



International Congress
**MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

**The Fourth International Congress
“Microbial Biotechnology for Development”
(MICROBIOD 4)
Agadir, April, 24-26 2019
<http://microbial-biotechnology.com/>**



Programme / program

Mardi 23 Avril 2019 / Tuesday, 23th April 2019

16h00-19h00 Accueil des participants et Enregistrement / Welcome and registration of participants
Préparation et affichage des Posters / Preparation of Posters

Mercredi 24 Avril 2019 / Wednesday, 24th April 2019

08h00-09h00 Enregistrement des participants (Suite) / Registration (Continued)

09h00-10h00 Cérémonie officielle d'ouverture / Official opening ceremony



**International Congress
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Mot du Président de l'université Ibn Zohr, Agadir.
Mot du Doyen de la Faculté des Sciences, Agadir.
Mot du Président de l'Association Microbiona.
Mot du Président du Congrès Microbiod 4.

10h00-10h30 Welcoming cocktail

10h30-11h15. Conférence inaugurale / Opening conference

SALLE 1/ROOM 1

Moderator: Nouredine MEZRIOUI, Thierry HEULIN, Mohammed HAFIDI, Brahim BOUIZGARNE, Moulay Mustapha ENNAJI

Rapporteurs :

“The Genomic Encyclopaedia of *Bacteria* and *Archaea* (GEBA) – An Universal Resource for Microbial Biotechnology in Bioindustry, Agriculture, Human & Animal Health and Environment”

Hans-Peter KLENK & the GEBA Team (Newcastle University, UK).

11h15-12h00. Conférence plénière -Discussion / Plenary conference -Discussion

Plant growth promoting rhizobacteria for controlling phytopathogens and enhancing the productivity of saline soils

Naveen Kumar ARORA

Department of Environmental Science, BBA University, Lucknow, Uttar Pradesh, India.

Thème I : Biotechnologies microbiennes en Agriculture et Agro-alimentaire.

Topic I : Microbial Biotechnology in Agriculture and Agri-Food industry:

12h00. Thème I. Communications Orales/Topic I. Oral communications

12h00-12h10	COI-1	<u>ABOULOIFA H., ROKNI Y., BELLAOUCHI R., GHABBOUR N., KARBOUNE S., BRASCA M., BEN SALAH R., SAALAOUI E., ASEHRAOU A.</u> Screening for antifungal activity of lactic acid bacteria strains isolated from natural fermenting green olive. <i>Faculty of Sciences, Mohammed Premier University, Oujda, Morocco.</i>
12h10-12h20	COI-2	<u>ACHKOUK I., AARAB S., LAGLAOUI A., BAKKALI M., ARAKRAK A.</u> Effectiveness of PGPR for improving the growth of <i>Lotus creticus</i> under greenhouse conditions. <i>Faculty of Sciences et Techniques, Tangier, Morocco.</i>



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MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

12h20-12h30	COI-3	ALIYAT FZ., NASSIRI L., EL GUILLI M., IBIJBIJEN J. Performance of rhizobacteria isolated from phosphate solid sludge to Solubilize insoluble phosphate. <i>Faculty of Sciences, Meknes, Morocco.</i>
12h30-12h40	COI-04	AZAROUAL S.E., EL MERNISSI N., BOUIZGARNE B., MEFTAH KADMIRI I. Natural phosphate solubilizing <i>Bacillus</i> strains improved physiological, biochemical parameters and nutrient uptake of gnotobiotically grown wheat. <i>Faculty of Sciences, University Ibn Zohr-Agadir & MAScIR, Rabat, Morocco.</i>
12h40-13h00	Discussion	

13h00-14h30 Déjeuner / Lunch

14h30-15h15. Conférence pléniare -Discussion / Plenary conference -Discussion

Moderators: Khalid OUFDOU, wafa ACHWAK, Yedir OUHDOUCH, Jamal IBIJBIJEN

Reporter: Abdesslam Asehraou, Mustpaha Barakate.

Endophytes of plant organs: an underutilized reservoir of biofertilizers and / or microbial biopesticides

Pr. Robin DUPONNOIS & Yves PRIN (LSTM, Montpellier, France).

15h15-16h00. Conférence pléniare -Discussion / Plenary conference -Discussion

Toward a sustainable agriculture: Deciphering the beneficial interaction between *Paraburkholderia phytofirmans* and grapevine face to biotic and abiotic stresses

Pr. Essaid Ait BARKA (University of Reims, France)

Sanchez Lisa, Esmaeel Qassim, Miotto Lidiane, Clément Clément, Jacquard Cédric & Aït Barka Essaid

16h00-16h30 Pause café / Coffee break et Session Poster / and Poster session

16h30 - Thème I. Communications Orales/Topic I. Oral communications

16h30 -16h40	COI-05	BELLAOUCHI R., HASNAOUI A., ROKNI Y., ABULOIFA H., GHABBOUR N., HAKKOU A., BECHCHARI A. ASEHRAOU A. Production of citric acid by <i>Aspergillus niger</i> using the juice of Assiane date variety.
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International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT

4th



April 24-26, 2019 Agadir - Morocco

		<i>Faculty of Sciences, Mohammed Premier University, Oujda, Morocco.</i>
16h40 -16h50	COI-06	BENNIS M., KADDOURI K., BOUHNIC O., LAMIN H., EL FAIK S., ALAMI S., ABELMOUMEN H., MISSBAH EL IDRISSE M. Plant growth activities of some bacteria isolated from <i>Vachellia gummifera</i> rhizospheric soils <i>Faculty of Sciences, University Mohammed V, Rabat, Morocco</i>
16h50-17h00	COI-07	BOUHRAOUA D., AARABS., LAGLAOUI A., BAKKALI M., ARAKRAK A. Evaluation of PSB, native arbuscular mycorrhizal fungi and rhizobia as biotertilizers for the improvement of growth and yield of peanut (<i>Arachis hypogaea</i> L.). <i>Faculty of Sciences & Techniques de Tanger, Morocco</i>
17h00-17h10	COI-08	BOUKAYA N., GOUDJAL Y., ZAMOUM M., ALLALI K., CHAABANE CHAOUCH F., BOUZNADA K., SABAOU N., ZITOUNI A. Evidence of biocontrol and plant-growth-promoting capacities of <i>Streptosporangium becharensense</i> strain SG1: an antagonistic actinobacterium from the Algerian Sahara. <i>Ecole Normale Supérieure de Kouba-Alger, Algeria.</i>
17h10-17h20	COI-9	BOUSKOUT M., ALFEDDY M. N., OUAHMANE L. Response of caper (<i>Capparis spinosa</i>) to inoculation with mycorrhizal fungi under salt stress. <i>Faculty of Sciences Semlalia, Marrakesh & Institut National de la Recherche Agronomique, Marrakesh, Morocco</i>
17h20-17h40	Discussion	
17h40-17h50	COI-10	CHANDA M-J., RACHIDI F., BENHIMA R., EL MERNISSI N., AASFAR A., SBABOU L., EL ARROUSSI H. Biostimulatory effect of microalgae polysaccharides on the metabolic and biochemical pathways involved in plant defense against biotic and abiotic stress. <i>MASCIR, Rabat– Morocco & Faculty of sciences, Rabat, Morocco.</i>
17h50-18h00	COI-11	CHAOUI J., ASFERS A., AIT HOUSSA A., ASEHRAOU A. Evaluation of the effectiveness of fungicides combinations in controlling post-harvest diseases of peach and nectarine fruits. <i>Faculty of Sciences, Oujda, Morocco.</i>
18h00-18h10	COI-12.	DIJON D., DUPONNOIS R., AUBÉRY P. Development of a biopesticide in the fight against Black Sigatoka in Martinique and biofertilizers promoting banana growth. <i>UMR LSTM, Montpellier, France & SOBANOR SARL, Martinique, France.</i>
18h10-18h20	COI-13.	GARGOURI M., KARRAY F., CHEBAANE A., ZOUCHE H., KALLEL N., MHIRI N., ARMOUGOM F., SAYADI S., MLIKI A. Impacts of increasing aridity on the soil and root microbiome of cactus. <i>Centre of Biotechnology Borj Cedria, Tunisia</i>
18h20-18h30	COI-14.	GHABBOUR N., ROKNI Y., ABOULOIFA H., BELLAOUCHI R., CHIHIB N.E., BEN SALAH R., LAMZIRA Z., SAALAOUI N., ASEHRAOUA. Effect of pH, NaCl and glucose on Biodegradation of Oleuropein by <i>Lactobacillus plantarum</i> FSO175. <i>Faculty of Sciences, Oujda, Morocco.</i>
18h30-18h40	COI-15.	HAMANE S., AARAB S., HASSANI ZERROUK M., ELYEMLAHI A., LAGLAOUI A., BAKKALI M., ARAKRAK A. Screening and characterization of phosphate solubilizing rhizobia isolated from <i>Hedysarum</i> nodules in North of Morocco. <i>Faculté des Sciences et Techniques, Tanger, Morocco.</i>
18h40-19h00.	Discussion	



Moderator: Klenk Hans-Peter, Naveen ARORA

Reporter:

SALLE 1/ROOM 1

08h30-09h15 Conférence plénière -Discussion / plenary conference -Discussion

SALLE 1/ROOM 1

Pr. HEULIN Thierry (CNRS, France)

Phenotyping underground to select plant varieties for C storage into soils
(e.g. pearl millet and 4‰)

Thierry HEULIN and Wafa ACHOUAK (CNRS, FRANCE)

09h15 -10h00: Conférence plénière -Discussion / Plenary Conférence -

Pr. Wafa ACHWAK (CNRS, France)

Plant root exudates shape microbiota diversity and functions

HAICHAH Feth el Zahar, HEULIN Thierry & ACHOUAK Wafa

10h00-10h30

Pause café / Coffee break et Session Poster / and Poster session

10h30-SESSION I (SALLE 1/ ROOM 1)

Thème I : Biotechnologies microbiennes en Agriculture et Agro-alimentaire

Topic I : Microbial Biotechnology in Agriculture and Agri-Food industry

10h30- Thème I. Communications Orales/Topic I. Oral communications

10h30-10h40	COI-16.	HAMIM A., DUPONNOIS R., MRABET R., HAFIDI M. Effects of inoculating putative ericoid mycorrhizal fungi and dark septate endophyte on the growth and nutritional status of Blueberry (<i>Vaccinium corymbosum</i>). <i>National Institute of Agronomic Research (INRA), Morocco & Faculty of Sciences Marrakesh, Morocco</i>
10h40-10h50	COI-17.	HARKOUSSE O., OUAHMANE L., KOUSSA T., ALFEDDY MN. Effects of in vivo mycorrhization and PGPR inoculation on growth parameter of date palm (<i>Phoenix dactylifera</i> L.). <i>Faculty of Sciences, EL Jadida, Morocco.</i>
10h50-11h00	COI-18.	HAZZOUMI Z., AZAROUAL S E., EL MERNISSI N., DUPONNOIS R., HATIMI A., BOUIZGARNE B, MEFTAH KADMIRI I. Effect of AMF symbiosis on barley (<i>Hordeum vulgare</i>) nutrition and



**International Congress
MICROBIAL BIOTECHNOLOGY
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4th



April 24-26, 2019 Agadir - Morocco

		some physiological parameters <i>Moroccan Foundation For Advanced Science Innovation and Research- ,Rabat & Faculty of sciences, Agadir-Morocco.</i>
11h00-11h10	COI-19.	HNINI M., AURAG J. PGP activities, drought and salinity tolerance in bacteria associated with <i>Acacia tortilis</i> subsp. <i>raddiana</i> growing in arid regions. <i>Faculty of Sciences, Mohammed V University, Rabat, Morocco.</i>
11h10-11h20	COI-20.	LAHDACHI F. Z., NASSIRI L., IBIJBIJEN J. Evaluation of the symbiotic efficiency of bacteria nodulating <i>Acacia gummifera</i> Wild <i>Faculty of Sciences, Moulay Ismail University, Meknes, Morocco.</i>
11h20-11h40	Discussion	
11h40 -11h50	COI-21.	MALDANI M., ALIYAT F.Z., NASSIRI L., IBIJBIJEN J. Comparative study of glyphosate and paraquat effect on the nitrogen-fixing bacteria growth <i>Faculty of Sciences, Moulay Ismail University, Meknes, Morocco</i>
11h50-12h00	COI-22.	MERCHA I, LAKRAM N., KABBOUR M.R., BENALI A., BOUKSAIM M., DOUAIK A., ZKHIRI F., ELMAADOUDI EH. Characterization of technological and probiotic features of interactive lactic acid bacteria from a Moroccan Argane biotope. <i>Faculty of Science and Techniques, Mohammedia, Morocco & INRA, Rabat, Morocco.</i>
12h00-12h10	COI-23.	MISBAH A., IBNSOUDA KORAICHI S., TAHRI JOUTI M.A. Production, purification and biochemical characterization of extracellular lipase from <i>Staphylococcus</i> sp. <i>Faculty of Sciences & Techniques, Fès. Morocco.</i>
12h10-12h20	COI-24.	MNIF S., JARDAK M., AIFA S. Innovative strategies to eradicate biofilm colonization in dairy processing lines. <i>Centre of Biotechnology of Sfax, Sfax, Tunisia.</i>
12h20-12h30	COI-25.	MOUSSAID S., OUNINE K., BENALI A., KABOUR M.R., MAADOUDI E.H. Isolation and characterization of lactic acid bacteria producing extracellular lipase isolated from camel milk. <i>CRRRA, INRA, Rabat, Morocco.</i>
12h30-13h00	Discussion	

13h00-14h30 Déjeuner / Lunch

10h30- SESSION 2 SALLE 2/ ROOM2

Thème III : Biotechnologie microbienne et Environnement

Topic III : Microbial Biotechnology and Environnement

10h30- Thème III. Communications Orales/Topic III. Oral communications

Moderator: Mustpaha BARAKATE, Abdesslam ASEHRAOU.

Reporter:

10h30-10h40	COIII-1	ALAMI S., LAMIN H., BOUHNIC O., EL FAIK S., BENNIS M., TALBI C., ABDELMOUMEN H., FILALI-MALTOUF A., BEDMAR E. J.
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**International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

		MISSBAH EL IDRISSI M. Phenotypic and genotypic characterization of rhizobia isolated from <i>Astragalus algarbiensis</i> growing in Maamora forest (Morocco). <i>Faculty of Sciences, Mohammed V University, Rabat</i>
10h40-10h50	COIII-2	BOUACHA C., ALOUACHE S. Isolation and identification of potential probiotic bacteria from the digestive tract of red Tilapi. <i>High National School of Marine Sciences & Coastal Management. Campus universitaire Dely Ibrahim- Algiers Algeria.</i>
10h50-11h00	COIII-3	BOUHIA Y., EL FELS L., LYAMLOULI K., ZEROUAL Y., HAFIDI M. Effect of microbial Inoculation on the assessment and maturity of compost of olive mill wastewater sludge. <i>Faculty of Science Semlalia, Marrakesh, Morocco & University Mohammed VI, Benguerir, Morocco.</i>
11h00-11h10	COIII-4	BOUHNIC O., LAMIN H., ELFAIK S., ALAMI S., ABDELMOUMEN H., FILALI-MALTOUF A., MISSBAH EL IDRISSI M. Diversity of rhizobia nodulating <i>Acacia gummifera</i> in Morocco. <i>Center for Biotechnology, Biodiversity & Environment, Faculty of Sciences, Mohammed V University, Rabat, Morocco.</i>
11h10-11h20	COIII-5	BOUSSETTINE R., HASSOU N., SAIF I., KASMI Y., BESSI H., ENNAJI M. M. Molecular and prediction modelling of the VP1 epitopes and protein homogeneity of <i>Enteroviruses</i> serotypes can block viruses transmission into water environment targeting improving public health quality <i>Faculty of Sciences & Techniques Mohammedia, Morocco.</i>
11h20-11h40	Discussion	
11h40 -11h50	COIII-6	CHAHOURI A., BANAOUI A., YACOUBI B., MOUKRIM A. Study of Faecal Contamination and Occurrence of pathogenic bacteria in Oued Souss estuary. <i>Faculty of Sciences, University Ibn Zohr, Agadir, Morocco.</i>
11h50-12h00	COIII-7	CHAIB N., DZIZI S., KADDECHE H., NOUNE F., LAMRAOUI S. First Attempts to Valorize the Lipid Content of Benthic Diatoms for the Production of Third-generation Biofuels at the Lab Scale <i>L.C.Z.H, University Guelma – Algeria & Faculty of Technologie, University of 20 août 1955 Skikda, Algeria.</i>
12h00-12h10	COIII-8	CHEBAIBIS, LAZIRI F, BARRECA D. Protein enrichment of lignocellulosic substrate by solid state fermentation using <i>Neurospora sitophila</i> . <i>Faculty of Sciences, University Moulay Ismail, Meknes, Morocco.</i>
12h10-12h20	COIII-9	DAHMANI I., OUBOHSSAINE M., AURAG J., SBABOU L., MOULIN P., FILALI-MALTOUF A., BRUNEEL O. Study the diversity of the bacterial communities in the mining district of oujda region (Morocco) by using pyrosequencing techniques. <i>Faculty of Sciences, University Mohammed V, Rabat, Morocco.</i>
12h20-12h30	COIII-10	DANOUCHE M., BAHAFID W., AGZOUR K., EI GHACHTOULI N. Biosorption and Biodegradation mechanisms for the bioremediation of textile dyes by using yeast cells <i>MAScIR Biotechnology, Rabat, Morocco & Faculty of Sciences & Techniques, Fez, Morocco.</i>
12h30-13h00	Discussion	

13h00-14h30

Déjeuner / Lunch



14h30-15h15 Conférence plénière -Discussion / plenary conference -Discussion

Moderator: Mohamed HAFIDI, Thierry HEULIN.

Reporter:

SALLE 1/ROOM 1

Micro-phytoremediation of heavy metal contaminated soils
Helena FREITAS (University of Coimbra, Portugal)

15h15- SESSION 1 SALLE 1/ ROOM1

Thème I : Biotechnologies microbiennes en Agriculture et Agro-alimentaire (suite)

Topic I : Microbial Biotechnology in Agriculture and Agri-Food industry (Continued)

15h15-Thème I. Communications Orales/Topic I. Oral communications

15h15-15h25	COI-26.	OUBELLA K., MOUMNI M. Screening for endomycorrhizal strains associated with Moroccan date palm for their application as biofertilizers on olive seedlings <i>Faculty of Science, My Ismail University, Meknes, Morocco.</i>
15h25-15h35	COI-27.	OULGHAZI S., LAFKIH N., FAURE D., MOUMNI M. Genomic analysis of the first <i>Dickeya dianthicola</i> isolated in the north of Morocco. <i>Faculty of Sciences, Meknes, Morocco & CEA CNRS Univ. Paris-Sud, University Paris-Saclay, France.</i>
15h35-15h45	COI-28.	OUTAMAMAT E. M., MANAUT N., DOUNAS H., KHASSALI H., SANGUIN H., HAFIDI M¹, OUAHMANE L. Screening of highly benefit interactions Arbuscular Mycorrhizal Fungi-plant for agronomic and environmental purposes. <i>Faculty of sciences-Semlalia, Cadi ayyad University Marrakesh, Morocco.</i>
15h45-16h00	Discussion	

16h00-16h30 Pause café / Coffee break et Session Poster / and Poster session

16h30-Thème I. Communications Orales/Topic I. Oral communications

16h30-16h40	COI-29.	REAKIA., ZENNOUHI O., NASSIRI L., IBIJBIJEN J. Abundance and prospecting of Rock Phosphate-Solubilizing Bacteria in the Rhizosphere Soil of Faba Bean (<i>Vicia faba L.</i>) in Morocco. <i>Faculty of Sciences, Meknes, Morocco & National Centre for Scientific Research and Technical Research (CNRST), Rabat, Morocco.</i>
16h40-16h50	COI-30.	ROKNI Y., GHABBOUR N., ABULOIFA H., BELLAOUCHI R.,



International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT

4th



April 24-26, 2019 Agadir - Morocco

		<p>TAYBI A. F., MABROUKI Y., CHAOUI J., LAMZIRA Z., SAALAOUI E., ASEHRAOU A. β-Glucosidase activity of <i>Lactobacillus plantarum</i> FSO1 and <i>Candida pelliculosa</i> L18 isolated from fermenting Moroccan green olive. <i>Faculty of Sciences, Mohammed Premier University, Oujda, Morocco.</i></p>
16h50-17h00	COI-31.	<p><u>SAMMAMA H</u>, AL FEDDY M.N, HSISSOU D., EL KAOUA M. Evaluation of the agronomic and biochemical performance of intercropping soft wheat and faba bean in organic agriculture. <i>Faculty of Science and Technology Marrakesh Morocco.</i></p>
17h00-17h10	COI-32.	<p><u>SLIMANI A.</u>, OUAHMANE L., KOUSSA T., ALFEDDY M. N. Effect of a combined inoculation of Arbuscular Mycorrhizal Fungi (AMF) and Plant Growth Promoting Rhizobacteria (PGPR) on Biochemical properties of marketed tomato seedlings under water deficit conditions. <i>Faculty of sciences, EL Jadida, Morocco.</i></p>
17h10-17h20	COI-33.	<p><u>SMAIL-SAADOUN N.</u>, BRAHIMI R., REZKI-SEKHI L., BELKEBIR-BOUKAIS A. Fruit's mycoendophytes diversity of <i>Pistacia atlantica</i> L. in Metlili (Ghardaïa, Algeria) <i>Université Mouloud Mammeri, Tizi-Ouzou – Algeria.</i></p>
17h20-17h30	COI-34.	<p><u>TABRIKA I.</u>, ELBAKHOUCHE Y., AZIM K., DIHAZI A. MAYAD E.H, ZAAFRANI M. Suppressive effect of different compost extracts against <i>Fusarium wilt of chickpea (Fusarium oxysporum ciceri)</i> <i>Faculty of Sciences, Agadir & INRA, Agadir, Morocco.</i></p>
17h30-17h40	COI-35.	<p><u>TAHIRI A.</u>, RAKLAMI A., BECHTAOUI N., ANLI M., BOUTASKNIT A., OUFDUO K., MEDDICH A. Effects of PGPR bacteria, arbuscular mycorrhizal fungi and composts on growth parameters and yield of lettuce under open field conditions <i>Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakesh, Morocco.</i></p>
17h40-17h50	COI-36.	<p><u>ZAARAOUA M.</u>, DOUNAS H., AL FEDDY M. N., OUAHMANE L. Inoculation with arbuscular mycorrhizal fungi improves the growth and mineral nutrition of <i>Retama monosperma</i>. <i>Faculty of Sciences, Cadi Ayyad University, Marrakesh, Morocco.</i></p>
17h50-18h00	COI-37.	<p><u>ZENNOUHI O.</u>, RFAKI A., NASSIRI L., IBIJBIJEN J. Solubilization of insoluble rock phosphate by phosphate-solubilizing bacteria and its effects on wheat (<i>Triticum aestivum</i> L.) growth and P uptake. <i>Faculty of Sciences, Moulay Ismail University, Meknes, Morocco.</i></p>
18h00-18h10	COI-38.	<p><u>ZIANE M.</u>, ABDELLAOUI F. A quantitative exposure assessment of <i>Staphylococcus aureus</i> in cheese consumed in El Maleh region (Algeria). <i>Centre universitaire Ain Témouchent, Ain Témouchent, Algeria.</i></p>
18h10-18h30	Discussion	

15h15-**SESSION 2** SALLE 2/ ROOM2

Thème III : Biotechnologie microbienne et Environnement

Topic III : Microbial Biotechnology and environnement



15h15-Thème III. Communications Orales/Topic III. Oral communications

Moderators: Nouredine MEZRIOUI. AZIM Khalid.

Reporter:

15h15-15h25	COIII-11	EL BERKAOUI A., MOUKRIM A. EL FILALI F., HANOUNE S., MIRI M., BOUM'HANDI N. Isolation and characterization of halophilic and halotolerant bacteria producing extracellular hydrolytic enzymes from salt marshes in Morocco. <i>National Research Institute of Marine Fisheries (INRH), Agadir, Morocco. & Faculty of Sciences, Agadir, Morocco.</i>
15h25-15h35	COIII-12	EL JAÏ S., BHAR H. Contribution to the study of genetic characterization of <i>Escherichia Coli</i> multiresistant strains in broiler chicken in Morocco. <i>Institut Agronomique et Vétérinaire (IAV) Hassan II. Rabat, Morocco.</i>
15h35-15h45	COIII-13	EL MOHALIL S, AZIZ F., DILAGUI I., SORAA N., BOULARBAH A, LOQMAN S. Detection of multidrug-resistant bacteria in hospital effluents of the university hospital Mohammed VI, Marrakesh, Morocco. <i>FST, Marrakech, & Faculty of Medicine and Pharmacy, Marrakesh, Morocco.</i>
15h45-16h00	Discussion	

16h00-16h30 Pause café / Coffee break et Session Poster / and Poster session

16h30-Thème III. Communications Orales/Topic III. Oral communications

16h30-16h40	COIII-14	HASSOU N., ABOUCHOAI B N., ORBI A., RGUIBI IDRISSE H., ENNAJY M.M. Impact of environmental conditions on viral and bacterial aetiology of Pacific oysters <i>Crassostrea gigas</i> mass mortalities in Oualidia lagoon. <i>Faculty of Sciences & Techniques Mohammedia, Morocco.</i>
16h40-16h50	COIII-15	KODAD S., AMAR L., BEKKALI M. Occurrence of GI, GII noroviruses and Hepatitis A virus in Moroccan shellfish <i>Faculty of Sciences Ain-Chock, Casablanca Morocco.</i>
16h50-17h00	COIII-16	KORICHI W., LEMEE L., OUHDOUCH Y., LOQMAN S. Antagonistic potential of actinomycetes against Multi-drug resistant bacteria of hospital wastewater <i>Faculty of Sciences Semlalia, & Faculty of Medicine and Pharmacy, Marrakesh, Morocco & Institut de Chimie des Milieux et Matériaux de Poitiers, Université de Poitiers, France</i>
17h00-17h10	COIII -17	LAAOUIDI Y., ZITOUNI Z., BENIDIRE L., BOULARBAH A. Rhizosphere microbial activities and biochemical responses of Parsley and Coriander plants grown under metallic stress. <i>Faculty of Sciences and Techniques Marrakesh, Morocco.</i>
17h10-17h20	COIII -18	LAMIN H., BOUHNIC O., ALAMI S., EL FAIK S., BENNIS M., TALBI C., ABDELMOUMEN H., BEDMAR E. J., MISSBAH EL IDRISSE M. Isolation and characterization of the rhizobia nodulating of <i>Retama</i>



**International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

		<i>monosperma</i> in the mining soils of the Touissit region of eastern Morocco. <i>Faculty of Sciences, Mohammed V University, Rabat, Morocco.</i>
17h20-17h30	COIII -19	MADLINE A, BENIDIRE L, BOULARBAH A. Effect of metal resistant plant growth promoting rhizobacteria (PGPR) on the barley seed germination under metallic stress <i>Faculty of Sciences et Techniques Marrakesh, Morocco.</i>
17h30-17h40	COIII -20	NAYLO A., PEREIRA S. I. A, BENIDIRE L, EL KHALIL H., CASTRO P. M. L, OUVRARD S., SCHWARTZ C., BOULARBAH A. Microbial communities structures of urban soils of Marrakesh city along an anthropization gradient. <i>Faculty of Sciences et Techniques Marrakesh, Morocco,</i>
17h40-17h50	COIII -21	OUBANE M., KHADRA A., EZZARIAI A., KOUISNI L., HAFIDI M. The assessment of the effectiveness of three wastewater treatment systems by the genotoxicity test on <i>Vicia faba</i> roots. <i>Faculty of Sciences-Semlalia, Marrakesh, Morocco</i>
17h50-18h00	COIII -22	OUBOHSSAINE M., DAHMANI I., SBABOU L., BRUNEEL O., AURAG J. Structure and diversity of bacterial communities in heavy metal multi-polluted soils in the region of Oujda (Morocco). <i>Faculty of Sciences, Mohammed V University, Rabat, Morocco.</i>
18h00-18h10	COIII -23	RAKLAMI A., EI ALAOUI A., TAHIRI A., BECHTAOUI N., IMZILN B., MEDDICH A., OUFDOU K., PAJUELO E. The inoculation effect with rhizobacteria on <i>Medicago sativa</i> growth and physiology under heavy metals stress. <i>Faculty of Sciences Semlalia, Marrakesh, Morocco.</i>
18h10-18h20	COIII -24	TAREK F., HASSOU N. BENANI A. , ENNAJI M. M. Wild lagoon biomonitoring of Norovirus GI and II by using bivalve mollusks as environment biomarkers <i>Faculté des Science et Techniques Mohammedia, Université Hassan II de Casablanca. Morocco.</i>
18h20-18h50	Discussion	

Vendredi 26 Avril 2019 / Friday, April 26th 2019

Thème II : Biotechnologies microbiennes et santé humaine.

Topic II : Microbial Biotechnology and human Health

SALLE 1/ ROOM 1

Moderator: Khalid LAIRINI, Souad LOQMAN, Sami MNIF

Reporter:

08h30-09h15

Conférence plénière -Discussion / plenary conference -Discussion

“Recent advances of cancers Epidemiology in Africa: Viral ethology, Risk factors and molecular characterization”.

Moulay Mustapha ENNAJI (FST-Mohammedia, Morocco)



09h15-10h00

Conférence plénière -Discussion / Plenary conference-Discussion

“Colon Microbiomes”
Prof Hassan GHAZAL–CNRST, RABAT)

10h00-10h30

Pause café / Coffee break et Session Poster / and Poster session

10h30 - SESSION 1 SALLE 1/ ROOM 1

10h30 -Thème II. Communications Orales/ Topic II. Oral communications

10h30-10h40	COII-1	AIT HAMMOU R, BENHESSOU M., ENNAJJI M M. Identification of 3 miRNAs as biomarkers of early diagnosis of breast and gynecologic cancers among Moroccan women. <i>Faculty of Sciences and Technics-Mohammedia. Morocco.</i>
10h40-10h50	COII-2	AMAKRAN A., HAMOUDANE M., PAGNIEZ F., LAMARTI A., PICHOT C., FIGUEREDO G., NHIRI M., LE PAPE P. Volatile oil composition, antifungal and antioxidant activities of wild Moroccan <i>Thymus capitatus</i> . <i>Faculty of Sciences & Techniques, Tangier, Morocco.</i>
10h50-11h00	COII-3	AMZIL M., NAYME K., CHARAFDDINE O., BARGUIGUA A., TIMINOUNI M. Study of the correlation between antibiotic resistance and the ability to form <i>Escherichia coli</i> biofilm isolated from products of avian origin. <i>Faculty of Sciences and Techniques, University Hassan II, Casablanca, Morocco.</i>
11h00-11h10	COII-4	BOUHOUDAN A., CHIDI F., KHADDOR M. Mycotoxins of <i>Penicillium aurantiogriseum</i> : a promising source for anti-cancer therapy <i>Normal High School, Martil, Morocco & Faculty of Sciences, Tetouan Morocco.</i>
11h10-11h20	COII-5	DILAGUI, LOQMAN S., SORAA N. Occurrence of carbapenemases in uropathogenic <i>Enterobacteriaceae</i> at Mohammed VI University Hospital Center of Marrakesh, Morocco. <i>Faculty of Medicine and Pharmacy, Marrakesh, Morocco & Mohammed VI University Hospital Center, Marrakesh, Morocco.</i>
11h20-11h40	Discussion	
11h40 -11h50	COII-6	EL HADI H., BENANI A., QMICHOU Z.1, LAZAR F., BAKRI Y., AIT BENHASSOU H., MOUMEN A. Development and validation of an RT-qPCR assay for rapid detection and quantification of hepatitis c virus rna for routine testing in Moroccan clinical specimens. <i>Moroccan Foundation for Advanced Science Innovation and Research (MASCIR), Rabat, & Faculty of Science, Rabat, Morocco.</i>
11h50-12h00	COII-7	ELHIDAR N., NAFIS A., AITSIDI BRAHIM M., KASRATI A., GOEHLER A., BOHNERT JA., ABBAD A, HASSANI L., MEZRIOUI N. <i>Thymus leptobotrys</i> a NorA efflux pump inhibitor. <i>Faculty of Science Semlalia, Marrakesh, Morocco & University of Medicine Greifswald, Germany.</i>
12h00-12h10	COII-8	EN-NASSIRI H, HAMMOUMIA A, BERRADIB T, RAJAALLAHB M, ES-SOUCRATTIA K, ASMAIC R, AZZOUZ D S, BOUHRIFE B,



**International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

		KARRAOUANE B. Molecular epidemiology of nalidixic acid resistant <i>Salmonella enteritidis</i> isolated from human and nonhuman origin in Morocco. <i>Faculty of Sciences Ain Chock, Hassan II University, Casablanca, Morocco.</i>
12h10-12h20	COII-9	Es-SADEQY Y., ACHMIT M., CHOUATI T., RAHHALI M., EL FAHIME EM., ZEROUALI K., RHALLABI N., AIT MHAND R., MELLOUKI F. Anti-biofilm efficacy of honey against biofilm forming <i>Staphylococcus aureus</i> isolates from chronic wounds. <i>FSTM, University Hassan II, Casablanca, Morocco.</i>
12h20-12h50	Discussion	

13h00-14h30 Déjeuner / Lunch

14h30-Thème II.Communications Orales/Topiuc II. Oral communications

Moderator: My Mustapha Ennaji, Ghazal Hassan, Bennani

Reporter: Mohamed HASSI

14h30-14h40	COII -10	JAZOULI M., LIGHTOWLERS M., GAUCI C., TADLAOUI K., BELMLIH A., ENNAJI M. M., ELHARRAK M. Vaccination against hydatidosis: molecular cloning and optimal expression of the EG95NC - recombinant antigen in <i>Escherichia coli</i> . <i>Faculty of Science & Technology, University Hassan II-Casablanca, Mohammedia, Morocco</i>
14h40 -14h50	COII -11	KATIF C., EL BARHDADI K., ELMEKES A, BELATMANIA Z., OUBAHA B., SABOUR B., BARAKATE M. Diversity and bioactivity of microflora associated with red seaweeds from the Atlantic Coast of Morocco. <i>Faculty of Sciences Semlalia, Marrakech, Morocco & Faculty of Sciences, El Jadida, Morocco.</i>
14h50-15h00	COII -12	KHATABY K., LOUTFI C., ENNAJI M.M. Evaluation of the efficacy of a novel inactivated vaccine against a new emerging Italy02 infectious bronchitis virus in Morocco. <i>Faculty of Sciences and Techniques, University Hassan II of Casablanca, Morocco & Society Biopharma, Rabat, Morocco.</i>
15h00-15h10	COII -13	LAMSISI M., HASSOU N., ENNAJI MM. Study of the differential expression of non-coding RNAs as promising biomarker in breast and gynecological cancers. <i>Faculty of Science and Technology-Mohammedia. Hassan II University of Casablanca. Morocco.</i>
15h10-15h20	Discussion	
15h20-15h30	COII -14	MOUSSAID FZ, EL BARNOSSI A, IRAQI HOUSSEINI A. Control of <i>Aspergillus fumigatus</i> strain isolated from pulmonary Aspergilloma by microorganisms. <i>Faculty of Sciences Dhar El Mahraz. Sidi Mohammed Ben Abdellah University, Morocco.</i>



**International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

15h30-15h40	COII-15	SADOUD M., MOKHTAR M., RIAZI A. Assesment of some biological activities of a high value-added compound obtained from an Algerian fresh water microalgae, <i>Haematococcus pluvialis</i> <i>Faculté des Sciences de la Nature et de la Vie, Abdelhamid Ibn Bads University, Mostaganem, Algeria</i>
15h40 -15h50	COII-16	SOUNA D., DRISSI M., MAURIN M. Enterobacter: genetics of CTX-M extended-spectrum β-lactamases. <i>University of Hassiba Ben Bouali Chlef, Algeria.</i>
15h50-16h20	Discussion	

10h30 - SESSION 2 SALLE 2/ ROOM 2

SESSION 2

Thème IV : Biotechnologies microbiennes et ressources naturelles

Topic IV : Microbial Biotechnology and natural resources.

10h30 –Thème IV. Communications Orales/Topic IV. Oral communications

Moderator: Hatimi Abdelhakim, Tahrouch Saïda.

Reporter: Khadija El Mehrach

10h30-10h40	COIV -1	AITBOULAHSEN M.¹, ZANTAR S.², LAGLAOUI A.³, CHAIRI H.¹, ARAKRAK A.³, BAKKALI M.³, HASSANI ZERROUK M.¹ Effect of essential oils incorporation on edible films against common foodborne pathogens <i>Polydisciplinary Faculty , Larache, Morocco.</i>
10h40-10h50	COIV -2	BELGHITI A., ZOUGAGH S., ROCHD T., ZERDANI I., MOUSLIM J. <i>Opuntia ficus-indica</i> fruit: Alternative to Antibiotics Growth Promoters for Broilers. <i>Faculty of Sciences Ben M'sik, Hassan II University, Casablanca, Morocco.</i>
10h50-11h00	COIV -3	DEBIB A., TIR-TOUIL A., MEDDAH B., BENRIMA A. Phenolic content and antifungal activity of <i>Ficus carica</i> extracts against resistant <i>candida albicans</i> strains. <i>Faculty of Natural Sciences and Life, Blida, Algeria. & Faculty of Natural Sciences and Life, Mascara, Algeria.</i>
11h00-11h10	COIV -4	ELAANACHI S., AASSILA H., RAMMALI S., HENTOUR, S., BENSOUICI C., BENCHARKI B., DARI K. Antimicrobial, antioxidant and sun protection factor activities of leaves of <i>Marrubium vulgare</i>. <i>Faculty of sciences and techniques, Settat, Morocco-</i>
11h10-11h20	COIV-5	EL JAIS., REMMAL A., EL ALAMI Y. Demonstration of the effect of antibiotic's alternatives on multidrug resistant <i>E. coli</i> strains <i>in vivo</i> and <i>in vitro</i> in broiler chicken in Morocco. <i>Institut Agronomique et Vétérinaire Hassan (IAV) II. Rabat. Morocco.</i>



**International Congress
MICROBIAL BIOTECHNOLOGY
FOR DEVELOPMENT**

4th



April 24-26, 2019 Agadir - Morocco

11h20-11h40	Discussion	
11h40 -11h50	COIV-6	GAAMOUCHE S., ARAKRAK A., BAKKALI M., LAGLAOUI A. The antimicrobial effect of bacteriocinogenic activity, <i>Rosmarinus officinalis</i> essential oil and their combination against <i>Escherichia coli</i> O157:H7 in sausages. <i>Faculty of Sciences & Techniques, Tangier, Morocco.</i>
11h50-12h00	COIV-7	JABER H., OUBIHI A., OURYEMCHI I., BOUALAMTAT R., RHAJEM N., BOURKHISS B., OUHSSINE M. Antimicrobial effect of three medicinal plants on 82 <i>Escherichia Coli</i> strains isolated from turkey meat marketed in the Kenitra city. <i>Faculty of Sciences, University Ibn Tofail, Kenitra, Morocco.</i>
12h00-12h10	COIV-8	KERSANI L., ZADI-KARAM H., KARAM N.E. Isolation of exopolysaccharides from coccal lactic acid bacteria. <i>University of Oran1, Ahmed BEN BELLA, Oran, Algeria.</i>
12h10-12h20	COIV-9	LEKBACH Y., XU D., EL ABED S., BENNOUNA F., IBNSOUDA KORAICHI S. Effects of <i>Cistus ladanifer</i> ethanolic extract on microbiologically influenced corrosion mitigation of 304L stainless steel in caused by <i>Pseudomonas aeruginosa</i> biofilm. <i>Faculty of Science and Technology, Fez, Morocco. Northeastern University, Shenyang, China.</i>
12h20-12h30	COIV-910	OUBIHI F., OULKHEIR S., KAAAYA A., AGHROUCH M. Antibacterial effect of some plant extracts against different Gram-positive and Gram-negative bacteria associated with nosocomial infections. <i>Faculty of Science, Ibn Zohr University, Agadir Morocco.</i>
12h30-13h00	Discussion	

13h00-14h30 Déjeuner / Lunch

14h30- Thème IV. Communications Orales/ Topic IV. Oral communications

14h30-14h40	COIV-11	OULKHEIR S., OUBIHI F., KAAAYA A., AGHROUCH M. Evaluation of synergistic effect between antibiotics and some essential oils against <i>Escherichia coli</i> ATCC 35218, <i>Staphylococcus aureus</i> ATCC 29213 and <i>Pseudomonas aeruginosa</i> ATCC 278533. <i>High Institute of Nursing Professions and Health Techniques, Agadir, Morocco.</i>
14h40 -14h50	COIV-12	RAZZOUK S., JELDI L., ALFEDDY MN., OULED TAARABT K., OUAHMANE L., ABBAD A. Chemical composition, antimicrobial and antioxidant activity of <i>Thymus leptobotrys Murb</i> essential oil in Morocco. <i>Faculty of Sciences Semlalia,, Marrakesh, Morocco & National Institute of Agricultural Research, Marrakech, Morocco.</i>
14h50-15h00	Discussion	

18h30 Cérémonie de clôture du congrès MICROBIOD4 / Congress Ceremony closing

Acknowledgments

On behalf of the organizing committee, we would like to thank all contributors to this event:

- The honorable international and national guest speakers,
- All participants and scientific contributors
- The Scientific Committee
- The book abstract Edition Committee.

The Co-organizers and Partners:

- The Moroccan Association of Biotechnologies and Protection of Natural Resources (MICROBIONA), Morocco.
- University of Ibn Zohr, Agadir, Morocco.
- Faculty of Sciences, Agadir, Morocco.
- University of Cadi Ayyad –Marrakesh, Morocco.
- Faculty of Science Semailia -Marrakech
- Faculty of Sciences and Techniques-Mohammedia,
- Laboratory of “Plant Biotechnology”, Faculty of Sciences, Agadir, Morocco.
- Laboratory of Biology and Biotechnology of microorganisms, Faculty of Sciences, Marrakesh, Morocco.
- Laboratory of Virology Microbiology, Quality and Biotechnologies/ Ecotoxicology and Biodiversity, Faculty of Sciences and Techniques-Mohammedia, Morocco.

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All contributors to the congress are acknowledged for their efforts and financial support. We hope a great scientific moment for all our guests, attendees and participants.

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- The Minister of Higher Education, Scientific Research and Training;
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- The Minister of Health;
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Welcome

On behalf of the organizing and scientific committees, it's a great honor for me to welcome all lecturers, guests and participants to the Fourth International Congress "Microbial Biotechnology for Development" (MICROBIOD 4). After the success of the first and the second editions of the congress, held in Marrakesh in November 2009 and October 2012, and the third edition, held in Mohammedia, Great Casablanca in October 2016, we are pleased to invite you to this event. The congress is organized by the Faculty of Sciences, University Ibn Zohr, Agadir, in collaboration with the Moroccan Association of Biotechnology and Protection of Natural Resources (MICROBIONA). I would like to thank all members of the Laboratory of Plant Biotechnology, particularly Prof. **Abdelhakim Hatimi** head of the Laboratory of Plant Biotechnology, Prof. **Saida Tahrouch**, member of our Laboratory, and prof. **Noureddine Mezrioui**, president of MICROBIONA for their great commitment.

This congress is gathering researchers and scientists working on microbial biotechnology and their involvement in diverse scientific fields. One of the main objectives of MICROBIOD is to overview and update the scientific research progress in the field of Microbial Biotechnologies and their applications. The second objective is to promote research and create synergies between researchers, to boost scientific research and create bridges between university researchers and industry. Vital sectors of agriculture, health, environment and natural resource valorization through microbial biotechnology approaches are covered by the activities of the congress. Thus main themes of the congress are: I: Microbial Biotechnology in Agriculture, Agri-Food and Bioindustry, II: Microbial Biotechnology and Health, III: Microbial Biotechnology and Environment and IV: Microbial Biotechnology and natural resources.

During this congress, 10 plenary conferences will take place. We received more than 400 abstracts. All abstracts were peer reviewed and best communications were selected. These proceedings contain the Abstracts of works presented at the 4th International Congress Microbial Biotechnology for Development" held in Agadir, on the 24th, 25th and 26th April, 2019.

Chairman

Pr. (Dr) Brahim BOUIZGARNE

***Quatrième Edition du Congrès international « MICROBIOD 4 »
"Biotechnologie microbienne au service du développement"
24-26 avril 2019***

Mot du Président de l'Association MICROBIONA

Chers Congressistes,

Au nom de tous les membres de l'Association Marocaine des Biotechnologies et de Protection des Ressources Naturelles, dénommée MICROBIONA, je souhaite la bienvenue à tous les participants au Congrès « Microbiod 4 » qui se tient, dans sa quatrième édition ici à la ville d'Agadir, perle du Sud Marocain.

Durant les trois jours que va durer cette manifestation scientifique, nous allons débattre et discuter d'une thématique relative à la biotechnologie microbienne et son rôle dans le développement économique et sociétal de tout pays.

Nul aujourd'hui n'ignore le rôle joué par les biotechnologies dans notre vie active. Le progrès des biotechnologies a non seulement permis à la recherche scientifique de faire un pas de géant, mais a également permis l'amélioration de la qualité de vie de l'espèce humaine. La recherche en sciences du vivant et les biotechnologies apportent d'ores et déjà des améliorations concrètes dans les domaines de la santé et de l'environnement, ainsi que pour les productions industrielle, agricole et énergétique.

A l'instar d'autres domaines de pointe, les biotechnologies, comme vous le savez tous, constituent une niche d'excellence à fort potentiel d'innovation scientifique et technologique pour le Maroc et aussi pour l'ensemble des pays en voie de développement.

Au Maroc les biotechnologies constituent l'un des programmes nationaux prioritaires de recherche arrêtés par le Ministère de l'enseignement supérieur et de la formation des cadres et de la recherche scientifique et définis en fonction des orientations et de stratégies sectorielles prioritaires du Maroc en matière de développement tel le plan Maroc vert et la stratégie nationale de l'eau, le plan assainissement, le plan énergie et bien d'autres.

Dans ce sens, notre association MICROBIONA a été créée pour contribuer à l'amélioration de la recherche scientifique et de l'enseignement dans les domaines de la biotechnologie et de la protection des ressources naturelles. Elle a pris l'initiative d'organiser des manifestations scientifiques pour discuter des avancées scientifiques dans tous les domaines ayant trait aux biotechnologies. Elle a également participé à la diffusion et à la valorisation des travaux de recherche, en relation avec les thématiques de l'association, au niveau national et international.

Je souhaite que ce Congrès « Microbiod 4 » constitue un espace d'échange entre chercheurs, doctorants universitaires et partenaires nationaux et internationaux. Cette manifestation permettra sans aucun doute la dynamisation du développement des relations interuniversitaires et favorisera les collaborations entre les différents laboratoires concernés par la recherche scientifique dans ce domaine des biotechnologies. Microbiod 4 permettra sûrement de sensibiliser les décideurs et les industriels sur l'importance de la valorisation des biotechnologies microbiennes dans le développement de certains secteurs vitaux, notamment l'agriculture, l'agro-industrie, la santé humaine et la sauvegarde de l'environnement.

Avant de conclure, je voudrais, en mon nom et à celui de tous les membres de MICROBIONA, adresser mes vifs remerciements aux comités d'organisation et scientifique de Microbiod 4 qui ont mobilisé énormément d'énergie pour réussir cette manifestation.

Agréable séjour à Agadir à tous les participants, et plein de succès à notre Congrès.

