUTANT LINES

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### ABSTRACT

Drought is thought to compromise crops that are highly dependent on rainfall, but in reality it is good to consider the costs of irrigated crops that need abundant irrigation. Reducing irrigation rates, even for crops such as pepper (*Capsicum* spp.), is of economic importance for its production at lower prices and with less labor. The purpose of the study was to select tolerant to water deficit within a *Capsicum annuum* collection perspective for pepper breeding with valuable traits. We looked for advanced proteomics technology to investigate the response of plants to this type of abiotic stress, outlining the global problem of global warming, which is directly related to drought. For better understanding the *Capsicum annuum* behavior during drought stress treatment, protein profiles were generated from mutant and initial sweet pepper genotypes after treatment with water deficit showed different responses. Further analysis revealed changes in the regulation pattern (up- and down-) of a set of enzymes. Also, accumulation of the well-known stress-related proteins markers like dehydrins and small heat shock proteins was observed as well. These findings support the further selection of drought tolerant pepper lines for a sustainable agriculture. The success of breeding programs can be enhanced by the efficient and integral application of proteomics approach to characterize mutants.

**Key words:** *Capsicum annuum*; drought tolerance; mutant lines; varieties; proteomics

## YIELD ENHANCEMENT OF WATER STRESSED CHICKPEA GENOTYPES BY INOCULATION WITH RHIZOBIA

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### ABSTRACT

Chickpea (*Cicer arietinum* L.) is one of the most ancient Eurasian crops. Their ability to grow in hot and dry climates and the nutritional value of seeds allowed the fast spread of their cultivation from the respective domestication areas to the western side of Mediterranean basin, and successively to all continents. The selection of improved varieties characterized by higher yields and resistance to biotic and abiotic stress was important. As part of a multilateral project (PRIMA), two local Algerian genotypes of chickpea displaying contrasted drought resilience were evaluated under water stress regime. After sowing the stressed plants received only 25% quantity of water depending on the field capacity of each pot, with or without the inoculation with 2 different rhizobium strains (CC4 and SMA2). Control he received 75%. Morpho-physiological parameters were measured as following: shoot length (SL) (cm), chlorophyll index (CI)(SPAD units), Relative Water Content (RWC %), root Dry Matter (DM %) and yield component (number and weight of seeds). The data showed that chickpea plants inoculated with *Rhizobium spp* strains increase in the biomass. Stressed plants in association with the different strain give better results in comparison with the control. It seems that the native strains of rhizobium used have positive effects on the resilience of plants impacted by water stress.

**Key words:** Drought stress, chickpea genotypes, Rhizobium



## EFFECT OF CLIMATE VARIABLES ON SUNFLOWER YIELD IN THE REPUBLIC OF MOLDOVA

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### ABSTRACT

Sunflower seed yield can vary substantially depending on the genetic characteristics of the hybrids, pedoclimatic conditions and agronomic factors. Among them, climate is a prominent factor influencing agricultural production systems, recent trends in the change of climate variables being responsible for the essential impact of the global harvest of crops. To develop more accurate yield predictions and appropriate adaptation and risk mitigation strategies, it is important to know how yield is affected by changes in different climate variables. In this context, the relationship between sunflower yield and climate factors, such as temperature and amount of precipitation during cold and vegetation period, in the Republic of Moldova were analyzed using datasets from 35 sites (administrative territorial units) over 2003–2021. Pearson correlation and linear regression methods were used for analysis. Precipitation, was found to primarily have a positive correlation with sunflower yield. So, moderate and strong correlations ( $r=0,45 \dots 0,78$ ) with amount of precipitation from the period of vegetation and cold season were found in 54% and, respectively, 28% of sites. The influence of temperature from the vegetation period was less obvious, the correlational analysis revealing the existence of statistically significant, negative correlations, only in two sites. In temporal aspect, it was more pronounced in the dry years 2007, 2009, 2012, 2015 and 2020, the maximum values of the Pearson regression coefficients ( $r=-0.72 \dots -0.83$ ) being revealed in the years with severe droughts 2007, 2012 and 2020. According to the regression analysis, climate variable has explained only 22.5% of the variation in the sunflower yield, while the rest of the variability can be attributed to other factors such as soil fertility, planting date, use of high-yielding hybrids, agricultural technologies, management of crop control and protection from weeds, pests and diseases etc. The contribution importance rank of climate variables to sunflower yields was precipitation from vegetation period > precipitation from cold season > temperature from vegetation. The information can be used by decision makers to prioritize agricultural resilience efforts and improve agricultural practices.

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**Keywords:** sunflower, yield, climate change, climate variables



## DETERMINING THE CONTRIBUTION OF THE ENVIRONMENTAL FACTORS IN THE VARIATION OF SUNFLOWER SEED YIELD BY MULTIVARIATE ANALYSIS

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### ABSTRACT

The variation of climatic conditions in recent years and their impact on the sunflower crop (*Helianthus annuus*) has increased intensively. Thus, adaptation and determination of performance genotypes is a long process that needs a lot of investigations. In order to determine the contribution of environmental factors in the yield variability of sunflower seeds, different experimental PCA (*Principal Component Analysis*) models generated based on various combinations of variables and observations were studied: 21 approved hybrids of the State Commission for Crops Variety Testing (H1-H21) ; 6 years (2015-2020); 5 experimental lots from several localities (Visoca, Pelinia, Bacioi, Grigorievca, Svetlii) of the Republic of Moldova; seed yield and 4 climate indices (average annual t°C – AAT, annual rainfall – AR, rainfall in the vegetative period of the year – RVP, rainfall in the cold period – RCP). PCA analysis based on general parameters of the climatic conditions revealed variables with the greatest contribution in the agrometeorological differentiation of the cultivation areas, and those that present a direct association with the average yield value of the hybrids in these areas. Those 5 localities differed according to the AR content, especially, those recorded in 2020, considered a dry year, and RVP. The RCP variable did not reveal a significant factor in discrimination of agricultural areas, nor of influence on seed yield. PCA analysis also highlighted the year 2020 with the most variable indices of the weather conditions for the all studied localities. The Svetlii locality stands out from the others due to a more variable monthly rainfall content in the period 2017-2019. There was little rainfall recorded in Svetlii in may (15.4/23.7 mm) and august (13.8/4.7 mm) months in 2017 and 2018, respectively. In september 2017, the rainfalls were missing, and in 2019 the most fell (103 mm) compared to the other localities and years. The seed yield of the hybrids cultivated in this locality is lower compared to the other and shows relatively heterogeneous values (CV=23%). The hybrids cultivated in Visoca (6 years) showed the highest yield values and a higher degree of stability of seed production from year to year (CV=15%, relatively homogeneous). Also, the rainfall indices have the higher values (exception 2015 and 2020), relatively homogeneous from year to year. The seed yield of the most hybrids during the 2015-2017 period did not vary significantly depending on the locality, with the exception of some hybrids from Svetlii. For the period 2018-2020, a relatively higher degree of variation in the average values of the annual yield was observed especially for the hybrids grown in Bacioi and Grigorievca. Hybrids from the semi-early maturity stage (H7-H10) are distinguished by a comparatively higher degree of seed yield stability, in the years with favorable climatic conditions and their value was not affected by location. At the same time, the hybrids with a greater degree of yield variation depending on the year and locality are the hybrids with medium maturity stage H13, H15, H16; semi-late H18, H20 and late H1, H3, H4.

**Acknowledgments:** This study was supported by the research project 20.80009. 5107.01-Genetico-molecular and biotechnological studies of the sunflower in the context of sustainable management of agricultural ecosystems, funded by the project of the State Program.

**Keywords:** sunflower, hybrid, *Principal Component Analysis*, rainfall, seed yield

## PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE OF PHENOLIC EXTRACTS OF POMEGRANATE PEEL (*PUNICA GRANATUM*)

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### ABSTRACT

Pomegranate or *Punica granatum*, an ancient remedy which used for both medical and nutritional purposes. This work aims to evaluate pharmacological properties of pomegranate peel extracts and establish their phytochemical profile. The pharmacological profile was determined by evaluating the antibacterial and cicatrizing power of three extracts (ethereal, butanolic extracts). The antibacterial activity of phenolic extracts of pomegranate peel at a dose of 500mg was carried out by the method of diffusion on agar medium against three bacterial strains. The cicatrizing effect of extracts of *Punica granatum* was evaluated by the excisional model in rats, the results were expressed by the percentages of reduction of the surfaces of the treated wounds using AutoCAD software. The phytochemical profile of pomegranate peel extracts was established by HPLC analysis. The HPLC profiles revealed the richness of pomegranate peel extracts by phenols compounds such as quercetin, orientin, iso-orientin, apigenin, ferulic, acid. The antibacterial activity of pomegranate peel extracts showed that the butanolic was the most effective in inhibiting the growth of strains bacteria (*Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*) with inhibition diameters respectively 17, 22 and 25mm for butanolic extract. However, the ethereal extract showed the less antibacterial effect with inhibitory diameters in order to 13, 11 and 16mm respectively. The histological analysis of the healing effect of phenolic extracts of pomegranate bark revealed total healing of wounds treated with butanol with a 100% reduction in wounds the ethereal extract reveals partial healing with 70% reduction in wounds. The present study shows that the phenolic extracts of pomegranate peel characterized by an interesting pharmacological properties.

**Key words:** *Punica granatum*, HPLC, phenol compounds, cicatrizing effect, antibacterial

## CHROMATOGRAPHIC ANALYSIS AND HYPOGLYCEMIC ACTIVITY OF TWO MEDICINAL PLANTS

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### ABSTRACT

Diabetes is growing rapidly worldwide, this is why scientific works must more focused on the search for new, less expensive and more effective alternatives. The present work aims to establish a scientific justification for the use of *Moringa oleifera* and *Globularia alypum* in herbal medicine for hypoglycemic effect and determine the bioactive compounds responsible for this therapeutic effect by HPLC (High-performance liquid chromatography) analysis. The glucose tolerance test evaluates the potential of *Moringa oleifera* and *Globularia alypum* infusion extract leaves at dose of 500mg/Kg of body weight in mice to reduce the concentration of glucose previously administered to the order of 4g/kg. The mice's blood sugar was measured at times (t): 30, 60, 120, 150 min on a drop of blood taken from the caudal end of the animals, using the glucometer. Methformin at 500mg/Kg was used as the reference drug. The bioactive compounds in the both infusion extracts were identified by HPLC analysis. The glucose tolerance test shows that the infusions of *Moringa oleifera* and *Globularia alypum* are more effective in lowering blood sugar than metformin around 2.23, 1.05 and 1.02 units respectively for the three treatments. HPLC chromatogram indicated the simultaneous presence of kaempferol and rutin in both infusion of *Moringa oleifera* and *Globularia alypum*. These compounds are known for its inhibition of glucosidase activity in vitro by binding directly to the enzyme by hydrophobic bonding. This study justifies the traditional use of *Moringa oleifera* and *Globularia alypum* as antidiabetic treatment.

**Key words:** plants, *Globularia alypum*, *Moringa oleifera*, HPLC, bioactive compounds, hypoglycemic

## ANTI-INFLAMMATORY AND ANALGESIC ACTIVITY OF AQUEOUS EXTRACT OF *INULA VISCOSA* LEAVES

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### ABSTRACT

The objective of the present study was to evaluate the anti-inflammatory and the analgesic effects activity of aqueous extract of *Inula viscosa* leaves. The leaves are used as traditional folk medicine in north of Algeria to treat inflammatory and painful diseases. Anti-inflammatory activity was evaluated by using the xylene-induced ear edema induced inflammation, whereas acetic acid-induced abdominal constrictions were used to determine antinociceptive effects. The extract of *Inula viscosa* (300 and 150 mg/kg) produced a significant inhibition of ear edema inflammation, and produced a significant reduction of the number of writhes. These findings suggest the aerial parts of *Inula viscosa* exhibits potent anti-inflammatory and analgesic activities on chemical behavioral models of nociception and inflammation in mice.

**Key words:** *Inula viscosa*, xylene, analgesic effect, anti-inflammatory

## IN VITRO, MOLECULAR DOCKING AND TOXICITY PREDICTION OF PINE RESIN EXTRACT

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### ABSTRACT

The aim of this study was to evaluate the *in vitro* and *in silico* antibacterial activity of an oleoresin of Pine used in the Algerian traditional phytotherapy. The antibacterial effect of the oleoresin was evaluated by the agar diffusion test against three bacterial strains; *E. coli* (ATCC 25922), *S. aureus* (ATCC 25923) and *P. aeruginosa* (ATCC 27853). The *in silico* antibacterial study was performed against the bacterial enzyme TyrRS via AutoDock Tools 1.5.7 software using the main compounds of the resin extract and the toxicity was evaluated via Molinspiration Cheminformatics and SwissADME online tools. Both of the resins acted on *E. coli* and *S. aureus* with inhibition diameters of 17 mm at 200mg/ml. However, *P. aeruginosa* was completely resistant. All the molecules integrate at the active site of the enzyme but with different scoring. The Dehydroabietic acid has the best binding energy (-10.06 kcal/mol) which is much higher than that of gentamicin (-5.59 kcal/mol). The vanillin is the most weakly integrated with -4.48 kcal/mol. The prediction of toxicity indicated that vanillin, limonene and 4-allylanisole can be individually toxic with mutagenic, tumorigenic and irritant effects. It is concluded that the compounds of the resin act on different targets and not only on the TyrRS and probably synergistically not individually.

**Key words:** Pine resin, TyrRS , molecular docking, ADMET prediction

**THE ACCUMULATION OF PROLINE AND SOLUBLE SUGARS UNDER THE  
LOW TEMPERATURES IN SOME GRASS AND LEGUME MEADOW IN THE  
SEMI ARID REGION SETIF , ALGERIA SPECIES**

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**ABSTRACT**

The objective of this study is to improve fodder and pastoral production in natural areas, including moderately degraded grasslands, to ensure more fodder resources for livestock, in order to reduce burdens as well as a better sustainability of farms to climate change events through the introduction of perennial cultivars (grasses and legumes), developed in different farming systems. The experiment was carried out under controlled and semi-controlled conditions, evaluating the effect of heat stress on this fodder mix. Based on a frequency study of the climate in the Setif region, three main temperatures were studied: -3.2°C (stress1), -1.2°C (stress2), 0.5°C (stress3), for 3 hours to quantify the degree of adaptation of these grassland plants introduced by biochemical markers such as proline and sugars. In our experiment, variations in the content of these biomarkers are monitored at the vegetative stage of the plant (early spring). The results obtained show that the effect of cold weather causes a significant increase in proline production depending on two factors: family and stress where grasses are much more sensitive to a temperature of -3.2°C which induces a low accumulation of proline compared to the other two temperatures (-1.2°C and 0.5°C) and to legumes recording much higher values at a temperature of 0.5°C. Whereas a non-significant difference is noticed between legume types. On the other hand, both families recorded a significant accumulation of sugars with an increase of 60% for grasses and 31.13% for pulses compared to the control. Keywords: Proline, Soluble sugars, low temperatures, grassland species, Semi arid region

**Key words:** Proline, Soluble Sugars. Low temperatures, Grassland species, Szmi arid region

## STEREOLOGICAL ANALYSIS OF THE SUNFLOWER ROOT SEEDLING

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### ABSTRACT

The aim of this research was to determine the histological basis of the genotypic differences for drought tolerance, calculate tissue volume densities ( $V_v$ ), examine the variability, and assess tissue proportions along the root maturity gradient. For the stereological analyses of root tissues four sunflower genotypes, 14 days old seedlings which were grown in rhizotrons, have been carried out on the primary (axial) root. The total length of the axial roots varied among genotypes, but not significantly. Root cross-sections were cut along the root maturity in five segments according to the principle of systematic uniform random sampling method. Cross-sections were made applying cryo-technique procedure and proportion of tissues was estimated by point-counting method. The vessel network characteristics (number and diameter of vessels) vary along maturity gradient and individual roots. Consequently, branching vessels pattern and axial conductance may limit water flow through root systems. Characteristics, such as (i) arrangement, number and size of vessels, (ii) volume density of xylem, and (iii) volume density of cortex parenchyma are promising criteria that can help in the selection of more drought tolerant genotypes. Therefore, the root anatomical features have to be included in future breeding strategies to improve the sunflower cultivars for climate changes.

