I. ABSTRACTS OF ORAL PRESENTATIONS

Sifth International Date Palm Conference
Abu Dhabi - United Arab Emirates; 19 - 21 March, 2018

Conference Proceedings, Conveners, Chairpersons and Committees

I. Registration

- **Sunday – 18 March 2018**
  14:00 – 19:00 Registration for early arrivals.
  Participants are kindly requested to report to the conference desk (at the three lodging hotels: Emirates Palace, Intercontinental and Rotana); you will receive your conference badge, a kit with full of conference material and program.

- **Monday – 19 March 2018**
  08:30 – 09:30 Registration for late arrivals.

II. Summary of the Conference's Program

Etihad Ballroom

Keynote Speech	:	Unique experience of Matrouh governorate in initiating a sustainable development project built around the Date Palm Ecosystem through the partnership between the Governorate of Matrouh, Khalifa International Award and the private sector in West Siwa.
FAO Presentation	:	**Red Palm Weevil:** - Follow-up on the International Scientific Consultation and High Level Meeting on Red Palm Weevil. management, Rome, Italy, 29–31 March 2017 - FAO The state of the art for the control of the Red Palm Weevil. - Canary Islands, story for Eradication of Red Palm Weevil. - Mauritania, story for containment of Red Palm Weevil.
AOAD Presentation	:	- Date palm value chain development in the Arab countries: key constraints and opportunities.
ICBA Presentation	:	- Real water requirements of date palm in the United Arab Emirates.
ICARDA Presentation	:	- An overview of ICARDA new strategy for the coming 10 years (2017 – 2026).

Tuesday - 20 March 2018

Room A - Session 1	:	Genetic Engineering and Biotechnology / Tissue Culture. 9:00 – 18:45
Room B - Session 2	:	Red Palm Weevil. 9:00 – 13:45
Session 3	:	Pests and Diseases of Date Palm. 15:00 – 20:00

Wednesday -21 March 2018

Room A - Session 4	:	Technical Practices of Date Palm. 9:00 – 18:00
Room B - Session 5	:	General Topics on Date Palm. 9:00 – 19:15
Room C	:	Conclusions and Recommendations. 17:00 – 18:30
Thursday -22 March 2018	:	Post conference tour.

III. Conference conveners

Prof. Ghaleb Ali Alhadrami
Deputy VC for
Research & Graduate Studies,
UAE University
P.O.Box.17555, Al Ain, UAE.
Tel.: +9713 713 4564
Fax: +9713 713 6902
E-mail: hadrami@uaeu.ac.ae

Prof. Abdelouahhab Zaid
Advisor at Ministry of Presidential Affairs and
Secretary General of Khalifa International Award
for Date Palm and Agricultural Innovation
P.O.Box. 3614, Abu Dhabi, UAE.
Tel.: +9712 3049999
Fax: +9712 3049990
E-mail: abdelouahhabz@mopa.ae

IV. Conference chairpersons

Tuesday - 20 March 2018

Room A - Session 1	:	Franz Hoffmann / USA & Ibrahim Saqer Mssallem / KSA.
	:	Harrison Hughes / USA & Salah Eddine Zaid / USA.
	:	Yvon Martel / Canada & Mukarram Bel Haj Faraj / UAE.
	:	Bhanu Chowdhary / UAE & Sajed Maqsood / UAE.
Room B - Session 2	:	Abdallah Oihabi / Morocco & Amin Mridha / Bangladesh.
Session 3	:	Hassan Shabana / UAE & Abdel Jaleel Cheruth / UAE.

Wednesday - 21 March 2018

Room A - Session 4	:	Jose Ignacio Cubero / Spain & Samir Al Shakir / Iraq.
	:	Sherif F. El Sharabasy / Egypt & Ahmed Al-Harrasi / Oman.
Room B - Session 5	:	Mohamed Ben Saleh / Oman & Zougari Baulheina / Tunisia.
	:	Glenn C. Wright / USA & Saleh Mohamed Aleid / KSA.