**Pr. Nour-Eddine MEZRIOUI
Président de MICROBIONA**

Summary

Acknowledgments.....	II
Honor committee	III
Organizing committee.....	III
Scientific Committee.....	III
Welcome	IV
Mot du Président de l'Association MICROBIONA	V
Summary	VI
Plenary lectures	XIII
PL01. KLENK H-P. The Genomic Encyclopaedia of Bacteria and Archaea (GEBA) – An Universal Resource for Microbial Biotechnology in Bioindustry, Agriculture, Human & Animal Health and Environment.....	1
PL02. ARORA N.K. Plant growth promoting rhizobacteria for controlling phytopathogens and enhancing the productivity of saline soils	3
PL03. KUMAR V. Microbial Resources for Viable Agricultural Structure	5
PL04. AÏT BARKA E. Toward a sustainable agriculture: Deciphering the beneficial interaction between Paraburkholderia phytofirmans and grapevine face to biotic and abiotic stresses	7
PL05. DUPONNOIS R.. Endophytes of plant organs: an underutilized resr of biofertilizers and / or microbial biopesticides.....	8
PL06. ENNAJI M.M. Recent advances of cancers Epidemiology in Africa: Viral ethology, Risk factors and molecular characterization.	10
PL07. GHAZAL H. Le Cancer Colorectal et Microbiome Intestinal chez des patients Marocains ...	13
PL08. ACHOUAK W. Plant root exudates shape microbiota diversity and function.....	15
PL09. FREITAS H. Micro-phytoremediation of heavy metal contaminated soils.....	17
PL10. HEULIN T. Phenotyping underground to select plant varieties for C storage into soils (e.g. pearl millet and 4%)	19
Project Presentation: BacPlant Project (Poster)	20
Oral Communications	21
TOPIC I-	22
OCI-1. ABOULOIFA et al. Screening for antifungal activity of lactic acid bacteria isolated from natural fermenting green olive.	22
OCI-2. ACHKOUK et al. Effectiveness of PGPR for improving the growth of Lotus creticus under greenhouse conditions.	22
OCI-3. ALIYAT et al. Performance of rhizobacteria isolated from phosphate solid sludge in the P Solubilization.	23
OCI-4. AZAROUAL et al. Natural phosphate solubilizing Bacillus strains improved physiological, biochemical parameters and nutrient uptake of gnotobiotically grown wheat.	23
OCI-5. BELLAOUCHI et al. Production of citric acid by Aspergillus niger using the juice of Assiane date variety	24
OCI-6. BENNIS et al. Plant growth activities of some bacteria isolated from Vachellia gummifera rhizospheric soils.....	25
OCI-7. BOUHRAOUA et al. Evaluation of PSB, native arbuscular mycorrhizal fungi and rhizobia as biotertilizers for the improvement of growth and yield of peanut (Arachis hypogaea L.) L.).....	26
OCI-8 BOUKAYA et al. Evidence of biocontrol and plant-growth-promoting capacities of Streptosporangium becharensense strain SG1: an antagonistic actinobacterium from the Algerian Sahara.	26
OCI-9. BOUSKOUT et al. Response of caper (Capparis spinosa) to inoculation with mycorrhizal fungi under salt stress.	27
OCI-10. CHANDA et al. Effect of microalgae polysaccharides on biochemical and metabolomics pathways related to plant defense in Solanum lycopersicum.	27
OCI-11. CHAOUI et al. Evaluation of the effectiveness of fungicides combinations in controlling post-harvest diseases of peach and nectarine fruits.	28
OCI-12. DIJON et al. Development of a biopesticide in the fight against Black Sigatoka in Martinique and biofertilizers promoting banana growth.	29
OCI-13. GARGOURI et al. Impacts of increasing aridity on the soil and root microbiome of cactus.	29
OCI-14. GHABBOUR et al. Effect of pH, NaCl and glucose on Biodegradation of Oleuropein by Lactobacillus plantarum FSO175.	30

OCI-15. HAMANE et al. Screening and characterization of phosphate solubilizing rhizobia isolated from Hedysarum nodules in North of Morocco.	31
OCI-16. HAMIM et al. Effects of inoculating putative ericoid mycorrhizal fungi and dark septate endophyte on the growth and nutritional status of Blueberry (<i>Vaccinium corymbosum</i>).	31
OCI-17. HARKOUSSE et al. Effects of in vivo mycorrhization and PGPR inoculation on growth parameter of date palm (<i>Phoenix dactylifera</i> L.).	32
OCI-18. HAZZOUNI et al. Effect of AMF symbiosis on barley nutrition and some physiological parameters.	33
OCI-19. HNINI & AURAG. PGP activities, drought and salinity tolerance in Bacteria associated with <i>Acacia tortilis</i> subsp. <i>raddiana</i> growing in arid regions.	34
OCI-20. LAHDACHI et al. Evaluation of the symbiotic efficiency of bacteria nodulating <i>Acacia gummiifera</i> Wild.	34
OCI-21. MALDANI et al, Comparative study of glyphosate and paraquat effect on the nitrogen-fixing bacteria growth.	35
OCI-22. MERCHA et al. Characterization of technological and probiotic features of interactive lactic acid bacteria in camel milk from a Moroccan biotope.	35
OCI-23. MISBAH et al. Production, purification and biochemical characterization of extracellular lipase from <i>Staphylococcus</i> sp.	36
OCI-24. MNIF et al. Innovative strategies to eradicate biofilm colonization in dairy processing lines.	37
OCI-25. MOUSSAID et al. Isolation and characterization of lactic acid bacteria producing extracellular lipase isolated from camel milk.	37
OCI-26. OUBELLA & MOUMNI. Screening for endomycorrhizal strains associated with Moroccan date palm for their application as biofertilizers on olive seedlings.	38
OCI-27. OULGHAZI et al. The Genomic Analysis of the First <i>Dickeya dianthicola</i> Isolated in the north of Morocco.	38
OCI-28. OUTAMAMAT et al. Screening of highly benefit interactions Arbuscular Mycorrhizal Fungi-plant for agronomic and environmental purposes.	39
OCI-29. RFAKI et al. Abundance and prospecting of Rock PSB in the Rhizosphere Soil of Faba Bean (<i>Vicia faba</i> L.) in Morocco.	40
OCI-30. ROKNI et al. β -Glucosidase activity of <i>Lactobacillus plantarum</i> FSO1 and <i>Candida pelliculosa</i> L18 isolated from fermenting Moroccan green olive.	40
OCI-31. SAMMAMA et al. Evaluation of the agronomic and biochemical performance of intercropping soft wheat and faba bean in organic agriculture.	41
OCI-32. SLIMANI et al. Effect of a combined inoculation of Arbuscular Mycorrhizal Fungi (AMF) and Plant Growth Promoting Rhizobacteria (PGPR) on Biochemical properties of marketed tomato seedlings under water deficit conditions.	42
OCI-33. SMAIL-SAADOUN et al. Fruit's mycoendophytes diversity of <i>Pistacia atlantica</i> L. in Metlili, (Ghardaïa, Algeria).	42
OCI-34. TABRIKA et al. Suppressive effect of different compost extracts against <i>Fusarium wilt</i> of chickpea (<i>Fusarium oxysporum ciceri</i>).	43
OCI-35. TAHIRI et al. Effects of PGPR bacteria, arbuscular mycorrhizal fungi and composts on growth parameters and yield of lettuce under open field conditions.	44
OCI-36. ZAARAOUA et al. Inoculation with arbuscular mycorrhizal fungi improves the growth and mineral nutrition of <i>Retama monosperma</i>	44
OCI-37. ZENNOUHI et al. Solubilization of insoluble rock phosphate by PSB and its effects on wheat growth and P uptake.	45
OCI-38. ZIANE & ABDELLAOUI. A quantitative exposure assessment of <i>S. aureus</i> in cheese consumed in El Maleh region (Algeria).	46
TOPIC II-	47
OCII-1. AIT HAMMOU et al Identification of 3 miRNAs as biomarkers of early diagnosis of breast and gynecologic cancers among Moroccan women.	47
OCII-2. AMAKRAN et al. Volatile oil composition, antifungal and antioxidant activities of wild Moroccan <i>Thymus capitatus</i>	47
OCII-3. AMZIL et al. Correlation between antibiotic resistance and the ability to form <i>E. coli</i> biofilm isolated from products of avian origin.	48
OCII-4. BOUHOUDAN et al. Mycotoxins of <i>Penicillium aurantiogriseum</i> : a promising source for anti-cancer therapy.	48
OCII-5. DILAGUI et al. Occurrence of carbapenemases in uropathogenic Enterobacteriaceae at Mohammed VI University Hospital Center.	49

OCII-6. EL HADI H et al. An RT-qPCR Assay for rapid detection & quantification of Hepatitis C virus RNA in clinical specimens.....	50
OCII-7. ELHIDAR et al. Thymus leptobotrys a NorA efflux pump inhibitor	50
OCII-8. EN-NASSIRI et al. Molecular epidemiology of nalidixic acid resistant <i>S. enteritidis</i> from human and nonhuman origin.....	51
OCII-9. Es-SADEQY et al. Anti-biofilm efficacy of honey against biofilm forming <i>S. aureus</i> from chronic wounds	52
OCII-10.ES-SOUCRATTI et al. Prevalence of <i>Campylobacter</i> in chickens sold in large markets in Morocco	52
OCII-11. JAZOULI et al. Vaccination against Hydatidosis : Molecular Cloning & Expression of EG95NC- Recombinant Antigen in <i>E. coli</i>	53
OCII-12. KATIF et al. Diversity and bioactivity of microflora associated with red seaweeds from the Atlantic Coast of Morocco	54
OCII-13. KHATABY et al. Evaluation of the efficacy of a novel inactivated vaccine against a new emerging Italy02 infectious bronchitis virus.....	55
OCII-14. LAMSISI et al. Expression of non-coding RNAs as Promising Biomarker in Breast and Gynecological Cancers.....	55
OCII-15. MOUSSAID et al. Control of <i>Aspergillus fumigatus</i> strain isolated from pulmonary Aspergilloma by microorganisms.....	56
OCII-16. SADOUD et al. Biological activities of compound obtained from an Algerian fresh water microalgae, <i>Haematococcus pluvialis</i>	56
OCII-17. SOUNA et al. Enterobacter: Genetics Of Ctx-M Extended-Spectrum B-Lactamases.....	57
TOPIC III-	58
OCIII-1. ALAMI et al. Phenotypic and genotypic characterization of rhizobia isolated from <i>Astragalus algarbiensis</i> growing in Maamora forest.	58
OCIII-2. BOUACHA & ALOUACHE. Isolation and identification of potential probiotic bacteria from the digestive tract of red Tilapia	58
OCIII-3. BOUHIA et al. Effect of microbial Inoculation on the assessment and maturity of compost of olive mill wastewater sludge.....	59
OCIII-4. BOUHNİK et al. Diversity of rhizobia nodulating <i>Acacia gummifera</i> in Morocco.	59
OCIII-5. BOUSSETTINE et al.. Molecular and prediction modelling of the VP1 epitopes and protein homogeneity of Enteroviruses serotypes can block viruses transmission into water environment targeting improving public health quality	60
OCIII-6. CHAHOURI et al. Study of Faecal Contamination and Occurrence of pathogenic bacteria in Oued Souss estuary	61
OCIII-7. CHAIB et al. First Attempts to Valorize the Lipid Content of Benthic Diatoms for the Production of Third-generation Biofuels.....	61
OCIII-8. CHEBAIBI et al. Protein enrichment of lignocellulosic substrate by solid state fermentation using <i>Neurospora sitophila</i>	62
OCIII-9. DAHMANI et al. Study the diversity of the bacterial communities in the mining district of Oujda region by pyrosequencing.....	63
OCIII-10. DANOUCHE et al. Biosorption and Biodegradation mechanisms for the bioremediation of textile dyes using yeast cells	63
OCIII-11. EL BERKAOUI et al. Isolation and characterization of halophilic and halotolerant bacteria producing extracellular hydrolytic enzymes from salt marshes in Morocco.....	64
OCIII-12. EL JAÏ & BHAR. Contribution to the study of genetic characterization of <i>E. Coli</i> multiresistant strains in broiler chicken.....	65
OCIII-13. EL MOHALIL et al. Detection of Multidrug-Resistant Bacteria in Hospital Effluents of the University Hospital Mohammed VI, Marrakesh, Morocco.....	65
OCIII-14. HASSOU et al. Impact of environmental conditions on viral and bacterial aetiology of Pacific oysters <i>Crassostrea gigas</i> mass mortalities in Oualidia lagoon	66
OCIII-15. KODAD et al. Occurrence of GI, GII noroviruses and Hepatitis A virus in Moroccan shellfish	67
OCIII-16.KORICHI et al. Antagonistic potential of actinomycetes against Multi-drug resistant bacteria of hospital wastewater	67
OCIII-17. LAAOUIDI et al. Rhizosphere microbial activities and biochemical responses of Parsley and Coriander plants grown under metallic stress.....	68
OCIII-18. LAMIN et al. Isolation and characterization of the rhizobia nodulating of <i>Retama Monosperma</i> in the mining soils of the Touissit region of eastern Morocco	69

OCIII-19.MADLINE et al. Effect of metal resistant plant growth promoting rhizobacteria (PGPR) on the barley seed germination under metallic stress	70
OCIII-20.NAYLO et al. Microbial communities structures of urban soils of Marrakesh city along an anthropization gradient.....	70
OCIII-21.OUBANE et al. The assessment of the effectiveness of three wastewater treatment systems by the genotoxicity test on <i>Vicia faba</i> roots	71
OCIII-22. OUBOHSSAINE et al. Structure and diversity of bacterial communities in heavy metal multi-polluted soils in the region of Oujda (Morocco).....	72
OCIII-23.RAKLAMI et al.The inoculation effect with rhizobacteria on <i>Medicago sativa</i> growth and physiology under heavy metals stress	73
OCIII-24.TAREK et al. Biomonitoring of Norovirus GI and II in a wild lagoon by using bivalve mollusks as environment biomarkers	73
TOPIC IV-	75
OCIV-1.AITBOULAHSEN et al. Effect of essential oils incorporation on edible films against common foodborne pathogens.	75
OCIV-2. BELGHITI et al. <i>Opuntia ficus-indica</i> fruit: Alternative to Antibiotics Growth Promoters for Broilers	75
OCIV-3. DEBIB et al. Phenolic content and antifungal activity of <i>Ficus carica</i> extracts against resistant <i>Candida albicans</i> strains	76
OCIV-4.EL JAÏ et al. Demonstration of the effect of antibiotic's alternatives on multidrug resistant <i>E. coli</i> in vivo & in vitro in broiler chicken.....	76
OCIV-5.ELAANACHI et al. Antimicrobial, antioxidant and sun protection factor activities of leaves of <i>Marrubium vulgare</i>	77
OCIV-6.GAAMOUCHE et al. The antimicrobial effect of bacteriocinogenic activity, <i>Rosmarinus officinalis</i> essential oil and their combination against <i>E. coli</i> O157:H7 in sausages.....	78
OCIV-7. JABER et al. Antimicrobial effect of three medicinal plants on 82 <i>E.Coli</i> strains isolated from turkey meat marketed in the Kenitra city.....	78
OCIV-8. KERSANI et al. Isolation of exopolysaccharides from coccal lactic acid bacteria.....	79
OCIV-9. LEKBACH et al. Effect of <i>Cistus ladanifer</i> ethanolic extract on microbiologically influenced corrosion of 304L stainless steel caused by <i>Pseudomonas aeruginosa</i> biofilm	79
OCIV-10. OUBIHI et al. Antibacterial effect of some plant extracts against nosocomial Gram-positive and -negative bacteria.....	80
OCIV-11.OULKHEIR et al. Synergistic effect between antibiotics & some essential oils against <i>E. coli</i> , <i>S. aureus</i> and <i>P. aeruginosa</i>	81
OCIV-12. RAZZOUK et al. Chemical composition, antimicrobial and antioxidant activity of <i>Thymus leptobotrys</i> Murb essential oil.....	81
Poster communications	83
TOPIC I-	84
P.1. AMMAD & BOUKERCHAOUI. Effect of <i>Trichoderma</i> sp against of pathogen agents of BDA grapevine cankers	84
P.2. BAHA N. Using bio-fertilizers for mitigation of effects of salt stress on the growth of seedling alfalfa	84
P.3. BECHTAOUI et al. The impact of intercropping and co-inoculation with PGPR strains on yield, phosphorus and nitrogen content of wheat and faba bean.	85
P.4. BENCHABANE et al. Etiological and epidemiological study of wood disease of the citrus in Algeria.....	85
P.5. BENHIBA et al. Mycorrhizae enhance growth and development of date palm (<i>Phoenix dactylifera</i> L.) micropropagated plants after ex vitro transplantation.....	86
P.6. BENMECHERNENE et al. Molecular and proteomic characterization of <i>Leuconostoc mesenteroides</i> isolated from Algerian raw camel milk.	87
P.7. BEN MESSAOUD et al. Microbial inoculation effect on the <i>Medicago arborea</i> 's growth.....	88
P.8. BENOUDAH et al. Study of the variation of microbial biodiversity and dynamics of organic matter (OMS) of a cultivated soil under semi-arid conditions (Tiaret city, Algeria)	88
P.9. BOUAICHI et al. Characterisation and evaluation of antagonistic bacteria and essential oils in the management of olive knot disease caused by <i>Pseudomonas savastanoi</i> pv. <i>savastanoi</i>	89
P.10. BOUALI et al. In vitro PGP, amyolytic and proteinolytic activities of <i>Bacillus</i> isolated from a soil in Algeria.....	90
P.11. BOUDIAF NAIT KACI et al. Root symbiosis and phosphorus in the rhizosphere of oleaster (<i>Olea europaea</i> ssp. <i>sylvestris</i> L.) in degraded soil of Tizi Rached (Algérie)	90

P.12. BOUSMAHA et al. Standardization and application of a novel starter culture for fermented vegetables and fruits.....	91
P.13. BOUTASKNIT et al. Effects of arbuscular mycorrhizal fungi on physiological and biochemical responses to drought stress and recovery of the carob tree (<i>Ceratonia siliqua</i>)	91
P.14. CHEBAANE et al. Use of Cactus rhizospheric microbiome to rescue grapevine rootstock performance under climate change conditions.	92
P.15. CHERIF-SILINI & SILINI. Enzymatic and antimicrobial potentialities of Actinobacteria isolated from extreme ecosystems.....	93
P.16. DEKKICHE et al. Mesorhizobium gobiens and Mesorhizobium tamadayense species are symbionts of chickpea (<i>Cicer arietinum</i> L.) in eastern Algeria	93
P.17. ELAMERANY et al. The co-application of the bio-organic fertilizer chitosan and AMF increases the growth of tomato plants through the uptake of nutrients less available in the soil	94
P.18. EL FAIK et al. Diversity of bacteria nodulating three species of Lupine in Maamora forest in Morocco	95
P.19. ERAHIOUI et al. Preliminary study of the microbiological quality of fruits and vegetables commercialized in the city of Kenitra-Morocco.....	95
P.20. FARSSI et al. Co-inoculation effect of rhizobia and Plant Growth Promoting Rhizobacteria on <i>Medicago sativa</i> growth under phosphorus deficiency	96
P.21. FARSSI et al. Physiological characterization of rhizobia strains isolated from different agrosystems in Beni- Mellal (Morocco).....	96
P.22. GASMI et al. Effect of abiotic stress on bacterial growth of Plant Growth Promoting Rhizobacteria isolated from the <i>Terfezia</i> rhizosphere	97
P.23. GRAJA et al. Endophytic bacteria are an immense constraint in date palm micropropagation but their abundance is a good plant health indicator	98
P.24. HASNAOUI et al. Enzymatic and Antibacterial properties of lactic acid bacteria isolates from natural fermenting green olive	98
P.25. HAZZOUNI et al. Comparative study of the effects of root exudates and branching factors on <i>Glomus</i> hyphal ramification	99
P.26. KARRAY et al. Bacterial communities network associated to <i>Opuntia ficus indica</i>	100
P.27. KOTBA et al. Genetic diversity among Moroccan isolates of <i>Rhizoctonia solani</i> kühn	100
P.28. LAHDACHI et al. Evaluation of the symbiotic efficiency of bacteria nodulating <i>Acacia gummifera</i> Wild	101
P.29. LARIBI- HABCHI et al. Chitinase and insecticidal activities of <i>Shewanella basaltis</i> strain isolated from the marine environment.....	101
P.30. LAZALI et al. Identification of genes involved in the tolerance to environmental constraints in nodulated legumes.....	102
P.31. LOUGRAIMZI H., et al. In vitro Antibacterial activity of <i>Mentha pulegium</i> essential oil against <i>Clavibacter michiganensis</i> subsp. <i>michiganensis</i> , the causal agent of tomato bacterial canker.....	103
P.32. MECHIAH et al. Biodiversity and abundance of arbuscular mycorrhizal fungus spores in <i>Pistacia atlantica</i> Desf. From Saadi Hassi Delaa, Laghouat (southern Algeria).....	103
P.33. MEDDICH et al. Beneficial Effects of Actinobacteria and Mycorrhizae on tomato (<i>Lycopersicon esculentum</i>) growth and nutrition.....	104
P.34. MERIBAI & BAHLOUL. Raw camel milk production in algerian's south eastern arid areas: constraint related to collection, storage and transport: impact on product quality	105
P.35. MERIBAI et al. Physicochemical stability's exploration and microbiological quality's assessment of a processed soft cheese, type: camembert, after storage for three weeks at different temperatures	105
P.36. MESSAOUI et al. Hydrolysis of whey proteins by strains of <i>Lactobacillus plantarum</i> isolated from ewe's milk	106
P.37. OUATIKI et al. Use of mycorrhizal fungi in phytoremediation strategies in an abandoned mine site	106
P.38. OUBELLA et al. Isolation and morphological identification of desert arbuscular mycorrhizal fungi from Errachidia region in Morocco.....	107
P.39. OULGHAZI et al. Phylogenetic diversity of <i>Pectobacterium</i> and <i>Dickeya</i> strains causing Blackleg disease of Potato's in Morocco	107
P.40. OURRADI et al. Antifungal activity of seed oils from four varieties of dates (<i>Phoenix dactylifera</i> L) against the fungus <i>Fusarium oxysporum</i>	108
P.41. RAKLAMI et al. Effect of the inoculation by rhizobacteria and arbuscular mycorrhizal fungi on the growth and yield of <i>Vicia faba</i> and <i>Triticum aestivum</i>	108

P.42. SAOUDI et al. Effect of heavy metals, pH, temperature and salt concentrations on bacteria isolated from Phaseolus.....	109
P.43. SEBIHI et al. Isolation of <i>Pseudomonas fluorescens</i> from wheat rhizosphere showing in vitro PGPR effect.....	110
P.44. SOUFIANI et al. Physicochemical characterization of Lactic Acid Bacteria used as a starter culture in the olive fermentation process.....	110
P.45. TANKIOUINE et al. Adhesion kinetics of <i>Staphylococcus</i> on the support of glass treated with UHT milk.....	111
P.46. ZERGUI et al. Purification and molecular characterization of two antimicrobial peptides produced by <i>Lactobacillus plantarum</i> DU10.....	112
P.47. ZIANE & ABDELLAOUI. A quantitative exposure assessment of <i>Staphylococcus aureus</i> in cheese consumed in El Maleh region (Algeria).....	112
TOPIC II-	114
P.48. ANOUAR TADLAOUI et al. PRR11 survey in Moroccan women cervical cancer.....	114
P.49. AZMI et al. Study of hypovitaminosis d prevalence in moroccan population with type 2 diabetes.....	114
P.50. BOUDIAF et al. Evaluation of the antimicrobial and anti-inflammatory properties of <i>Olea europaea</i> L. leaf extract.....	115
P.51. DEROUICH et al. Comparative study of antimicrobial activity of olive leaf (<i>Olea europaea</i> L) aqueous and methanolic extracts.....	115
P.52. IBRAHIMI et al. Marine predatory actinobacteria: A new therapeutic approach against multidrug resistant bacteria.....	116
P.53. KHATABY et al. Avian infectious bronchitis disease: isolation of viral IBV strains in 2018.....	117
P.54. LABYED et al. Vitamin D receptor gene polymorphisms and breast cancer virus-induced risk.....	117
P.55. RAMMALI et al.. Evaluation of Actinobacterial biological activities against multi-resistant pathogens.....	118
P.56. SOUNA et al. Resistance of Gram-negative bacilli to antibiotics in the Chlef community....	118
P.57. ZALEGH et al. Crude extract of <i>Inula viscosa</i> as an antibacterial agent against clinical strains of Methicillin Resistant <i>Staphylococcus aureus</i>	119
TOPIC III-	121
P.58. BELOKDA et al. First assessment of Phytoplankton diversity in a Moroccan shallow reservoir (Sidi Abderrahmane).....	121
P.59. BENAZZOUK et al. Phytohormones and polyamines in food-waste -derived vermicompost leachate.....	121
P.60. BENIDIRE et al. Effects of inoculation of metal resistant rhizobacteria and organo-mineral amendment on antioxidant activities of <i>Lolium perenne</i> growing in heavy-metal contaminated mine tailings.....	122
P.61. BOUYATAS et al. Isolation and characterization of soil actinobacteria from abandoned for their lead tolerance.	123
P.62. EL FAIK et al. Diversity of bacteria nodulating three species of Lupine in Maamora forest in Morocco.....	124
P.63. EL MEZOUARI EL GLAOUI. et al. Impact of compost from lagoon sludge and green waste on soil properties and yield of fababean.....	124
P.64. ELGOULI et al. Effect of temperature on <i>Pseudomonas aeruginosa</i> ATCC27853 adhesion on glass and 316 stainless steel under dynamic water flow conditions.....	125
P.65. HAKIM et al. Study of the predictive adhesion between bacteria from an anaerobic digester and different supports (biocarriers).....	125
P.66. HATIB et al. Rotavirus A related to Moroccan aquatic environment.....	126
P.67. KADDOURI et al. Isolation of rhizobacteria from the soils of two semi arid regions using different types of culture media.....	127
P.68. LAAOUIDI et al. Microbial contamination of soils and vegetables from gardens of (peri)urban areas in Marrakesh city.....	127
P.69. LAICHE & AFILAL. Improvement of biogas production through the use of a microbial consortium adapted to each substrate: application on horse dung.....	128
P.70. OUATIKI et al. Use of mycorrhizal fungi in phytoremediation strategies in an abandoned mine site.....	128
P.71. TOUIOUI BOULKOUR et al. Purification and characterization of a novel manganese peroxidase from the white-rot fungi <i>Irpex lacteus</i> strain SBT16 for lignin degradation.....	129
TOPIC IV-	131

P72. ACHRAF et al. Antifungal activity of essential oil from <i>Anethum graveolens</i> L. on fungal species development.....	131
P73. ADRAR et al. Effect of combination of essential oils of <i>Citrus x paradisi</i> and <i>Coriandrum sativum</i> on fungal strains.....	131
P74. AISSAOUI et al. Antimicrobial, antioxidant power of the phenolic extract of <i>Coffea arabica</i>	132
P75. BENDIF et al. Antimicrobial activity of essential oils and polar extracts of two Lamiaceae form eastern Algeria: <i>Rosmarinus eriocalyx</i> and <i>Thymus munbyanus</i> ssp. <i>coloratus</i>	132
P76. BENYAGOUB et al. Selective extracts of <i>Quercus robur</i> L. leaves': Do they have an inhibitory effect against uropathogenic microbial strains?	133
P77. GHAZI- YAKER et al. Diversity of endophytic and epiphytic fungal associated with twigs of <i>Ziziphus lotus</i> in Tizi-ouzou (Algeria).	133
P78. KERSANI et al. Isolation of exopolysaccharides from coccal lactic acid bacteria.....	134
P79. KHELLAF et al. The antibacterial effect of <i>Lavandula stoechas</i> and <i>Laurus nobilis</i> essential oils alone or in combination with antibiotics and essential oils major components.....	134
P80. LOUGRAIMZI et al. Antibacterial in vitro activity of plant <i>Mentha pulegium</i> essential oil against <i>clavibacter michiganensis</i> subsp. <i>michiganensis</i> , the causal agent of tomatoes bacterial canker	135
P81. OUZID et al. In vitro evaluation of the antimitotic and antiproliferative activities of the crude fungal extract of <i>Aspergillus: foliar endophytic fungus of Peganum harmala</i> L. (dayate Aiat, Laghouat, Algeria)	136
P82. RABIB et al. Study of Antioxidant and Antibacterial Activity of Essential Oils of <i>Tetraclinis articulata</i> (Vahl) Masters from Morocco	136
P83. ZADNI et al. The natural diversity of mycorrhizal fungi associated to the rhizosphere of argan trees (<i>Argania spinosa</i> L.) and mycorrhizogenic potential of argan from North West Morocco (Oued cherrat)	137

Plenary lectures

PL01. The Genomic Encyclopaedia of *Bacteria* and *Archaea* (GEBA) – An Universal Resource for Microbial Biotechnology in Bioindustry, Agriculture, Human & Animal Health and Environment

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Keywords: *Microbial Genomics, Genome Sequencing, Functional Annotation, Type Strains, Microbial Diversity, Phylogenomics, Systematics*

This work aims for a systematic, genomic exploration of all species of Bacteria and Archaea with validly published names. It will generate an exhaustive database for all the microbial type material available from world-leading culture collections to satisfy the needs for various biotechnological applications that depend on available genomic resources that cover the known microbial diversity. Whole-genome sequences and high quality genome drafts were generated using various state-of-the-art genome sequencing technologies, starting with Sanger sequencing (in the mid 2000 years), proceeding with second generation 454 and Illumina technologies to currently applied Third generation PacBio and Nanopore sequencing tools. Genomes were assembled and functionally annotated with in-house developed software using the Integrated Microbial Genomes (IMG) platform at JGI followed by deposit of all information in INSDC databases. About 4000 bacterial and archaeal genomes were sequenced and analyzed, with over 55 thousand new protein clusters identified. Over 25 thousand Biosynthetic Gene Clusters (BGCs) were identified as further targets for biotechnological applications. More than 150 new species and genus names were validly published after systematic analysis with newly developed phylogenomic procedures. In conclusion, the impact of over 300 publications derived from GEBA-generated data can already be documented in thousands of citations across plenty of fields in biotechnology, systematics and bioindustry; however, this constitutes only the humble beginning of big data analysis performed on microbial genome data with more to come in near to medium future.

Achievements

Hans-Peter Klenk is a leader in microbial genomics, a field that has transformed microbiology. Some of his instrumental contributions in shaping the field of Microbiology include his contribution to the Sequencing of Orphan Species (SOS) Initiative and the Genomic Encyclopaedia of Bacteria and Archaea (GEBA). As a former Head of Microbiology at one of the largest culture collection centres in the world (German Collection of Microorganisms and Cell Cultures, DSMZ), he has been instrumental for establishing genome sequencing of type strains.

Accomplishments

Professor Hans-Peter Klenk is a pioneer and leader in the field of microbial genomics. He has been part of the microbial genomics revolution from the very beginning of whole genome sequencing (including leading the analysis of the second archaeal genome, that of *Archaeoglobus fulgidus*), and he has been playing an instrumental role in the sequencing and analysis of thousands of bacterial and archaeal genomes since then. During the last few years he has played a pivotal role in shaping projects

and research directions for studying the evolution of microorganisms and the genealogical relationships among prokaryotes. His achievements in these directions and through his critical role in such projects as SOS and GEBA include the sequencing of the genomes over 3,000 type strains as well as getting funding approved for sequencing another 5,000 type strains in the next couple of years. The results of his work have already a dramatic impact on the field of bacterial taxonomy. In recognition of his critical role and contributions in systematic bacteriology, he was the recipient of the prestigious 2014 Bergey Awards by the Bergey's Manual Trust (USA). He is also an Honorary member of the Hungarian Society of Microbiology (2009) and the Association of Indian Microbiologists (2010) and an elected Fellow of the Royal Society of Biology (2015) and the American Academy of Microbiology (2015). Key positions in Professor Klenk's scientific career include: 1996/1997 Associate Investigator in Craig Venter's legendary 'The Institute for Genomic Research, TIGR' (USA), 1998 Head of Genomics Laboratory, Georg-August University, Goettingen (Germany), 2007-2014 Head of Section Microbiology at DSMZ (Germany), 2014-2017 Head of School of Biology, Newcastle University (UK); since 2018 Emeritus Professor of Microbial Genomics & Diversity, Newcastle University (UK)

PL02. Plant growth promoting rhizobacteria for controlling phytopathogens and enhancing the productivity of saline soils

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Soil considered as the skin of the earth is also the foundation of the agro-ecosystems. However, due to increase in the pace of industrialization, intensive agricultural practices and global warming, soil salinization has emerged as a global menace affecting not only the quality and productivity of the land but also causing agro-ecological degradation. It has been estimated that about 20% of the irrigated land around the globe is facing the problem of soil salinization, as a result of which significant reduction in crop production has been observed worldwide. Reclamation of such salt affected soil through physical and chemical means is not only costly but also hampers sustainability of the environment. Hence, adoption of a biotic approach such as use of plant growth promoting rhizobacteria (PGPR) and their metabolites in place of conventional agronomic practices can be important for the alleviation and restoration of saline soils. These bacteria by diverse mechanisms such as nutrient assimilation, production of phytohormones, exopolysaccharides and siderophores can combat salinity/osmotic stress. In addition, these mechanisms effectively improve the yield of crops grown in these degraded soils along with significant biocontrol activity against phytopathogens. Such synergistic interactions among rhizobacteria and their associated plant make an excellent substitute to the agro-chemicals.

In a case study, salt tolerant rhizobacterial isolates (mainly fluorescent pseudomonads and rhizobia) from different regions of saline soils of Northern India were checked for various PGP traits such as production of indole acetic acid, siderophore, exopolysaccharides, zinc and phosphate solubilisation under salinity stress. The isolates were also found to be potent antagonists against phytopathogens *Macrophomina phaseolina* and *Fusarium moniliforme* which are endemic to the saline fields of the region. Selected strains of salt-tolerant rhizobacteria were checked by field trials (as bioinoculants) in high salt affected sites (electrical conductivity EC of 8.2-10.5 dS/m) for diverse crops like chickpea, sunflower, wheat and lettuce. The quality and productivity of each of the tested crop were found to be significantly improved due to beneficial characteristics of rhizobacteria even at high soil salinity. In case of chickpea, seed treatment with pseudomonads and its metabolite showed significant increment in dry weight and seed yield in comparison to non treated seeds (control). Similarly, dry weight and seed yield of sunflower were found to increase significantly after treatment with pseudomonads and its metabolites in comparison to control. However, best results were obtained when combination of cell and metabolite based formulation was used. On the other hand, application of rhizobial strain brought increment in dry weight of lettuce plant by 108% as well as significant increase in other vegetative parameters as compared to non treated seeds.

Repeated use of such salt tolerant PGPR was found to reclaim the saline soils thereby increasing their productivity, quality of produce and productivity. The strains have been submitted to major culture collection centers of India and in future will be used to develop tailor made bioinoculants for enhancing productivity of saline soils and simultaneously resulting in remediation of such agro-ecosystems.

Keywords: Soil salinity, PGPR, Biocontrol, Sustainable agriculture, Fluorescent pseudomonads, rhizobia

Bibliography: Prof (Dr) Naveen Kumar Arora, PhD in Microbiology, Professor in Department of Environmental Science, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, Uttar Pradesh, India is a renowned researcher in the field of Environmental Microbiology and Biotechnology. His specific area of research is rhizosphere biology and plant growth promoting rhizobacteria (PGPR). He has more than 60 research papers published in premium international journals and several articles published in magazines and dailies. He is editor of 12 books, published by Springer. He is member of several national and international societies, Secretary General of Society for Environmental Sustainability, in editorial board of 04 journals and reviewer of several international journals. He is also the Editor in Chief of the journal “Environmental Sustainability” published by Springer Nature. He has delivered lectures in conferences and seminars around the globe. He has a long standing interest in teaching at the PG level and is involved in taking courses in bacteriology, microbial physiology environmental microbiology, agriculture microbiology and industrial microbiology. He has been advisor to 118 post graduate and 09 doctoral students. Recently he was awarded for excellence in research by the Honorable Governor of Uttar Pradesh. Although an academician and researcher by profession he has a huge obsession for the wildlife and its conservation and has authored a book, *Splendid Wilds*. He is President of Society for Conservation of Wildlife and has a dedicated website www.naveenarora.co.in for the cause of wildlife and environment conservation.

PL03. Microbial Resources for Viable Agricultural Structure

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Abstract

Green revolution all over the world undoubtedly brought about self-reliance in food and fodder production. Application of chemicals in the form of fertilizers and pesticides resulted in this food self-sufficiency. On the other hand, disproportionate usage of chemicals as fertilizers and plant protectant agents for enhancing crop growth and yields lead to worsening and weakening of chemical, physical and biological health of agricultural soils. We now understand that, continuous application of chemical fertilizers in soil further necessitates its enhanced application in order to get higher crop yields. Accordingly, now we are concerned and bothered about agricultural sustainability. The “sustainability refers to the productive performance of a system over time. It involves the application or usage of biological resources to fulfil the current requirements without endangering or threatening the future prospective. Owing to the unwarranted usage of mineral fertilizers and plant safeguard chemicals, agricultural production sustainability has emerged as one of the most noteworthy and important matters. For that reason, and alternative resources of inorganic pesticides and fertilizers are being searched for. Potential microorganisms and organic manure are alternative resources for fulfilling the nutritional requirements and managing diseases and pests of crop plants to bridge the future needs.

Healthy soils harbour massive numbers of diversified living macro and microorganisms, these are gathered in varied and complex communities. They range from the innumerable of unseen microbes, most commonly bacterial and fungal species to the more acquainted macro-fauna such as ants and earthworms, which are natural pal of farmers. We can also consider the plant roots as soil creatures in view of their synergetic associations and communications with other components of soil, especially the microbes. In the soil ecosystem, dissimilar micro and macro organisms interrelate and co-operate with each other and also with numerous animals and plants in the environment, resulting in formation of a biologically active complex web. Abiotic environmental factors, such as salinity, excess or no moisture, temperature and acidity, as well as anthropogenic activities, particularly in managing agronomic and forestry practices, also influences the varied soil biological functions and communities.

In the last 50 years, we have seen the application of beneficial microbes in agriculture, and we have to appreciate the role of microbes in maintaining the sustainable agricultural system and production. Potential microbes have been exploited as plant growth promoters and as biocontrol agents in managing pests. Furthermore, the judicious use of beneficial microbes along with organic manure will surely result in food security, food safety, recycling of dead and decay organic materials, human nutrition and value added agro-products. Finally, development of efficient microbes as biofertilizers / bioinoculants and their application in agriculture alone or in the form of a bioformulation will certainly result in a step towards viable agricultural structure.

Bibliography: Dr. Vivek Kumar is working as Senior Associate Professor, involved in teaching, research and guidance with a pledge to enduring knowledge. Dr. Kumar works at Himalayan School of Biosciences, Swami Rama Himalayan University, Jolly Grant, Dehradun, India. His research interests are plant-microbe-interactions, sustainable agriculture, environmental microbiology and bioremediation. He currently serves on the editorial boards of many prominent international journals, viz. Environment Asia, International Journal of Biological & Chemical Sciences, Environmental Sustainability, Journal of Advanced Botany and Zoology, and Journal of Ecobiotechnology and He is also a reviewer for many prestigious International journals such as; Journal of Hazardous Materials, Environmental Sustainability, Science International, Acta Physiologiae Plantarum, Environmental Science & Pollution Research, Rhizosphere, etc. He has more than 100 publications to his credit, including peer reviewed research papers, review articles, book chapters, and also edited several Springer books. Dr. Kumar also served as a Microbiologist for eight years at the Department of Soil and Water Research, Public Authority of Agricultural Affairs & Fish Resources, Kuwait. He has been credited with first time reporting and identification of Pink Rot inflorescence disease of Date palm in Kuwait caused by *Serratia marcescens*. He has also been awarded 'Young Scientist Award' for the year 2002 in 'Agricultural Microbiology' by the Association of Microbiologists of India (AMI). He has also organized various outreach activities.

PL04. Toward a sustainable agriculture: Deciphering the beneficial interaction between *Paraburkholderia phytofirmans* and grapevine face to biotic and abiotic stresses

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Plant diseases cause losses of agricultural and horticultural crops every year leading to billions of dollars worth of crop losses worldwide. With 7.55 billion to date, the world population is projected to reach 9.1 billion people by 2050. In order to keep adequate yield, conventional agriculture is extremely dependent on chemicals to control crop diseases. However, many of these products are now being phased out because of concerns about their environmental impact and safety, or the resistance developed by the targeted organisms. Enhanced consumer awareness of food safety and environmental issues has also hastened the claim for pesticide reduction in conventional agriculture. Plant growth-promoting rhizobacteria (PGPR) are of great interest since they are beneficial naturally occurring soil bacteria that colonize plant roots and confer beneficial effects. They can increase yield, stimulate plant growth, reduce pathogen infection, and reduce biotic and abiotic stresses. Among these PGPRs, endophytes are defined as those bacteria that are able to colonize the internal tissue of the plant without causing external signs of infection or negative effects on their host. *Paraburkholderia phytofirmans* PsJN, classified as an ePGPR, was first isolated from surface-sterilized onion roots infected with the mycorrhizal fungus *Glomus vesiculiferum*. This rhizobacterium significantly promotes growth and protects the grapevine against biotic (grey mould disease) and abiotic (cold) stresses. Results obtained on *P. phytofirmans*-induced resistance against abiotic (cold stress) and biotic (*B. cinerea*) stress indicated that this PGPR acts *via* a priming effect rather than elicitation. We will provide a mechanistic insight into the interaction between grapevine *Vitis vinifera* L. and *Paraburkholderia phytofirmans* and how the presence of the bacterium induces plant resistance to abiotic and biotic stresses.

Biography: Essaid Ait Barka is a professor of Plant Physiology at the University of Reims. He studied Plant Biology at the Cady Ayad University in Marrakesh, and then got his Ph.D. from Reims University (1993), on the plant responses to low temperatures stress. After a postdoc at Laval University (Canada) and Penn State University (USA), he worked as research professor at NSAC (Nova Scotia, Canada). Interested in the interactions between plants and pathogenic/non-pathogenic microorganisms, his current research is directed towards basic and applied aspects of using beneficial microorganisms as microbial inoculants to promote plant growth and provide biological resistance against plant biotic and abiotic stresses. His investigation aims to understand the molecular mechanisms of cross-talk between plant defense signal transduction pathways and the beneficial microorganisms. He has many partnerships with the private and public sectors and is co-inventor of two patents in the field of biocontrol.

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PL05. Endophytes of plant organs: an underutilized reservoir of biofertilizers and / or microbial biopesticides

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Keywords: *Agroecology, biofertilizers, biopesticides, microbial diversity, seed microbial endophytes*

The "Green Revolution", born in the 1960s, consisted of an industrialization of agriculture using improved varieties, massively introducing fertilizers and phytosanitary products and, finally, using excessively groundwater. Despite convincing results in terms of significant poverty reduction and a clear improvement in food security in some parts of the world, it turned out that this conception of agriculture led to profound environmental degradation (soil pollution, loss of biodiversity, etc.) leading to the undeniable finding that an alternative model should be rapidly identified through an ecological and environmental approach to agricultural production. In this context emerged the concept of "Doubly Green Revolution" which is based on a scheme combining the objectives of the "Green Revolution" (optimal productivity of the agrosystem) and those aimed at reducing the environmental footprint of current agricultural practices. As a result and at the beginning of this century, the main challenge of agriculture is to produce more with less in order to: (i) feed humanity in constant demographic expansion, (ii) reduce its environmental impacts, (iii) be a major player in the processes of adaptation to global changes and (iv) be the source of research and innovation for the bioeconomy by fully exploiting plant and animal biomass.

Strategies that can be developed to meet these imperatives include the development of soil microbial resources. The use of microbial diversity of soils as biological agents promoting plant growth has in recent years become spectacularly popular due to the fact that the harmful impacts of agricultural practices on the environment are taken into account (pollution, impoverishment biodiversity, etc.) (Philippot et al., 2013). This microbiota associated with the plant affects major host traits such as the production of metabolites, resistance to phytopathogenic microorganisms, chronology of flowering and biomass production. Given the potential of these microbial resources that can be expressed in favor of plant growth and phytosanitary status, a lot of work has been done to identify microorganisms from the rhizosphere and / or phyllosphere likely to be involved in the mechanisms governing the development of the host plant and / or its phytosanitary state (Maignien et al., 2014). While many studies have been devoted to the study of rhizospheric and / or phyllospheric microbial communities, other compartments of the plant such as the anthosphere (Shade et al., 2013), the carposphere (Telias et al., 2011) and the spermosphere (Okek et al., 2011) have been little studied as to their content in microorganisms. Since these plant organs are involved in the different stages of the plant reproductive process and are therefore involved in the vertical transmission of microorganisms from one generation to another, these habitats potentially represent reservoirs of microbial biodiversity potentially favorable to the development of their plant life. host plant (Truyens et al., 2015)

During germination, these endophytic microorganisms of the seeds will multiply at the level of the radicle by colonizing the endorhizosphere and the exorhizosphere and then spread to the soil level (Hardoim et al., 2012).. The role of these endophytes on the development of the plant is still little known. Work has shown that these microorganisms facilitate the growth of the host plant by improving its mineral nutrition (N, P), producing growth hormones, etc. or by exhibiting antagonistic activities against different phytopathogens. (Gagne-Bourgue et al., 2013,). On the other hand, these endophytes can impact seed germination via the production of hormonal compounds such as cytokinins (Goggin et al., 2015). They can also interact with other microorganisms introduced (eg inoculation of microbial agents such as PGPR) and thus limit the effect of biofertilizer on the growth of the plant (Bacillio-Jimenez et al., 2001). Referring to various works on the seed microbiota, this communication will mainly aim to show the potential of these endophytic seed microorganisms in the development of biofertilizers and / or biopesticides and to identify strategies for isolating the most performant microbial inoculants.

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Biography: Robin Duponnois is a senior scientist at the IRD (Directeur de Recherche. Classe Exceptionnelle) and leads the laboratory of tropical and Mediterranean symbioses in Montpellier (UMR LSTM, CIRAD / INRA / IRD / AGRO-M / Montpellier University). His work focuses on the role of mycorrhizal symbiosis in the productivity and stability of tropical and Mediterranean agroecosystems. Its scientific output attests to: 587 scientific references including 147 A-grade articles, 44 non-indexed articles, 56 book chapters, 6 books, 322 oral or poster communications and 12 patents (H Index: 27). Its research objectives aim to understand the role of mycorrhizal symbiosis in the bio-functioning of the soil in order to valorize this microbial resource in the rehabilitation programs of degraded environments. After having spent several years in West Africa (Senegal, Burkina Faso) and North Africa (Morocco), he was able to demonstrate in situ the interest of developing this fungal symbiosis in order to improve the productivity of agroecosystems and to conserve the endemic plant diversity of these environments. Convinced of the importance of training and valorization of research for the development of many Southern LDC countries, he has largely contributed to the training of young researchers and the creation of innovative companies in Senegal, Madagascar and in Morocco. He is also a member of various evaluation and research management committees.

PL06. Recent advances of cancers Epidemiology in Africa: Viral etiology, Risk factors and molecular characterization.

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Gynecological and mammary cancers (Breast, Cervical, Ovarian, Vaginal, Endometrial, and Vulvar cancers) are considered to be amongst the most preoccupying public health concerns, not just for the African community (where it's the third cause of deaths) but as well for the global world (72% of cancer deaths were recorded and Gynecological cancers account for 19% of cancer in the globe). This is due to their important causing rate of mortality and morbidity among women. Gynecological and mammary cancers englobe many types of cancers.

In Morocco alone, Ovarian, breast, and gynecological cancers are an alarming national public health issue. Annually, Morocco records nearly 30,000 new cases of cancer. However, Ovarian, breast, and gynecological cancer represent 60% of all women's cancers in Morocco.

The purpose of this study is mainly to describe and to update data regarding the above chronic pathologies. In the course of 2018, new information has been available about epidemiological and genomics information, and were reported. Cancers risk factors are multifaceted, such as genomics, epigenetics and environmental linkages, nutritional, etc.

Consequently, research attempting to identify the real causes of breast and gynecological cancers are manifold including viral etiology, which mainly involves the HPV (Human Papilloma Virus), EBV (Epstein Barr Virus), MMTV (Mouse Mammary Tumor Virus), HBV (Hepatitis B Virus). Etiology as a viral risk factor is often reported in these kinds of cancers. Furthermore, the study of p53 protein which is the tumor suppressor factor, acting as a negative regulator of cell growth by inducing cell cycle arrest or apoptosis, and can be regarded as a marker for predicting evolution in tumors.

In the other side, according to a report prepared by the Regional Office of Africa of the World Health Organization, the health status of African populations has improved considerably, as evidenced by the observed improvement in healthy life expectancy, from 50.9 in 2012 to 53.8 years in 2015¹. Also, the third of the deadliest diseases in Africa, namely respiratory diseases, HIV and diarrhoeal diseases, experienced a significant decline in mortality from 87.7 to 51.3 deaths per 100.000 people between 2000 and 2015¹. Although, the

burden of morbidity and mortality risk factors does not show comparable reductions. A resident of the Region aged 30 to 70 years has a 20.7% risk of dying from one of the major non-communicable diseases.

In addition, the burden of non-communicable diseases is rising to the surface, and according to WHO estimates, NCDs are expected to account for half of all deaths by 2030, compared to a quarter in 2004. According to WHO projections, the number of deaths from non-communicable diseases will reach 44 million in the world by the year 2020, an increase of 15% compared to 2010. As a result, WHO estimates that non-communicable diseases will cause 4 million deaths in the African region by 2020².

The main NCDs are cardiovascular diseases, type 2 diabetes, chronic obstructive lung diseases and cancer. In its Global Action Plan (2013-2020)³, WHO recommends that countries address these four types of diseases by addressing four risk factors (alcohol abuse, physical inactivity, poor nutrition and tobacco use). Indeed, according to the results published in the WHO 2018 State of Health Report on the African Region, each of the four above-mentioned risk factors presents a significant risk given their magnitude at the regional level: Alcohol consumption (consumption of 6.3 litres of alcohol per capita per year); Lack of physical activity (82.3% and 87.9% respectively among adolescents of the same sex male and female); Poor nutrition (7.7% and 15.1% of obese children and 15.1% of adolescents); and Smoking (24.2% and 2.4% of smoking cases, respectively among boys and girls aged 15 years).

Regarding cancer, 64% of new cancer cases worldwide are registered in developing countries⁴. Expensive access to care, lack of knowledge of the disease and behavioural habits may explain the high frequency of advanced stages of diagnosis⁵. However, in sub-Saharan countries, 80% of the population has no health insurance. The use of traditional healers and illicit drugs remains the only alternative for the poorest people⁶.

The latest IARC (International Agency for Research on Cancer) statistics indicate an increase in the global incidence of cancer with 18 million new cases in 2018 compared to 12 million in 2012. In Africa, the cancer mortality rate is 7% and exceeds the incidence of 5.83%. As globally, breast cancer is the most common form of cancer and has the highest mortality rate (10% of cancer mortality) in Africa compared to other continents. The profile of cancer for women in Africa is characterized by the high incidence and mortality due to cervical cancer with estimates of 119 284 new cases and 81 687 deaths in 2018 according to the IARC, ranking the continent second after Asia. In addition to colorectal cancer, ovarian cancer (4th in the top 10) is also common, with an incidence of 20 390 new cases and an estimated 15 183 deaths in 2018, but after Asia and Europe, it is in Africa that this cancer has the highest incidence and mortality rates. For men, prostate cancer predominates with 80 971 new cases and 42 298 deaths in 2018. Also, GLOBOCAN statistics show that among the cancer diseases with a high incidence and mortality rate is Kaposi's sarcoma, in fact, on a continental scale, this cancer has the highest rates in Africa among men, with an estimated incidence of 20 714 new cases in 2018 and a mortality rate of 11 486 cases.

In this chapter, a special intention will be dedicated to the presentation of molecular characterisation on the most important gynecomammary cancers in Africa mainly in Morocco, Mali, Congo, and Gabon; and statistical and epidemiological data, with a focus on North Africa. In the other hand, the main oncogenic viruses implicated in these cancers (seen that 20% of all reported cancers are related to oncoviruses), their oncogenic mechanisms, and other risk factors in relation with the oncogenesis. Finally, the recent results in integrative and transcriptomics analysis, where the computational biology has various and several applications.

Some African countries are making progress in improving health conditions, particularly in the fight against communicable diseases, but efforts should be made in another field, that of non-communicable diseases, by putting in place appropriate and well-supervised strategies for the prevention and reduction of risk factors, care and surveillance.

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Biography: Prof. Dr. Moulay Mustapha ENNAJI is a Moroccan citizen native of Marrakesh (Morocco). He is a scientist specialized in the fields of Virology, Hygiene and Microbiology, he got a Master of science in 1986 and a PhD in Virology in 1993 at Armand Frappier institute, University of Quebec (Canada). Between 1991 and 1993, he completed a post doctorate at the Canadian Red Cross. From 1993 to 1995, he was Research Associate (RA) and from 1995 to 1996 a Research Officer (RO) at the National Council of research of Canada (CNRC). He was also a visiting researcher at the University of California, Irvine in the US and abroad Lecturer at the Histochemistry Institutes of Paris (France). He was a guest researcher of the Franklin Foundation in USA NIH Bethesda. He was recruited in 1996 to the Faculty of Sciences and Techniques Mohammedia (FSTM), falling under Hassan II University of Casablanca (UH2C), as a Lecturer and enabled Professor where he was the head of the biology department from 1997 to 2000. He is currently Professor of Higher Education (PES C) in the same Faculty. As he is a scientist who is concerned by the research development, he gives numerous conferences and lectures in Virology, Cancerology, Hygiene and Microbiology since 1986 at many Moroccan, Canadian and American universities.

Between 2005 and 2010 he was appointed Director of Virology, Hygiene & Microbiology, and coordinator of the consortium of Biomedical and Environmental Sciences laboratories at UH2C-FSTM. Since 2010 to present, He is Director of the Laboratory of Virology, Microbiology, Quality and Biotechnology / Eco-toxicology and Biodiversity, Leader of Virology Oncology and Medical Biotechnology Team, and deputy director of the Research Centre of Natural Resources and Food (rensa) of UH2C. He was also responsible for the Master programs in Biotechnology and Biomedical Technologies (2000-2003), DESA of Microbiology and Bioengineering (2005 to 2010) and Master of Science and Technology (MST Microbiology, Applied Virology and Bio-industry Engineering and MST of Livings (Immuno-Virology and Applied Microbiology) from 2010 to 2015. He is a member of the Council of the Center of Doctoral Studies (CEDoc) at FSTM-UH2C since 2008. Between 2005 and 2010 he was deputy head of the UFR DESA Biomedical Sciences and from 2000 to 2005 deputy leaders of the UFR PhD in Health and Environment. Since 2005 to present, he is Deputy Head of Life and Environment Sciences Doctoral UFR. From 2010 to 2015 he was national expert at CNRST and member of the National Commission for scholarships. Previously, from 2012 to 2014, he was also a UNESCO expert on governance reform of university systems.

Throughout his career, he was rewarded with 24 awards. He has organized numerous national and international meetings in the fields of virology, microbiology and hygiene. To date, he is Vice President of the Moroccan Association of Biosafety, cancer and Microbiology.

PL07. Le Cancer Colorectal et Microbiome Intestinal chez des patients Marocains

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Le cancer colorectal (CCR) est le troisième type de cancer le plus fréquent. L'approche "omique" nous permet d'appréhender de façon assez précise les mécanismes moléculaires à l'œuvre dans l'émergence et la progression de cette forme de cancer. L'analyse des relations entre environnement et développement tumoral retiennent particulièrement le plus d'intérêt. A cet égard, le Microbiome Intestinal (MI) joue un rôle majeur dans les troubles gastro-intestinaux dont le CRC. L'avènement récent de la métagénomique, permettant de s'affranchir de la culture des microorganismes, via les techniques de séquençage d'ADN "NGS" basées sur l'analyse des gènes ribosomiaux bactériens 16S (gARNr 16S) ou du métagénome, offre la possibilité d'analyser de façon exhaustive ce vaste écosystème. La comparaison des résultats obtenus à partir d'échantillons tissulaires ou de matières fécales chez des sujets "sains" et des patients cancéreux a permis de mettre en évidence chez ces derniers des modifications de la composition de la flore microbienne. Dans notre étude (Allali et al., 2018, PMID:29687353), nous avons comparé le microbiome de selles de patients cancéreux marocains à celui des individus en bonne santé par séquençage d'amplicons d'ARNr 16S. Les échantillons CCR contenaient des proportions plus élevées de Firmicutes, plus précisément de *Clostridia* et de Fusobactéries, en particulier des *Fusobacteriia*, tandis que les bactéroïdes ont été enrichis dans des échantillons sains, en particulier la classe des Bacteroidia. *Porphyromonas*, *Clostridium*, *Ruminococcus*, *Selenomonas* et *Fusobacterium* étaient significativement surreprésentés chez les patients malades, comme dans d'autres études. La prédiction fonctionnelle comparative des métagénomes par inférence a montré que les protéines de motilité bactérienne, d'assemblage flagellaire et du métabolisme de la biosynthèse des acides gras étaient significativement surreprésentés chez les patients cancéreux, tandis que le métabolisme des acides aminés et la biosynthèse des glycanes étaient surreprésentés chez les témoins. Ces données d'analyse comparative entre sujets sains et patients atteints de CCR demeurent descriptives et se fondent sur des corrélations, incitant à une interprétation prudente. Il se peut que ces modifications du MI traduisent simplement des changements dans l'environnement secondaires au développement de la tumeur. Néanmoins, cette étude a permis d'identifier des taxons bactériens pertinents pour la population marocaine et encouragent des études d'échelle afin de pouvoir proposer des approches thérapeutiques population-spécifiques.

Mots clés: Séquençage; ARNr 16S; Métagénomique; Communauté bactérienne; Cancer colorectal (CCR); Microbiome intestinal (MI); Population marocaine

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concernent la Génomique, la Métagénomique (microbiome) et la Bioinformatique. Il est membre du Réseau Africain de Bioinformatique H3Abionet/H3africa, et Ambassadeur au Maroc de l'Association Américaine de Microbiologie (2016-2021).

PL08. Plant root exudates shape microbiota diversity and functions

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The rhizosphere is an active compartment where plant and microorganisms establish a molecular dialogue and where selected microbiota interact with plant roots in a continuum of ecological interactions ranging from pathogenicity, mutualism to symbiosis. Stable Isotope Probing (SIP) approaches allow investigating the fate of fresh and recalcitrant carbon in the rhizosphere with ¹³C enriched-root exudates, and identifying key players in carbon cycling.

DNA- and mRNA-Stable Isotope Probing (SIP) were used to determine bacterial communities assimilating each carbon source in the rhizosphere of four plant species, and to investigate the impact of plants on bacterial community structure and the expression of certain beneficial genes. We also investigated the structure of microbiota and the denitrifying function in the rhizosphere of different plant species

Our results have shown that plant species shape denitrification activity and modulate the diversity and gene expression of active microbiota through root exudation. A positive effect of the root exudates on denitrification activity was observed on the root system of *Arabidopsis thaliana* and *Triticum aestivum*, while *Brassica napus* appears to alter denitrification activity on the root system through root exudates. This inhibition of denitrification is probably due to competition between *B. napus* and the denitrifiers for nitrate, since nitrate is preferentially utilized by *B. napus*. Network analysis indicated that *Nitrospirales* and *Solirubrobacterales* were positively correlated with high denitrification activity (DEA) in the rhizosphere of *T. aestivum* and *B. napus*, while a positive correlation was observed between *Cytophagaceae*, *Chitinophagaceae* and *Microbacteriaceae* and a high DEA on the roots of *A. thaliana* and *T. aestivum*.

