



PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Abdelhafid Boussouf University Center Mila

Institute of Sciences and Technologie Department of Natural and Life Sciences

Laboratory of Natural Sciences and Materials (LSNM)



NATIONAL SEMINAR ON BIOTECHNOLOGICAL APPLICATIONS IN AGRICULTURE

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The President of the Seminar: Dr. BOUSMID Ahlem

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Institut des Sciences et Technologie
Département des Sciences de la Nature et de la Vie
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The National Seminar on Biotechnological Applications in Agriculture, organized by the Abdelhafid BOUSSOUF University Center of Mila, represents an exceptional opportunity to discuss recent advances in the field of biotechnology applied to agriculture, exchange ideas, and strengthen collaborations among the various stakeholders in the sector. This event brings together researchers, experts, agricultural industry professionals, students, and biotechnology enthusiasts from across the country.

In response to the growing challenges related to food security, climate change, and sustainable resource management, biotechnology offers innovative solutions to improve agricultural productivity, enhance crop resilience, and reduce the environmental footprint of agriculture. This seminar aims to create a platform for the exchange and sharing of knowledge on biotechnological techniques, covering areas ranging from genetic manipulation to bioinformatics, and their practical applications in improving agricultural yields and combating plant diseases.

GOALS

The goal of this scientific event consists mainly of:

- Promote biotechnologies in human health in Algeria;
- Promotion of the research activities of our laboratories;
- Exchange of knowledge and experience between different researchers and students from other universities;
- Integration of post-graduate and master's students in scientific events;
- Strengthening of fruitful cooperation between biological researchers and farmers.

THEMES

Theme 01 : Plant biotechnology and plant breeding.

Theme 02 : Agriculture and environment

Theme 03 : New technologies in biotechnology research.

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PLENARY CONFERENCE



Plant Biotechnologies in Constant Evolution

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Abstract

Plant biotechnologies constitute a dynamic field crucial to modern agriculture and the sustainable stewardship of natural resources. These technologies encompass diverse techniques aimed at enhancing plants to achieve higher yields, improved disease resistance, and enhanced adaptation to challenging climatic conditions. Recent advancements in genetic manipulation, tissue culture, and bioinformatics have significantly contributed to the development of more resilient and nutritious plant varieties.

Genetic manipulation techniques, such as genetic engineering and genome editing, enable precise modification of plant genomes to introduce desirable traits like pest resistance, drought tolerance, and increased nutrient content. This approach accelerates the breeding process, resulting in plants capable of thriving in diverse environments and under varying stress conditions.

Tissue culture techniques facilitate plant propagation from small tissue samples under controlled conditions, enabling rapid multiplication of elite plant varieties. This method is particularly valuable for conserving rare or endangered species and producing disease-free planting material.

Bioinformatics plays a pivotal role by providing tools and computational resources to analyze complex biological data, predict gene functions, and optimize genetic modifications. This integration of biological and computational sciences enhances the efficiency and precision of biotechnological applications in plant breeding.

The impact of these biotechnological innovations extends beyond enhancing agricultural productivity. By bolstering crop resilience and productivity, they contribute to global food security by ensuring stable food production amidst population growth and environmental challenges. Furthermore, these technologies help mitigate agriculture's environmental footprint by reducing dependence on chemical inputs, conserving natural habitats, and promoting sustainable farming practices.

In conclusion, plant biotechnologies strive to harmonize agricultural productivity with ecological sustainability, paving the way for long-term agricultural development that is resilient and adaptable to future challenges.

Keywords: Plant biotechnologies, Genetic manipulation, Tissue culture, Bioinformatics

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ORAL SESSION

**Theme 1: Plant Biotechnology and Crop
Improvement.**



Biotechnological Application of Controlled Mycorrhization in Enhancing Growth and Development of a Typical Mediterranean Conifer

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Abstract

With its umbrella-shaped silhouette, the Stone Pine (*Pinus pinea*) is considered one of the most beautiful conifers in the Pinaceae family. This species is typical of the Mediterranean region and holds significant ecological and economic value. Known since ancient times for its edible pine nuts widely used in pastry, the species has been cultivated for pine nut production in Europe for over 6000 years, with wild harvesting benefiting local communities in indigenous and non-indigenous areas alike. This conifer is extensively grown and utilized in environmental conservation projects due to its soil conservation capabilities, dune stabilization, protection of coastal agricultural crops, and fire resistance. *Pinus pinea* is now one of the most valuable trees in reforestation programs. Preserving and enhancing the development of this species is therefore of great importance. Controlled mycorrhization is considered an effective biotechnological tool for stimulating and improving plant growth. This study aims to associate *Pinus pinea* seedlings with a desert truffle species for this purpose. The results of mycorrhizal synthesis between these two partners have demonstrated the beneficial effect of desert truffle inoculation on various morpho-physiological parameters of *Pinus pinea* seedlings over one year old. The success of this mycorrhizal synthesis opens promising prospects for using desert truffles as bio-fertilizers to enhance the growth of young Stone Pine plants in nurseries and after transplantation in the field.

Keywords: *Pinus pinea*, desert truffle, controlled mycorrhization, biotechnology, growth enhancement.



Use of molecular docking in plant protection

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Abstract

Plant enemies cause considerable damages to plants each year. Over the centuries, man has struggled to protect his crops against invasion by insects, microbial pathogens and other pests (Dimetry, 2012). However, the massive use of chemical pesticides led to many problems such as resistance within treated pests, damages on the useful organisms (pollinators, earthworm....), pollution and harms to human health (cancer, poisoning). Thus, alternative control methods with low secondary effects for sustainable development are preferred, including the use of plants. The use of botanical pesticides in Integrated Pest Management offers several advantages over synthetic pesticides (Dimetry, 2012). Recent investigations in several countries confirm that some plant essential oils have contact and fumigant insecticidal actions against specific pests, and fungicidal actions against some important plant pathogens (Isman, 2000). Essential oils demonstrate a wide range of bioactivities from direct toxicity to insects, microorganisms and plants, to oviposition and feeding deterrence as well as repellence and attraction (Isman et al., 2007).

The aim of all R&D activities in crop protection companies is to discover new active ingredients with ideal properties at lowest cost in the quickest time. This simple principle led to the introduction of a multitude of new technologies designed to accelerate the classical research process (Schleifer, 2007). Among these technologies, molecular docking has an important role. It is a computational methodology that provides automatic means to determine the conformation of proteins-ligand complex (Azevedo et al., 2012). It is usually performed between a small molecule and a target macromolecule. This is often referred to as ligand-protein docking, but there is growing interest in protein-protein docking (Morris & Lim-Wilby, 2008). Computational biology has gradually become one of the core disciplines and methods of modern life science research (Li et al., 2019). Molecular docking helps one in narrowing down on the compounds which show affinity towards the target, this way enormous amount of time is saved and helps reduce the cost (Habeeb & Chandrasekhar, 2014). The field of molecular docking has emerged during the last decades driven by the needs of structural molecular biology and structure-based drug discovery (Morris



& Lim-Wilby, 2008). Over the last two decades, more than 60 different docking tools and programs have been developed for both academic and commercial use (Pagadala et al., 2017).

In the domain of plant protection, there is an increasing importance given to the use of molecular docking to test potential pesticidal activities of molecules, especially against insects. For instance, many authors used this new technology to evaluate insecticidal effect of essential oils compounds (Singh et al., 2017; Chohan et al., 2018; Lebbal, 2020). In addition, the use of natural products with insect repellent property can be identified by using in silicomolecular docking tools (Gopal & Kannabiran, 2013).

There are a lot of perspectives in this research field, particularly because of the availability of databases with new 3D structures and the development of new softwares.

Keywords: insect pests, environment, insect control, entomo-informatics



Study of the Effect of Osmopriming on the Germination of Aleppo Pine Seeds in the Chrea Region

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Abstract

In Algeria, Aleppo pine is present in all bioclimatic variants, with a predominance in the semi-arid zone. Its plasticity and hardiness have given it the character of an essence with great expansion potential, forming vast forest masses. Aleppo pine, covering 35% of the forested area, remains the predominant species in Algeria. Its ecological and socioeconomic importance includes soil fixation (erosion control) and various uses in the wood industry.

Our study applies osmopriming technique to improve the germination of Aleppo pine seeds collected from the Chr ea region, Blida province, in two different stations:

- The 1st station: seeds collected from within a fire-affected area.
- The 2nd station: seeds collected from outside the fire-affected area.

Our method involves soaking Aleppo pine seeds from both stations in NaCl solutions for 48 hours to enhance seed germination rates.

Results: The osmopriming technique resulted in a high germination rate (80%) at station 2. In contrast, the first station affected by fire showed zero germinated seeds due to seed crystallization. The moisture content of the seeds emerged as a crucial indicator of post-fire germination of the studied forest species.

The distance of trees from fires plays a significant role in seed germination. In conclusion, the germination ability of Aleppo pine seeds is influenced by various factors.

Keywords: Osmopriming, Seeds, Aleppo Pine, Germination.



In vitro Evaluation of the Antibacterial Activity of Aqueous Hydrosol Extract from an Endemic Medicinal Plant Collected from Southern Algeria

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Abstract

The aim of our work was to quantitatively compare the bacteriological activity of the aqueous hydrosol extract from an endemic medicinal and aromatic plant collected in the Algerian Sahara, belonging to the Ephedraceae family.

Our study began with steam distillation extraction of the aerial parts of our species (400 g). A solution of 1.6 L of aqueous extract (hydrosol) was obtained after filtration and concentration using a rotary evaporator. The aqueous extract underwent successive liquid-liquid extractions using solvents of increasing polarity, starting with Petroleum Ether (PE), followed by Chloroform (CH), Ethyl Acetate (EA), and n-Butanol (BuOH). The four extracts were subjected to antimicrobial activity testing.

Pathogenic activities including *Staphylococcus aureus* (ATTC 6538), *Bacillus subtilis* (ATTC 6633), *Pseudomonas aeruginosa* (ATTC 9027), and *Escherichia coli* (ATTC 8739) were evaluated using the agar diffusion method on Mueller-Hinton agar (MH) medium. Activity was determined by measuring the clear inhibition zone after incubating the media at 37°C for 24 h.

The results of antimicrobial activity for different extracts are as follows:

- *Staphylococcus aureus*: [PE (MIC: IZ) (30 mg/ml: 7.5 mm)], [CH (MIC: IZ) (30 mg/ml: 8 mm)], [EA (MIC: IZ) (60 mg/ml: 6.5 mm)], [BuOH (MIC: IZ) (60 mg/ml: 7.5 mm)]
- *Bacillus subtilis*: [PE (MIC: IZ) (30 mg/ml: 11 mm)], [CH (MIC: IZ) (60 mg/ml: 6.5 mm)], [EA (MIC: IZ) (30 mg/ml: 7.5 mm)], [BuOH (MIC: IZ) (120 mg/ml: 7.5 mm)]
- *Pseudomonas aeruginosa*: [PE (MIC: IZ) (120 mg/ml: 8 mm)], [CH (MIC: IZ) (120 mg/ml: 8 mm)], [EA (MIC: IZ) (60 mg/ml: 6.5 mm)], [BuOH (MIC: IZ) (120 mg/ml: 7 mm)]
- *Escherichia coli*: [PE (MIC: IZ) (30 mg/ml: 7.5 mm)], [CH (MIC: IZ) (120 mg/ml: 8.5 mm)], [EA (MIC: IZ) (30 mg/ml: 8 mm)], [BuOH (MIC: IZ) (120 mg/ml: 8 mm)]

The results of this analysis showed strong activity of the Petroleum Ether (PE) extract compared to the other extracts.