**Acknowledgment:** This work is supported by the Science Fund of the Republic of Serbia, through IDEAS project “Creating climate smart sunflower for future challenges” (SMARTSUN) grant number 7732457

**Key words:** root anatomy, sunflower, stereology



## **URTICA DIOICA L., ALGERIAN WILD PLANT WITH HYPOGLYCEMIC EFFECT**

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### **ABSTRACT**

Medicinal plants will always remain a reliable source of active principles of therapeutic interest. Faced with the phobia of synthetic chemical molecules, their use is constantly increasing. The issue raised in this work is part of this concern for the exploration and screening of new sources of biomolecules contained in native plants. This work concerned exploitation of Algerian plants specially aromatic ones as *Urtica dioica* (Urticaceae). The *invitro* antioxydant activity was studied with two different methods: technique of reduction of the free radical DPPH, and the reducing power, followed *by invitro* experiment of anti-hyperglycemiant effect. The phytochemical screening showed the presence of different classes of metabolites namely: flavonoids, tannins, sterols, compound (made up) reducers, phenols, and true tannins. The total polyphenolic content was estimated at 28mg GAE/g extract and 8.4mg RE/g extract for flavonoids, this result indicated a very important richness of *Urtica dioica* L leaves. The *invitro* antioxydant activity showed a moderate effect, IC50 of order of 1.87 mg/ml for DPPH, and EC50 of order of 0.344 mg/ml for of reducing power test. The *invivo* evaluation of anti-hyperglycemia showed that methanolic extract with three doses of extract 250, 500 and 1000 mg / kg, administered intraperitoneally and the Metformin solution at 100 mg / kg, proved a significant reduction in the level of blood sugar after 3 hours of experience at percentages 28.57%, 41.13%, 45.83% and 40.88%, respectively compared to the untreated groups which recorded a reduction of glycemia with percentage of 21.01%. Hypoglycemic effect of extract was tested with three doses 250, 500 and 1000 mg/kg of methanolic extract of *Urtica dioica* L. results of experiment showed that extract caused a dose-dependent reduction in the blood sugar of groups, the hypoglycemia induced by extract appeared significant after 2 hours of intraperitoneal injection compared to the control group. The obtained results showed that *Urtica dioica* extract has a potential hypoglycemic and anti-hyperglycemic effect.

**Key words:** *Urtica dioica*, antioxidant activity, anti-hyperglycemia, hypoglycemia

## DIVERSE METHODS TO EVALUATE THE ANTIOXYDANT EFFECT OF PLANT EXTRACT

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### ABSTRACT

For a long time, the bark and the leaves have been used in traditional medicine in Algeria to treat laxative, diuretic, anti-diarrheal diseases and for the treatment of gastroenteritis in breastfeeding babies. It is also used as a food supplement by the pharmaceutical and food industries. In order to analyze the antioxidant properties of the leaves, the butanol extract was subject for phytochemical screening, and different antioxidant activities in order to confirm its potential properties. BuOH extract phytochemical characterization revealed the absence of saponins and a low presence of true tannins with a more or less important presence of anthocyanins, steroids and flavonoids. On the other hand, this extract indicated a very important presence of free quinones, alkaloids, and glycosylated flavonoids. The total content of phenolic compounds, flavonoids, and antioxidant activities results of different methods are presented in the following table. The obtained results showed the richness of the butanolic extract in total phenols and flavonoids. Compare to standards, BuOH extract presented a similar effect with butylated hydroxytoluene (BHT) in CUPRAC test, and better effect than Tannic acid in FRAP test. This richness can very well explain its potential antioxidant effect proven by the different methods used. For this, EL KHAROUB may be a great bioresource of therapeutic substance and alimentary complement.

**Key words:** Plant, DPPH, CUPRAC, FRAP, ABTS, Phenanthroline

## EVALUATION OF BIOLOGICAL ACTIVITY OF CRUDE EXTRACTS FROM PLANT USED IN TRADITIONAL MEDICINE

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### ABSTRACT

*Silybum marianum* is a plant of the family Asteraceae which grows in the Mediterranean region. This study is performed on the hydromethanolic extracts of the seeds and leaves of *Silybum marianum*. Phytochemical tests revealed the richness of the plant in flavonoids, phenols, flavonoid glycosides, tannins, sterols and polyterpenes and reducing sugars. The total polyphenol content of the seed extract is equal to 630 mg GAE/g extract, while that of the leaves is 590 mg GAE/g extract. The content of flavonoids is 236 mg RE/g of extract for the seeds while for the leaves it is 128 mg RE/g of extract. The results obtained for the antioxidant activity by DPPH show that the extracts have a low power to trap this radical with IC<sub>50</sub> in the order of 0.557 mg/ml for seeds, and 0.468 mg/ml for leaves. The reducing power evaluation (FRAP) of both extracts is EC<sub>50</sub> = 0.301mg /ml for seeds, and EC<sub>50</sub> = 1.709 mg /ml for leaves. The antihyperglycemic activity tested in rats with temporary glucose-induced hyperglycemia and the hypoglycemic activity in normal rats shows that both extracts of *Silybum marianum* have good hypoglycemic and antihyperglycemic potential.

**Key words:** *Silybum marianum*, Secondary metabolites, Antioxidant activity, hyper-glycemia

## AN INVASIVE WEED OF CROPS: OXALIS PES-CAPRAE

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### ABSTRACT

These last years the rate of biological invasions has increased all over the world due to massive movements as well in the urban as in the rural sites. In agriculture many weeds affect crops through competition for water, nutrients and soil, leading to yield reduction. among these species Bermuda-buttercup or *Oxalis pes-caprae* L. (*O. cernua* Thunb.) is very resistant to a huge range of herbicide treatments apart of the glyphosate under a specific concentrations (Tanji, 1994). This species is indigenous to south Africa, but its presence was reported by Battandier since 1888 in Algeria, where it grows and perennates from bulbs, nowadays it is largely widespread. the aim of this work is to analyse this species in morphological, biological and cytological aspects. Plant material was collected in the field during flowering stage from four localities in Algeria. fresh material was used for analysing morphology and anatomy using light microscopy, pollen mother cells (PMC) was used for karyological analysis. For all the populations studied the flowers showed heterostyly morphology. Cytological study showed that pollen sterility reaches a medium rate. we also presented chromosome counting for all the examined population. Asynchronous meiotic abnormalities were observed in the PMCs. No fruits production was observed in the field.

**Key words:** invasive species, weeds, crops, *Oxalis*, meiotic abnormalities

## PHYSICAL CHEMISTRY ANALYSIS, ANATOMICAL STUDY AND ANTIOXIDANT ACTIVITY OF ROSMARINUS OFFICINALIS

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### ABSTRACT

The purpose of this work is to investigate the physicochemical properties of *Rosmarinus officinalis* secondary metabolites in addition to a biological study for better knowledge. The plant was collected from mountains surrounding the city of Batna in the east of Algeria. An anatomical study of the plant is carried out on fresh parts using double coloration method. The aerial parts (leaves and stems) are then cleaned of impurities, dried and grounded to a powder before being subjected to various analyses. First, a phytochemical analysis is conducted by extracting the samples using petroleum ether, dichloromethane, and methanol. This allows for the separation and identification of different chemical compounds present in the samples. Next, a qualitative determination of secondary metabolites is performed, which involves identifying and categorizing specific classes of compounds such as alkaloids, flavonoids, and terpenoids. Additionally, the ash percentage and metals content in the samples are calculated, providing valuable information about the inorganic composition of the plant material. Finally, the antioxidant power of the different extracts is assessed, evaluating their ability to combat oxidative stress and potentially contribute to health benefits. The results showed that the extraction yield was higher using dichloromethane (6.2 %) compared to methanol (3.8%) and petroleum ether (2.4 %) while the phytochemical screening revealed the presence of tannins, alkaloids, flavonoids, heterosides, triterpenes, cyanidin and saponosides. Furthermore, it was found that the plant ash was about 24,5 % and its contents of toxic metals such as Hg and Pb were very low which render the plant harmless. Furthermore, the extracts have shown a high ability to scavenge the reactive oxygen species.

**Key words:** Rosmarinus officinalis, Phytochemistry, Trichomes, Oxidative stress, Antioxidants

## PHYTOCHEMISTRY AND ANTIOXIDANT ACTIVITY OF CERATONIA SILIQUA L. PULP EXTRACTS

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### ABSTRACT

Our study focused on a plant native to the Mediterranean region called *Ceratonia siliqua* L. (locally known as Kharoub) belonging to the *Fabaceae* family. It is both a fruit and forest tree widely used in traditional Algerian medicine for its several biological. The aim of this study is to explore the chemical composition and to evaluate the antioxidant activity of the acetone and ethanol extracts obtained from the carob pulp of *C. siliqua* L. The extracts were obtained by maceration with respective yields of 9.337% and 1.53% (w/w). Phytochemical screening revealed the presence of several secondary metabolites in both extracts. The colorimetric determination of total polyphenols by the Folin- Ciocalteu method showed levels of 73.55±0.36 and 20.62±0.76 µg GAE/mg of ethanolic and acetone dry extract respectively, while the dosage of flavonoids on one hand and flavones and flavanols on another hand by the method of aluminum trichloride in the same extracts revealed respective contents 1.884±0.266 and 4.75±0.063 µg QE/mg DE and of 0.486±0.012 and 1.205±0.247 µg QE/mg DE. The condensed tannins determined in the same extracts by the vanillin method showed contents of 134.38±0.537 and 106.685±0.544 µg CE/mg DE respectively. Evaluation of the antiradical power by the DPPH test and that of the reduction of iron FRAP *in vitro* showed activities expressed in CI50 of 54.14 µg/mL and CE50=612.75 µg/mL for the acetone extract and 193.38 µg/mL and 2495.55 µg/mL for the ethanolic one. The phosphomolybdate test showed a total antioxidant capacity expressed in quercetin and ascorbic acid equivalent to 14.44% and 64.66% for the acetone extract; whereas, the ethanolic extract showed activities of 7.20% and 32.22% respectively. These results lead to conclude that acetone extract from carob pulp is richer in active compounds with antioxidant potential and consequently confirms the use of this plant for its therapeutic virtues as a food additive (or complement).

**Key words:** *Ceratonia siliqua* L. , pulp, maceration, ethanol extract, acetone extract, phenolic compounds, antioxidant activity

## PHYTOCHEMISTRY AND ANTIOXIDANT ACTIVITY OF CERATONIA SILIQUA L. SEEDS EXTRACTS

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### ABSTRACT

*Ceratonia siliqua* L. (*Fabaceae* family) locally known as "Kharroub" is a medicinal plant widespread in Algeria. The aim of this work is to valorize this plant via its organic extracts obtained by maceration using two solvents: ethanol and acetone. The respective yields were 2% and 1.15% (w/w). The phytochemical screening showed the presence of several secondary metabolites. Total phenolic contents were determined using the Folin-Ciocalteu reagent, they were  $25.33 \pm 0.07$  and  $63.51 \pm 1.94$   $\mu\text{g GAE/mg DE}$  in ethanol and acetone extract respectively. The determination of flavonoid contents on one hand and flavones and flavonols on another hand was conducted according to aluminum trichloride method, it was  $0.65 \pm 0.02$  and  $12.31 \pm 1.93$   $\mu\text{g QE/mg DE}$  in ethanol and acetone extract respectively for the former, and  $15.03 \pm 0.36$  and  $54.11 \pm 1.29$   $\mu\text{g QE/mg DE}$  for the latter, while the condensed tannins content was determined using vanillin and estimated as  $184.76 \pm 3.25$  and  $225.92 \pm 9.24$   $\mu\text{g CE/mg DE}$  in ethanol and acetone extracts respectively. The antioxidant activity was evaluated by the DPPH test, total antioxidant capacity and the reducing power of ferric iron. For the first test the IC50 was estimated at 1545.78% and 1095.87% for the ethanol and acetone extracts respectively, meanwhile that of BHA is 9.48%. For the second test, using 0.3 ml of the respective extracts and two standards ascorbic acid and quercetin, the results showed an antioxidant capacity of 44.58 - 52.22 % AAE and 9.96- 11.65 % QE. Therefore, the reducing power of ferric iron is 2348.5 and 1609.33  $\mu\text{g/ml}$ , and 50.06 and 38.73  $\mu\text{g/ml}$  for positive control BHA and quercetin respectively. These results demonstrate that acetone extract is richer in active compounds with antioxidant potential and consequently confirm the use of these seeds, then this plant, for its therapeutic virtues as a food additive (or complement).

**Key words:** *Ceratonia siliqua* L., *Fabaceae*, seeds, polyphenols, organic extracts, antioxidant activity

## EXPANDING THE GENETIC BASE OF FLAX FOR IMPROVEMENT OF BIOTIC AND ABIOTIC STRESS TOLERANCE

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### ABSTRACT

Flax (*Linum usitatissimum* L.) is among the highest plant sources of omega-3 fatty acid critical for human and animal health. Cultivated flax is well known to have narrow genetic base due to its domestication, consequently it hindered the progress of genetic improvement and reduced the crop ability to cope with biotic and abiotic stresses. Hybridization with wild species will broaden the genetic diversity and allows introduction of favourable alleles for many traits including disease resistance into cultivated flax. The research was conducted to expand the genetic base of cultivated flax. Several crosses between *L. usitatissimum* and a set of *Linum* wild species were completed. From 213 cross combinations, successful fertilization was observed in cross combinations that used diploid *L. grandiflorum* and *L. decumbens*, and tetraploid *L. grandiflorum* and *L. usitatissimum* pollens to cross with *L. usitatissimum*. Crosses with other species had only limited success. Progeny from crosses between *Linum usitatissimum* x *Linum bienne* are of special interest as *L. bienne* is mostly resistant to pasmo, the most prevalent disease of flax in Canada. The progeny of *Linum usitatissimum* x *Linum bienne* cross, however, exhibits undesirable characteristic of boll dehiscence. A better understanding of the genetic control and molecular mechanisms of boll dehiscence is of great significance for flax breeding. We evaluated boll dehiscence in nine interspecific F2 populations derived from reciprocal crosses between cultivated flax and nine *L. bienne* accessions under controlled conditions. Three populations from reciprocal crosses between CDC Bethune and three *L. bienne* accessions (accessions#19022, 107258, and 19716) with wide distribution of boll dehiscence scores were selected for QTL sequencing to identify genomic regions associated with boll dehiscence. Three to ten potential QTLs associated with boll dehiscence in different populations were mapped on chromosomes Lu1, Lu3, Lu4, Lu6, Lu7, Lu8, Lu10, Lu12, Lu13, Lu14, and Lu15.

**Key words:** Flax, genetic base, wild species, biotic stress, boll dehiscence, QTL-Seq



## FATTY ACID COMPOSITION AND YIELD COMPONENTS OF HEMP (*CANNABIS SATIVA* L.) GENOTYPES OF DIFFERENT ORIGINS CULTIVATED IN LATVIA

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### ABSTRACT

Hemp is an important eco-friendly and multipurpose crop. The present study aim is focused on the variability in fatty acid profile and yield components of two types and seven varieties/lines of *Cannabis sativa* for increasing further the diversity of genetic resources of hemp in order to promote the use of this crop in the food chain for human health and animal welfare in Latvia. Genotypes from diverse European and Latvian origins of oil hemp varieties/lines 'Adzelvieši', 'Pūriņi', KA-2-2011, KA-3-2020, 'Finola', 'Henola' and fiber hemp varieties 'USO 31', 'Austa' were observed. Data for hemp genotypes were collected from the field trials conducted over three years (2020–2022) in the Institute of Agricultural Resources and Economics Department of Plant Breeding and Agroecology at Vilani located in the East part of Latvia in the mild continental humid climate. Linoleic acid (C18:2 n-6) was the predominant fatty acid in all the analyzed oil which covers up 65% of the total fatty acids.  $\alpha$ -Linolenic acid (C18:3 n-3) was the second dominant fatty acid followed by oleic acid (C18:1 n-9) and palmitic acid (C16:0). A well-balanced  $\omega$ -6 to  $\omega$ -3 fatty acid ratio (2.3 – 2.7:1) was determined in all genotypes. All the measured parameters strongly varied under the influence of growing years and genotypes. The most promising hemp genotypes exhibited 'Henola' significantly ( $p \leq 0.05$ ) highest seed yield (3.2 t ha<sup>-1</sup>), highest  $\alpha$ -linolenic (24%) and oleic acid (16%), 'Adzelvieši' highest linoleic (65%),  $\alpha$ -linolenic (28%) and arachidic acid (1.1%), 'Pūriņi' highest 1000 seed weight (13.48 g),  $\gamma$ -linolenic (5%), palmitic (6.3%) and cis-vaccenic (0.9%) acid as well KA-2-2020 highest stearidonic (1.8%) acid compared to all genotypes. Hemp oil contents range from 35.8 ('Austa') to 39.25% (KA-2-2020) were identified.