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Wafa ACHOUAK :Research director at the CNRS, at the Biosciences and Biotechnology Institute in France. Since 2004 she is leading the Microbial Ecology lab, focusing on adaptive response of bacteria to environmental stresses especially in the rhizosphere of plants. Her present research focuses on bacterial adaptive response to changing environments, the regulation and expression of phytobeneficial traits of plant root-associated bacteria, and their exploitation for environmentally friendly agricultural applications. She has been involved in the development of microbial fuel cells since 2005. She has published about 90 publications and a dozen book chapters. She holds a PhD (1993) from the University of Nancy I and the Habilitation to supervise research in Sciences (2002) from Aix-Marseille University.

PL09. Micro-phytoremediation of heavy metal contaminated soils

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Keywords: Plant growth promoting microorganisms, Micro-phytoremediation, Heavy metal polluted soils

Plants and microbes coexist or compete for survival and their cohesive interaction plays a vital role in adapting to metalliferous environments and thus represent a potential source for micro-phytoremediation of heavy metal contaminated soils. The root exudates from plants are offered to the soil microbes as useful carbon sources and may establish the intricate systems of communications with them, so that the growth and metabolism of microbes can be actively promoted. Some plant growth promoting bacteria and arbuscular mycorrhizal fungi may alleviate metal phytotoxicity, act as plant growth promoting microorganisms (PGPM), alter heavy metal availability and have significant effects on plant growth by lowering the level of growth-inhibiting stress ethylene, inducing defense reactions to the phytopathogens, providing essential minerals and modulating phytohormones levels. However, the cohesive interpretation of mechanisms underlying the effects of PGPM and plant root exudates on the state of heavy metal compounds and nutrients in the sophisticated soil-plant-microbe system during the bioremediation process remains elusive. Hereby, I have highlighted the biochemical basis of plant-microbe interactions and their role in modulating plant growth, plant defense responses, heavy metal tolerance, phytoremediation efficiency, as well as the molecular aspect of chemical communications between host plants and microbes under heavy metal stress conditions in an elaborate schematic sketch.

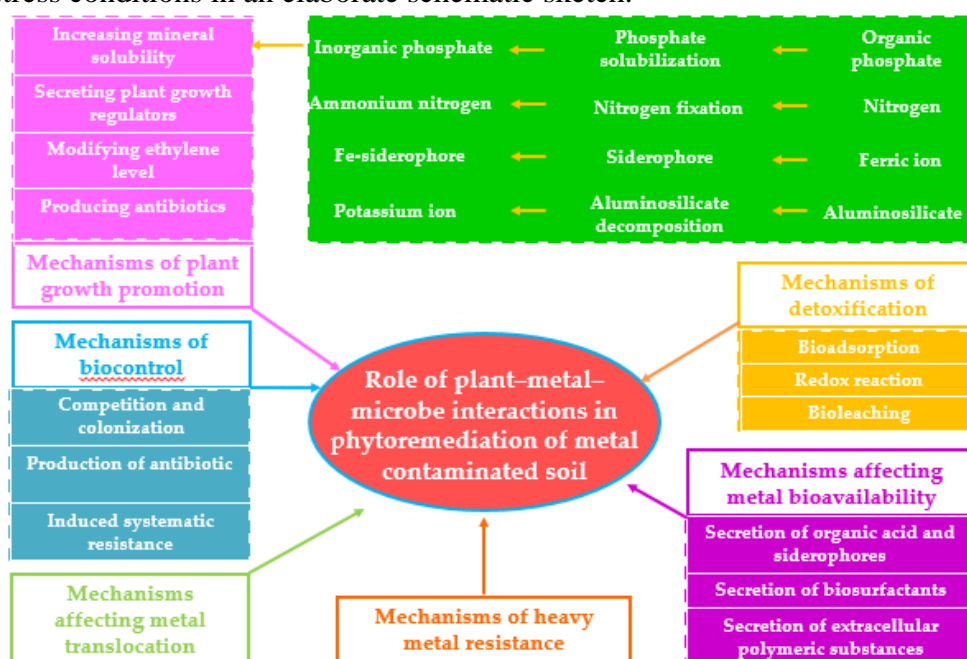


Fig. 1. Role of plant-metal-microbe interactions in phytoremediation of metal contaminated soils

Biography: **Helena Freitas** holds a PhD in Ecology from the University of Coimbra, in collaboration with the University of Bielefeld, Germany, and was a Post-Doc at the University of Stanford, USA. A full Professor in the fields of Biodiversity and Plant Ecology at the Department of Life Sciences (DLS), Faculty of Sciences and Technology of the University of Coimbra, she also served as Vice-Rector at the UC from March 2011 to August 2015.

Presently, she is the Coordinator of the research unit Centre for Functional Ecology (cfe.uc.pt) and member of the Board of FitoLab (Phytosanitary Laboratory of Instituto Pedro Nunes, Coimbra).

Helena Freitas was part of the Scientific Council of the Department of Life Sciences and a member of the General Council of the University of Coimbra (2009-2011). She was the Director of the Botanical Garden of Coimbra from 2004-2012, President of the Portuguese League for the Protection of Nature, between 1999 and 2002, the first Ombudsman for the Environment and Quality of Life of Coimbra's City Council, from 2002 to 2005, President of the Portuguese Ecological Society (2004-2013) and Vice-President of the European Ecological Society, from 2009 to 2012.

Helena Freitas' areas of scientific expertise deal with: biotic interactions and Mediterranean ecosystem dynamics; ecology and management of exotic and invasive species; plant diversity and conservation; metal-tolerance and bioremediation; environmental policy; ecology and societies sustainable development. She has coordinated or been a

participant in several national and international projects and consortiums, including the Millennium Ecosystem Assessment. She was supervisor or co-supervisor of more than 30 Master Thesis and 50 Doctoral Dissertations, already approved by public examination. She has published nearly 300 peer-reviewed international publications. As a committed citizen, she also publishes regularly in the national and regional press on the relation between society and the environment, land use planning and policy, and is also a frequent guest on national television channels.

Helena

Freitas

Full Professor

Coordinator of CFE

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PL10. Phenotyping underground to select plant varieties for C storage into soils (e.g. pearl millet and 4‰)

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The "4 per 1000" initiative aims to evaluate to what extent carbon storage in agricultural soils can contribute to limit the impact of climate change by reducing atmospheric CO₂ concentrations, and that this is compatible with a global food security objective. Among the many possible options for increasing C storage in soils, we have chosen to opt for varietal selection based on the ability of a crop to exude more C into soil than current varieties. The idea is to stimulate, within the soil microbiota, bacterial populations capable of transforming labile C from exudates into more stable carbon macromolecules (EPS) capable of structuring the soil around the root system and thus preventing the plant from water stress. An example of ongoing work on pearl millet in Senegal will be presented.

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Thierry Heulin, research director at the CNRS, directed the UMR 7265 BVME "Plant Biology and Environmental Microbiology" (CEA/CNRS/Aix-Marseille II) from 2003 to 2011. He is Director of FR ECCOREV (FR 3098, Continental Ecosystems and Environmental Risks). ECCOREV FR research themes are risks (seismic, climatic, forest fires), water resources, soils, biodiversity and ecotoxicology as well as environmental technologies. His main research topics are the ecology of nitrogen-fixing bacteria and exopolysaccharide-producing bacteria in the rhizosphere of cultivated plants (diversity, taxonomy, physiology, genetics). He particularly focused on understanding the role of bacterial exopolysaccharides in soil aggregation and their valorisation in water economics in agriculture and in plant selection. His more recent research aims to understand the adaptation mechanisms of bacteria in desert environments and more specifically the tolerance of *Ramlibacter tataouinensis* to desiccation and the regulation of its cell cycle by light. He has published about a hundred publications on a dozen bacterial rhizospheric species with properties promoting plant growth. He holds an engineering degree from the Ecole Nationale Supérieure Agronomique et des Industries Alimentaires (ENSAIA) in Nancy (1983) and a "Habilitation à Diriger les Recherches" from the University of Nancy I (1991). Bronze medal of the CNRS (1990). He was appointed member of CoNRS Section 29 (2013-2016) and president of the CS de France Génomique (2013-2017) and currently member of the Scientific Council of the INEE Institute (CNRS), and several other scientific councils (Lascaux, CESAB-FRB, Labex DRIIHM), member of the CPS of the AllEnv Alliance, member of the Permanent Group of Experts at GPRADE (ASN), member of the International Scientific Advisory Board (SAB) of AnaEE-F and of the International Scientific Advisory Board (SAB) of France Génomique.

Plenary lectures

Agadir, April 24-26th, 2019

Project Presentation (Poster)**BacPlant Project: Towards a sustainable agriculture by increasing plant tolerance to biotic stress under climatic change**

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Bread wheat and durum wheat are of strategic importance for Mediterranean agriculture. As other plants, wheat is subjected to several fungal diseases, altering the yield and the quality of the crop. Septoria tritici blotch (STB) and powdery mildew (PM) are the most prevalent wheat foliar diseases, (up to 30-35 q/ha yield losses), especially when climatic conditions are favorable.

Because abiotic factors, such as temperature and drought, affect host susceptibility to pathogens and pathogen aggressiveness, changes in interaction between biotic diseases and abiotic stress may symbolize the most substantial impact of climate change (CC) on plant diseases.

Development of technical tools and innovative options for agriculture that do not intensify climate and other environmental changes is crucial. There are currently an increasing number of results from both field and laboratory studies, which confirmed that inoculation with microbial biocontrol agents, can have positive effects on plant health and growth. These beneficial microbes can also enhance plant resistance to several environmental stresses, e.g., drought, salinity, and nutrient deficiency.

BacPlant project is based on collaborative interdisciplinary Mediterranean consortium aiming to develop a sustainable agriculture to increase wheat tolerance against STB and PM by using biological control agents under CC context.

Our project will adopt environmentally sustainable strategy to face drought and heat effects while preserving or even improving crop yield, health and quality. Furthermore, the use of microbial biocontrol agents will improve soil quality by using low inputs, and mitigate carbon emissions in future climates.

<http://www.univ-reims.fr/site/bacplant/home,19602,33139.html?>

Oral Communications

OCI-1. Screening for antifungal activity of lactic acid bacteria strains isolated from natural fermenting green olive.

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Keywords: antifungal, lactic acid bacteria, fungi, olive, fermentation

Aims of the work: Lactic acid bacteria (LAB) and fungi are the main microorganisms associated with the natural fermenting green olive process. The aim of this work was to evaluate the antifungal activity of some LAB isolates, isolated from natural fermenting green olives.

Methods: A total of 104 LAB isolates, obtained from natural fermenting green olives, were screened for their antifungal activity against *Penicillium sp.*, basing the agar overlay method. LAB isolates showing high antifungal activity were tested against other fungi species. The antifungal activity of the Cell Free Supernatant (CFS) of selected LAB isolates was determined against *Penicillium sp.* The selected LAB isolates were then identified basing their phenotypic and molecular (16S rRNA) properties.

Results: Among the 104 LAB isolates studied, 58 isolates showed high inhibitory effect against *Penicillium sp.* 5 LAB selected isolates showed antifungal activity against other mould species (*A. niger*, *Penicillium sp.*, *F. oxysporum* and *Rhizopus sp.*), after 72 hours of incubation at 30°C. The inhibition of *Penicillium sp.* was obtained also with the CFS of five selected

LAB isolates. The inhibition zones obtained ranged between 15.55±0.78 mm and 16.4±0.57 mm. The CFS of the five LAB isolates inhibited the biomass growth of the fungi. The 5 LAB selected strains were identified as *Lactobacillus pentosus* (03 strains) and *L. plantarum* (02 strains).

Conclusion: The results obtained indicate the capacity of 5 LAB strains, belonging to *L. pentosus* (03 strains) and *L. plantarum* (02 strains), to produce antifungal biomolecules in the environment.

OCI-2. Effectiveness of PGPR for improving the growth of *Lotus creticus* under greenhouse conditions.

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Key words: *Fusarium oxysporum*, *Lotus creticus*, PGPR, Phosphate Solubilizing Rhizobacteria.

Aims of the work: The use of beneficial bacteria as agricultural inputs for increasing crop production needs the selection of competent rhizobacteria with plant growth promoting (PGP) attributes. Thus, this study focuses on the screening of effective rhizobacteria isolated from the rhizosphere of the legume *Lotus creticus* to contribute to the rehabilitation of degraded soils.

Methods: PGPR were isolated and tested for their capacity of solubilizing tricalcium phosphate (TCP) on PVK medium. Effective phosphate solubilizing bacteria (PSB) were selected and characterized for PGP traits: production of IAA, HCN, siderophores, ammonia and ACC deaminase (ACCD). Then, the quantity of solubilized TCP was determined. Furthermore, the selected PSB were tested *in vitro* for antagonism against phytopathogenic fungus *Fusarium oxysporum*. The effect of these PSB on growth of *L. creticus* plants

was investigated under greenhouse conditions.

Results: A total of 113 bacteria were isolated from the rhizosphere of *L. creticus* from which 29 isolates were capable of solubilizing TCP. Five PSB were selected and the highest concentration of IAA was produced by LCR33 (19.08 ± 0.96 mg/L). All 5 PSB could produce HCN, siderophores, ammonia and ACCD. The highest concentration of solubilized phosphate was 173.57 ± 0.77 mg/L. All 5 PSB, were capable of inhibiting the growth of *Fusarium oxysporum*. The inoculation of *Lotus creticus* plants with 2 PSB strains showed positive influence on *L. creticus* growth significantly in comparison to un-inoculated control.

Conclusion: The tested and selected PSB could be recommended as a base of biofertilizers for contributing to the rehabilitation of degraded soils.

OCI-3. Performance of rhizobacteria isolated from phosphate solid sludge in the P. Solubilization.

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Keywords: Phosphate sludge; phosphate solubilizing bacteria; biofertilizer.

Aims of the work: Excessive use of P fertilizers can lead to soil and water pollution, therefore using rhizobacteria able to solubilize inorganic phosphates as biofertilizers can be a solution for a sustainable agriculture. The present study aimed to isolate, and select the phosphate solubilizing bacteria from Phosphate solid sludge.

Methods: From 13 phosphate sludge samples, more than 150 strains were tested for their ability to solubilize phosphate in NBRIP medium with tricalcium phosphate (TCP) as the sole source of phosphorus, strains with a solubility index (SI) greater than 2 were selected. The isolates obtained

have been studied for their ability to solubilize TCP quantitatively, and their phosphate solubilizing activity was estimated by the vanadate-molybdate method. In addition, the production of indol-1-acetic acid (IAA), siderophores, and HCN by the isolates were tested.

Results: Twenty-eight strain were isolated on selective medium NBRIP from Phosphate solid sludge, the 28 strains showed different abilities to solubilize P; CB19 was the most efficient strain in NBRIP agar with SI= 4.79; the soluble phosphate ranged from $33.2 < P$ ($\mu\text{g/ml}$) < 174.33 ; BM11 was the most efficient strain in NBRIP liquid medium releasing $174.33 \mu\text{g/ml}$ soluble P. All the strains have ability to produce IAA, the BT3S171 strain showed the highest IAA production ($43.80 \mu\text{g/ml}$), and five strains are able to produce HCN.

Conclusion: In summary, 28 PSB were isolated from 13 samples of phosphate sludge. The studied PSB isolates varied in their *in vitro* PGP traits and could thus be considered as biofertilizer candidates for a sustainable agriculture.

Acknowledgement: The Authors would like to acknowledge the support through the R&D Initiative – Appel à projets autour des phosphates APPHOS – sponsored by OCP (OCP Foundation, R&D OCP, Mohammed VI Polytechnic University, National Center of Scientific and technical Research CNRST, Ministry of Higher Education, Scientific Research and Professional Training of Morocco MESRSFC) under the project entitled * Valorisation des boues solides des phosphates en arboriculture fruitière et foresterie *, project ID *BIO-ELG-01/2017*

OCI-4. Natural phosphate solubilizing Bacillus strains improved physiological, biochemical parameters and nutrient uptake of gnotobiotically grown wheat.

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Keywords: *Bacillus*, rhizosphere soil, natural phosphate, gnotobiotic conditions, chlorophyll, proteins, enzymatic activities, wheat

Aims of the work: The present study aims to assess the effects of selected *Bacillus sp.* strains isolated from wheat rhizosphere and rock phosphate soils on P uptake by wheat plant under gnotobiotic conditions. In these experiments, natural phosphate (NP) was used as sole source of P. The role of these strains on plant growth performance was assessed by determining chlorophyll, proteins and phosphate related uptake enzyme activities.

Methods: Five *Bacillus sp.* strains (3 isolates from wheat rhizosphere soil and 2 isolates from rock phosphate; RP soil) were selected for their ability to enhance the P nutrition in wheat plant in pots containing vermiculite. Wheat seeds were surface sterilized and coated with the five isolates using carboxymethylcellulose and allowed to germinate. The experiment was based on 8 treatments. Three treatments were control (coated uninoculated seeds) and five treatments were conducted with *Bacilli* inoculated plants and NP as P source. After 20 days of planting, wheat plants were harvested and biometrics parameters (root, shoot length and dry weight), plants P content, chlorophyll and proteins were measured.

Results: Results showed that shoot dry weight increased by 51 to 64% after inoculation with rhizosphere and RP strains over control. P, N and K content in the shoot generally increased approximately by more than 50%, 40%, 60% respectively in plants inoculated with *Bacillus sp.* compared to uninoculated plants. In other hand chlorophyll a and chlorophyll b ranged between 7,74µg/ml - 13,78µg/ml and 6,14µg/ml-14,53µg/ml, proteins content varied from 2,77mg/g to 9,43mg/g and were not significantly different between treatments.

Conclusion: In conclusion, the coating of wheat plant seeds with the selected strains can increase the biomass and P content in wheat plants.

“The Authors would like to acknowledge the support through the R&D Initiative – Appel à projets autour des phosphates APPHOS – sponsored by OCP (OCP Foundation, R&D OCP, Mohammed VI Polytechnic University, National Center of Scientific and technical Research CNRST, Ministry of Higher Education, Scientific Research and Professional Training of Morocco MESRSFC) under the project entitled *Bioformulations d'un consortium de microorganismes solubilisateurs du phosphate : effets bénéfiques sur la croissance et la protection des plantes>*, project ID *BIO-BIZ-01/2017”.

OCI-5. Production of citric acid by *Aspergillus niger* using the juice of Assiane date variety

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Keywords: Citric acid, *Aspergillus niger*, date by-products, fermentation.

Aims of the work: Citric acid is a non-toxic and biodegradable organic acid, widely used in food, pharmaceutical, paper and textile industries. Biotechnological production of citric acid, using selected strains of *Aspergillus niger*, is economically profitable, since it's based on an ecofriendly process based on biotransformation of by-products and it improves income for farmers in rural area. The main objective of this work is to optimize the production of citric acid by *A.niger* using by-products of Assiane date variety as a fermentative medium.

Methods: A total of 40 strains of *Aspergillus niger* were isolated from undervalued dates using the serial dilution technique, then identified basing the cultural characteristics and direct microscopic observations of the fruiting bodies and spores using standard manuals.

The screening of selected strains for their production capacity of citric acid was done basing two methods, qualitative method performed with Czapek Dox Agar, and

quantitative method using submerged fermentation. After fermentation, the extracted solution was made spore-free by filtering it through Whatman No. 1 filter paper. The pH of the extracted solution was determined using a pH meter (VWR-SB70P Symphony) after calibration. The citric acid was determined spectrophotometrically by the acetic anhydride-pyridine method developed by Marier and Boulet (1958). Total reducing sugars were measured by the 3-5-dinitrosalicylic acid (DNS) method of Miller (1958).

Results: The results obtained showed that among the 40 strains, 07 strains gave larger diameters of yellow zones (53 and 67 mm) around their colonies, due to the production of organic acids in the medium. Three selected strains of *A. niger* were studied for their optimal conditions of production of citric acid, mainly the carbon and nitrogen sources, pH and shaking speed. The results obtained indicated that the strain *A. niger* ASP26, produced the highest concentration of citric acid (15.3 g/L), after 96 hours of incubation at 30°C under shaking at 200 rpm, in a fermentative liquid medium (Assiane date juice) initially adjusted to a pH 5 and a brix of 12.5%.

Conclusion: This work allowed us to select *A. niger* ASP26 as a most powerful strain producing citric acid, basing undervalued Assiane dates as substrate.

OCI-6. Plant growth activities of some bacteria isolated from *Vachellia gummifera* rhizospheric soils.

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Keywords: PGPR, *V. gummifera*, desertification,

Aims of the work: The growth of plants in the arid and semi-arid areas is an ecological challenge. However, some plants

have the ability to grow in these areas thanks to the associative rhizospheric microorganisms, called PGPRs (Plant Growth Promoting Rhizobacteria) that contribute to the plant survival and growth in harsh conditions. The aim of this work was to select and characterize some PGPRs in the rhizosphere of *Vachellia gummifera*, wildy growing in two arid zones of Morocco (Haha, and Haouz of Marrakesh).

Methods: To this purpose, we isolated 1000 bacteria from both soils and retained only 581 isolates following the colonies phenotypic analysis. Forty-four isolates were then selected for their performance, based on the PGPR tests, including the production of Auxin and siderophores as well as their phosphate solubilization ability. The isolates were characterized by phenotypic and molecular approaches. The phenotypic characterization consisted in analyzing the tolerance to different salt concentrations, pHs, temperatures as well as catalase production. The genetic diversity of the isolates was assessed by rep-PCR using REP primers.

Results: A great genetic diversity of the isolates was observed using the REP-PCR which allowed the distinction of 16 and 18 different fingerprints; ie, 16 and 18 strains from Bounaga and Amhach soils respectively. The phenotypic and genetic analysis permitted the selection of six strains (Strains 89.A, 131.A, 144.A from Amhach and strains 228.B, 242.B, 154.B from Bounaga) which were used to inoculate *V. gummifera* seedlings to test their plant growth improving ability. The levels of phosphate solubilization were quite good and varied from 99 to 124 ng/ml and the sidérophores and AIA production were also interesting. Different combinations of the strains were used to inoculate the plant in axenic conditions and different levels of growth rate improvement ranging from 100% to 178% were obtained following the combinations.

Conclusion: According to these results, we can argue that the six PGPRs strains isolated can be used as bio-fertilizers

to mitigate the effects of drought and improve the survival and growth of the plant and contribute to fight against desertification and restore the ecosystems.

OCI-7. Evaluation of PSB, native arbuscular mycorrhizal fungi and rhizobia as biofertilizers for the improvement of growth and yield of peanut (*Arachis hypogaea* L.)

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Keywords: AMF, growth, Peanut, *Pseudomonas putida*, rhizobia.

Aims of the work: The use of microorganisms has a great importance in improving the availability of nutrients to plants. It offers the great advantage of being inexpensive and environmentally friendly. The present work aims to evaluate the application of different biofertilizers on growth and yield of peanut cultivated in the northwest region of Morocco.

Methods: A pot experiment was conducted to investigate the potential effects of plant interactions with native arbuscular mycorrhizal fungi (AMF), phosphate solubilizing bacteria (PP22) and rhizobial strain (V3). Pregerminated disinfected seedlings of peanut were transferred to the pots, filled with non-sterilized field soil, and inoculated at the root region. After 60 days of growth, mycorrhizal infection, nodulation, leaf area, number of leaves, shoot dry weight, and nitrogen content of plants were estimated. Spores of AMF in the rhizosphere soil were counted.

Results: Results showed that number of spores in rhizospheric soil is 4060 per 100g. Also, all inoculated and uninoculated plants were mycorrhized and nodulated. Microbial inoculations increased leaf area and number of leaves. Thus, number of nodules per plant, root and shoot length were significantly improved by the single inoculation with

PP22. Similarly, shoot dry weight and nitrogen contents were higher for rhizobial inoculated plants. Nodulation and mycorrhizal infection were significantly enhanced by the combined inoculation of PP22 and rhizobia. Indeed, co-inoculation with these two bacterial strains increased yield and nitrogen contents by 222% over control. However, low increases were observed in single and combined inoculation with native AMF compared with bacterial inoculation.

Conclusion: Combined application of PP22 and V3 could improve efficiently growth and yield of peanut. This sustainable fertilizer management approach might also benefit peanut farmers to reduce cost and need for mineral fertilizer.

OCI-8. Evidence of biocontrol and plant-growth-promoting capacities of *Streptosporangium becharense* strain SG1: an antagonistic *Actinobacterium* from the Algerian Sahara.

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Keywords: *Actinobacteria*; *Streptosporangium becharense* strain SG1; biocontrol; *Fusarium culmorum*; plant-growth-promotion; durum wheat

Aims of the work: Twenty actinobacterial strains isolated from various ecological niches in the Algerian Sahara were screened for their biocontrôle potential in root rot disease caused by *Fusarium culmorum* and their promotion of durum wheat growth.

Methods: All actinobacteria were investigated for *in vitro* antagonistic activity and plant-growth promotion traits, for the production of proteases, cellulases, chitinases, cyanhydric acid, siderophores, and indole-3-acetic acid, and for the solubilisation of inorganic phosphate.

Strongly antagonistic actinobacteria were selected for the biocontrol of *F. culmorum* *in vivo* and for the growth promotion of durum wheat plants in autoclaved and non-autoclaved soils.

Results: The *Streptosporangium becharense* strain SG1 showed remarkable positive results in all trials. Compared to untreated wheat seeds, the root rot severity index was decreased significantly ($P < 0.05$) by all seed bacterization treatments. However, the highest protective effect was obtained by the strain SG1, which reduced the disease severity index from 77.8% to 16%, whereas it was only reduced to 24.2% by chemical seed treatment with *Dividend*®.

Conclusion: strain SG1 led to significant increases in the shoot length, root length and dry weight of plants, thus opening up interesting perspectives for possible exploration in crop improvement.

OCI-9. Response of caper (*Capparis spinosa*) to inoculation with mycorrhizal fungi under salt stress

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Keywords: *Capparis spinosa*, Salt stress, Arbuscular mycorrhizal fungi, Chlorophyllous fluorescence (Fv/Fm), antioxidant enzymes

Aims of the work: Evaluate the impact of salt stress on caper *Capparis spinosa* growth and investigation the role of arbuscular mycorrhizal fungi (AMF) in enhancing the salt tolerance.

Methods: To apply salt stress levels, healthy tree month aged plants were treated with increasing concentrations of sodium chloride (NaCl) (0, 2, 4, 6, 8, and 10 g/L) with acclimation. Inoculation of the plants grown from seedlings was carried out by a mixture of native AMF species isolated from

the rhizospheric soils of the caper (*Capparis spinosa*) in the Safi region of Morocco. It was dominated mainly by strains belonging to the genus *Glomus*. The effect of a mixture of native AMF on growth parameters, proline, soluble sugars and antioxidant enzyme activities of caper under different NaCl concentrations was evaluated.

Results: After four months of growth in greenhouse, the morphological parameters of AMF inoculated and uninoculated plants were measured. AM fungal inoculated plants showed highly significant improvements compared to control plants. The salt stress significantly decreases the efficiency of chlorophyll fluorescence (Fv/Fm) ($p < 0.001$) measured in all leaves of mycorrhizal and non- mycorrhizal plants. The activities of antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), polyphenol oxidase (PPO), ascorbate peroxidase (APX) and compatible solutes were increased by salt stress and were further enhanced by AMF inoculation. An accumulation of chlorophyll content, soluble sugars and proline in AMF-inoculated plants often also mediated the elimination of ROS radicals.

Conclusion: Increasing NaCl doses had a negative effect on the plants samples in the way of the parameters examined. Deadly damage has been recorded in plants from a dose of 6g/L. These results suggested that AM fungal can protect caper *Capparis spinosa* plants growth under salt stress conditions.

OCI-10. Effect of microalgae polysaccharides on biochemical and metabolomics pathways related to plant defense in *Solanum lycopersicum*.

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Keywords: Microalgae, Polysaccharides, biotic and abiotic stress, *Solanum lycopersicum*.

Aims of the work: Microalgae are photosynthetic microorganisms that produce several bioactive molecules that have received considerable attention in scientific and industrial communities. Today, many plant biostimulants including seaweed extracts and polysaccharides are used in agriculture. However, microalgae have not been largely exploited in this field as a potential source of plant bio stimulants. This study investigated the biostimulatory effects of microalgae polysaccharides on different metabolomic and biochemical pathways related to plant defense.

Methods: 0.2mg mL⁻¹ of crude polysaccharides from four green microalgae species (*Chlamydomonas reinhardtii*, *Chlorella vulgaris*, *Chlorella sorokiniana* and *Dunaliella salina*) was injected into tomato plants (*Solanum lycopersicum*). Phenylalanine ammonia Lyase (PAL) and β -1,3-glucanase activity were determined according to Chandra et al. (2017) while Lipoxygenase (LOX) activity was determined according to Hu et al. (2011). Determination of all antioxidant enzyme activities (APX, POD and CAT) was performed by the method of Campo et al (2009).

Results: Plants treated with crude polysaccharides extracted from *C. vulgaris* and *C. sorokiniana* exhibited a significant increase in β -1,3-glucanase activity. Accordingly, *C. sorokiniana* crude polysaccharides had a significant stimulatory effect on PAL activity with a percentage increase of 188.73% compared to the control. GC/MS quantitative lipidomics analysis revealed that treatment with *D. salina*, *C. sorokiniana*, and *C. reinhardtii* crude polysaccharides increased PUFA content by 50.37%, 34.46%, and 33.37% respectively. Microalgae polysaccharides also enhanced stearic acid, palmitic acid, and VLCFA content, the optimal value of which increased by 45.50%, 32.83%, and 60.60% respectively under treatment with *C.*

reinhardtii crude polysaccharides compared with the control. *C. vulgaris* and *C. reinhardtii* crude polysaccharides also exhibited higher APX and POD activity respectively.

Conclusion: The present results therefore indicate the potentiality of microalgae crude polysaccharides as a promising renewable bio resource in the development plant bio stimulants.

OCI-11. Evaluation of the effectiveness of fungicides combinations in controlling post-harvest diseases of peach and nectarine fruits.

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Keywords: Peach, Nectarine, rot, fungicides, *Rhizopus spp.*, Postharvest

Aims of the work: In this work, the effectiveness of fungicide treatments on the development of post-harvest rot of fruit was evaluated on one cultivars of peach Alexandra and two cultivars of nectarine Emeraude and Spring bright, located in the Sefrou region of Morocco.

Methods: Four preharvest treatments were applied to the trees 15 days before harvesting according to a complete random block design with 4 replicates [a mixture of Iprodione (1025g ai/ha) and thiophanate-methyl (700g/ha), a mixture of cyproconazole (12g ai/ha) and captane (1000g ai/ha), *Bacillus subtilis* (0.075g ai/ha), phosphite ions (700 g ai/ha) and a control without fungicide treatment]. Two postharvest treatments were applied to the fruit immediately after harvesting according to a complete random block design with 4 replicates replicates [*Bacillus subtilis* (0.075g ai/ha) and phosphite ions (700g ai/ha)]. Fruits were harvested, packaged, placed in ambient air and arranged according to the

experimental design with 4 replicates. Infected fruits were counted daily and the causative agent was identified accordingly.

Results: Results showed that only *Rhizopus spp.* was responsible for the spoilage of fruit in post-harvest conditions. On the control packing cases, the spoiled fruit varied from 40 to 80% after 7 days after harvesting and depending on the cultivars. The least effective treatment was the postharvest *Bacillus subtilis*, and the most effective treatment was the mixture of captane and cyproconazole with a protective periods of 6 to 9 days.

Conclusion: Finally, it is advisable to use these combinations of captane and cyproconazole for effective rotting control during the fruit storage period.

OCI-12. Development of a biopesticide in the fight against Black Sigatoka in Martinique and biofertilizers promoting banana growth.

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Keywords: Biofertilizer, biopesticide, black sigatoka, biological control, bacteria, endophyte, banana

Aims of the work: Black Sigatoka is a disease caused by the fungus *Pseudocercospora fijiensis* (Marin *et al.*, 2003). The fight against this disease requires frequent applications of chemical pesticides. Unfortunately their excessive application had adverse effects on the environment (Churchill, 2011). Faced with this impasse, it is urgent to identify biological alternatives to the use of these products.

Methods: For this purpose we will try to identify one or more interesting endophytic bacterial strains isolated of wild banana seeds through the study of the diversity of our bacterial collection (taxonomic characterization) and the study of

their activities "growth promoter" and antagonist (functional characterization).

Results: We succeeded in isolating 56 endophytic bacterial strains from wild banana seeds. We made a preliminary taxonomic study of these strains. In this study, three major groups, Firmicute (67%), *Actinobacterium* (22%) and *Proteobacterium* (11%) were determined. Among the Firmicute group, *Bacillus spp.* is the predominant (46%). Siderophore production capacity *In vitro* was shown by 79% of isolated strains and 36% of isolated strains showed ability to solubilize inorganic phosphate and to produce auxin. Nine strains among the 56 produce a higher auxin rate than the others. We also tested in *in vitro* condition the antagonistic effect of our bacterial strains on the development of a phytopathogenic fungus *Fusarium oxysporum*. This fungus, although different from *Pseudocercospora fijiensis* responsible for black Sigatoka, is a good study model in the laboratory. Eight of these 56 strains inhibit between 15 and 20% growth.

Conclusion: The three identified groups are those generally found in the seeds of plants (Truyens *et al.*, 2015). *Bacillus spp.* have a positive plant growth effect and antagonistic activities against phytopathogens (Karthik *et al.*, 2017; Gang *et al.*, 2010). In our study, the majority of endophytic strains with growth promoting properties and antagonistic effect on *F. oxysporum* belong to the genus *Bacillus*.

OCI-13. Impacts of increasing aridity on the soil and root microbiome of cactus.

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Keywords: DGGE, MiSeq, microbial Communities,

Aridity, *Opuntia ficus indica*

Aims of the work: Soil bacteria and fungi are largely responsible for key ecosystem services, including soil fertility and climate regulation. The species *Opuntia ficus indica* (Prickly pear) is considered one of the most known natural tolerant plants widely planted in drylands. It was suggested that this capability to be adapted to dry areas depends on the presence of efficient soil microbes. However, the associations *Opuntia* cacti establish with microorganisms and the rules governing microbial community assembly remain poor understood. Therefore, the characterization of the Tunisian cactus specific stress-microbes association mechanisms under increasing aridity and its microbial symbionts effects for enhancing the tolerance of Mediterranean economic plants to abiotic stress is the focus of this study.

Methods: Soil and roots samples were collected following a bioclimatic gradient from low (fertile soil) to high (desert) arid conditions. Microbial diversity was investigated using cultivation-independent (DGGE) and high-throughput sequencing (Miseq Illumina) approaches.

Results: Bacterial and fungal sequencing analysis showed that the composition and assembly of microbial communities associated with cacti and root or soil were significant distinct and highly influenced by the bioclimatic stages and soil physicochemical properties - e.g. Upper-arid soils exhibited the highest levels of microbial diversity (*Firmicutes* and *Ascomycota*) whereas the root part the lowest (*Cynobacteria* and *Basidiomycota*)

Conclusion: The data suggest that increasing in aridity may compromise the stability and genetic potential of the arid microbiome between root and soil of cactus. Native beneficial soil and root microbes derived from many natural tolerant plants could be a promising biofertilizer to increase the ability of economic-crop plants to adapt to abiotic stresses.

OCI-14.Effect of pH, NaCl and glucose on Biodegradation of Oleuropein by *Lactobacillus plantarum* FSO175.

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Keywords: Oleuropein, Biodegradation, Hydroxytyrosol, Stress condition, *L. plantarum*

Aims of the work: The main objective of this work was to study the biodegradation of OLP by *L. plantarum* FSO175, previously selected in our laboratory as OLP degrading strain, under the main stress factors (pH 4.5, NaCl 5% and glucose 1%) affecting the industrial green table olive process.

Methods: the biodegradation of oleuropein (OLP) by *Lactobacillus plantarum* FSO175 under conditions (pH 4.5, NaCl 5% and glucose 1%), was monitored during 7 days of incubation at 30°C, in modified MRS broth containing OLP as carbon source.

Results: The results obtained, by HPLC analyses, showed that the biodegradation of OLP by *Lactobacillus plantarum* FSO175, is accompanied with increase of hydroxytyrosol (HT) content and acidity values. The drastic reduction in OLP biodegradation, obtained at pH 6.7 (trial C), decreased significantly (at p<0.005) in presence of NaCl 5% (trial E) and with glucose 1% (trial D). Indeed, the OLP biodegradation rate increased and was maximal at pH 4.5 (trial F) even in combination with NaCl 5% (trial G). In the presence of glucose 1%, pH 4.5 and NaCl 5% (trial H), the biodegradation of OLP decreased significantly (p<0.05).

Conclusion: The effectiveness of OLP biodegradation by *L. plantarum* FSO175 strain demonstrated under the studied conditions, revealed its promising perspectives as starter culture, under acidic condition (pH 4.5) and reduced salt content (NaCl 5%), allowing the production of green table olives rich of HT, the main antioxidant highly desired in foods.

OCI-15. Screening and characterization of phosphate solubilizing rhizobia isolated from *Hedysarum* nodules in North of Morocco.

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Keywords: Bio-inoculants, *Botrytis cinerea*, *Hedysarum flexuosum*, PGP, Rhizobia.

Aims of the work: Excessive use of fertilizers and pesticides has adversely degraded the quality and fertility of the cultivation soils. In the process of land rehabilitation, plant growth promoting rhizobacteria (PGPR) have been found to have beneficial effects on soil. The exploitation of PGPR offers a powerful eco-friendly alternative in order to improve soil properties.

Methods: In this study, we have isolated rhizobia from *Hedysarum flexuosum* nodules. The plant growth promoting (PGP) activities of isolated strains were evaluated through *in vitro* screening for tricalcium phosphate (TCP) solubilization, and the production of hydrogen cyanide (HCN), indole acetic acid (IAA), siderophores and ACC deaminase. Hydrolytic exo-enzymes production was also evaluated *in vitro*. Besides, the PGPR isolates were tested for antagonistic activity against *Botrytis cinerea*.

On the basis of 16S rRNA genes sequencing, three of selected bacteria were characterized.

Results: Out of eleven isolates, seven bacteria were able to solubilize TCP. None of these seven selected bacteria were able to synthesize HCN, while the amounts of IAA produced ranged between 0.27mg l⁻¹ and 1.51 mg l⁻¹. Besides, only three strains were positive for siderophores production, and for ACC deaminase activity five were positive. As for extra cellular enzymes production; cellulase, amylase, protease and chitinase, the percentage of isolates that produced these enzymes was respectively: 100%, 28%, 100% and 85%. The concentrations of solubilized P were between 52 mg l⁻¹ and 81 mg l⁻¹. The antagonism test showed that all the seven rhizobia were able to inhibit the fungus growth. Analysis of 16S rRNA identified the three most efficient bacteria as *Pseudomonas*, *Rhizobium* and *Enterobacter*.

Conclusion: This study reveals the potential of some rhizobia present in *Hedysarum flexuosum* nodules that can be recommended as bio-inoculants for the plant-soil system.

OCI-16. Effects of inoculating putative ericoid mycorrhizal fungi and dark septate endophyte on the growth and nutritional status of Blueberry (*Vaccinium corymbosum*).

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Keywords: *Vaccinium corymbosum*, ericoid mycorrhizae, identification, PGPR traits, inoculation, growth,

Aims of the work: Highbush blueberry (*Vaccinium corymbosum*) is a

complex genus of great economic importance for Morocco. As a member of the Ericaceae family, *Vaccinium corymbosum* is able to associate symbiotically with soil fungi to form a distinctive type of mycorrhiza called ericoid mycorrhizae (ErM). Inoculation with ErM may improve productivity and quality of *Vaccinium* plants, it may also decrease mortality rate, reduce fertilizer consumption. The aim of the present study is to contribute to the understanding of physiological effect in ericaceous plants influenced by ericoid fungi and DES fungi.

Methods: the isolation of fungi was performed through three to five surface-sterilized root pieces of ericaceous plants (1cm) placed onto modified Melin Norkrans Agar media (MMN) in petri-dish and incubated at 25°C in the dark. Therefore, the amplification of the ITS rDNA regions was performed using the primer pairs ITS1 and ITS4 for isolated fungi. To evaluate PGPR activities, different traits such as the production of siderophore according to Schawyn and Neilands, Indole acetic acid (IAA) with Salkowski's reagent and production of hydrogen cyanide (HCN) according to Bakker and Schippers was studied. Inoculation was performed by pipetting directly 5-10-20 mL of the homogenate inoculum under the plants. The experiment was harvested after 10 months of inoculation. The inoculation effects of all strains were assessed by growth parameters (plant length, leaf area, fresh weight, dry weight, root weight, nitrogen (N) and phosphorus (P) content).

Results: Ericoid mycorrhizal fungi isolated were able to solubilize insoluble phosphate (145.5mg/L) and produce AAI (138.83 µg/mL) and siderophore. The effect of inoculation on the growth of *vaccinium corymbosum* plants was observed. Results were more prominent which ANOVA revealed a significant effect of strains for root weight, length and leaf area. However, some of other selected fungi strains were proved not to stimulate plant growth.

Conclusion: Our study indicated that our isolates strains has identified as ericoid

mycorrhizal species and has positively affect plant nutrition of blueberry cuttings.

OCI-17. Effects of in vivo mycorrhization and PGPR inoculation on growth parameter of date palm (*Phoenix dactylifera* L.).

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Keywords: Palm date, water stress, mycorrhizal, PGPR bacteria, Tolerance, Growth

Aims of the work: Morocco has known a decrease in the total area of palm groves due to the Bayoud disease and prolonged water deficit. A symbiotic relationship between arbuscular mycorrhizal fungi (AMF) and PGPR, can be an adaptation strategy against water stress. Our study highlights the importance of selected AMF and PGPR bacteria in improving the growth and the tolerance of the date palm to water deficit.

Methods: Fungi isolated from Zagora palm groves Morocco, and one strain of PGPR bacteria were tested for their efficiency to infect and improve tolerance of date palm to water stress. The physiological parameters of the palm date plants infected by the selected mycorrhizae and PGPR bacteria were evaluated for varying degrees of field capacity.

Results: After 30 weeks of plants mycorrhization, the selected mycorrhizal fungi have shown a great ability to infect the palm date roots with a high frequency and seems to allow the plants to withstand the application of a severe field capacity. Treatments were significantly different (P<0.05) for mycorrhizal and mycorrhizal + bacterial treatments concerning the number

of leaves with a value of 3 leaves and 2 leaves, relative growth rates with an average elongation value of 53.6667 ± 2.399 and 40.700 ± 0.556 at 50% CC respectively compared to 34.600 ± 1.75214 at 50% CC for the control treatment, leaf area index, fresh and dry weight of shoot, Furthermore, Results showed positive effects of these rhizobacteria combined with mycorrhization on growth of the plants.

Conclusion: In conclusion, the use of mycorrhizal fungi and PGPR can help the plants to overcome the drought stress conditions as well as enhancing their growth. This approach could be one of the most promising biological means in agriculture to increase the natural resistance of palm date trees under biotic and abiotic stress conditions.

OCI-18.Effect of AMF symbiosis on barley (*Hordeum vulgare*) nutrition and some physiological parameters

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Keywords: Mycorrhizal fungi; Triple Superphosphate (TSP); Rock Phosphate; Mycorrhizal frequency (F%), growth, chlorophyll.

Aims of the work: Barley (*Hordeum vulgare*) has weak adaptation to rock phosphate (RP) as it can't use this insoluble, complex phosphate form as phosphorus source for nutrition. Arbuscular mycorrhizal fungi (AMF) are largely known microorganisms able to improve the growth and resistance of plants and enhance water and phosphate nutrition. The aim of this work was to investigate the beneficial effect

of AMF inoculation on barley nutrition and morphologic and physiologic parameters when using RP as phosphate source is investigated.

Methods: In this work, six treatments with three repetitions each have been applied (ten plants/pot for each repetition): 1) NM(-RP)/(+TSP) : non mycorrhizal barley plants, Triple Superphosphate (TSP) as available P source (without RP); 2) NM(+RP) : non mycorrhizal with rock phosphate; 3) NM+TSP : non mycorrhizal plants with TSP as available, free source of phosphate; 4) M(-RP)/(-TSP) AMF mycorrhizal plants without RP nor TSP ; 5) M+RP: AMF mycorrhizal plants with rock phosphate and 6) M+TSP : AMF mycorrhizal plants with TSP as free source of phosphate). RP and TSP were used at $45\mu\text{g/g}$ soil and $13\mu\text{g/g}$ soil respectively in experiments where RP and TSP were used as phosphate source. Barley seedlings were ten weeks aged at harvest.

Results: Colonization results showed a higher variation between the mycorrhizal plant amended with RP or TSP. Mycorrhizal frequency (F %) in M+TSP plants was around 60% and 45% in M+RP plants, respectively. The major difference consisted of the arbuscular abundance which clearly decreased in M+RP plants. The non mycorrhizal plants didn't show the presence of mycorrhizal structures. The obtained results showed a significant increase in length and weight of plants inoculated with AMF. Roots and stems were more developed, especially in M+TSP (170% increase over the control) and M+RP (130% increase over the control). However, NM-TSP and NM-RP showed a very limited root system. In the same way, the chlorophyll contents changed slightly in NM plants (in the presence or the absence of RP and TSP), but still remained below the chlorophyll content of mycorrhizal plants. In the same way, the nutritional profiles were clearly "positively" affected by the presence of AMF.

Conclusion: This experiment showed the potential beneficial effect of AMF

associated with RP as phosphate source on barley.

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OCI-19.PGP activities, drought and salinity tolerance in Bacteria associated with *Acacia tortilis* subsp. *raddiana* growing in arid regions.

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Keywords: *Acacia tortilis* subsp. *raddiana*, rhizobia, rhizobacteria, stress tolerance, PGP activities

Aims of the work: Salinity and drought are the most important abiotic constraints impacting negatively plants growth and productivity in arid and semi-arid regions. Unfortunately affected areas are spreading more and more as a result of the climate change. Under these conditions, beneficial bacteria can enhance plants tolerance. In this context, we have studied the cultivable bacteria associated with *Acacia tortilis* subsp. *raddiana*, a very tolerant leguminous tree growing naturally under the harsh arid climate prevailing in the Guelmim region (south of Morocco).

Methods: A bacterial collection of 102 symbiotic rhizobia, 152 rhizobacteria and 230 bulk soil isolates was screened for phosphate solubilization, auxin and siderophore production, as well as adaptation to saline and water stresses, and exopolysaccharides production.

Results: Strains producing auxin or solubilizing rock phosphate were more

abundant among the rhizobia (respectively 26,5% and 30.4%). At 6% of NaCl, 40% of tolerant rhizobia were recorded and only 20% come up at 10% NaCl, while approximately one-half of the rhizospheric and bulk soil isolates grew at both concentrations. Water stress tolerance was also widespread among the bacterial collection, but huge differences exist between the three groups of isolates and also within each group. Surprisingly exopolysaccharides production didn't seem to be an important feature of the isolated bacteria.

Conclusion: Based on the PGP properties and stresses tolerance, rhizobia isolate R94, rhizobacteria isolate SR8, and bulk soil isolate SNR 199 were selected for subsequent experiments aiming at producing biofertilizers for helping the installation and survival of *Acacia* in the studied region.

OCI-20. Evaluation of the symbiotic efficiency of bacteria nodulating *Acacia gummifera* Wild

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Keywords: *Rhizobium*, *Acacia gummifera*, symbiotic efficiency.

Aims of the work: The aim of this work was to study the symbiotic performance of certain nodulating isolates *Acacia gummifera* Wild.

Methods: *Acacia* seedlings were inoculated with eight different *Rhizobium* strains isolated from nodules of *A. gummifera*. The seedlings were arranged in randomized complete blocks with four replicates for each strain. After 6 and 12 months of culture, nodulation parameters (number and dry weight of nodules), dry biomass per plant, total nitrogen, fixed nitrogen and symbiotic efficiency were studied.

Results: All eight strains showed root nodules with variable number which

Oral Communication: Theme I

varied between 2 and 25 nodules per plant and dry weight between 1.5 and 15 mg.plant⁻¹. In addition, the statistical analysis showed that *Rhizobium* was more infective in 12-month-old *Acacia*. The symbiotic efficiency has shown considerable variability, the most effective symbiotic association was recorded in the strain A24 (*Rhizobium azibense*: MF769718) with 200% and an increase in the total nitrogen of 2 times compared to control seedlings fertilized with Potassium nitrate (KNO₃) as nitrogen source.

Conclusion: This association can be selected as an experimental model to evaluate for the rehabilitation of degraded soils.

OCI-21. Comparative study of glyphosate and paraquat effect on the nitrogen-fixing bacteria growth

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Keywords: Nitrogen-fixing bacteria, Soil, Paraquat, Glyphosate.

Aims of the work: Glyphosate and paraquat are the most used herbicides in the world; also in Meknes area, Morocco. The inappropriate use of these herbicides represents an immense pollution problem for soil. Nitrogen-fixing bacteria play a crucial role in soil fertility and their alteration decreases soil fertility. Unfortunately, data concerning the effect of these herbicides on microorganisms are scarce. The aim of this study was to compare the effect of these herbicides on four nitrogen-fixing bacteria: *Pantoea agglomerans*, *Rhizobium nepotum*, *Rhizobium tibeticum* and *Rhizobium radiobacter*. To assess the effects of glyphosate and paraquat concentration on the growth of these four bacterial strains, glyphosate and paraquat were used as a sole source of carbon.

Methods: Glyphosate and paraquat were applied as the sole carbon source at the 0 g/l, 0.5 g/l, 1g/l, 3g/l, 6g/l and 12 g/l. The effect of glyphosate and paraquat was

determined by agar diffusion method and the rate of the growth of bacterial colonies in each treatment. Microbial growth was measured by the Colony Forming Units (CFUs /ml) method.

Results: Results showed that the continuous use of glyphosate affect nitrogen-fixing bacteria. Comparing strains with each other, *Rhizobium radiobacter* (6. 10⁶ CFUs/ml) was the most resistant strain to glyphosate (1g/l). Concerning paraquat herbicide we obtained evidence that paraquat herbicide affects the viability of the four nitrogen-fixing bacteria, especially at high concentration (6g/l and 12g/l). In addition, the results showed that microbial response to this herbicide depends on the bacterial species, whose effect is reflected by the different degrees of tolerance to the paraquat. Comparing strains with each other's, *Rhizobium radiobacter* (5.18 10⁵ CFUs/ml) is the most resistant strain to paraquat (3g/l).

Conclusion: Our results showed that glyphosate is more toxic than paraquat. Furthermore, our study has shown the impact of the glyphosate and paraquat recommended doses in Morocco on beneficial bacteria. These results could lead to recommendations regarding the impact of pesticides on the natural environment particularly soil beneficial bacteria. More research is needed in the field to better understand the effect of glyphosate on soil fertility.

OCI-22. Characterization of technological and probiotic features of interactive lactic acid bacteria in camel milk from a Moroccan biotope.

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Keywords: lactic acid bacteria, camel milk, probiotic properties, technological aptitudes, antibacterial activity,

Aims of the work: Lactic acid bacteria (LAB) occupy a central role as starter cultures in fermentation process and for their ability to create a healthy equilibrium between beneficial and potentially harmful microorganisms in the gut. The objective of this study was to isolate, identify and characterize the technological potential and the probiotic properties of the resident lactic flora in camel milk from a Moroccan biotope.

Methods: Our study has led to the isolation of 101 strains of lactic acid bacteria from camel milk characterized by a diet based on argan by-product and obtained from the rural region of Ounagha (Essaouira, Morocco) and were further investigated for several probiotic features and for antimicrobial activities against three tested pathogenic strains (*E. coli* CIP 53126, *Staphylococcus aureus* and *Salmonella enterica* CIP 483 CIP 8039). Total acidity was determined by titration of culture samples with NaOH and exopolysaccharides production was evaluated in ruthenium red milk (RRM) plates (Jamaly 2011).

Results: The evaluation of technological capabilities indicated that all strains showed good acidifying capacity, while 95.23 % of them were able to produce texturizing agents (exopolysaccharides) suggesting their possible use to manufacture fermented products. The revelation of the antibacterial activity showed that 61.90% of lactic strains possess an antagonistic effect. The results of the antibacterial microplate test demonstrate that bacterial fractions treated by centrifugation and then by filtration have 60.31 % antibacterial activity with minimum bacterial load able to stop the growth of pathogenic strains varying between $1.5 \cdot 10^7$ and $1.5 \cdot 10^4$ CFU mL⁻¹.

Conclusion: The results obtained indicate the interesting technological and probiotic features of isolated lactic strains, *Lactobacillus plantarum*, *Lactobacillus brevis* and *Lactococcus lactis* sp *lactis*.

OCI-23. Production, purification and biochemical characterization of extracellular lipase from *Staphylococcus* sp.

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Key words: lipase, production, purification, characterization, biotechnological application.