V. Conference committees

■ High Committee

- H.H. Sheikh Nahayan Mabarak Al Nahayan, Minister of Tolerance and President of the Award's Board of Trustees.
- Prof. Abdelouahhab Zaid, Advisor, Ministry of Presidential Affairs, KIADPAI General Secretary, Chair Organizing Committee.
- Dr. Helal Humaid Saed Al Kaabi, Member of the Award's Board of Trustees, Head of the Award's Financial and Administrative Division.

■ Scientific Committee

- Prof. Ghaleb Ali Alhadrami, Deputy Vice Chancellor for Research and Graduate Studies, Chair Scientific Committee.
- Prof. Bhanu Chowdhary, CFA, UAEU.
- Prof. Franz Hoffmann, USA, KIADPAI.
- Prof. Harrison Hughes, USA, KIADPAI.
- Prof. Yvon Martel, Canada, KIADPAI.
- Prof. Jose Ignacio Cubero, Spain, KIADPAI.
- Dr. Samir Al Shakir, Iraq, KIADPAI.
- Dr. Ibrahim Saqer Mssallem, KSA, KIADPAI.
- Dr. Fatima M. Al-Ansari, UAE, KIADPAI.
- Dr. Mukarram Belhaj Faraj UAE, ICBA.
- Dr. Mohammed Abdul Muhsen Salem, CFA, UAEU.
- Dr. Ayesha Aldhaheri, CFA, UAEU.
- Dr. Carine Platat, CFA, UAEU.
- Dr. Abdul Jaleel Cheruth, CFA, UAEU.

■ Media Committee

- Dr. Emad Saad from KIADPAI, will be responsible for the media coverage in collaboration with concerned parties.
- Mr. Mohamed Alaidaroos, FAO.
- Mr. Abdumutalib Begmuratov, ICBA.
- Mr. Showkat Rather, ICBA.

■ Organizing Committee

- Prof. Abdelouahhab Zaid, Advisor, Ministry of Presidential Affairs, KIADPAI General Secretary, Chair Organizing Committee.
- Dr. Aisha Abushelaibi, UAEU.
- Dr. Ahmed Hussein, UAEU.
- Dr. Shyam S. Kurup, UAEU.
- Dr. Tariq Chfadi, UAEU.

- Mr. Ghazi Jawad Aljabri, ICBA.
- Mr. Ahed Abdul Halim Karkouti, KIADPAI.
- Mr. Tag Elsir Musa, KIADPAI.
- Ms. Afra Mohamed Al Kaabi, KIADPAI.
- Ms. Esra Ali Shatnawi, KIADPAI.
- Ms. Yasmine Ali Alantari, KIADPAI.
- Mr. Wazef Al Zeydani, UAEU.
- Mr. Roger Francis, UAEU.
- Ms. Emily Shea Dunn, UAEU.
- Mr. Salem Al Kaabi, UAEU.
- Mr. Jassim Al Harmoudi, UAEU.
- Mr. Mohamed Disawi, UAEU.
- Mr. Abdul Rasheed Ezhikkottayil, UAEU.
- Mr. Jihad Khalil, UAEU.
- Mr. Ali Mohamed Fadil, UAEU.

PROGRAM

Sixth International Date Palm Conference
Abu Dhabi - UAE; 19 – 21 March 2018

Conference Program

Monday - 19 March 2018

08:30 – 09:30	:	**Registration for late arrivals**
10:00 – 12:00	:	**Opening Ceremony (Etihad Ball Room)**
12:30 – 13:00	:	**Visit to the Photo Gallery**
13:00 – 14:30	:	**Lunch Break**