**Key words:** hemp seed, oil contents, fatty acid profile, 1000 seed weight, genotypes

**COMPARATIVE ASSESSEMENT OF THE PHYSIOLOGICAL AND MORPHOLOGICAL EFFECTS OF AN ORGANIC FERTILIZERS VERSUS A CHEMICAL FERTILIZER ON GREEN BEANS (PHASEOLUS VULGARIS L.)**

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**ABSTRACT**

The present study aimed to conduct a comparative evaluation of the effect of an organic fertilizer versus a chemical fertilizer on the morpho-physiological parameters of green beans. With the increasing demand for sustainable and eco-friendly agricultural practices, it is crucial to explore the efficacy of organic fertilizers in comparison to conventional chemical fertilizers. In this research, a controlled experimental design was employed to assess the impact of two different fertilizers treatments (Fertilizer A, B). Various morpho-physiological parameters including plant height, leaf area, root length, chlorophyll and proline content, were measured and compared among the treatments. The results revealed significant differences in the responses of green beans to the different fertilizers. Organic fertilizers Fertilizers A and, demonstrated favorable effects on the morphological characteristics of green beans, including increased plant height, leaf area, and root length. Additionally, they exhibited a positive impact on chlorophyll and proline content. Furthermore, the organic fertilizers contributed to the improvement of soil fertility and promoted sustainable agricultural practices. The chemical fertilizer, while exhibiting satisfactory results in terms of yield, showed limited benefits regarding other morpho-physiological parameters.

**Key words:** Comparative analysis, plant growth, nutrient uptake, organic farming natural fertilizers, synthetic fertilizers, agronomic performance

## **ROLE OF POST-HARVEST RESIDUE TREATMENT ON THE WHEAT PRODUCTIVITY, FLOUR PROPERTIES AND BREAD-MAKING QUALITIES**

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### **ABSTRACT**

The effect of the soil tillage and sowing machines (Traditional system - TS and Combination system - CS) and of the type of the previous crop post-harvest residue treatment (common bean, maize, sunflower) on the wheat flour properties and bread-making qualities were investigated in six-field crop rotation. The wheat post-harvest residues (PHR) were utilized in three different ways (removed from the field -RF; chopped and subsequently incorporated into the soil - I; and burned - B). The trial was carried out at Dobrudzha Agricultural Institute on Haplic Chernozems. It is characteristic for the research period that the bean predecessor in both systems increases the farinographic evaluations of stability and development time of the dough, degree of softening and the number of the quality coefficient of the flour. Except for the softening degree data, the TS has contributed higher data values for the listed indicators compared to the CS one. Sedimentation and wet/dry gluten content highest after maize predecessor and again with TS. The removal of plant residues from the field leads to an increase in the values of sedimentation (TS-CS), wet gluten (TS), dough stability (TS-CS) and especially the rheological properties. Contrary, incorporation of plant residue into the soil leads to a noticeable decrease in the values of these indicators. However, in the case of CS, the same leads to an increase in the values of the degree of softening. It was also found that the burning of post-harvest residues and CS leads to higher values of wet gluten and increases the extensibility of the dough. The years with an optimal combination of the main meteorological elements (2017) have a significant contribution to obtain higher values for sedimentation, wet/dry gluten and farinographic indices for quality. In years with an insufficient amount of precipitation combined with higher temperatures in critical phases of the permanent wheat vegetation (2018), the development time and degree of softening of the dough are higher compared to the other years. Bread volume is the quality characteristic that is practically unaffected by the way of using the post-harvest residues and by its interactions with other factors in both tested systems. Its values in both systems are mainly influenced by the meteorological factor, and this fact is to a much greater extent valid for TS compared to CS. Multiple correlations were established between the tested qualitative characteristics of the tested indicators by years of research and average for the period. They differ both in the direction of interaction and in the strength of the correlation dependences by sowing systems.

**Key words:** ways of utilization of post-harvest residue, wheat, flour properties, bread-making qualities

## EVALUATION OF PHYTOSANITARY PRESSURE IN CEREAL GROWING IN AN ARID REGION

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### ABSTRACT

This study focuses on phytosanitary practices in cereal growing in the region of Biskra south-east of Algeria. It is based on field surveys of 259 farmers used to calculate phytosanitary pressure indices (FTI and PPI). The results of the surveys show that the majority of cereal farmers protect their crops against various pests, particularly weeds. However, a wide range of active ingredients has been identified, mainly Cloquintocet-Mexyl, Clodinafop-Propargyl and 2.4 D. Fourteen active ingredients are moderately dangerous (class II) according to the WHO. However, our study confirms an uncontrolled use of pesticides. Namely, the non-respect of the DAR and its ignorance, the bad dosages of pesticides and the non-respect of the treatment periods. The lack of supervision does not allow cereal producers, the majority of whom are illiterate or with a low level of education, to use phytosanitary products in a reasoned way. The assessment of the consequences of these practices is based on the calculation of the Treatment Frequency Indicator (TFI) and the Phytosanitary Pressure Index (PPI). These indices make it possible to classify the study sites according to the level of risk linked to the use of pesticides generated by the phytosanitary practices of cereal farmers in each site. The use of these indices shows that the total Plot TFI (herbicide TFI and non-herbicide TFI) is greater for durum wheat and soft wheat compared to barley. However, a very strong phytosanitary pressure of cereal crops is recorded in the site of Ain Naga (IPP=2.60) and strong phytosanitary pressures of these crops are exerted at the level of the sites of El feidh, El Outaya, Mlili, Oumeche and Ourllal. Whereas, the Doucen site presents a moderate pressure. These practices can contribute to lower cereal yields and can also cause environmental pollution that has consequences on human and animal health that are not targeted, due to the phenomena of bioaccumulation and biomagnification at the top of the food chain. For this, the mastery of phytosanitary practices imperatively requires the training, awareness and monitoring of cereal farmers in order to ensure the sustainability of agriculture and therefore the protection of human and animal health and the environment.

**Key words:** cereals, phytosanitary practices, survey, PPI, FTI, arid region

## DIAGNOSIS OF AGRICULTURAL PRACTICES OF QUINOA CULTURE IN ALGERIAN ARID REGIONS

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### ABSTRACT

Quinoa is a crop with high nutritional value and resistance to extreme environmental conditions. Since its introduction in 2014, it has been the subject of studies of its adaptation to the agro-ecological conditions of Algeria. The present study is carried out at the level of three regions, Biskra, El-oued and El Mgheir belonging to the Saharan bioclimatic stage, essentially aiming to evaluate the introduction of the culture of quinoa (*Chenopodium quinoa* Willd) in an arid environment by studying, the influence of cultural practices on the production of this crop. The field survey allowed us to diagnose the situation of this new crop in these regions, to assess the perception of farmers on its cultivation and its use, as well as to study its socio-economic situation and the potential for extend its practice and include it in the culinary habits of Algerian society. Indeed, the sandy-clayey texture of these regions is considered to be the best texture that promotes the development of quinoa cultivation and gives the best yields. Most farmers perform plowing as a primary step in seedbed preparation. To this end, we found that 63.64% of farmers perform shallow plowing and 36.36% of them do not practice plowing. However, fertilization having a considerable effect on the yield of quinoa cultivation, mainly sheep manure, the results of the survey reveal that 90.9% of farmers amend their soils with organic manures against 9.1% fertilize with mineral fertilizers. The most cultivated varieties in the farms studied are ammarilla sacaca (54.55%), followed by (Q101; 102; 104; 105, Giza01 and 02; Santa maria) cultivated by 27.27% of farms. While, Q black, Q105, Q102 represent 18.18% of cultivated varieties. Mechanized sowing is only practiced by 36.36% of farmers and the drip system is the most used for irrigation. Regarding protection, (63.64%) of farmers weed their plots while birds remain the biggest problem farmers face (66.67%). The majority of farmers with a university education level find that quinoa cultivation is easy to practice and (88.89%) of them choose the varieties according to the main production criteria (germination capacity, production capacity, resistance to diseases and pests). On the other hand, few farmers (11.11%) are interested in their choices only by the production capacity. All of the respondents know the Technical Institute of Saharan Agriculture (ITDAS) which supplies 54% of these seeds and its extension system intended for farmers in the various agricultural fields. About 1/3 of the seeds harvested (72.73%) are directed towards marketing, 18.18% of the seeds are presented in the popularization days of the technical institutes of agriculture and in the trials of university students. While 9.09% is kept by farmers for personal use. The majority of farmers (81.82%) use their product for human food, preparing various dishes and recipes such as salads, soups and biscuits. While the other respondents keep their product in order to reuse it in the new campaign. A real willingness is shown by farmers to try quinoa cultivation and they claim that the cultivation operations are easier to master. They hope to develop and intensify this culture, despite the obstacles they encounter such as the lack of mechanization, in particular the operation of sowing, harvesting and transformation of the raw material into a ready-to-eat product (saponin elimination). Although the culture of quinoa is newly introduced in these areas, it is necessary to study more deeply the cultural practices and test their adequacy in order to develop this culture. Finally, the development of quinoa cultivation in arid regions is necessary to take advantage of its benefits.

**Key words:** Survey, Quinoa, agricultural practices, arid regions, Algeria

## **SEEDYIELD AND PROTEIN CONTENT IN SOME BULGARIAN SUNFLOWER HYBRIDS**

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### **ABSTRACT**

The aim of this research was to investigate the correlations on seed yield and protein content in sunflower hybrids. The field experiment was carried out at Dobudzha Agricultural Institute, General Toshevo location. Four sunflower hybrids were examined. Three hybrids are conventional (Linzi, Deveda, Krasela) and one is Clearfied Plus - Dalena CLP. The trial was arranged as randomized complete block desing whit three replications. Analysis of variance (ANOVA) showsd interactions seeds yield and protein content. The highest seeds yield found in hybrid Deveda (4.77 t/ha) and Krasela (4.34 t/ha). Significantly higher protein content, showed hybrid Linzi (16.94%). Protein content above the overall average value, was achieved in hybrid Dalena CLP (16.11%).

**Key words:** hybrid, protein content, seed yield, sunflower

## CONTENT ESSENTIAL MACRONUTRIENTS IN THE ORGANS OF SUNFLOWER (HELIANTUS ANNUS) - HYBRID DEVEDA DEPENDING ON THE MAIN TILLAGE SYSTEM

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### ABSTRACT

During the period from 2016 to 2022, the changes in the concentration of main macroelements in the organs of hybrid Deveda depending on the application of main soil tillage (MSTS) were tracked. The research was conducted on slightly leached Chernozems (Haplic Chernozems) in the experimental field of the Dobrudzhan Agricultural Institute - General Toshevo. The tested systems for MSTS are: 1. CP - conventional plowing (24-26 cm); 2. D - disking (10-12 cm) 3. C – cutting (chisel-plough); 4. NT - No-till (direct sowing); 5. Conventional plowing (for spring crops) - No-till (for wheat) - CP-No-till; 6. Cutting (for spring crops) - Disking (for wheat) - C-D and 7. Conventional plowing (for spring crops) - Disking (for wheat) - CP-D. The first four were applied continuously and independently in the 4-crop rotation (beans-wheat-sunflower-maize). The other three involve alternating between them. The mineral fertilization in the crop rotation was as follows: Common bean – N60P60K60; Wheat – N120P120K60; Sunflower - N60P120K120 and Maize – N120P60K60. The years and methods of soil cultivation are the basis of the highly varying values in the concentration of macroelements in the sunflower organs. Of all the organs, the defatted kernel of the sunflower seed has the highest concentration of nitrogen. It varies from 9.10 %N (2016) to 8.18 % N(2020). MSTS have significantly less influence, because the average variation is from 8.69% N and 8.68% N (in the 1. CP) to 8.40 % N (6. C-D). The content of phosphorus in the defatted kernel is also characterized by a strong dynamic in the values - from 1.70 %P<sub>2</sub>O<sub>5</sub> (2017) to 5.06 %P<sub>2</sub>O<sub>5</sub> (2020). Depending on the tillage systems, this variation is much weaker - from 3.96%P<sub>2</sub>O<sub>5</sub> (5. CP-No-till) to 5.06% P<sub>2</sub>O<sub>5</sub> (4.No-till). The indicated trends regarding the influence of the tested factors on the chemical composition of the defatted kernel were fully confirmed for the other organs as well. It was found that the head (without the seeds), followed by the defatted kernel and the vegetative mass, are distinguished by the maximum concentration of potassium. The concentration of nitrogen, phosphorus and potassium remained at the lowest values in defatted husks. Systems involving deep tillage lead to an increase in nitrogen concentration in the organs of the vegetative mass (leaves and stems).

**Key words:** main tillages systems, sunflower, NPK% concentration, organs



## CONTROL OF POLLEN BEETLE (*MELIGETHES AENEUS* F.) IN OILSEED RAPE USING INSECTICIDE LAMBDA-CYHALOTHRIN

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### ABSTRACT

Many harmful insects with different economic influences are part of oilseed rape production. Therefore, the protection of this crop is highly challenging. Pollen beetle (*Meligethes aeneus* F.) is the most significant oilseed rape pest during spring. This pest occurs regularly in diverse intensities which impacts chemical control that is carried out every year, in almost all areas where oilseed rape is grown. In this study, the experiments were carried out during April 2023 at three localities in the northern part of the Republic of Serbia, according to EPPO methods in the rapeseed fields (hybrid LG Architect and variety NS Zlatna). The plant protection product (PPP) based on lambda-cyhalothrin (250 g a.s./l preparation, CS) was applied in the amount of 0.05 and 0.07 l/ha, PPP with 100 g a.s./l (CS) was applied in the amount of 0.125 and 0.175 l/ha, while PPP with 50 g a.s./l (CS) was used in the amount of 0.35 l/ha. The treatment was carried out foliar, when the oilseed rape was in the BBCH 52-55 stage. The efficacy of PPP was determined according to Henderson and Tilton and ANOVA. Before setting up the trial, the average number of imago pollen beetles by variant ranged from 60.5 to 615.3, i.e. 1.2 - 12.3 on inflorescences. One day after the application of the PPP, the number of rapeseed pollen beetles was at a significantly lower level compared to the control, and the efficacy ranged from 63.4 to 95.1%. After four days, the efficacy was 74.8-91.1%, and the number of rapeseed pollen beetles was still at a significantly lower level compared to the control. Ten days after the application of lambda-cyhalothrin, the number of pollen beetles was at a significantly lower level compared to the control, with an efficacy of 71.8 - 87.6%, depending on the PPP, applied amount, and localities. The obtained results indicate that the pollen beetles showed significant sensitivity to lambda-cyhalothrin, which enables the continued use of this insecticide in controlling of *M. aeneus*.

**Key words:** *Meligethes aeneus*, lambda-cyhalothrin, efficacy

## THE NUTRITIONAL VALUE OF TWO FODDER PLANTS (*MEDICAGO SATIVA* L. AND *CYPERUS ROTUNDUS* L)

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### ABSTRACT

The study of the nutritional value of two fodder plants (*Medicago sativa*; and *Cyperus rotundus*) taken from an arid region located in the south-eastern of Algeria (Biskra) was carried out during the flowering stage of the two plants. The following were analyzed for their contents: dry matter (DM), mineral matter (MM), organic matter (OM) and nitrogenous matter (MA). Chemical analysis of these fodder plants has shown that they are different in several nutrient constituents and that they have important nutritional value hence their use as green fodder for livestock. The fodder plants studied are rich in dry matter (DM) The rate of dry matter at *Medicago sativa* is 13.07% however at *Cyperus rotundus* is 8.89%. The organic matter content of the two fodder plants analyzed has an average of 94.08% for *Cyperus rotundus*, and 91.11% for *Medicago sativa*. However, mineral matter has low values, the lowest rate is noted in the *Cyperus rotundus* species 5.92 % against 8.89 % in the *Medicago sativa* species. The nitrogen contents of the two fodder plants studied are very low with a value of 4.68% for *Medicago sativa* and 1.55% for *Cyperus rotundus*.