Aims of the work: Since industrial processes are commonly carried out under harsh conditions, it would be of great importance to obtain lipases which retain their activity at adverse environments (i.e. extreme temperature, pH, presence of organic solvents...). In this work, we isolated lipolytic bacterium from industrial effluent, and described the production and purification of its extracellular lipase. The enzyme was characterized with respect to substrate specificity and biochemical properties.

Methods: The lipase activity was measured by a pH-stat technique using Tributyrin TC4 as substrate. The purification essay comprises 3 steps: ammonium sulfate precipitation at 65% saturation, filtration on sephacryl S-200 and mono S-sepharose cation exchange chromatography. The purified lipase was analyzed electrophoretically on 12% polyacrylamide gels in the presence of SDS. Protein concentration was measured by the method of Bradford using BSA as standard.

Results: A new *Staphylococcus* sp. Strain was isolated. The highest extracellular lipase production amounting to 17 U/ml was achieved after 24 h of cultivation at 30°C and 180 rpm. The lipase was purified 16,2 -fold and its molecular mass was found to be around 43 kDa as revealed by SDS-PAGE. The specific activity of about 1878,9 U/mg or 854,04 U/mg was measured using tributyrin or olive oil, respectively, as substrate at pH 8.5 and at 45 °C in the presence of 3 mM CaCl₂ and 2 mM NaDc. The lipase was fairly stable in the pH range

from 6.0 to 9.0, and about 50% of its activity was retained after incubation at 50°C for 60 min. The enzyme showed a good stability in organic solvents, especially in alkanes and long-chain alcohols.

Conclusion: The *staphylococcus sp.* lipase showed interesting biochemical properties, exhibiting maximum activities at alkaline pH values and tolerating organic solvents. It will be interesting to follow future developments in biotechnological applications of this microbial lipase, e.g. its potential use in organic synthesis reactions.

OCI-24. Innovative strategies to eradicate biofilm colonization in dairy processing lines

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Keywords: *Biofilm, stainless steel, dairy industry, biofilm removal, enzymes cleaners*

Aims of the work: The formation of undesirable microbial biofilms in dairy industries is the main cause of chemical cleaning agent inefficiency. Consequently, biofilm-associated contamination represents one of the major threats to the dairy industry. The aim of this study is to propose novel formulations active against *Macrocooccus caseolyticus* biofilm, a selected model to study microbial biofilm elimination in a dairy processing line.

Methods: Biofilm formed on stainless-steel surfaces was quantified using crystal violet method (Saha et al., 2014). Biofilm removal was assessed using matrix quantification and cell count methods, and viability was checked using flow cytometry and fluorescent microscopy analysis. For the evaluation of eradication efficacy with selected enzymes, the same protocol was applied on polystyrene and on stainless-steel coupons.

Results: In this study, 197 bacterial strains were isolated from the center of collect of milk and neighboring farms in Sfax, Tunisia.

6 strains were selected according to their ability to form a thick biofilm on polystyrene microplates. Their capacities to form an important monospecies biofilm on stainless steel surfaces were also confirmed. The biofilm formed by *Macrocooccus caseolyticus* was selected to be used as a model for the evaluation of eradication efficacy. For that, different hydrolase and polysaccharidase enzymes were applied separately to treat these biofilms. Moreover, the buffer composition has been also improved to increase the diffusion of molecules inside the formed biofilm and to kill bacteria by the addition of selected active biomolecules. Our results revealed that *Macrocooccus monospecies* biofilm removal exceeded 50%. Moreover, when a concentrated cocktail (cock2) was applied, the biofilm removal was more efficient compared to the use of the chemical detergent.

Conclusion: This present study is providing novel bio-cleaner formulations, active against biofilms encountered in dairy industries.

OCI-25. Isolation and characterization of lactic acid bacteria producing extracellular lipase isolated from camel milk

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Keywords: *Lactic acid bacteria ; lipolytic bacteria, camel milk*

Aims of the work : Microbial lipases are the most valuable biocatalysts with a wide variety of industrial applications. This study was designed to isolate extracellular lipase-producing lactic acid bacteria isolated from camel milk from the Rhamna region.

Methods: A total of 50 lactic acid bacteria were isolated from camel milk on

MRS medium. Their lipolytic activity was demonstrated on agar medium supplemented with olive oil, tween 20 or tween 80 and CaCl₂. Then the Assay of enzymatic activity Supernatants are prepared by centrifugation of lactic acid bacteria cultures at 4 ° C, 12000 rpm for 30 min. They are used as a source of crude enzyme. The enzymatic activity of the lipase is calculated by titration of the fatty acids released from the degradation of olive oil. The identification of the best performing isolates was made by PCR followed by electrophoresis.

Results: isolate 31 identified as *Enterococcus* spp showed the highest values in olive oil by an activity of 4.75 u / ml followed by isolates of *Lactococcus lactis* and *Lactobacillus plantarum* with an activity of 3.5 and 2.9 u / ml respectively.

Conclusion: the lipolytic activity of isolates can be used for flavour development in dairy products and processing of other foods, such as meat, vegetables, fruit, baked foods, milk product and beer, in egg yolk treatment for the production of mayonnaise and other emulsifiers, and for the oil-degumming step in the refining of vegetable oils. As it can be used in the detergent industry to have non-intensive type.

OCI-26. Screening for endomycorrhizal strains associated with Moroccan date palm for their application as biofertilizers on olive seedlings.

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Keywords: *Arbuscular mycorrhizal fungi (AMF), diversity, bio-fertilizer, growth, olive, mineral uptake*

Aims of the work: The objective of the study is to isolate, to assess the biodiversity and to identify Moroccan strains of endomycorrhizae associated to date palm; (*Phoenix dactylifera* L), at Errachidia region (Morocco) and to determine their effect on plant growth and development.

Methods: AMF were isolated by the trapping culture of soil samples.

Subsequently, we used the wet sieving method for spore extraction that was identified according the International culture collection of Vesicular Arbuscular Mycorrhizal fungi; (<https://invam.wvu.edu>) identification key (INVAM). The strains were then used for inoculum production in the greenhouse on sorghum as a host plant. The produced inoculum was tested for the biofertilising effect on olive seedlings. Olive seedlings were inoculated with 200 spores per plant. Mycorrhized and control plants were maintained in greenhouse at 26° C for twelve months. The following growth parameters: root, shoot biomass and mineral nutrients (phosphor, potassium and total nitrogen) were measured each fifteen days during twelve months. Data were analyzed using one-way ANOVA followed by Duncan's test with a significance level of $\alpha = 0.05$. Analyses were performed using SPSS statistical software (version 20, IBM).

Results: Twelve species of fungi were identified, belonging to genus: *Acaulospora* (6 species); *Glomus* (5 species); *Entrophospora* (1 species) and one unidentified species. For the biofertilising effect, the tests were performed after twelve months. Inoculated plants showed increased biomass production (the gain rate in fresh weight of the leaves of the olive tree was 45.22%, and their dry weight improved with a percentage of 28.54%. Similarly, the fresh and dry root weight gain rate was 92% and 51%, respectively), and mineral nutrient contents (the rate of gain for Phosphorus, potassium and total nitrogen was respectively: 54.4%, 29.2% and 107%) than control plants.

Conclusion: The rhizosphere of the date palm contains a high richness in endomycorrhizae, which have proved their beneficial effect on the growth and development of plants. For these reasons, these strains act as bifertilizer, which seems to be an alternative to the use of chemical treatments.

OCI-27. The Genomic Analysis of the First *Dickeya dianthicola* Isolated in the north of Morocco

Oral Communication: Theme I

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Keywords: *Dickeya dianthicola*; North of Morocco;
genomics

Aims of the work: To investigate species composition of the Moroccan *Dickeya*, from diseased potato tubers and stems using genomic approach and investigate the phylogenetic relatedness between the strains.

Methods: The pathogenic isolates on potato plants have been characterized using microbiological and molecular tools. Two strains belonging to *Dickeya dianthicola* specie were sequenced using illumina technology. The genomes were assembled using denovo-assembly. An MLSA was performed using 13 housekeeping genes (*fusA*, *rpoD*, *acnA*, *purA*, *gyrB*, *recA*, *mdh*, *mtlD*, *grpEL*, *secY*, *glyA*, *gapA*, *rplB*) and the reads were mapped against *D. dianthicola* RNS049 using CLC genomic workbench v.10.1.1 the unmapped reads were assembled and annotated using RAST.

Results: The pathogenic isolates on potato plants have been characterized and showed 23% of the population belonging to *Dickeya* genus. The genomic analysis of the Moroccan *Dickeya dianthicola* and references strains using Multi-Locus Sequence Analysis (MLSA) showed that Moroccan *Dickeya* belonging to *Dickeya dianthicola* clade and now specific gene or region.

Conclusion: *Dickeya dianthicola* are described for the first time in Morocco using microbiology and genomic tools for monitoring the spreading of this specie in different Moroccan area. These findings will increase awareness and offer new technologies to producers and phytosanitary authorities to adopt prophylactic measures

and preventing the spreading of this pathogen.

OCI-28. Screening of highly benefit interactions Arbuscular Mycorrhizal Fungi-plant for agronomic and environmental purposes.

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Keywords: Arbuscular Mycorrhizal fungi, isolates, *A. spinose*, *C. siliqua*, *P. dactylifera*, water stress.

Aims of the work: In Morocco, the state of knowledge on Arbuscular Mycorrhizal fungi (AMF) communities, precisely at the level of rhizospheric soils in areas of economic and/or environmental interest (cultivated soils, degraded soils...) remains very limited and their diversity is still underestimated.

The aim of this study was, to evaluate and compare the ability of six Arbuscular mycorrhizal fungi isolates to improve the growth, mineral nutrition and Content of chlorophyll pigments of some tree plants (*Argania spinosa*, *Ceratonia siliqua*, *Phoenix dactylifera*).

Methods: The AMF spores and roots isolated from the rhizosphere soils under trees in seven sites in the region of Essaouira, Marrakesh and Zagora were tested in two plants (*Argania spinosa*, *Ceratonia siliqua*) The response of plants to mycorrhizal inoculation was estimated by determining the root collar diameter, elongation of the aerial part of the plant and biomass production and Drymass was measured after drying in an oven at 105°C for 24h. The mineral content was estimated by measurement of P, N, K, Ca²⁺ and Mg²⁺ in the aerial parts of the plant. Other biochemical analyzes are measured:

Chlorophyll fluorescence and Content of chlorophyll pigments.

Results: Results indicate that the six AM fungi stimulate significantly the growth (after eight months an increase in plant height between 41% and 44%. Similarly, the air biomass is increased between 45% and 51,2% and the root biomass by 60%. in some isolates compared to the control. the same results for mineral nutrition there are a significant increase in P. N. K. Ca and Mg levels of the aerial parts compared to the control.

Biochemical analyses confirm these results with a significant increase in chlorophyll content and fluorescence confirms this.

Conclusion: This study confirms the importance of AMF to improve the ability of these plants to growth and mineral nutrition and biochemical content were significantly improved with different isolates.

OCI-29. Abundance and prospecting of Rock Phosphate-Solubilizing Bacteria in the Rhizosphere Soil of Faba Bean (*Vicia faba* L.) in Morocco

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Keywords: rock-phosphate-solubilizing bacteria; faba bean; rhizosphere soil; correlation; density.

Aims of the work: The composition and structure of phosphate-solubilizing bacteria (PSB) within rhizospheric soil vary greatly and are influenced largely by the physicochemical and biological characteristics of the soil. The aim of the present research is to study the relationship between density of rock phosphate-solubilizing bacteria population with physical, chemical, and biological properties of the rhizosphere soil of faba bean (*Vicia*

faba L.) growing in different regions of Meknes.

Methods: One hundred and thirty-two samples of rhizosphere soil of *V. faba*, were collected and analyzed from 14 agricultural areas in Meknes. One g from each composite soil sample was used for counting the total bacteria (TB) and PSB, while the rest of the soil was air-dried, then used for chemical and physical soil properties determination (Available P-Olsen; total N; organic matter; cation exchange capacity and pH). To find out if there is a significant correlation between the number of PSB and physical, chemical, and biological properties of our soil samples, a multiple correlation test was performed.

Results: The results revealed that all samples were inhabited with indigenous PSB ranging from 3.55 to 0.002 ($\times 10^5$ CFU/g soil). The correlations between PSB counts and cation exchange capacity, available phosphorus (P), and pH were insignificant. On the contrary, a highly significant correlation ($p \leq 0.01$) was found between the numbers of PSB and total soil bacteria (TB) ($r = 0.80$), total nitrogen (N) ($r = 0.86$), and organic matter ($r = 0.90$).

Conclusion: This research enhances our knowledge on PSB population and their interaction with physical, chemical, and biological properties of the rhizosphere soil of faba bean to provide a new index for better use in organic agricultural practices.

OCI-30. β -Glucosidase activity of *Lactobacillus plantarum* FSO1 and *Candida pelliculosa* L18 isolated from fermenting Moroccan green olive

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Keywords: *Oleuropein, β -glucosidase, Lactobacillus plantarum, Candida pelliculosa, olive.*

Aims of the work: Oleuropein is the main polyphenol responsible of green olives bitterness. This bitter glucoside may be degraded by the β -glucosidase enzyme to produce glucose and other phenolic compounds.

Methods: *Lactobacillus plantarum* FSO1 and *Candida pelliculosa* L18 strains, isolated from natural fermenting green olive, were cultured in modified MRS medium, containing oleuropein as a sole carbon source, and measured for their β -glucosidase activity at different initial pH, NaCl and temperature.

Results: The results obtained showed that the production of β -glucosidase is extracellular and induced by the substrate (oleuropein). The highest production of β -glucosidase was obtained at pH 5 and 6, respectively for *L. plantarum* and *C. pelliculosa*. The increase of NaCl concentration, from 0% to 10%, inhibited the production of β -glucosidase. However, the enzyme was activated by increasing concentrations of NaCl, with a maximum activity at 8% NaCl (w/v). The optimal conditions for enzyme activity were pH 5 for both strains, and a temperature of 45°C for *L. plantarum* and 35°C for *C. pelliculosa*.

Conclusion: The strains *L. plantarum* FSO1 and *C. pelliculosa* L18 showed ability to produce extracellular and induced β -glucosidase enzyme. The enzyme production was optimal in the absence of NaCl and at pH5 for *L. plantarum* and pH 6 for *C. pelliculosa*. The enzyme activity was maximal at 45°C for *L. plantarum* and 35°C for *C. pelliculosa*, and at pH5 and NaCl 8% for both strains. These conditions demonstrate that these strains are of great interest in starter formulation for table olive transformation, in terms of their biological-debittering and fermentation activities.

OCI-31. Evaluation of the agronomic and biochemical performance of intercropping soft wheat and faba bean in organic agriculture.

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Keywords: *Intercropping, Pure culture, Soft wheat, Faba bean, Organic agriculture*

Aims of the work: The objectives of this study were therefore to evaluate the agronomic and biochemical performances of soft wheat and faba bean in intercropping, and the benefits of intercropping compared to monospecific culture.

Methods: This work was conducted in field experiments on fallow soil, in the Saâda experimental station of the National Institute of Agronomic Research (Marrakesh) during four months. Monospecific soft wheat and faba bean crops sown on rows at recommended densities (100%) and in half (50%) was compared to intercropping at a density of 50%-50% The effects of the intercropping on agronomic parameters (weed development and fungal disease attacks) and on proteins (Bradford, 1976), sugars (Dubois *et al.*, 1956) and chlorophyll (Arnon, 1949) contents and nitrate reductase activity (Heuer *et al.*, 1978)) were studied on six plants.

Results: Benefits of intercropping soft wheat and faba bean compared to the pure crops were noticed: After 4 months of culture, results showed a reduction of weed by 60.38% ; 41.66% ; 50.68% et 39.51% compared to monospecific F50%, F100%, W50% and W100% respectively and fungal disease of *Septoria* by 90% and 87.6% compared to W50% and W100% respectively. Biochemical study showed an increase in protein content by 71%, 51.46%, 47% and 23.61% compared to their control F50%, F100%. W50% and W100% respectively, sugar content by 26.55% and 60.7% compared to F50% and W50% respectively, chlorophyll content by 42.86%,

28.57%, 21.87% and 61.15% compared to monospecific F50%, F100%, W50% and W100% respectively and stimulation of nitrate reductase activity by 41.28% and 22.34% compared to F50% and W50% respectively.

Conclusion: If the choice of the previous crop is important to take into consideration, there are other complementary agronomic solutions to improve the agronomic and biochemical parameters of the crops, precisely the crops demanding nitrogen. In our study, the use of the intercropping could replace nitrogen fertilization for pure wheat crop.

OCI-32. Effect of a combined inoculation of Arbuscular Mycorrhizal Fungi (AMF) and Plant Growth Promoting Rhizobacteria (PGPR) on Biochemical properties of marketed tomato seedlings under water deficit conditions

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Keywords: Arbuscular Mycorrhizal Fungi (AMF), Plant Growth Promoting Rhizobacteria (PGPR), drought stress, inoculation, biochemical parameters, tomato.

Aims of the work: Evaluating the effect of a combined inoculation of an AMF complex and a PGPR strain on biochemical parameters of tomato seedlings under different levels of drought stress, and the effect of each microbe on each other.

Methods: Three different inoculation treatments were applied to tomato seedlings (a complex of AMF composed mainly of *Glomus* genus; a PGPR treatment composed mainly of *Bacillus* genus, and a combination of *Bacillus* and *Glomus*). Then, they were subjected to different levels of drought stress (75%, 50%, and 25% of field capacity) and

the following biochemical parameters were assessed: proline content, total protein, soluble sugars, chlorophylls and some antioxidant enzymes.

Results: Our results showed that mycorrhizal and PGPR treatments, especially *Bacillus* and *Glomus* combination treatment, improved the biochemical parameters compared to the non inoculated plants. For instance, soluble sugars, increased from an average of 0.32 g.L⁻¹ in the non inoculated control plants to 1.25 g.L⁻¹ in the AMF plants, and to 1.39 g.L⁻¹ in the PGPR plants, while the highest value was recorded in the plants inoculated with combination and estimated at 2.74 g.L⁻¹ under severe drought stress conditions (25% of field capacity). Moreover the enzymatic activity of catalase, peroxydase, and superoxyde dismutase of the inoculated seedlings were higher, compared to the non-inoculated control plants either under drought stress or in controls. For example, peroxydase activity showed an average of 400 mg⁻¹protein in the mycorrhized plants compared to 150 mg⁻¹protein in the control plants under severe stress (25% of field capacity).

Conclusion: The capability of AMF and PGPR to confer tomatoes a resistance to drought stress is very pronounced in our experiments, especially when they are combined, which may provide a biological mean of facilitating plant growth in arid environments where drought is endemic, and also using them as alternatives to the harmful chemical products.

OCI-33. Fruit's mycoendophytes diversity of *Pistacia atlantica* L. in Metlili, (Ghardaïa, Algeria)

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Key words: mycoendophytes, fruit, *Atlas pistachio*, mutualism, aridity, Ghardaïa (Algeria).

Aims of the work: The Atlas pistachio (*Pistacia atlantica* L.) is both protective and productive tree. It shows a great adaptation to aridity. The present work has focused on the presence and diversity of mycoendophytes in the fruits of this species. Indeed, these fungi live in all plant organs, in symbiosis with the host plant, providing many benefits. This study concerned the diversity of mycoendophytes in the fruits of Atlas pistachio in the Metlili region, wilaya of Ghardaïa, Algeria.

Methods: The ripe fruits of the Atlas pistachio were collected in September from several female trees. They were cultured on PDA medium, at room temperature, after a surface sterilization made according to the protocol of Helander et al. (1995). The morphological (macroscopic and microscopic) identification of the fungal isolates was monitored.

Results: Six fungal genera are isolated as mycoendophytes from the Atlas pistachio fruits of Metlili. *Aspergillus* is the most abundant and the most diverse genus: nine species in total. We also identified other genera: *Absidia*, *Gliocladium*, *Phoma*, *Rhizopus* and *Trichophyton*. Several strains could not be identified.

Conclusion: The results showed the presence of mycoendophytes in the fruit of the Atlas pistachio, therefore, suggesting that vertical transmission exists within these species. Endophytic-host plant associations are very important, given the number of benefits they provide in plant protection against biotic and abiotic stresses.

OCI-34. Suppressive effect of different compost extracts against *Fusarium wilt* of chickpea (*Fusarium oxysporum ciceri*)

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Keywords: Composting, tomato wastes, chickpea wilt, suppressive effect, legumes

Aims of the work: *Fusarium wilt*, caused by the soilborne fungus *Fusarium oxysporum f. sp. ciceris*, (FOC) has become a major threat to chickpea production worldwide. The aim of this work is to assess the antifungal activity of different compost extract belonging to different stage of composting against (FOC) in *in vitro* conditions.

Methods: Composting assay was elaborated using 220 liter bio-composter. Six mixtures (C1 to C6) were prepared using tomatoes plant residues (TPR), sheep manure (SM), olive pomace (OP), chicken manure (CM) along with sawdust (SW) as bulking agent. Subsamples were collected in days 4, 13, 21, and 36 during composting, from which aqueous extract (8:1 V/W) were evaluated against (FOC) *in vitro* conditions. Different concentrations from compost aqueous extract were split in two parts. One part was sterilized and the other part was kept fresh to test the chemical antagonistic ability. For direct confrontation, selected antagonist and FOC in five mm discs were centered in petri-plates and incubated at 25 ± 1°C. After seven days incubation, the colony diameter was measured. Each treatment was maintained in triplicates and PDA medium with sterile water served as control.

Results: Results showed that sterilized and unsterilized extracts of the composts significantly inhibited the mycelia growth of FOC and the percentages of inhibition were 36% to 50% and 53% and 89% respectively. Extracts of composts C1 and C3 inhibited FOC growth by more than 42%, whereas those of C2, C4, C5 and C6 showed an inhibition less than 40%. The concentrations 100% and 75% of the extract of the different composts showed the most important percentages of inhibition. The most efficient extract in sporulation

inhibition was noted in compost C2 and compost C1, with more than 90% of reduction.

Conclusion: The success of different composts in controlling FOC is not only related to physicochemical factors, but also depends on the microbial interaction complexity that occurs during thermophilic and the maturation phase.

OCI-35. Effects of PGPR bacteria, arbuscular mycorrhizal fungi and composts on growth parameters and yield of lettuce under open field conditions

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Keywords: Arbuscular mycorrhizal fungi, PGPR, compost, biofertilizers, yield, *Lactuca sativa L.*, field.

Aims of the work: A field experiment was conducted to evaluate the impacts of selected biofertilizers on the plant growth and the yield of lettuce crop in field. The lettuce (*Lactuca sativa L.*) plants were grown on agricultural soil with low levels of organic and mineral matter. We used biofertilizers based on PGPR, arbuscular mycorrhizal fungi (AMF), composts in different combination and a commercial organic fertilizer (Bacteriosol®).

Methods: A complete random block device was used. Fourteen treatments were applied, and for each treatment four repetitions were performed. The biofertilizers were applied alone or in different combinations. After harvest, the fresh weight (FW) and dry weight (DW) of the aerial and root part. The soluble proteins and the total soluble sugars were determined. The mineral determination (Na, K, Ca and phosphorus) was carried out after plant material mineralization and the total nitrogen content

in plants was determined by the Kjeldahl method.

Results: The applied biological treatments showed noticeable results compared to the control without inoculation. Indeed, the amendment by the compost M3 has considerably improved the shoot height and the root elongation of the salad culture (24%, 21% respectively compared to control). While, the combined use of PGPR bacteria and mycorrhizal consortium A5 among with compost M3 (P+A5+M3) has increased the leaves number by 81% in comparison to control. Furthermore, the application of Bacteriosol® gave the highest shoot FW and DW with increase of 68%, 119% respectively compared to control. Whereas, the PGPR strains increased the root FW by 74% than the un-inoculated plants. Although, for the root DW, the combination between the pure strain of AMF and compost M3 (S1+M3) gave the most important result with 129% more than the control plants. The Bacteriosol® gave the highest lettuce yield (52.18 t ha⁻¹) compared to the non-inoculated control (31.04 t ha⁻¹). It is noticeable that in all the treatments there was a positive effect of the applied biofertilizers alone or in the different combinations on the final yield of lettuce compared to the control plants non-inoculated.

Conclusion: The evaluation of the impact of biofertilizers on the lettuce crop, allowed us to conclude that the organic and biological fertilizers used in our study gave good results compared to the control. In light of the obtained results, we can underline that biofertilizers may be an interesting alternative to chemical fertilizers.

Acknowledgments: This work is financially supported by the project PPR2/2016/42, CNRST, Morocco.

OCI-36. Inoculation with arbuscular mycorrhizal fungi improves the growth and mineral nutrition of *Retama monosperma*.

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Keywords: Mycorrhizal fungi with arbuscules, *Retama monosperma*, Inoculum, Growth.

Aims of the work: The main objective of this study was to analyse the mycorrhizal status from the rhizosphere soil of *Retama monosperma* in order to isolate and select arbuscular mycorrhizal fungi and to determine the effect of inoculation with these arbuscular mycorrhizal fungi on the development of *Retama monosperma*.

Results: On the basis of the morphological characters of the spores, a variety of mycorrhizal fungi was demonstrated in the different study sites. This diversity has shown a significant richness and about 900 spores of AMF per 100 g of soil were collected under *Retama monosperma*. The morphological identification of spores revealed the presence of at least four genera under *Retama monosperma* in the Marrakesh-Safi region: *Glomus*, *Acaulospora*, *Scutellospora* and *Gigaspora*. A native soil inoculum from the rhizosphere of the plant was prepared for inoculation of *Retama monosperma*. After six months under nursery conditions height, fresh and dry aerial and root biomass and biochemical parameters are evaluated in inoculated and uninoculated control plants. A beneficial effect of inoculation with AMF is observed in inoculated plants. The analysis showed that inoculation significantly improved plant growth in height, the chlorophyll content (29.08 mg /g FM), which reflects an improvement in photosynthesis, proteins (8.37 mg /g FM) and soluble sugars (36.07 mg /g FM), confirming the positive contribution AMF to improve growth and phosphate (0.129 mg /g DM), potassium (11.16 mg /g DM), sodium (1.56 mg /g DM) and calcium (7.64 mg /g DM).

Conclusion: The results indicate the importance of mycorrhizal inoculation in *retama monosperma* plants, suggesting that

the use of AMF as a biofertilizer is a promising strategy for contributing to the improvement of plant productivity.

OCI-37. Solubilization of insoluble rock phosphate by phosphate-solubilizing bacteria and its effects on wheat (*Triticum aestivum* L.) growth and P uptake.

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Keywords: rock-phosphate-solubilizing bacteria, *Triticum aestivum*, PGP traits, growth, P uptake.

Aims of the work: Phosphorus is an essential macroelement for the growth and development of plants. This study aimed to isolate rock phosphate solubilizing bacteria (PSB) and evaluate their effect on growth and P accumulation of wheat (*Triticum aestivum* L.).

Methods: From 198 rock PSB isolates, five were selected on the basis of their plant growth promoting traits (indole acetic acid, siderophores, hydrogen cyanide and antifungal activity). The effect of rock PSB mono-inoculation on wheat was determined in a completely randomized experiment in Leonard jar and pot. The application treatments included negative control (no inoculation and fertilizer), three positive controls (rock phosphate (RP), chemical fertilizer 100 % and 200 %), and two bacterial inoculation (*Pseudomonas* sp. (B26) and *Pantoea* sp. (A17) with RP). Shoot length, shoot dry weight, root surface, root dry weight and P and N contents were assessed in 60-day-old wheat plants.

Results: The results revealed that inoculation with rock PSBs A17 and B26, significantly ($p \leq 0.05$) enhanced shoot length (2-3 %), root surface area (16-31 %), shoot dry weight (13-28 %), root dry weight (57-70 %), phosphorus uptake (91-106 %) and nitrogen uptake (129-132%) over control with complete fertilization.

Conclusion: The present study results suggest that use of rock PSB with insoluble rock phosphate play an important role in plant growth promotion and improvement of P availability in soil.

OCI-38.A quantitative exposure assessment of *Staphylococcus aureus* in cheese consumed in El Maleh region (Algeria)

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Keywords: Cheese, exposure assessment, food poisoning, *Staphylococcus aureus*.

Aims of the work: *Staphylococcus aureus* is the most causes of food poisoning in Algeria. Like others states, the notified cases are underestimated. The purpose of this work was to estimate the number of persons consuming a critical concentration of these bacteria in cheese (the most consumed food and assigned with *Staphylococcus aureus* food poisoning).

Methods: In the first step, the data of its consumption has been collected in the EL Malah region according to the areal method as described by Grawitz (2001). Then in the second step, informations about *Staphylococcus aureus* were collected from the cheese according to JORAD n° 68 and n°

14 of 2014 and 2015 respectively. In the third step, the consumption flow was split in four Modular process risk model according to Nauta (2002): 1- Initial contamination (H0), 2- Growth of SA during transport and storage (G1) and 3- SA concentration at time of consumption. At each module, the mathematical (statistic and probabilities) model describe the prevalence, concentration, the growth of bacteria compiled with the frequency of using and consumption, for estimate the exposure percent. The @risk software was used basing on Monte Carlo simulation for simulate all iterations.

Results: The microbiological results showed a contamination of 33% samples with concentrations varied from 0.6 log cfu /g to 3.7 log cfu/g. At module H0, no one persons could could ingest (take account the transport times) a critical concentration (5 log cfu /g) of *Staphylococcus aureus*. After growth during storage the SA can growth and achieve a critical concentration as showed by the results: mean and median of 0.04285 and 0.317 log cfu/g respectively. Therefore, the simulation results showed a 1.2% of cheese portions contain ≥ 5 log ufc/g at time of consumption for different scenario.

Conclusion: Taking into account all variables in the model, the *number* of persons who could consume a critical concentration is at 80 persons per year from 15000 persons. Finally, to minimize the exposure rate, the cold chain must be respected and shorter as possible.

TOPIC II-

OCII-1. Identification of 3 miRNAs as biomarkers of early diagnosis of breast and gynecologic cancers among Moroccan women

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Keywords: Biomarkers, Breast Cancer, Gynecologic cancers, MiRNAs, real time PCR, Viral etiology.

Aims of the work: Breast and gynecological cancers (cervical cancer, ovarian cancer...) represent a real public health problem in Morocco. In 2011, these cancers accounted for 60% of all cancers among women and 50% of cancers among women treated at the National Institute of Oncology. Currently, more research are directed towards the molecular signatures of different cancers including research on newly discovered biomarkers and highlighted called MicroRNAs (miRNAs) that allow early diagnosis of these cancers. The identification of miRNAs, which are epigenetic biomarkers able to regulate genes promoters of cancer cells and are released early in the general circulation, could provide potential targets for diagnosis. Thereby, the aims of this study were to determinate the expression profile of miRNAs and establish their relation with viral etiology of these cancers.

Methods: It is in this context that our research project established the link between cervical cancer and HPV using specific primers, and detected once extracted and purified miRNAs associated to breast and gynecologic cancers among 70 Moroccan patients collected from Obstetrics gynecology service of CHU Ibn Rochd of Casablanca using real time PCR.

Results: Results demonstrate the presence of HPV in almost 70% of biopsies, and detection of miRNAs in 90% of fresh biopsies.

Conclusion: These newly discovered molecules could contribute to an early and selective cancer diagnosis. Furthermore with an established molecular profile, we can provide a new tool of prevention to ensure a better prognosis and improving therapeutic monitoring for patients in Morocco for breast and gynecologic cancer or another type of cancers.

OCII-2. Volatile oil composition, antifungal and antioxidant activities of wild Moroccan *Thymus capitatus*

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Keywords: *Thymus capitatus*, antifungal, antioxidant, hemolytic.

Aims of the work: Plants are rich sources of bioactive compounds that exhibit a variety of biological effects. The objectives of this work were the identification and quantification of the components of Moroccan *Thymus capitatus* essential oil, the *in vitro* study of its antioxidant potential and antifungal activity against pathogenic fungi affecting human health.

Methods: Gas chromatography-flame ionization detection and gas chromatography-mass spectrometry system were used to determine the chemical composition of *Thymus capitatus* essential oil. Antioxidant activity was estimated by 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging, β -carotene bleaching inhibition and ferric reducing power. The antifungal

activity was investigated on thirteen clinical isolates belonging to the genera (*Candida*, *Aspergillus* and *Rhizopus*) by using broth microdilution method.

Results: Twenty eight constituents were identified, representing 99% of the total detected compounds. Essential oil was characterized by high amount of oxygenated monoterpenes followed by monoterpene hydrocarbons. *Thymus capitatus* exhibits a good DPPH radical scavenging ($IC_{50}=110.53 \mu\text{g.ml}^{-1}$), a remarkable protection effect against lipid peroxidation ($IC_{50}=251.76 \mu\text{g.ml}^{-1}$), and an important ferric reducing ability ($EC_{50}=644.4 \mu\text{g.ml}^{-1}$). *Thymus capitatus* showed a broad spectrum of antifungal activity against all of the strains tested (inhibitory concentrations ranged from 125 to 500 $\mu\text{g.ml}^{-1}$). The toxicity evaluated through the hemolytic activity showed no effect on human red blood cell at low concentrations.

Conclusion: These results raised the importance of *Thymus capitatus* essential oil as antioxidant and antifungal agent. This plant deserves extensive study in order to be used in the food industry and as preventive agent from various diseases.

OCII-3. Study of the correlation between antibiotic resistance and the ability to form *Escherichia coli* biofilm isolated from products of avian origin.

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Keywords: *Escherichia coli*, biofilm, antimicrobial resistance, MDR, Casablanca / Mohammedia.

Aims of the work: Biofilms are microbial communities associated with surfaces and embedded in an extracellular matrix. The ability of some biofilm-forming bacteria to survive in the presence of antibiotics could be increased, which could lead to therapeutic failure. This study consists of determining the correlation between antibiotic resistance and the ability to form the biofilm.

Methods: The study is based on a total of 178 strains of *Escherichia coli* isolated from products of avian origin marketed in the city of Casablanca and Mohammedia. The antibiogram was performed by the Mueller-Hinton agar diffusion method according to the recommendations of CA-SFM (2013). The quantification of the biofilm was performed on static polystyrene plates, by measuring the optical density and the visualization by Cristal Violet staining (0.1%).

Results: The study of the antimicrobial resistance profile showed that 72% of *E. coli* tested strains are multidrug-resistant. The majority of strains were resistant to Tetracycline (96%), Amoxicillin+Clavulanic Acid (88%), Cefoxitin (84%), Norfloxacin (74%), and Ofloxacin (62%). The quantification of the biofilm showed that the majority of strains were biofilm-forming with different intensities. The capacity of the multidrug-resistant strains to form a biofilm was almost always greater than that of non-multidrug-resistant strains.

Conclusion: The emergence of *E. coli* strains virulent and / or multidrug-resistant foodborne is a real threat to public health. So, the establishment of a monitoring system for these bacteria is required.

OCII-4. Mycotoxins of *Penicillium aurantiogriseum*: a promising source for anti-cancer therapy

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Aims of the work: The search for natural substances with therapeutic effect seems to be a requirement for the treatment of several cancer diseases. Mycotoxins had several advantages for research on cancer diseases, including security and ease of collection by simple, inexpensive and non-invasive methods. As a species of *Penicillium* ubiquitous in most foods and in many different environments, *P. aurantiogriseum* represents an advantage in terms of setting simple and easy culture. This species includes most of the mycotoxins have a proven anticancer effect some already marketed as a chemotherapeutic drug.

Methods: Several tests are used in vitro to study the potential effect of mycotoxins on the viability of various human cancer lines. The demonstration of the anticancer activity involves a range of tests that control proliferation, viability, apoptosis, angiogenesis and tumor immunity, and the specific effects of the targets, signaling pathways and biomarkers. The most used cytotoxicity tests are the MTT test or the SRB test. Other techniques, such as flow cytometry are used to determine whether the cytotoxic activity of mycotoxins is related to the apoptosis induction. This technique can be coupled with Western blot. The in vivo antitumor effect of mycotoxins is achieved by various methods such as the Wound Healing Test (WHA), Cultrex BME Cell Invasion Test, or Immunocytochemical Fluorescent Staining Assay.

Results: Among 37 mycotoxins of *P. aurantiogriseum*, 10 have proved their anticancer effect. These mycotoxins and their derivatives belong to different classes of the most commonly used anticancer compounds such as Polyketides (Orsellinic acid), compounds containing nitrogen (Quinazolin,

Anacine, Anicequol, Penicillic acid), Cyclic dipeptides (Aurantiamine, Aurantiamide), Terpene (Paclitaxel, Penitrim), and Pseurotin with Mixed Biosynthetic origin. These compounds function as Analgesic and antipyretic drug, or Inhibitor of tumor cells growth, or cell cycle inhibitor, or Specific inhibitor of calcium-ATPase dependent, or block PAF-mediated neuronal apoptosis, or Angiogenesis inhibitor.

Conclusion: To date, few studies have been conducted on the return to biological substances with antitumor effect and which cause less adverse effects and may be specific against cancer cells. In general, mycotoxins meet the required specifications of which more than ten recommended mycotoxins belong to *P. aurantiogriseum*.

OCII-5. Occurrence of carbapenemases in uropathogenic Enterobacteriaceae at Mohammed VI University Hospital Center of Marrakesh, Morocco.

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Keywords: *Enterobacteriaceae, Urinary tract infections (UTIs), carbapenem resistance, phenotypic characterization.*

Aims of the work: The spread of carbapenemase producing *Enterobacteriaceae* (CPE) in community and hospitals represents a major public health. In this study, we investigated the prevalence and phenotypic characterization of carbapenemase producing *Enterobacteriaceae* recovered from urine specimens in Mohammed VI University Hospital Center, Marrakesh, Morocco.

Methods: From January to October 2018, the study was conducted on all uropathogenic *Enterobacteriaceae* resistant to at least one carbapenem (ertapenem, imipenem). Identification and antibiotic susceptibility of species were performed by

Oral Communication: Theme II

BD Phoenix system. Screening of carbapenemase production was done by modified Hodge test. The determination of carbapenemase classes was carried out by using combined disks with and without inhibitor (EDTA, Cloxacillin) and sensibility to temocillin.

Results: The 57 non-duplicate uropathogenic *Enterobacteriaceae* resistant to carbapenem including *Klebsiella pneumoniae* (n=31, 54.3%), *Escherichia coli* (n=12, 21%), *Enterobacter cloacae* (n= 5, 8.77%) and one of each *Enterobacter aerogenes* and *Citrobacter freundii* (1.8%) were analyzed. Most of carbapenem resistant strains were isolated from patients in emergencies (n=12), nephrology ward (n=10), pediatric ward (n=7) and urology ward (n=6). The mean patient age was 40.64 years and the male/female ratio for these patients was 0.47. Of 57 strains resistant to carbapenem, 34 were carbapenemase producing. The main carbapenemase class detected was class D oxacillinase (n=23). The metallo- β -lactamase was founded in 7 stains including 2 associated with oxacillinase and 2 other with cephalosporinase. The class A carbapenemase was suspected in 6 strains.

Conclusion: These results highlight emergence of CPE in UTIs. For identification of carbapenemases genes, the molecular approach is needed.

OCII-6. Development and validation of an RT-qPCR Assay for rapid detection and quantification of Hepatitis C virus RNA for routine testing in Moroccan clinical specimens.

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Keywords: Hepatitis C, RTqPCR, viral load quantification, molecular diagnostic

Aims of the work: In the current study, we have developed and validated a one-step real-time RT-PCR using specific hybridization probes, in combination with simple RNA extraction. We evaluated the assay for applicability to routine testing for HCV RNA in clinical specimens in quality control laboratories.

Methods: A one-step reverse transcription quantitative PCR (RT-qPCR) assay in combination with rapid RNA extraction was evaluated for routine testing of HCV RNA. Specific primers and probes were designed for the detection of a 150 bp sequence located in the 5'-UTR of HCV RNA. The target sequence was selected as the most conserved region between the six known HCV subtype sequences following an alignment

Results: The assay was able to quantify a dynamic linear range of 10^8 to 10^1 plasmid copies/reaction ($R^2=0.98$) containing the target sequence. Two copies of this HCV plasmid corresponds to one international unit (IU) measured using a standard obtained by serial dilutions of the WHO standard. The detection limit of the assay was about 10 IU/ml of HCV RNA (20 copies/ml) in plasma samples. The assay was comparable to Cobas Ampliprep/Cobas TaqMan[®] HCV Test, v2.0 Quantitative assay with correlation coefficient $R^2=0.98$. The present assay could be completed within 3 hours from RNA extraction to data analysis of at least 30 plasma samples

Conclusion: Our test provides sufficient sensitivity, specificity and reproducibility and proved to be fast, labor-saving and cost effective. Indeed, our system will definitely allow low-income countries to monitor accurately this viral infection and to efficiently treat their infected patients.

OCII-7. Thymus leptobotrys a NorA efflux pump inhibitor

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Oral Communication: Theme II

Agadir, April 24-26th, 2019

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Key words: Multidrug resistant bacteria, *S. aureus*, *NorA* efflux pump, Essential oil, *T.leptobotrys*, efflux pump.

Aims of the work: Efflux pumps (EP) play an important role in the emergence of multidrug resistant (MDR) bacteria. *Staphylococcus aureus* is a clinically important pathogen because it possesses a number of efflux pumps such as *NorA*. In the clinic, treatment options against *S. aureus* diseases encompass fluoroquinolones. However, these antibiotics are subject to extrusion by *NorA* which limit treatment options, and with the lack of potent antibiotics, exploration of new therapy strategies is increasingly needed. Thus, the search for new natural molecules able to inhibit EPs and restore the susceptibility of resistant strains might be a fruitful option. For this, Medicinal plants like *Thymus* sp. may constitute a source of molecules capable of inhibiting EP owing to their strong antibacterial properties. The aim of this study was to determine the antibacterial and efflux-pump-inhibiting activities of *T. leptobotrys* essential oil (EO) against two *S. aureus* strains: an efflux pump overproducing strain (*NorA* in *S. aureus* SA1199B) and a wild type strain (SA1199), constitutively expressing *norA* at low levels.

Methods: The antibacterial and efflux-pump-inhibiting activities of *T. leptobotrys* essential oil (EO) against two *S. aureus* strains: an efflux pump overproducing strain (*NorA* in *S. aureus* SA1199B) and a wild type strain (SA1199), constitutively expressing *norA* at low levels, were evaluated using microdilution assays, and

Ethidium bromide real time accumulation and efflux assays.

Results: Results showed that the EO at sub-inhibitory concentration decreased ciprofloxacin and levofloxacin MICs of SA1199B by 4 to 64-fold. However, no reduction was noticed in the SA1199. Thus, the EO contributed to a large accumulation and efflux inhibition of EtBr in both strains comparing Carbonyl cyanide *m*-chlorophenylhydrazone (CCCP).

Conclusion: Our findings demonstrate the ability of the EO to restore antibiotic susceptibility in bacterial efflux pump overproducers. This combination therapy may be a viable option for treating MDR infections.

OCII-8.Molecular epidemiology of nalidixic acid resistant *Salmonella enteritidis* isolated from human and nonhuman origin in Morocco

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Keywords: *Salmonella enteritidis*, quinolone, sequencing, Pulsed Field Gel Electrophoresis, *spvC*.

Aims of the work: *Salmonella enterica* serotype *Enteritidis* remains the major causative agent of foodborne diseases and human infections worldwide. The purpose of this study was to investigate the molecular characteristics of nalidixic acid resistant *Salmonella enteritidis* in Morocco.

Methods: A total of 862 human and nonhuman *Salmonella* strains were collected and isolated from 2002 to 2018 in different cities in Morocco. Antimicrobial susceptibility was determined using the disc diffusion assay and sequencing the PCR amplified *gyrA* and *parC* genes. The feasibility of genotyping *Salmonella enterica* serotype *Enteritidis* strains using *Xba*I restriction enzyme was evaluated. Separation of restricted fragments was performed by Pulsed Field Gel Electrophoresis (PFGE).

Results: The overall percentage of *Salmonella enteritidis* was 12% (100/862). Drug susceptibility assay revealed that 80% of isolates was resistant to nalidixic acid, this resistance is due to mutations in *gyrA* (Asp87Asn) and in *parC* (The57Ser) genes. PCR amplification and plasmid profiling analysis revealed that 80% of strains harbored the *spvC* virulence gene (669 bp) and a 54 kb plasmid. The PFGE analysis revealed that strains of *salmonella enteritidis* had a discriminating power.

Conclusion: Our study showed a high rate of nalidixic acid resistant *S. Enteritidis* in human and nonhuman isolates in Morocco. Taking this into account is essential in order to take rapid measures in livestock to ensure control of this emergence of multi-resistant bacteria.

OCII-9. Anti-biofilm efficacy of honey against biofilm forming *Staphylococcus aureus* isolates from chronic wounds

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Keywords: *Staphylococcus aureus*, Multidrug-resistant bacteria, MRSA, Wounds, Biofilm, Honey, Antibiofilm.

Aims of the work: The aims of this work were to assess the ability of clinical isolates of *S. aureus* to form biofilm using both phenotypic and genotypic characterization and to determine whether biofilm ability of *S. aureus* isolates from chronic wounds was affected by honey.

Methods: 74 isolates of *S. aureus* were collected at the University Hospital Ibn Rochd in Casablanca. Phenotypic assessment of biofilm formation ability was carried out by the Tissue Culture Plate method (TCP), whereas, genotypic study was focalized on the research of genes *icaA*, *icaD*, *icaB*, and *icaR* by PCR amplification.

Results: The phenotypic study indicated that 78.4% of the concerned isolates were able to form biofilm and that skin isolates most associated with multidrug resistance (MDR and MRSA) formed biofilms of low degree. The genotypic assessment demonstrated that all strains were *icaB* and *icaR* positive while *icaA* and *icaD* were present with a percentage of 19% and 97.27% respectively. Regarding the antibiofilm activity of a single-flower honey from euphorbia on MRSA pathogenic isolates of the skin, our results showed a dose-dependent inhibitory effect with complete inhibition of biofilm formation when strains confronted to 40% (w/v) of honey.

Conclusion: Our study showed that the ability of 74 clinical isolates of *S. aureus* to form biofilm was clearly detected with a good correlation between genotypic and phenotypic characterization and that euphorbia honey has potential in the control of biofilms in chronic wounds and justifies further studies.

OCII-11. Prevalence of *Campylobacter* in chickens sold in large markets in Morocco

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Keywords: Foodborne illness, *Campylobacter*, Chicken, Market, Morocco.

Aims of the work: The aim of this study to contribute to establishing control, surveillance and management of the incidence of *Campylobacteriosis* by identification of *Campylobacter* species in chicken samples.

Methods: In this study, validation of the method for isolation and identification of *Campylobacter* in chickens were undertaken. Between March and June 2017, 100 samples of chicken droppings were collected. The classical bacteriology method was used for isolation and identification according to Moroccan Standard NM ISO / TS 10272-3 (2013). Then we carried out the development and validation of the *Campylobacter jejuni* and *Campylobacter coli* genotype confirmation protocol Cam by PCR. Based on a positive control (*Campylobacter jejuni* ATCC 33560) and a negative control.

Results: Among these 140 analyzed samples 102 (73%) *Campylobacter*.spp was identified by conventional method of biochemical identification of a bacterium according to the Moroccan standard by carrying out the biochemical test and confirmation by the "APIE Campylo". After the biochemical confirmation we go to molecular confirmation by the classical PCR method, among 80 strains analyzed, 32 strains were *Campylobacter jejuni* by biochemical confirmation was isolated 120 strains but for the molecular confirmation was made only 80 strains the rest of the strains (40 strains) are outstanding, we have not finished yet.

Conclusion: The species were primarily *Campylobacter* thermotolerants

(*Campylobacter. Jejuni* et *Campylobacter coli*). The presence high of *Campylobacter* thermotolerants and especially *Campylobacter jejuni*, species the most implied in gastroenteritis of bacterial origin, in chickens supposes a risk of *Campylobacteriose* in Morocco.

OCII-11.Vaccination against Hydatidosis: Molecular Cloning and Optimal Expression of the EG95NC-Recombinant Antigen in *Escherichia coli*

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Keywords: *Echinococcus granulosus*, Hydatidosis, *Escherichia coli*, Recombinant Protein, Vaccin.

Aim of the Work: The objective of this study was to clone and optimize production conditions of the truncated recombinant protein, EG95NC, in *E. coli* using three different media formulations that favor veterinary vaccine candidate.

Methods: Synthesis of the truncated EG95NC-cDNA, with codon optimization and cloning into pGEX vector for prokaryotic expression using BL21 DE3 bacteria. Three different media were tested: Luria broth (LB), terrific broth (TB) and super broth (SOC). To evaluate the EG95NC recombinant protein production, duplicate cultures induced with IPTG were carried out. Pellets from 2 L fermentation of the recombinant *E. coli* expressing the EG95NC-GST-tagged proteins, were lysed by sonication and purified by FPLC and purity was analyzed by SDS-PAGE. The purified protein concentration was estimated using

Oral Communication: Theme II

Agadir, April 24-26th, 2019

the method of Bradford. Total soluble protein expression was estimated with increasing concentrations of BSA protein loaded onto SDS-PAGE with *E. coli* lysate products by using Gel Quant NET software.

Results: Cloning and expression of recombinant protein EG95NC-GST with approximately 40 kDa, analyzed in SDS-PAGE. Production optimization of the EG95NC-GST using LB, SOC and TB medium gave high level of EG95NC-GST recombinant protein expression obtained by SOC medium and scale-up of the antigen production using fermentor. Purification on a GST column using FPLC, provided significant amounts of purified antigen (260 mg.L⁻¹) which represents 5200 doses.L⁻¹.

Conclusion: This study allows optimization of EG95NC-GST expression, using recombinant *E. coli* (BL21DE3) growth in SOC medium to produce for ruminants the hydatidosis vaccine, including the genotype G1 of *Echinococcus granulosus*, which represent the most prevalent genotype, in Morocco. High yields of the recombinant protein were obtained in a fermentor reaching up to 7000 sheep doses.L⁻¹. Purification of the antigen was possible by affinity chromatography to increase the quality of the final antigen that can be used for immunological studies and vaccine production.

OCII-12. Diversity and bioactivity of microflora associated with red seaweeds from the Atlantic Coast of Morocco

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Key words: Bioactivities, Biodiversity, Endophytic microorganisms, Multidrug resistant bacteria. *Rhodophyta*

Aims of the work: Emerging infectious diseases are a major public health problem, leading to high mortality rates. They are mainly caused by drug-resistant microbes, mainly involving bacteria and fungi, which are gradually becoming more resistant to conventional antibiotic compounds. Nature has always been a source of medicinal and pharmaceutical agents. Among these bio-sources, endophytic microorganisms from seaweeds are receiving an increasing attention since they constitute an important source of bioactive secondary metabolites. The objective of this study is to study the diversity and bioactivity of microflora associated with *Rhodophyta* species harvested from the Atlantic coast of Morocco.

Methods: The collected marine algae underwent different optimized treatments for the isolation of associated endophytic microorganisms. The study of the diversity of purified bacterial and fungal isolates was carried out based on the morphological criteria. Moreover, isolates were screened for their ability to produce bioactive antimicrobial substances against several tested microorganisms including Multidrug resistant bacteria MDR strains, and using the agar cylinder method.

Results: 295 endophytic microorganisms were isolated from 41 tested red seaweeds samples with dominance of no filamentous bacteria (87%). While only 7% and 6% of isolates belong to actinobacteria and fungi respectively. Based on different macroscopic and microscopic morphological characteristics and physiological criteria, obtained endophytic isolates showed a great diversity. The screening of purified isolates for antimicrobial activities showed that 66% were active against at least one tested pathogenic microorganism and among these 65%, and 23% have an antibacterial and antifungal activities respectively. The screening against MDR obtained from an intensive care unit in the Hospital University Mohammed 6 showed that while 18% and

25% of screened actinobacteria and fungi isolates respectively were active.

Conclusion: Isolated endophytic microorganisms associated with red seaweeds showed a great biodiversity with the potential of some isolates to produce bioactive compounds. Further required investigations were undertaken are for the biological and chemical characterization of elaborated bioactive metabolites.

OCII-13. Evaluation of the efficacy of a novel inactivated vaccine against a new emerging Italy02 infectious bronchitis virus in Morocco.

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Keywords: Infectious bronchitis (IB), infectious bronchitis virus (IBV), homologous, vaccine, Italy02, antibodies

Aims of the work: Infectious bronchitis (IB) is an economically important viral disease with worldwide distribution. Every country with an intensive poultry industry has infectious bronchitis virus (IBV). Different serotypes of this virus show little cross-protection. The present study aimed to evaluate the ability of a novel Inactivated infectious bronchitis virus homologous Vaccine (genotype Italy02) to induce maternal antibodies in broiler chicks.

Methods: An inactivated vaccine against Italy02 infectious bronchitis virus, prepared using an IBV/RA strain isolated from Moroccan broiler chickens was administered to Specific Pathogen Free (SPF) chicks at one day old, leaving the control birds unvaccinated. SPF Chicks obtained of all groups were subjected for serology along the period of study. All sera carried out using ELISA test. In post vaccination, all the chicks remained free of clinical signs of IBV.

Results: Serology response revealed a geometric mean titer in ELISA test on days post vaccination. The ELISA test indicated that the level of maternal antibody (Anti - IBV) in the vaccinated chicks was significantly ($P < 0.01$) higher than that of unvaccinated chicks. No mortality was observed in the all chicks. All birds vaccinated with the Italy02 vaccine are sero-converted, with high antibody titers.