Master Sessions – Panel Discussion

Time	Organization	Session tittle / Presenter	Panelists
15:00 - 15:15	**Matrouh Governorate**	Unique experience of Matrouh governorate in initiating a sustainable development project built around the Date Palm Ecosystem through the partnership between the Governorate of Matrouh, Khalifa International Award and the private sector in West Siwa. **His Excellency General Alaa Abu Zaid, the governor of Matrouh, Egypt.**	-
15:15 - 16:15	**FAO**	**Red Palm Weevil** **Facilitator: Alfredo Impiglia, FAO** - Follow-up on the International Scientific Consultation and High Level Meeting on Red Palm Weevil management, Rome, Italy, 29–31 March 2017. **Thaer Yaseen, FAO-RNE.** - FAO The state of the art for the control of the Red Palm Weevil. **Michel Ferry / FAO-RNE.** - Canary Islands, story for Eradication of Red	- Hassan Al Eyied / KSA. - Salim Ali Al Khatri / Oman. - Michael Ferry / Spain. - Moisees Alberto Fajardo Bello / Spain. - Romeno Faleiro / India.

		Palm Weevil. **Moises Fajardo, FAO-KSA.** - Mauritania, story for containment of Red Palm Weevil. **Romeno Faleiro, FAO-India.** - Open discussion **Hassan Al Eyied / KSA.** **Salim Ali Al Khatri / Oman.**	
16:15 - 17:15	**AOAD**	Date palm value chain development in the Arab countries: key constraints and opportunities. **Jozimo Santos Rocha / FAO.**	- Ibrahim El Dukheri DG / AOAD. - Alfredo Impiglia / FAO.
17:15 – 17:30	**Refreshment Break**		
17:30 - 18:30	**ICBA**	Real water requirements of date palm in the United Arab Emirates. **Steve Green, New Zealand.**	- Seta Tutundjian, Partnerships and Knowledge Management Division, ICBA. - Ismahane Elouafi, Director General, ICBA. - Abdessalam Ould Ahmed, Regional Representative for Near East and North Africa, FAO. - Ahmed Al Muaini, Environment Agency – Abu Dhabi. - Abdullah J. Al-Dakheel, ICBA.
18:30 - 19:30	**ICARDA**	An overview of ICARDA new strategy for the coming 10 years (2017 – 2026) **Kamel Shideed ICARDA / Assistant DG for International Cooperation**	- GCC General Secretariat Rep., ICARDA. - Theib Oweis, ICARDA. - Francesco Bonechi, Univ. of Florence, Italy. - Mustapha El-Bouhssini, ICARDA.

Tuesday – 20 March 2018

Room A

Session 1: Genetic Engineering and Biotechnology / Tissue Culture

Chairpersons	**:**	**Franz Hoffmann / USA & Ibrahim Saqer Mssallem / KSA**
9:00 – 9:15	:	Metabolomic approaches applied on the analysis of fruits and products of the date palm *Phoenix dactylifera* L. **Hans Brückner / Germany.**
9:15 – 9:30	:	Genetic diversity analysis of various date palm cultivars in the Kingdom of Bahrain using RAPD-based molecular cloning. **Malabika Roy Pathak / Bahrain.**
9:30 – 9:45	:	microsatellites usage for standardizing cultivar identification in date palm, *Phoenix dactylifera* L. **Salah E. Zaïd / USA.**
9:45 – 10:00	:	Sex determination in Iraqi date palms based on DNA markers. **Shatha A Yousif / Iraq.**
10:00 – 10:15	:	Effects of palm dates on expression of target genes of PPAR alpha in the liver of Rabbits. **Mohamed Saad Alshibani / Libya.**
10:15 – 10:30	:	Fingerprinting of Omani date palm cultivars. **Marwa Al Hinai / Oman.**
10:30 – 10:45	:	Genetic structure and diversity of commercially important date palm cultivars (*Phoenix dactylifera* L.) using phylogenetic relationships and simple sequence repeats (Microsatellites). **Salah E. Zaïd / USA.**
10:45 – 11:00	:	A three-tier approach can differentiate gender in immature date palm trees. **Ahmed Al-Harrasi / Oman.**
11:00 – 11:30	:	**Discussion**
11:30 – 11:45	:	**REFRESHMENT BREAK**