Keywords: Ephedraceae, Antimicrobial, aqueous hydrosol extract, Minimum Inhibitory.



In vitro* and *in vivo* efficacy of Salicylic Acid and Gibberellic acid in the reduction of *Allium sativum* Infection by *Fusarium verticillioides

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Abstract

In Algeria, fungal diseases are the most important biotic limiting growth of garlic (*Allium sativum* L.). The application of salicylic acid is known as a plant hormone that has the signaling role in defence responses, including systemic resistance acquired. Gibberellic acid (GA3) is a very powerful hormone whose natural appearance in plants controls their development. This study aimed to evaluate the affectivity of certain concentrations of salicylic acid (SA) and gibberellic acid (GA3) under laboratory and greenhouse conditions against the phytopathogenic fungus *Fusarium verticillioides* and on the height of garlic (*Allium sativum* L.).

The results showed that the inhibitory effect of (SA) on the development of this phytopathogen increased with increasing concentration. In the case of gibberellic acid, the concentrations 100 ppm and 150 ppm were the most inhibitory, its effect was more marked on the fungus during the first three weeks of infection. Inhibition decreases sharply during the fourth week of infection. Gibberellic acid at 150 ppm was an inhibitor over the first, second and third weeks. For morphological parameters, the results showed that the concentration of 150 mg / l recorded the highest values of the height of garlic for both growth regulators. *In vitro*, the diameter of the colony decreases significantly to 200 mg / l for salicylic acid and 150 mg / l for gibberellic acid. Therefore, our results showed that garlic treatment with (SA) and (GA3) was effective in reducing infection of the disease and increasing yield.

Key words: *Allium sativum* L, *Fusarium verticillioides*, Salicylic acid, Gibberellic acid, fungal disease.



Nanotechnology in Biotechnological Research

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Abstract

Nanotechnology is utilized for numerous applications in chemical, agricultural, medical, biological, and other industries. However, its use in agriculture is still in its infancy. The indiscriminate use of pesticides and fertilizers causes environmental pollution, increases resistance to pathogens and pests, and leads to biodiversity loss. This has prompted biotechnology researchers to seek alternative solutions that mitigate the hazards of chemical products. Several types of nanobiopesticides incorporating essential oils have been reported.

In this context, we focused on preparing a nanobiopesticide using essential oils from *Origanum sp* from the Blida region and *Thymus sp* from the Djelfa region. The droplet size of the emulsion was determined using Dynamic Light Scattering (DLS) with a NanoPartica system. The droplet size was estimated as the mean of three measurements and is presented as the average diameter of the volume distribution. Results showed an average diameter of (349.93 ± 6.94) nm for Blida samples and (981.73 ± 33.84) nm for Djelfa samples.

Biopesticides have proven effective as alternatives to chemical pesticides because they are biodegradable, leave no harmful residues, can be cheaper when produced locally, and may prove more effective in the long term.

Keywords: nanotechnology, biopesticide, essential oil, *Origanum sp*, *Thymus sp*.



In Vitro Evaluation of the Antibacterial Activity of Some Essential Oils on *Pseudomonas aeruginosa*.

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Abstract

Since ancient times, humans have used plants to treat common infectious diseases, with some traditional treatments still part of the regular treatment of various ailments. Plants, especially medicinal ones, are well-known for their chemical richness and diversity. Indeed, plants produce more than 100,000 therapeutic molecules from their secondary metabolism, many of which possess antimicrobial activities against pathogens or their mechanisms of antibiotic resistance. *Pseudomonas aeruginosa* is among these multi-resistant pathogens that continue to develop new resistance mechanisms. This has driven the scientific community to seek solutions and find new therapeutic strategies. The aim of this work is to evaluate the effect of three essential oils: "Roman Chamomile" (*Anthemis nobilis*), "Chaboba" (*Cistus munbyi*), and "Clove" (*Syzygium aromaticum* L.) on three strains of *P. aeruginosa* isolated from urinary infections and one reference strain ATCC.

The essential oils were extracted by hydrodistillation using a Clevenger-type apparatus. The antimicrobial activity of the essential oils was evaluated using the aromatogram method and the micro-dilution method in a liquid medium.

The results allowed us to conclude that clove essential oil and *C. munbyi* essential oil have a remarkable antimicrobial effect on the studied strains, with inhibition zones ranging from 8 to 10 mm and MICs between 0.25 and 1, except for the clinical strain 2 of *P. aeruginosa*, which was less sensitive to the three essential oils. On the other hand, chamomile oil was found to be inactive against the four strains.

Keywords: Urinary infections, essential oil, *Pseudomonas aeruginosa*, aromatogram.



Chemical Composition and In Vitro Evaluation of Antioxidant Activity of *Rosmarinus officinalis* L. Extract

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Abstract

This study aimed to extract and identify secondary metabolites present in *Rosmarinus officinalis* L. leaves and evaluate their biological activities. Four compounds were identified in the methanolic extract: total polyphenols, anthocyanins, C-glycosides, and aglycones. The content of total polyphenols was determined using the Folin-Ciocalteu reagent, yielding 12.87 mg GAE/g DW. Flavonoid identification by the AlCl₃ method revealed the presence of anthocyanins, C-glycosides, and aglycones, with contents of 1.13 mg/g, 0.07 mg/g, and 0.045 mg/g, respectively.

The antioxidant activity of the compounds in the methanolic extract was evaluated in vitro using several tests. In the DPPH assay, the IC₅₀ values were 0.122 mg/ml, 0.130 mg/ml, 0.350 mg/ml, and 0.370 mg/ml for anthocyanins, total polyphenols, C-glycosides, and aglycones, respectively. For the FRAP test, at a concentration of 1 mg/ml, the iron reducing power showed OD values of 0.122 mg/ml, 0.130 mg/ml, 0.350 mg/ml, and 0.370 for anthocyanins, total polyphenols, aglycones, and C-glycosides, respectively.

In conclusion, anthocyanins and total polyphenols exhibit significant antioxidant activity. These results are promising and justify further research, including the identification of antioxidant components in active extracts.

Keywords: antioxidant activity, chemical composition, methanolic extract, *Rosmarinus officinalis* L.



Phytochemical study and antioxidants activities of phenolic extracts of various pulp and peel figs

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Abstract

Phenolic compounds are common plant secondary metabolites which have not only physiological functions in plants but also positive effects for human health because they can act as antioxidants. Antioxidants play important roles in preventing pathogenic processes related to cancer, cardiovascular disease, macular degeneration, cataracts and asthma, and can enhance immune function. Antioxidant defenses protect the body from the detrimental effects of free radicals generated as by-products of normal metabolism

Fig (*Ficus carica* L., Moraceae), one of the most ancient cultivated fruit trees in the Mediterranean region which is the most important fig growing center worldwide, has recently drawn much attention because of its medicinal and nutritional values.

In this context, we have tried to estimate the reactivity of antioxidant phenolic extracts of various pulp and peel figs. The results of quantitative estimation showed for these vehicles in a way Folin-Ciocateu it contains between 4.345 and 32.18 mg equivalent Gallic acid/10 g acid of dry matter .pent results set the ability to resist oxidation that these extracts have the ability in the face of free radicals compared antiretroviral standard oxidation as we recorded correlation positive between the total content of phenols and the ability to resist oxidation and this is suggesting that this ability linked and related to the amount of phenolic compounds, as well as the existence of effective compounds vital values.

Keywords: figs, antioxidant capacity, phenolic compounds.



**Enhancement of Resistance to Fungal Diseases and Growth Potential in
Tomato (*Lycopersicon esculentum* Mill.) through Inoculation with Soil
Actinomycetes**

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Abstract

Tomato (*Solanum lycopersicum* Mill.) is one of the most widely grown vegetables worldwide and holds significant economic importance in Algeria. However, phytopathogenic diseases pose a serious threat to its cultivation, causing considerable production losses. Fungal diseases appear to be particularly frequent and aggressive in this crop. Actinomycetes constitute a substantial portion of soil microbial biomass and have shown capability in protecting plants against diseases, serving as a valuable source of agronomic compounds and biological control agents.

This study focuses on investigating the antagonistic effects of selected actinomycete isolates against *Botrytis cinerea*, aimed at protecting tomato crops from gray mold.

Actinomycete isolation was conducted from a semi-arid soil in the Batna region (Algeria) using soil dilution series followed by seeding on two media, GLM and ISP2. Evaluation of antifungal activity against *Botrytis cinerea* was determined using agar cylinder technique, and pathogenicity tests were performed according to Koch's postulates. In total, 42 morphologically distinct bacterial strains were isolated from five soil samples from different locations. Actinomycetes were identified based on morphological characteristics, both macroscopic and microscopic, following the International Streptomyces Project (ISP) guidelines. Among them, 10 actinomycete isolates exhibited in vitro inhibitory effects; unfortunately, 73.81% of the isolates showed pathogenic effects. Conversely, only three strains (S17E5, S18E51, and S4E21) were non-pathogenic and demonstrated antagonistic effects.

The findings highlight the inhibitory potential of actinomycetes and suggest that the three strains (S17E5, S18E51, and S4E21) could be utilized as biological control agents to combat gray mold in tomato cultivation, thereby enhancing productivity.

Keywords: Actinomycetes, antifungal activity, *Botrytis cinerea*, *Solanum lycopersicum* Mill., fungal diseases.



***Salvia officinalis* and *Origanum majorana* L.: From Biotechnology to Human Health**

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Abstract

The concept of cultivating plants for human health is slowly transforming plant biotechnology and medicine. The rediscovery of the relationship between plants and health has led to the development of a new generation of herbal therapies that include pharmaceuticals and herbal medicines. Many of these products are poised to complement traditional pharmaceuticals in the treatment, prevention, and diagnosis of diseases, while adding value to agriculture. In this context, our study aims to investigate the inhibitory effect of phenolic extracts from two aromatic and medicinal plants cultivated in Algeria against multidrug-resistant enterobacterial species of urinary origin.

Three extracts were prepared from the aerial parts of both *Salvia officinalis* and *Origanum majorana* through bio-guided fractionation: chloroform extract, ethyl acetate extract, and n-butanol extract. Semi-quantitative analysis of total polyphenols in the fractions was performed using colorimetry. The antibacterial effect of these fractions was determined in vitro using the disk diffusion method followed by minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) determination via microdilution method.

The results revealed significant variability in the quantitative levels of phenolic compounds among the extracted fractions of *S. officinalis* and *O. majorana*. Antibacterial activity tests showed that the ethyl acetate, chloroform, and butanol extracts of *O. majorana* exhibited substantial inhibitory activity against the tested strains, with inhibition zones ranging from 12 to 21 mm, 13 to 20 mm, and 9 to 19 mm, respectively. Similarly, the strains subjected to the effects of the three extracts of *S. officinalis* also showed high sensitivity to ethyl acetate (10 to 21 mm), chloroform (14 to 21 mm), and butanol (9 to 18 mm) extracts. The lowest MIC and MBC values were observed with the chloroform extract of *O. majorana* against *Serratia marcescens* and *Serratia liquefaciens*.