**Key words:** *Medicago sativa*, *Cyperus rotundus*, dry matter, organic matter, nitrogen, mineral matter

## CHANGES IN THE NITROGEN CONCENTRATION IN THE ORGANS OF WINTER WHEAT VARIETIES DEPENDING ON THE AGRICULTURAL PRODUCTION SYSTEM

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### ABSTRACT

The aim of the study was to characterize the changes in nitrogen concentration in the organs of 5 varieties of *Tr. aestivum* L., selected at the Dobrudzhan Agricultural Institute - General Toshevo, grown in transition to organic production (TOP) and conventional production (CP) during the period 2018-2020. The tested varieties - Dragana, Rada, Pchelina, Kocara and Kalina were grown after 4 predecessors (winter canola, spring peas, sunflower and corn for grain). At CP, four levels of nutritional regime were tested, differentiated depending on the type of predecessor: after spring peas 0, 30, 60 and 90 kg N/ha, and after the others - 0, 60, 120 and 180 kg N/ha. Nitrogen fertilization is on a phosphorous-potassium background of 60 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O/ha. In both agricultural systems for the production of wheat, the concentration of nitrogen in the organs of the crop in the final phase varies significantly depending on the tested factors in the experiment. In TOP, the nitrogen content of the leaves is influenced to the maximum extent by the type of the predecessor. For the concentration of nitrogen in the stems and the non-grain part of the spike, the meteorological conditions during the years of research are decisive, and for the nitrogen content in the grain/protein - the variety. In 2018 and 2019, the grain of the tested varieties had the highest protein content after the predecessor pea, and in 2020 - after corn. In TOP, the varieties Pchelina and Rada are distinguished by a higher protein content compared to the others. A persistent trend was found for a highly positive correlation of nitrogen concentration in the grain with that in the stems and non-grain part of the spike. In the case of the conventional production system (CP), the reliability of the influence of the tested factors on the nitrogen concentration cannot be doubted. However, mineral fertilization has a determining role for the dynamics of nitrogen concentration in leaves, stems and grain, while that in the non-grain part of the spike - the conditions of the year. The influence of the meteorological factor significantly precedes that of the predecessor and the variety. It was established that the concentration of nitrogen in the organs of the vegetative mass is more strongly influenced by the type of variety, while that in the grain - by the type of the predecessor. The organs of wheat are distinguished by the maximum concentration of nitrogen in the variants with the participation of the highest nitrogen rate. Cultivation of the varieties after a maize predecessor results in higher nitrogen concentrations remaining in the organs of the non-economic part of the crop (vegetation mass). At CP, on average for the studied period, wheat forms a grain with the highest protein content after the predecessor winter oil rap. As with TOP, the varieties Pchelina and Rada are distinguished by a higher protein content compared to the others. As a result of mineral fertilization, the concentration of nitrogen in the organs of wheat grown under CP is higher than the same under TOP. The most significant dynamics by year was found in the nitrogen content in the leaves, where the excess was respectively 87.85% (2018), 78.89% (2019) and 18.47 (2020). For grain, these values are respectively - 38.15%, 25.40% and 9.03%.

**Key words:** winter common wheat, N concentration by organs, transition to organ production, conventional production

## USES OF POST-HARVEST RESIDUES AND THEIR INFLUENCE ON GRAIN PRODUCTIVITY AND GRAIN PHYSICAL PROPERTIES OF WINTER WHEAT

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### ABSTRACT

The investigation was carried out at Dobrudzha Agricultural Institute during 2017-2019. The effects of the traditional (TS) and combining (CS) soil tillage systems and sowing machines, the type of the previous crop post-harvest residue (common bean, maize, sunflower) and their treatment on the yield from cv. Enola (*Triticum aestivum* L.) was investigated in six-field crop rotation. The spring crop post-harvest residues (PHR) were utilized in three different ways - removed from the field (RF); burned (B) and chopped and subsequently incorporated into the soil (CSIS). During the studied period, a wide dynamic was established in the productivity of the wheat, depending on the type of the predecessor and the method of utilization of its plant residues. The traditional system of soil preparation and wheat sowing for the Dobrudzha region provides higher yields compared to the combined system in all years of the study. The average increase is 352.17 kg/ha (6.61%). The role of the predecessor also has a stronger impact on productivity in the TS. The cv. Enola was expected to have the highest yields in both systems after the predecessor bean. The lowest productivity in the experiment was found after the predecessor sunflower, where the biggest difference between the systems was also found - 552.30 kg/ha in favor of the TS. To obtain the maximum expression of the productive possibilities of the wheat, a differentiated approach to the ways in which we will use the post-harvest residues (PHR) of the predecessor and the technical means for this is required. In areas with minimal presence of PHR, the CS of soil preparation and sowing contributes to obtaining 403.3 kg/ha more compared to TS one. However, it is extremely unsuitable in cases of burning the residues or their complete plowing. The use of the TS in such situations provides higher yields compared to the CS with 314.1 kg/ha (B) and 1145.8 kg/ha (CSIS), respectively. The TS definitely contributes to obtaining a larger grain compared to the CS one of the tested predecessors and ways of utilizing their plant residues. The grain hectoliter is mainly influenced by the weather conditions of the years, but not by the sowing systems. Its values do not always follow the established trends for the mass of 1000 grains and are characterized by a weaker, although reliable, dynamics. Strength of effect of each of the tested factors on the values of the studied indicators was determined. The correlative dependence between the productivity of the variety and the hectoliter weight of the grain is reliable. The correlation with TS has higher coefficient values (0.615\*\*) compared to that with CS (0.486\*\*). The relationship between the yield and the 1000 kernel weight is negative and unreliable. There is a positive and reliable correlative relationship between the two indicators characterizing grain physics.

**Key words:** utilization of post harvest residue, wheat, yields, grain physical properties

**IN RURAL AREAS INTERNET CONNECTION PROBLEMS AND SOLUTION  
RECOMMENDATIONS EXPERIENCED IN THE PROCESS OF USING SMART  
AGRICULTURE METHODS IN OLIVE FARMING**

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**ABSTRACT**

The olive is one of the most important crops grown in the Mediterranean region, both in terms of total surface area and its socioeconomic and environmental impacts. Olive and olive oil are the essential components of the Mediterranean diet and are largely consumed in the world. It is very significant to provide economic and environmental sustainability by better managing scarce natural resources in olive farming. Modern planting systems, mechanization and digitalization are taking place rapidly in olive farming around the world. In Türkiye, olive production mostly is done with traditional methods, and most producers belong to rural communities. The rise of new technologies, such as the Internet of Things, is expected to contribute to the increase of the productivity of agricultural and farming activities by improving yields and reducing cost. Olive fruit fly is the primary pest of olive and causes a significant amount of yield and quality losses. Using early warning systems could accurately determine the spraying times by using climate data in the control of diseases and pests in olive orchards. In this research; at the workshop organized within COMECT, an EU HORIZON project (Project aims to contribute to a balanced territorial development of the EU's rural areas and their communities by making smart agriculture) the views of 65 selected olive producers on the use of early warning systems, their connection status and the problems experienced were evaluated. As a consequence in this study connection problems and solution recommendations were underlined and recent developments in this area were discussed with cost-effective and environmentally friendly approaches.

**Key words:** Olive farming, smart agriculture, sustainability, environment, olive producers

**EFFECTS OF DIFFERENT POLYETHYLENE GLYCOL (PEG)  
CONCENTRATIONS ON GERMINATION AND ROOT LENGTH OF SOYBEAN  
[GLYCINE MAX (L.) MERR.]**

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**ABSTRACT**

Osmotic stress affects water availability, which can significantly impact seed germination and seedling growth. Polyethylene glycol (PEG) creates negative water potential on the outside of the seed, thereby impeding the ingress of water into the seed and impeding the initiation of germination. High concentrations can seriously impede seedling growth, leading to stunting and even necrosis. This investigation aimed to examine the impact of different PEG concentrations, specifically 0%, 10%, 15%, 20%, 25%, and 30% with three replications on both the germination rate and root length in soybean. The germination rate and root length were assessed every day over a period of six days. The control group showed a germination rate of 100.00%, while the groups exposed to a 10% PEG concentration displayed germination rates ranging from 90.00% to 100.00%. In contrast, experimental groups with high PEG concentration shows reduced rates of germination whereas zero germination were occurred in the groups with 25% and 30% PEG concentrations. In addition, the roots length also exhibited a decline as the concentrations of PEG increased. The results of this study emphasize the negative effects of increased PEG concentrations on both the germination process and root length in soybean plants.

**Key words:** Osmotic stress, Polyethylene Glycol, Soyabean

## RECENT ADVANCES IN THE USE AGRICULTURAL-BASED MATERIALS FOR WASTEWATER TREATMENT

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### ABSTRACT

Nowadays, pollution of surface and ground water resources is a global issue to address with the rapid growth of industrialization and agriculture. Consequently, value-added and inexpensive materials using either agricultural or industrial wastes have become common and feasible alternatives for wastewater treatment [1]. The application of adsorbents and biochar-based photocatalysts utilizing the waste products of the agricultural sector, mostly sugarcane bagasse, rice husk, and coconut husk, has received considerable interest in eliminating recalcitrant pollutants from water [1, 2]. The preparation of biochar-based TiO<sub>2</sub> and ZnO photocatalysts composed of agricultural by-products supports them to have a higher degradation efficiency of organic compounds as well as promotes a high eco-efficiency. Moreover, these photocatalysts open a new way for further developments to overcome the limitations of TiO<sub>2</sub> and ZnO that lower the application performance due to the reduction of the band energy gap and the recombination of electron/hole pairs.

**Key words:** Agricultural-based materials, agricultural wastes, biochars, photocatalysis, water treatment



## SUNFLOWER HYBRID SEED PRODUCTION - CHALLENGES AND PERSPECTIVES

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### ABSTRACT

The introduction of sunflower hybrids into production became possible after the discovery of the CMS source in 1969. The first hybrids were put into production in Romania, Yugoslavia and France at the end of the eighties of the last century. Today, sunflowers are grown on over 28 million hectares in the world, and hybrid seeds are sown on over 85% of this area, the rest of the area is still occupied by open-pollinated varieties. The production of hybrid seeds involved certain specificities. Since the female and male parental lines often do not have the same length of vegetation, they need to be sown at different times to achieve a flowering match. This problem was largely overcome by introducing recessive branching into the male line, which extended its flowering period. The main problems in production are related to fertilization, which can lead to low seed yields. The reasons for poor fertilization lie in incompatibility, low attractiveness for pollinators and other factors. These problems are overcome by finding lines with good compatibility, changing the ratio of the number of rows, increasing the number of hives/ha, but also by using preparations based on pheromones that increase bee visits. A successful hybrid must be good and yielding in seed production too, otherwise its production is not worthwhile. The decrease in the number of wild pollinators and the problems in beekeeping have a direct impact on the success of sunflower seed production, except in areas where pollination is carried out by hand. The increase in the area under commercial sunflower in the world makes it difficult to find areas for seed production. The necessary spatial isolation for the production of seeds of the C1 category used to be 3 km, but now in some countries it has been reduced even to 500 m., which makes it easier to find areas for production but leads to other problems related to the genetic purity of the seeds. Multiphase sowing complicates the fight against weeds due to the need for multiphase treatments, this is greatly facilitated by the introduction of hybrids tolerant to certain groups of herbicides. Recently, a large number of fungicides and insecticides for seed treatment have lost their registration in certain countries. This primarily affects the quality of seed treatment of all seed categories and therefore production, but also leads to restrictions on seed trade due to uneven legal regulations between countries. Chemical desiccation is a necessary measure in the production of hybrid sunflower seeds, but most desiccants have lost their registration and new solutions are not yet on the horizon, which will further complicate the production of quality seeds. Finally, the situation caused by the Covid-19 epidemic and especially the restrictions on the production and trade of seeds in the two largest sunflower producing countries (Ukraine and Russia), caused by the current political situation, led to additional challenges. In order to produce sufficient quantities of high-quality hybrid sunflower seeds in the future, it will be necessary to constantly work on the permanent improvement of the technological process itself,

as well as on overcoming all other obstacles in the production and trade of seeds. Without quality seeds, it will not be possible to successfully produce sunflowers on ever-larger areas.

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**Key words:** sunflower, hybrid, seed production, pollinator, seed treatment, spatial isolation

## NEGLECTED AND UNDERUTILIZED A CROP IN TURKEY: LINSEED (*LINUM USITATISSIMUM* L.)

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### **ABSTRACT**

Linseed (*Linum usitatissimum* L.) is the only economically important crops species of the Linaceae family, which includes 13 genus and 300 species. It has two different types, is an annual industrial crop used in fiber and oil production. The tall, high branching types with strong fibers are grown for fiber production and the short, partially low branching types are grown for oil production. Linseed contain 30-45% oil and are an important raw material for the dye and varnish industry as the oil has a natural drying characteristic. Linolenic fatty acid (omega-3) content of linseed oil is high and in recent years, its varieties with high quality oil for edible use have been developed using some breeding methods. Despite the many uses of linseed, it has remained a minor or alternative oilseed crop in Turkey. Therefore, scientific research on this crop is necessary and popularize it as a commercial crop for edible oil, dye and varnishes industry, source of  $\alpha$ -linolenic acid, quality and cool keeping fabric. In addition, if the cultivation of oilseed flax can be expanded in our country and cultivated primarily in fallow areas, it can be one of the alternative oilseed crops that have the potential to close the vegetable oil deficit of Turkey.

**Key words:** oilseed crops, linseed, flax, neglected crops

## DEVELOPMENT OF ORGANIC SOYBEAN GROWING IN POLAND

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### ABSTRACT

Poland imports much more protein crops, especially soybean meal, than its own domestic production. In Poland the main protein crops used to be lupin (at present mainly the blue one *Lupinus augustifolium*), pea (*Pisum sativum*), horse bean (*Vicia faba*), which occupied in 2022-2023 the area of 150, 110 and 36 thousands ha, respectively. The latest data show that soybean (*Glycine max*) is already one of the main pulse crops in Poland, with the area of 46 thousands ha. Due to high protein and fat content it is more and more demanded by feed industry, especially organic one. For decades predominating opinion was that soybean cannot be grown in Poland on bigger scale (especially in northern Poland) due to environmental constrains (too cold and too long days). However in last decades climate has been change considerably - there is much less rainfall (soybean easier than other above mentioned pulses tolerates droughts) and much higher temperature. Data from northern Poland (namely Meteorological Station of University of Warmia and Mazury in Bałcyny near Ostróda) show that in the period of 1980 – 2020 the average annual temperature rose by more than 1°C. Moreover in the last decades more and more soybean cultivars has been bred which are suitable to be grown in north part of Europe. In the period of 2004-2022 few field studies has been done, both at agricultural experimental station and at organic farmers fields (on-farm research) to improve organic method of soybean growing. Two main obstacles to be overcome were: development and availability of effective strains of *Bradyrhizobium japonicum* for inoculation, and development of effective methods of non-chemical weed control. Since few last years effective inoculates for soybean are available and the problem of too high weed infestation is less problematic. Thanks to new machinery (e.g. precision row-crop cultivator with camera steering system and rotative weeder) weed control is more effective and less time demanding, so the crop can be grown on bigger areas. Yields of organically grown soybean varied a lot: from below 1 ton per ha to over 4 tons per ha. Soybean yields mainly on soil quality, weather conditions, cultivar selection. There are also substantial differences in crude protein (28 – 43%) and crude fat content (17 – 23%). The lower soil quality (more sandy soil) the higher oil content and the better soil quality (especially higher humus content) the higher protein content.

**Key words:** soybean, organic farming, cultivar selection, weed control, yield

## SOIL FERTILITY, PRODUCTIVITY AND CARBON STOCKS OF DIFFERENT OIL PALM (*ELAEIS GUINEENSIS*) HYBRIDS IN TUNGABHADRA COMMAND AREA OF KARNATAKA.