Chairpersons	: :	**Harrison Hughes / USA & Salah Eddine Zaid / USA**
11:45 – 12:00	:	Differential expression profiling of date palm stem to identify proteins modulated in the date palm stem infested with red palm weevil. **Khawaja Ghulam Rasool / KSA.**
12:00– 12:15	:	Detection of two candidate DNA markers associated with date palm fruit skin texture using single locus association analysis. **Hussam S.M. Khierallah / Iraq.**
12:15 – 12:30	:	Date palm (*Phoenix dactyliferous* L.) genetic diversity and conservation under the climate change. **S. Mohan Jain / Finland.**
12:30 – 12:45	:	Production of single cell protein from some date by-products. **Abul-Hamd E. Mehanni / Egypt.**
12:45 – 13:00	:	Biotechnological studies on the acclimatization of date palm plantlets produced *via* tissue culture techniques. 1- effect of growth regulators. **Adel Hegazy / Egypt.**
13:00 – 13:30	:	**Discussion**
13:30 – 15:00	:	**LUNCH BREAK**
Chairpersons	:	**Yvon Martel / Canada & Mukarram Bel Haj Faraj / UAE**
15:00 – 15:15	:	Micropropagation of Cv. Dhakki a high value date palm cultivar of Pakistan using offshoot and inflorescence explants. **Mushtaque Ahmed Jatoi / Pakistan.**
15:15 – 15:30	:	Date palm micropropagation and its key role in the current development strategy of date sector in Morocco. **Larbi Abahmane / Morocco.**
15:30 – 15:45	:	Refined and field proven micropropagation technology for commercial-scale date palm olant production. **C. Sudhersan / Kuwait.**
15:45 – 16:00	:	Conform and healthy tissue culture propagation of date palm. **Catherine Chambo / France.**
16:00 – 16:15	:	Enhanced in vitro multiplication and rooting of date palm cv. Yellow Maktoum by zinc and copper ions. **Zeinab E. Zayed / Egypt.**
16:15 – 16:45	:	**Discussion**
16:45 – 17:00	:	**REFRESHMENT BREAK**

Chairpersons	:	**Bhanu Chowdhary / UAE & Sajed Maqsood / UAE**
17:00 – 17:15	:	Cryopreservation of embryogenic cultures of date palm using encapsulation-dehydration technique and assessment of genetic stability. **Shawky A. Bekheet / Egypt.**
17:15 – 17:30	:	Effect of light conditions on germination and conversion of date palm somatic embryos to plants. **Mansour Abohatem / Yemen.**
17:30 – 17:45	:	cadmium and lead- induced genotoxicity in date palm (*Phoenix Dactylifera* L.). **Mohammed H. Abass / Iraq.**
17:45 – 18:00	:	A new interspecific date palm hybrid. **L. Al-Sabah / Kuwait.**
18:00 – 18:15	:	Date palm: application of molecular markers. **Ahlem Guettouchi / Algeria.**
18:15 – 18:45	:	**Discussion**