These findings are promising and provide scientific validation for the widespread use of *O. majorana* and *S. officinalis*. Thus, the effect of natural active principles isolated from medicinal plants could potentially rival that of antibiotics, paving the way for further extensive studies in the field of medicinal plant cultivation and usage in Algeria.

Keywords: *S. officinalis*, *O. majorana*, Medicinal Plants, Antibacterial Activity



Antimicrobial Activity of *Thymus numidicus* Poiret Essential Oil

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Abstract

Plant extracts possess significant antimicrobial activities and can successfully substitute antibiotics. For centuries, synthetic origin drugs have shown inefficiency against resistant microorganisms. To promote plant-based treatments, we studied the antimicrobial potency of *Thymus numidicus* Poiret essential oil.

In this study, essential oil was extracted using the steam distillation method, which revealed a high concentration of terpenes. The antimicrobial activity of this oil was tested using the disc diffusion method against several microbial strains, including Gram-positive bacteria such as *Bacillus subtilis* and *Staphylococcus aureus*, and Gram-negative bacteria such as *Escherichia coli*, *Pseudomonas aeruginosa*, and *Pseudomonas fluorescens*.

The results of the antimicrobial activity demonstrated strong efficacy of the essential oil against Gram-positive bacteria, showing significant inhibition zones ranging from 35.33 to 22.33 mm. Gram-negative bacteria exhibited moderate sensitivity with inhibition zones ranging from 17.66 to 15.66 mm. *Thymus numidicus* Poiret essential oil displayed good antimicrobial activity with low MIC and MBC values ranging from 0.125% to 0.5%.

Keywords: antimicrobial activity, Minimum Inhibitory Concentration (MIC), Minimum Bactericidal Concentration (MBC), essential oil, *Thymus numidicus* Poiret.



Efficiency of Salicylic Acid *in vitro* and *in vivo* in Reducing *Fusarium oxysporum* f. sp. *lycopersici* and *Botrytis cinerea* Infection in *Lycopersicum esculentum* Mill. Tomato

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Abstract

Among the fungal diseases affecting tomato cultivation, fusarium wilt caused by *Fusarium oxysporum* f. sp. *lycopersici* and gray mold caused by *Botrytis cinerea* cause considerable yield losses under optimal pathogen development conditions. The application of salicylic acid is known as a plant hormone that acts as a signaling molecule in defense responses (systemic acquired resistance). The aim of this study is to determine the effectiveness of salicylic acid in enhancing resistance against fungal pathogens and reducing their effects both *in vitro* and *in vivo*. Treatment of plants with different concentrations of salicylic acid (150, 200, and 250 mg/l) showed that the best inhibition of fungal mycelial growth *in vitro* was recorded at 200 mg/l SA, with reductions of 44.82% for *Fusarium oxysporum* f. sp. *lycopersici* and 45.71% for *Botrytis cinerea* at 250 mg/l SA. *In vivo*, treatment of two tomato varieties with salicylic acid showed a complete reduction (100%) in disease incidence in the Elgon variety infected by *Fusarium oxysporum* f. sp. *lycopersici* at concentrations of 150 and 250 mg/l SA, and by *Botrytis cinerea* at 250 mg/l SA compared to infected plants.

Keywords: tomato, systemic acquired resistance, salicylic acid, *Fusarium oxysporum* f. sp. *lycopersici*, *Botrytis cinerea*.



Comparison of Antioxidant and Antimicrobial Activities of Two Different Extracts from *Atriplex halimus*

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Abstract

Atriplex halimus is an aromatic medicinal plant long used in traditional Algerian medicine. This study aimed to evaluate the antioxidant and antibacterial activities of different extracts from the leaves of this plant collected in the Biskra region. The methanol extraction yield (25.13%) was higher than that of aqueous extraction (14.06%). The polyphenol content of *Atriplex* was 325.076 ± 6.60 μg EAG/mg of methanolic extract and 320.176 ± 4.22 μg EAG/mg of aqueous extract, while the flavonoid content of the aqueous extract (109.096 μg EQ/mg) was higher compared to the flavonoid content of the methanolic extract (92.81 μg EQ/mg). Furthermore, both methanolic and aqueous extracts showed similar moderate antioxidant activity against the DPPH radical with IC₅₀ values around 63 and 65 mg/ml, respectively. The aqueous extract of our plant also exhibited reducing power almost comparable to that of ascorbic acid compared to the methanolic extract with an EC₅₀ of 0.468, 0.440, and 0.724 mg/ml, respectively.

Antibacterial activity was also tested against three reference strains: *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Staphylococcus aureus* ATCC 25923; revealing that both methanolic and aqueous extracts of *Atriplex halimus* showed positive reactions against at least one of the microbial strains. Overall, this plant is a source of bioactive substances with significant biological effects.

Keywords: *Atriplex halimus*, aqueous and methanolic extraction, biological activity.



Protection and Improvement of Beans against Fungal Diseases.

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Abstract

Beans (*Phaseolus vulgaris*) hold significant importance in terms of food, economic, and agronomic value. Unfortunately, their production faces several challenges, one of which is pests (bacteria, fungi, viruses, etc.). Various control methods are available and applied, notably chemical control, which is favored once producers have access to pesticides. While quick to apply with immediate effects, chemical methods are delicate and hazardous to humans, animals, and the environment, potentially causing diseases such as cancer, neurological disorders, infertility, teratogenicity, etc.

Our study aims to enhance food quality and safety through more natural protection methods, such as using microorganisms like lactic acid bacteria in biological control. We tested the antagonistic power of a strain of lactic acid bacteria isolated from raw goat milk against several fungal strains isolated from beans.

Results from direct confrontation tests of the lactic strain *Leuconostoc mesenteroides* against four pathogens (*Fusarium oxysporum f. sp. phaseoli*, *Botrytis cinerea*, *Aspergillus flavus*, *Alternaria alternata*) on PDA and MRS Agar media showed superior inhibition on MRS Agar. *Leuconostoc mesenteroides* exhibited the highest inhibition rate of 56.09% against *Botrytis cinerea* and (29.03%, 33.33%, 26.08%) against *Alternaria alternata*, *Fusarium oxysporum f. sp. phaseoli*, *Aspergillus flavus*, respectively, on solid PDA medium. In contrast, on MRS Agar medium, inhibition rates were 88.09% and 80.48% against *Botrytis cinerea* and *Aspergillus flavus*, respectively, with complete inhibition observed against *Alternaria alternata* and *Fusarium oxysporum f. sp. phaseoli* in the presence of *Leuconostoc mesenteroides*, indicating production of inhibitory substances by the lactic strain in its specific environment.

Keywords: Beans, confrontation, inhibition rate, *Leuconostoc mesenteroides*, lactic acid bacteria.



Comparative study of karyomorphology in six genotypes of *Lens culinaris* MEDIK.

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Abstract

This work is part of a cytogenetic study of the lens (*Lens culinaris* Medik, $2n = 2x = 14$). We are interested in the karyomorphological analysis of the chromosomes of six genotypes (Idlep1, Flip 90-31, Idlep3, Metropole, Syria 229 and Dahra), revealed by the classic staining technique, and the comparison of the karyotypes studied. Karyograms compared to idiograms show significant variation in chromosome size, location and number of satellites. The largest chromosome size is observed in the Idlep1 genotype (7.44 μ m) and the smallest chromosome size is detected in the Dahra genotype (1.59 μ m). The Idlep3, Flip 90-31 and Metropole genotypes present a pair of satellites located on chromosome 4, while the Syria229 genotype reveals two pairs of satellites located on chromosomes 4 and 6. In contrast, the Idlep1 and Dahra genotypes are lacking.

All karyotypes consist of four metacentric chromosome pairs and three submetacentric pairs with the exception of the Metropole genotype which is distinguished by the presence of five metacentric pairs and two submetacentric pairs. The karyotypes are symmetrical (60.51%, 63, 11%, 62.30%, 60, 13%, 61.45%, 64.32%), and this means that they are primitive. Our results also reveal the existence of B chromosomes 1 to 2 in all genotypes except Metropole. Our genotypes are introduced but selected and cultivated in Algeria, in arid climatic conditions. The presence of B chromosomes in this case could be explained as a manifestation of their adaptation.

Keywords: cytogenetic study, *Lens culinaris*, karyomorphological analysis, chromosomes, genotypes.



Involvement of Polar Auxin Transport in Mediating Growth and Aluminum Tolerance of Maize Roots by *Bacillus toyonensis* Bt04

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Abstract

Following previous work on plant growth-promoting bacterial strains of Algerian origin, we conducted further studies on the mechanisms of action of PGPR in plant growth promotion and alleviation of abiotic stresses in maize. In this context, we investigated the involvement of auxin transport pathways in aluminum resistance mediated by the auxin and cytokinin-producing strain *Bacillus toyonensis* Bt04. In this study, two inhibitors of polar auxin transport were used: 1-N-naphthylphthalamic acid (NPA) and 1-naphthoxyacetic acid (1-NOA).

The results demonstrated that polar auxin transport is crucial for root development. We showed that NPA and 1-NOA can alter the plant phenotype. Furthermore, this work revealed that the effectiveness of the Bt04 strain in promoting maize growth is linked to auxin transport, signaling, and interaction with cytokinins. Studying root response to aluminum toxicity and auxin transport inhibitors confirmed that auxin pathways are necessary for Al-induced stress. We demonstrated that NPA can reverse the inhibitory effect of Al toxicity.

Keywords: *Bacillus toyonensis* Bt04, Auxin transport inhibitors, Growth promotion, Aluminum toxicity.

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ORAL SESSION

Theme 2: Agriculture and Environment.



Use of *Salvia officinalis* L. Extract in Anti-Locust Control

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Abstract

In order to preserve the environment by testing alternative anti-locust products to chemical control, a study on the biological activity of *Salvia officinalis* L. (Asteraceae) extract against *Aiolopus strepens* (Orthoptera, Acrididae) was conducted.

Five doses were obtained from the mother solution. Treatment solutions were sprayed on *Triticum durum* (Desf.) (Poaceae) to highlight the effect of sage extract on food intake, mortality rate, LD50, and LT50. The results revealed that this plant has a completely deterrent action affecting food intake. Doses D3, D4, and D5 yielded better results. Acute toxicity was recorded for the 4th and 5th doses, which acted quickly, with 100% mortality reached within 48 hours and 72 hours respectively for D4 and D5. Low doses showed sufficient activity of the plant extract. The LD50 (0.102g/20ml) is lower than D1. Calculated LT50 values show that D4 provides satisfactory results in a very short time compared to other tested doses.

The results obtained reveal that the natural extract of *Salvia officinalis* has both repellent and acaricidal effects and can be suggested as a bio-insecticide.

Keywords: Biological activity, *Aiolopus strepens*, LD50, extract, *Salvia officinalis*.



Introduction of Argan Tree (*Argania spinosa* (L.) Skeels) to M'doukel (W. Batna) and Evaluation of Some Drought Resistance Parameters

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Abstract

Considered as a relic from the Tertiary era, the argan tree is found in its most extreme limit (Tindouf) forming a natural population. It is a "multi-use" forest tree where every part or product of the tree (wood, leaves, fruits, and oil) is usable, representing a source of income and food for its users. Besides its economic role, the argan tree plays an irreplaceable role in ecological balance, combating both water and wind erosion. These characteristics make it particularly valuable for development in arid zones. The aim of this study is to investigate the behavior of the argan tree under water stress conditions and identify potential morphological criteria to evaluate its tolerance to water stress, for its introduction trial in the M'doukel region.