Conclusion: This reflects that our vaccine is capable of inducing an immune response. Based on the results of the present study, we can conclude that the homologous adjuvanted inactivated vaccine capable to induce a better immune response, indicating complete protection against homologous challenge.

OCII-14. Study of the Differential Expression of non-coding RNAs as Promising Biomarker in Breast and Gynecological Cancers

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Keywords: Breast, Gynecological cancers

Aims of the Work: The objective of our study is the detection of 3 noncoding RNAs (ncRNA1, ncRNA2 and ncRNA3) present in breast and gynecological cancers (breast, ovarian and cervical cancers), the establishment of a profile of their expression in cancer and the study of their possible use as biomarkers of these cancers.

Methods: Thirty biopsies were collected from the Casablanca University Hospital Center and conserved in liquid nitrogen. The extraction of total RNAs was held, using Trizol reagent followed by reverse transcription using random hexamers. Finally, through qPCR, the levels of ncRNAs expression were determined in malignant breast, ovarian, cervical tissues as well as fibromas.

Results: The results showed the expression of ncRNAs, in all tissue types, with different expression patterns. The Ct values indicated higher levels of expression, in malignant tissues, compared to control, with distinguished expression patterns between the different studied tissues (breast, ovarian and cervical).

Conclusion: We have observed differential expression of 3 ncRNAs in breast, ovarian and cervical cancers compared to controls. These results suggest that these non-coding molecules could be used as promising biomarkers. The correlation to clinicopathological features and survival rate is ongoing, in order to evaluate the significance of these 3 ncRNAs as prognostic biomarkers.

OCII-15. Control of *Aspergillus fumigatus* strain isolated from pulmonary Aspergilloma by microorganisms

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Keywords: *Aspergillus fumigatus*, microorganisms, antifungal activity

Aims of the work: *Aspergillus* is the ubiquitous genus of fungi in the environment. *Aspergillus fumigatus* is the frequent pathogenic nosocomial fungi especially in immunocompromised people. The search for new antifungal agents with fewer side effects is an important approach for better control of human pathogenic fungi. Microorganisms have been used as a source for the production of variety of bioactive metabolites. The aim of this study was the search for new microbial inhibitors against of *A. fumigatus*.

Methods: *A. fumigatus* was isolated from a pulmonary Aspergilloma provided by University Hospital Complex (CHU) from Fez. Isolation of antagonistic stains from soil,

water and household waste was performed and their antifungal activity was evaluated by direct confrontation on Malt Extract Agar (MEA). Macro and microscopic morphological characters were studied in order to identify the strains.

Results: Two different strains of *A. fumigatus* (ASP37 and ASP42) from a pulmonary Aspergillosis were isolated. In addition, 73 potential antagonistic isolates belonging to bacteria, fungi (molds and yeasts) were tested against *A. fumigates* by confrontation on MEA revealed that the growth of *A. fumigatus* ASP42 was inhibited to 33% by a Gram-negative bacterial isolate. ASP37 was inhibited to 77% and 75% by the two strains F52 and A11 respectively. In the preliminary screening among the yeasts, three isolates (F49, F50 and F51) showed anti-*A.fumigatus* activity that varies depending on the strain. ASP42 was inhibited to 80%, 78% and 75% and ASP 37 was inhibited to 70%, 67% and 52% respectively by F49, F50 and F51 strains. The tested molds showed no activity against the two strains of *A. fumigatus*

Conclusion: All these results provide a basis for further research aiming to characterize the bioactive metabolites of the selected strains, and a motivation to search for other biological substances to control harmful fungi. Molecular identification of the selected isolates is in progress.

OCII-16. Assessment of some biological activities of a high value-added compound obtained from an Algerian fresh water microalgae, *Haematococcus pluvialis*

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Keywords: *Haematococcus pluvialis*, carotenoids, astaxanthin, antioxidant, anti-inflammatory.

Aims of the work: The aim of this work was to evaluate the antioxydant

potential and the anti-inflammatory activity of astaxanthin produced by *H. pluvialis* cells exposed to strong light and nitrate deficiency.

Methods: The antioxidant activity of astaxanthin produced by *H. pluvialis* microalgae under strong light and nutrient starvation was determined by DDPH test, β -Carotene-linoleic acid assay, Ferric Reducing Antioxidant Power (FRAP) test and ferric thiocyanate method (FTC), the anti-inflammatory effect of this carotenoid was determined by measuring of the percentage inhibition of paw edema induced in mice by carrageenan injection.

Results: The radical scavenging activity evaluated by DPPH test of this carotenoid used at a concentration of 200 μ g/mL, is about 89.97% with an IC₅₀ of 25.82 μ g/ml. The inhibition of β -carotene bleaching is of about 99.12 \pm 2.36% at the same concentration of extract. Iron reducing capacity of astaxanthin evaluated with FRAP test is about 3.7 times higher than that recorded with the standard, ascorbic acid. According to the FTC test, the lipid peroxidation inhibition rate of the extract is 2 times higher than that of the ascorbic acid. Oral administration of the *H. pluvialis* extract at 100 μ g/kg has shown an anti-inflammatory activity in animals injected with carrageenan.

Conclusion: *H. pluvialis* microalgae is a promising source of potential antioxidant and could have several therapeutical uses.

OCII-17. *Enterobacter*: Genetics Of Ctx-M Extended-Spectrum B-Lactamases

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Keywords: *Enterobacter*; extended-spectrum β -lactamase; CTX-M; antibiotic resistance; Algeria.

Aims of the work. We evaluated the β -lactam resistance phenotypes of clinical and environmental strains belonging to the *Enterobacter* species isolated in different Algerian hospitals. This study aimed to identify the CTX-M ESBL-producing *Enterobacter* at three university hospitals located in the north west of Algeria.

Methods. Identification of isolated bacteria was performed using the API 20E test system, then by using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) methodology. The antimicrobial susceptibility testing of all *Enterobacter* strains producing an ESBL were determined using an agar diffusion method according to the CA-SFM. Four conventional simplex PCR tests were performed for the detection of CTX-M-1, CTX-M-2, CTX-M-9 and CTX-M-8/25 groups encoding genes using specific primers.

Results. Among 36 ESBL-producing *Enterobacter* strains, 32 (88.9%) and 3(8.3%) belonged to the *E.cloacae* and *E.hormaechei* species, respectively. *E.kobei* was found only once (2.8 %). All isolates were resistant to ticarcillin, piperacillin, cefoxitin, cefotaxime, ceftazidime, ceftriaxone and aztreonam, but susceptible to ertapenem and imipenem. The genetic analyses only allowed the detection of resistance genes of the CTX-M-1 group (32 strains, 88.9%), including mainly CTX-M-15. None of the isolated strains harbored CTX-M-2, CTX-M-9 or CTX-M-8/25 group genes.

Conclusion. These results demonstrated that the prevalence of multidrug resistant *Enterobacter* strains is dramatically increasing in Algerian hospitals, which represents a serious public health challenge and warrants the reinforcement of hygiene measures.

TOPIC III-

OCIII-1. Phenotypic and genotypic characterization of rhizobia isolated from *Astragalus algarbiensis* growing in Maamora forest (Morocco)

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Keywords: *Astragalus algarbiensis*, *Bradyrhizobium*, rep-PCR, housekeeping genes, biodiversity.

Aims of the work: The Maamora's Cork Oak forest suffers from desertification, intensified uncontrolled overgrazing, as well as the effects of climate change, resulting in the absence of natural regeneration of cork oak. The aim of our study was to characterize the rhizobia isolated from the nodules of *Astragalus algarbiensis*.

Methods: The phenotypic characterization included the growth of 56 isolates at Temperatures from 30 to 45°C and NaCl from 0.01 to 5%; the assimilation of carbohydrates and amino acids as single carbon and nitrogen sources respectively and the ability to produce some enzymes. The molecular analysis consisted in a genotyping by rep-PCR and ARDRA and the amplification and sequencing of the 16S rDNA, housekeeping genes and the *nodC* gene which is among the genes necessary to induce nodulation.

Results: Fifty-six bacteria were isolated from the root nodules of *Astragalus algarbiensis*. The strains studied tolerate 2% NaCl and some grew at 45 °C. They use a wide range of carbohydrates and amino acids as a carbon and nitrogen sources. Nitrate reductase, catalase, and phosphatase were

produced by 77, 89 and 95% of the strains respectively. Our results showed the high diversity of the strains nodulating *A. algarbiensis*. The rep PCR using ERIC primers subdivided the 56 isolates into two distinct groups at 46% of similarity. ARDRA assays using *HaeIII*, *MspI* and *EcoRI* restriction enzymes showed that the 56 isolates are grouped in 2 different ribotypes. Based on these results we selected two representative strains As21 and As36 for the further genetic studies. The sequencing and NCBI-BLAST comparison of the two representative strains showed that they are closely related to *Bradyrhizobium cytisi*.

Conclusion: *Astragalus algarbiensis* is nodulated by slow growing rhizobia in the Maamora Forest in Morocco. The isolated strains have a great phenotypic and genetic diversity. This aptitude is a major advantage which allows the establishment of symbiosis and fixation of nitrogen in Maamora forest.

OCIII-2. Isolation and identification of potential probiotic bacteria from the digestive tract of red Tilapia

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Keywords: Probiotique, *Enterococcus*, *Tilapia*, aquaculture.

Aims of the work: Modern industrial aquaculture requires strategies that help maintain microbiological environmental health, improved organic production away from the antibioresistance risk. Intestinal lactic bacteria in fish and shellfish play a very important role in intestinal flora and can be used as probiotic. The aim of this work was the isolation of potential probiotic bacteria from digestive tract of red Tilapia.

Methods: Thirty nine strains isolated on MRS medium were identified by biochemical tests and tested for bioactivity by antagonism test. The active strains were

Oral Communication: Theme III

Agadir, April 24-26th, 2019

identified by molecular test, tested for lactic acid production (Bouziane et al 2004), bile salts and pH resistance (Balcázar et al., 2008) and biofilm formation *in vitro* (Maldonado et al., 2007).

Results: The results showed that four strains (about 10%), assigned to *Enterococcus faecium*, have been bioactive on the following bacterial reference strains: *Escherichia coli* ATCC25922, *Staphylococcus aureus* ATCC 25923, *Klebsiella pneumoniae*, *Aeromonas sp.* and *Vibrio fluvialis*. They have a very important probiotic potential: good production of lactic acid, a high resistibility to bile salts and pH and have an average adhesion power.

Conclusion: These four isolates must be tested *in-vivo* in aquaculture application in order to maintain microbiological environmental health and improve aquaculture production away from selection pressures and antibiotic resistance.

OCIII-3. Effect of microbial Inoculation on the assessment and maturity of compost of olive mill wastewater sludge

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Keywords: Olive oil mill wastewater sludge, Polyphenols, Composting, Bioreactor.

Aims of the work: This work aims to produce a compost through valorization of sludge generated from olive mill wastewater. The toxicity of the sludge, which is due to the high phenolic and lipids content was efficiently addressed by optimizing the composting conditions, through the inoculation with thermophilic bacteria and precise control of the process parameters.

Methods: The composting assays were carried out in 100L bioreactor through mixing olive mill sludge and green wastes (v/v). In order to stimulate microbial activity, the initial mixture has been inoculated with thermophilic microorganisms. For each experiment, physico-chemical properties were evaluated, and polyphenols content was determined by Folin-ciocalteu method. Furthermore, the lipid content was evaluated after an extraction with dichloromethane followed by evaporation to dryness under partial vacuum. Ultimately, compost phytotoxicity was evaluated via the monitoring of germination index of both *Brassica rapa* and *Lepidium sativum*.

Results: Results showed that the composting process reduced polyphenols and lipids content by almost 90% during the stabilization phase. Thermophilic phase (55°C) was achieved after 9 days. At the end of the experiment, the registered pH value was 7.7, the decomposition rate exceeded 60%, and the germination index of *Brassica rapa* and *Lepidium sativum* was significantly improved.

Conclusion: The microbial inoculation of olive mill wastewater sludge and Green waste during composting process allowed enrichment of the microbial population, resulting in better degradation efficiency with regards to phenolic and lipid compounds. Moreover, the initial phytotoxicity was significantly reduced. Hence demonstrating the potency of the process.

OCIII-4. Diversity of rhizobia nodulating *Acacia gummifera* in Morocco.

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Keywords: *Acacia gummifera*, *Ensifer*, nitrogen fixing symbiotic, reforestation

Aims of the work : The isolation, selection, characterization and identification of efficient nitrogen fixing rhizobial strains from *Acacia gummifera* to produce an inoculum, which could be used as biofertilizer in agricultural and reforestation programs, instead of chemicals that are expensive and environmentally harmful.

Methods: Fifty-four bacteria were isolated by trapping from root nodules of the Moroccan endemic tree, *Acacia gummifera* growing in soils of two regions, Essaouira and Marrakesh. The isolates were genetically characterized by rep-PCR, and the sequencing of 16S rDNA, symbiotic genes and four housekeeping genes. The phenotypic analysis consisted in the determination of 81 physiological and biochemical parameters.

Results: The isolates are able to nodulate their original host and possess the nodulation gene (*nodC* gene). The use of the rep-PCR allowed the reduction of the number of the isolates from 54 to 24 strains on the basis of fingerprints similarities; showing therefore the high genetic diversity of the strains. The phenogram obtained using STATISTICA program and the UPGMA method showed the high phenotypic diversity of the strains. Besides their abilities to tolerate heavy metals and high temperatures, some strains were also able to solubilize tricalcium phosphate, to produce siderophores and indole acetic acid, in addition to their ability to fix nitrogen. Sequencing and phylogenetic analysis of 16S rRNA as well as three symbiotic and four housekeeping genes showed that these strains belong to *Ensifer* genus.

Conclusion: All together, these results suggest that the strains herein studied could serve as inocula to use as biofertilizers in the western, central and southern area of Morocco.

OCIII-5. Molecular and prediction modelling of the VP1 epitopes and protein homogeneity of Enteroviruses serotypes can block virus transmission into water

environment targeting improving public health quality

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Keywords: Enteroviruses, Environment, Epitopes, VP1 protein, Conservation, Real time PCR.

Aims of the work: The Enteroviruses (EV) are associated with the emergence of specific diseases such as foot-hand-mouth syndrome involving EV71 and acute hemorrhagic conjunctivitis associated to EV70 or bronchiolitis (EV68), as well as flaccid paralysis caused by EV70 and EV71. VP1 protein is involved in the binding phase of the virus to the host cell, as the major structure of the site but also through its antigenicity carrying a set of epitopes included in the specific recognition of these viruses. The aim of this work was to isolate EV from bivalve mollusks collected from Oualidia lagoon, Morocco and to assess the similarity of the structural protein VP1 between the 3 serotypes EV68, EV70, EV71 by modelling prediction approaches, in order to consider an eventual specific common treatment between EV68, EV70 and EV71 targeting blocking of the virus binding phase to the host cell.

Methods: Enteroviruses were searched in 300 bivalves mollusks collected from Oualidia lagoon, from march2018 to April 2019. These bivalves were dissected, their gastrointestinal gland was shredded, then viral concentration was determined via the PEG 900 method, and then viral RNA was extracted by a specific kit. DNA was amplified by real time PCR using specific primers and probes and suitable PCR conditions. Moreover, the following prediction modelling approaches were used: Montecarlo MC model, Artificial neural network (ANN), Stabilized matrix method

Oral Communication: Theme III

Agadir, April 24-26th, 2019

(SMM), SMM with a Peptide: MHC Binding Energy Covariance matrix (SMMPMBEC), Scoring Matrices derived from Combinatorial Peptide Libraries (Comblib_Sidney2008) NetMHCpan, NetMHCcons and PickPocket.

Results: The EV were concentrated from water environment, the RNA was extracted, then quantified and amplified by RT PCR combining with prediction modelling approaches. The results of this study revealed that the VP1 protein expression seem high conservation among all the strains tested. The rate of conservation is about 60% especially with 70 and 71 strains. Our results demonstrate that the main epitopes present in peptidic sequences of VP1 protein are situated in the position 160-230 which is the conserved region and also in 125-135 positions.

Conclusion: This study revealed a great homogeneity between strains of the three tested serotypes therefore allow us to consider a specific common treatment between EV68, EV70 and EV71 targeting blocking of the virus binding phase to the host cell by any of the strains mentioned above. This might reduce waterborne transmission from the environment which will improve water resources quality as added value to the global public health.

OCIII-6. Study of Faecal Contamination and Occurrence of pathogenic bacteria in Oued Souss estuary

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Keywords: *Scrobicularia plana, microbiological pollution, fecal coliforms, fecal Streptococci, Vibrio, Salmonella spp; Oued Souss estuary*

Aims of the work: The estuary of Oued Souss, is an ecosystem that present environmental constraints linked to various human activities. In order to monitor the evolution of health status of this ecosystem,

the present work was conducted in seawater, sediment and molluscs using the microbiological analyses of fecal coliforms (FC) and streptococci (FS) and the pathogenic bacteria *Salmonella* spp and *Vibrio* spp.

Methods: Samples were collected monthly in Oued Souss estuary: Eight samples of each of seawater, sediment and molluscs were collected. For *Vibrio* spp., NF in ISO / TS 21872: 2007 methods were used (enrichment at 37°C, isolation in TCBS agar at 44.5°C and purification at 37°C). For *Salmonella* spp. AFNOR NF EN ISO 6579 V08-013 methods were used (pre-enrichment and enrichment at 37°C, isolation in Hektoen, SS and XLD agar at 44.5°C and purification at 37°C). For FS and FC, filtration of 100ml of seawater (0.45µm) was performed, followed by culture in Slanetz Bartley medium for FS and TTC Tergitol 7 Agar for FC, respectively at 37°C and 44.5°C, while incorporation in BEA for FS and VRBL for FC at 37°C was used for sediment and molluscs,

Results: Analysis results of the twenty-four samples, showed a low presence of *Vibrio* (only 30, 14 and 6 isolates were selected respectively in molluscs, sediment and seawater) and absence of *Salmonella* spp. Fecal contamination indicator revealed a value of 2.07 log₁₀ cfu/100ml for FS and 2.09 log₁₀ cfu/100ml for FC in seawater, 6.54 log₁₀ cfu/g for FS 4.95 log₁₀ cfu/g for FC in sediment, and 5.84 log₁₀ cfu/g for FS and 4.73 log₁₀ cfu/g for FC in mollusc. For seawater, those bacteria have slightly exceeded the standards values (2 log₁₀ CFU/100ml), while sediment and mollusc revealed higher values that exceeded detection limits (4 log₁₀ CFU/100ml).

Conclusion: The results of this work will constitute an important database, which could be used in decision support as part of the Agadir coastal development global project.

OCIII-7. First attempts to valorize the lipid content of benthic diatoms for the

production of third-generation biofuels at the lab scale

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Keywords: Diatom Algae, SDEP, Lipid Extraction, Transesterification, Biofuel

Aims of the work: Algae hold a great promise as a resource that, if developed correctly, could become a sustainable biomass source for energy and fuels. The aim of our bioassays at the lab-scale were to characterize the lipid content of benthic selected diatoms, sampled from a phototrophic biofilm extended in Safsaf wadi (region of Skikda- Algeria), and grown in a photobioreactor.

Methods: A biomass of diatom species was cultivated in a photobioreactor that made it possible to monitor high yields and limited contamination. The species *Thalassiosira pseudonana*, *Cyclotella sp.* and *Nitzschia sp.* were selected. The lipid extraction from wet microalgae was carried out using the procedure of ‘Simultaneous Extraction and Distillation Process (SDEP)’. The characterization of the biodiesel was carried out by measuring its density, viscosity and its pH and was identified by infrared spectroscopy.

Results: The lipid content was considerably increased and reached 36%, 45% and 22% of the dry matter, respectively for *Cyclotella sp.*, *Nitzschia sp.* and *Thalassiosira pseudonana*. Biofuel total yield was 69.99%.. The comparison of density, viscosity and pH with those of gasoline and diesel fuel, allowed us to conclude that the quality of our biodiesels was closer to that of diesel in terms of viscosity and density. Its boiling point is

280°C, and practically insoluble in water. Infrared spectroscopy allowed us to identify the biodiesel obtained, and confirmed that the biodiesel produced is a methyl ester.

Conclusion: In conclusion, the obtained strongly support the hypothesis of the possibility use of microalgae as a source of biofuel. The use of diatoms for the production of algo-fuel is a first innovative experiment not yet exploited by scientists because of their low lipid content, and our results show rather the possibility of their use as raw materials of biofuel.

OCIII-8. Protein enrichment of lignocellulosic substrate by solid state fermentation using *Neurospora sitophila*

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Keywords: Protein enrichment, olive pomace, *Neurospora sitophila*, Solid state fermentation.

Aims of the work: Olive oil mills wastes constitutes an important pollution factor for the olive oil-producing regions, since a large wastes amounts are produced in relatively small time interval. One of the by-products generated by the olive sector is the solid wastes: olive pomace, this substrate is very high in lignocellulosic material and fairly low in protein. However, this material would be very promising substrate for to produce microbial protein.

The aim of the present study was to examine the potential of *Neurospora sitophila* for the production of protein enriched feed stuff using olive pomace by solid state fermentation.

Methods: Two types of olive pomace were utilized in this study a fresh olive pomace (FOP) and defatted olive pomace (DOP). The strain was isolated and cultivated on both substrates under solid-state fermentation for protein enrichment.

Optimum conditions (temperature, duration, moisture...) for protein enrichment of this by-product were investigated, and the protein content and other components were determined.

Results: From this experimental study, optimal moisture content for growth on FOP was 60 % whereas for DOP it was 65%, optimal temperature for both substrates was 25°C. The protein content of FOP and DOP after one week fermentation period was increased by 30 and 24 % respectively.

Conclusion: According to the results obtained, this by-product could be very promising for large scale production of animal feed, and therefore, these results highlight the opportunity of the agronomic use of this agro-industrial by-product, because it can be considered a strategic resource for integrated agricultural management, including agro-industrial waste disposal and the agronomic valorization of the organic materials.

OCIII-9. Study the diversity of the bacterial communities in the mining district of Oujda region (Morocco) by using pyrosequencing techniques

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Keywords: Diversity; bacteria; metals; metalloids; pyrosequencing

Aims of the work: This work aimed to study the diversity and taxonomic position of the bacterial populations (rhizospheric and non rhizospheric ones) present in mining environments of the Oujda

region (Morocco).

Methods: We have used the pyrosequencing 454 technology based on the amplification and sequencing of 16S rRNA genes extracted from the soils. Data were analyzed by using bioinformatics "mothur" software (<http://www.mothur.org/wiki>).

Results: A single run of 454 pyrosequencing from 72 independent 16S rRNA gene libraries yielded a total of 1545801 sequence reads with a mean length of 400 bp. Trimming and processing with the software Mothur lead to the recovery of 706373 of good quality reads. Analysis of these sequences led to the identification of 10061 OTUs. The taxonomic analyses identified a total of 18 bacterial phyla in the studied soils. Seventy six percent of the sequences have been affiliated at the phylum level, with the phyla *Proteobacteria* and *Actinobacteria* being predominant. A large majority of *Proteobacteria* sequences are affiliated to the genus *Sphingomonas* while the genus *Arthrobacter* is the most important for *Actinobacteria*.

Conclusion: Mining has been a pillar of the Moroccan economy and has led to the accumulation of thousands of tons of tailings, composed by very fine particles and highly toxic compounds such as lead or arsenic and then have a significant impact on the environment and human health. The semi arid climate of the Mediterranean favor leaching and spread of pollutants and make difficult the installation of a vegetable cover. Microorganisms can greatly accelerate the phytostabilisation process by influencing plant growth through various mechanisms. They can also act directly on the mobilization / immobilization of metals and metalloids in the soil.

OCIII-10. Biosorption and Biodegradation mechanisms for the bioremediation of textile dyes using yeast cells

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Oral Communication: Theme III

Agadir, April 24-26th, 2019

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Keywords: Yeast, azo dye, mechanisms, lactase activity, Biodegradation, Biosorption

Aims of the work: Worldwide, textile industry is one of the leading and headlong developing sectors. It is also one of the greatest generators of contaminated effluents with various recalcitrant chemicals such as azo dyes. In this work, the potential of yeast cells in the bio-sorption and biodegradation of textile dyes was studied

Methods: In this study, two yeast strains (*Cyberlindnera fabianii* (M₁) and *Candida tropicalis* (M₃)) previously isolated from contaminated sites in the region of Fez were used. The rate of decolorization of azo dye Acid red 14 (AR) was measured by spectrophotometer, thin-layer chromatography analysis (TLC) and HPLC was used to confirm the biodegradation of dye. Laccase activity was measured using ABTS as substrate. FT-IR was used to characterize and identify possible binding sites for biosorption and scanning electron microscopy was used to characterize the biomass before and after dye biosorption.

Results: The decolorization rate of 50 mg.L⁻¹ of AR was more than 95% and 96%, by M₁ and M₃ respectively. The decolorization was confirmed by the vanishing of the maximum adsorption band at 516 nm by UV-Vis and by TLC and HPLC analysis. Laccase activity of yeast showed an increase following the addition of 25 mg.L⁻¹ of the dye, suggesting the involvement of this enzyme in the degradation process. On the other hand, dead yeast biomass was also able to remove 30% and 40% of the dye, respectively by M₁ and M₃. Kinetic and isothermal models were created to evaluate the biosorption mechanisms. Biosorption followed the Langmuir model and second order kinetics for both strains. FT-IR analysis

confirmed the involvement of hydroxyl, carboxyl, amine and phosphate groups in the biosorption process.

Conclusion: Our results suggest that biodegradation and biosorption are two mechanisms involved in the dye decolorization by the yeasts M1 and M3. Our findings therefore prove the great potential of the use of these yeast cells in the bioremediation of textile effluents.

OCIII-11. Isolation and characterization of halophilic and halotolerant bacteria producing extracellular hydrolytic enzymes from salt marshes in Morocco.

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Keywords: Extremophiles, halophiles, extracellular hydrolytic enzymes, screening

Aims of the Work: As adaptive strategies against harsh salt stresses, the majority of halophiles and halotolerant microorganisms living in Hypersaline environments often synthesize valuable extracellular biomolecules, including extracellular hydrolytic enzymes. These enzymes have a great interest in several biotechnological applications. The present study aimed to determine the diversity of the halophilic and halotolerant bacteria with hydrolase activities.

Methods: Determination of extracellular hydrolytic activities was performed as follow: cellulolytic activity of each strain was revealed as described by Sadfi-Zouaoui et al (2008). DNase activity was tested according to Jeffries et al. (1957). Amylolytic, lipolytic and proteolytic

activities were revealed according to the methods described by Cowan (1991), Sierra (1957) and Sadfi-Zouaoui et al. (2008), respectively.

Results: A total of 486 halophilic bacterial isolates from two hypersaline environments in Center and South of Morocco were able to produce different hydrolases (cellulases, amylases, DNases, lipases and proteases). The majority of these isolates were considered as moderately halophilic bacteria growing optimally between 5-15% of salt and, in few cases, as extremely halophilic microorganisms that required 15-20% of salt for optimal growth. Most of these bacterial strains were designated mesophilic and, in some cases, were thermotolerant. The pH tolerance was quite large (4.5 to 9.4) with an optimum of 7.2. The results of the biochemical characterization indicated that most of the Gram-positive bacteria isolated from salt marshes studied belonged to *Staphylococcus cohnii*, *Staphylococcus warneri*, *Staphylococcus epidermidis*, *Staphylococcus haemolyticus* and *Staphylococcus christinae*.

Conclusion: In this work we uncovered a rich biodiversity of halophilic and halotolerant bacteria isolated from salt marshes in Morocco, the growth of strains obtained under different physico-chemical conditions and the screening of hydrolytic enzymes have shown great diversity.

OCIII-12. Contribution to the study of genetic characterization of multiresistant strains *Escherichia Coli* in broiler chicken in Morocco

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Keywords: Avian *Escherichia coli*, genetic characterization, virulence genes, genes of resistance to antibiotics, ExPEC, STEC.

Aims of the work: In Morocco, the

intensification of poultry farming is accompanied by the emergence of new pathologies responsible for high mortality and important economic losses.

This study was conducted in order to characterize phenotypic and genetic strains of *E. coli* isolated from pathological avian cases of colibacillosis, commensal strains and from chicken droppings. Thus, the main virulence genes for APECs and STECs and resistance genes for beta-lactams and quinolones have been studied.

Methods: Eight antibiotics were assayed by the agar medium diffusion method to assess the sensitivity of *E. coli* isolates. The antibiograms showed high levels of resistance to oxytetracycline, trimethoprim / sulfamedazole, enrofloxacin, nalidixic acid, amoxicillin and florenfenicol. On the other hand, the resistance rate for colistin was nil. Furthermore, 54 samples of *E. coli* were identified by PCR uniplexe twenty of them were tested for their virulence (papC and stx1) genes and their resistance bla TEM, qnrA and qnrB.

Results: PCR results showed that the gene for virulence papC was present with a frequency of 22.86%, 28.57% and 0%, respectively for the pathogenic strains, commensal strains and samples of the environment. The gene for virulence that is transmissible to human was absent. Finally, 20 isolates selected from 54 strains were tested by PCR uniplexe for the detection of genes resistance to Ampicillin (blaTEM), and the Nalidixic acid (qnrA, qnrB). A high prevalence has been obtained for gene blaTEM (80%) with a significant association with phenotypic resistance, followed by the prevalence of qnrA genes (71,43%) and the qnrB (52,38%).

Conclusion: This preliminary study needs to be completed by phylogenetic and genotypic characterization to determine the phylogenetic groups of *Escherichia coli* present in Morocco.

OCIII-13. Detection of multidrug-resistant bacteria in hospital effluents of the

Oral Communication: Theme III

Agadir, April 24-26th, 2019

university hospital Mohammed VI, Marrakesh, morocco.

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Keywords: antibiotics, multidrug-resistant bacteria, physicochemical characterization, hospital Wastewater.

Aims of the work: Detection of Multidrug-Resistant bacteria and physicochemical characterization of hospital effluents of the University Hospital Mohammed VI, Marrakesh, Morocco.

Methods: Thirty ml of effluent (for microbiological analysis) and 500ml of same effluent (for physicochemical analysis) were collected from eight wastewater outlets from all clinical services, laboratories, and the kitchen of University Hospital Mohammed VI of Marrakesh. The samples were characterized by physicochemical: conductivity, Total Suspended Solids (TSS), BOD₅, COD, NH₄⁺, NO₃⁻, NO₂⁻ and Total Kjeldahl Nitrogen (TKN) and microbiological analysis (isolation of total bacterial flora and antibiotic resistant bacteria). All parameters were measured according to the standard methods.

Results: The results reveal a significant chemical pollution COD (1714.71mg/l ±648) BOD₅ (1305.1mg/l ± 536.5), TSS (1548.75 mg/l ± 499), conductivity (1774µs/cm±550.65), pH (7.03±0.39). The average contents of NH₄⁺, NO₃⁻, NO₂⁻, and NTK are in order about (7.14 mg/l ± 3.17), (10.8 mg/l ±1.05), 71,4mg/L (± 34, 15), and (143.67 L± 32), and the average of pH is (7.03 ± 0.39).The microbiological

characterization showed that the average concentration of the samples in total bacterial flora and resistant bacterial flora was 3.17 x 10⁵ CFU/ ml and 5.76 * 10³ CFU / ml respectively. 121 strains of multidrug-resistant bacteria have been isolated, the most common of which are: *Enterobacteriaceae* producing extended-spectrum beta-lactamases (53%), methicillin-resistant *Staphylococcus aureus* (19%), vancomycin-resistant *enterococcus* (11%) imipenem resistant *Acinetobacterbaumannii* (8%), and ceftazidim resistant *Pseudomonas aeruginosa* (7%).

Conclusion: The University Hospital Mohammed VI effluents introduce major physicochemical and biological parameters of pollution and contain a large proportion of multidrug-resistant bacteria that represents an environmental risk.

OCIII-14. Impact of environmental conditions on viral and bacterial aetiology of Pacific oysters *Crassostrea gigas* mass mortalities in Oualidia lagoon

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Keywords: Pacific oyster, Mortality, Hydrodynamics, Environment.

Aims of the work: The Oualidia lagoon, located on the Atlantic coast between El Jadida and Safi, is one of the coastal sites in Morocco where oyster farming is one of the main socio-economic activities of the region. However, after a very flourishing period before 2011, the economic performances of oyster companies has deteriorated in several parks and brutal crises have occurred in particular episodes of oyster mortalities. The objectives of this study are to improve the understanding of mass mortality phenomena

in Pacific oysters *Crassostrea gigas* in the Oualidia lagoon and to examine the effect of climatic conditions on the viral and bacterial aetiology of this phenomenon.

Methods: Our study was conducted on mortality data of *Crassostrea gigas* oysters collected between 2012 and 2018 in an oyster farm in the Oualidia lagoon.

Results: In the Oualidia lagoon, mortality starts when seawater temperature is higher than 24°C corresponding to June, July and August. Mortality of oysters varies as a function of temperature, hydrodynamics and cultivation practises. This environmental conditions may cause stress of the oysters leading to the development of viruses mainly Oyster herpes virus and bacteria such as *Vibrio splendidus* in the oysters causing mortality episodes

Conclusion: During the summer period and during the activity of the deep water resurgences, in addition to the return effect of hot lagoon water coming from the inner dam at low tide, the waters of the lagoon undergo a strong thermal variability which exceeds 4 °C at the central part of the lagoon where the temperature goes from 16 °C at high tide to 20 °C at low tide, which is a stress that affects the oyster tolerance capacity which leads to their physiological weakening and therefore increase their vulnerability to the

OCIII-15. Occurrence of GI, GII noroviruses and Hepatitis A virus in Moroccan shellfish

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Keywords: Noroviruses, Hepatitis A virus, RT-PCR, Shellfish, Morocco.

Aims of the work: Filter feeding bivalve molluscan shellfish concentrate microbial contaminants and may present a human health risk. Human enteric viruses including noroviruses and hepatitis A virus

are the pathogens most associated with illness shellfish consumption. The monitoring system for shellfish production areas does not include human enteric virus detection, in Morocco.

The aims of this study is the evaluation of the viral contamination and the report of the occurrence and seasonal abundance of Noroviruses genogroups GI and GII and hepatitis A virus of two shellfish producing areas in particular Dakhla Bay and the Oualidia Lagoon.

Methods: A total of 70 samples of bivalve molluscan shellfish are collected between January 2015 and January 2017. The sampling concerned three species in particular oysters (*Crassostrea gigas*), mussels (*Mytilus galloprovincialis*) and solen (*Solen marginatus*). The method used for detection of noroviruses and hepatitis A virus is according to standard ISO/TS 15216-2 (2014). Briefly, a process control (Mengo virus) added of each sample and viral RNA extraction was by lysis with guanidine thiocyanate and adsorption to magnetic silica. Extracted viral RNA was amplified and detected by RT-PCR using hydrolysis probes (TaqMan).

Results: The results showed the presence of noroviruses genogroups GI and GII and hepatitis A virus. The total prevalence was 34.2% (n=24). The detection of noroviruses Nov GII was predominant and some samples were co-infected with Nov GII and Nov GI or hepatitis A virus.

Conclusion: In summary, our study highlight that the potential sanitary risk associated with the presence of enteric viruses in the shellfish producing areas is significant.

OCIII-16. Antagonistic potential of actinomycetes against Multi-drug resistant bacteria of hospital wastewater

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Keywords: Hospital wastewater, Multidrug-resistant bacteria, Actinomycetes, chemotaxonomy, Thermochemolysis

Aims of the work: The aim of this study was to develop a new means of biological control against multidrug resistant bacteria (MDRB) of Marrakesh hospital wastewater through actinomycetes having MDRB antagonistic activities by investigating the cellular fatty acids composition. The distributions of these microbial biomarkers were used for chemotaxonomy and to monitor the evolution of multidrug resistant bacteria during their interaction with antagonistic actinomycetes in effluents of the Marrakesh hospital.

Methods: Co-culture of six strains of MDRB (methicillin resistant *Staphylococcus aureus* (MRSA), ceftazidime-resistant *Pseudomonas aeruginosa* (PARC), Imipenem-resistant *Acinetobacter baumannii* (ABRI), vancomycin-resistant *Enterococci* (VRE), extended-spectrum β -Lactamase (ESBL)-producing *Escherichia coli* and *Klebsiella pneumoniae*) and three strains of actinomycetes were conducted during 2 weeks at 28 °C under constant shaking using the sterilized untreated wastewater of Marrakesh hospital as liquid medium. Thermochemolysis coupled with gas chromatography and mass spectrometry (THM-GCMS) at 600°C was used to identify the cellular fatty acids detected as methyl esters (FAMES) and monitor their fate during the treatment of untreated hospital wastewater.

Results: THM-GCMS produced different FAMES from MDRB and actinomycetes and allowed to discriminate

between Gram+ and Gram- bacteria. The amounts of fatty acids, characteristic of bacteria, decreased during the treatment. That was the case of C12 (from 2,52 mg/g to 0,99 mg/g), C14 (from 4,28 mg/g to 2,71 mg/g), C16:1 (from 1,43 mg/g to 0,24 mg/g) and C18:1 (from 5,35 mg/g to 2,29 mg/g). However, we noted an increase of the amounts of fatty acids characteristic of actinomycetes, such as branched C16 and iso C17, from 3,89 mg/g to 4,32 mg/g and 0,71 mg/g to 0,75 mg/g respectively.

Conclusion: This study demonstrated the capacity of actinomycetes to be used for hospital wastewater treatment and the potentiality of THM-GCMS for chemotaxonomy study of bacteria and for monitoring their fate amongst a treatment process.

OCIII-17. Rhizosphere microbial activities and biochemical responses of Parsley and Coriander plants grown under metallic stress

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Keywords: Urban soils, heavy metals, urban agriculture, phosphatase, agronomic proprieties, coriander, parsley, nutritional quality, human health, environment.

Aims of the work: Urban soils contamination by heavy metals is one of the major environmental problems closely related to anthropic activity and in particular through urban agriculture. In fact, the transfer of heavy metals via this route is the main human exposure source to metal contamination, thus posing a potential risk to human health. This work aims to study the disturbances (plant growth, sugars, proteins and MDA contents, antioxidant enzyme

activities) observed in coriander and parsley as well as in their rhizospheric soil following their culture under greenhouse condition in soil artificially contaminated by a mixture of four increasing concentrations of metal salts (Zn, Cu, Cd, Cr, Ni and Pb).

Methods: The effect of metallic pollutants on rhizosphere microbial activities and bio-chemical parameters of two plants during two months of the growth was determined and compared with those of the same plants harvested from the old sewage treatment area of the Marrakesh city and an agricultural suburban area used as a control.

Results: The results showed a strong changes in the biological and physicochemical characteristics of the soils (pH, conductivity, available phosphorus, OM) depending to the degree of metallic contamination. The metallic stress lead to an increase in the phosphatase activity at low concentration (up to 34%) and a decrease in high level (up to 38%). The metals cause also a decrease of plant growth (40 -75%) and sugars contents (23% -25%), an increase in proteins levels (66-130%) and MDA content (0.001-0.05 $\mu\text{mol g}^{-1}$) as well as disruption of the antioxidant enzyme system for both species studied in comparison to control.

Conclusion: The comparison of results obtained in green house experiment and those obtained in the field confirmed the strong involvement of heavy metals in the ecological disturbance of urban soils for agricultural use, thus affecting the nutritional quality of the plants for consumption, which constitutes a serious risk to human health.

OCIII-18. Isolation and characterization of the rhizobia nodulating of *Retama Monosperma* in the mining soils of the Touissit region of eastern Morocco

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Keywords: *Retama monosperma*, *Ensifer*, phytostabilization, nitrogen fixing symbiotic, heavy metals

Aims of the work: The use of heavy metals tolerating and nitrogen-fixing symbioses could be a good strategy to adopt for the phytostabilization of dikes from mining wastes. *Retama monosperma* is a wild nitrogen fixing shrubby legume in symbiosis with rhizobia. This ability allows the plant to settle and survive in environments that are difficult for other crops. The bacteria isolated from the root nodules of the plant were characterized phenotypically and genetically.

Methods: Forty-four bacteria were isolated from root nodules of *R. monosperma* grown in the soil of the Touissit abandoned lead mine, in the north-eastern area of Morocco. The isolates were genetically characterized by rep-PCR, and the sequencing of 16S rDNA, three symbiotic genes and three housekeeping genes. The phenotypic analysis consisted in the determination of 95 physiological and biochemical parameters.

Results: All the isolates are fast growing with a high phenotypic and metabolic diversity. The sequencing of the 16S rDNA and the NCBI blasting showed that all the strains belong are very close to *Ensifer aridi* species. The taxonomic position of some strains representing the different rep-PCR clusters was confirmed as *E. aridi* by the sequencing and phylogeny of all the three symbiotic genes and three housekeeping genes.

Conclusion: Our results showed the nodulation of *Retama monosperma* by fast growing rhizobia. This is the first report about the nodulation of a *Retama* species by a member of the *Ensifer* genus. *E. aridi* was

isolated from legumes growing in the deserts in three continents, Merzouga in Morocco, the Thar Desert in India and the Baja California in Mexico.

OCIII-19. Effect of metal resistant plant growth promoting rhizobacteria (PGPR) on the barley seed germination under metallic stress

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Keywords: Phytoremediation, heavy metals, Plant Growth Promoting Rhizobacteria, seed germination

Aims of the work: Phytoremediation is one of the best management techniques available for rehabilitation of mine tailing deposits around the world. However, using plants alone for bioremediation is subjected to different unfavorable growth conditions (pH, metallic, drought and salt stress). Thus, use of interaction microorganisms-plants could be beneficial for growth and survival of plants under stressed conditions. The aim of this work is to select plant growth promoting rhizobacteria (PGPR) that could be used in phytoremediation process.

Methods: In this study, four rhizobacterial strains with potential for plant growth promoting, were selected out of 40 strains that were isolated from the rhizosphere of some metallophytes growing on metal contaminated soils. Thus strains, namely *Mesorhizobium tamadayense* (BKM04), *Tetrathlobacter kashmirensis* (BKM20), *Pseudomonas azotifigens* (BKM07) and *Paenibacillus hainensis* (BKM32), were chosen for their ability to tolerate drought (40% of PEG), salt stress (80g L⁻¹ NaCl) and high level of metals (up to 10 mM of Zn, Cu, Cd and Pb). The chosen bacteria were examined for their ability to stimulate barley seed germination and root

elongation under increasing concentrations of Cu, Zn, Cd and Pb.

Results: For all studied metals, the results showed that the increase in metal concentration lead to a sharp decrease in seed germination and root elongation. Indeed, un-inoculated seeds showed a marked decrease in germination percentage by almost 60% under 8 mmol L⁻¹ of Pb and Cu with an inhibition of roots growth, compared to the uncontaminated control. Moreover, when seeds were exposed to 12 mmol L⁻¹ Cd, seed germination decrease by 80%. Compared to un-inoculated test, inoculation of seeds with BKM04 improved roots growth by 1,5 time and by 2,2 time after inoculation with the consortium of four rhizobacteria under Pb and Cu contamination. However, inoculation with rhizobacteria mixture stimulated the average germination efficiency by almost 75% and the average root length by 60% under Cd stress.

Conclusion: considering our current results, the subject of future investigations will address the native interactions occurring under natural conditions in contaminated fields among PGPR and autochthonous plants in relationship with various environmental stresses.

Acknowledgements: The authors acknowledge the financial support of Centre National de Recherche Scientifique et Techniques [grant N°PPR 22/2015].

OCIII-20. Microbial communities structures of urban soils of Marrakesh city along an anthropization gradient

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Keywords: urban soils, anthropogenic gradient, technogenic fraction, metal contamination, bacterial communities

Aims of the work: Due to their close proximity with the population, urban soils are extensively affected by human activities that release considerable technogenic inputs resulting in an overall soil degradation and leading to an increase of water extractable fraction of trace elements. This work aimed to determine the influence of anthropization on trace elements concentrations and assess how it might also affect soil bacterial structure in urban area of Marrakesh city, Morocco.

Methods: The work was carried out on nine top soils located along an anthropogenic gradient from suburban area (soil 1) to the city center (soil 9). The total fraction of trace elements and their water-soluble fraction were analyzed with an ICP-OES, the structure and diversity of soil bacterial communities were determined by denaturing gradient gel electrophoresis (DGGE) technique, and Shannon-Wiener (H') diversity index was determined.

Results: Trace elements concentrations showed increasing levels along the anthropogenic gradient, except for B and Cd. However, they have remained below the standard international limits for soils. H' revealed a higher bacterial diversity in soils collected close to the city center (S7, S8 and S9) than in soils from the less anthropized area, with exception of site 5 that was similar to the above-mentioned soils. DGGE profiles revealed differences in bacterial community structure among soils collected along the anthropogenic gradient, where they seemed to be influenced by the total concentrations of Zn, As, Cr, Cu, Ni, Pb without been translated into bacterial diversity decline.

Conclusion: Bacterial structure and diversity appeared significantly influenced by the anthropogenic inputs without being

systematically decreasing along the anthropogenic gradient.

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OCIII-21. The assessment of the effectiveness of three wastewater treatment systems by the genotoxicity test on *Vicia faba* roots

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Keywords: Wastewater, Activated Sludge, Natural Lagoon, Infiltration-percolation, Genotoxicity, Phytotoxicity, Risk Assessment.

Aims of the work: The assessment of a potential environmental contamination risk related to the use of wastewater in agriculture cannot be precisely assessed only through physicochemical evaluations. Therefore, ecotoxicological bioassays especially *Vicia faba* micronucleus test can be used as bioindicators to evaluate the genotoxicity of these effluents. In this study. Physicochemical, phytotoxicological and genotoxicological characteristics of wastewaters taken from three wastewater treatment systems (activated sludge, natural lagoon and infiltration-percolation) were performed to evaluate their treatment efficiency.

Methods: Physicochemical parameters (pH, electrical conductivity, TSS, COD, NH₄ and PO₄) were characterized for inlet and

outlet effluents of each station. Their phytotoxicity was determined through the germination index (GI) applied on two species: *Lactuca sativa* (lettuce) and *Lepidium sativum* (cress). Genotoxicity of wastewater effluents was assessed using the *Vicia faba* root tip micronucleus bioassay.

Results: The results showed that the physicochemical characteristics of treated wastewater were below Moroccan applied discharge and reuse standards. Activated sludge wastewater treatment showed excellent phytotoxicity elimination, with a germination index exceeding 100% for cress. However, a GI of less than 80% was obtained for the two studied species after treatment by treated water from infiltration-percolation and natural lagooning. Furthermore, the genotoxicity, determined by the frequency of micronuclei, decreased significantly after wastewater treatment. While a high genotoxic effect was obtained for all raw wastewater samples, the reduction in micronucleus frequency reached 100%, 89% and 80.5%, after treatment with activated sludge, infiltration-percolation, and natural lagooning respectively.

Conclusion: From this study, we concluded that *Vicia faba* micronucleus test is a very inexpensive, easy, sensitive and useful method, to quickly predict the genotoxicity. It can easily replace the physicochemical methods currently used to monitor the effective elimination of toxic substances in treated wastewater.

OCIII-22. Structure and diversity of bacterial communities in heavy metal multi-polluted soils in the region of Oujda (Morocco)

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Keywords: Mining sites, bacterial communities, diversity, PGP traits, heavy metals tolerance

Aims of the work: Pollution by heavy metals is a serious problem that exists all over the world and has serious consequences on the functioning of ecosystems. In the Mediterranean region, soils affected by this type of pollution are characterized by harsh environmental conditions. These conditions allow the emergence of new ecological niches in which certain pioneer microorganisms more adapted to these constraints can grow. The objectives of our study were to compare the soils polluted by heavy metals in three different sites and situations (rhizospheric soils of different plants species and non-rhizospheric soils). We compared and correlated the results of physico-chemical analyzes of the soils, the microbial biomass, the phylogeny and diversity of bacteria, as well as their biological activities.

Methods: More than 700 bacteria were isolated from three mining sites in the region of Oujda (East of Morocco). These isolates were tested for their tolerance to heavy metals (Pb, Zn, As) and a screening for their plant growth promoting activities was performed (nitrogen fixation, phosphate solubilization, auxine and siderophore production, etc). The best performing strains were identified at the molecular level (16S rDNA sequencing). The diversity indices and bacterial species richness index were calculated.

Results: The results showed large microbial diversity and higher diversified bacterial activities (PGP and tolerance to heavy metals) in rhizospheric soils compared to non-rhizospheric ones. The most abundant genera that were identified are *Bacillus* sp., *Arthrobacter* sp., *Stenotrophomonas* sp. and *Rhodococcus* sp. and they are the most performing strains with high PGP and tolerance levels.

Conclusion: The properties of bacteria described in this study could be a driving force for some essential soil metabolic processes and plants growth under the prevailing stressful conditions. Furthermore, the obtained data constitute a good scientific basis for the choice of bacteria to be used in rehabilitation programs in the studied contaminated ecosystems.

OCIII-23. The inoculation effect with rhizobacteria on *Medicago sativa* growth and physiology under heavy metals stress

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Keywords: rhizobacteria, *Medicago sativa*, bioremediation, heavy metals, PGP

Aims of the work: In recent decades, the problem of environmental pollution has been accentuated because of anthropogenic activities. This deterioration is coming from the diffusion of pollutants, especially heavy metals. Some living organisms have the means to counteract the toxicity of heavy metals and can tolerate large doses compared to others. The tolerance properties of these tolerant organisms (plants and / or microorganisms) can be exploited to restore contaminated sites with heavy metals. From this point of view, the expected objectives are: (i) to determine the effect of heavy metals on the PGP activities; (ii) to evaluate the impact of rhizobacteria on growth and physiological responses of *Medicago sativa* to heavy metals stress.

Methods: To reach the purpose of this study, PGP activities (AIA, phosphate and potassium solubilization and

exopolysaccharides production) were studied *in vitro* in the presence and the absence of heavy metals. Six treatments were used including the control to evaluate the effect of both heavy metals and inoculation with a bacteria consortium on growth and physiology of *Medicago sativa* under a greenhouse.

Results: The presence of heavy metals enhanced or reduced the ability of the isolates to exhibit PGP properties, depending on the metal nature and its concentration. The production of AIA by DSP1, DSP17 and RhOL8 strains was improved by the presence of Cu at different concentration range. On the other hand, the greenhouse results displayed that the inoculation of *M. sativa* with a consortium of bacteria alleviate the stress caused by heavy metal. We noted an improvement of the growth parameters evaluated by the shoot and root length, plant weight and number of leaves.

Conclusion: The relation metallo-resistant bacteria/ leguminous can be used as an instrument to remediate contaminated soils with heavy metals.

Acknowledgments: This work is financially supported by the project PPR2/2016/42, CNRST, Morocco.

OCIII-24. Biomonitoring of Norovirus GI and II in a wild lagoon by using bivalve mollusks as environment biomarkers

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Keywords: Environnement, Morocco, Norovirus, Real time RT-PCR, Molluscan bivalves.

Aims of the work: Noroviruses belonging to genogroups I and II (GI and GII) are the leading cause of human gastroenteritis in the world. Faecal-oral transmission is the main route of spread

among the population, while contamination of the environment occurs during the transport of contaminated water. Studies of environmental contamination by Noroviruses are routinely performed using bivalve molluscs.

Methods: Local clams (*Venerupis decussata*, n = 48 samples) and cockle (*Cerastoderma edule*, n = 48 samples) from the Moulay Bouselham lagoon were collected weekly for 12 months from September 2016 to August 2017. Bivalve mollusc samples were processed according to the protocol described in ISO / TS 15216-2 (standardized method for the detection of Norovirus GI and GII), then analyzed by OneStep RT-PCR in real time by using primers targeting a virus capsid protein for NoV GI and the RNA dependent RNA polymerase gene for NoV GII.

Results: 88.54% of samples showed good Efficiency regarding RNA extraction by using internal control. Positive results for. Samples spiked with the IC had Ct values between 35 and 38. While positive control for PCR process has showed Ct ranging between 28 and 35. This analysis showed the presence of Norovirus GII in 6.25% (3/48) clam samples, but in none of the cockle samples. Artificial contamination (inoculation of known amounts of *Mengovirus* or other viral material) is needed to control the viral extraction step and calculate the method performance, Genetic material has been detected in very low quantity so that make difficult to know the actual level of contamination of bivalve molluscs.

Conclusion: the presence of Norovirus in a wild lagoon indicates the circulation of wastewater not or badly treated in the studied area. A quantitative study on Norovirus contamination could provide information on the circulation of Norovirus strains in Moroccan aquatic environments and on hygiene conditions in wild areas.

TOPIC IV-

OCIV-1. Effect of essential oils incorporation on edible films against common foodborne pathogens

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Keywords: Bioactive packaging, food safety, essential oil, antimicrobial activity

Aims of the work : Essential oils (EOs) are well known by their antimicrobial and antioxidant activity and are capable of reaching pathogens through the liquid and the gas phase. The aim of this study is to evaluate the antimicrobial functions of an edible film incorporated with essential oils against common foodborne pathogens in order to develop new bioactive packaging with the potential to preserve and extend the shelflife of food products.

Methods: Edible films were fabricated using casting method by dissolving 4% of gelatin combined with pectin in distilled water. *Mentha pulegium* essential oil (MEO) and *Lavandula angustifolia* essential oil (LEO) were added to the mixture at different concentrations (0.5 and 1.5%). The antibacterial activity of the fabricated films was evaluated against four common foodborne bacteria (*Escherichia coli*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Listeria monocytogenes*) with the disc diffusion method.