Room B

Session 2: Red Palm Weevil

Chairpersons	**:**	**Abdallah Oihabi / Morocco & Amin Mridha / Bangladesh**
9:00 – 9:15	:	Isolation and molecular identification of *Fusarium solani* from the red palm weevil cocoons collected from infested date palms in the Kingdom of Bahrain. **AbdulAziz M.A. Mohamed / Bahrain.**
9:15 – 9:30	:	Comparative susceptibilities of different life stages of the red palm weevil treated by entomopathogenic nematodes. **Esmat M. Hegazi / Egypt.**
9:30 – 9:45	:	RNAi-mediated silencing of vitellogenin gene abolishes egg production in the red palm weevil, *Rhynchophorus ferrugineus* (Olivier)-A highly destructive pest of palm trees. **Muhammed Tufail / KSA.**
9:45 – 10:00	:	Determination of imidacloprid against the red palm weevil *Rhynchophorus ferrugineus* in Egypt. **Sabbour M.M. / Egypt.**
10:00 – 10:15	:	Red palm weevils in Saudi Arabia and efforts to control it using genome editing with CRISPR/Cas9 technology to produce red weevil resistant (RPW) date palm. **Ibrahim Mssallem / KSA.**
10:15 – 10:30	:	Flight activity of red palm weevil *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae) in Montenegro. **Sanja Radonjić / Montenegro.**
10:30 – 10:45	:	Pheromone-communication disruption through gene silencing of odorant binding and receptor proteins, a novel approach for controlling red palm weevil, *Rhynchophorus ferrugineus.* **Binu Antony / KSA.**
10:45 – 11:00	:	Preliminary study of red palm weevil and its resistance under Gaza Strip conditions. **Mufeed F. Al-Banna / Palestine.**
11:00 – 11:30	:	**Discussion**
11:30 – 11:45	:	**REFRESHMENT BREAK**

11:45 – 12:00	:	Multi-use ecological biocide formulations: application to red palm weevil. **M'Hamed Elmorabit / Morocco.**
12:00 – 12:15	:	Transcriptome analysis of fat body tissues to identify the genes responsible for red palm weevil, *Rhynchophorus ferrugineus* (Olivier), reproduction. **Khalid Mehmood / KSA.**
12:15 – 12:30	:	Eco-friendly management of red palm weevil (*rhynchophorus ferrugineus olivier*) in date palm (*phoenix dactylifera* L.) - seven innovative approaches. **Amin Mridha / KSA.**
12:30 – 12:45	:	Cognitive palm tree utilizing artificial intelligence and internet of things technologies for early detection of red palm weevil in date palm tree farms. **Mohamed Abdelrahman Khalil / UAE.**
12:45 – 13:00	:	Implementation of inesfly paint and some integrated pest management elements for controlling Ephestia spp. in date palm orchards and date warehouses in Iraq. **Abass Al-Joudi / Iraq.**
13:00 – 13:15	:	Electrap evaluation experiment in Jordan Valley. **Basil Faisal Obeidat.**
13:15 – 13:45	:	**Discussion**
13:45 – 15:00	:	**LUNCH BREAK**

Room B

Session 3: Pests and Diseases of Date Palm

Chairpersons	**:**	**Hassan Shabana / UAE & Abdel Jaleel Cheruth / UAE**
15:00 – 15:15	:	Sustainable date palm production and bio pesticide research. **Mohammad Kamil / UAE.**
15:15 – 15:30	:	MiSeq analysis reveals high fungal diversity and the presence of new fungal pathogens of date palms. **Abdullah Mohammed Al-Sadi / Oman.**
15:30 – 15:45	:	Susceptibility of date palm dust mites to the entomopathogenic fungus *Beauveria bassiana.* **AlJabr AM / KSA.**
15:45 – 16:00	:	Management of root rot and wilt diseases by using some biological control agents on date palm under organic farming system. **Mohamed Farouk / Egypt.**
16:00 – 16:30	:	**Discussion**
16:30 – 17:00	:	**REFRESHMENT BREAK**
17:00 – 17:15	:	Using ginger (*Zingiber officinale*) extract as organic antibacterial source for controlling the endogenous bacterial problem of date palm micropropagation. **Maiada M. El-Dawayati / Egypt.**
17:15 – 17:30	:	Effect of plant extract Ruta graveolens against the date scale, Parlatoria blanchardi Targ., (Homoptera, Diaspididae) at Biskra oasis, Algeria. **Nacer Tarai / Algeria.**
17:30 – 17:45	:	Biological studies on the acarid mite Tyrophagus Putrescentiae feeding on sored date palm fruits (Acari: Astigmata: Acaridae). **Mariam A. El-Sanady / Egypt.**
17:45 – 18:00	:	Phylogenetic and pathogenic characterisation of Mauginiella scaettae as the causal agent of date palm (*Phoenix dactylifera* L.) inflorescence rot. **Bensaci Messaoud Bachagha / Algeria.**
18:00 – 18:15	:	Promoting the Application of ICT Tools in management programs of date Palm pests in Arab countries. **Mohamed El-Said El-Zemaity / Egypt.**