Germination tests revealed high germination rates of 45% in the laboratory, and relatively low rates (8 – 12%) in M'doukel. Regarding morphological parameters, severe water stress (20% and 10%) induced reductions in height, leaf number, radial growth, biomass reduction, increased root length, and preferential biomass allocation towards roots in this species. Moderate water stress (30% and 40%) resulted in better outcomes.

At M'doukel, concerning growth-related variations, four growth periods were observed. Both direct seeding and polyethylene bag planting techniques showed feasibility, with the latter not exceeding 6 months.

In conclusion, the argan tree demonstrates morphological adaptive traits under deficit conditions, exhibiting good behavior under the pedoclimatic conditions of the M'doukel site, suggesting a possibility for introducing the argan tree into this arid zone.

Keywords: *Argania spinosa*, water stress, tolerance, morphological parameters, arid zone.



Enhancement of seed germination of wheat (*Triticum aestivum* L.) by PGPR isolated from maize (*Zea mays* L.).

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Abstract

Plant growth-promoting rhizobacteria (PGPR) are considered to have wide range of positive impact on plant growth by direct and indirect mechanisms, and therefore become promising tool to enhance agricultural productivity of widely consumed crops. The present study was undertaken to screen efficient PGPR from maize for enhancing seed germination in wheat.

A set of 62 strains was isolated from five rhizospheric soil samples of cultivated maize; the ability of each isolate to solubilize phosphate and to produce Indole Acetic Acid (IAA) and Hydrogen Cyanide (HCN) was tested. The most competent isolates were then selected for analysis of their effects on seed germination and vigor index of wheat.

On the basis of multiple PGPR attributes, four isolates were selected to test their potential on seed germination and vigor index of wheat. High level of phosphate solubilization and IAA production was observed among isolates. The most competent strains, identified as *Achromobacter*, *Burkholderia*, *Azospirillum* and *Arthrobacter* were characterized with high potential of seed germination of wheat and their vigor index was highly appreciated. The bacterial isolates *Achromobacter* and *Burkholderia* exhibited notable PGP traits that can be explored as accelerators of seed germination and plant vigor of wheat.

Keywords: PGPR, seed germination, bio-stimulant, vigor index.



Effect of Seven Mediterranean Environments on the Expression of Some Algerian Durum Wheat (*Triticum turgidum var.durum*) Varieties

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Abstract

This study was conducted to analyze the performance, adaptation, and stability of 14 varieties of durum wheat (*Triticum turgidum spp.durum*), tested in seven environments represented by two sites (Sétif and Khemis Miliana) over two years and a third site (Oued Smar) over three years. The experimental sites belong to the experimental stations of the Technical Institute of Field Crops (ITGC). Field trials were conducted using a completely randomized block design with four replications. Several agro-morphological, physiological, and biochemical parameters were evaluated per environment.

The results of the combined analysis of variance (Genotype, Environment, and GxE) show the predominance of the environment effect over the genotype effect and the GxE interaction for all the studied variables. The genotypic effect reveals two subsets of varieties. The first subset consists of early and semi-dwarf varieties, including GTA dur, Simeto, Amar06, Vitron, Ofanto, Cirta, Megress, Boussalem, Mexicali, Waha, and Chen's. The second subset consists of late, tall-stemmed varieties, including Bidi17, Hedba03, and MBB. These two groups differ mainly in grain yield, the number of grains per spike, the number of spikes per m², and the number of grains per m², which favor the first subset. The presence of significant GxE interaction suggests performance instability. The use of the Pi index highlighted two varieties, GTA dur and Simeto, which are stable and high-performing across all seven environments. The analysis of correlation coefficients between character pairs indicates that indirect selection for grain yield via the number of grains per m² could be effective. The correlation coefficients between environment pairs of the studied variables confirm the presence of GxE interaction and suggest that the selection of the best varieties should be based on specific adaptation. Thus, Ofanto performs significantly better under the ecological conditions of Sétif, while GTA dur and Simeto are significantly more productive in the environments represented by the two sites, Oued Smar and Khemis Miliana.

Keywords: adaptation, stability, interaction, diversity, agro-climatic zones



Variation in responses of olive plantlets (*Olea europaea*) to native and exotic arbuscular mycorrhizal fungal inoculations

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Abstract

The most important symbiosis on earth is arguably the mycorrhizal symbiosis. The mycorrhizal fungus provides the host plant with nutrients, such as phosphate and nitrogen, and increases the abiotic (drought, salinity, heavy metals) and biotic (root pathogens) stress resistance of the host. In order to improve the production of olive (*Olea europaea* L.), plantlets of Variety Ferkani were inoculated with three arbuscular mycorrhizal fungal (AMF) spores (*Glomus* sp.1, *Glomus* sp.2, *Septoglomus constrictum*) isolated from a hot-arid zone in Algeria and three commercial AMF (*Rhizophagus intraradices*, *Funneliformis mosseae*, *Gigaspora margarita*). Mycorrhization parameters and nine growth traits were estimated in two-year-old plantlets, then the variation of growth traits following mycorrhizae parameters of various AMF inoculums was tested. The tested AMF species were all infective and effective for the mycorrhization of Ferkani variety. *Glomus* sp.1 gave the best results for mycorrhizal colonization and growth parameters. Indeed, the highest colonization frequency ($F\%$) was recorded in plantlets inoculated with *Glomus* sp.1 ($58 \pm 6.5\%$), whereas the highest values of colonization intensity of in the root system ($M\%$) were obtained with *R. intraradices* ($2.45 \pm 1.46\%$) and *Glomus* sp.1 ($2.26 \pm 0.76\%$). Abundances of arbuscules were low for all AMF inoculums. The controlled inoculation improved the growth of all plantlets compared to the AMF-free plantlets. AMF-inoculated plantlets showed significantly higher growth in terms shoot height, fresh and dry weights of shoot and root, and number of leaves and nodes. Statistical models revealed that all the latter growth parameters including mycorrhizal responsiveness increased significantly when mycorrhizal parameters increased, and that $F\%$ most strongly correlated with plant growth compared to other mycorrhizal parameters. Findings of this controlled inoculation research underline the importance of local AMF isolated from the rhizosphere of Ferkani variety in rapidly and extensively infecting the root system and then increasing growth of the host.

Keywords: native soil fungi; arbuscular mycorrhizae; biotic plant responses; controlled inoculation.



Study of pollen's germination of some Rosaceae.

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Abstract

This study explores the germination process of pollen from various species within the Rosaceae family, which includes economically and ecologically important plants like apples, cherries, and roses. The primary objective is to understand the factors influencing pollen viability and germination rates, which are critical for successful fertilization and fruit set. By examining different environmental conditions, such as temperature and humidity, as well as the chemical composition of the pollen and the stigma's receptive surface, the research aims to provide insights into the reproductive biology of Rosaceae. The study examines how different temperature ranges affect pollen germination and tube growth, identifying optimal conditions for each species. The impact of varying humidity levels on pollen viability and the germination process is analyzed to determine the best conditions for successful fertilization.

The research investigates the biochemical makeup of the pollen, including the presence of essential nutrients and enzymes that facilitate germination. The study also examines the chemical properties of the stigma's receptive surface, which can influence pollen adhesion and tube penetration.

In Vitro Germination Tests: Pollen is germinated in controlled laboratory conditions to observe germination rates and pollen tube growth. Different media compositions are used to identify optimal germination environments.

Microscopic Analysis: Advanced microscopy techniques are employed to visualize pollen tube growth, structure, and interaction with the stigma. This helps in understanding the physical and chemical interactions during the germination process.

Overall, this comprehensive study aims to provide valuable knowledge on the reproductive mechanisms of Rosaceae plants, contributing to advancements in horticultural practices and agricultural productivity.

Keywords: pollen, germination , Rosaceae, Microscopic Analysis.



***Orobanche crenata* Forsk, a Parasitic Plant in Cultivated Fields in the Tafna
Valley**

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Abstract

Orobanche crenata Forsk, a plant from the Orobanchaceae family, parasitizes many plants and is particularly aggressive towards legumes. It extracts water and nutrients from the host plant, causing damage that can lead to the loss of an entire crop, such as beans. This parasite can grow up to half a meter in height, sometimes reaching one meter, indicating the extent to which it depletes the host plant.

Through field visits, we discovered the presence of this parasite in the cultivated and irrigated fields adjacent to the Tafna Valley, where the land is considered fertile for many crops. *Orobanche crenata* Forsk parasitizes the roots of two species cultivated in the Tafna Valley: the first, *Lactuca sativa* L. (lettuce) from the Asteraceae family, and the second, *Vicia faba* L. (broad bean) from the Fabaceae family.

In-depth studies by specialists to understand how this parasite spreads, its impact on agricultural yields, and how to eradicate it have become a necessity, as farmers still rely on mechanical treatments and suffer significant losses.

Keywords:

Orobanchaceae, *Orobanche crenata*, Oued Tafna, parasite, *Lactuca sativa*, *Vicia faba*.



Field Phenotyping of Durum Wheat Resistance to Fusarium Head Blight

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Abstract

Durum wheat is the most important cereal crop in Algeria, and despite the large cultivation areas, production remains low, highly irregular, and insufficient to meet the country's needs. Nationally, several studies conducted over the past two decades have highlighted the importance of the agents responsible for Fusarium head blight. Additionally, certain Fusarium species affect grain health quality by producing mycotoxins. This information motivated our interest in studying the phenotyping of resistance in some durum wheat genotypes (parental varieties and lines) for their behavior against Fusarium head blight caused by several Fusarium species. For this purpose, disease evaluation was carried out under field conditions. Our research focused on monitoring the development of symptoms throughout grain filling, after artificial inoculation of spikes with Fusarium strains to establish an initial picture of the differences in genotype behavior towards Fusarium head blight. The evaluation criteria included disease assessment using a rating scale, measurement of thousand-grain weight, and AUDPC (Area Under Disease Progress Curve). The results revealed that the varieties and lines resulting from crosses had varying levels of sensitivity to Fusarium species, and no genotype showed complete resistance (immunity) under our cultivation conditions. Among the tested material, some lines exhibited higher resistance than their parents. The results also indicated slight variability in behavior related to the aggressiveness of the Fusarium species studied in this work.

Our results open up significant research prospects on Fusarium head blight in Algeria, particularly the search for mycotoxins as possible causes of poorly understood human diseases and the factors that contribute to their accumulation in grains.

Keywords: Durum wheat, Fusarium head blight, resistance, sensitivity, aggressiveness.