Results: Results showed that all the films containing essential oils (EOs) had a high antibacterial activity against all the examined strains with *Pseudomonas*

aeruginosa as the most resistant. Furthermore, as the concentration of EOs increased, the diameter of inhibition zones increased significantly for all bacterial strains tested. It is also observed that MEO was more effective than LEO against all bacterial strains tested.

Conclusion: In conclusion, the incorporation of essential oils on the edible films fabrication can be considered as a way to enhance the bioactive functions of the packaging potentially destined to food preservation.

OCIV-2. Opuntia ficus-indica fruit: Alternative to Antibiotics Growth Promoters for Broilers

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Keywords: *Opuntia ficus-indica*, AGP, Oxytetracycline, Broilers

Aims of the work: The current study aims to investigate the ability of *Opuntia ficus-indica* (OFI) fruit to serve as a growth promoter food supplement for broilers. Through this study we tried to use the OFI fruit as an alternative to the antibiotic growth performance promoters (AGPs) view their public health risks.

Methods: One-hundred eighty male chicks of the Ross 208 breed were grouped into three experimental groups of 60 chicks each; the first group taken as a control (T group) was fed by classical basic diet, the second group (F group), fed by the same diet supplemented with crushed dried OFI fruit and the third Group (ATB group), fed by the same food but supplemented with Oxytetracycline as antibiotic growth

promoter. The four plate test (FPT) was used for the detection of the antimicrobial activity in tissues. Four different media were prepared, including *Bacillus subtilis* seeded at pH 6 TS agar, in order to detect Tetracycline/beta-lactams, *Bacillus subtilis* seeded at pH 8 TS agar for Aminoglycoside detection, *Micoroccus luteus* seeded at pH 7,4 TS agar for the detection of Sulfa-drug and *Micoroccus luteus* seeded at pH 8 TS agar, in order to detect Macrolides.

Results: According to the obtained results, we recorded a weight gain of 8% in the group of diet-fed broilers supplemented with the dried OFI fruit's mash, compared to the control group. Thus, a weight gain of 15% was presented by the second group. The tissues examination revealed that the antimicrobial activity was detected only in the ATB group's broilers tissues. All positive samples in our current study were detected from TS agar seeded at pH 6 with *Bacillus subtilis* and no activity was noted in the tissues from the other tested groups.

Conclusion: The diet based on the OFI fruit allowed both a weight increase in the treated group and a total absence of antimicrobial activity in the tissues. The integration of this fruit into the food formula as an alternative to the AGPs can minimize the risks presented by the residues of these molecules retained in the tissues.

OCIV-3. Phenolic content and antifungal activity of *Ficus carica* extracts against resistant *Candida albicans* strains

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Keywords: *Candida albicans*, fungal infections, polyphenols, *Ficus carica*, antimicrobial activity

Aims of the work: Fungal infections are of great interest due to the increasing

rates observed in patients with immunosuppression. Among the hospital-acquired infections are the filth leading cause for patients in the Intensive Care Unit. *Candida albicans* strains are one of the most common pathogenic fungi which are isolated at a proportion of approximately 80% from clinical samples. Since the administration of antifungal medication results in resistant strains, there is an urgent need to screen for new antimicrobial compounds.

Methods: The present study deals with the evaluation of the *in vitro* antimicrobial potential of four different extracts of two varieties (Azendjar and Taamriout) of dried figs (*Ficus carica* L.) by using two methods: Disk Diffusion Assay and Agar Well Diffusion Assay. Moreover, the extracts were investigated for their polyphenolic,

flavonoidal and tannin content by using the Folin–Ciocalteu assay, the aluminium trichloride method and precipitation with casein, respectively.

Results : The results showed that the highest Pronounced antimicrobial activity was observed by the methanolic extract of Taamriout variety. Moreover, the results showed that the phenolic compounds and flavonoids were abundant in acetone and aqueous extracts.

Conclusion: Our data suggest that the high content of phenolic compounds, flavonoids and tannins is responsible for antimicrobial activities. This work highlights the relevance of Algerian dried fig varieties as a part of the Mediterranean diet, as a healthy food stuff and as a source of antimicrobial agents to better human health and nutrition.

OCIV-4. Demonstration of the effect of antibiotic's alternatives on multidrug resistant *E. coli* strains *in vivo* and *in vitro* in broiler chicken in Morocco

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Keywords: Avian *Escherichia Coli*, multidrug resistant, essential oils, alternatives of antibiotics

Aims of the work: Colibacillosis is an infectious disease caused by the bacterium *Escherichia coli*, and is seen in poultry flocks worldwide. Avian colibacillosis primarily affects broiler chickens and is responsible for a significant proportion of the mortality found in poultry flocks. The present work aims to evaluate the action of a natural product (NP) based on essential oils on multidrug-resistant *E. coli* strains *in vitro* and *in vivo*, as well as the impact of this treatment on zootechnical performance in broilers.

Methods: *In vitro*, the technique that was used to perform the antibiogram for the 7 discs of antibiotics tested is the agar diffusion method (CA-SFM). As for the NP, its antimicrobial action was tested in solid medium by incorporation in the Mueller Hinton agar and in broth medium by the macrodilution method at different dilutions in order to determine the minimum concentration of inhibition (MIC). *In vivo*, the experiment was carried out on eight batches of 40 chicken each dispatched as follows: Treatment with NP and its association with amoxicillin; colistin using a therapeutic and subtherapeutic doses and with amoxicillin.

Results: The outcomes of this work has revealed a strong effect of the NP product on multiresistant strains of *E. coli in vivo* and *in vitro*. It also showed the development of antibiotic sensibility of the strains originally multiresistant taken from the NP-treated lots of amoxicillin and florfenicol. Finally, the clinical status of chicks treated with NP was the best comparatively to the other batches.

Conclusion: These results deserve to be further studied to guide breeding strategies and antibiotic therapy in this case

the use of alternatives based on natural products and essential oils.

OCIV-5. Antimicrobial, antioxidant and sun protection factor activities of leaves of *Marrubium vulgare*

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Keywords: *Marrubium vulgare*; antimicrobial; phenolic compounds; Antioxidant; SPF.

Aims of the work: The present study focused on the determination of the content of total phenolic content, antioxidant activity and antimicrobial activity and sun protection factor of hexane, dichloromethane and methanol extracts of leave of *Marrubium vulgare* collected in Meknes (Northeast Morocco).

Methods: The total phenolic content (TPC) in extracts was determined by using Folin-Ciocalteu (FCR), Total flavonoids were determined by trichlorure aluminium method. Tannins were determined by vanillin method. The free radical scavenging activity of extracts was evaluated using DPPH assay described by Blois (1958). The reducing power was determined by method of Oyaizu (1986), ABTS radical-scavenging activity by method of Re et al. (1999) and measurement of sun protection factor (SPF) was performed by method of Mansur et al. (1986).

Results: The methanolic extract had the highest phenolic and flavonoids contents with $106.55 \pm 5.62 \mu\text{g GAE.mg}^{-1}$ extract and $86.36 \pm 5.36 \mu\text{g QEs.mg}^{-1}$ extract respectively. The extract exhibited largest antioxidant activities, in DPPH (IC₅₀: $12.96 \pm 1.06 \mu\text{g.ml}^{-1}$), Metal Chelate (IC₅₀: $41.99 \pm 0.92 \mu\text{g.ml}^{-1}$) FRAP (A_{0.5}: $11.84 \pm 1.72 \mu\text{g.ml}^{-1}$). ABTS (IC₅₀: $8.63 \mu\text{g.ml}^{-1}$) compared to standards. Methanolic extract had also the highest SPF (39.16 ± 0.28). The inhibition zones diameters and

(MIC) values for tested microorganisms were in the range of 11–15 mm and 3.5–55 mg/ml, respectively.

Conclusion: This study aimed to investigate phenolic compounds and antioxidant activity in methanolic extracts of leaves of *Marrubium vulgare*. This plant may be considered as having remarkable pharmacological activities

OCIV-6. The antimicrobial effect of bacteriocinogenic activity, *Rosmarinus officinalis* essential oil and their combination against *Escherichia coli* O157:H7 in sausages

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Keywords: Bacteriocinogenic activity, Rosemary essential oil, Antimicrobial activity, Food preservation.

Aims of the work: The aims of this work was to prove the inhibitory action of bacteriocinogenic activity of two lactic acid bacteria *Enterococcus faecium* strains (isolated from table olive brines) in combination with *Rosmarinus officinalis* essential oil in sausages contaminated with *Escherichia coli* O157 a Gram-negative bacterium which is generally recognized as being insensitive to bacteriocinogenic activity.

Methods: Microbiological and physicochemical analyzes were carried out on 8 batches of sausages (treated with bacteriocinogenic activity and essential oil), of which 6 batches were inoculated (contaminated) with food-borne pathogenic bacteria, plus a negative control (not inoculated) and a positive control (sausages inoculated with the pathogenic strain) for 66 hours at 25 °C.

Results: The results expressed remarkable antibacterial effects up to 5

cycles of inactivation at the end of treatment when *Rosmarinus officinalis* essential oil was combined with lactic acid bacteria and bacteriocinogenic activity compared to the positive control.

Conclusion: The application of lactic strains and bacteriocins in combination with essential oil in sausages contaminated with *Escherichia coli* O157 showed interesting antibacterial activity and demonstrated the possibility of using different combinations of natural antimicrobial compounds to control effectively foodborne pathogens.

OCIV-7. Antimicrobial effect of three medicinal plants on 82 *Escherichia Coli* strains isolated from turkey meat marketed in the Kenitra city (Morocco).

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Keywords: turkey Meat, essential oil, *Escherichia Coli*, antibacterial activity, Kenitra

Aims of the work: Poultry meat contamination and the use of antibiotics in the poultry sector are a major public health issue. Including toxi-infection, antibiotic resistance and the presence of antibiotic residues in meat, which leads us to search for alternatives that can replace synthetic antibiotics and used as preservatives, to prevent the development of germs on the surface of food. Our objective was to study the antibacterial activity of essential oils (EO) of three medicinal plants on *Escherichia coli* strains isolated from turkey meat marketed in the Kenitra city.

Methods: *Mentha pulegium*, *Mentha spicata* and *Syzygium aromaticum* plants are purchased from the herbalist. EO was extracted by hydrodistillation, the antibacterial effect was evaluated by the diffusion method on solid medium.

Determination of MIC and MBC is based on the microdilution of EO.

Results: The EOs of three plants are characterized by a moderate yield. 7.18% for *Syzygium aromaticum* EO, followed by 2.33% for *Mentha pulegium* EO, then 1.98% for *Mentha spicata* EO which was reported as the low yield. All EOs reacted positively against the strains tested with different activities, the MIC and MBC are the same and the MBC/MIC ratio was less than 4 which shows a bactericidal effect of the EO tested.

Conclusion: In general, the antimicrobial activity of *Syzygium aromaticum* is greater with lower doses than that of *Mentha pulegium* and *Mentha spicata* which showed a moderate antibacterial effect with high MIC and MBC. It can then be seen that these essential oils can be used as a substitute for synthetic antibiotics and as a preservative for raw meat.

OCIV-8. Isolation of exopolysaccharides from coccal lactic acid bacteria

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Keywords: CLAB- EPS- sucrose-based medium- apparent viscosity- amount of EPS)

Aims of the work: consist to isolate and screen exopolysaccharides (EPS) producing strains of coccal lactic acid bacteria from natural environments of Algeria, in order to evaluate their capacity to produce these EPS and select the most performing strains.

Methods: Coccal lactic acid bacteria used in this study were isolated from two natural resources of Algeria (camel's milk and fresh red meat). These stains were evaluated for EPS production on certain solid medium and ruthenium red milk agar plate. Quantitative estimation of EPS was realized by measurement of apparent viscosity and determination of sugar and protein total in

these EPS, previously, extracted and purified from the various culture strains.

Results: Based on their EPS-producing colony phenotype in agar plates, five strains were chosen giving an important white-color with different capacities of production and a glistening and slimy appearance on sucrose-based media which was determined as the best for detecting the EPS. The amount of sugar in the polymer rendered more than 400 mg/L and the apparent viscosity ranged from 2.1 to 2.9 mPa.s. Therefore, no clear-cut relationship between the slimy phenotype, the medium viscosity occurs and amount of EPS produced by a ropy strain when different strains were compared. For protein assay, a low content of protein was obtained on crude polymer revealing the quality of EPS extracts.

Conclusion: Many CLAB stains were screened for the ability to produce EPS using the qualitative and quantitative analysis. Three strains were selected for their significant production of EPS, yielded an important amount of polysaccharide.

OCIV-9.Effect of *Cistus ladanifer* ethanolic extract on microbiologically influenced corrosion of 304L stainless steel caused by *Pseudomonas aeruginosa* biofilm

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Keywords: Microbial corrosion; 304L stainless steel; *Pseudomonas aeruginosa*; Pitting corrosion; Green inhibitor; Antibiofilm.

Aims of the work: Biofilms formed on metal surfaces are directly responsible for microbiologically influenced corrosion (MIC) because of their metabolic activities or secreted metabolites. MIC continues to be

a wide-spread environmental and economic problem in many industries and environments. Thus, the challenge is to mitigate MIC by using safe approaches such as antimicrobial, antibiofilm and anticorrosion natural products.

Methods: In this study, the effect of *Cistus ladanifer* ethanolic extract on microbial corrosion of 304L stainless steel in the presence of *Pseudomonas aeruginosa* was investigated. The biofilm viability and thickness, and the surface morphologies were examined under confocal laser scanning microscopy (CLSM) and scanning electron microscopy (SEM). For the electrochemical study, LPR, EIS and potentiodynamic polarization tests were performed to evaluate the corrosion behavior of 304L SS immersed in media with and without *P. aeruginosa* and the extract. Finally, the extract was characterized by HPLC-Q-TOF-MS.

Results: The data showed that *P. aeruginosa* formed biofilms on the surface which resulted in pitting corrosion of the 304L SS coupons with a maximum pit depth of 19.4 µm. Moreover, *C. ladanifer* extract was found to inhibit the bacterial growth and mitigate the biofilm formation. The electrochemical tests demonstrated the excellent MIC inhibition efficiency of the extract. Furthermore, the HPLC-Q-TOF-MS revealed the presence of different phenolic compounds in the investigated extract.

Conclusion: The data showed that the compounds from *C. ladanifer* extract exhibited a dual-effect; (i): antibiofilm effect against *P. aeruginosa* (ii) anti-MIC effect due to the adsorption of plant extract compounds on the SS surfaces.

OCIV-10. Antibacterial effect of some plant extracts against different Gram-positive and Gram-negative bacteria associated with nosocomial infections

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Keywords: essential oils, *P. aeruginosa* *S. aureus*, disk diffusion method.

Aims of the work: The aim of this study was to compare the antibacterial effects of some essential oils (EOs) against different Gram-positive and Gram-negative bacteria associated with nosocomial infections.

Methods: *Ocimum basilicum*, *Cymbopogon citratus*, *Melaleuca alternifolia* and *Origanum vulgare* EOs, were tested against six clinical strains: *Escherichia coli* A 48, *Staphylococcus aureus* S 143, *Pseudomonas. aeruginosa* A 13, *Klebsiella pneumoniae* A 18, *Acinetobacter baumannii* A 36 and *Salmonella typhimurium* F 3/8. The antibacterial activity of essential oils was evaluated using the disk diffusion method (10µl EO/disc). The minimal inhibitory concentration (MIC), and bactericidal concentration (MBC) was also Determined.

Results: Results indicated that essential oil of *O. vulgare* had antimicrobial effects on all tested bacteria. Inhibition zone was highest against *S. aureus* S 143 (44±12,72mm) and lowest towards *P. aeruginosa* A 13 (14, 5 ±2,121mm). The antibacterial effect of *O.basilicum* indicates that the most sensitive bacterium is *A. baumannii* A 36 (19 mm). However, *S. typhimurium* F 3/8 was resistant for which inhibition zone did not exceed 8, 5±0,70mm. *M. alternifolia* essential oil showed the highest inhibitory effect on *A. baumannii* A 36 (24 mm) and *E. coli* ATCC 35218 (20,5±0,70 mm). However, the *C. citratus* EO, revealed no inhibitory effect against all tested strain. The most sensitive bacterium was *A. baumannii* A 36, (12 mm) and *S. aureus* S 143(12±1.41 mm). According to the results of MIC and CMB, it was concluded that essential oils exhibited a bacteriostatic or bactericidal effect.

Conclusion: the present study indicates that *Melaleuca alternifolia* and *Origanum vulgare* EOs are most effective in inhibiting the growth of the microorganisms. The significant effect of these EOs suggests that plant extracts represents a good alternative to eliminate microorganisms that could represent a risk for human health.

OCIV-11 Evaluation of synergistic effect between antibiotics and some essential oils against *Escherichia coli* ATCC 35218, *Staphylococcus aureus* ATCC 29213 and *Pseudomonas aeruginosa* ATCC 278533

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Keywords: Essentials oils, antibiotics, interaction, *E.coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*.

Aims of the work: The aim of the study was to assess *in vitro* the synergistic effect between four essentials oils and some antibiotics against three reference strains: *Escherichia coli* ATCC 35218, *Staphylococcus aureus* ATCC 29213 and *Pseudomonas aeruginosa* ATCC 278533.

Methods: The essentials oils used in this study were *Ocimum basilicum*, *Cymbopogon citratus*, *Melaleuca alternifolia* and *Origanum vulgare*. The tested antibiotics for all combinaisons were Pénicilline, Aztreonam, Chloramphenicol, Amoxicilline clavulinic acid, *Vancomycin*, *Tetracycline* and *Ertapénème*. The synergistic effect between essentials oils and antibiotics was assessed by using disk diffusion method with 10µl of essential oils/disc of antibiotic.

Results: Results revealed that a significant increase of the antibacterial activity of the majority of antibiotics was

observed when they were combined with *Cymbopogon citratus*. The best synergistic activity was recorded between *Cymbopogon citratus* and Pénicilline against *S. aureus* ATCC 29213. The interaction between antibiotics and *Origanum vulgare* showed the strongest synergistic antibacterial activity with Pénicilline and Aztreonam on *S. aureus* ATCC 29213. But the antagonistic effect was observed against *E. coli* ATCC 35218 and *P. aeruginosa* ATCC 27853, when this oil was combined with the rest of antibiotics. In addition, synergistic activity was observed between *Ocimum basilicum* and most tested antibiotics. Only Aztreonam showed antagonistic activity. The oil of *Melaleuca alternifolia* showed synergistic effect on *S. aureus* ATCC 29213 when combined with Pénicilline. However, with the rest of antibiotics, this oil showed antagonistic activity.

Conclusion: The combination between antibiotics and essentials oils can be a good alternative in order to cope with infections resulting from drug-resistant bacteria and restore the currently unused clinical antibiotics due to the phenomenon of resistance.

OCIV-12. Chemical composition, antimicrobial and antioxidant activity of *Thymus leptobotrys* Murb essential oil in Morocco.

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Keywords: Essential oil, antioxidant activity, antimicrobial activity, *Thymus leptobotrys*.

Aims of the work: *Thymus leptobotrys* Murb is endemic Moroccan medicinal species that is intensively exploited from the wild because of their wide ranging therapeutic properties. So, this study aims to valorize and preserve these valuable medicinal plants in order to ensure their sustainable utilization: Extract the essential oil from the *Thymus leptobotrys* Murb. And determine its chemical composition and evaluate, in vitro, the antioxidant and antimicrobial activity of this oil.

Methods: The essential oil tested in the present study from the rural commune Taфраout, in Morocco, It was extracted by hydrodistillation at a low pressure and stored at 4°C before use. The chemical composition of essential oil was analyzed by CG-MS. The oil was investigated for in vitro antimicrobial activity against a panel of standard reference strains using well diffusion and broth dilution methods. The antioxidant activity was investigated by 1,1-diphenyl-2-picryl-hydrazyl (DPPH).

Results: The data showed that the carvacrol-rich oils (72.1%) obtained from *T. leptobotrys*. The essential oil was studied for its antimicrobial activity in vitro against five microbial strains from the European Pharmacopoeia. The essential oil was found remarkably active against all the strains tested, with the exception of *Pseudomonas aeruginosa* that was insensitive. In a liquid medium, the minimum inhibitory concentrations (MIC) and the minimum bactericidal / fungicidal concentration (CMB) were 0,23 and 0,28 mg / ml respectively. The antioxidant activity was studied by Determination of radicals (1,1-diphenyl- 2-picryl-hydrazyl (DPPH)). The results of this study reveals that the essential oil have a strong antioxidant activity starting from the concentration of $25,37 \pm 0,09$ µg/ml, due to the various phenols present in the oil.

Conclusion: The conclusion drawn of these results, the medicinal value that *Thymus leptobotrys* can offer as a source of

biomolecules potentially required in the food industry and in the pharmaceutical field.

Poster communications

TOPIC I-

P.1. Effect of *Trichoderma* sp against of pathogen agents of BDA grapevine cankers

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Keywords: Antagonist activity, *Botryosphaeria* sp., Hydrolytic enzymes, FTIR. *Trichoderma* spp.

Aims of the work: The objective of this study is to evaluate the efficacy of an antagonist agent: *Trichoderma* spp. against three pathogenic fungal species belonging to the family Botryosphaeriaceae.

Methods: The fungal strains tested in this study are: the antagonist agent *Trichoderma* sp, family Hypocraceae and three species responsible for vine dieback belonging to the genus *Botryosphaeria* their identity was confirmed on the basis of morphological characters, cultural and molecular analysis, using universal primers: Internal Transcribed spacer (ITS 1 and ITS4). To detect functional groups of secondary metabolites, an FTIR spectral analysis, Fourier Transformed Infra Red Spectroscopy (Fourier Transformed Infrared Spectroscopy); it is made from filtrates of *Trichoderma* sp. Using the Opus software from TENSOR II / BRUKER. The antagonistic action of *Trichoderma* sp on the mycelial growth of pathogens is carried out according to two methods: direct confrontation, indirect (remote) confrontation through the production of volatile substances.

Results: The results of this study showed that the *in vitro* application of *Trichoderma* against pathogens had significant antagonistic activity by direct or indirect confrontation and by the culture

filtrate where it significantly inhibited mycelial growth of all pathogens tested with a variable percent inhibition (19% to 62% versus controls). Microscopic observations at the contact zone showed mycoparasitism, vacuolation and lysis of the hyphae of the pathogen. This study revealed the ability of *Trichoderma* to act by antibiosis against Botryosphaeriaceae by releasing volatile and nonvolatile active substances on mycelial growth. In order to identify the nature of the active substances of the tested antagonist, a chemical analysis was carried out by the FTIR method and it revealed 25 functional chemical groups by the dominance of acids, alkanes, alcohols, phenols, aromatic groups, carboxylic acids, amides and lactams.

Conclusion: In this context, biological control of causative agents of withering with antagonistic fungi appears to be a promising alternative to the use of fungicides.

P.2. Using bio-fertilizers for mitigation of effects of salt stress on the growth of seedling alfalfa

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Key words: Salinity, Lucerne, PGPR inoculation, solutes organic, mineral accumulation, bio-fertilizers.

Aims of the work: This study was carried out to investigate the effects of bio-fertilization by plant growth promoting rhizobacteria on the salt tolerance of lucerne (*Medicago sativa* L.).

Methods: The effects of inoculation with *Sinorhizobium meliloti* and other rhizospheric bacteria were investigated in a greenhouse pot experiment. At vegetative

growth, photosynthetic pigments, mineral content (Na^+ , K^+ and NO_3^+) were monitored after six weeks of culture. Also, leaf samples were analyzed for relative water content (RWC), proline, total soluble sugars and soluble proteins.

Results: Bacterial inoculation positively affected growth parameters. Conversely, increasing salinity reduced significantly alfalfa growth, leaf area and chlorophyll content, however, it resulted in an increase in the total soluble sugars, proline, soluble proteins contents and mineral uptake.

Regarding to inoculated plants, salinity affected negatively growth parameters which remained better than without bacterial inoculation. Sodium content was more reduced in leaves under co-inoculated conditions than after single inoculation, this supposes that Na^+ ions were confined by used bacteria.

With regard to others parameters, this study indicated clearly that under salt stress plants with higher leaf area, total proteins, chlorophyll contents and unaffected IAA production were more tolerant to salt stress as compared to the plants with lower values for these attributes.

Conclusion: These results indicate that all inoculation with *Sinorhizobium meliloti Sm78D and 104* and especially co-inoculation at proportion 1/2 could alleviate the adverse effects of soil salinity on lucerne growth suggesting these bio-fertilization could be used as a novel biotechnology for increasing productivity in arid and semi arid area.

P.3. The impact of intercropping and co-inoculation with PGPR strains on yield, phosphorus and nitrogen content of wheat and faba bean.

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Keywords: PGPR, intercropping, *Triticum aestivum*, *Vicia faba*, nitrogen, phosphorus.

Aims of the work: Intercropping is a farming practice that fights pests, diseases and improves plant growth. Inoculation with PGPR strains solubilizing phosphate for intercropped plants is a promising tool to boost the crop yield. The aim of this study was to evaluate the impact of simple and co-inoculation with PGPR strains on plant biomass, phosphorus and nitrogen content in intercropping system.

Methods: Greenhouse experiment with 12 treatments was designed, included treatments of cropping wheat or faba bean alone, and treatments of cropping wheat with faba bean. Each cropping system was simple inoculated with PGP13 or PS11 or co-inoculated with the two PGPR strains, in addition to uninoculated control. First of all, *in vitro* tests of nitrogen fixation, of phosphate and potassium solubilization were performed to the strains.

Results: Our finding indicated that both strains are free nitrogen fixers and they solubilized phosphate and potassium with a higher SI recorded to PGP13. Moreover, the strains produced significant amounts of IAA, exopolysaccharides, and siderophores. The greenhouse experiment showed that the simple inoculation improved the dry matter, phosphorus, and nitrogen content in shoots, roots, as well as in the fruits of *V. faba* and *T. aestivum*. Nevertheless, these parameters become more pronounced if wheat and faba bean were intercropped and co-inoculated.

Conclusion: the inoculation with the strains possessing strong PGPR potentialities is an important condition to guarantee a better yield in the intercropping systems.

P4. Etiological and epidemiological study of wood disease of the citrus in Algeria

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Keywords: Algeria, Decline, Epidemiology, Etiology, Biological Control, Citrus

Aims of the work: The objective of this work was to assess the state of decline of *Citrus* in the Mitidja region and the identification of the pathogens involved. In this context, our research objective was to carry out a study on the decline of the *Citrus* on the epidemiological and etiological aspects.

Methods: The epidemiological survey concerned two orchards; located in Mitidja, the severity of the decline (incidence, infection rate and severity index of the decline). The method used to assess the impact of decline disease on each orchards consists of an evaluation of the sanitary status of each tree according to a gradual ranking scale using five classes as follows: no symptoms = class 1, symptoms on herbaceous organs (Leaf necrosis, stunting and / or foliar destruction)= class 2, partial dieback = class 3, total decline class 4 and dead vines = class 5.

In a second step, etiological study and identification of fungal pathogens were performed. Molecular identification by using two primers: Internal Transcribed Spacer ITS1 primers ITS1 (5'-TCCGTAGTGAACCTGCGG-3') and ITS4 (5'-TCCTCCGCTTATTGA TATGC-3'), were conducted to identify the fungal agents associated with disease of *Citrus*.

Results: The results of symptomatology diagnostics revealed the presence of various categories of symptoms in almost all surveyed orchards. These are the total dieback situations and / or partial (one or more dead arm), the most characteristic symptoms were expressed in

forms necrosis wood of several types (sectorial brown colored, central necrosis sectorial gray and light-brown central necrosis. It was also possible to detect the presence of the fungal genera *Fusarium* sp (35%), and *Botryosphaeria* (65%). The identification of fungal flora was confirmed by Internal Transcribed Spacer ITS2 and ITS4 molecular analysis. Research in the gene bank (Gen bank) (NCBI) showed that the ITS sequences gene of *Botryosphaeriaceae* isolates have 99-100% of homology with *Botryosphaeria dothidea*.

Conclusion: Our results represent the report on the presence of Black dead arm associated *Botryosphaeriaceae* in Algeria

P.5. Mycorrhizae enhance growth and development of date palm (*Phoenix dactylifera* L.) micropropagated plants after ex vitro transplantation

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Keywords: Arbuscular mycorrhizal fungi (AMF), Date palm (*Phoenix dactylifera* L.), Ex vitro conditions, Symbiosis, Vitroplants.

Aims of the work: Successful conditioning of *in vitro* grown plants under *ex-vitro* conditions and field transfer are the majors' challenges for successful micro-propagation methods. Improper acclimatization may cause death of large numbers of vitro-plants as a result of change in environment conditions. In fact, substantial numbers of *in vitro* cultured plants do not survive transfer from *in vitro* conditions to the greenhouse or field environments. Nowadays, arbuscular mycorrhizal fungi (AMF) have attracted a great interest and it is generally accepted that they can enhance plant tolerance to harsh

environments, showing thereby a real potential to promote acclimatization, establishment and survival of *in vitro* cultured plants. These microorganisms have been successfully used to increase the endurance of several plant species during the acclimatization process. In fact, AMF enhanced host plants' autotrophic and nutrients status during the transition to *ex-vitro* conditions. They also positively influenced their growth and development after field transplantation (Stancato and Silveira, 2010). The aim of this study is to access the AMF effectiveness in increasing micropropagated date palm performance in terms of growth and survival after *ex vitro* transplantation.

Methods: Local strains of arbuscular mycorrhizal fungi previously identified and multiplied, in the laboratory of plant biotechnology and agro-physiology of symbioses, were used to inoculate two varieties of date palms (Boufeggous and Nejda) during the *in vitro* acclimatization stage. After six months of culture under semi-controlled conditions, mycorrhizal parameters (%F, %M), growth parameters and the survival rate were determined.

Results: After six months of growth, mycorrhizal micropropagated plants showed a significant increase in their growth expressed as shoot height, number of leaves and biomass production (fresh and dry weights). More than 70% of *in vitro* mycorrhizal plants survived and grow vigorously, showing improved growth and biomass production, after *ex-vitro* transfer. While, less than 50% of the non-inoculated plants have survived this critical stage.

Conclusion: These results highlight the importance of arbuscular mycorrhizal fungi in enhancing growth and establishment of *in vitro* regenerated plants of date palm when transferred to *ex vitro* conditions.

P.6. Molecular and proteomic characterization of *Leuconostoc*

mesenteroides isolated from Algerian raw camel milk.

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Keywords: Genomic- MALDITOF MS-MS, camel milk, *Leuconostoc*, Probiotique.

Aims of the work: The majority of researches on camels focused principally on their anatomic characteristics and physiological adaptation for desertation, however, information on camel milk is very limited. For these reasons we suggested in the present work a molecular characterization and evaluation of the genetic variability and a proteomic identification of thirteen (13) putative producing bacteriocin *Leuconostoc* strains exhibiting anti-listerial activity, with a view to elucidate their potential application as additives in raw food destined for human consumption.

Methods: DNA sequencing of the 13 selected strains revealed high homology among the 16S rRNA gene for all strains. In addition, 99% homology with *Leuconostoc mesenteroides* was observed when these sequences were analyzed by the BLAST tool against other sequences from reference strains deposited in the Genbank. Furthermore, the isolates were characterized by Matrix-Assisted Laser Desorption/Ionization Time of Flight Mass Spectrometry (MALDITOF MS) which allowed for the identification of 2 mass peaks 4442.78 m/z and 5117.81m/z that resulted to be specific to the species *Leuconostoc mesenteroides*.

Results: Remarkably, the phyloproteomic tree provided more intra-specific information of *L. mesenteroides* than

16S rRNA-based phylogenetic analysis. Thus, phyloproteomic analysis allowed to group *L. mesenteroides* strains into different sub-branches, while all *L. mesenteroides* isolates grouped in the same branch according to phylogenetic analysis.

Conclusion: This study represents to our knowledge, the first report on the use of MALDITOF MS on the identification of LAB isolated from camel milk. Give conclusion not ascertainment.

P.7. Microbial inoculation effect on the *Medicago arborea*'s growth

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Keywords: *Environmental protection, inoculation, microorganisms, selection, leguminous, symbiosis.*

Aims of the work: The microorganism biodiversity plays a key role on the environmental balance. To fight against the environmental degradation, the use of a rehabilitation process is required. Mainly the process that consist on the use of methods improving the soil quality and the ability of species planted to resist to the environmental constraints and by the way to provide nutrient fodder for animals. Since *Medicago arborea* is known by its valuable potential as fodder shrubs in the Mediterranean countries due to its use by small ruminants. The plant biomass is affected by agronomic and environmental factors. This work aims to evaluate the response of *Medicago Arborea* to the microbial inoculation.

Methods: In the present study, the effectiveness of the strains, isolated from diverse soils of Meknes region, was assessed on applying them as inoculums. We have evaluate their effects on the growth of *Medicago Arborea*. Furthermore, we have select the strains able to establish a symbiosis relationship with *Medicago*

Arborea. For that, many parameters were evaluated principally: the plant height, the weight of aerial part and of the roots, the leaves number and the nodules numbers.

Results: The application of the different strains as inoculums to *Medicago Arborea* increase its growth. Three applied strains nodulated *Medicago Arborea*. However, seven others have shown no nodulation.

Thus, the strains that nodulate *Medicago Arborea* have shown an important effect, on the different parameters: the height and the plant biomass, comparing to the other seven strains, which were unable to nodulate our leguminous.

Conclusion: The response of *Medicago Arborea* to the inoculation was important. A positive effect have been shown for the plant growth mainly for the strains that nodulate the plant. These results lead us to realize the same study in the field (diverse sites from where the nodulating strains were isolated) to evaluate the adaptability of our leguminous shrub.

P.8. Study of the variation of microbial biodiversity and dynamics of organic matter (OMS) of a cultivated soil under semi-arid conditions (Tiaret city, Algeria)

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Keywords: *Microbial biodiversity / organic matter / soil / rhizosphere.*

Aims of the work: Microbial biodiversity covers all soil microorganisms; MOS is the main source of energy and nutrients for these organisms. Knowing that our soils testify a clear need to quantify the microbial population and its fluctuations, it is in this context that our study is inscribed with the aim of a better knowledge of the fields of

interactions between microbial biodiversity, the organic matter soil and environmental conditions.

Methods: The density of microbial germs was determined by the indirect method and the organic matter through organic carbon which is determined

Results: The results saved according to the different vegetative stages of wheat growth: at time T1, a relative microbial biomass of 12295.08.106 germs / gram of soil and 2.5% is recorded of MO), then a decrease of this in T2 corresponds to (3531.92.106germs / gram of soil and 1.7% of MO). In T3, it is clear that the increase in microbial density is maximal (120448.106germs / gram of soil and 5% MO) coinciding with the tillering stage when the living roots supply energetic substances to their environment. It is found that in T4, the density decreases reaching (631.68.106germs / gram of soil and 6.5% MO).

Conclusion: So the presence of wheat in the soil has a stimulatory effect for microbial biomass on the one hand as autotrophic organisms because these microorganisms meet their energy needs by the degradation of carbon products from photosynthesis and on the other hand contributes to the maintenance of OM in soils.

P.9.Characterisation and evaluation of antagonistic bacteria and essential oils in the management of olive knot disease caused by *Pseudomonas savastanoi* pv. *savastanoi*

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Keywords: *P. savastanoi* pv. *savastanoi*, olive knot disease, biocontrol, antagonistic bacteria, essential oils.

Aims of the work: Olive knot disease caused by *Pseudomonas savastanoi* pv. *savastanoi* (PSS) is considered one of the most serious diseases affecting olive trees (*Olea europaea* L.) in most olive growing regions worldwide and mainly in Mediterranean countries. This disease can lead to severe damage in olive groves. Prevention is considered as the only reliable strategy to limit the disease. Naturally occurring antagonistic microorganisms or natural products such as essential oils with capacity to suppress *P. savastanoi* pv. *savastanoi* are of great importance. The main aim of this work was to evaluate the effects of antagonistic bacteria and essential oils to control pathogen strains previously isolated from olive trees in Morocco.

Methods: *in vitro* efficiency of 18 antagonistic bacteria and four essential oils as biocontrol agents against the pathogen was assessed and *in planta* experiment were conducted under greenhouse by using *Bacillus subtilis* (2515-1) as effective biocontrol agent against two strains.

Results: *In vitro* experiments revealed that many bacterial strains such as *Rahnella aquatilis* and *Bacillus subtilis* selected from collection of Regional Center of Agronomic Research were efficient on solid media against pathogen strains. *B. subtilis* 2515-1 was selected for pots experiment using olive trees (cv. Arbequina). This bacterium significantly reduced number and weight of knots of two pathogens strains (PSS 2064-8 and PSS 2102-4). Also, essential oils (EO) *Thymus ciliatus* and the *Origanum compactum* exhibited *in vitro* inhibition of *P. savastanoi* pv. *savastanoi*

strains. Their inhibition rates were respectively 56.25 % and 50%.

Conclusion: The use of these antagonistic bacteria as biological control agents against PSS could be a promising tool to reduce olive knot incidence on olive crops.

P.10. *In vitro* PGP, amylolytic and proteinolytic activities of *Bacillus* isolated from a soil in Algeria

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Keywords: *Bacillus*, PGPR, soil, temperature

Aims of the work: This study aims to characterize isolates of *B. cereus* from soil for a better appreciation for their potential plant growth promoting (PGP), such as IAA production, phosphate solubilization, starch hydrolysis and proteolytic activity.

Methods: Isolation was carried out from several soil plots in South-Western region of Algeria from different areas. Serial dilutions were heated at 80°C for 10 min to eliminate vegetative cells and to select for spores. A total isolates of *B. cereus* group, were isolated according to adequate protocols. The effect of temperature on the maximal specific growth rate of *Bacillus cereus* was studied. Identification via phenotypic approach by hemolytic activity, inability to utilize mannitol, and the production of an extremely active lecithinase and other biochemical characterizations of isolates are tested using the API 20E. In addition, the characterization of their PGP activities was carried out *in vitro* (indole acetic acid (IAA) production, phosphate solubilization) in addition to their amylolytic and proteolytic activity,

Results: A total of 36 was isolated, presumably belonging to *Bacillus*. The isolates showed growth at 15°C to 45°C. The preliminary phenotypic characterization showed a low diversity of isolates and dominance in the soil of a specific type, *s.* The ability to solubilize precipitated phosphate was positively exhibited by three isolates and five isolates showed ability to produce IAA. All the bacterial isolates (36) had amylolytic and proteolytic activity.

Conclusion: The preliminary results of this study showed the presence of a group of ubiquitously facultative anaerobic spore-forming in soil. The present study was conducted to identify, characterize *Bacillus* isolates. These strains have *in vitro* PGP traits and could be used to affect positively plant growth and plant health.

P.11. Root symbiosis and phosphorus in the rhizosphere of oleaster (*Olea europaea* ssp. *sylvestris* L.) in degraded soil of Tizi Rached (Algeria)

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Keywords: *Oleaster*, *Mycorrhizal*, *Endophyte*, *Phosphorus*, *Soil*

Aims of the work, : The over exploitation of the natural resources has an increasing need of soils which gives rise to its disfunctions. The symbiotic microorganisms are known for being the key components in the function of the principal biogeochemical cycles, especially phosphorus. Among the plentiful natural resources in the damaged medeteranean territories, oleaster is an example. The purpose of this work is to put in evidence the eventual root symbiosis. Complete the sentence.

Methods: The rootlets were taken from seven subjects according to four depths of ten centimeters among oleaster population

within a damaged soil situated in north Algeria. The observation of root fragments colored by the technique of Philips and Hayman marked the presence of structures which characterizes mycorrhizal arbuscular and dark fungus septate on all the fixed blades.

Results: The calculation of the frequency of colonization by the methodology of Nicolson (1955) revealed that the colonization rate is high and varied between 46 and 99% at the level 0-10cm and 6 to 66 at the level of 30-40cm. Concerning the studied soils, they showed low levels in organic carbon and phosphorus. Those results explain the high frequency of mycorrhization and a significant presence of dark septate endophyte.

Conclusion:

P.12. Standardization and application of a novel starter culture for fermented vegetables and fruits.

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Keywords: starter culture, vegetables and fruits fermentation, *Lactobacillus amylovorus*, *Candida guilliermondii*, olives, lemons, carrots.

Aims of the work: Controlled fermentations using starter culture allows better control of the fermentation process and prevent the spoilage of non desirable microorganisms. The aim of this work was the application of a suitable selected starter culture with a minimum of microorganisms for fermented lemons, carrots and olives.

Methods: Evaluation of spontaneous fermentation of some plant material at different concentrations of salt provides an interesting starter culture. Selection of strains for microbial inoculum focused on technological criteria such as rapid acidification, the growth in low pH and tolerance of a high concentration of salt (10%). A total of twenty five indigenous

lactic acid bacteria (LAB) and yeasts were isolated from spontaneous fermented plant material. Among these twenty-five isolates *Lactobacillus amylovorus* and *Candida guilliermondii* were selected and identified. Controlled fermentations were conducted with the selected strains at 10% of salt. The parameters measured were cell counts (yeasts, lactic acid bacteria, FMAT, coliforms), contents of organic acids, pH and temperature.

Results: The results showed that the Controlled fermentation allowed us to reduce the time of fermentation. The content of organic acids increased with time to reach at the end of fermentation: 1.2% for fermented carrots, 1.1% for fermented olives and 2.1% for fermented lemons. The pH dropped with time from 7,00 to 3,9 after 28 days for olives, from 7.00 to 2.95 after 21 days of fermentation of carrots and from 7.00 to 2.1 for fermented lemons after 28 days. *C. guilliermondii* and *L. amylovorus* used for the first time as a starter culture for different products with different specifications allowed us to obtain stable products for 12 months. Coliforms were absent after a few days of fermentation, mesophilic flora strains were present at a low rate. Homogeneous and satisfactory final hygienic quality was obtained.

Conclusion: Final pH values, acid development and hygienic quality support the potential of *Lactobacillus amylovorus* and *Candida guilliermondii* as a starter culture. The results may lead to industrial applications.

P.13. Effects of arbuscular mycorrhizal fungi on physiological and biochemical responses to drought stress and recovery of the carob tree (*Ceratonia siliqua*)

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Keywords: Carob tree (*Ceratonia siliqua*); drought stress; physiology; biochemical; rehydration; tolerance.

Aims of the work: The present experiment was carried out to get more insight into the influence of arbuscular mycorrhizal fungi (AMF) on the physiological and biochemical aspects of carob tree during drought and rehydration periods.

Methods: An experiment was conducted on two series of carob tree plants: non-mycorrhizal (NM) plants and AMF plants. Then, plants aged 6 months, were subjected to drought stress by cessation of irrigation for 30 days followed by rehydration for 4 days.

Results: The obtained results showed that drought stress significantly decreased the stomatal conductance (gs) as well as relative water and proteins contents in mycorrhizal and non-mycorrhizal plants. However, the AM plants exhibited increased performance in terms of physiological (gs and RWC) and biochemical (proteins) parameters compared to NM plants. The recovery of plants as a response to rehydration, was significant and rapid in AMF plants compared to NM plants.

Conclusion: AMF strengthened the mechanisms involved in drought tolerance of carob plants by improving the physiological and biochemical parameters. Likewise, recovery of mycorrhizal plants is rapid in response to rehydration.

P.14. Use of *Cactus* rhizospheric microbiome to rescue grapevine rootstock performance under climate change conditions

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Keywords: *Cactus*, grapevine rootstock, rhizobiome, climate change

Aims of the work: The effect of a consortium of AMF and PGPRs contained in

the rhizospheric soil of cactus and collected from the different bioclimatic stages in Tunisia is applied to improve the tolerance of grapevine rootstock to abiotic stresses. The rootstock is the American rootstock 140Ru which is widely used in Tunisian vineyards owing to its capacity of tolerance to salinity and drought. However, due to the climate change effects during the last decades and to the deterioration of the soil fertility, the efficacy of this rootstock is more and more compromised and alternative rootstocks are claimed by farmers.

Methods: Two months old plants of the rootstock 140Ru were inoculated with a rhizospheric soil sampled of cactus (*Optunia ficus indica*). This rhizospheric soil revealed to be rich in arbuscular mycorrhizae and PGPR and is supposed to improve the performances of this grape rootstock and promote its use for longer time under prevailing climate change conditions. Inoculated and control plants were cultivated under greenhouse (70% humidity, 25-28°C, 14-16h photoperiod) and subjected to salt stress, phosphorus limitation and water shortage. Growth, water and osmotic potentials, root and leaf physiological parameters were monitored during the different stresses.

Results: Stomatal conductance measurement of stressed sample versus control sample demonstrated that the stomatal conductance of the inoculated samples were significantly less affected by the different stresses and particularly under drought stress. In addition, the leave physicochemical measurements showed that the leaves of the inoculated rootstocks absorb three time less of Na as compare to control samples and their uptake of N, P and K was not impaired. The high increase of intensity and abundance percentage of AMF was observed in the treated inoculated rootstocks by phosphorus deficiency which is the evident benefic effect of AMF role on the regulation of phosphorus uptake and utilization. However, these percentages were significantly decreased in the early

inoculated rootstocks during salt and drought stresses.

Conclusion: The analysis of our physiological and phenotypical results suggested that grape rootstocks exhibited considerable variations in the salinity, drought and Phosphorus deficiency tolerance as evident from relative shoot length, total fresh weight of shoot and root biomass, stomatal conductance and net photosynthesis rate. The tolerant rootstocks were those inoculated and exhibited high growth and high total fresh matter accumulation as compare to the plants controls. These findings consolidated the idea that stress specific cacti microbes are important in sustainable agriculture because they improve plant water relations and drought resistance of host plants.

P.15. Enzymatic and antimicrobial potentialities of Actinobacteria isolated from extreme ecosystems

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Keywords: *Actinobacteria, extreme ecosystems, extracellular enzymes, antagonism.*

Aims of the work: Actinobacteria isolated of extreme ecosystems allow the discovery of strains which have high and unexploited potential production. The bioactive potential of Actinobacteria isolated from the stones and monuments of an archaeological site (Djemila) and the sand of Sebkha (Melghir) was determined by the detection of their enzymatic and antimicrobial activities.

Methods: In this study, the strains were isolated, from the two sites on GYM *Streptomyces* and Luedmann media. Enzyme activity was performed on different specific culture media for each enzyme. The antimicrobial activity was performed by the

agar cylinder technique against three bacteria and five fungi test. Molecular identification was performed by 16S rRNA gene sequencing.

Results: A total of 79 isolates of Actinobacteria showed a large diversity (form and pigmentation). The strains had at least one or more hydrolytic enzymes. They produced xylanase (60,29%), cellulase (48.10%), glucanase (45,58%), amylase (45.56%), chitinase (54.43%), tyrosinase (35,29%) and protease (21.51%). Furthermore, 17.72% of strains hydrolyzed gelatin, Tween 20 (68.35%) and 80 (44.30%). The antifungal activity showed that 48.52% of the actinobacteria were active against test fungi (*Botrytis cinerea*, *Alternaria alternata*, *Phytophthora infestans*, *Fusarium solani*, *Fusarium oxysporum* f. sp. albedinis) but only eight strains showed activity against *Staphylococcus aureus*. The phylogenetic analysis based on PCR amplification of the 16S rDNA partial sequence revealed that the strains belonged to many genera: *Streptomyces*, *Arthrobacter*, *Kocuria*, *Micromonospora*, *Geodermatophilus*, *Cellulomonas*.

Conclusion: These results showed that the unexplored ecosystems harbor previously undescribed Actinobacteria with the capability to produce diverse metabolites that may be explored for application in biotechnology.

P.16. Mesorhizobium gobiens and Mesorhizobium tamadayense species are symbionts of chickpea (Cicer arietinum L.) in eastern Algeria

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Key words: diversity, *Mesorhizobium*, 16S rDNA, *recA*, *IGS*, *nifH*, *nodC*, chickpea.

Aims of the work: The aim of this work is to examine nodule bacteria in chickpea for their diversity and biogeography, by examining the effect of the physicochemical characteristics of different soils on their distributions on the various prospected sites.

Methods: These bacteria were isolated by trapping from the root nodules of chickpea, grown in soils from nine sites in eastern Algeria. In addition to their different climates, the soils have undergone a physicochemical characterization. Contents of available nitrogen and carbon were analyzed at the IRD Analytical Laboratory in Dakar, Senegal (ISO 9001 certified). pH was measured using 10 g sample/100 ml water. Texture was resolved by the Eastern Civil Engineering Laboratory (Constantine, Algeria).

Results: Molecular analysis which concerned the sequences of five DNA fragments: *rDNA16S*, *recA*, *IGS (16S-23S)*, *nodC* and *nifH*, showed that the genus *Mesorhizobium* is present in nodules of chickpea with great diversity. Within this genus, at least 5 different known genospecies are present (*M. ciceri*, *M. amorphae*, *M. gobiense*, *M. opportunistum* and *M. tamayadense*). Among these species, *M. gobiense* and *M. tamayadense* are, for the first time, chickpea symbionts. In contrast to the *rDNA16S*, *IGS* and *recA* sequences that exhibit sequence molecular diversity, the symbiotic diversity is low. This could reflect an acquisition within these species of symbiotic genes by lateral transfer.

Conclusion: The obtained results open possibilities for the use of bacterial strains with a broad spectrum for the selection of reliable symbiotic partners for the improvement of the culture and yield of chickpeas.

P.17. The co-application of the bio-organic fertilizer chitosan and AMF increases the growth of tomato plants through the uptake of nutrients less available in the soil

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Keywords: Chitosan, arbuscular mycorrhizal fungi, tomato plant, nutrient deficiency.

Aims of the work: is providing sufficient range of nutrients in order to solve the problem of the poverty of Moroccan soils on nutrients and organic matter and to maximize growth without any physiological disorders. This study evaluates the impact of the combination of chitosan and arbuscular mycorrhizal fungi (AMF) on the growth, histological and physiological parameters of vegetable crops.

Methods: In this experiment, we used chitosan that was locally produced from the shells of *Parapenaeus longirostris* as well as a complex of AMF isolated from Tafilalet palm grove to ameliorate the growth of tomato plant (*Solanum lycopersicum*) growing in a soil deficient in mineral elements and organic matter.

Results: After 12 weeks of growing, our experiment indicated that chitosan combined with AMF was efficiently improved the root length, fresh and dry weight of shoot and root, leaf area, quantum yield, xylem vessel and diameter of stem compared to control plants.

Conclusion: The co-application of chitosan and AMF was increased the tolerance of plants to nutrient deficiency through the utilisation of chitosan as a source

of carbohydrate and nutrients to increase the establishment of the fungi as well as the plant.

P.18.Diversity of bacteria nodulating three species of Lupine in Maamora forest in Morocco

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Keywords: *Lupinus-Rhizobium-nodC-ARDRA-Siderophores-AIA.*

Aims of the work: Wild species of *Lupinus* occur naturally in the Mediterranean region, whereas Northern Africa. They are usually used as green manure because of their ability to establish a nitrogen fixing symbiosis with soil bacteria called rhizobia. Our work focuses on the evaluation of the biodiversity of bacteria nodulating lupines in the Maâmora forest, in the area of Rabat, Morocco.

Methods: seventy-one bacteria were isolated from the root nodules of *Lupinus albus*, *L. cosentinii* and *L. luteus*, grown in the soil of Maamora forest. The phenotypic study consisted in analyzing 75 physiological and metabolic parameters. The genetic analysis consisted in a rep-PCR, as well as the search for nodulation genes by amplification of the *nodC* gene using specific primers. For the ribotyping, we performed the ARDRA method using 5 restriction enzymes.

Results: The rep-PCR revealed a very high genetic diversity between the isolates, with 50 different profiles and all the representative strains do possess the *nodC* gene. The ARDA allowed the classification of the isolates into three main different ribotypes. The sequencing of 16S rDNA from 3 strains representing the 3 ribotypes showed that they belong to three different

species of the genus *Bradyrhizobium*. Furthermore, the strains were evaluated for their PGPR activities such as phosphate solubilization, siderophore and indol acetic acid production. Some strains were able to solubilize phosphate and produce siderophores and AIA as well.

Conclusion: Our results showed that the three species of lupines is nodulated by slow growing rhizobia belonging to *Bradyrhizobium* genus. Furthermore, the strains showed a very high diversity in physiological and PGPR activities.

P.19.Preliminary study of the microbiological quality of fruits and vegetables commercialized in the city of Kenitra-Morocco

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Keywords: *fruits, vegetables, Kenitra, microbiological analysis, quality*

Aims of the work: Fruits and vegetables are essential for human health because of their nutritional qualities, but the consumption of raw foods causes food safety problems, which are recognize as an important transmission source of infectious diseases. Therefore, the objective of this work is to evaluate the microbiological quality of some fruits and vegetables marketed in Kenitra city.

Methods: The samples were purchased from the markets of fruits and vegetables from April to July 2018. The search for microorganisms in the samples requires several steps which are weighing,

dilution, isolation, enumeration and identification.

Results: The results of the microbiological analysis of different samples show the charge microbienne of the total flore aerobie mesophile, which varies between 2.25 and 5.48 log₁₀ ufc/g. For total coliforms, the contamination rates vary between 1.92 and 4.42-log₁₀ cfu/g and the presence of faecal coliforms between 1.13 and 3.05 log₁₀ cfu/ml. In the same analyzed samples, we identified tow strains: *Escherichia coli*, *Staphylococcus aureus* and *Clostridium perfringens*. *Salmonella sp* and *Shigella sp* are total absent in all the samples analyzed.

Conclusion: In order to improve the safety and hygienic quality of fruits and vegetables, the implementation of good hygienic practices and continuous microbial quality control are necessary to protect the health of consumers.