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### ABSTRACT

Oil palm belongs to the genus, *Elaeis* (from Greek, meaning "oil") containing two species, *Elaeis guineensis* and *Elaeis oleifera* and it belongs to family of Palmae. Oil palm is a perennial crop growing for the production of palm oil. It is one of the highest oil yielding crops derived from the mesocarp (reddish pulp) of the fruit among the all perennial crops. A study was undertaken in All India Co-ordinated Research Project on Palms (Oil palm), Agricultural Research Station, Gangavathi, Koppal District of Karnataka which belongs to Northern Dry zone of Karnataka (Agro climatic Zone no-3). The hybrids used were NRCOP-1, NRCOP-2, NRCOP-3, NRCOP-4, NRCOP-5, NRCOP-6, NRCOP-7, NRCOP-8, NRCOP-9 and NRCOP-10. The maximum palm height 3.45 m was recorded in NRCOP-1 and significantly higher palm girth was recorded in NRCOP-2 (2.9 m). The highest annual leaf production was recorded by NRCOP-1 (17.1) whereas, the minimum number of male inflorescence was recorded by hybrid NRCOP-2 (4.4) and maximum number of female inflorescence was found in NRCOP-9 (9.0) and NRCOP-9 (14.9) possessed highest number of total inflorescence and the sex ratio varied among different oil palm hybrids, the highest sex ratio was noticed in NRCOP- 4 (62.1%). The number of bunches was significantly higher in NRCOP-9 (8.9), mean bunch weight was in the range of 10.6 -15.8 and the highest FFB yield palm-1 was recorded in NRCOP-4 (109.09 kg) and the significantly higher fresh fruit bunch yield of 15.6 t ha<sup>-1</sup> was noticed in NRCOP- 4. The soil pH varies with depth. Maximum pH was in the rhizosphere of NRCOP-1(8.45) for 0-25 cm soil depth and in 25-50 cm it was higher in the rhizosphere NRCOP-1(8.42). EC decreased with increasing depth with highest value recorded in the rhizosphere of NRCOP-1(3.87ds m<sup>-1</sup>) over other different hybrids of oil palm. Bulk density was increased with soil depth in all hybrids. At surface soil (0-25 cm) the maximum inorganic carbon (%) was recorded in the rhizosphere of NRCOP-3 (0.40%). At surface soil (0-25 cm) significantly higher organic carbon was recorded in the rhizosphere of NRCOP-1(0.83%) and highest organic carbon was found in the rhizosphere of NRCOP-6 (0.65%) at sub-surface soil (0-25 cm). In 25-50 cm, the available nitrogen was highest in the rhizosphere of NRCOP-1(363.23 kg ha<sup>-1</sup>). Available phosphorus content varied significantly w.r.t. different oil palm hybrids and also soil depth. It was in the range of 31.90-51.26 kg ha<sup>-1</sup> in surface soil where as in sub surface soil it is in the range of 26.67- 48.17 kg ha<sup>-1</sup>. Available potassium was in range of 489.82 to 540.59 kg ha<sup>-1</sup>. Total biomass in ten different oil palm was statistically significant and the highest was noticed NRCOP-1(8.85 t ha<sup>-1</sup>) and the highest standing biomass was recorded in NRCOP-1(54.23 t ha<sup>-1</sup>) whereas the highest above ground biomass carbon stock was recorded in NRCOP-1(27.12 t ha<sup>-1</sup>) and highest below ground biomass stock was recorded in NRCOP-1(8.14 t ha<sup>-1</sup>). At surface soil (0-25 cm) the highest soil organic carbon stock was recorded in NRCOP-1 (31.54 t ha<sup>-1</sup>) while at subsurface soil (25-50 cm) the highest soil carbon stock was recorded in NRCOP-1(24.34 t ha<sup>-1</sup>). The soil inorganic carbon stock was recorded higher in NRCOP-3 (15.27 t ha<sup>-1</sup>). The highest total carbon stock was recorded in NRCOP-1(121.08 t ha<sup>-1</sup>) among the 10 hybrids of oil palm. **Conclusion:** Oil palm hybrid NRCOP- 4 recorded significantly

higher fresh fruit bunch yield 15.6 t ha<sup>-1</sup> and it was suitable to Gangavathi region. Oil palm is one of perennial crop stores 121.08 t ha<sup>-1</sup> carbon that is highest soil carbon stocks compared to agricultural systems. So, the policy makers should give immense importance to afforestation projects and mitigation of deforestation.

**Key words:** Oil palm, carbon stock, productivity, soil fertility

## LEGUMES IN TERMS OF SUSTAINABLE AGRICULTURAL PRACTICES FOR GLOBAL WARMING AND CLIMATE CHANGE

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### ABSTRACT

The study was carried out in 2021/22 with chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* M.) varieties in 5 different locations in the Konya closed basin of Turkey's Central Anatolia region, where dry conditions are experienced. Sowing was done by two methods: traditional and direct sowing. For the purpose of the study, the role of legumes in increasing soil fertility and farmer income, adaptation to climate change and reducing global warming in a region with a high risk of desertification and low organic carbon was investigated. In the study, by planting without tillage, there was no productivity loss while saving about 5 lt/da of fuel. It has been determined that planting without tillage saves 11.7 tons of water per decare compared to traditional planting. The amount of CO<sub>2</sub> emission was 17.5 times higher in traditionally sown chickpeas than directly sown and 18.4 times higher in lentils. This study has shown that despite the extreme drought in the region and year where the experiment was established, chickpeas and lentils can play an important role in the dry farming system with their yield performance and can make a significant contribution to the environment in terms of climate change and carbon emissions by ensuring more moisture and nitrogen retention in the soil.

**Key words:** Chickpea, lentil, direct planting, conventional planting, CO<sub>2</sub> emission, global warming, saving on water, yield

## **EFFECTS OF DIFFERENT SALT DOSES ON SEEDLING GROWTH AND RELATIVE WATER CONTENT OF SUNFLOWER (*HELIANTHUS ANNUUS* L.)**

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### **ABSTRACT**

This study was conducted to determine the effects of different salt doses on seedling growth and relative water content of sunflower (*Helianthus annuus* L.) varieties. In the study, three sunflower varieties [Pioneer MM54 (C1), Pegaz (C2), Buleria (C3)] and three different salt doses [0 (control) (S1), 50 mM (S2), 100 mM (S3)] were used. In the study, seedling length (SL), root length (RL), seedling fresh weight (SFW), root fresh weight (RFW) and relative water content (RWC) characteristics were examined. As a result of the study, it was determined that there were generally decreases with increasing salt doses in all varieties in terms of the parameters examined. It was determined that the highest salt dose applied in the study (100 mM) had a greater negative effect on seedling, root development and relative water content. In terms of varieties, it was determined that the Pioneer MM54 variety was more tolerant to salt applications than other varieties.

**Key words:** abiotic stress, relative water content, salt tolerance, sunflower



## **ROLE OF POST-HARVEST RESIDUE TREATMENT ON THE WHEAT PRODUCTIVITY, FLOUR PROPERTIES AND BREAD-MAKING QUALITIES**

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### **ABSTRACT**

The effect of the soil tillage and sowing machines (Tradicional system - TS and Combination - CS) and of the type of the previous crop post-harvest residue treatment (common bean, maize, sunflower) on the wheat flour properties and bread-making qualities were investigated in six-field crop rotation. The wheat post-harvest residues (PHR) were utilized in three different ways (removed from the field -RF; chopped and subsequently incorporated into the soil - I; and burned - B). The trial was carried out at Dobrudzha Agricultural Institute on Haplic Chernozems. It is characteristic for the research period that the bean predecessor in both systems increases the farinographic evaluations of stretchability and stability of the dough, degree of softening and the number of the quality coefficient of the flour. Except for the softening degree data, the TS has contributed higher data values for the listed indicators compared to the CS one. Sedimentation and wet/dry gluten content highest after maize predecessor and again with TS. The removal of plant residues from the field leads to an increase in the values of sedimentation (TS-CS), wet gluten (TS), dough stability (TS-CS) and especially the rheological properties. Contrary, incorporation of plant residue into the soil leads to a noticeable decrease in the values of these indicators. However, in the case of CS, the same leads to an increase in the values of the degree of softening. It was also found that the burning of post-harvest residues and CS leads to higher values of wet gluten and increases the extensibility of the dough. The years with an optimal combination of the main meteorological elements (2017) have a significant contribution to obtain higher values for sedimentation, wet/dry gluten and farinographic indices for quality. In years with an insufficient amount of precipitation combined with higher temperatures in critical phases of the permanent wheat vegetation (2018), the dough extensibility and degrees of softening are higher compared to the other years. Bread volume is the quality characteristic that is practically unaffected by the way of using the post-harvest residues and by its interactions with other factors in both tested systems. Its values in both systems are mainly influenced by the meteorological factor, and this fact is to a much greater extent valid for TS compared to CS. Multiple correlations were established between the tested qualitative characteristics of the tested indicators by years of research and average for the period. They differ both in the direction of interaction and in the strength of the correlation dependences by sowing systems.

**Key words:** Ways of utilization of post harvest residue, Wheat, Flour properties, Bread-making qualities

## CHANGES IN THE NITROGEN CONCENTRATION IN THE ORGANS OF WINTER WHEAT VARIETIES DEPENDING ON THE AGRICULTURAL PRODUCTION SYSTEMS

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### ABSTRACT

The aim of the study was to characterize the changes in nitrogen concentration in the organs of 5 varieties of *Tr. aestivum* L., selected at the Dobrudzhan Agricultural Institute - General Toshevo, grown in transition to organic production (TOP) and conventional production (CP) during the period 2018-2020. The tested varieties - Dragana, Rada, Pchelina, Kocara and Kalina were grown after 4 predecessors (winter canola, spring peas, sunflower and corn for grain). At CP, four levels of nutritional regime were tested, differentiated depending on the type of predecessor: after spring peas 0, 30, 60 and 90 kg N/ha, and after the others - 0, 60, 120 and 180 kg N/ha. Nitrogen fertilization is on a phosphorous-potassium background of 60 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O/ha. In both agricultural systems for the production of wheat, the concentration of nitrogen in the organs of the crop in the final phase varies significantly depending on the tested factors in the experiment. In TOP, the nitrogen content of the leaves is influenced to the maximum extent by the type of the predecessor. For the concentration of nitrogen in the stems and the non-grain part of the spike, the meteorological conditions during the years of research are decisive, and for the nitrogen content in the grain/protein - the variety. In 2018 and 2019, the grain of the tested varieties had the highest protein content after the predecessor pea, and in 2020 - after corn. In TOP, the varieties Pchelina and Rada are distinguished by a higher protein content compared to the others. A persistent trend was found for a highly positive correlation of nitrogen concentration in the grain with that in the stems and non-grain part of the spike. In the case of the conventional production system (CP), the reliability of the influence of the tested factors on the nitrogen concentration cannot be doubted. However, mineral fertilization has a determining role for the dynamics of nitrogen concentration in leaves, stems and grain, while that in the non-grain part of the spike - the conditions of the year. The influence of the meteorological factor significantly precedes that of the predecessor and the variety. It was established that the concentration of nitrogen in the organs of the vegetative mass is more strongly influenced by the type of variety, while that in the grain - by the type of the predecessor. The organs of wheat are distinguished by the maximum concentration of nitrogen in the variants with the participation of the highest nitrogen rate. Cultivation of the varieties after a maize predecessor results in higher nitrogen concentrations remaining in the organs of the non-economic part of the crop (vegetation mass). At CP, on average for the studied period, wheat forms a grain with the highest protein content after the predecessor winter oil rap. As with TOP, the varieties Pchelina and Rada are distinguished by a higher protein content compared to the others. As a result of mineral fertilization, the concentration of nitrogen in the organs of wheat grown under CP is higher than the same under TOP. The most significant dynamics by year was found in the nitrogen content in the leaves, where the excess was respectively 87.85% (2018), 78.89% (2019) and 18.47 (2020). For grain, these values are respectively - 38.15%, 25.40% and 9.03%.

**Key words:** winter common wheat, N concentration by organs, transition to organic production (TOP), conventional production (CP)

## POST-HARVEST RESIDUE TREATMENT EFFECT ON THE WINTER WHEAT PRODUCTIVITY

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### ABSTRACT

The investigation was carried out at Dobrudzha Agricultural Institute during 2017-2019. The effects of the traditional (TS) and combining (CS) soil tillage systems and sowing machines, the type of the previous crop post-harvest residue (common bean, maize, sunflower) and their treatment on the yield from cv. Enola (*Triticum aestivum* L.) was investigated in six-field crop rotation. The spring crop post-harvest residues (PHR) were utilized in three different ways - removed from the field (RF); burned (B) and chopped and subsequently incorporated into the soil (CSIS). During the studied period, a wide dynamic was established in the productivity of the wheat, depending on the type of the predecessor and the method of utilization of its plant residues. The traditional system of soil preparation and wheat sowing for the Dobrudzha region provides higher yields compared to the combined system in all years of the study. The average increase is 352.17 kg/ha (6.61%). The role of the predecessor also has a stronger impact on productivity in the TS. The cv. Enola was expected to have the highest yields in both systems after the predecessor bean. The lowest productivity in the experiment was found after the predecessor sunflower, where the biggest difference between the systems was also found - 552.30 kg/ha in favor of the TS. To obtain the maximum expression of the productive possibilities of the wheat, a differentiated approach to the ways in which we will use the post-harvest residues (PHR) of the predecessor and the technical means for this is required. In areas with minimal presence of PHR, the CS of soil preparation and sowing contributes to obtaining 403.3 kg/ha more compared to TS one. However, it is extremely unsuitable in cases of burning the residues or their complete plowing. The use of the TS in such situations provides higher yields compared to the CS with 314.1 kg/ha (B) and 1145.8 kg/ha (CSIS), respectively. The TS definitely contributes to obtaining a larger grain compared to the CS one of the tested predecessors and ways of utilizing their plant residues. The grain hectoliter is mainly influenced by the weather conditions of the years, but not by the sowing systems. Its values do not always follow the established trends for the 1000 kernel weight and are characterized by a weaker, although reliable, dynamics. Strength of effect of each of the tested factors on the values of the studied indicators was determined. The correlative dependence between the productivity of the variety and the test weight of the grain is reliable. The correlation with TS has higher coefficient values (0.615\*\*) compared to that with CS (0.486\*\*). The relationship between the yield and the 1000 kernel weight is negative and unreliable. There is a positive and reliable correlative relationship between the two indicators characterizing grain physics.

**Key words:** utilization of post harvest residue, wheat, yields, grain physical properties

## VALORIZATION OF LOCAL NATURAL RESOURCES IN LIVESTOCK FEED IN ARID REGIONS OF ALGERIA

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### ABSTRACT

Our study aims to evaluate the possibility of partially or completely substituting imported raw materials used in animal feed with local natural resources in arid regions. For this purpose, we conducted an analysis of the chemical composition and assessed the energy and nitrogen values of these resources. The objective is to find viable and economically advantageous alternatives for livestock feeding using locally available resources. PCA (Principal Component Analysis) allowed us to characterize the studied samples as follows: Sesbania and alfalfa are characterized by their richness in total nitrogen content; Wheat bran and barley have the highest levels of organic matter and digestibility (d DM). The study of energy and nitrogen values revealed that Sesbania has the highest UFL (1.04) and UFV (1.01) values, making it equally or even more energetic than cereals. Wheat bran, barley, and alfalfa also have high UFL and UFV values. On the other hand, panicum and olive branches and leaves have the lowest values. Regarding nitrogen values, PDIE and PDIN are the highest (111.84 g/kg and 101.63 g/kg of DM, respectively) for Sesbania. Hierarchical Cluster Analysis (HCA) allowed us to group the samples into three distinct classes.

**Key words:** Keywords: valorization, local plant resources, animal feed, arid regions

## VALORIZATION OF OLIVE CAKE, AN OLIVE OIL INDUSTRY BY PRODUCT, IN THE DIET OF GROWING RABBITS

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### ABSTRACT

In Algeria, the olive tree holds significant socio-economic and cultural importance. The olive oil industry generates substantial quantities of olive cake annually, which accounts for 35% of the weight of crushed olives. This undervalued byproduct is often discarded into waterways or round oil mills. Given its extended degradation period, it poses an environmental pollution risk, thereby jeopardising the sustainability of these production systems. Olive cake can be valorized through various means, such as its use as a fuel source, in leather tanning, composting, activated carbon production, and pomace oil extraction. Additionally, it can be employed in animal feed. However, understanding its chemical composition and nutritional value are essential to use any raw material in animal nutrition. The objective of our study is to determine the nutritional value for growing rabbits of two types of olive cake: one from a traditional oil mill (TOC) and the other from a modern oil mill employing a three-phase centrifugation extraction process (MOC). To achieve this, we compared four diets containing 10 or 20% TOC or MOC as substitutes for a basic diet to a control diet containing no olive cake (OC0). Five groups of 12 rabbits were provided with one of the five diets from weaning (days 35) to days 46, with *ad libitum* access. Faecal digestibility was individually measured between 42 and 46 days. The results demonstrated that TOC and MOC are sources of dietary fibre, with 707 and 787 g/kg dry matter (DM) of neutral detergent fiber (NDF), 530 and 554 g/kg DM of acid detergent fiber (ADF), and 242 and 243 g/kg DM of acid detergent lignin (ADL), respectively. The digestible energy content of TOC, and MOC was  $3.24 \pm 0.41$  and  $2.94 \pm 0.52$  MJ/kg DM, respectively. The digestible protein content was  $27.9 \pm 4.2$  g VS  $22.4 \pm 6$  g/kg DM for TOC and MOC, respectively. Olive cake can be used as a fiber source in rabbit nutrition.