Effect of environmental factors on the biodiversity of wild apricot found in arid and semi-arid areas

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Abstract

Prunus armeniaca known also as *Armeniaca vulgaris*, is a rosacea family stone fruit, present in domesticated and wild forms. This species is cultivated in various parts of the world for its economical, nutritional and therapeutic value. Knowing that environmental factors affect many characteristics of the plants (morphological, phenological), this research aimed to evaluate the morphological diversity of the flowers of various wild apricots selected from four distinct geographical regions of Algeria. Eleven quantitative and qualitative characteristics for six wild apricots were analyzed using the UPOV morphological keys. the flower morphology of wild Algerian apricot is characterized by a diameter between (2,69-3,41cm), petal length around 1,14-1,47cm , a width between 1,26-1,65cm , pistil length ranged from 0,62 to 1,72cm, 29 to 33 number of etamines, oblong or round petal shape, petal number were 5 or 6, stigma position were below or on the same level, defined by one pistils, and finally a downwards sepal. The comparison of the six genotypes showed a significance statistical differences for the color of petals (36.79 %) and location of the stigma (24.80 %). environmental parameters recorded (temperature, altitude) for the samples sites had a significant positive and negative correlation with the character studied. According to the ACH report, the genotypes were divided into two major groups depending on the temperature and altitude of the sampling areas and revealed variability among them. Based on the current PCA study, almost all variables were able to illustrate variation among the accessions. The findings revealed the existence of morphological variations between accessions, may be due to environmental change.

Keywords: *Prunus armeniaca*, UPOV, Flowers, Wild apricot.



***In vitro* and *in vivo* fungicidal activity of essential oils against *Fusarium* sp, *Alternaria* sp and *Botrytis cinerea* associated to tomato crop**

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Abstract

The present study assesses the antifungal activity of essential oils of four medicinal plants: peppermint *Mentha × piperita* L, myrtle *Myrthus communis* L, eucalyptus *Eucalyptus radiata* Sieber ex DC and lemon verbena *Aloysia citrodora* Palau. This work was carried out in two main steps : first evaluation of the inhibition of mycelial growth and of spores germination of the tomato pathogenic fungal agents *Fusarium* sp, *Alternaria* sp and *Botrytis cinerea* during an *in vitro* assay. Then, measuring the the disease severity reduction *in vivo* using tomato detached leavflets of the sensitive variety Marmande. The essential oils were emulsified in a 1% Tween 80 solution to attain a concentration of 5 %. This concentration was adopted for The hole study. The results of both *in vitro* and *in vivo* tests showed significant differences between the studied essential oils (at a level of 5%) and this for all the shosen parameters. The Ecalyptus essential oil was the most effective in inhibiting the mycelial growth and the spores germination of the fungi followed by myrtle and peppermint while the least effective was the lemon verbena essential oil. Furthermore, *Alternaria* sp was the most sensitive when treated with Eucalyptus essential oil (75.3 % of mycelial growth inhibition, 80.5% of spores germination inhibition) when the least sensitive fungus was *Fusarium* sp treated with lemon verbena essential oil (45.6 % of mycelial growth rate inhibition, 50.5% of spores germination inhibition).

The *in vivo* test results followed the same tendency as the *in vitro* tests where the eucalyptus essential oil was associated to the highst disease severity reduction rates (65.5, 75.33 and 75.25 % for *Fusarium* sp, *Alternaria* sp and *Botrytis cinerea* infections respectively), whereas the lowest disease severity reduction rates were due to treatments with lemon verbena essential oil (46.5 35.25 and 50.0 % for *Fusarium* sp, *Alternaria* sp and *Botrytis cinerea* infections respectively). The findings of the current survey suggests that essential oils could represent an effective substituant for chemical fungicide.

Keywords: essential oils, *Alternaria* sp, *Fusarium* sp, *Botrytis cinerea*, *in vitro*, *in vivo*.



Agronomic Interest of the Pallid Swift [*Apus pallidus* (Shelley, 1870)] in the Biological Regulation of Crop Depredating Insects in Suburban Areas of Algiers

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Abstract

The agronomic importance of the pallid swift, *Apus pallidus*, as a hyper-predator of crop-damaging insects is highlighted through the study of its trophic ecology. This study is based on the laboratory analysis of 60 droppings collected in the botanical garden of the National Higher Agronomic School of El Harrache, an area characterized by a mosaic of forest patches interspersed with gardens, orchards, and experimental agricultural plots with various seasonal and annual crops. The wet alcohol method used to process these droppings allowed the identification of 5,630 individuals belonging to 227 species, spread across 72 families, 5 orders, and 2 classes. These results are presented in a systematic inventory and analyzed using ecological indices, including total and average richness and relative abundance. It was observed that the class Insecta forms the basis of the pallid swift's diet (98.2%). Additionally, within the Insecta, the pallid swift primarily consumes species in the orders Coleoptera (47.1%), Heteroptera (23.4%), and Hymenoptera (21.6%). Among the families of prey species consumed by *A. pallidus*, the Chrysomelidae family, which includes several harmful species to cultivated plants, is the most represented at 8.4%. This is followed by the Formicidae family at 7.1%, which includes many harmful species, particularly the genera *Tapinoma* and *Plagiolepis*, which raise, protect, and promote the multiplication of aphids and scales. Similarly, *Crematogaster scutellaris* (Olivier, 1791) is harmful to forest trees. It is also worth noting the presence in the diet of other pest insect families such as Tingidae, Curculionidae, Scolytidae, and many others, also found in the trophic menu of this Apodidae. This study highlights the opportunistic nature of *Apus pallidus* and qualifies it as a regulator of harmful insect populations and an ally of farmers.

Keywords: Suburban ecosystem, crop depredators, *Apus pallidus*, natural enemy, trophic ecology.



***Trichoderma* sp.: A Promising Alternative against Collar Rot and Head Blight Caused by
Fusarium spp. in Wheat in Algeria**

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Abstract

Durum wheat (*Triticum durum* Desf.) is one of the most important cereals worldwide. Unfortunately, the wheat plant is targeted by several species of the genus *Fusarium*, causing two severe diseases: collar rot (FCR) and head blight (FHB).

The search for new indigenous strains of *Trichoderma* with a high biocontrol potential against these two diseases.

The biocontrol potential of fifteen *Trichoderma* spp. (T1 to T15) isolated from different Algerian ecosystems was evaluated against four strains of *Fusarium culmorum* through in vitro tests (direct and indirect confrontation) and confirmed by in vivo tests.

In vitro results showed significant inhibition of *F. culmorum* mycelial growth compared to the control. The highest inhibition percentages were achieved by isolates T9, T12, T14, with maximum inhibition percentages of 81.81%, 77.27%, and 80.68%, respectively. T14 was selected for biocontrol in in vivo tests. Tube and pot experiments for FCR against *F. culmorum* showed that T14 decreased the disease percentage by 50% and 63.63%, respectively. In greenhouse experiments, FHB infection was significantly reduced by T14 in all tested durum wheat cultivars with disease reduction of 49.77%, 43.43%, 48.25%, and 74.60% for the genotypes Simeto, Waha, Bousselem, and Setifis, respectively. Yields also increased for almost all cultivars. The antagonist T14 was characterized using molecular tools with TEF1- α and ITS1 factors. Results identified T14 as *T. afroharzianum* with accession numbers assigned by NCBI Genbank as MW171248 and MW159753, respectively.

Trichoderma afroharzianum is a promising biocontrol approach against FCR and FHB, evaluated for the first time in Algeria.

Keywords: *Triticum durum*, *Trichoderma*, *Fusarium*, biocontrol.

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Présidente du Séminaire
Dr. BOUSMID Ahlem



ORAL SESSION

**Theme 3: Emerging Technologies in Biotechnology
Research.**



Comparative Metabolomic Profiling of Roots from Three Date Palm (*Phoenix dactylifera* L.)

Cultivars

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Abstract

The date palm is Algeria's most valuable plant, having the second-largest socio-economic impact on the vast Saharan region of the country after petroleum. With approximately a thousand cataloged cultivars, this plant deserves attention in biotechnological and omics studies. Untargeted metabolomics is among the most widely used methods, facilitated by the increasing availability of open-access bioinformatics platforms (XCMS, MetaboAnalyst, MS-Dial, MS-Finder), enabling large-scale data processing. This study aims to establish a metabolomic footprint of the three most cultivated date palm cultivars in Algeria.

Seeds resulting from controlled pollination of Deglet Nour (DN), Ghars (Gh), and Mech-Degla (MD) cultivars were sterilized and germinated in vitro in a reduced MS medium without sugar. Metabolites were extracted using a methyl tert-butyl ether (MTBE)/methanol/water solvent system. Subsequently, analysis was performed using ultra-performance liquid chromatography coupled with an Exactive mass spectrometer (UPLC-MS) in positive (ESI+) and negative (ESI-) ionization modes. Raw data were converted to mzXML format using MSConvert. LC-MS spectra processing was conducted on the XCMS platform, and resulting peak intensity tables were median normalized and logarithmically transformed for functional and statistical analysis on the MetaboAnalyst 5.0 platform.

The resulting metabolomic profiles, for both negative and positive ion modes, revealed contrasting differences between Deglet Nour on one hand, and Mech-Degla and Ghars on the other. Multivariate analysis confirmed the genotypic distance between the cultivars at the metabolomic level. Furthermore, functional analysis, using DN as a reference, highlighted the importance of enriching metabolic pathways based on candidate chemical compounds corresponding to libraries linked to MetaboAnalyst 5.0.

Keywords: *Phoenix dactylifera*, Metabolomics, Bioinformatics.



Highlighting the Biopesticidal Properties of *Pistacia lentiscus* Seeds on the Model Insect *Thaumetopoea pityocampa* SCHIFF by Contact

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Abstract

Phytosanitary interventions have adverse effects on the environment and promote the development of strains resistant to active substances used. Faced with these issues and the awareness of consumers regarding health problems associated with pesticide residues in food and demanding quality products, new crop protection strategies based on the use of biopesticides are emerging. These aim to ensure profitability for farmers and avoid adverse effects on the environment. Biopesticides can be classified into three major categories based on their nature: microbial biopesticides, animal biopesticides, and plant biopesticides. Our work focuses on studying the bioefficacy of aqueous extract from *Pistacia lentiscus* seeds on the pine processionary moth *Thaumetopoea pityocampa* by contact.

To achieve this, we administered three doses: D1=100g/l; D2=50g/l; and D3=25g/l of aqueous extract from *P. lentiscus* seeds by direct spraying on the 5 larval stages of *T. pityocampa*, and studied its action on daily mortality over 11 days, as well as estimating LC50 and LC90 values.

The mean mortality rates recorded were very high from the first day of administration of the aqueous extract of *P. lentiscus* seeds to *T. pityocampa* larvae by contact. These rates progressively increased over time, reaching $98.33 \pm 3.73\%$, $100 \pm 0.00\%$, and $93.18 \pm 9.33\%$ for doses D1, D2, and D3 respectively by the end of the monitoring period. The LC50 and LC90 values recorded were approximately 10.67g/l and 81.24g/l, respectively.

These results demonstrate that the aqueous extract of *P. lentiscus* seeds is toxic to *T. pityocampa* larvae, paving the way for its integration into campaigns against other crop pests. It is therefore highly interesting to isolate and purify these molecules and study the genetic heritage responsible for their synthesis to exploit them in the development of environmentally friendly bioinsecticides.

Keywords: *P. lentiscus*, *T. pityocampa*, Bio-Insecticide, LC50, Forest.



The Effect of Aqueous Extracts from the Lichen *Lobaria pulmonaria* (Lobariaceae) on the Mortality of *Drosophila melanogaster* Larvae (Diptera; Drosophilidae)

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Abstract

In recent years, environmental issues have prompted research organizations and institutions to develop more biological methods to limit the use of chemical pesticides. One such approach is the use of plant secondary compounds to control insect pests.