P.20.Co-inoculation effect of rhizobia and Plant Growth Promoting Rhizobacteria on *Medicago sativa* growth under phosphorus deficiency

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Keywords: Alfalfa, Symbiosis, Rhizobia, PGPR, Phosphorus.

Aims of the work: Symbiotic nitrogen fixation also leads to additional demands of phosphorus (P) with up to 20% of total plant P being allocated to nodules and any P deficiency may influence the symbiosis efficiency. In this context, Co-inoculation of PGPR and Rhizobacteria was

used as a strategy to enhance Moroccan alfalfa -under low P availability.

Methods: Two Moroccan alfalfa (*Medicago sativa* L.) populations (P1 & P2) were inoculated with two *Sinorhizobium meliloti* strains (RhL1 and RhL2) separately or in a combination with two PGPR (PGPR 1 & PGPR 2) to evaluate the effect on growth, nodulation and some physiological and biochemical parameters.

Results: Under low P availability, co-inoculation of the two alfalfa populations with “RhL2+PGPR2” has significantly improved the biomass of nodules, roots and shoots compared to the inoculation with *Sinorhizobium meliloti* strains allone (P<0.01).The improvement observed in plant growth was correlated to the contents of plants in N, P, K and the stability of the membranes evaluated by electrolyte leakage contents. The low level of available P accentuated the enzymatic activity of acid phosphatases in nodules of both populations.

Conclusion: P deficiency negatively affected the growth and nodulation of *M. sativa*. Co-inoculation with RhL2 + PGPR2 has improved the growth and nodulation in both alfalfa populations. The increase in acid phosphatases activity could be an adaptation mechanism developed by alfalfa plants for tolerance to P deficiency.

P.21.Physiological characterization of rhizobia strains isolated from different agrosystems in Beni- Mellal (Morocco)

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Keywords: Legumes, Rhizobia, Salinity, Polyethylene glycol, pH, Phosphate solubilization

Aims of the work: Rhizobia form an endosymbiotic nitrogen-fixing association with legumes. This symbiosis has a very favorable influence on soil fertility. However, it is limited by various environmental constraints. In this context, the present work aimed at physiological characterization of rhizobia strains isolated from different agrosystems of Beni- Mellal in Morocco.

Methods: A total of 60 strains were isolated from legumes nodules. The strains were purified on YEM medium containing Congo red and tested for their tolerance to different levels of NaCl (0 to 6%), Polyethylene glycol (6 to 9%), different levels of pH (4 to 9.5) and their solubilization potential of inorganic phosphate on solid and broth formulations of PVK medium.

Results: The majority of strains tested had developed a moderate level of salt tolerance that ranged between 2 to 3% NaCl. However, some strains were able to grow under saline conditions ranging up to 4% NaCl. For PEG-6000 tolerance, results showed that the rhizobial growth was unaffected till 7% PEG-6000 concentration. For pH, all strains showed an optimum growth of 100% under pH margin from slightly acidic to slightly alkaline (5.5 to 8 pH). Comparison among the different strains tested showed that some strains have a high potential of inorganic phosphate solubilization.

Conclusion: The results of these tests have allowed us to identify some strains with high tolerance to drastic conditions of the environment. They will serve as inoculums for legumes plants to select the symbiotic combinations more adapted to unfavorable conditions.

Acknowledgement: *This work was supported by the CROSYMED Project, funded through the ARIMNet2 2017 Joint Call by the funding agency MESRSFC, Morocco.*

P.22.Effect of abiotic stress on bacterial growth of Plant Growth Promoting

Rhizobacteria isolated from the Terfezia rhizosphere

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Keywords: *Terfezia, abiotic stress, PGPR, heavy metals.*

Aims of the work: Plant Growth Promoting Rhizobacteria (PGPR) is an effective and ecologically sustainable method for improving crop growth in arid regions. The aim of this study was to characterize the effect of abiotic stress and to examine the heavy metals tolerance of twenty PGPR isolated from the *Terfezia* rhizosphere.

Methods: The ability to grow at different concentrations of salt, of PEG and at different pH values was performed on LB medium supplemented with NaCl (0 to 2M.), PEG (0, 10, 20, 40 and 60%.) and having different pH (3, 4, 7, 9 and 11). The ability to tolerate different temperatures was verified by incubating bacterial cultures at 4, 30, 37, 45 and 55°C. The heavy metal tolerance (Pb, Cd, Co, Hg) was conducted at different concentrations.

Results: The majority of the strains tolerated 400 mM of NaCl. Three of them grew at 1600 mM. They were neutrophils and half were acidotolerant, only two strains grew at pH 11. These bacteria tolerated 20% of PEG while some were able to reach 40%. All the bacteria were mesophilic and thermotolerant, five were able to grow at 4°C. The heavy metals tolerance showed that the totality of the strains was resistant to 1000ppm of Pb and 100 ppm of Co. The tolerance to Cd and Hg at 500 and 1000 ppm respectively was only for a limited number of strains.

Conclusion: The strains RK2 and EpT11 tolerant to abiotic stress can be used

as biofertilizers for saline arid or heavy metal-polluted soils.

P.23. Endophytic bacteria are an immense constraint in date palm micropropagation but their abundance is a good plant health indicator

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Keywords: Date palm, micropropagation, endophytic bacteria, Brittle Leaf Disease.

Aims of the work: This study aimed: (1) to identify the most fastidious endophytic bacterial strains affecting date palm *in vitro* tissue cultures and (2) to determine if populations of indigenous bacterial endophytes in tissue cultures are influenced by host genotype and disease such as the brittle leaf disease (BLD).

Methods: *In vitro* tissue cultures were established from leaves, less than 2 cm in size, that were excised from healthy and BLD affected date palm offshoots for the cultivar ‘Deglet Nour’ and from leaves taken from cv. Barhee offshoots. Bacteria hampering the large-scale micropropagation of date palm were isolated from 3-year-old *in vitro* tissue cultures and then purified by successive subcultures on BSM-Sigma. Identification was performed using MALDI-

TOF MS technology. The statistical analysis was computed using SPSS 13 software.

Results: Two strains of endophytic bacteria hampering date palm micropropagation were isolated from two cultivars (‘Deglet Nour’ and ‘Barhee’). They were orange yellow and white of colors. Microbiological testing using MALDI-TOF MS technique showed that they are *Paenibacillus flaviporus* and *Achromobacter xylosoxidans*, respectively. Furthermore, we showed that more than 85 % of contaminations were caused by white bacteria. Significant differences in bacterial population densities were observed in the cultures of the two genotypes and in cultures established from healthy and Brittle Leaf Disease-affected plants. Indeed, the percentage of contaminated recipients in 3-year-old *in vitro* tissue cultures established from ‘Deglet Nour’ and ‘Barhee’ were 15 % and 30 %, respectively. Moreover, we found that percentage of contaminated recipients in 3-year-old *in vitro* tissue cultures established from healthy and BLD-affected palms cv. Deglet Nour were 15% and 2%, respectively. Embryogenic and organogenic cultures were seriously damaged by these fastidious bacteria. They slowly turned yellow and brown and then died within three months.

Conclusion: This study showed the ubiquitous presence of endophytic bacteria in date palm *in vitro* tissue cultures. However, we have to notify that abundance of endophytes is a good plant health indicator. Our findings showed that only juvenile explants could be used to establish relatively clean *in vitro* tissue cultures, since antibiotics such as cefotaxim have only a bacteriostatic effect.

P.24. Enzymatic and Antibacterial properties of lactic acid bacteria isolates from natural fermenting green olive

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Keywords: enzymatic activity, lactic acid bacteria,
olive, fermentation

Aims of the work: The aim of this work was to characterize the enzymatic and antibacterial activities of 19 lactic acid bacteria (LAB) isolates, isolated from natural fermenting Moroccan Picholine green olive.

Methods: 19 LAB isolates, obtained from natural fermenting green olives, were identified by phenotypic (Gram, catalase, Mobility) and physiological properties (growth at different pH, temperature and NaCl concentrations). The LAB isolates were then characterized, on agar culture media, for their ability to produce protease, lipase, cellulase and amylase enzymes. The cell free supernatants of the LAB isolates were tested for their antibacterial activity against test bacteria (*Escherichia coli* and *Listeria innocua*), using the agar diffusion method.

Results: The results obtained showed that all the LAB isolates are bacilli, Gram positive and catalase negative. All the isolates showed tolerance up to 10% NaCl, pH 9 and temperatures below 45°C. The LAB isolates showed high proteolytic and cellulolytic activities, while no amyolytic and lipolytic activities were detected. Cell free supernatants of the LAB isolates showed inhibition zones ranges of 08-14 mm and 13-16 mm against *Escherichia coli* and *Listeria innocua*, respectively.

Conclusion: The LAB isolates showed important enzymatic profile and antibacterial activity, and can be used in different food fermentation.

P.25.Comparative study of the effects of root exudates and branching factors on *Glomus* hyphal ramification

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Keywords: Biochanine; branching Factors
formanonetine; root exudates, spore, AMF, Head-Space

Aims of the work: Branching factors (mainly flavonoids compounds) are synthesized by root exudates. They represent an essential biochemical signal in plant/mycorrhizal communication as they regulate fungal genes like *dmi* (1, 2 and 3). This later impacts the association between root system and hyphal spores and also the hyphopodium formation, and the presence of arbuscules in the cortical cells. The aim of this work was to present a comparative study of the effects of root exudates and two flavonoids (biochanine and formanonetine) largely known as branching factors of mycorrhizal spores, and as key factors for signalization plant/fungi interactions mainly in *Glomus* spores ramification.

Methods: The roots exudates were extracted and analyzed by head space (GC/MS) system. They were applied to *Glomus* spores. Two known flavonoides were used as standard in order to compare their impact on mycorrhizal spores ramification.

Results The obtained results showed a ramification of spore hyphal in the case of exposition to root exudates. The GC/MS analysis of root exudates revealed the presence of 3 pics, one of them match with biochanine standard, whereas the 2 other pics were not identified.

Conclusion: This study demonstrated the presence of branching factors in root

exudates that significantly impact mycorrhizal spores amplification and symbiosis establishment.

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P.26. Bacterial communities network associated to *Opuntia ficus indica*

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Keywords: DGGE, MiSeq, Bacterial Communities, Aridity, *Opuntia ficus indica*

Aims of the work: In Tunisia, the *Cactaceae* species *Opuntia ficus indica* is widely planted in the arid and semi-arid ecosystems and successfully associated with water harvesting structures, yet the associations *Opuntia* cacti establish with microorganisms and the rules governing microbial community assembly remain poor understood. Therefore, the characterization of the cactus specific stress-microbes association mechanisms under adverse climatic conditions and its microbial symbionts effects for enhancing the tolerance of Mediterranean economic plants to abiotic stress is the focus of this study.

Methods: In order to characterize the cactus specific stress-microbes association mechanisms under adverse climatic conditions and its microbial symbionts effects, microbial diversity of Tunisian

rhizospheric cacti were investigated using cultivation-independent (DGGE) and high next-generation sequencing approaches. Soil and roots samples we collected from cacti following a bioclimatic gradient from low to high arid conditions.

Results: DGGE sequences obtained from soil and root showed that sequences were regrouped in *Actinobacteria* and *Proteobacteria* phyla, whereas *Firmicutes* was only detected in soil. High-throughput sequencing demonstrated that the abundant OTUs were mainly related to *Proteobacteria* and *Actinobacteria* in the soil and roots samples. In addition, soil and roots were also dominated by *Firmicutes* and *Cynobacteria* phyla, respectively.

Conclusion: The composition and assembly of microbial communities associated with *Cacti* were highly influenced by the bioclimatic stages and soil physicochemical properties, the diversity was higher specifically in upper arid areas as compare to humid, semi-arid and lower arid areas. Upper-arid soils exhibited the highest levels of microbial diversity whereas the root parts the lowest.

P.27. Genetic diversity among Moroccan isolates of *Rhizoctonia solani* Kühn

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Keywords: *Rhizoctonia solani*, Potato, Soilborne, Isolates, Anastomosis group (AG), RFLP.

Introduction: *Rhizoctonia solani* Kühn, belonging to the phylum *Basidiomycota*, is a worldwide prevalent soilborne plant pathogen, which causes

various diseases on many economically important crops. *R. solani* is a complex species comprising distinct genetic groups named anastomosis groups (AGs). Currently, 14 AGs are known for *R. solani* featuring defined degrees of host specificity.

Methods: The aim of this study was to identify the anastomosis group of sixty (60) strains of *R. solani* obtained from tuber sclerotia of potato crop collected from Agadir and Casablanca regions (Morocco). Two tests were set up; the first test was conducted using microscopic slides and concerned the study of the interaction among mycelia produced by unknown *R. solani* isolates and the following tester strains: AG-1; AG-2 ; AG-2-2 ; AG-3 ; AG-4 ; AG-5 and AG-9. Depending on the type of interaction, we deduced the relationship between unknown *R. solani* isolates and the tester strains: C0 (No contact: Different AGs); C1 (Simple contact: Different or same AGs); C2 (Death of cells in contact: Same AGs); C3 (Perfect fusion: Isolates from the same AGs and are identical). The second test concerned the internal transcribed spacer RFLP groupings of unknown *R. solani* isolates with tester strains.

Results: Study of anastomosis interaction on microscopic slides, between unknown *R. solani* isolates and the tester strains, revealed that 90,4 % of interactions are type C1, 0,53% are type C2 and 9% are type C3. Also, comparison of the restriction maps, of the internal transcribed spacers sequences that belong to unknown *R. solani* isolates and tester strains, helped to separate our collection into two groups AG-4 and AG-3.

Conclusion: There is a genetic diversity of *R. solani* populations isolated from potatoes because according to this study, *R. solani* strains isolated from potato tubers belong to two Anastomosis Groups, AG-3 and AG-4.

P.28. Evaluation of the symbiotic efficiency of bacteria nodulating *Acacia gummifera* Wild

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Keywords: *Rhizobium*, *Acacia gummifera*, symbiotic efficiency.

Aims of the work: The aim of this work was to study the symbiotic performance of certain nodulating isolates *Acacia gummifera* Wild.

Methods: *Acacia* seedlings were inoculated with eight different *Rhizobium* strains isolated from nodules of *A. gummifera*. The seedlings were arranged in randomized complete blocks with four replicates for each strain. After 6 and 12 months of culture, nodulation parameters (number and dry weight of nodules), dry biomass per plant, total nitrogen, fixed nitrogen and symbiotic efficiency were studied.

Results: All eight strains showed root nodules with variable number which varied between 2 and 25 nodules per plant and dry weight between 1.5 and 15mg.plant⁻¹. In addition, the statistical analysis showed that *Rhizobium* was more infective in 12-month-old *Acacia*. The symbiotic efficiency has shown considerable variability, the most effective symbiotic association was recorded in the strain A24 (*Rhizobium azibense*: MF769718) with 200% and an increase in the total nitrogen of 2 times compared to control seedlings fertilized with Potassium nitrate (KNO₃) as nitrogen source.

Conclusion: This association can be selected as an experimental model to evaluate for the rehabilitation of degraded soils.

P.29. Chitinase and insecticidal activities of *Shewanella basaltis* strain isolated from the marine environment

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Key words: chitinases; *Shewanella*; bioinsecticide; biofungicide

Aims of the work: Chitinases have stimulated interest in various biotechnology applications due to their ability to degrade chitin in the cell walls of fungi and insects, which leads to the use as antifungal agents and insecticides.

Methods: The research conducted in this study is to screen the chitinolytic strains and select a candidate bacterium for the production of chitinases using marine biomass (chitine) as alone carbon source and nitrogen, after tested their ability to degrade chitin of fungi and insects, which leads to the use as antifungal agents and insecticides. An isolate identified as *Shewanella basaltis*, was tested for its insecticidal and chitinase activities against wheat weevil by confrontation at different doses and for fungicide activity against *Fusarium oxysporium* responsible for wheat fusariosis by diffusion method on solid medium.

Results: Among the seven strains grown, a labeled "HE3" showed a degree of hydrolysis of chitin 94%. The morphology allowed to describe a coccobacille, mobile Gram negative. Biochemical and phylogenetic identification revealed a similarity percentage of 98% with *Shewanella basaltis*. To enhance bacterial growth and the production of chitinases, the physico-chemical parameters were optimized. The results have mounted a very significant production of chitinases pH 8, at a temperature of 30 ° C and a salinity of 30 mg / l. The results obtained showed that the mortality rate according to the dose tested and the contact time varies from 10 to 100% relative to the control of 0%. Chitinases showed a fungicidal effect with a 16 cm inhibition zone.

Conclusion: the chitinase tested revealed an antifungal and insecticidal activity (zones of inhibition) (mortality) depending of the doses tested.

P.30. Identification of genes involved in the tolerance to environmental constraints in nodulated legumes

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Keywords: Legumes, N₂ fixation, nodule respiration, gene expression, phosphorus deficiency

Aims of the work: Phosphorus (P) deficiency initiates a myriad of transcriptional, biochemical and physiological responses stimulating either the root's extracellular abilities to acquire soil-P in the rhizosphere or optimize its intracellular use efficiency and allocation through all plant organs. Enhancing activity of acid phosphatases (APase) to acquire and remobilize Pi from organic P compounds is one important strategy for improving plant P nutrition. The release of APase to the rhizosphere is a typical and almost universal P-starvation response in higher plants. However, relatively little is known about the functions of intracellular APase in legume nodules. The aim of this study was to track the enzyme activity along with the intranodular localization of APase, and its contribution in the rhizobial symbiosis tolerance to P-deficiency.

Methods: In order to assess the contribution of APases and phytases in the tolerance of legume nodules to P-deficiency, an in situ RT-PCR methodology was used to localize and quantify the transcripts of candidate APase and phytases genes in nodules of common bean in hydroaerobic culture under deficient vs sufficient P supply.

Poster Communication: Theme I

Results: Our findings have revealed that expression of APase and phytases genes and activities of the corresponding enzymes were positively correlated with increases both of the P use efficiency for N₂ fixation and nodule O₂ permeability in the rhizobial symbiosis with legumes. The induced enzyme activity and the marked transcripts localization of APase and phytase in nodule cortex would control nodule respiration and contribute to adaptation of nodulated legumes to low-P availability.

Conclusion: It is concluded that the increase of APase and phytase activities in legume nodules supports a physiological role of these enzymes in the regulation of nitrogenase activity in connection with the nodule-P status, and opens up a new scenario for a better understanding of the regulation of N₂ fixation in legumes.

P.31. *In vitro* Antibacterial activity of *Mentha pulegium* essential oil against *Clavibacter michiganensis* subsp. *michiganensis*, the causal agent of tomato bacterial canker

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Keywords: Essential oil; *Mentha pulegium*; Bactericidal effect; *Clavibacter michiganensis* subsp. *michiganensis*.

Aims of the work: The bacterial canker caused by *Clavibacter michiganensis* subsp. *michiganensis* (Cmm), account among the most important phytosanitary tomato problems.. The purpose of the present study

is to propose an alternative treatment based on the use of natural products such as *Mentha Pulegium* essential oil as alternative of chemical compounds.

Methods: The essential oil of *Mentha Pulegium* was obtained by the hydrodistillation method. The inhibitory effect of this essential oil has been tested against Cmm using the paper disk diffusion method. The minimal inhibitory concentration (MIC) of this essential oil was determined in liquid medium. The minimal bactericidal concentration (MBC) was determined by spreading 50µl of each tube, the concentration is greater than or equal to the MIC on YPGA medium and incubated at 25 °C for 72 h.

Results: *In vitro* test showed a high efficacy of *Mentha Pulegium* essential oil against Cmm with inhibition zone diameter greater than 30 mm. However, the MIC of this essential oil is 0.5% (v/v). Thus, the MBC was equal to 0.5% (v/v). The report of MBC and MIC was equal to 1, indicating the bactericidal effect of *Mentha Pulegium* essential oil against the Cmm.

Conclusion: Based on results of our tests, the plant *Mentha Pulegium* essential oil is strongly be recommended as an alternative treatment to the bacterial canker of tomato. However, further experiments are needed to obtain information regarding the economic aspects and antibacterial activities of essential oil *in vivo* without phytotoxic effects on seed germination. Then, research on the chemical composition of the essential oil used.

P.32. Biodiversity and abundance of arbuscular mycorrhizal fungus spores in *Pistacia atlantica* Desf. From Saadi Hassi Delaa, Laghouat (southern Algeria).

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Keywords: *Pistacia atlantica* Desf., Biodiversity, Glomeromycota, AMF, Saadi Hassi Delaa, Laghouat (Algeria).

Aims of the work: In natural ecosystems, soil fungi are a major component of the rhizosphere of most terrestrial plants. Although arid ecosystems are characterized by low density of vegetation cover, roots fungi are common as a necessity for the existence of the ecosystem. The aim of this research was to investigate the biodiversity and abundance of indigenous Glomeromycota living inside the rhizosphere soils of *Atlas pistachio*.

Methods: This study was conducted at dayate Saadi Hassi Delaa. The soils Samples were taken during the spring, 2016. AMF spores were extracted by wet sieving and decanting method of Gerdemann and Nicolson (1963). The spores were mounted on slides and examined with an optical microscope. Species identification was done by morphological analysis, using the descriptions of AMF found in the web site <http://invam.caf.wvu.edu>.

Results: A total of 61 AMF species belonging to three genera: *Acaulospora*, *Glomus* and *Ambispora* were extracted, counted and identified on the basis of their morphological characteristics. It was observed that most dominant genus was *Acaulospora* accounting for 58.81% of the total spores recovered, and it was monitored by *Glomus* (34.03%). However the diversity of the last genus was considerably high.

Conclusion: This first investigation on the Glomeromycota associated with *Atlas pistachio* in Algerian arid area revealed an interesting diversity. This study shows that our tree is able to develop symbiotic associations with fungi belonging to the phylum of Glomeromycota. The presence of AMF, as in wide range of host plants in the other region suggests the importance of this relationship in arid ecosystems.

P.33. Beneficial Effects of Actinobacteria and Mycorrhizae on tomato (*Lycopersicon esculentum*) growth and nutrition.

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Keywords: Arbuscular Mycorrhizal Fungi, actinomycetes, compost, biofertilizers, growth, nutrition, Tomato.

Aims of the work: The use of beneficial microorganisms such as rhizobacteria (PGPR) and arbuscular mycorrhizal fungi (AMF) is an alternative way to encourage organic crops production. In this context, this study aims to evaluate the effect of inoculation with an actinomycete in combination with AMF and compost (derived from green waste and phosphate sludge) on growth and mineral nutrition of tomato.

Methods: Tomato crops have been grown in greenhouse on agricultural soil characterized by low organic and mineral matter. five treatments were applied and compared to control plants: Actinomycete strain (SA16) alone, AMF (*G. irregularis*) alone, Compost alone and two combinations : SA16-compost and AMF-compost.

Results: After 7 weeks of culture, all the treatments showed beneficial effects for the improvement of growth, physiological and biochemical parameters of tomato. SA16 alone showed a significant effect in comparison with other treatments. In fact, inoculation with this bacteria significantly improved the growth parameters: dry biomass (37%), leaf area (30%), sugars (88%) and total chlorophyll content and protein (33%). Application of compost and AMF separately improved the mineral content: potassium (40.74% and 18.30% respectively) and calcium (38.87% and 16.04% respectively).

Conclusion: The use of these biofertilizers may be an interesting strategy for the management and development of tomato plants.

P.34. Raw camel milk production in algerian's south eastern arid areas: constraint related to collection, storage and transport: impact on product quality

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Keywords: Camel milk, Stability, Physicochemical, Analysis.

Aims of the work: Camel the most adapted species to arid's areas. Camel's milk, has nutritional and therapeutic properties, rich in salts, enzymes, inhibiting microbial activity, hence it's long shelf life and low ability coagulation. In Algeria, camel population is about 315000 heads, distributed over 17 provinces, with 75% in eight desert provinces and 25% in nine steppe provinces. Camel breeding, practiced in extensive, dependent on climatic conditions, low milk productivity, because of the lack of collection system, intended more to camel's meat production. Although this milk, highly required in urban areas and Northern provinces for therapeutic use. However, the collection and transport for long-distance alters it's physico-chemical quality. The aims of this work were to explore stability of physicochemical parameters pH, conductivity, viscosity, Titratable acidity, density, total azote, protein, whey and dry matter, during milking collection, transport and storage.

Results: values obtained for physicochemical parameters were: pH(6,38-6,58); conductivity (5,73- 7,24 μ s/cm); viscosity (3- 3,75mpa/s); Titratable acidity (23,58- 27,06 $^{\circ}$ D); density (0,93- 1,03); total azote (3,68- 5,62g/l); protein (25- 34g/l); whey (71,78- 81,6%) and dry matter (24,5-

35,63%). Results showed the heterogeneity and instability of explored physicochemical's tests.

Conclusion: Freezing seems the ideal method for the collection, storage, preservation and transportation of raw camel milk which is accessible only in arid areas.

P.35. Physicochemical stability's exploration and microbiological quality's assessment of a processed soft cheese, type: camembert, after storage for three weeks at different temperatures

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Keywords: Camembert, Stability, Storage, Physicochemical tests, Microbiological analysis

Aims of the work: Cheese has always been a safe source for human nutrition. Stabilizing cheese technology, used for the acidification and maturation of thermophilic starters (incomplete sentence??). Stability of the products during storage and/or marketing is controversial subject. The aim of this Study is to assess the physicochemical and microbiological characteristics stability of a Camembert cheese collected in the North-East of Algeria (Provinces: Setif and Bordj Bou Arreridj).

Methods: Fifty two samples were collected during February, March and April 2018. Half of the samples were kept at temperature 04 $^{\circ}$ C, and the others were stored at 23 $^{\circ}$ C for three weeks. Analyzes were carried out either at the end of each week and after opening the packaging and exposure of their contents to the ambient air for two hours at the end of the 3rd week.

Results: Physico- chemical tests, after storage life, at 04 $^{\circ}$ C and 23 $^{\circ}$ C, gave the average values: pH: (5.54- 5.62), Titratable acidity: (16.72D- 18.18D $^{\circ}$), Conductivity (4.41ms/cm-4.53ms/cm), Total

Dry Extract (53.66%-55.6%), Relative Humidity (46.4%-44.46%) respectively. The results of the tests carried out, after the direct opening of packaging at the end of the 3rd week, were respectively pH: (5.68- 5.57), Titratable acidity: (16.72- 20.24°D), Conductivity: (4.48 ms/cm- 4.69 ms/cm), total dry extract: (57.8%- 61%), relative humidity: (42.2%- 39%). Microbiological analyzes, by counting microflora revealed stability and compliance of the product with national standards, during the first and second week at 4°C and 23°C. However, an increase in total mesophilic flora (FTAM) estimated at 02×10^4 CFU/g for both temperatures of storage (04°C and 23°C) at the end of the third week.

Conclusion: All the samples had a stability of the physicochemical parameters. High numbers in mesophilic aerobic flora were recorded at the end of the third week of storage at 04°C and 23°C. The study deserves to be deepened by a more representative sampling plan and by more physicochemical

P.36. Hydrolysis of whey proteins by strains of *Lactobacillus plantarum* isolated from ewe's milk

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Keywords: *Whey proteins, Lactobacillus, hydrolysis, SDS-PAGE electrophoresis.*

Aims of the work : Whey is an abundant by-product of the dairy industry, resulting from either cheese or casein production. It represents about 85–90% of milk volume and retains approximately 55% of milk nutrients. Despite its elevated nutritional value, the use of whey is limited due to its perishable characteristics and elevated dilution of its components. In this way, production of hydrolysates can be an interesting approach to add value to whey.

Methods : The hydrolysis of whey proteins extracted from cow's milk, by two strains of *Lactobacillus plantarum* isolated from ewe's milk and one strain of *Lactobacillus brevis* isolated from camel milk was estimated by SDS-PAGE electrophoresis, Folin-Ciocalteu assay and Assessment of degree of hydrolysis (DH).

Results: All the methods used showed a much greater hydrolysis of whey proteins with *Lactobacillus plantarum* strains than with the strain of *Lactobacillus brevis*.

Conclusion: Protein susceptibility to hydrolysis determines its biological value. Thus, the protein hydrolysates obtained may contain active peptides having various biological activities (antimicrobial, antioxidant, antihypertensive activities, etc.). Whey can therefore be valorized by exploiting it for the production of such hydrolysates. On the other hand, these lactic acid bacteria strains with high proteolytic activity have proved interesting and can be used in food technology for the production of bioactive peptides, as well as to reduce the allergenicity of milk proteins like β -lactoglobulin which is one of the main milk allergens.

P.37. Use of mycorrhizal fungi in phytoremediation strategies in an abandoned mine site

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Keywords: *Phytoremediation, Heavy Metals, Mycorrhizae, Pinus halepensis*

Aims of the work: The objective of this work was to study the ability of the technique of phytoremediation, using a model plant Aleppo Pine (*Pinus halepensis*) infected with ectomycorrhizal fungi to fix heavy metals released in an abandoned mine site.

Methods: The first part of this work highlighted the ability of 20 Aleppo pine seeds to germinate and live for six months in 5-liter pots that contain polluted soil from the mine site diluted to (0% - 10% - 25% - 50% - 75% - 100%) with sand. We infected the roots of Aleppo pine with the spores of the fruiting body of genus scleroderma sampled in the Amizmiz forest.

Results: This study shows that the presence of ectomycorrhizae increases the tolerance of the species *Pinus halepensis* to heavy metals up to 75% dilutions.

Conclusion: The remainder of our study will focus on the measurements of heavy metals at soil and also at the different parts of the plant to determine the type of phyoremediation used by Aleppo pine.

P.38. Isolation and morphological identification of desert arbuscular mycorrhizal fungi from Errachidia region in Morocco

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Key words: *Arbuscular mycorrhizal fungi (AMF), date palm, diversity*

Aims of the work: The present study was undertaken in semi-arid areas of Errachidia region in southern Morocco. The objective of the study was to assess the level of root mycorrhization and to identify Moroccan endomycorrhizal fungi associated to date palm.

Methods: Fragments of root were mounted on slide to estimate the extent of

arbuscular mycorrhizal infection, and were observed under microscope, after coloration by Trypan blue. We isolated the fungi by the trapping culture of soil samples; subsequently we used the wet sieving method for spore extraction. We have then colored the spores by the Melzer and PVLG reagent, and the morphological characterization is done based on the INVAM identification key. Data were analyzed using one-way ANOVA with a significance level of $\alpha = 0.05$. Analyses were performed using SPSS statistical software (version 20, IBM).

Results: Colored root fragments showed typical mycorrhizal structures, such as hyphae and vesicles (V); showing the mature stage of the colonization along root of date palm. The highest arbuscular colonization was found in site 1 (83 %) and the lowest was in site 3 (35.7 %). Twelve species of arbuscular mycorrhizal fungi were identified in all studied sites. The genera identified were: *Acaulospora* (6 species), *Glomus* (5 species), *Entrophospora* (1 species) and one unidentified species. A great variation in species richness was detected between soil and trap culture in several samples regardless of the origin where samples were performed. Our study demonstrated that AMF have a widespread occurrence in all sites and they sporulate more abundantly in trap cultures than in soil.

Conclusion: The rhizosphere of the date palm contains a lot of species of endomycorrhizae, which must be sorted to valorize the high-performance strains, in agriculture as an alternative to chemical inputs.

P.39. Phylogenetic diversity of Pectobacterium and Dickeya strains causing Blackleg disease of Potato's in Morocco

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Keywords: *Pectobacterium*, *Dickeya*, Diversity, MLSA, blackleg disease, Morocco

Aims of the work: The main objectives of our study were; to investigate the species composition of the Moroccan *Dickeya* and *Pectobacterium* isolated between 2015 and 2017 from diseased potato tubers and stems using genomic approach, to investigate the phylogenetic relatedness between the strains and to evaluate the virulence of some identified pathogens in potato tuber.

Methods: Sampling and isolation of pectinolytic bacteria and Molecular characterization of *Pectobacterium* and *Dickeya* isolates using gapA gene. Ten representatives of our Moroccan collection were deeply studied. Firstly, a draft genome was used to refine their taxonomical position using Multi-locus sequence Analysis (MLSA) Average nucleotide identity and DNA-DNA hybridization, and then their virulence was measured on potato tubers.

Results: Most of the isolates (84.6%) were belonging with *Pectobacterium*, while 15.4% with *Dickeya*. Genomic Data were used to calculate ANI and DDH all the species isolated in Morocco showed the value higher than 95% and 70% respectively with close type strain. On the other hand, some strains construct a separate clade with *Pectobacterium carotovorum* SCC1 designed as model strain and close to *Pectobacterium carotovorum* subsp. *carotovorum* (*Pcc*) showed an in silico DDH low than 70% and ANI value higher than 95% with the closest species.

Conclusion: Three Moroccan region visited in our study showed the presence of the pathogens which are responsible for causing blackleg and soft rot disease with different proportions. Two regions showed 100% of the *Pcc* and *Pectobacterium carotovorum* subsp. *brasiliense* (*Pcb*) genus with dominance of

Pcb specie however, the region third showed the presence of *Pecobacterium polaris* described for the first time in Morocco.

P.40. Antifungal activity of seed oils from four varieties of dates (*Phoenix dactylifera* L) against the fungus *Fusarium oxysporum*

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Keywords: *Phoenix dactylifera* L, *Fusarium oxysporum*, seeds oil, antifungal activity

Aims of the work: This study was inspired by the problems of fungal contamination of fruits that are sensitive to many spoilage microorganisms such as fungi and are responsible for food poisoning, for which reason our study focused first on studying the antifungal activity of oils of four varieties of date seed (*Phoenix dactylifera* L): Mejhoul (MJ), Boufeggous (BF) (Feggous (FE), Bouslikhane (BO) and Admou (AD) from Soxhlet extraction.

Methods: The test is performed using the direct contact method applied to test the sensitivity of the fungus *Fusarium Oxysporum* to different concentrations (0.5%, 1%, 50% and pure) of oil and also to evaluate the performance of each oil against *Fusarium oxysporum* mycelial growth on a blueberry fruit treated with date ring oil.

Results: The results show that all concentrations induced partial inhibition of the growth of the fungus *Fusarium oxysporum*; an inhibition index of 72.86% with the concentration of 0.5% also the study of the effect of date stone oil on blueberry contamination showed that date stone oil is more effective against mycelial growth and fruit protection than other oils.

P.41. Effect of the inoculation by rhizobacteria and arbuscular mycorrhizal

fungi on the growth and yield of *Vicia faba* and *Triticum aestivum*

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Keywords: Arbuscular mycorrhizal fungi, rhizobia, growth, soil quality, yield, *Vicia faba* L., *Triticum aestivum*, fields,

Aims of the work: Inoculation with rhizosphere bacteria and mycorrhizal arbuscular fungi is considered to be one of the biological ways for plants to resist more to biotic and abiotic stresses. These biofertilizers may allow an increase growth and productivity of crops. In this context, the purpose of this study was to evaluate the effect of the inoculation with rhizobacteria and arbuscular mycorrhizal fungus on the soil quality and the growth of *Vicia faba* and *Triticum aestivum*.

Methods: The effect of the inoculation, was studied in a field experiment in agricultural soil with six treatments: the control without inoculation (C), PGPR alone (P), rhizobia alone (R), mixture of PGPR and rhizobia (PR), AMF alone (M) and a mixture of PGPR, rhizobia and AMF (PRM). The bacterial strains used are able to: (i) solubilize potassium, (ii) solubilize three sources of phosphorus, (iii) produce auxin (iv) and produce exopolysaccharides.

Results: The application of these inoculations improved soil quality by enhancing the range of nitrogen, phosphorus, total organic matter and carbon. The greatest inoculation effects were observed in the inoculation with a mixture of PGPR-rhizobia-AMF. Furthermore, this inoculation improved the growth parameters such as length, fresh and dry weight of shoots and

roots, number of leaves. Moreover, this inoculation improves the productivity of the plants tested by increasing the number of bean pods and wheat ears

Conclusion: The mixed inoculation stimulated significantly the growth and the productivity of the tested crops and could be used as potential bio-fertilizers to optimize plant growth and yield.

Acknowledgments: This work is financially supported by the project PPR2/2016/42, CNRST, Morocco.

P.42. Effect of heavy metals, pH, temperature and salt concentrations on bacteria isolated from Phaseolus

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Aim of the work: *Phaseolus* is one of the most important legumes in the world because of its commercial and nutritional value. The bean has a positive impact on soil fertility through the process of biological nitrogen fixation. However, This fixation is ensured by bacteria nodulating the roots of the legume. isolation of bacteria, study the influence of abiotic factors on the growth of these bacteria.

Methods: i) intrinsic determination of the resistance of bacteria to heavy metals, ii) the tolerance of isolates to different concentrations of NaCl, iii) estimate the optimal temperature of growth and iv) finally the growth at different pH.

Results: All isolates tolerate acidic pH and alkaline pH with an optimum pH of 5. It is noted that the bacteria thus isolated no longer support high concentrations of NaCl. Our study reveals a diversity regarding the tolerance of isolates at fairly high temperatures with an optimum temperature of 30 ° C. We notice that all the isolates tolerate a rather high concentration of cadmium that means that these isolates have provided some resistance to this metal with a MIC of 1000.

Conclusion: The present study shows the influence of abiotic factors, in particular the intrinsic resistance of heavy metals, the tolerance to different pH, and also the temperature. In addition, the isolates show a sensitivity to NaCl with more or less high concentrations.

P.43. Isolation of *Pseudomonas fluorescens* from wheat rhizosphere showing in vitro PGPR effect

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Aims of the work: *Fluorescent Pseudomonas* can suppress various soilborne diseases, and their efficacy related both; to their antagonistic activities and rhizosphere competitiveness. This study aimed to isolate antagonistic *Pseudomonas fluorescens* from Wheat rhizosphere (from the region of Constantine, Algeria) and evaluate their Plant promoting traits.

Methods: Fifty-five antagonistic strains were isolated from wheat soil, cultivated in Constantine region (Algeria), characterized morphologically, biochemically and molecularly, and screened for their Plant growth promoting traits. At the end, the biocontrol capacity of these strains and growth promotion potential against two species of *Fusarium*: *F. culmorum* and *F. pseudograminearum* were evaluated *in planta*.

Results: All the isolates showing a biochemical and morphological of *Pseudomonas fluorescens*. Under in-vitro conditions, all isolates produced cellulase and pectinase, 90.9% produced siderophore; hydroxamates type, 96.43% produced IAA.

A 96.36% of isolates produced a clear zone around the colony, exhibiting different sorts of phosphate solubilizing index (PSI) and 76.36% solubilized the phosphate in liquid medium. The selected strains inhibited *Fusarium* sp growth and stimulated wheat growth with various extraction of enzymes when tested in pot experiments. Nine bacterial strains, which showed a maximum growth promoting traits were identified by using 16S rDNA gene sequencing as *Pseudomonas fluorescens*.

Conclusion: Isolated strains of *Pseudomonas fluorescens*, showed variation in their plant promoting characteristics that can contribute to their ability to suppress fungal diseases. It is therefore interesting to use these *Pseudomonas fluorescens* as biofertilizers inoculants for Wheat in order to reduce or replace chemical fertilizers and pesticides.

P.44. Physicochemical characterization of Lactic Acid Bacteria used as a starter culture in the olive fermentation process

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Keywords: lactic Acid Bacteria, physicochemical characterization, starter cultures, MATS (Microbial Adhesion to Solvents) and contact angle measurements.

Aims of the work: Lactic Acid Bacteria are the most species used in the process of controlled fermentation as a starter culture, due to their homofermentative metabolism and their high capacity of acidification of the medium (brine) which will accelerate the fermentation process. The behavior of the lactic acid bacteria and changes made to Lactic Acid Bacteria in the brine of fermentation (the relationship between the physicochemical properties and the capacity of oleuropein-degrading Lactic Acid Bacteria) were studied.

Methods: the physicochemical characterization of the starter cultures was performed using Microbial Adhesion to Solvents (MATS) and contact angle measurement combined with equation of Van Oss. Those measurements were carried out in three concentrations of NaCl (5%, 6% and 8%). MATS: Experimentally, Lactic Acid Bacteria strains were suspended to an optical density of 0.7 and 0.8 at 405nm (A₀) (approximately 10⁸ CFU ml⁻¹ cell density) in three concentrations of NaCl (5%, 6% and 8%). 2.4 ml of each bacterial suspension was vortexed for 90 s with 0.4 ml of the solvent. The mixture was allowed to stand for 15min to ensure complete separation of the two phases. The optical density of water phase was then measured using a spectrophotometer. The percentage of bound cells (percentage of adhesion) to each solvent was subsequently calculated by the following equation: % adhesion = ((1-A)/A₀)/100.

Result : Results showed that the surface of the lactic acid bacteria exhibit an electron donor character, subsequently this character varies depending on the salt content in the brine (5%,6% and 8%) this means that the increase in the salt content leads to the decrease donor character. Concerning the hydrophobicity of Lactic Acid Bacteria strains surfaces, The results show that they present an hydrophilic character because the percentage of adhered cells to hexadecane are less than 50%, but this hydrophobicity increase by the increasing of NaCl concentration.

Conclusion: in conclusion the hydrophobicity and the components of the interfacial surface energy, particularly the electron donor, acid-base and Van der Waals components, were strongly involved in the bioadhesion of Lactic acid Bacteria.

P.45. Adhesion kinetics of *Staphylococcus* on the support of glass treated with UHT milk

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Keywords: *adhésion, contact angle, Milk, semi-skimmed, staphylococcus aureus.*

Aims of the work: Microbial contamination of the surfaces of equipment used in the food industry can lead to lower yields and higher production costs. These microorganisms cause premature degradation of equipment and alteration of the organoleptic properties of products during manufacture, and also end up in the finished product and promote the development of collective foodborne diseases. The main objective of this work was to study the physico-chemical properties of the glass surface treated with UHT milk (semi-skimmed), and to study the adhesion kinetics of *S. aureus* ATTC25923 on this support.

Methods: The hydrophobicity of supports was determined by measuring contact angle of water (θ_w). The Lifshitz-van der Waals (γ_{LW}) component and the electron-donor (γ^-), and electron-acceptor (γ^+), surface energy parameters of glass were determined by measuring contact angles using the approach proposed by van Oss et al. and images processed by the MATLAB program of *S.aureus* adhesion.

Results: The results of the contact angle show that the glass changes its hydrophobicity to the first contact with UHT milk. The results of *S.aureus* ATTC25923 adhesion on glass treated with UHT milk at different contact, showed an increase in the degree of attachment of bacterial cells to this support over time.

Conclusion: An understanding of the effect of film formed on supports, commonly used in food processing environment, is essential in order to find ways to prevent contamination and to develop strategies. Thus fat component should be considered as an important factor which could affect bacterial adhesion and this requires a further study in order to understand its role in

microbial adhesion. Finally, the results obtained here show that it is necessary to take into account the fat component in cleaning and disinfection procedures.

P.46. Purification and molecular characterization of two antimicrobial peptides produced by *Lactobacillus plantarum* DU10

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Keywords: Lactic acid bacteria, *Lactobacillus*, purification, peptide, bacteriocin

Aims of the work: The aim of this study was the characterization of new probiotic strains from the raw camel milk and screening of probiotic strains showing good anti-microbial activity.

Methods: After isolation of *L. plantarum* DU10 w and its identification by 16S rDNA sequencing (Sanger method and Capillary Electrophoresis), antimicrobial activities of supernatant of *L. plantarum* DU10 culture was tested against several pathogenic bacteria such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*. The activity as determined by the proteolytic action of trypsin, pepsin and proteinase K, plantaricin MZ was maintained even after a treatment at 121°C for 15°C and a pH of 2-10. The characterization of the bacteriocin was performed by filtration with QuixStand™ benchtop system, by salt precipitation using ammonium acetate, and partial purification by Size Exclusion Chromatography, Molecular mass determination was estimated with tricine-sodium dodecyl sulphate-polyacrylamide gel electrophoresis then confirmed by mass-assisted laser desorption ionization time of flight mass spectrometry. The molecule was purified by HPLC (25-µl sample eluted in a linear

gradient from 90% solvent A [0.1% (w/v) trifluoroacetic acid (TFA) in 5% (v/v) acetonitrile in water] and 10% solvent B (0.1% TFA in 100% acetonitrile)

Results: The capacity of *Lactobacillus* species to produce bacteriocins active towards spoilage or pathogenic bacteria, in particular *Listeria*, might be a powerful tool for the protection of food products. In this study, we have isolated *L. plantarum* strain, purified antimicrobial peptides which remained to be active against several pathogens and maintained even after a treatment at 121°C for 15°C and a pH range from 2-10. We also perform a partial characterization of plantaricin MZ, a two-component antimicrobial peptides produced by the putative probiotic bacteria *Lactobacillus plantarum* DU10, The producing strain and its antimicrobial peptides may find an application as a bio-preservative agent.

Conclusion: Application of these antimicrobial peptides may help reduce the use of chemical preservatives and/or the intensity of heat and other physical treatments, satisfying the demands of consumers for foods that are fresh tasting, ready to eat, and lightly preserved.

P.47.A quantitative exposure assessment of *Staphylococcus aureus* in cheese consumed in El Maleh region (Algeria)

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Keywords: Cheese, exposure assessment, food poisoning, *Staphylococcus aureus*.

Aims of the work: *Staphylococcus aureus* is the most causes of food poisoning in Algeria. Like others states, the notified cases are underestimated. The purpose of this

work was to estimate the number of persons consuming a critical concentration of these bacteria in cheese (the most consumed food and assigned with *Staphylococcus aureus* food poisoning).

Methods: In the first step, the data of its consumption has been collected in the EL Malah region according to the areal method as described by Grawitz (2001). Then in the second step, the information about *Staphylococcus aureus* were collected from the cheese according to JORAD n° 68 and n° 14 of 2014 and 2015 respectively. In the third step, the consumption flow was split in four Modular process risk model according to Nauta (2002) : 1- Initial contamination (H0), 2- Growth of SA during transport and storage (G1) and 3- SA concentration at time of consumption. At each module, the mathematical (statistic and probabilities) model describe the prevalence, concentration, the growth of bacteria compiled with the frequency of using and consumption, for estimate the exposure percent. The @risk software was used basing on Monte Carlo simulation for simulate all iterations.

Results: The microbiological results showed a contamination of 33% samples with concentrations varied from 0.6 log cfu /g to 3.7 log cfu/g. At module H0, no one persons could could ingest (take account the transport times) a critical concentration (5 log cfu /g) of *Staphylococcus aureus*. After growth during storage the SA can growth and achieve a critical concentration as showed by the results: mean and median of 0.04285 and 0.317 log cfu/g respectively. Therefore, the simulation results showed a 1.2% of cheese portions contain ≥ 5 log ufc/g at time of consumption for different scenario.

Conclusion: Taking into account all variables in the model, the *number* of persons who could consume a critical concentration is at 80 persons per year from 15000 persons. Finally, to minimize the exposure rate, the cold chain must be respected and shorter as possible.

TOPIC II-

P48. PRR11 survey in Moroccan women cervical cancer

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Keywords: PRR11, Cervical Cancer, Cell Progression, Metastasis.

Aims of the work: Cervical cancer (CC) is the fourth most frequent female cancer with high incidence and mortality, mainly due to late detection and bad prognosis. Recent studies have revealed that proline-rich protein 11 (PRR11) is dysregulated in different cancers and participates in their cell progression. However, the involvement of PRR11 in CC is not yet clear. Our study consists of isolating and identifying the PRR11 associated with BC in Moroccan women, as well as characterizing the related cell signaling pathways.

Methods: The expression of PRR11 in CC tissues were evaluated by immunohistochemical staining, quantitative reverse transcription (RT-PCR) and Western blot. Then, an analysis of correlation between PRR11 expression and clinicopathological data of the patients were carried out. However, to specify the PRR11 role in the biological malignant behavior of CC, in vitro, a positive and negative regulation of PRR11 expression through a PRR11 overexpression vector and a small interfering RNA (SiRNA) specific to PRR11, respectively, were performed.

Results: The expression level of the PRR11 gene in CC tissues was significantly higher than that in normal cervical tissues. This

overexpression correlated with advanced FIGO stage, lymph node metastasis, and large tumor size. Additionally, our preliminary results demonstrated that downregulation of PRR11 inhibited cell proliferation, invasion and migration of the cells, whereas opposite results were observed in CC cells upon PRR11 upregulation.

Conclusion: The study results show that PRR11 plays a critical role in the progression and metastasis of CC, and as such, may serve as a potential new target for the CC diagnosis and treatment.

P49. Study of hypovitaminosis D prevalence in moroccan population with type 2 diabetes

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Keywords: vitamin D, insufficiency, Diabete, Casablanca.

Aims of the work: Hypovitaminosis D is very common and affects about 50% of the world's population. Some studies suggest a link between this epidemic and various pathologies, like diabetes. The aim of this study is to determine the correlation between the status of vitamin D and diabetes in the greater region of Casablanca.

Methods: This is a retrospective epidemiological study carried out at the level of the two offices of the two rheumatologists, using a questionnaire on 1078 diabetic patients who have a vitamin D status between 2010 and 2017. We also manipulated the dosage of vitamin D (ECLIA Test), blood glucose and 1 Iba 1 c in medical analysis laboratory (ARMESS) in Casablanca.

Results: The results are recorded and processed by SPH I NCS PLUS ^ 2 software (version5). The prevalence of hypovitaminosis D (25 (OH) D <30ng / ml) was 90.3% in the general population. 62.4% have an deficiency (25(OH) D entre10-20ng/ml), 27.9% have a deficiency (25(OH) D<30ng/iiiI).This deficiency was higher among women than men (52.1%), particularly among postmenopausal women between 41-50 years (17.2%), as predominantly in the population over 50 years (31.8% %). 53.1% of patients with vitamin D deficiency no longer have a dairy-rich diet, and 67.5% do not participate in sport. There is a predominance of type 2 diabetes compared to type 1 diabetes (93.8%), particularly in people older than 50 years (51%), 40.1% of type 2 diabetics already have cases Of diabetes DNID in their families. A correlation between diabetes and vitamin D deficiency was 58.9% in type 2 diabetics and 3.5% in type I diabetics.

Conclusion: The prevalence of hypovitaminosis D was very high in the greater Casablanca region in the population over 50 years of age and was consistent with the literature. These data must be confirmed by more powerful multicenter studies including different levels and regions of Morocco.

P50.Evaluation of the antimicrobial and anti-inflammatory properties of *Olea europaea* L. leaf extract

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Keywords: *Olea europaea* L., antibacterial activity, anti-inflammatory activity, phenolic compounds.

Aims of the work: The present study aimed to evaluate the *in vitro* antibacterial

and *in vivo* anti-inflammatory activities of olive tree (*Olea europaea* L.) leaf extract.

Methods: Olive leaf extract (OLE) was obtained by a 24h maceration in absolute methanol followed by rotary evaporation of the solvent. The antibacterial activity of OLE extract was evaluated by disc diffusion method against three pathogenic bacteria isolated in bacteriology laboratory of Cancer center (CAC)-Batna. Finally, λ -carrageenan-induced pleurisy was used to evaluate the effect of OLE on acute inflammation in rats.

Results: Quantitative analysis of OLE revealed a high content in phenolic compounds. The antibacterial activity of OLE by using the disc diffusion assay showed no activity towards *E. coli* and de *K. pneumoniae*, whereas the effect on the growth of *Staphylococcus aureus* was remarkable (inhibition zone diameter of 20.33 mm). This activity was directly correlated to the amount of phenolic compounds in OLE. Finally, the study of the effect of OLE on λ -carrageenan-induced plural inflammation revealed that treatment of rats by i.p. injection of OLE (100 mg/kg) provoked a strong and significant decrease of PMN accumulated in the pleural cavity of animals (inhibition of 96%, $p < 0.005$), an effect equal to that obtained with the anti-inflammatory drug MELOVEM.

Conclusion: Our results show a double benefit of olive leaves as antibacterial and anti-inflammatory, suggesting their efficiency in treating bacterial-associated inflammatory conditions.

P51. Comparative study of antimicrobial activity of olive leaf (*Olea europaea* L) aqueous and methanolic extracts

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Keywords: olive leaves, *Olea europaea* L, antibacterial activity, MIC, MBC.

Aims of the work: *Olea europaea* L (olive) leaves are widely used as traditional medicine against human diseases. This study was designed to investigate the antioxidant and antibacterial activities of aqueous and methanolic extracts from olive leaves against bacterial strains: *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella enterica*, *Klebsiella pneumoniae*, *Listeria monocytogenes* and *Acenitobacter baumannii*.

Methods: Antioxidant activity was determined by DPPH radical scavenging method and antibacterial by disc diffusion method. Total phenolic contents were quantitated by Folin-Ciocalteu method. Antibacterial activity was also confirmed by the minimal inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) assays.

Results: Results demonstrated that aqueous extract contained was the most total phenolic content and methanolic extract was the highest antioxidant. Both extracts have a highly significant activity ($p < 0.0001$) against all tested bacteria but the high activity observed was for aqueous extract. The high activity of the aqueous extract was for *Salmonella enterica* and the lower was for *Pseudomonas aeruginosa*. Methanolic extract showed the high activity for *Klebsiella pneumoniae* but the lower for *Escherichia coli* and *Listeria monocytogenes*. MBC/MIC ratio confirmed that aqueous extract has bactericidal action (2 to 4) against *Staphylococcus aureus*, *Acenitobacter baumannii* and *Klebsiella pneumoniae* but bacteriostatic action (8 to 16) for the others strains. Methanolic extract has bactericidal action (1 to 4) against all strains except bacteriostatic action (equal to 8) for *Acenitobacter baumannii*.