**Key words:** olive cake, nutritional value, growing rabbit

## VALORIZATION OF OLIVE OIL INDUSTRY BYPRODUCT, OLIVE CAKE, IN THE DIET OF JAPANESE QUAIL: IMPACT ON ZOOTECHNICAL PERFORMANCE AND HEALTH STATUS

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### ABSTRACT

In Algeria, poultry feed formulation relies on the use of imported raw materials such as maize and soybean meal, resulting in increased feed costs and consequently the cost of meat production. Therefore, the exploration of alternative feed sources is imperative. Olive cake, a byproduct of the olive oil industry, can be used in animal nutrition. The objective of our study is to assess the effect of incorporating olive cake on the zootechnical performance of Japanese quails. To achieve this, a total of 370 one-day-old quails raised on the ground were randomly divided into three groups, labeled T, E1, and E2, receiving *ad libitum* feed containing increasing levels of olive cake: T (0%), E1 (10%), and E2 (20%). The weights of the animals and the amounts of feed consumed were measured weekly, while the health status and mortality rates were recorded daily. The findings indicate that including olive cake in the quail diet does not exert any adverse impact on the health status of the quails. Mortality rates remained consistent across all three experimental groups throughout the observation period, with elevated rates during the initial days of incorporation. However, it is noteworthy that the weight gain of the animals decreased with the inclusion of olive cake, while daily feed intake rises (43.70g for the E1 group and 44.31g for the E2 group). Olive cake can be regarded as a significant dietary resource for quails. To fully exploit this raw material in poultry feed, further research is needed to establish the optimal inclusion rates.

**Key words:** olive cake, animal nutrition, Japanese quails

## ASSESSING THE NUTRITIONAL VALUE OF FORAGE PLANTS IN ARID REGIONS OF ALGERIA

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### **ABSTRACT**

The sheep farming in arid and semi-arid regions of Algeria faces significant fluctuations in forage availability. This shortage is particularly challenging for pregnant ewes, whose nutritional requirements are at their highest, and it constitutes a major constraint for the development of this sector. Our work aims to study the influence of these difficult conditions on the reproductive and nutritional status of ewes. Analyses of the chemical composition and nutritive value of three main forage plants from grazing areas (two legumes: *Melilotus sulcata* and *Vicia monantha*, and one grass: *Cynodon dactylon*) covering the arid zones of Biskra and preferred by sheep have been conducted. Chemical analysis revealed that these forage plants are significantly rich in mineral matter, insoluble ash, NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), but less rich in ADL (Acid Detergent Lignin), total nitrogenous materials, and fats. This major constraint, particularly detrimental to pregnant ewes with increased nutritional needs, emphasizes the importance of adaptive management for the sustainable development of this sector.

**Key words:** Arid zones, nutritive value, forages, Ouled Djellal ewes



## **FUNCTIONAL PROPERTIES OF STARCH EXTRACTED FROM LANDRACES OF ALGERIAN PEARL MILLET USING VARIOUS TECHNIQUES, INCLUDING WET MILLING AND ULTRASOUND**

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### **ABSTRACT**

The millets are the sixth highest-value crop in the world; they are extremely nutritious and can survive challenging environmental circumstances (very low rainfall and saline soils). The goal of the current study was to characterize the starches of seven landraces of pearl millet (*Pennisetum glaucum* (L.) R. Br) from south Algeria, adding value through two processes: conventional wet milling with sodium azide added as a microbial growth inhibitor and a new green technology called ultrasound-assisted isolation. SPSS software, version 23 was used to conduct the data analysis and test for statistical significance. The impact of the starch isolation method on several functional parameters of the isolated starches were examined in terms of swelling power and water solubility index. The evaluated characteristics increased after heat treatment, especially as the temperature approached that of gelatinization [70–80 °C]. We concluded that the majority of the studied starches that received ultrasonic pre-treatment during their isolation showed a lower absorbency and a lower degree of solubility in water compared to starches isolated by traditional wet milling isolation methods. This is attributed to the pre-treatment of the isolated starches (steeping solution type and nature). Thus, the effectiveness of ultrasound-assisted isolation was assessed. The results were clear, and the isolation of pearl millet starch appeared to have good potential.

**Key words:** Isolation ; Pearl millet ; SPSS ; Starch ; Ultrasound ; Wet milling

## DIETARY INTERVENTION OF BETALAINS FROM AMARANTHUS VIRIDIS FOR DETOXIFICATION OF ENVIRONMENT-INDUCED OXIDATIVE STRESS

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### ABSTRACT

The purpose of this project is to investigate the potential of *Amaranthus viridis* (*A. viridis*) in detoxifying oxidative stress induced by environmental contaminants. Aqueous extraction of plant without roots was carried out and concentration of two betacyanin ( $124 \pm 1.02$  mg/100 ml) and betaxanthin ( $23 \pm 0.86$  mg/100 ml) was estimated. Two contaminants, including a heavy metal and a basic dye, were used to induce oxidative stress in female mice over a period of 25 days. The levels of five biomarkers, namely catalase, dismutase, lipid peroxidation, glutathione, and protein carbonyl content, were measured along with a baseline complete blood count. The significant decrease ( $p \leq 0.0005$ ) in catalase dismutase and Glutathione and increase in protein carbonyl content and Malondialdehyde showed reversible cellular damage as the dietary supplementation of betalains derived from *A. viridis*. Significantly ( $p \leq 0.005$ ) improve the markers health.

**Key words:** Amaranthus Viridis, Toxins, Oxidative stress, mammals

## INSIGHT INTO RADIATION DEVELOPED AMA RANTH SEED - ANALYSIS OF STARCH AND STARCH-RELATED GENES

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### ABSTRACT

Amaranth (*Amaranthus* spp.) is an ancient pseudocereal used in the native cuisine of South America but has been revived and adopted into the Western diet. Amaranth possesses several important attributes, however, its nutritional value appears to be the most interesting. The high content of starch and gluten-free proteins makes amaranth a suitable crop to cover nutrient requirements in developing countries and an appropriate choice for individuals suffering from celiac disease. This study analyzed the amylose, amylopectin, and total starch content in seeds of the Slovak variety 'Pribina' (*A. cruentus* L.), generated by an approach based on  $\gamma$ -radiation mutagenesis that was employed to improve yield-associated traits in the original genotype Ficha. The analysis showed higher starch content in 'Pribina' and small alterations in amylose/amylopectin ratio in comparison to the control genotype. The results were supported by expression analysis of genes involved in starch biosynthesis. Various levels of upregulation were observed for investigated genes in 'Pribina' seeds compared to the control. Polysaccharides are the major compound of amaranth seed, and starch is the main constituent of this fraction. The increase in starch content makes 'Pribina' seeds more nutritionally valuable, and suitable for food production. Thus, induced mutagenesis represents a powerful tool in breeding programs, and can assist in obtaining new varieties with desirable traits.

**Key words:** Amaranth, Starch, Gene expression

## CHARACTERIZATION OF SOME CORN GENOTYPES IN TERMS OF PRODUCTION AND PROTEIN CONTENT

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### ABSTRACT

Corn (*Zea mays* L.) is one of the main crop plants on the globe, with importance in human food, for animal feed, for industrialization. The present study analyzed 18 corn genotypes in terms of production, yield and protein content (% , kg ha<sup>-1</sup>, DPro). The research was done within the ARSD Lovrin, Romania, in the conditions of the Western Plain, Romania. The comparison of corn genotypes was made against a commercial hybrid (CH-Ct1) and against a hybrid of ARSD Lovrin (HSLv-Ct2), and the experiment included 20 variants (in repetition). STAS production (14% moisture) varied between 6753.50±222.45 kg ha<sup>-1</sup> (HSLv4) and 11507.50±222.45 kg ha<sup>-1</sup> (CH-Ct1). The yield (Y, %) varied between 78.20±0.45% (HSLv15) and 84.10±0.45% (HSLv13). The protein content (Pro, %) varied between 7.10±0.23% (CH-Ct1) and 11.35±0.23% (HSLv15). Protein production (kg ha<sup>-1</sup>) varied between 597.68±19.83 kg ha<sup>-1</sup> (HSLv4) and 944.26±19.83 kg ha<sup>-1</sup> (HSLv15). In relation to CH-Ct1, three genotypes generated increased growth (D) of protein production (HSLv8 with DPro=30.94 kg ha<sup>-1</sup>; HSLv16 with DPro=37.08 kg ha<sup>-1</sup>; HSLv15 with DPro=127.23 kg ha<sup>-1</sup>). In relation to HSLv-Ct2, the same three genotypes generated increased growth (D) of protein production (HSLv8 with DPro=21.84 kg ha<sup>-1</sup>; HSLv16 with DPro=27.98 kg ha<sup>-1</sup>; HSLv15 with DPro=118.13 kg ha<sup>-1</sup>). The obtained results are of interest for the selection of valuable genotypes in the maize breeding program.

**Key words:** cluster analysis, maize, models, pca, protein, yield

## **ANTI-INFLAMMATORY ACTIVITY OF ETHYL ACETATE AND BUTANOLIC EXTRACTS OF ARBUTUS UNEDO L.**

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### **ABSTRACT**

The growing concern for the side effects and toxicity experienced with the use of currently available anti-inflammatory drugs makes it necessary to search for novel compounds. Medicinal plants provide a ready source of anti-inflammatory agents with minimal side effects. The present study is devoted to evaluate the anti-inflammatory activity of the ethyl acetate and butanolic extracts from the leaves of *Arbutus unedo* L. using croton oil-induced ear edema in mice and human red blood cell membrane stabilization method. Results showed that the topical application of 2 mg/ear of ethyl acetate or butanolic extract reduced the ear edema induced by croton oil with an inhibition of 74% and 66%, respectively. This value is better than those obtained with indomethacin, used as reference. On the other hand, the ethyl acetate and butanolic extracts inhibited the erythrocytes hemolysis by 96% and 97% respectively against 98% exerted by diclofenac. Our finding may indicate the possibility of using the extracts of *Arbutus unedo* L. to prevent the inflammatory processes.

**Key words:** Inflammation, anti-inflammatory activity, *Arbutus unedo* L., edema, medicinal plants

## QUALITY INDICES VARIATION IN SEEDS OF SOME HEMP GENOTYPES

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### ABSTRACT

Hemp (*Cannabis sativa* L. ssp. *sativa*) is a plant with multiple uses, for the production of fibers, seeds, bioactive compounds. The present study evaluated the main quality indices of six hemp genotypes (protein - Pro; lipids - LIPID; dry matter - DM; ash - Ash). The six hemp genotypes (hemp genotype - Hg; Hg1 to Hg6) were cultivated in the specific climate and soil conditions for the Western Plain, Agricultural Research and Development Station Lovrin (ARDS), Romania. The studied hemp genotypes presented different values of the quality indices, and based on them it was possible to detect the genotypes through multiple multicriteria analyses (PCA, CA). Depending on the content of lipids and dry matter, PC1 explained 70.713% of variance, and PC2 explained 29.287% of variance. The cluster analysis facilitated the grouping of variants based on Euclidean distances, depending on the degree of similarity to the values of the studied quality indices. The obtained results facilitated the characterization of the hemp genotypes considered in the study and the highlighting of valuable genotypes for hemp breeding programs, but also for agricultural practice.

**Key words:** Breeding programs, Hemp genotypes, Lipid, PCA, Protein, Quality indices

**SUGAR AND PROTEIN CONTENTS, SUPEROXIDE ANION RADICAL  
SCAVENGING AND ANTIHEMOLYTIC ACTIVITIES OF ETHANOLIC EXTRACT  
OF APPLES (MALUS DOMESTICA BORKH)**

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**ABSTRACT**

In Algeria, apples (*Malus domestica* Borkh) are the second most eaten fruit after oranges in terms of consumption. They serve as the primary source of vitamins, minerals, and antioxidants in the diet of people. This work was undertaken to evaluate the sugar and protein contents, the antiradical and antihemolytic activities of the ethanolic extract of apples consumed in the region of Setif in Algeria. The sugar and protein contents of apples were 382.16±21.73 mg EG/g of dry extract and 0.73±0.05 mg EBSA/g of dry extract, respectively. *M. domestica* ethanolic extract shown *in vitro* antioxidant activity to be able to scavenge anion superoxide radicals with a value of IC<sub>50</sub> = 14.17±3.59 mg/ml, which was lower than that of the reference (ascorbic acid), which has a value of 0.002±0.00037 mg/ml. When compared to ascorbic acid, which had an IC<sub>50</sub> value of 0.06±0.006 mg/ml, *M. domestica* ethanolic extract showed an anti-hemolytic effect with a value of 1.75±0.30 mg/ml. This study demonstrates apple extract's effectiveness against free radicals, which might be used in this situation.

**Key words:** *Malus domestica*, Sugar content, Proteins content, Superoxide scavenging, Antihemolytic activity

**SUGAR AND PROTEIN CONTENTS, SUPEROXIDE ANION RADICAL  
SCAVENGING AND ANTIHEMOLYTIC ACTIVITIES OF ETHANOLIC EXTRACT  
OF WATERMELON (CITRULLUS LANATUS L.)**

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**ABSTRACT**

*Citrullus lanatus*, a fruit with many healing characteristics, is one of the fruits utilised in phytotherapy. This work was undertaken to evaluate sugars and proteins the content, the antiradical and antihemolytic activities of ethanolic extract of Watermelon consumed in the region of Setif in Algeria. The watermelon fruit's sugar and protein concentrations were  $135.01 \pm 23.81$  mg EG/g and  $0.11 \pm 0.001$  mg EBSA/g of dry extract, respectively. *In vitro* antioxidant activity showed that *C. lanatus* ethanolic extract had the ability to scavenging anion superoxide radicals with a value of  $IC_{50} = 4.62 \pm 0.46$  mg/ml, which was lower than that of ascorbic acid, which has an  $IC_{50}$  value =  $0,00204 \pm 0,00037$  mg/ml. *C. lanatus* ethanolic extract had the anti-hemolytic effect with a value of  $IC_{50} = 0.46 \pm 0.045$  mg/ml, this value was compared to the ascorbic acid which ( $IC_{50}$  value =  $0,068 \pm 0,006$  mg/ml). According to this work, Watermelon extract shows efficacy against free radicals, which could be exploited in this context.

**Key words:** *Citrullus lanatus*, Sugar content, Proteins content, Superoxide scavenging, Antihemolytic activity



**PROTEIN AND SUGAR CONTENTS, ALKALINE DMSO SUPEROXIDE RADICAL  
SCAVENGING AND ANTIHEMOLYTIC POTENTIALS OF HYDROALCOHOLIC  
EXTRACT OF WATERMELON**

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**ABSTRACT**

This work was undertaken to evaluate sugars and proteins contents, the antiradical and antihemolytic activities of ethanolic extract of watermelon (*Citrullus lanatus* L.) consumed in the region of Setif in Algeria. Sugars and proteins contents of watermelon were 135,01 mg EG/g of dry extract and 0,11 mg EBSA/g of dry extract respectively. *In vitro* antioxidant activity showed that watermelon ethanolic extract had the ability of scavenging anion superoxide radicals with a value of IC<sub>50</sub> = 4,62 mg/ml, but lower than that of the standard (ascorbic acid) which had a value of IC<sub>50</sub> = 0.001 mg/ml. watermelon ethanolic extract had anti-hemolytic effect with a value of IC<sub>50</sub> = 0,00204 mg/ml, this value was compared to that of ascorbic acid (IC<sub>50</sub> value = 0.32 mg/ml).

**Key words:** *Citrullus lanatus* L, Sugar content, Proteins content, Superoxide scavenging, Antihemolytic activity

**PROTEIN AND SUGAR CONTENTS, ALKALINE DMSO SUPEROXIDE RADICAL  
SCAVENGING AND ANTIHEMOLYTIC POTENTIALS OF HYDROALCOHOLIC  
EXTRACT OF HAWTHORN FRUITS**

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**ABSTRACT**

This work was undertaken to evaluate sugars and proteins contents, the antiradical and antihemolytic activities of ethanolic extract of hawthorn red fruits (*Crataegus oxyacantha* L.) consumed in the region of Setif in Algeria. Sugars and proteins contents of hawthorn red fruits were 0.106 mg EG/g of dry extract and 0.064 mg EBSA/g of dry extract respectively. *In vitro* antioxidant activity showed that hawthorn fruits ethanolic extract had the ability of scavenging anion superoxide radicals with a value of IC<sub>50</sub> = 9,191 mg/ml, but lower than that of the standard (ascorbic acid) which had a value of IC<sub>50</sub> = 0.001 ± 0.00036 mg/ml. Hawthorn red fruits ethanolic extract had the anti-hemolytic effect with a value of IC<sub>50</sub> = 1.068 mg/ml, this value was compared to that of ascorbic acid (IC<sub>50</sub> value = 0.32 ± 0.093 mg/ml).