As part of research conducted in our laboratory, we initiated a protocol to study the delayed effects of aqueous extracts from *Lobaria pulmonaria* on the oviposition behavior of *Drosophila melanogaster*. The lichen is harvested from the oak forests of the Zeen region in Séraïdi, Annaba (Algeria), known for its therapeutic effects in respiratory diseases, as well as its antioxidant and anti-inflammatory activities for *L. pulmonaria*.

Drosophila melanogaster is a laboratory insect that occupies a central place in biological research. Larvae can cause intestinal irritation or diarrhea if ingested by eating infested fruits.

In this study, second-stage larvae were treated with three different concentrations: 0.20µg/ml, 0.25µg/ml, and 0.5µg/ml. Treatment was administered through ingestion. Larvae were monitored for 15 days, the time required to complete development. The results show that the aqueous extract of *L. pulmonaria* resulted in mortality of *D. melanogaster* flies during treatment (larval and adult stages).

This indicates the presence of toxic secondary metabolites in the studied extract, which could lead to the development of bioinsecticides based on *L. pulmonaria* for use in agriculture and sale in the pesticide market.

Keywords: *Drosophila melanogaster*, *Lobaria pulmonaria*, aqueous extract, toxicity.



Study of Pesticides as Potential Factors in the Onset of Neurodegenerative Diseases via Molecular Modeling

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Abstract

Pesticides, also known as phytopharmaceutical products, are intended to protect plants against harmful organisms, regulate their growth, preserve crops, and improve the quantity and quality of food products. However, they remain toxic and hazardous to human health. The use of carbamates exposes farmers and applicators to various pathologies such as neurodegenerative diseases.

These diseases progressively and slowly affect the nervous system, leading to impaired cognitive abilities and intellectual skills. Occupational exposure to pesticides poses a significant health risk, highlighting the need to explore biological alternatives to minimize their impact.

In this research, molecular modeling will enable us to visualize and calculate potential reactions using computer software to determine the molecules implicated in the onset of these diseases.

Keywords: Agriculture, pesticides, risk factors, health, neurodegenerative diseases, molecular modeling.



Role of Osmolytes in Salt Tolerance of *Atriplex halimus* L.

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Abstract

Atriplex halimus L. is a xero-halophytic species widespread in the Mediterranean basin. It is extensively used in traditional medicine, human and animal nutrition, as well as in soil restoration. Faced with environmental constraints, halophytic plants exhibit a wide range of morphological, physiological, and biochemical adaptations. The most common mechanisms involve osmotic adjustment through the accumulation of osmolytes such as proline and soluble sugars.

The objective of our study is to evaluate the response of *Atriplex halimus* L. seedlings to salinity stress. To achieve this, saline stress induced by sodium chloride (0, 100, 300, and 600 mM) under semi-controlled hydroponic conditions was applied. After 5 days of treatment, proline and soluble sugars were quantified.

The results show significant accumulation of proline and soluble sugars in the leaves of seedlings subjected to 600 mM NaCl stress, with respective contents of 0.15 and 2.69 µg/g. Compared to controls recording values of 0.03 µg/g proline and 0.48 µg/g soluble sugars.

Our study demonstrated that salt stress stimulates the synthesis of osmotic compounds in the leaves of *Atriplex halimus* L. seedlings. These osmolytes effectively contribute to the species' tolerance mechanisms. Their accumulation varies with the intensity of the stress; severe stress leads to significant synthesis of compounds within the cells.

Keywords: *Atriplex halimus* L., Salt stress, NaCl, Proline, soluble sugars



Impact of Irrigation on Groundwater Quality in Semi-Arid Regions. Case Study: Moyen Cheliff Region

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Abstract

This study was conducted in the irrigated perimeters of the Kherba-Abbadia and Oued Fodda-El Karimia plains (Moyen Cheliff region), located in northwestern Algeria, characterized by a semi-arid climate. The region contains an alluvial aquifer, the primary water resource used for various sectors, including drinking water supply and agriculture. The irrigable area of the Kherba-Abbadia and Oued Fodda-El Karimia plains was estimated at 8533 ha and 4932 ha, respectively, in 2008. The eastern Moyen Cheliff plains have witnessed significant agricultural development in recent years following the implementation of agricultural development programs such as PNDA in 2000 and FNRDA in 2001, leading to increased water demand for irrigation and consequent overexploitation of the Moyen Cheliff alluvial aquifer.

Previous studies have indicated seasonal fluctuations in water quality (between dry and wet seasons) due to increased water demand for agricultural activities and natural factors such as drought, exacerbating constraints on this resource temporally and spatially. This study aims to assess the effects of irrigation on the physicochemical properties of groundwater in the region. Fifty-seven (57) samples were collected and analyzed during high and low water periods in 2016 and 2017 by the National Agency for Water Resources. Modern tools such as Principal Component Analysis (PCA), mapping, Piper diagram, binary diagrams, base exchange indices, and saturation indices were used for data processing and representation.

The interpretation of these data revealed the following: water quality is good in the northern part of the aquifer (El Abadia El Amra zone), fair to poor in the eastern and central parts with the presence of contaminants from nitrates used in agricultural activities, and very poor in the west (near Mount Témoulga) due to high salinity influenced by lithology. The use of certain waters may have a negative impact on soil evolution. A notable characteristic of the Moyen Cheliff alluvial aquifers is the enrichment of Cl⁻ compared to Na⁺, which cannot be explained solely by halite dissolution (anthropogenic origin). Local perturbation of the piezometric level occurs in the central, eastern, and southwestern parts of the plain during dry periods due to overexploitation of the aquifer for irrigation purposes.

Keywords: groundwater, agricultural activities, irrigation, quality, salinity, Moyen Cheliff



Application of Antifungal Power of Essential Oils in Combating Fungi Causing Apple Rot

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Abstract

Aromatic and medicinal plants constitute a very important natural wealth whose valorization requires a perfect understanding of the properties to be highlighted. Several studies have highlighted the various biological activities of aromatic and medicinal plants, especially their antifungal, antibacterial, antioxidant, and insecticidal properties. Therefore, essential oils could serve as food preservation agents due to these properties. The objective of the present work is to test the in vitro antifungal activity of essential oils from *Eucalyptus camaldulensis*, *Rosmarinus officinalis*, and *Ruta graveolens* against *Alternaria alternata* and *Penicillium expansum* responsible for fruit and vegetable rot.

The antifungal power of essential oils obtained by hydrodistillation, against *Alternaria alternata* and *Penicillium expansum* responsible for apple rot during storage, was studied using the micro atmosphere technique. The quantity of pure essential oils tested ranged from 2.5 to 30 μ l.

All three plant extracts completely inhibited the growth of *A. alternata* and *P. expansum*. However, *Ruta graveolens* essential oil was the most active; indeed, 2.5 μ l of its extract was sufficient to completely inhibit the mycelial growth of both fungi, whereas 30 μ l of *Eucalyptus camaldulensis* and *Rosmarinus officinalis* essential oils were required to achieve the same effect on both fungi. This antifungal activity is mainly due to the chemical composition of the essential oils. These results warrant further investigation through in vivo tests to develop a biological control method using natural substances against fungi causing apple rot.

Keywords: *Eucalyptus camaldulensis*, *Rosmarinus officinalis*, *Ruta graveolens*, Essential oils, Antifungal activity, apple rot.



Induction of Callogenesis in Various Chickpea (*Cicer arietinum* L.) Varieties Using In Vitro Culture Technique

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Abstract

Chickpea (*Cicer arietinum* L.) is cultivated for its importance as a food crop, providing a protein-rich and energy-rich food source for humans. This leguminous plant contributes to soil fertility by enriching it with nitrogen fixed by bacteria in the nodules of its roots. Given its importance, applying biotechnological tools to enhance its quality and quantity, and selecting varieties resistant to biotic (phytosanitary diseases) and abiotic factors (drought, salinity, etc.), is of interest. The aim of our research is to induce callus formation (callogenesis) in *Cicer arietinum* L. and to study the influence of biotic factors (variety and organ) and abiotic factors (hormones) controlling this physiological phenomenon of callogenesis.

Explants (leaflets and internodes) from the varieties to be tested are disinfected and cultured on MS medium containing different types of hormones (2,4-D, IAA, Kin, and BAP). These explants are exposed to a temperature between 22 and 25°C and a photoperiod of 16 hours.

The results obtained show that callogenesis could be initiated in chickpea (*Cicer arietinum* L.). The expression of this physiological phenomenon of callogenesis is controlled by factors related to variety, organ type, and hormones: a high percentage of calli is obtained from stems in the presence of a high concentration of 2,4-D and a lower concentration of kinetin. Internodes of the Flip97/657 variety produced 95% of calli in the presence of 1.5 mg/l of 2,4-D and 0.5 mg/l of kinetin, while the ILC199 variety required different concentrations: 1 mg/l of 2,4-D and 0.25 mg/l of kinetin. Callogenesis was successfully initiated in varieties (Flip87/5, Flip97/657, ILC263, ILC3996, ILC4107, ILC1929, and ILC199) using tested organs (stems and leaflets) and with hormones (auxin such as 2,4-D or IAA associated with a cytokinin such as kinetin or BAP).

Three types of calli (beige and friable, green and compact, brown and friable) could be produced depending on the variety and hormonal combination: beige calli were obtained from stems in all four tested varieties in the presence of IAA and kinetin hormonal composition. Green calli were produced from stems and leaflets in the ILC199 variety with varying concentrations of kinetin and IAA. Brown calli were only observed in the ILC3996 variety with the same hormones but at different doses: 1 mg/l of IAA and 0.5 mg/l of kinetin.

Keywords: Biotechnology, callogenesis, in vitro culture, *Cicer arietinum*, auxins, cytokinins.



Evaluation of the Efficacy of Two Formulations Based on Essential Oils of *Rosmarinus tournefortei*

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Abstract

The general context of this study aims to explore new bioactive molecules with biocidal activity, constituting an approach in integrated pest management.

The overall effectiveness evaluation of two formulations of essential oils from *Rosmarinus tournefortei*, derived from different modes of organic nutrition (liquid vermicompost application, solid vermicompost application, and tap water) and salt stress was conducted to assess the effect through foliar application on the adult model plant. During this study, essential oils were extracted from this plant through hydrodistillation (Clevenger) to evaluate their insecticidal potential through contact and ingestion against adults of a formidable pest of stored products, "*Tribolium confusum*," compared to a positive control (without essential oil).

In terms of biocidal activity, both formulations of essential oils tested under the influence of all stimulants proved highly effective. It was noted that the mortality rate significantly decreased with increasing doses of 1g, 1.5g, and 2g respectively, and exposure time.

However, the liquid formulation based on rosemary essential oils appears to be more effective than the solid formulation.

These results indicate that the tested essential oils could serve as alternative solutions to synthetic chemical pesticides in combating this pest of stored products.

Keywords: Biocidal activity, solid formulation, liquid formulation, essential oil, *Rosmarinus tournefortei*, *Tribolium confusum*, Stimulants.