18:15 – 18:30	:	Ten years of Dubas Bug control by using biorational insecticides in Yemen. **Salem Mohammed Bashomaila / Yemen.**
18:30 – 18:45	:	Pathogenicity of the toxin diketopiperazines from entomopathogenic fungi *Nomuraea rileyi* against the red palm weevil *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae) in Egypt. **Sabbour M.M. / Egypt.**
18:45 – 19:00	:	Description of chemical and ultrastructural alterations in cell-wall of the date palm leaves affected by the brittle leaf disease. **Khaled Latreche / Algeria.**
19:00 – 19:15	:	Biological control of root rot, wilt diseases complex in offshoot date palm and improvement of growth parameters in new valley governorate, Egypt. **Magd E. A. El-Morsi / Egypt.**
19:15 – 19:30	:	Biology of the major storage pests of dates and their management using tnau probe traps and exposure of insects to carbon dioxide and cold treatments. **Merlin Isaac / India.**
19:30 – 20:00		**Discussion**

Wednesdaysday – 21 March 2018

Room A

Session 4: Technical Practices of Date Palm

Chairpersons	**:**	**Jose Ignacio Cubero / Spain & Samir Al Shakir / Iraq**
9:00 – 9:15	:	Date value chain in Saudi Arabia: major obstacles to the international date marketing. **Abdallah Oihabi / KSA.**
9:15 – 9:30	:	Architecture and colonization study of adult date palm root system (*Phoenix dactylifera* L.). **Hanane Bedjaoui / Algeria.**
9:30 – 9:45	:	Enhancement the production of agro-biodiversity of date palm (*Phoenix dactylifera* L.) in Siwa Oasis. **Sherif F. El Sharabasy / Egypt.**
9:45 – 10:00	:	Predicting farmers' willingness to adopt liquid pollination and polycarbonate drying house technologies: a case study from the date palm growers in the Sultanate of Oman. **Boubaker Dhehibi / ICARDA-Jordan.**
10:00 – 10:15	:	Drying dates using solar energy under polycarbonate house - new promising technology to dry dates in Oman. **Mohamed Ben Salah / ICARDA-Oman.**
10:15 – 10:30	:	Liquid pollination Technology as new technology to ameliorate date palm pollination and facilitate date palm field operations. **Youssif Al-Raisi / ICARDA-Oman.**
10:30 – 10:45	:	Rooting the off-Shoots of "Shahani" date palm. **Abdolhossein / Iran.**
10:45 – 11:00	:	Improvement of the culture in the oasis agro-ecosystem by the development of appropriate biofertilizers: case of date palms and underlying crops. **Meddich Abdelilah / Morocco.**
11:00 – 11:30	:	**Discussion**
11:30 – 11:45	:	**REFRESHMENT BREAK**