**Key words:** *Crataegus oxyacantha*, Sugar content, Proteins content, Superoxide scavenging, antihemolytic activity

## ANTI-INFLAMMATORY AND ANALGESIC EFFECT OF ETHANOLIC EXTRACT OF CITRUS RETICULATA

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### ABSTRACT

This study is to evaluate the anti-inflammatory and analgesic effect of the ethanolic extract of Citrus reticulata fruit. The model of xylene and croton oil was used to stimulate inflammation and acetic acid to stimulate pain, using two doses (200 and 600 mg/kg) of this extract. The results showed that the extract have a good anti-inflammatory effect, as the difference was not significant compared to indometacine in both samples. The highest inhibition rate was recorded at the dose of 600 mg/kg, estimated at  $72.07 \pm 7.212\%$  when stimulated with xylene and  $78.49 \pm 2.776\%$  when stimulated with croton oil. The results also exhibited that the same extract of this fruit had analgesic activity in the model of pain stimulated by acetic acid, which was estimated at  $29.99 \pm 6.44\%$  at the 200 mg/kg dose and  $34.09 \pm 8.138\%$  at the 600 mg/kg dose compared to aspirin. These results indicate that the extract of this fruit can be a good source of anti-inflammatory and analgesic effect.

Key words: Citrus reticulata, anti-inflammatory activity, analgesic effect

## EVALUATION OF ANTI-INFLAMMATORY ACTIVITY OF OLIVE OIL IN PAW AND INTESTINE OF ALBINO FEMALE MICE.

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### ABSTRACT

Olive oil is known for its therapeutic benefits, particularly in the treatment of pathologies with an inflammatory component. The aim of this study was to evaluate the effect of olive oil, extracted from *Olea Europaea* trees harvested in the Tizi Ouzou region, on acute paw oedema induced by carrageenan (1%) and colitis induced by acetic acid (5%) in female mice. L'effet de l'huile d'olive (0,5 ml / jour) sur l'œdème des pattes a été comparé aux résultats obtenus dans un lot traité au diclofénac (75 mg / kg). Pour la colite, les résultats ont été comparés à un lot de souris traitées à la sulfasalazine. Les résultats montrent que le prétraitement à l'huile d'olive (0,5 ml / jour) a induit une réduction de l'inflammation des pattes des souris (29,59%) par rapport au lot traité au diclofénac (30,34%). Pour l'activité anti-colite, le traitement à l'huile d'olive a significativement réduit l'indice d'activité anti-colite, le score de lésion macroscopique et le rapport poids/longueur par rapport au groupe témoin acide acétique. L'effet de l'huile d'olive dans cette étude a montré une inhibition plus efficace de l'inflammation que le traitement de référence, la sulfasalazine. Nous concluons que l'huile d'olive a un potentiel thérapeutique dans le traitement des maladies inflammatoires, plus précisément, l'inflammation de l'intestin.

**Key words:** Olive oil, inflammation, intestine, colitis, acute oedema

## ANTI-INFLAMMATORY AND ANALGESIC ACTIVITIES OF ETHANOLIC EXTRACT OF CITRUS SINENSIS

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### ABSTRACT

This study aims to estimate the anti-inflammatory and analgesic activity of the ethanolic extract of *Citrus sinensis* fruit, which belongs to the *Rutaceae* family. The model of xylene and croton oil were used to stimulate inflammation and acetic acid to stimulate pain, using two doses (200 and 600 mg/kg) of this extract. The results showed that when rats were orally treated with 200 and 600 mg/kg of this extract, there was a significant inhibition of xylene-stimulated ear edema with a percentage of  $44.13 \pm 9.54\%$  and  $76.72 \pm 4.65\%$ , respectively compared to indomethacin which was used as a typical anti-inflammatory. While the croton oil induced ear edema test results showed  $66.85 \pm 3.51\%$  and  $75.81 \pm 4.55\%$ , respectively. On the other hand, the results of estimation of the analgesic activity showed that the number of sprains was inhibited by an estimated percentage of  $17.15 \pm 1.85\%$  and  $28.72 \pm 3.75\%$  at the concentrations of 200 and 600 mg/kg, respectively compared to aspirin. These results support the use of *Citrus sinensis* as an anti-inflammatory and analgesic.

**Key words:** Citrus sinensis, Anti-inflammatory activity, Analgesic activity

## EVALUATION OF PROTEIN AND SUGAR CONTENTS AND *IN VITRO* ANTIOXIDANT ACTIVITY OF QUINCE ETHANOLIC EXTRACT

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### ABSTRACT

Fruits are a significant source of external antioxidants that lessen oxidative stress brought on by free radicals, which lowers the risk of disease. As a result, the body's antioxidant content is crucial. This work was undertaken to evaluate the sugar and protein contents, the antiradical and antihemolytic activities of the ethanolic extract of quinces (*Cydonia oblonga* Miller) consumed in the region of Setif in Algeria. The protein and sugar contents of quinces were  $0.06 \pm 0.002$  mg EG/g of dry extract and  $111.95 \pm 0.02$  mg EBSA/g of dry extract, respectively. *C. oblonga* ethanolic extract shown *in vitro* antioxidant activity to be able to scavenge anion superoxide radicals with a value of  $IC_{50} = 17.08 \pm 2.11$  mg/ml, which was lower than that of the reference (ascorbic acid), which has a value of  $0.001 \pm 0.00036$  mg/ml. When compared to ascorbic acid, which had an  $IC_{50}$  value of  $0.32 \pm 0.093$  mg/ml, *C. oblonga* ethanolic extract showed an anti-hemolytic effect with a value of  $1.58 \pm 0.61$  mg/ml. This study demonstrates quince extract's effectiveness against free radicals, which might be used in this situation.

**Key words:** *Cydonia oblonga*, Sugar content, Proteins content, Superoxide scavenging, Antihemolytic activity

## EVALUATION OF PROTEIN AND SUGAR CONTENTS AND *IN VITRO* ANTIOXIDANT ACTIVITY OF MELON ETHANOLIC EXTRACT

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### ABSTRACT

*Cucumis melo* var. *inodorus*, a fruit with many healing characteristics, is one of the fruits utilised in phytotherapy. This work was undertaken to evaluate sugars and proteins the content, the antiradical and antihemolytic activities of ethanolic extract of melon consumed in the region of Setif in Algeria. The melon fruit's protein and sugar concentrations were  $0.22 \pm 0.06$  mg EG/g and  $118 \pm 30$  mg EBSA/g of dry extract, respectively. *In vitro* antioxidant activity showed that *C. melo* ethanolic extract had the ability to scavenging anion superoxide radicals with a value of  $IC_{50} = 4.4 \pm 0.2$  mg/ml, which was lower than that of ascorbic acid, which has an  $IC_{50}$  value =  $0.003 \pm 0.0003$  mg/ml. *C. melo* ethanolic extract had the anti-hemolytic effect with a value of  $IC_{50} = 2,53 \pm 0,47$  mg/ml, this value was compared to the ascorbic acid which ( $IC_{50}$  value =  $0,044 \pm 0,003$  mg/ml). According to this work, melon extract shows efficacy against free radicals, which could be exploited in this context.

**Key words:** *Cucumis melo*, Sugar content, Proteins content, Superoxide scavenging, Antihemolytic activity

## ANTI-INFLAMMATORY AND ANALGESIC ACTIVITIES OF ETHANOLIC EXTRACT OF CITRUS SINENSIS.

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### ABSTRACT

This study aims to estimate the anti-inflammatory and analgesic activity of the ethanolic extract of *Citrus sinensis* fruit, which belongs to the *Rutaceae* family. The model of xylene and croton oil were used to stimulate inflammation and acetic acid to stimulate pain, using two doses (200 and 600 mg/kg) of this extract. The results showed that when rats were orally treated with 200 and 600 mg/kg of this extract, there was a significant inhibition of xylene-stimulated ear edema with a percentage of  $44.13 \pm 9.54\%$  and  $76.72 \pm 4.65\%$ , respectively compared to indomethacin which was used as a typical anti-inflammatory. While the croton oil induced ear edema test results showed  $66.85 \pm 3.51\%$  and  $75.81 \pm 4.55\%$ , respectively. On the other hand, the results of estimation of the analgesic activity showed that the number of sprains was inhibited by an estimated percentage of  $17.15 \pm 1.85\%$  and  $28.72 \pm 3.75\%$  at the concentrations of 200 and 600 mg/kg, respectively compared to aspirin. These results support the use of *Citrus sinensis* as an anti-inflammatory and analgesic.

**Key words:** Citrus sinensis, Anti-inflammatory activity, Analgesic activity



**PROTEIN AND SUGAR CONTENTS, ALKALINE DMSO SUPEROXIDE RADICAL  
SCAVENGING AND ANTIHEMOLYTIC ACTIVITIES OF HYDROALCOHOLIC  
EXTRACT OF WATERMELON**

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**ABSTRACT**

This work was undertaken to evaluate sugars and proteins contents, the antiradical and antihemolytic activities of ethanolic extract of watermelon (*Citrullus lanatus* L.) consumed in the region of Setif in Algeria. Sugars and proteins contents of watermelon were 135,01 mg EG/g of dry extract and 0,11 mg EBSA/g of dry extract respectively. *In vitro* antioxidant activity showed that watermelon ethanolic extract had the ability of scavenging anion superoxide radicals with a value of IC<sub>50</sub> = 4,62 mg/ml, but lower than that of the standard (ascorbic acid) which had a value of IC<sub>50</sub> = 0.001 mg/ml. watermelon ethanolic extract had anti-hemolytic effect with a value of IC<sub>50</sub> = 0,00204 mg/ml, this value was compared to that of ascorbic acid (IC<sub>50</sub> value = 0.32 mg/ml).

**Key words:** *Citrullus lanatus* L, Sugar content, Proteins content, Superoxide scavenging, Antihemolytic activity

## PRODUCTION METHODS OF VIRGIN COCONUT OIL: THE IMPACT ON NUTRIENTS AND THEIR BIOLOGICAL ACTIVITIES

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### ABSTRACT

Virgin coconut oil (VCO) is a vegetable oil product that is made from fresh, mature coconut meat (*Cocos nucifera* L.) using mechanical or natural methods. It can be produced with or without the addition of additional chemical refining, bleaching, or deodorizing. In other words, the wet process of producing VCO involves using coconut milk. There are many ways to produce VCO, such as centrifugation, fermentation, enzymatic, fishing, and stirring. However, commercial VCOs are usually made using fermentation or centrifugation. To create VCO quickly and efficiently, high-speed centrifuges are used to separate it from fresh coconut milk. This process typically takes less than ten minutes in industrial settings. Interestingly, VCO can also be made at home or by small and medium-sized businesses utilizing a natural fermentation process that takes about two weeks. VCO has a wide range of applications in industries like food, pharmaceuticals, and cosmetics. This review's purpose was to talk about some methods to obtain VCO, as well as that compound's nutrients and biological properties. We managed to find some great resources that we think will be helpful for our research. During our review, we thoroughly searched several databases such as Science Citation Index, PubMed, Medline, Scopus, WoS, and Google Scholar to identify and download relevant abstracts, review articles, and research papers related to the extraction, physicochemical properties, nutrient, and biological activities of VCO. The keywords used during searching of information were: extraction + physicochemical properties + nutrient + antioxidant (or anti-inflammation, anti-hyperlipidemia, anti-bacterial) activities + VCO. Nutrient compositions of VCO consists fat, protein, and carbohydrates. VCO shown a variety of pharmacological properties because of the phenolic chemicals it contains, including antioxidant, anti-inflammatory, immunomodulatory, anti-hyperlipidemia, anti-cancer, antidiabetic, anti-bacterial, and neuroprotective actions. The bioactive components of VCO were not qualitatively or quantitatively impacted by the centrifugation and fermentation methods used in its manufacture.

**Key words:** biological activity, *Cocos nucifera* L., nutrient, virgin coconut oil

## BIOLOGICAL ACTIVITY AND EFFICIENCY IN FOOD PRESERVATION OF THYMUS VULGARIS EXTRACTS

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### ABSTRACT

One of the main problems facing the agro-food industry is to ensure that food is well preserved, and much attention has been paid to compounds of natural origin. In this context, our study aims to examine the antimicrobial properties of crude extracts of *Thymus vulgaris* L. and their incorporation into fresh cheese production process in an effort to improve the cheese's sensory properties and shelf life. The plant was collected from the region of Setif (Algeria), cleaned of impurities, dried in the shade for a few days and ground to a powder. This later was subjected to methanol solvent extraction. The antibacterial activity is determined using four strains: *Pseudomonas aeruginosa* ATCC 27853, *Escherichia coli* ATCC 29522, *Staphylococcus aureus* ATCC 3865, and *Staphylococcus aureus* ATCC 29523, while the antifungal activity is evaluated using as strains *Aspergillus niger*, *Fusarium oxysporum* and *Cladosporium sp.* The results indicated that the employed bacterial isolates were only moderately sensitive to Thymus extract, with the exception of *Staphylococcus aureus*, which exhibited high sensitivity with an inhibition diameter of 27 mm at a concentration of 100 mg/ml. Furthermore, the extracts had no effect on *Aspergillus niger*, but the sensitivity of the other strains was relatively modest, with inhibition diameters ranging from 15 to 16 mm. The impact of *Thymus vulgaris* extract on the cheese shelf life was assessed by monitoring the changes in physicochemical and microbiological parameters over a period of 18 days at a temperature of 4°C. The results of the microbiological analysis of the cheeses during storage at 4°C for 20 days have revealed a change in the odor and the appearance of on the control cheese which was not the case for the extract enriched cheese. However the results of the hygiene quality of the cheese showed that the addition of *Thymus vulgaris* extract to the fresh cheese has a good effect on bacterial flora and therefore extend the cheese shelf life.

**Key words:** Agro-food, Food additives, *Thymus vulgaris*, Antimicrobial activity, Plant extract

## CHEMICAL COMPOSITION OF ESSENTIAL OIL FROM MEDICINAL PLANT AND ANTI MICROBIAL ACTIVITY

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### ABSTRACT

Although many pathogens can cause foodborne illnesses. These may also be potential bioterrorism agents for food sources. The aim of this study is the used of bioactive compounds of essential oil from *glycyrrhiza glabra* leaves like antimicrobial activity and describes the chemical composition of essential oil . The essential oil of *Glycyrrhiza glabra* leaves was obtained by hydrodistillation and analyzed by GC and GC-MS. Other parameters such as refractive index, optical rotation; density, polarimetric deviation;freezing point and Solubility in ethanol are also measured. The main hydrocarbon and oxygen containing compounds were: Isoniazid (13.36 %) ; Diethyltoluamide (6.56 %), Benzoic acid (5.37 %), Benzene (4.58%), Linalool (2.25 %), Prasterone (5.63 %), Warfarin (1.43 %), Iodoquinol (1.90 %), Phenol, 4-(2-aminopropyl)(1.30 %). The antibacterial activity of the oil was determined using the agar diffusion method and it was found that it was active against *Escherichia coli* (ATCC 25923), *Salmonella typhimurium* (ATCC14028), *Staphylococcus aureus*(ATCC-29213) ,*Bacillus subtilis* (ATCC-6633) , *Escherichia coli* (G-)( ATCC 35218) and *Pseudomonas aeruginosa* (ATCC 27853).

**Key words:** food safety, Essential oil, antimicrobial activity

## EXCEPTIONAL AMARANTH SEEDS

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### ABSTRACT

Amaranth, a multipurpose crop, is used as food, animal feed, ornamental plant, and raw material for biofuel production. In recent decades, grain amaranth has been studied for its highly nutritious seeds: they are rich in proteins, starch, fats (squalene), vitamins (folates), minerals and fiber. Unlike typical grains, amaranth's proteins consist mainly of albumins and globulins. Due to the low content of gluten-forming proteins, amaranth products are suitable for people suffering from celiac disease. In this study, we characterize Slovak amaranth varieties bred by mutation for their oil and protein content in comparison with other cereals and pseudocereals species. Seeds of 'Pribina' (*A. cruentus* L.) and 'Zobor' (*A. hypochondriacus* × *A. hybridus*) showed protein content of 13-14%. Glutamic acid, aspartic acid, and arginine were the most represented amino acids. Amaranth seeds generally have a higher lipid content than common cereals, but lower compared to oilseeds. In the Slovak varieties, the crude oil content was about 5%. We found a significantly higher oil yield than the commercially preferred amaranth varieties. In addition, investigated varieties can be considered an exclusively rich squalene plant source. Seeds of 'Pribina' and 'Zobor' are stable in terms of yield, have a balanced nutrition and are suitable for cultivation even under Central Europe conditions.