Use of Some Chemical Reagents for the Identification of Edible Basidiomycete Fungi

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Abstract

In mycology, studying the morphological characteristics of fungi, such as shape and color, is essential for their identification. To characterize and confirm their identity, there are simple macrochemical methods that can be applied directly to the fruiting body of the mushroom. In this study, we highlighted the use of several chemical reagents to identify two edible basidiomycete fungi.

In practice, we used the following reagents: pure formaldehyde, concentrated ammonia, iron sulfate, Melzer's solution (a thick liquid composed of iodine, potassium iodide, chloral hydrate, and water), 3% sulfovanillin, and 10% KOH. A few drops of each reagent were separately applied to the mushroom flesh. A spontaneous color change in the tested part indicated a positive reaction. Melzer's solution was applied to a mushroom fragment, which was then observed under a light microscope.

In the results section, we noted that both fungi exhibited different colors in the presence of the various reagents tested. The dark blue coloration resulting from the use of pure formaldehyde confirmed that one of the two studied fungi belongs to the genus *Lactarius sp.* additionally; the appearance of transparent spots (resembling oil spots) after using concentrated ammonia confirmed the genus *Pleurotus sp.* for the second fungus.

In conclusion, the use of chemical reagents provides a rapid and effective method to identify and recognize edible mushrooms among many others in the field.

Keywords: Mushroom, chemical reagent, identification, *Lactarius*, *Pleurotus*.

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POSTER PRESENTATIONS



Improvement of Agriculture through the Use of Biofertilizers from Glyphosate-Degrading Strains

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Abstract

The excessive use of glyphosate, which is the most widely used herbicide globally in agriculture to increase yield, has led to the accumulation of this herbicide in the soil. It is essential to understand the fate of this product in the environment and assess the ecotoxicity of these phytosanitary substances. Several physico-chemical treatment processes exist for this purpose, such as photodegradation, oxidation, and membrane techniques. However, these processes are costly and ineffective, whereas biodegradation by enzymatic systems of certain microorganisms, which are responsible for recycling elements and soil fertility, leads to the production of the main metabolite; aminomethylphosphonic acid (AMPA), and ultimately to the production of water, carbon dioxide, and phosphate, which are then used by plants. The objective of this study is to identify new glyphosate-degrading strains from uncontaminated soil.

soil sampling, physico-chemical analysis of the soil, screening of strains using the ELISA technique, biochemical and Gram identification, antimicrobial activity.

Most of the glyphosate-resistant strains are Gram-positive bacilli with the ability to degrade glyphosate at high concentrations into several metabolites.

Keywords: soil microflora, bioremediation, biodegradation, toxicity, biofertilizer.



Determination of Minor Compounds in Virgin Olive Oil and Evaluation of Its Potential Protective Effects on the Renal Profile of Wistar Rats with NPTiO₂ Toxicity

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Abstract

Recent studies indicate that TiO₂ nanoparticles (NPTiO₂) can induce oxidative stress in rats. This study aims to evaluate the potential protective role of virgin olive oil from the Biskra region by determining its content of antioxidant compounds (polyphenols, carotenoids, and flavonoids) and its antioxidant activity both in vitro (DPPH test) and in vivo in rats with oxidative stress induced by NPTiO₂.

Biochemical analysis of some minor compounds in the oil shows a total polyphenol content of (321 mg of GAE/kg), chlorophylls (1.56 ppm), carotenoids (8.56 ppm), and flavonoids (34 ppm). The antioxidant activity, indicated by the inhibition percentage, is (0.15%), which is attributed to the oil's richness in antioxidants, particularly polyphenols.

For the in vivo study, male Wistar rats were randomly divided into four groups (n=6): a control group receiving distilled water (group A), (group B) with oxidative stress induced by NPTiO₂ (40 mg/kg BW), and two groups C and D treated with NPTiO₂ and olive oil extract at doses of 20ml/g and 40ml/g. These components were administered daily by gavage for 2 months. Treatment with olive oil significantly elevated renal antioxidant enzymes compared to the NPTiO₂ controls. Conversely, the renal MDA levels significantly increased in these same rats.

In conclusion, it can be deduced that the administration of virgin olive oil extract to NPTiO₂ rats showed beneficial effects on the renal profile and antioxidant defense status.

Keywords: polyphenols, flavonoids, carotenoids, NPTiO₂, oxidative stress, DPPH.



Antioxidant Activity of Phenolic Compounds of *Herniaria glabra*

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Abstract

To investigate antioxidant activity, total phenolic and flavonoid content of methanol and aqueous extracts of *Herniaria glabra* root, stem and leaf parts selected from Ain Arnat Sétif regions of Algeria. The antioxidant activity of different extracts (aqueous and Methanol fractions) from *Herniaria glabra* was evaluated by the DPPH scavenging test. The total phenolic and total flavonoid content of these extracts was determined according to the Folin-Ciocalteu procedure and Aluminum chloride colorimetric assay respectively. Total phenolic content was measured by Folin Ciocalteu reagent. All the extracts showed significant antioxidant activities and contained important levels of phenols. The methanol extract from *Herniaria glabra* showed the greatest antioxidant capacity, which was probably due to its high content of polyphenols. Total flavonoid content was found equal for all extracts. Our results of antioxidant assays were justified and partially supported the popular usage of the tested plants. The high antioxidant activity found in the plant in this region suggested that *Herniaria glabra* is a good source of natural compounds which might have benefits for health.

Keywords: *Herniaria glabra*, Folk medicine, Flavonoids contents, Polyphenols, Antioxidant activity.



Effect of culture medium on hairy root induction frequency from medicinal plant in order to produce pharmacological compounds

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Abstract

The aim of this study is genetic transformation of *Calotropis procera*, medicinal shrub grown in Africa, Asia and Algeria in order to produce bioactive molecules associated with biological and pharmacological effects. Cotyledon explants were infected with *Agrobacterium rhizogenes* (strain A4), which induced hairy roots. The transformed hairy root lines were confirmed by PCR using rolB gene- specific primers. Various solid media culture was used for induction of hairy roots in in vitro grown tissues of the plant. GC-MS analysis was conducted for phytochemical analysis. Our results revealed that *A. rhizogenes* was effective in inducing transformed roots in *C. procera* and that different culture media types responded differently to hairy root induction. Among the four-culture media evaluated, half strength B5 medium produced maximum of transformed roots frequency. PCR analysis detected the rolB gene in the transformed samples. In addition, we also investigated phytochemical composition of transformed roots using GC-MS. Most abundant molecules were phytosterols.

The *A. rhizogenes* strain played a significant role in producing and promoting the growth of transformed roots in *C. procera*. This approach can potentially be utilized for the replacement of conventional field methods for secondary metabolite production from plants.

Keywords: *Agrobacterium rhizogenes*, *Transformed roots*, *C. procera*, *half strength B5 medium*



Impact of Water Stress and Exogenous Proline on Some Biochemical and Physiological Markers of *Triticum aestivum* L.

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Abstract

Drought is one of the main constraints limiting crop productivity worldwide. It can lead to a decrease in the yield of major crops through morphological and physiological alterations. The maintenance of water potential during dehydration is expressed by maintaining turgor through osmotic adjustment. Numerous studies have demonstrated that during water stress, the application of exogenous proline confers osmoprotection and osmoregulation to several plant species. To highlight the effects of exogenous proline on the tolerance and/or resistance of wheat (*Triticum aestivum* L.) under severe water stress conditions, water stress was applied on the seventh day of growth by adding a polyethylene glycol (PEG-6000) solution (-1.027 MPa) supplemented with exogenous proline at a concentration of 6 mM. Relative water content (RWC), stomatal conductance, compatible solutes (sugars and proline), and total amino acids were evaluated after 30 days of growth. The results showed a remarkable decrease in RWC and stomatal conductance under water stress. Conversely, there was a significant accumulation of soluble sugars, total amino acids, and endogenous free proline in the leaves and roots of wheat, which can mitigate the effects of this stress.

The addition of proline under water stress conditions significantly increased RWC and stomatal conductance, as well as the content of endogenous free proline in wheat plants compared to the same water conditions without proline supplementation. These beneficial effects of exogenous proline on cellular turgor are accompanied by higher RWC and a strong accumulation of endogenous free proline. Overall, our results showed an improvement in plant tolerance to water stress following the enrichment of the medium with exogenous proline. It indeed appears that the addition of proline under water deficit conditions is effective in improving water stress tolerance.

Keywords: drought, exogenous proline, RWC, osmotic adjustment, resistance.



Phylogenetic relationships in Citrus fruit trees revealed by molecular markers

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Abstract

Application of molecular markers, have now been increasingly adopted to address the problems in Citrus taxonomy. This work seeks to use an effective protocol to identify, enhance and conserve Citrus biodiversity in Algeria. 37 chloroplast molecular markers were used to assess genetic diversity and infer the phylogenetic relationship of Algerian Citrus accessions. SNPs (Single Nucleotide polymorphism) and Indels (Insetion/deletion) markers generated by 26 primers were used to classify Algerian Citrus accessions (*C. sinensis*, *C. reticulata*, *C. limon*, *C. clementina* and *Citrus maxima*). 13 chloroplast molecular markers (10 SNPs and 3 Indels) were used to discriminate *Citrus* groups and species. The sequence of chloroplast DNA of *Citrus sinensis* was used as reference. Our results indicated that Pomme d'Adam and Beni Abbes varieties should be grouped in another group different that the lemon group. All varieties studied from *Citrus reticulata* and *Citrus clementina* have the molecular markers characteristic of the recent mandarins. Then, they are considered as recent mandarins as well as Fina, contrarily to Sunki which is an "old" mandarin. SNP markers allowed us to discard two varieties (Morro clone Dombasle and Shamouti Skikda) from sweet orange group. These results show that some of these accessions can be wrong classify and how can these molecular markers help to make accurate in botanical classification of *Citrus* species.

Keywords: *Citrus*, characterization, Genetic, Molecular marker, cultivar



Biodiversity and Nutritional Use of *Moringa oleifera* in the Tlemcen Region
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Abstract

Moringa oleifera is a plant of nutritional and medicinal interest, originating from India. This study examines the uses of Moringa by the populations of Algeria, particularly those in the city of Tlemcen. It identifies the various parts of Moringa utilized, as the availability and knowledge of usage methods are prerequisites for the proper dissemination, cultivation, and preservation of this species. A diagnostic of usage methods was conducted among the populations, focusing on the following questions: What is the level of use and/or consumption of Moringa in the city of Tlemcen, and does the supply of Moringa meet the demand of the populations? The methodology used includes surveys with questionnaires and semi-structured interviews with the population and farmers, supplemented by field observations. The results show that a small proportion (20%) of respondents know about Moringa, and (3%) of them use the leaf powder. Moringa leaves are mainly used as a dietary supplement by the respondents. Awareness of cultivation techniques, management practices, and the virtues of this tree is necessary for its promotion, availability, and sustainability. Scientific research should provide the populations with technical references on the production and uses of different parts of Moringa. Policymakers should take measures to make Moringa accessible to all populations by creating plantations that can supply leaves, seeds, and roots of this species throughout the year. Development structures need to raise awareness and train populations on the techniques of using and processing different parts of Moringa in general, and on making leaf powder as a dietary supplement.

Keywords: *Moringa oleifera*, Biodiversity, Uses, Technological Transformation, Dietary Supplement.