11:45 – 12:00	:	A growth analysis of the young date palm root system. **Bennaceur Malika / Algeria.**
12:00 – 12:15	:	Impact of pollination by pollen-grain-water suspension spray on retained, bunch weight, yield and fruit quality of Segae date palm cultivar (*Phoenix dactylifera* L.). **Said Saad Soliman / Egypt.**
12:15 – 12:30	:	Effect of leaf pruning without chemical application on Sayer (Istamaran) date production infected by leaf spots. **Esmaeil Rahkhodaei / Iran.**
12:30 – 12:45	:	Desert adaptive strategies in date palm revealed by high resolution imaging technologies. **Ikram Blilou / KSA.**
12:45 – 13:00	:	Effectiveness of the arbuscular mycorrhizas in the protection of date palm against dry conditions of arid lands. **Qaddoury Ahmed / Morocco.**
13:00 – 13:15	:	Comparative performance of date palm varieties for production of fresh and dry dates under Green Glass House conditions. **Muhammad Mansoor / Pakistan.**
13:15 – 13:30	:	Integrated pest management for control the green date palm pit scale insect (Palmapis Phoenics Rao.)(Homopetra: Asterolecaniidae) in Sudan. **Mahdi Abdelrahman Ahmed / Sudan.**
13:30 – 13:45	:	**Discussion**
13:45 – 15:00	:	**LUNCH BREAK**
Chairpersons	**:**	**Sherif F. El Sharabasy / Egypt & Ahmed Al-Harassi / Oman**
15:00 – 15:15	:	Investigation and determination the best way of bunch thinning on Mordaseng variety. **Atefeh Davoodian / Iran.**
15:15 – 15:30	:	Use of 5-hydroxypipecolic acid as authenticity and biomarker for date palm fruit-based foodstuffs. **Hatem Salama Mohamed Ali / KSA.**
15:30 – 15:45	:	Effect of organic fertilizer on mineral nutrition and production of date palm var. Majhoul in Morocco. **Bouamri Rachid / Morocco.**
15:45 – 16:00	:	A Breakthrough in the Processing technology of Dhakki dates. **Shahzada A. Saleem / Pakistan.**

16:00 – 16:15	:	Long-term assessment of the impact of salinity on fruit yield and quality in eighteen date palm varieties from the Arabian Peninsula. **Abdullah Dakheel / UAE.**
16:15 – 16:30	:	Yield and fruit characteristics of "piarom" date palm as affected by trunk injected and soil applied iron in a calcareous soil. **Jahanshah Saleh / Iran.**
16:30 – 16:45	:	Impact of arbuscular mycorrhizal fungi (AMF) and/or baker's yeast on root rot/ wilt disease and growth parameters of date palm offshoots in new valley governorate, Egypt. **Montaser F. Abdel-Monaim / Egypt.**
16:45 – 17:00	:	Effect of foliar spray with potassium dihydrogen phosphate and yeast extract on yield and fruit quality of 'Sukkary' date palm (*phoenix dactylifera* L.). **Mahmoud A. Ahmed / KSA.**
17:00 – 17:15	:	Interaction of rhizosphere microbial communities in date palm under a biotic stresses. **Nadia S. Al-Kaff / KSA.**
17:15 – 17:30	:	Use of high hydrostatic pressure as an alternative preservation method for fresh dates. **Saleh Mohamed Aleid / KSA.**
17:30 – 18:00		**Discussion**

Room B

Session 5: General Topics on Date Palm

Chairpersons	**:**	**Mohamed Ben Saleh / Oman & Zougari Baulheina / Tunisia**
9:00 – 9:15	:	Physio-chemical, flavor compounds and sensory properties of some UAE commercial date syrups. **Isameldin Bashir Hashim / UAE.**
9:15 – 9:30	:	Preventing date palm fraud: towards developing a database for authentication of dates and their geographical origin. **Parvez Haris / UK.**
9:30 – 9:45	:	The date industry in the United States and Mexico. **Glenn C. Wright / USA.**
9:45 – 10:00	:	Preliminary evaluation of palm date (*Phoenix dactylifera* L.) fruit juice in production of biosurfactant by Pseudomonas aeruginosa isolated from fuel-contaminated soil. **Djaber Tazdait / Algeria.**
10:00 – 10:15	:	Evaluation of date palm (*Phoenix dactylifera* L.) production and soil properties in relation to the sources and levels of organic manure application in conjunction with *arbascular mycorrhizal fungi* (AMF) on sandy soils in Amghara area of the State of Kuwait. **S. Al-Khabaz / ICARDA-Kuwait.**
10:15 – 10:30	:	Project development of sustainable date palm production systems in the GCC countries of the Arabian Peninsula: objectives, activities and major achievements. **Mohamed Ben Salah / ICARDA-Oman.**
10:30– 10:45	:	Competitive advantage of GCC date palm sector in the international market: market shares, revealed comparative advantages, and trade balance indexes. **Boubaker Dhehibi / ICARDA-Jordan.**
10:45– 11:00	:	Evaluation of an off-road light aerial platform for date palm cultivation. **Francesco Bonechi / ICARDA-Italy.**
11:00 – 11:30	:	**Discussion**
11:30 – 11:45	:	**REFRESHMENT BREAK**