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**Key words:** Amaranth, Nutrition, Protein, Oil

## CHARACTERIZATION AND ANTIOXIDANT STUDY OF APRICOT KERNEL VEGETABLE OIL EXTRACTED BY COLD PRESSING

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### ABSTRACT

*Prunus armeniaca* L. (apricot) is a plant of the Rosaceae family. This fruit species is grown throughout the world especially in the Mediterranean. Apricot is produced in 69 countries in 2017 and Turkey (with 19% production), Uzbekistan (with 14% production), Algeria (with 7% production), are the main countries (FAOSTAT, 2020) [1]. In Algeria, apricots are the country's leading fruit crop. The kernel contains almonds which can be sweet or bitter. These almonds produce a vegetable oil rich in oleic acid and vitamins A and E, which makes them useful in a variety of ways [2]. It's an excellent ingredient for maturing skin, as it helps to nourish and rejuvenate dry skin, leaving it feeling soft and supple. Another benefit of apricot kernel oil is its anti-inflammatory properties, which make it an ideal ingredient for those with psoriasis and eczema. The aim of this work is to extract and characterize the vegetable oil from apricot kernels grown in Algeria for cosmetic use. The oil is extracted by cold pressing using an oil press in order to guarantee its extra virgin quality. The oil obtained is a viscous liquid, light and oily. It has a light yellow color and a slight nutty, bitter almond odor, with an extraction yield of 30%. A physical characterization of the vegetable oil obtained was carried out by measuring the various indices characteristic of vegetable oils, mainly the refractive, acid, peroxide and saponification indices. The refractive index found allows us to classify the extracted oil as semi-drying with a refractive index of around 1.47021 at 20°C, which allows us to assume that the oil is rich in linoleic acid. This oil has an acid number of 4 mg KOH/g of oil, which confirms its "virgin" quality according to the food codex [3]. The peroxide and saponification indices found (1 meq O<sub>2</sub>/Kg of oil and 196.38 mg KOH/g of oil respectively) indicate the quality of the oil according to the food codex. Infrared spectroscopic analysis revealed the presence of dl- $\alpha$ -tocopherol acetate, which was confirmed by high-performance liquid chromatography (HPLC). The fatty acid composition of the oil studied was determined by gas chromatography (GC). The most abundant acid in apricot kernel oil is oleic acid (68.5%), followed by linoleic acid (24.68%), which is essential for healthy human skin growth [4], and palmitic acid (5.03%). The three acids mentioned above make up around 98.21% of all fatty acids. The antioxidant study was carried out using the b-carotene bleaching method, which gave an inhibition of 91.31%.

**Key words:** *Prunus armeniaca* L, Cold pressing; Vegetable oil; Gas Chromatography, HPLC

## PREDICTION OF PRION-LIKE PROTEIN DOMAINS IN IRRADIATED AND CONTROL SAMPLES OF THE PEA SEEDLINGS

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### ABSTRACT

**Introduction and aim.** Nowadays an interest in the genetics and breeding of oil and protein crops directions of breeding for resistance to abiotic stresses is relevant. Studying of the prion-like proteins (PrLP) of different organisms is one of the important tasks of modern science. In the last decades, the researches of amyloid and PrLP gained active development because of their ability to cause of serious human diseases. But numbers of scientific reports, which were published during last years, testify about the possible presence of PrLP or protein-like domains (PrLD) in plants and their functional properties. Detailed research of the structure of known mammalian and yeast prion proteins made it possible to create bioinformatic algorithms capable to analyze the amino acid sequences of identified proteins and predict domains, which with some probability could have prion-like properties. Due to these algorithms, a prion-like domain of *Luminidependens* protein in *Arabidopsis thaliana* was predicted *in silico* (Chakrabortee S. et al, 2016). One of such prediction algorithms is PLAAC (Lancaster A. et al, 2014).

**Materials and methods.** PLAAC is a web application that scans protein sequences for domains with prion-like amino acid composition (<http://plaac.wi.mit.edu/>). FASTA sequences of the proteins in detergent-resistant fraction of pea in irradiated and control groups were scanning with PLAAC. FASTA sequences for analyses were obtained from database PlantBioinfoPF (<https://urgi.versailles.inra.fr>).

**Results and conclusion.** We detected 30 proteins in detergent-resistant fraction from isolated total proteins, which content was varied in irradiated and control groups. The five proteins were annotated as proteins with prion-like domains: the multiple organelles RNA editing factors (MORF), Argonaute 1 (AGO1), Pollen Ole e I, the mitogen-activated protein kinase kinase 4 (MKK4) and protein transport protein SEC31 homolog B (SEC31B). The content of these five proteins was increased in group pea seed irradiated with 50 Gy dose to compare of control group.

**Acknowledgment.** This work was supported by the project the National Research Foundation of Ukraine 2020.02/0316

**Keywords:** PLAAC, prion-like proteins, *Pisum sativum*, proteome



## CHANGE OF PROTEIN AND TRYPTOPHAN AMOUNT IN FRESH, DRY AND CANNED SEEDS OF SOME PEAS GENOTYPES

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### ABSTRACT

Amino acids are chemical building blocks and produce proteins in the body. Among them, tryptophan is one of the least essential amino acids in legumes, the richest protein in the plant kingdom. Various studies have been carried out on the world to evaluate the potential of legumes, which are still not widely used as a protein source. Over the past 30 years, the use of proteins derived from plant seeds has been increasing due to the importance of their functional properties, processing and nutritional value. As a matter of fact, in the USA, pea protein is among the important products used by the food industry commercially. Unlike other legumes such as chickpeas and lentils on the world, peas are widely cultivated in developed countries and have the highest unit area yield. In this study, the variation of crude protein ratio and tryptophan amount in fresh, dry and canned products of local pea lines were investigated. In the study, 30 lines selected by selection breeding from local pea populations and 6 commercial varieties as control were used. The experiments were carried out in creating 8 environments in 4 locations [in Amasya, Tokat and 2 different locations in Samsun (Gelemen, OMU Campus), sowing at 2 different sow times (November, March). According to analysis results by combining the data obtained from the experiments, it was determined that the genotype, sowing time and location had a statistical effect on protein and tryptophan in all three forms of use. In genotypes, the protein ratio was determined as 23.78% in fresh seeds, 23.98% in canned seeds, 24.30% in dry seeds, and tryptophan as 21767 mg/kg in fresh seeds, 22736 mg/kg in canned seeds, and 23194 mg/kg in dry seeds. It was determined that the amount of both protein and tryptophan was the highest in dry seeds. While B42 lines in fresh and canned seeds and B40 lines in dry seeds stand out in terms of crude protein content, B42 lines in fresh and dry seeds and B36 lines in canned seeds stand out in terms of tryptophan amount.

**Key words:** Protein, tryptophan, fresh peas, canned peas, dry peas



## BIOCHEMICAL, TRANSCRIPTIONAL AND FLUORESCENCE SPECTROSCOPY ANALYSIS OF FATTY ACIDS IN SEEDS OF CAMELINA CULTIVARS GROWN IN ORGANIC INTERCROPPING SYSTEM.

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### ABSTRACT

Climate changes and European tendencies to increase the organic farming in the coming years are imposing the necessity of diversification of the cultivated crops. Drought tolerance, short vegetation period and modest requirements to the environment, combined with good oil quality and exceptional level of omega-3 fatty acids are just some of the advantages of *Camelina sativa* L.. We have evaluated the variety response to sole crop and intercrop with pea (*Pisum sativum*) and vetch (*Vicia sativa*) of three varieties camelina – two introduced from Poland – Luna (K1) and Lenka (K2) and a Bulgarian landrace (K3), on certified organic farm of the Agricultural University - Plovdiv. The biochemical analysis showed that the percentage of oil content decreased in intercropping with leguminous crops in variant K3 but increased in variants K2 with pea (35.1% to 36.1%) and K3 with vetch (34.4% to 37.9%). Fatty acid levels and gene expression profiles for the *fad6* gene associated with the synthesis of fatty acids (FA) were also examined. The biochemical analyses of monounsaturated fatty acids (MUFA) as omega-9 oleic acid in camelina seeds show an increasing trend when intercropping K1 with pea and K2 with vetch. A similar tendency for increases was observed in polyunsaturated fatty acids (PUFA) as linoleic C18:2 and linolenic acids C18:3 profiles in all three variants. As a result of transcriptional analysis, the expression of *FAD6* in camelina intercropped with vetch was 5-fold higher compared to control plants grown sole. Monosaturated fatty acid content and expression in camelina depend directly on the intensity and spectral distribution of the emission fluorescence signal. Correlations were observed, except in the spectral distribution of the fluorescence signal and in its intensity when growing camelina alone and in combination with peas.

**Key words:** Key words: *Camelina sativa* L., variety testing, GC/MS; *fad6* expression; fluorescence spectroscopy analysis

## **THE EFFECT OF ADDING CANOLA OIL TO DIESEL FUEL ON ENGINE POWER, FUEL CONSUMPTION AND EMISSIONS.**

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### **ABSTRACT**

The increase in fuel consumption used in internal combustion engines causes an increase in fuel prices and a decrease in fossil resources. In addition, the harmful emission levels in the exhaust gases thrown into the environment are increasing day by day. For this reason, the search for alternative sources to fossil-based diesel fuel continues. By adding biodiesel produced from different vegetable oils to diesel fuel, harmful effects caused by fossil fuels will be reduced. In this study, 5-10-15-20% of the renewable energy source canola biodiesel was added to the diesel fuel and its effects on the engine were investigated. In this experimental study, the best results were obtained with the addition of 5% canola oil to the diesel engine and 25% engine load. Under these conditions, the engine's fuel consumption and exhaust emissions are reduced. It was observed that fuel consumption and exhaust emissions increased as the ratio of canola oil added to diesel oil increased.

**Key words:** Energy,power,fuel consumption , emission

## GLOBAL POLICY TO ELIMINATE TRANS FATS BY 2023 AND THE SITUATION OF PACKAGED FOOD IN TURKEY

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### ABSTRACT

*Trans-fatty acids (TFA)* can be defined as monounsaturated fatty acids (MUFA) or polyunsaturated fatty acids (PUFA) containing at least one carbon-carbon trans-double bond in fatty acids. According to the data of 2020, more than 5.7 million people worldwide and approximately one hundred thousand people (23% of all deaths) in Turkey died due to cardiovascular diseases per year due to (*TFA*)s clogging the heart vessels and causing heart attacks. It is stated that getting about 5 grams of (*TFA*) in daily consumption is associated with a 25 percent increase in the risk of heart disease. (*TFA*)-containing fat substitutes are used to meet the expectations of many foods, to provide desired textural, rheological and sensory properties, and to extend shelf life. The World Health Organization has published the "REPLACE" action plan, which aims to reduce global (*TFA*) consumption to zero by 2023. The "REPLACE" action package consists of 6 modules and provides a strategic roadmap for the extraction of industrially produced TFA from national food sources. The first module "**Review**" includes reviewing the available information on industrially produced TFA at the country level, examining the production-consumption processes, determining the policies implemented and to be implemented and gathering information on potential (*TFA*) sources in the market. The second module, "**Promote**", provides a roadmap for identifying industrially produced oils with the lowest risk of TFA and developing and implementing strategies to promote the use of these healthier oils. The third module, "**Legislate**", provides guidance on designing, enacting and implementing legislation appropriate to each country's structure or selecting policies so that existing legislation can be updated to reduce industrially produced TFA. The fourth module, "**Assess**", was created to guide the necessary practices to reset a country to its TFA consumption rates. The fifth module, "**Create**", addresses the necessity of conducting the communication channels with the most effective methods in policy determination and implementation processes and offers suggestions. The last module, "**Enforce**", includes a series of activities such as informing stakeholders about new legislation, collecting complaints from consumers, inspection of products and facilities, analysis, labeling control, sanctions in case of violation in the implementation of policies for resetting TFA. In this paper, (*TFA*) contents of packaged food products in Turkey were investigated according to the label information. In total, 1411 packaged food products divided into 11 categories were examined, and 71.2% of these products contain (*TFA*)-free ingredients. In all categories, the usage rate of the words "trans-fat free" on the front of the label is 25%. In addition, it was determined that 7.1% of these products used vague statements that did not provide clear information about (*TFA*) content. In general, the use of alternative substitutes should be encouraged and food processing processes should be improved in order to eliminate (*TFA*) from food products on a global scale.

**Key words:** Trans-fatty acids, 'REPLACE' action plan, food labeling, food security

## EXTRACTION AND CHARACTERISATION OF MILK THISTLE SEED PROTEIN: AN OPTIMIZATION STUDY

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### ABSTRACT

In this study, we focused on optimizing the parameters for extracting proteins from milk thistle seeds, with a primary emphasis on enhancing purity and yield. Additionally, we conducted a comprehensive characterization of the proteins isolated from these seeds. The ideal conditions for achieving high protein purity were identified as follows: a pH level of 9.47, a temperature of 30°C, and an extraction duration of 180 minutes. Conversely, for maximizing protein yield, the optimal conditions were determined to be a pH level of 12, a temperature of 50°C, and an extraction duration of 167 minutes. The Oil Absorption Capacity (OAC), emulsifying properties, foaming capacity, and stability of both Milk Thistle Protein (MTP) and Milk Thistle Yield (MTY) were found to be comparable with several other seed proteins documented in the literature. Notably, both proteins exhibited their highest solubility at a pH of 11, while their zeta potentials approached zero at pH 4, indicating their proximity to the isoelectric point. It is noteworthy that MTP and MTY exhibited relatively lower antioxidant capabilities compared to other protein isolates or concentrates. Furthermore, these proteins were found to have a high concentration of  $\beta$  sheets, suggesting their potential for excellent thermal stability and resistance to digestion. Consequently, milk thistle proteins appear to hold promise for various applications, given their unique characteristics."

**Key words:** protein, milk thistle

## THE IMPACT OF PERENNIAL FLOWER STRIP ON THE COLONIZATION OF WINTER RAPE PLANT BY SELECTED PEST AND BENEFICIAL SPECIES.

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### ABSTRACT

On agricultural land under organic rules a winter rapeseed plantation with a perennial (3 years old) flower strip 5 m wide and 50 m long was established in 2022, in plot design with four repetitions. Two varieties of rape were sown - Harry and Graf (hybrid and population variety). The presence of harmful and beneficial insects was assessed *in situ*. During the first and second inspections (May 17 and 25), the presence of insects on 10 plants/plot was noted. During the third and fourth inspections (June 16 and 26), the state of pods damage of 5 plants/plot caused by *Meligethes aeneus*, *Ceutorhynchus obstrictus*, *Dasyneura brassicae* and the presence of stem damage caused by stem beetles also on 5 plants/plot were assessed. The impact of flower strip was evaluated in relation to distance of 1 m to 40 m. After the first summarize of results was noted that only few colonies of aphids, including the beet aphid, were found, but no important strip effect was confirmed. Initially, it can be stated that during the first and second inspections, there were significantly lower number of *Delia radicum* on both rapeseed varieties growing near the flower strip, compared to plots located 40 m from the strip. Similar relationships were found in the case of *Ceutorhynchus* spp. On the other hand, only during the second inspection in the case of pollen beetle lower number was noted in the rapeseed plots near the strip – at the first inspection higher number of this pest can be related with flowering plants within strip. Additionally, near the flower strip numerous individuals of blackfly infected with a naturally occurring fungus of the order Entomophthora were also observed. Pod damage rates (0-completely destroyed, 1-completely healthy) were pre-calculated, which do not indicate positive flower strip presence. The research will be continued and the final effect will be assessed during the yield assessment.

**Key words:** beneficial insects, insect pests, organic farming, flower strip. Protection

**CENSUS OF THE ENTOMOFAUNA AND THE ADVENTICE FLORA  
SUBSERVIENT TO THE CULTURE OF QUINOA**

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**ABSTRACT**

The production of quinoa (*Chenopodium quinoa* Willd.) Could contribute to food security and could increase food production in the Mediterranean region, of which several approaches have been tried to provide knowledge in order to establish improvements. Were sampled at ITDAS level of weed flora and arthropods for the study of dynamics and influence while relying on ecological indices. A total of 15 spontaneous species and 50 species of arthropods were sampled and identified. The results of the study of ecological indices of diversity (H plants / Mechanics = 2.829 bits, Hplants / Manual = 3.005 bits and Harthropods / Manual = 4.456 bits, Harthropods / Mechanics = 4.674 bits), equity (Plants / mechanical = 0.789 , Plants / manual = 0.869 and Earthropods / mechanical = 0.841, Earthropods / manual = 0.841) and Margalef (Iplants / mechanical = 56.55, Iplants / manual = 21.23 and Iarthropods / mechanical = 64.12, Iarthropods / manual = 64.12, Iarthropods / manual = 53.17). The sampling calculations indicate a good diversity and balance in weed plants, and a high diversity in arthropod species identified and the populations are in balance between them

**Key words:** quinoa, food security, arid region, arthropods, weed, diversity

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