Exploitation of Natural Biodiversity in the Biocontrol of Bacterial Blackleg Disease in Potato Crops "*Solanum tuberosum*" and Perspectives for Improving Yield Quality

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Abstract

Agriculture in Algeria is an extremely important sector of the country's economy. It covers a large part of the national territory and contributes to the exploitation of natural resources on one hand, and strengthens food security on the other. In this regard, the current food situation in Algeria requires better management of the improvement of agricultural production, particularly strategic crops with large consumption, which are mainly cereals and potatoes.

Due to its intense productivity, cultivation conditions, and wide distribution, the potato "*Solanum tuberosum* L." is, like various other crops, one of the plant productions most exposed to numerous phytosanitary problems that severely limit food productivity and are responsible for significant economic losses in most seed-producing and using countries. Among the diseases affecting potato plants is a bacterial disease commonly called "blackleg," caused by the phytopathogenic agent "*Pectobacterium carotovorum*."

To address the challenges of reducing synthetic agricultural inputs, new approaches to protection and alternative stimulation of potato plants have been the subject of numerous studies using biological organisms with bactericidal or fungicidal properties to reduce bio-aggressor pressure, strengthen plant resistance, improve growth, and better protect the environment.

This is the context of our research perspective, which aims to exploit Algeria's natural biodiversity and study the effectiveness of new biological control methods based on beneficial microorganisms against bacterial blackleg disease in potatoes through a literature review.

Keywords: Blackleg, biological control, beneficial microorganisms, *Pectobacterium carotovorum*, food production, *Solanum tuberosum* L.



Seeds priming improves tolerance against salt stress in cowpea

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Abstract

Salt stress influence seed germination and seedling growth of many plants, such as Cowpea. Seed priming could be used to alleviate the depressive effects of salt stress. The study was carried out to assess whether salt tolerance could be enhanced by seed priming at the germination stage in Algerian Maghreb Cowpea (*Vigna unguiculata* L. Walp.). Seeds of two Cowpea landraces (A18 and TZ2) were soaked for 4 h at 25°C in the dark in distilled water (hydropriming) or 80 mM of NaCl, CaSO₄ or CaCl₂ (halopriming) separately. Untreated seeds were taken as control (Unprimed seeds). Both primed and unprimed seeds germinated under salt stress (0 (distilled water), 85 mM and 170 mM of NaCl). Germination traits all decreased gradually with increasing salt intensity. These effects were more pronounced in TZ2, landraces as compared to A18. However, seed priming increased significantly germination percentage, speed of germination, final germination percentage, radical length, hypocotyl length, epicotyl length induced better vigour index under saline and non-saline conditions as compared to the unprimed seed. Hydropriming, halopriming with NaCl or CaSO₄ proved to be the most effective since the seeds primed with these treatments had significantly higher germination performance and seedling Vigour index than those treated with CaCl₂ under saline and non-saline conditions as compared to the unprimed seed. Hydropriming, or halopriming with NaCl 80 mM or CaSO₄ 80 mM proved to be effective methods.

Keywords: Cowpea ; Halopriming ; Hydropriming ; Salinity tolerance.



Phytochemical, free radical scavenging and antimicrobial activities of *Coriandrum sativum*
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Abstract

The purpose of this study is to realize a phytochemical screening and determine the antioxidant and antibacterial activities of the phenolic compound of *Coriandrum sativum* L. fruits. The phenolic compounds were extracted by four solvents of increasing polarity (dichloromethane, ethyl acetate, butanol and methanol) respectively and analyzed using different tests in vitro in order to evaluate their total phenolic and flavonoid contents, antioxidant and antibacterial activities. The phytochemical study of the *Coriandrum sativum* fruits showed the presence of certain chemical compounds such as: alkaloids, flavonoids, saponins, reducing compounds, tannins and volatile oils, coumarins, triterpenes, resins and . The content of the total phenols by the Folin-Ciocalteu method and flavonoids by the AlCl₃ method with the methanolic extract gave higher values which estimated: (35.90 ± 3.20 mg AGE / g Ext) and (4.56 ± 3.78 mg QE / g Ext) respectively. The quantitative evaluation of the anti-radical activity has proved that methanolic extract is the most active (IC₅₀ = 0.030 mg / ml); however, ascorbic acid (used as control) showed approximately equivalent activity (IC₅₀ = 0.020 mg / ml), indicating the presence of compounds effective in the chemical composition of the plant that have a high capacity in reducing DPPH. The phenolic extracts from the fruits *Coriandrum sativum* showed considerable activity against all bacterial tested.

Keywords: *Coriandrum sativum* , Phytochemical Analysis, Phenolic Compounds, Antioxidant Activity, Antimicrobial Activities.



Screening of *Xylella fastidiosa* species in plant tissues: Evolution of molecular and serological methods.

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Abstract

Xylem bacteria, a prokaryotic species and obligatory parasite of plant xylem, attacks various plant species (olive trees, grapevines, citrus fruits, stone fruits, coffee, avocado, alfalfa, oleander, oak, maple, etc.), colonizing their xylem and obstructing the movement of raw sap. The bacterial species affects over 300 plant species, notably grapevines and olive trees. Symptoms such as wilting and leaf scorching are nonspecific, making diagnosis and detection of the pathogen challenging. A Gram-negative bacillus, strictly aerobic, non-motile, non-spore-forming, negative for oxidase, and positive for catalase. Optimal growth temperature ranges between 26°C and 28°C, with an optimum pH of 6.5 to 6.9. GC content between 51% and 52.4%. Auxotrophic and obligate xylem parasite. Various bacteriological media are proposed, with BCYE (Buffered Charcoal Yeast Extract) and GYE (Yeast Extract Agar) being most effective. In vitro growth is notably slow compared to in vivo cultures. The species is transmitted by sap-feeding insects belonging to the order Hemiptera and suborder Auchenorrhyncha. These insects have short rostrums and two stylets in their mouthparts, enabling access to xylem vessels for feeding on raw sap. Considered a quarantined organism, requiring mandatory reporting in phytopathology. Currently, no curative measures exist against this bacterium. European regulations specify eradication measures, including the destruction of sensitive plants within 50 meters and quarantine measures over several kilometers around contaminated vegetation to prevent further spread. In Algeria, there is limited available data on this epidemiological situation, necessitating urgent measures such as establishing a reference laboratory with qualified specialized teams and strain banks, and establishing a national observatory for monitoring and vigilance over global and national developments.

Keywords: Xylellosis, *Xylella fastidiosa*, Phytopathology, Plant species, Agroecology.



A study of natural enemies associated with invasive leaf miner *Tuta absoluta*, and their functional biodiversity on tomato crops in arid environment of Algeria.

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Abstract

The study concerns on control of *Tuta absoluta* in the arid agricultural circles, case of Biskra southeastern of Algeria. A survey of natural enemies was conducted on tomatoes crops during 6 months throughout the period 2019-2020, whereas many methods of monitoring and sampling were used as: yellow basins, yellow sticky traps, Barber pots and yellow bottles in the greenhouse, with randomly sampled of 120 infected leaves every 15 days; The abundance and the diversity of specimens were evaluated using quantitative data calculated in PAST version 2.17 and SPSS. In total, 339 beneficial arthropods were collected, 39.82% predators, 60.18% parasitoids, belonged to 2 classes, 18 families, 35 species, the most represented families were Braconidae (17.1%), Ichneumonidae (17.1%) and Miridae (8.5%), Eulophidae (8.5%), Anthocoridae (5.6%), Chalcididae (5.6%), Trichogrammatidae (5.6%), Salticidae (2.9%), Tachinidae (2.9%), Carabidae (2.9%), Coccinellidae (2.9%), Geocoridae (2.9%), Chrysopidae (2.9%), Formicidae (2.9%), Bethyridae (2.9%), Scelionidae (2.9%), Vespidae (2.9%), Pteromalidae (2.9%). Given that a value of specific diversity was moderate to high richness (H' values in 1 to 3 range), noted a density of species by month was higher in March (27.73%) and April (30.97%), then May (16.83%), February (16.22%), and January (8.25%), such most species were constant ($C\% = 60\%$ to 100%), and quite abundant. Behavior and temporal variations of natural enemies were related to temperature, but the development of large number of species collected was stopped between $30\text{ }^{\circ}\text{C}$ to $39\text{ }^{\circ}\text{C}$, which gave an insufficient potential for control the pest due to their perturbation and sporadic presence over the agricultural season with their feeble abundance compared to the host.

Keywords: *Tuta absoluta*, Biskra, natural enemies, diversity, abundance, temperature.



Biological control of Dairy products with Essential oils

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Abstract

Food safety is regarded as one of the most important concerns in the global food business. The use of essential oils as a preservative has gained popularity in this industry in recent years. Our work aimed to see how unripened cheeses with and without *cinnamon cassia* essential oil (CCEO) compared in terms of microbiological characteristics. Fresh cheeses were made from pasteurized milk by mixing in mesophilic lactic ferments that had previously been isolated from Algerian artisanal goods and identified within the species. All of the samples were tested for microbiological quality according to Algerian requirements over the 21 days of cold storage, enumerating the total aerobic mesophilic flora and searching for the pathogens *L.monocytogenes*, *S.aureus*, and *Salmonella sp.* In addition, pH and acidity measurements were taken.

We could see as predicted, the acidity of all cheeses with and without essential oil (EO) reduced after storage, although with non-significant variability, with values ranging from 5.71 to 6.10 on the first day and from 5.81 to 4.37 on the last day. The generation of lactic acid has very identical effects. However, the cheeses with CCEO exhibit surprising results in terms of microbiological quality, with absolute sterility of harmful bacteria and quantities of the total aerobic mesophilic flora range according to our Algerian requirements throughout the test time. The quantity of bacteria in cheeses without EO has grown to unsustainable levels, with the product becoming incompetent after two weeks.

Based on the findings, adding essential oils of plants with antagonistic action to dairy products "cheese" might be a beneficial protective strategy for extending shelf life and maintaining microbiological characteristics, but only in appropriate dosages.

Keywords: *cinnamon cassia* essential oil, microbiological characteristics, lactic ferments, cheese.



Physiological and biochemical changes observed in a variety of durum wheat after treatment with a systemic fungicide.

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Abstract

The objective of this study is to evaluate the toxicity of a widely used fungicide in the El-Tarf region, "Prosaro," on a variety of durum wheat, "*Triticum durum* Simeto," through monitoring of selected physiological and biochemical parameters to better understand its mechanism of action. For this purpose, two concentrations were selected, considering the field application rate as the first concentration and twice that amount as the second concentration. All assays were conducted after 7 days of exposure to Prosaro concentrations applied to leaves and roots. The parameters measured included chlorophyll content and total protein levels. Additionally, two oxidative stress biomarkers (enzymatic and non-enzymatic), Catalase (CAT) and Glutathione (GSH), were studied. The results indicated fluctuations in chlorophyll content and an increase in protein levels, suggesting stimulation of protein synthesis, including antioxidant enzymes like Catalase. Concurrently, the determination of GSH levels revealed a decrease, likely due to its involvement in the cellular defense system. Overall, these findings reflect the plant's ability to defend itself and tolerate low Prosaro concentrations, which generate free radicals during metabolism and are managed by the antioxidant system. Thus, we conclude that the concentrations applied in field conditions are not toxic to this variety of wheat.

Keywords: Toxicity, Fungicide, Prosaro, *Triticum durum*, Oxidative stress

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