Conclusion: In conclusion, differences could be explained by content and types of bioactive molecules. These findings are very encouraging for the use of olive leaves as natural antimicrobial agents for medicinal and food applications.

P52. Marine predatory actinobacteria: A new therapeutic approach against multidrug resistant bacteria

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Keywords: Predatory actinobacteria, isolation, screening, multidrug resistant bacteria, marine habitats.

Aims of the work: For decades one of the most alarming health problem is the emergence and spread of antibiotic resistant. Multidrug resistant bacteria are increasingly prevalent in hospitals faster than the discovery of new molecules. Consequently, in front of this major global healthcare problem, it is imperative to develop alternative treatment strategies. Currently, most of the molecules used against multidrug resistant bacteria (MDRB) are produced from actinobacteria. Antibiotics can be produced by actinobacteria either from antagonistic interaction through competition for a common resource, or via predation which seems more efficient. The aim of this study is the screening of actinobacteria predator of other bacteria, which could play an important role against multidrug resistant bacteria.

Methods: One hundred forty-two actinobacterial predator isolates were isolated from the water of the Moroccan marine habitats.

Results: Among our screening program, four actinobacteria showed a strong predatory activity and were selected. They have been found to be predatory, lysing a range of live washed microbial prey. All four retained isolates showed an ability to grow on different types of bacteria cells (Gram +,

Gram- and multidrug-resistant bacteria (MRSA type) as preys. Antibacterial activities by using the agar disk method against *Escherichia coli*, *Staphylococcus aureus* (MRSA), *Micrococcus luteus*, of the selected actinobacteria isolates showed activity against at least one of tested bacteria.

Conclusion: Predatory actinobacteria might be used as a new therapeutic approach against multidrug resistant bacteria.

P54. Avian infectious bronchitis disease: isolation of viral IBV strains in 2018

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Keywords: Avian infectious bronchitis, Coronavirus, coronaviridae, Specific pathogen free, poultry.

Aims of the work: Avian Infectious Bronchitis (IB) is an economically important, highly contagious and acute upper-respiratory tract disease of chickens. IB continues to be a threat for chicken production in many countries including Morocco, even in vaccinated flocks. The responsible viral is a positive-stranded RNA virus of 27.6 kb size, belonging to the Coronavirus family (Coronaviridae). The remarkable characteristic of avian coronaviruses is their high mutation ability, giving rise to new strains whose pathogenicity may have some specificities. Hence, this work aims to reveal the pathogenicity of avian infectious bronchitis virus in Moroccan chickens using embryonic eggs free of specific pathogens (EAPS).

Methods: In order to isolate the IBV viral strains, 100 chicken samples of age ranged between 25- and 38-day-old, from Moroccan poultry farms, showing symptoms reminiscent of the disease of avian infectious bronchitis, collected during the year of 2018. The mortalities in the all sampled flocks ranged from 10% to 40%. All the collected samples; organs and the tracheal swabs were

immediately suspended and macerated in Phosphate-buffered saline containing 4% antibiotics. It was implemented through inoculation of the homogenates within the allantoic sac route of 9-11-day-old embryonated Specific Pathogen Free (SPF) eggs and incubation during 6- 7 days (using five eggs by sample) at a temperature of 37°C (+/- 2°C) and a relative humidity of 75% (+/-10%).

Results: The embryos were examined and confirm the severity of virus pathogenicity by the presence of dwarfism and haemorrhagic traces from the first passage on embryonic SPF eggs, considered as being pathognomonic signs of IBV. Samples with embryos showing no lesions were considered negative.

Conclusion: The RT-PCR detection and molecular sequencing of these samples need to be further studied to characterize a new IBV strains circulating in the Moroccan poultry farms.

P54. Vitamin D receptor gene polymorphisms and breast cancer virus-induced risk.

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Keywords: Breast cancer, Viral etiology, Vitamin D, Receptor of vitamin D, Polymorphisms

Aims of the work: Breast cancer is the most common and lethal malignant cancer among women. It represents approximately one quarter of all cancers in women. It's the main cause of mortality in women between 35 and 65 years. Its incidence and mortality rate continues to increase each year.

About 20% of all human cancers in the world are attributed to viruses. Several studies tend to confirm the involvement of some viruses in breast cancer. In this respect, the more

widely suspected viruses are the Mouse Mammary Tumor Virus-like (MMTV-like), Human Papilloma Virus (HPV), Epstein Barr Virus (EBV) and Bovine Leukemia Virus (BLV). Also, other scientific studies are directed to the preventive confirmation of the vitamin D effect against this cancer.

Methods: The objective of our study is to identify the viral etiology of breast cancer by the nested PCR in biopsies collected from University Hospital Center. Then we will carry out molecular detection of the VDRs by the real time PCR using primers and specific probes of every studied polymorphism and finally we will realize a global analysis of the results obtained in order to establish the possible relation between the breast cancer viral etiology and one or several dominating polymorphism(s).

Results: The expected results are to highlight the viral etiology of breast cancer and the polymorphism(s) of the VDR associated to this cancer, and to determine the relation between them.

Conclusion: These results suggest that these polymorphism(s), could be used as promising biomarkers. This relation will guide us towards a new preventive way against this plague.

P55. Evaluation of Actinobacterial biological activities against multi-resistant pathogens

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Keywords: Bacterial resistance, pathogenic bacteria, Actinomycetes, antibacterial activity,

Aims of the work: Isolation and characterization of novel molecules produced by Actinomycetes and evaluation of their

antibacterial activity against pathogens and antibiotics multi-resistant bacteria.

Methods: Ten soil samples were taken from different regions of Morocco. Actinomycetes were isolated by four media (M2, ISP2, Bennett and M3) using the serial dilution technique. The antimicrobial activity was evaluated on four media (Bennett, GYEA, ISP1 and ISP2) against various antibiotics multi-resistant bacteria using both the technique of double layer and agar cylinder. Characterization by micro-morphological, physiological and biochemical properties, pigments production and growth in various pH and NaCl concentrations of the isolates were studied.

Results: The results of the isolation of the Actinomycetes revealed 2 isolates of interest (E1, E2). The antibacterial activity was tested against 17 strains multi-resistant and pathogens belonging to the following : Gram-negative bacilli, Gram-positive cocci, Gram-negative cocci and yeast, 10 of which were clinical and 7 were ATCC strains provided by Pasteur Institute of Casablanca. The E2 isolate showed the highest activity while the highest inhibition zone scored was by E1 against *Bacillus cereus* ATCC.

Conclusion: The M2 medium seems the best isolation medium of Actinomycete in comparison with the others: Bennett, ISP2 and M3. The best isolate tested for antibiotic production was E2 isolate regardless of the technique used. The strain E2 has the ability to produce melanoid pigments on GYEA medium while E1 had no pigment production. The micro-morphological observation showed that both strains were filamentous and branched.

P56. Resistance of Gram-negative bacilli to antibiotics in the Chlef community

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Keywords: Gram-negative bacilli; Antimicrobial resistance; Community infection; Chlef

Aims of the work: Antibiotic resistance has become a major public health problem in Algeria. The present work was conducted to estimate the antimicrobial resistance of GNB isolates from the Chlef community.

Methods: Between February and April 2018, a study on the GNB and antibiotic resistance was conducted in the hygiene laboratory of Chlef. An in-vitro study was conducted to determine the susceptibility of the isolated strains to four different families of antibiotics by the disk method according to the standards of the CA-SFM 2018. Résistants isolates were selected by PCR, *bla*_{TEM} and *bla*_{SHV}, using specific primers.

Results: 56 strains of GNB were isolated from 469 clinical specimens. 50 strains of *Enterobacteriaceae* were isolated, with predominance of *Serratia adorifera* (24%). The non-fermenting GNB accounted for 1.27% frequency of isolation with 4 strains of *Pseudomonas aeruginosa* and 2 strains of *Acinetobacter baumannii*. Antibioqram assay showed that most of the isolates confirmed higher sensitivities rates for β -lactams, aminosides, fluoroquinolones and colistin antibiotics. The analysis of *Enterobacteriaceae* resistance phenotypes to β -lactams showed the predominance of wild type. One strain of *A.baumannii* and one strain of *P. aeruginosa* exhibit the multiresistant phenotype. PCR molecular analysis showed the *bla*_{TEM} type was detected in two enterobacterial strains, whereas a single strain expresses the *bla*_{SHV} gene. Only the *bla*_{TEM} gene could be identified in the multiresistants strains of *A.baumannii* and *P.aeruginosa*.

Conclusion: Regular surveillance of antibiotic resistance in the Algerian population is essential to monitor the evolution of bacterial epidemiology and guide first-line treatments.

P57. Crude extract of *Inula viscosa* as an antibacterial agent against clinical strains of Methicillin Resistant *Staphylococcus aureus*

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Keywords: *Inula viscosa*, Crude extract, MRSA, Antibacterial activity.

Aims of the work: *Inula viscosa* (Asteraceae) is a plant woody at the base presents yellow flowered with a strong smelling, and profusely colonizes sub-nitrophile and sub-saline soils in abandoned fields in the Mediterranean region. It was used against several diseases such as microbial infections. Among severe pathogens, *Staphylococcus aureus*, is one that can cause serious human diseases. Besides the growing significance of Methicillin-resistant *S. aureus* as pathogen of nosocomial infections, today its resistance against several classes of antibiotics has become a serious health. The aim of our study was screening of a new bioactives molecules in medicinal plants which showed an interesting antibacterial activity.

Methods: In the present study, the methanolic extract of *I. viscosa* was obtained using Soxhlet, and screened for their

antibacterial activity against strains of *S. aureus*, both the standard “ATCC” strains of *S. aureus* ATCC 25923 / ATCC 6538 / MRSA ATCC 43300, and 2 clinical isolated strains of *Staphylococcus aureus* methicillin resistant. The antibacterial activity test was done by the agar (Mueller Hinton) disc-diffusion method with bacterial inoculum $5 \cdot 10^6$ CFU/mL.

Results: Crude extract of *I. viscosa* showed antibacterial activity against ATCC

and clinical strains of *S. aureus*. A good activity was also shown against *S. aureus* resistant to Methicillin with a diameter of inhibition between 14 and 17mm.

Conclusion: *Inula viscosa* provide interesting target for identifying and isolating antibacterial molecules, which represent a promising source of bioactive natural products.

TOPIC III-

P58. First assessment of Phytoplankton diversity in a Moroccan shallow reservoir (Sidi Abderrahmane)

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Keywords: Phytoplankton, diversity, trophic status, shallow reservoir, Morocco.

Aims of the work: In order to find effective measures to control a Moroccan shallow reservoir (Sidi Abderrahmane), a better understanding of phytoplankton composition, abundance, spatial and temporal distribution is necessary.

Methods: Trophic level and the stability status were assessed upon the basis of Shannon diversity index (H'), species richness (S), and evenness (J) index. Statistical tests were used to evaluate the different relationships between phytoplankton and the concentrations of several physico-chemical parameters, and the main soluble nutrients. In surveys, the samples were taken fortnightly from May 2011 to December 2012.

Results: Sixty four taxa belonging to seven groups of phytoplankton were identified, including Bacillariophyceae (25 taxa), Chlorophyceae (22 taxa), and Cyanophyceae (9 taxa). *Aulacoseira granulata*, *Nitzschia palea*, *Scenedesmus*

acuminatus, and *Oscillatoria* sp, were the main contributors to the dissimilarity in temporal distribution. Phytoplankton population never reached a monospecificity situation. Shannon and evenness indices were between ($0.0001 < H' < 0.15$; $0.003 < J < 0.085$) and manifested a young phytoplankton community with high multiplying power. There were significant correlations between total phytoplankton ($r = 0.015$, $p < 0.01$) and water temperature. Significant negative correlations were observed between transparency and Cyanophyceae ($r = -0.208$, $p < 0.05$) and between the number of species and transparency ($r = -0.206$, $p < 0.05$), orthophosphorus ($r = -0.377$, $p < 0.01$), and nitrates ($r = -0.301$, $p < 0.01$). A negative correlation was found between Orthophosphorus and Chlorophyceae ($r = -0.377$, $p < 0.01$). Similar correlations were also observed with nitrates and Chlorophyceae ($r = -0.297$, $p < 0.01$), Silica and Bacillariophyceae ($r = 0$, $p < 0.01$) and total phytoplankton ($r = -0.372$, $p < 0.07$). The underwater light condition, as indicated by Secchi depth fluctuations, hydraulic process conditions (short residence time, short outflow/inflow ratio) were shown to be the limiting factors in regulating the density of phytoplankton. With reference to Palmer pollution index, test results indicated an oligotrophic or mesotrophic reservoir.

Conclusion: The data presented provide the first contemporary account of the level of algal diversity present, the prominent environmental conditions and trophic status of Sidi Abderrahmane reservoir waters.

P59. Phytohormones and polyamines in food-waste -derived vermicompost leachate

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Keywords: *Biostimulant.PGRs. Phytohormones. Polyamines. Vermicompost leachate.*

Aims of the work: Through their decomposing activities, earthworms produce rich organic fertilizers called vermicomposts containing mineral nutrients although indirect evidences suggest the presence of biologically active substances such as phytohormones and polyamines. Aqueous extract of food waste derived vermicompost namely vermicompost leachate (VCL) was analyzed.

Methods: We established the phytohormonal profil and polyamines concentrations of vermicompost leachate (VCL) using ultra high performance liquid Chromatography coupled with mass spectrometry (HPLC/MS) and HPLC system coupled to fluorescence detector.

Results: Total *trans*-zeatin types formed the major (47.15 %) proportion of the CK content while total N6-Isopentenyladenine –type had the lowest (5.8%). Indole-3-acetic acid was the major detected auxins (10.39pmol/ml). Other phytohormones ABA (13.59pmol/ml), SA (164.89pmol/ml) and JA (0.76pmol/ml) were also quantified in the VCL samples. The most abundant polyamines observed in the VCL samples were the major putrescine (8.84 nmol/ml), spermidine (12.92 nmol/ml) and spermine (12.39 nmol/ml).

Conclusion: The successful detection and quantification of phytohormones and polyamines in VCL provide evidence of a rich diversity in biologically active products in VCL which may undoubtedly contribute to the numerous favorable physiological responses exhibited by VCL-treated plants

under both favorable and stressful conditions. We postulated that these compounds result from a microbial synthesis during composting, although an incomplete digestion of food waste organic matter could not be excluded.

P.60.Effects of inoculation of metal resistant rhizobacteria and organo-mineral amendment on antioxidant activities of *Lolium perenne* growing in heavy-metal contaminated mine tailings

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Keywords: *Kettara mine, Tailing, Plant growth promotion; rhizobacteria; antioxidant enzymes; bioremediation*

Aims of the work: In the process of remediation of metal contaminated mine sites, the establishment of a vegetation cover is one of the most important tasks. However, using plants alone for bioremediation is subjected to different constraints such as high metal content, acidic pH and low nutrient content. This study evaluate the efficiency of two different remediation approaches of mine tailing in order to improve soils physicochemical properties and then assist plant growth (1) addition of organo-mineral amendments and (2) Rhizobacterial inoculation.

Methods: Mine tailings were collected from the abandoned mine of Kettara region in Marrakesh and rhizobacterial inoculants were previously isolated from metallophyte species growing at the same site. Two rhizobacterial strains, *Mesorhizobium tamadayense* BKM04 and *Tetrathlobacter kashmirensis* BKM20 exhibiting a multiple plant growth-promoting activities (e.g. IAA and ACC deaminase activity, phosphate solubilization and

siderophore production), were used to inoculate the substrate. Alternatively, compost and rock phosphate were added to mine tailings mixed with agricultural soil in order to support plant establishment. Non-inoculated test was also used as a control. On treated and untreated soils, seeds of the grasses *Lolium perenne* were germinated, and the growth of the seedlings was monitored.

Results: At the end of the experiment, it was found that both chemical and biological treatments particularly when combined, enhanced plant shoot and root development. In comparison to non-inoculated control, results showed that shoot biomass of rye-grass were improved significantly ($p < 0.05$) by up to 1.14 fold after individual inoculation and by 1.16 fold after inoculation with the consortium of the two rhizobacteria. Furthermore, the maximum root biomass produced was obtained in the presence of inoculation and was 1.33 fold higher after individual inoculation and 1.46 fold higher after inoculation with rhizobacteria consortium. The effect of PGPR inoculation on plants growth improvement was also accompanied by a greater stimulation of the antioxidant system (enhancement of catalase (CAT), peroxidase (POD) polyphenol oxidase (PPO) and glutathione reductase (GR) activities), which probably help the plants to reduce oxidative damage related to metal stress.

Conclusion: In conclusion, it seems that the application of amendments and/or bacterial inoculations to enhance plant growth and reduce metal translocation in multi-contaminated soil could be a promising strategy for revegetation of Kettara mining site.

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MEC through the program QREN-POPH-Tipologia 4.1-Formação Avançada.

P.61. Isolation and characterization of soil actinobacteria from abandoned for their lead tolerance.

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Aims of the work: Lead (Pb) is a metal element is a major source of environmental contamination. The accumulation and concentration of this metal in a food web may lead to the intoxication of the body and disruption in the brain. Actinobacteria attracted the attention of many researchers due to their good potential of bioremediation and their active role in the removal of heavy metals.

Methods: Actinobacteria isolated from abandoned mining area (Sidi Bouatman) known with high concentration of lead were screened for their resistance to lead.

Results: 28 in Duxbury medium as a suitable medium to select Pb resistant actinobacteria. In this study, concentrations from 0.02 mg / ml of lead to 0.4 mg / ml of lead were tested. According to the finding results, 8 of the total isolates were found to be able to accumulate lead on lead-Duxbury agar and resist at a concentration up to 0.02 mg / ml of lead. At concentrations of 0.4 mg / ml of lead, only 1 isolates was found to be able to accumulate lead on lead-Duxbury agar and resist.

Conclusion: Actinobacteria from abandoned mine soil could be a promising source of resistant actinobacteria that could be used for bioremediation purposes.

P.62. Diversity of bacteria nodulating three species of Lupine in Maamora forest in Morocco

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Keywords: *Lupinus-Rhizobium-nodC-ARDRA-Siderophores-AIA.*

Aims of the work: Wild species of *Lupinus* occur naturally in the Mediterranean region, whereas Northern Africa. They are usually used as green manure because of their ability to establish a nitrogen fixing symbiosis with soil bacteria called rhizobia. Our work focuses on the evaluation of the biodiversity of bacteria nodulating lupines in the Maâmora forest, in the area of Rabat, Morocco.

Methods: seventy-one bacteria were isolated from the root nodules of *Lupinus albus*, *L. cosentinii* and *L. luteus*, grown in the soil of Maamora forest. The phenotypic study consisted in analyzing 75 physiological and metabolic parameters. The genetic analysis consisted in a rep-PCR, as well as the search for nodulation genes by amplification of the *nodC* gene using specific primers. For the ribotyping, we performed the ARDRA method using 5 restriction enzymes.

Results: The rep-PCR revealed a very high genetic diversity between the isolates, with 50 different profiles and all the representative strains do possess the *nodC* gene. The ARDA allowed the classification of the isolates into three main different ribotypes. The sequencing of 16S rDNA from 3 strains representing the 3 ribotypes

showed that they belong to three different species of the genus *Bradyrhizobium*. Furthermore, the strains were evaluated for their PGPR activities such as phosphate solubilization, siderophore and indol acetic acid production. Some strains were able to solubilize phosphate and produce siderophores and AIA as well.

Conclusion: Our results showed that the three species of lupines is nodulated by slow growing rhizobia belonging to *Bradyrhizobium* genus. Furthermore, the strains showed a very high diversity in physiological and PGPR activities.

P.63. Impact of compost from lagoon sludge and green waste on soil properties and yield of fababean

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Keywords: Compost, soil, faba bean, parameters of growth, yield.

Aims of the work: In agriculture, the intensive use of industrial inputs (fertilizers, phytosanitary products) and the effects of climatic hazards have a negative consequences on the environment. Indeed, composting is considered as the most widely used ecological approach to improve soil structure and plant resistance to disease. The goal of this study is to investigate the effect of different doses of compost (½ lagooning sludge + ½ green waste) and mineral fertilizers (NPK) on the different soil properties in order to compare their

effectiveness on soil propertise improvement and the plants growth.

Methods : A field experiment was conducted for eight months on a sand loam soil in Touama province of El Haouz, Marrakesh Morocco. A randomized complete block design was used with three repetitions and four doses of compost (D1=5 t / ha, D2=10 t / ha, D3=20 t /ha and D4= 40 t / ha), inorganic fertilizer (N : 80 kg/ha, P : 40 kg/ha and K : 30 kg/ ha) and unfertilized control (T), with the elementary plot size of (1m x 2m). Plant used for the field trial is faba bean. The evaluation of the impact of the various treatments included both a chemical analysis of the soil (pH, electrical conductivity, Polsen) and the monitoring of the different parameters of growth and yield (leaf index, Chlorophyll, aerial and root biomass and their height, dry weight of nodules and number of pods / plant, number of pods / m², number of seeds / pod, weight of 1000 seeds). *

Results : The results of this study has revealed that with the exception of NPK pH (7.367) which reduce, the pH of the various treatments increased compared to the pH of the control T (8,160).The EC and P Olsen were significantly higher in treated plots than T. Compared to untreated soil, The values of the parameters of growth and yield of faba bean showed a significant increase, proportional to the doses of composts applied, as well as an improvement by the addition of mineral fertilizer (NPK). Overall, the D4 treatment (40t/ ha) marked the maximum yield (71q/ha).

Conclusion: These results allow us to conclude that the use of compost is gainfull for the productivity of crops and the improvement of soil properties and one of the main strategies in bio-agriculture.

P.64.Effect of temperature on *Pseudomonas aeruginosa* ATCC27853 adhesion on glass and 316 stainless steel under dynamic water flow conditions

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Key words : *P. aeruginosa*, adhesion, PVC pipes, water flow

Aims of the work: The formation of a biofilm is generally a common phenomenon for most materials in the presence of a wetland full of microorganisms. This phenomenon, in the case of drinking water distribution networks, is influenced by different physical, chemical and biological parameters. This study therefore seeks to characterize the impact of temperature on the attachment and adhesion of a model bacterium drinking water quality indicator (*Pseudomonas aeruginosa*) on glass and 316 stainless steel under dynamic conditions by using a bioreactor.

Methods: Contact angle measurements were performed by a goniometer (GBX instruments, France) by the sessile drop method. Only one drop of a liquid is placed on each support. The number of adhered CFUs was estimated by a sonication bath.

Results: The adhesion of *P. aeruginosa* ATCC27853 to glass, and 316 stainless steel is apparently highly influenced by temperature, where the number of cells adhered increases with temperature growth for all substrates. It also appears that, whatever the temperature applied, the degree of colonization decreases in the following order : steel > glass.

Conclusion : In conclusion, our study shows that *P. aeruginosa* ATCC27853, a pathogenic opportunist and omnipresent in drinking water, can adhere to the internal surfaces of PVC pipes used in plumbing plus glass. The differences in adhesion may be due to changes in surface and environmental characteristics

P.65. Study of the predictive adhesion between bacteria from an anaerobic

digester and different supports (biocarriers)

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Aims of the work: The choice of biofilm carriers to put them in an anaerobic digester is important because it can improve performance and promote the development of biofilm. The adhesion between bacteria and a surface of a substrate is through nonspecific interactions that respond to physicochemical characteristics of both.

Methods: Using the contact angle measurement by a goniometer, on the surface of the bacteria as well as on 3 different materials PP (Polypropylene), PET (Polyethylene Terephthalate) and PVC (Polyvinyl Chloride), it was measured the contact angle of a droplet of each of the 3 different liquids, namely diiodomethane, formamide and pure water. The components of the surface tension of bacteria and the 3 materials, the Van der Waals interactions (γ_{LW}), the electron donor (γ^-) and the electron acceptor (γ^+) were calculated as well as the acid-base properties (γ_{AB}) by the approach proposed by Van Oss et al [1]:

$$\cos \theta = -1 + 2(\gamma_s^{LW} \gamma_L^{LW})^{1/2} / \gamma_L + 2(\gamma_s^+ \gamma_L^-)^{1/2} / \gamma_L + 2(\gamma_s^- \gamma_L^+)^{1/2} / \gamma_L$$

Where θ is the contact angle and S and L refer, respectively, to surface and liquid. One bacterium with a high performance in the early stages of degradation of organic matter was used in this study.

Results: Based on the results obtained, it can be theoretically esteemed that PET is thermodynamically the most favorable for the bacterial adhesion. After PET, we find PP which is also favorable for microbial adhesion, whereas PVC's

microbial adhesion will probably be less strong than with PET.

Conclusion: The prediction of microbial adhesion could be very interesting in improving the digester.

[1] Van Oss, C.J., Chaudhury, M.K., Good, R.J.: Interfacial Lifshitz-van der Waals and polar interactions in macroscopic systems. Chem. Rev. 88, 927-941 (1988)

P.66. Rotavirus A related to Moroccan aquatic environment

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Keywords: Rotavirus A; Gastroenteritis; Children under 5 year's agers; Environment; Vaccination

Aims of the work: Rotavirus A is the main etiological agent of diarrhea in children under five in Morocco. This diarrhea is accompanied by severe vomiting and dehydration with significant morbidity and mortality due to loss of water and electrolytes. Despite vaccination, oro-fecal transmission of rotavirus associated with nosocomial infections and zoonotic infections makes epidemiological surveillance difficult to implement. Molecular typing of the VP7 and VP4 genes can detect and quantify dominant strains in the study area and detect the presence of new strains resulting from combinations with vaccine strains, indigenous strains or other strains from African countries.

The objective of this work is to evaluate the risk of possible epidemics of rotavirus infant diarrhoea in the region of Mohammedia following the consumption of local shellfish and to genotype any strains found in the positive samples.

Methods: For this purpose, 48 samples of mussels and clams 48 samples were collected in the coastal region of Mohammedia since May 2018 and will be analyzed by RT-PCR.

Results: According to literature, we expect results comparable to those found by

Benhafid et al in 2013 where they was able to identify five genotype G rotavirus strains during the study period: genotype G1 (57.5%), G2 (14.7%), G9 (11.7%), G3 (0.5%) and G4 (0.5%). Mixed infections with two or three G genotypes were detected in 13% of the isolates. They was able to identify three strains of rotavirus genotype P: P [8] (79.2%), P [4] (9.7%) and P [6] (7.7%). Mixed infections with two or three P genotypes were also detected in 1.6% of the strains.

Conclusion: Finally, our study will highlight the need to establish an observatory and a national Rotavirus A database in conjunction with an effective vaccination program to control any possible outbreak.

P.67. Isolation of rhizobacteria from the soils of two semi arid regions using different types of culture media.

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Keywords: Semi-arid; Rhizobacteria; Complexing agents; Culture media.

Aims of the work: Arid and semi-arid regions soils are characterized by a lack in nutrients and organic matter necessary for the survival and development of microorganisms and crops. In these environments, bacteria play a vital role in the rehabilitation of degraded soils and their fertility. However, the rich culture media traditionally used to isolate bacterial strains may not be adapted to the isolation and growth of all the bacterial populations present in the soil. Thus, the main objective of this research was to develop new concepts which allow the isolation of a great diversity of bacteria.

Methods: In order to isolate the maximum types of bacteria from two rhizospheric soils, nine different media were used. The difference between the culture media concerned the ingredients composition and concentration.

Results: The result obtained showed that the addition of some complexing agents gave better bacterial diversity than the controls. The concentration of the ingredients in the culture medium gave also a greater diversity than the controls. However, there were no differences in the numbers of colonies obtained in the different media.

Conclusion: While studying the soil's microorganisms there is a big possibility of missing a significant number of rhizobacteria using traditional culture media. This could be restored partly by making some modifications in the composition and the concentrations of the culture media ingredients.

P.68. Microbial contamination of soils and vegetables from gardens of (peri)urban areas in Marrakesh city

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Keywords: Urban soils, urban agriculture, market gardens, fecal contamination indicators, human health.

Aims of the work: Urban agriculture has environmental and health risks due to the potential use of contaminated ground water and the inappropriate use of raw organic fertilizers that can flow into water sources. The objective of this work was to evaluate

the physicochemical quality and the fecal contamination levels of soils and edible parts of the vegetables collected from urban market gardens in Marrakech city.

Methods: Four different zones located in Marrakech urban and suburban areas were chosen: a rural area (as control), a residential area weakly anthropized, a former wastewater spreading area and an industrial area irrigated by wastewater.

Results: The garden soil quality had a physical and chemical fertility (texture, OM, available phosphorus), slightly higher than that of the control soils. Soils microbial concentration varied in the studied areas. Indeed, both industrial and old spreading sewage areas contained the highest concentration of bacteria ($10.3 \cdot 10^4$ to $18.4 \cdot 10^5$ CFU g⁻¹), fungi ($24.0 \cdot 10^2$ to $34.2 \cdot 10^3$ CFU g⁻¹) and actinobacteria ($13.0 \cdot 10^2$ to $20.5 \cdot 10^4$ CFU g⁻¹). Soil enzymatic activities showed similar phosphatase activities in all areas (14.4 to $19.6 \mu\text{g [pNP]g}^{-1} \text{PS h}^{-1}$). However, urease activity showed a gradual decrease (40.3 to $19.3 \mu\text{g [pNP]g}^{-1} \text{PS h}^{-1}$) from weakly to strongly anthropogenic soils. Evaluation of the soil total and fecal coliform revealed their presence in all soils tested, with high concentrations (95 - 458 UFC g⁻¹) in areas with a highly anthropogenic activity. The analysis of total and fecal coliforms and *E.coli* in some edible parts of the plants showed values, exceeding the required standards (NF V08-053).

Conclusion: The data related to the degree of disturbance of the urban soils and their contamination regarding fecal contamination indicators, especially of edible parts of coriander, parsley and lettuce, in the city of Marrakech may present a potential human health risk due to their ingestion.

P.69. Improvement of biogas production through the use of a microbial consortium adapted to each substrate: application on horse dung

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Keywords: fermentation, biogas, methane, energy, inoculum

Aims of the work: Methane fermentation is an innovative solution for the recovery of organic waste, and allows the production of biogas as renewable energy in addition to a high quality organic fertilizer and with several advantages over traditional fertilizers and chemical fertilizers. Our study aims to improve energy efficiency, by studying the influence of a biological activator consisting of specific bacteria (KT01) on anaerobic digestion

Methods: The tests are carried out in Batch (100ml Erlenmeyer flasks) linked to a gasometer consisting of an inverted graduated burette filled with a solution of guard (5% citric acid, 20% NaCl) for monitoring the production of biogas, and in 2000 ml Erlenmeyer flasks connected to an air chamber for storing biogas and measuring its methane composition

The bacterium (KT01) is adapted to the substrate for 20 days, then introduced into the vials containing a basic culture medium for methanogenic bacteria with the substrate studied. The physico-chemical parameters used to follow the evolution of cultures over time are: Organic matter, pH, microbial evolution and biogas production in quantity and quality

Results: The results show that compared to a witness, the inoculum used makes it possible to accelerate the biodegradation of the substrates (20 days instead of 45 days) and promotes the production of biogas in quantity and quality. Biogas yield for horse dung increased from 65 l / kg (MB) to over 83 l / kg (MB) with 68% CH₄.

Conclusion: This study allowed us to conclude that methane fermentation should be well conducted for better performance.

P.70. Use of mycorrhizal fungi in phytoremediation strategies in an abandoned mine site

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Keywords: Phytoremediation, Heavy Metals, Mycorrhizae, *Pinus halepensis*

Aims of the work: The objective of this work was to study the ability of the technique of phytoremediation, using a model plant Aleppo Pine (*Pinus halepensis*) infected with ectomycorrhizal fungi to fix heavy metals released in an abandoned mine site.

Methods: The first part of this work highlighted the ability of 20 Aleppo pine seeds to germinate and live for six months in 5-liter pots that contain polluted soil from the mine site diluted to (0% - 10% - 25% - 50% - 75% - 100%) with sand. We infected the roots of Aleppo pine with the spores of the fruiting body of genus scleroderma sampled in the Amizmiz forest.

Results: This study shows that the presence of ectomycorrhizae increases the tolerance of the species *Pinus halepensis* to heavy metals up to 75% dilutions.

Conclusion: The remainder of our study will focus on the measurements of heavy metals at soil and also at the different parts of the plant to determine the type of phyoremediation used by Aleppo pine.

P.71.Purification and characterization of a novel manganese peroxidase from the

white-rot fungi *Irpex lacteus* strain SBT16 for lignin degradation

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Keywords: White-Root Fungi, Manganese Peroxidases, Lignin Degradation.

Aims of the work: Peroxidases [E.C. 1.11.1.x; donor: H₂O₂ oxidoreductase] require H₂O₂ or other peroxides to oxidize various reducing substrates, which confers them an active role in different biological processes. Peroxidases, which are encoded by small or large multigenic families, are involved in several important physiological and developmental processes. They use various peroxides as electron acceptors to catalyse a number of oxidative reactions and are present in almost all living organisms. We have created a peroxidase database (<http://peroxidase.isb-sib.ch>) that contains all identified peroxidase-encoding sequences (about 6000 sequences in 940 organisms). They are distributed between 11 superfamilies and about 60 subfamilies.

Methods: The biochemical characterization of the pure peroxidases were investigated through physico-chemical determination as well as spectroscopy analysis.

Results: A novel extracellular manganese peroxidase-producing (75 U/mL) white-rot fungus was isolated from symptomatic wood at the Hamma Botanical Garden (Algeria) and identified as *Irpex*

lacteus strain BT16. The pure enzyme (MnP IL45) was purified to apparent electrophoretic homogeneity and biochemically characterized. The specific activity and Reinheitszahl value of the purified MnP IL45 were 632.58 U/mg and 2.71, respectively. MALDI-TOF/MS analysis revealed that the purified enzyme was a monomer with a molecular mass of 45,211.10 Da. The sequence of its 21 NH₂-terminal amino acid residues showed high homology with those of white-rot fungi peroxidases. MnP IL45 showed optimal activity at pH 6 and 80 °C using 2,6-DMP. This peroxidase was completely inhibited by sodium azide and potassium cyanide, suggesting the presence of heme-components in its tertiary structure. Interestingly, MnP IL45 showed higher catalytic efficiency of 5.2; 4.3; 2.5, and 1.7 fold than MnP TP55, MnP BA30, HRP, and MnP PC, respectively.

Conclusion: Data suggest that MnP IL45 may be considered as potential candidate for its useful tool for environmental applications mainly the development of enzyme-based technologies for lignin degradation.

TOPIC IV-

P72. Antifungal activity of essential oil from *Anethum graveolens* L. on fungal species development

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Keywords: *Essential oil, Anethum graveolens* L., Germination, Mycelial growth, Sporulation.

Aims of the work: This work aims to study the antifungal capacity of the essential oil of spontaneous aromatic plant *Anethum graveolens* L. with medicinal vocation used in traditional treatments in the South-West of Algeria.

Methods: Antifungal activity of the essential oil was studied with respect to seven fungal strains with various concentrations. Other physicochemical parameters were also measured.

Results: The results of direct contact method show that the oil of *Anethum graveolens* L. is very effective on the mycelial growth of the moulds. All strains were inhibited at minimum inhibitory concentrations (MICs) as from 1/500 v/v, except *Aspergillus niger* at MIC of 1/180 v/v. *Alternaria alternata* was most sensitive, being inhibited at MIC as weak as 1/6500 v/v. In addition to the growth of the mycelium, the essential oil of the plant showed, *in vitro*, an antifungal activity at least important on the two other developmental stages, germination and the sporulation, of all fungi. All strains were inhibited at concentration as weak as 1/370 v/v.

Conclusion: The essential oil of *Anethum graveolens* L. is very effective on

the fungal development and has a fungicide effect.

P73. Effect of combination of essential oils of *Citrus x paradisi* and *Coriandrum sativum* on fungal strains

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Keywords: *essential oils, combination, FIC index, fungal strain*

Aims of the work: The aim of the present study is to determine the effect of association of essential oils of *coriandrum sativum* and *citrus x paradisi* (grapefruit) with the phenolic extract of grapefruit seeds. Other associations have been made in particular, that of the essential oil of *Citrus x paradisi* with thymol and eugenol and tested on fungal strains namely: *Aspergillus flavus*, *Aspergillus niger* and *Botrytis cinerea*.

Methods: We used the microdilution or checkerboard method to determine the FIC index and characterize the type of effect obtained with the different combinations.

Results: The results obtained showed a good antifungal activity for the essential oils extracted from *Coriandrum sativum* and *Citrus x paradisi* with a minimum fungicidal concentration ranging from 2.8 to 11.21 mg / ml for *Citrus x paradisi* and from 2.46 to 19.72 mg / ml for *Coriandrum sativum* on *Aspergillus flavus*. The CMFSs of the two major components: eugenol and thymol and the ethanolic extract of grapefruit seeds ranged from 2.87 to 13.83 mg / ml. A synergistic effect is obtained with the combination of *Citrus paradisi* essential oil and *Coriandrum sativum* essential oil with an index FIC of 0.24 to 0.55.

Conclusion: These combinations can be used in antibacterial therapeutic to control antibiotic resistant microorganisms.

P74. Antimicrobial, antioxidant power of the phenolic extract of *Coffea arabica*

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Keywords: *Coffea arabica*, phenolic extract, antibacterial activity, antifungal activity and antioxidant activity.

Aims of the work: Natural plant substances have multiple interests in biotechnology and in different industries. Coffee is considered the second foodstuff in the world. Several studies have shown that coffee has beneficial biological properties for humans. In this work, we investigated the antimicrobial and antioxidant activity of the phenolic extract of *Coffea arabica*.

Methods: The antimicrobial activity tests were performed using the agar disk diffusion method and the MIC determination against 14 bacterial strains (Gram-positive and Gram-negative) and three reference *Candida albicans* yeasts. The evaluation of the antioxidant activity of this extract was carried out by the DPPH free radical scavenging method.

Results: Results of the antimicrobial tests showed that the phenolic extract has the best antibacterial activity against Gram-positive bacteria with diameters of the zones of inhibition of between 10 and 14 mm, and a strong antifungal activity vis-à-vis yeast *Candida albicans* ATCC 10231 with inhibition zones ranging from 19 to 24 mm. MICs were 100 µg / mL for all bacteria and 10 mg / mL for yeasts. The evaluation of the antiradical activity showed that the phenolic

extract has an IC₅₀ of DPPH interesting of the order of 0.182 mg / mL.

Conclusion The results confirm that *Coffea arabica* coffee beans have potent antimicrobial and antioxidant activity due to their high secondary metabolites.

P75. Antimicrobial activity of essential oils and polar extracts of two Lamiaceae form eastern Algeria: *Rosmarinus eriocalyx* and *Thymus munbyanus* ssp. *coloratus*

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Keywords: *R. eriocalyx*, *Th. munbyanus* ssp. *coloratus*, *Activité antibacterienne*

Aims of the work: In order to contribute to the valorization of the local medicinal plants, Antimicrobial activities of the ethanolic and aqueous extracts and the essential oils of *Thymus munbyanus* ssp. *coloratus* and *Rosmarinus eriocalyx* were assayed against some pathogenic bacteria.

Methods: essential oils obtained by hydrodistillation, and aqueous and methanolic extracts obtained by maceration, from flower and the mixture of stem/leaf.

Determination of antimicrobial activities of ethanolic, aqueous extracts and essential oils of *Th. Munbyanus* ssp. *coloratus* and *R. eriocalyx* were with the disk

diffusion method by using 10 µL of the extracts and oil.

Results: The results indicated that 10 µL of pure oils extracted from flower and the mixture of stem/leaf of *R. eriocalyx* showed the strongest activity against *C. albicans*, range from 7-10 mm. while for *Th. munbyanus* ssp. *coloratus*, oils of flower and the mixture stem/leaf exhibited activity against *S. aureus*, *E. faecalis*, *E. coli* and *C. albicans*.

Conclusion: The results of the antimicrobial activity showed that the oils from the aerial part of *T. munbyanus* subsp. *coloratus* have a significantly higher activity compared to flower oils. The essential oils of flowers and leaves of *Rosmarinus eriocalyx* seem to have strong antimicrobial properties against *C. albicans* while they did not affect the growth of *P. aeruginosa*, the ethanolic extracts were not very active and independent of the part of the plant from which they were extracted, conversely, *E. faecalis* and *E. coli* are not at all sensitive, the aqueous extracts are not active against all microbial species tested.

P76. Selective extracts of *Quercus robur* L. leaves': Do they have an inhibitory effect against uropathogenic microbial strains?

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Keywords: Tanins, Saponines, *Quercus robur* L., pouvoir antimicrobien, souches uropathogènes, CMI.

Aims of the work: Ce travail repose sur l'évaluation de l'activité antimicrobienne de deux extraits de feuilles de *Quercus robur* L. (Famille *Fagaceae*).

Methods: Le matériel végétal collecté a été dégraissé en premier lieu, puis l'extraction des tanins et saponines a été menée selon un protocole standard où les

extraits obtenus ont été testés sur quelques souches microbiennes uropathogènes par la méthode de diffusion sur gélose avec détermination de la CMI par la méthode de macro-dilution sur milieu liquide.

Results: Le rendement d'extraction des extraits sélectifs (tanins et les saponines) était 7.93 et 16.94 % respectivement. Les tanins et les saponines ont présenté une activité antimicrobienne basculée entre faible et forte (allaient d'absence d'inhibition à un diamètre de zone d'inhibition de 17.5 mm) selon les doses et les souches microbiennes testées,

Conclusion: Cette activité est proportionnelle aux concentrations testées, sachant que l'extrait des tanins était plus actif par rapport aux saponines.

P77. Diversity of endophytic and epiphytic fungal associated with twigs of *Ziziphus lotus* in Tizi-ouzou (Algeria).

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Keywords: Diversity, epiphytic fungi, mycoendophytes, twigs, *Ziziphus lotus*.

Aims of the work: Fungi are known to occur both on plant surfaces (epiphytes) and inside plant tissues (endophytes). Our study is carried out on the *Ziziphus lotus*, a plant commonly called "Sedra". The objective of this work is to establish an inventory of mycoendophytes and epiphytes associated with the twigs of this species.

Methods: Sampling is carried out in Djebba (Tizi-ouzou, Algeria) on eight healthy subjects at random in March 2017. Isolation of mycoendophytes is done after removal of epiphytes from the surface of twigs according to the protocol of HELANDER et al. (1994). Fragments are seeded on PDA

medium and incubated at room temperature. As for the epiphytes, the rinsing water of the twigs following the protocol of PUSZ *et al.* (2015) is cultured on PDA and incubated at room temperature.

Results: A total of 25 fungal genera are isolated from the twig segments. Of the 25 taxa, 12 are recorded as endophytes and 22 as epiphytes. Nine of the 25 genera were found to be common (*Acremonium*, *Alternaria*, *Aureobasidium*, *Cladosporium*, *Epicoccum*, *Penicillium*, *Phoma*, *Stemphylium* and *Ulocladium*). The genera *Aspergillus*, *Beauveria*, *Cephalosporiopsis*, *Embelisia*, *Exopiala*, *Fusarium*, *Mucor*, *Nigrospora*, *Penicillifer*, *Pseudallescheria*, *Rhizopus*, *Scedosporium* and *Trichoderma* only exist as epiphytes in the twigs of *Ziziphus lotus* and the genera *Dictyopolschema*, *Helicosporium* and *Pithomyces* exist only as endophytes.

Conclusion: The results obtained in this study based on morphological identification show a diversity in fungal genera identified as endophytes and epiphytes. However, the use of molecular identification can improve the knowledge of this biodiversity.

P78. Isolation of exopolysaccharides from coccal lactic acid bacteria

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Keywords: CLAB- EPS- sucrose-based medium- apparent viscosity- amount of EPS)

Aims of the work: consist to isolate and screen exopolysaccharides (EPS) producing strains of coccal lactic acid bacteria from natural environments of Algeria, in order to evaluate their capacity to produce these EPS and select the most performing strains.

Methods: Coccal lactic acid bacteria used in this study were isolated from two natural resources of Algeria (camel's milk

and fresh red meat). These stains were evaluated for EPS production on certain solid medium and ruthenium red milk agar plate. Quantitative estimation of EPS was realized by measurement of apparent viscosity and determination of sugar and protein total in these EPS, previously, extracted and purified from the various culture strains.

Results: Based on their EPS-producing colony phenotype in agar plates, five strains were chosen giving an important white-color with different capacities of production and a glistening and slimy appearance on sucrose-based media which was determined as the best for detecting the EPS.

The amount of sugar in the polymer rendered more than 400 mg/L and the apparent viscosity ranged from 2.1 to 2.9 mPa.s. Therefore, no clear-cut relationship between the slimy phenotype, the medium viscosity occurs and amount of EPS produced by a ropy strain when different strains were compared. For protein assay, a low content of protein was obtained on crude polymer revealing the quality of EPS extracts.

Conclusion: Many CLAB stains were screened for the ability to produce EPS using the qualitative and quantitative analysis. Three strains were selected for their significant production of EPS, yielded an important amount of polysaccharide.

P79. The antibacterial effect of *Lavandula stoechas* and *Laurus nobilis* essential oils alone or in combination with antibiotics and essential oils major components

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Key words: *Lavandula stoechas*, *Laurus nobilis*, essential oils, antibiotics, combination, antibacterial activity, synergy, checkerboard method

Aims of the work: The aims of this work is the determination of antibacterial activity of two essential oils, extracted from two aromatic plants *Lavandula stoechas* and *Laurus nobilis*, alone or in combination with major compounds or antibiotics.

Methods: This activity was evaluated in vitro by checkerboard method in Mueller Hinton medium on six bacterial strains.

Results: The extraction of essential oils by hydrodistillation gave yields of 1.40% for lavender and 0.64% for laurel. Both oils showed antibacterial activity against five bacterial strains, with minimal bacterial concentrations ranging from 3.75 to 15.65 mg / ml for *lavandula stoechas* essential oil and between 7.5 and 15 mg / ml. for *laurus nobilis* essential oil. The combination of the two essential oils gave a synergistic effect on all bacteria tested. The calculated index FBCs are between 0.625 and 0.75. The combination of *lavandula stoechas* essential oil with Thymol and Eugenol gave synergistic effects on three bacteria, with index FBCs ranging between 0.5 and 0.75. On the other hand, the association of *laurus nobilis* essential oil with the two major components showed several effects; synergistic, additive and indifferent. Associations between the two essential oils and the three antibiotics; Chloramphenicol, Cefotaxime and Colistine gave synergistic effects with index FBCs between 0.5 and 0.75.

Conclusion The combination of antibacterial agents and the search for synergistic effects seems to be a good approach to treat infectious diseases and solve the problem of antibiotic resistance.

P80. Antibacterial in vitro activity of plant *Mentha pulegium* essential oil against *clavibacter michiganensis* subsp.

***michiganensis*, the causal agent of tomatoes bacterial canker**

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Key words: Essential oil; *Mentha pulegium*; Bactericidal effect; *Clavibacter michiganensis* subsp. *michiganensis*.

Aims of the work: The bacterial canker caused by *Clavibacter michiganensis* subsp. *michiganensis* (Cmm), account among the most important phytosanitary tomato problems.. The purpose of the present study is to propose an alternative treatment based on the use of natural products such as *Mentha Pulegium* essential oil as alternative of chemical compounds.

Methods: The essential oil of *Mentha Pulegium* was obtained by the hydrodistillation method. The inhibitory effect of this essential oil has been tested against Cmm using the paper disk diffusion method. The minimal inhibitory concentration (MIC) of this essential oil was determined in liquid medium. The minimal bactericidal concentration (MBC) was determined by spreading 50µl of each tube, the concentration is greater than or equal to the MIC on YPGA medium and incubated at 25 °C for 72 h.

Results: *In vitro* test showed a high efficacy of *Mentha Pulegium* essential oil against Cmm with inhibition zone diameter greater than 30 mm. However, the MIC of this essential oil is 0.5% (v/v). Thus, the MBC was equal to 0.5% (v/v). The report of

MBC and MIC was equal to 1, indicating the bactericidal effect of *Mentha Pulegium* essential oil against the Cmm.

Conclusion: Based on results of our tests, the plant *Mentha Pulegium* essential oil is strongly recommended as an alternative treatment to the bacterial canker of tomato. However, further experiments are needed to obtain information regarding the economic aspects and antibacterial activities of essential oil *in vivo* without phytotoxic effects on seed germination. Then, research on the chemical composition of the essential oil used.

P81. *In vitro* evaluation of the antimetabolic and antiproliferative activities of the crude fungal extract of *Aspergillus: foliar* endophytic fungus of *Peganum harmala* L. (dayate Aiat, Laghouat, Algeria)

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Keywords: *Peganum harmala* L., *Aspergillus: foliar* endophytic fungus, fungal extract, antimetabolic activity, antiproliferative activity, Laghouat (Algeria).

Aims of the work: Medicinal plants are an inexhaustible source of bioactive molecules. They can be produced by the various organs of the plant or by mutual mycoendophytes present within the latter. It is with this in mind that we were interested in a spontaneous plant in the arid area of Algeria (Laghouat): *Peganum harmala* L. Our interest in this work focused on the demonstration of the antimetabolic and antiproliferative activities of the crude fungal extract of the genus *Aspergillus: foliar* endophytic fungus of *Peganum harmala* L.

Methods: Extraction of crude fungal secondary metabolites was performed using ethyl acetate. The antimetabolic activity of the latter was carried out according to the protocol of Shweta *et al.* (2012) on meristematic cells of *Allium cepa*. Mitotic

indices were calculated. Antiproliferative activity was tested using the yeast *Saccharomyces cerevisiae* as a eukaryotic cell model. Percentages of cytotoxicity were determined.

Results: The results confirm the action of *Aspergillus* crude fungal extract in the inhibition of mitosis, thus producing chromosomal and cellular abnormalities. The *Saccharomyces cerevisiae* tests also indicate the presence of an antiproliferative activity of this extract, thus reflecting a cytotoxic effect of the latter.

Conclusion: The secondary metabolites produced by this fungus have an inhibitory effect on mitosis as well as cell proliferation. This encourages us to use this path to find bioactive molecules of fungal origin, which can inhibit the proliferation of tumor cells.

P82. Study of Antioxidant and Antibacterial Activity of Essential Oils of *Tetraclinis articulata* (Vahl) Masters from Morocco

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Keywords: *Tetraclinis articulata* ; Essential Oils ;Antioxidant activity ;Antibacterial Activity.

Aims of the work: Morocco is a traditional supplier of the world market in aromatic and medicinal plants. A large number of species are used for the production of plant essences and other aromatic extracts mainly intended for the pharmaceutical and cosmetic industry. These metabolites include essential oils that are mixtures of aromatic substances present as tiny droplets in leaves, fruit barks, resin, branches and wood. These oils represent a very interesting group, which are endowed with antioxidant properties. This study aims to evaluate the antioxidant and antibacterial activity of essential oils

from the aerial part of cedar thuya (*Tetraclinis articulata*).

Methods: The extraction of the oils was carried out by hydrodistillation in a Clevenger type apparatus. The antioxidant activity of this oil was evaluated by the method of DPPH (2,2-diphenyl-1-picrylhydrazyl).

Results: percentage inhibition of the antioxidant activity is 81.06%. Also we could record a strong inhibitory activity for the microorganisms used.

Conclusion: According to the work carried out, it is concluded that the essential oil of *tetraclinis articulata* has a strong antibacterial and antioxidant effect.

P83. The natural diversity of mycorrhizal fungi associated to the rhizosphere of argan trees (*Argania spinosa* L.) and mycorrhizogenic potential of argan from North West Morocco (Oued cherrat)

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Keywords: *rhizosphere, argan, mycorrhizal fungi, mycorrhizal potential, arbuscular endomycorrhizae.*

Aims of the work: Mycorrhizal fungi play an important role in the tolerance of plants to environmental stresses. The aim of this work is to study the diversity of mycorrhizal communities associated with the argan tree located in North West of Morocco and to evaluate the Mycorrhizogenic Potential of the soils of the prospected trees.

Methods: six argan trees located in North West Morocco (Rabat/oued cherrat zone) were prospected. Sampling series of soil / argan tree roots, were carried out in February 2017 at an amount of 5 repetitions / site. Each sample is a mixture of 6 sub-samples taken around a tree at 20 cm of

depth and then kept for 0 to 3 months at 4 ° C. A natural mycorrhization of argan tree has been characterized by analyzing the root systems with staining described by Phillips & Hayman (1970). The mycorrhizal spores were separated from 100 g of soil by the method of Gerdman and Nicolson (1963), then counted and isolated under microscope. Their morpho-anatomical characteristics were identified based on identification manuals (Brundrett et al., 1996) and the INVAM site. The mycorrhizal potential of the soil which is used as a source of inoculum by the method of Plenchette et al, (1989). This potential is considered as a biological indicator of the state of soil degradation. Soil analysis was performed to characterize the composition of soil and its physicochemical qualities.

Results: This study confirms the presence of arbuscular endomycorrhizae in all samples of exploited trees. We found a variability of intensity from one tree to another. However, the isolation of the spores showed a richness of soils in these spores and revealed the presence of seventeen morphotypes including the genera *Acaulospora*, *Scutellospora* and the genus *Glomus* which is the most abundant compared to the other two genera. It also appeared that edaphic factor had a specific influence on the prosperity of the tree.

Conclusion: This study evaluated the association of argan from northwestern Morocco with mycorrhizal fungi, taking into account their natural diversity and the mycorrhizogenic potential of rhizosphere soil samples.