11:45 – 12:00	:	GAP and GHP analysis in date small farms in Baharia oases. **Aly Kassem / Egypt.**
12:00 – 12:15	:	Assessment of UAE date palm varieties in Iraq. **Mahdi Al-Attabi / Iraq.**
12:15 – 12:30		Effect of feeding date palm fruit (*Phoenix dactylifera* L.) on menstrual health in a convenient sample of females. **Hiba F. Al-Sayyed / Jordan.**
12:30 – 12:45	:	Producing vinegar from three Libyan date cultivars using double stage fermentation method. **Mohamed Fennir / Libya.**
12:45 – 13:00	:	Valorization of fibrillum from palm date by-products by production of transplanting pellets. **Khalid Fares / Morocco.**
13:00 – 13:15	:	Date palm value chain development in the Arab countries: key constraints and opportunities. **Santos Rocha / FAO.**
13:15 – 13:45		**Discussion**
13:45 – 15:00	:	**LUNCH BREAK**
Chairpersons	**:**	**Glenn C. Wright / USA & Saleh Mohamed Aleid / KSA.**
15:00 – 15:15	:	Impact of the weather conditions on the date palms in Al Qasem Region, Kingdom of Saudi Arabia. **Ramzy Abdelrahim Aboaiana / KSA.**
15:15 – 15:30	:	Economic and technical feasibility of investment in date Palm sector. **AbdulBasit Oudah Ibrahim / Oman.**
15:30 – 15:45	:	Socioeconomic analysis of date palm sector: Case of Biskra region of Algeria. **Mohamed Amine Benmehaia / Algeria.**
15:45 – 16:15	:	**Discussion**
16:15 – 16:45	:	**REFRESHMENT BREAK**

16:45 – 17:00	:	Stable carbon and nitrogen isotope signature and vegetation indices as indicators of date palm performance under salinity **Abdullah Dakheel / UAE**
17:00 – 17:15	:	Characterization of four Moroccan date palm cultivars and assessment of their seeds' oil antifungal activity. **Hanine Hafida / Morocco.**
17:15 – 17:30	:	The Biodiversity of Date Palm (*Phoenix dactylifera L.)* in the Sultanate of Oman. **Hameed CH. Ali Alkhafaji / Oman.**
17:30 – 17:45	:	Insecticidal activity of essential oil from *Citrus sinensis* and Artemisia *herba-alba* against *Ectomyeloisceratoniae*Zeller (Lepidoptera: Pyralidae). **Samah Ben Chaaban / Tunisia.**
17:45 – 18:00	:	Fermentation effect on total flavonoids and some biochemical parameters of date juice obtained from the variety Deglet-Nour. **Kheira Zerrouki / Algeria.**
18:00 – 18:15	:	Economic efficiency of innovative investment in date palm sector: the case of the Sultanate of Oman. **Nashwan AbdulWahab AbdulRazzak / Oman.**
18:15 – 18:30	:	The trajectory of evolution of the date palm chain in the Ziban region (Algeria), situation and prospects. **Benziouche Salah Eddine / Algeria.**
18:30 – 18:45	:	Investigation of new cultivars of date palm (*Phoenix dactylifera* L.) raised from seed (pit) germination **Hasan Shabana / UAE.**
18:45 – 19:15	:	**Discussion**

Wednesday – 21 March 2018

Room C

Meetings of All Sessions' Chairmen

17:00 – 18:30 : **Conclusions and recommendations**

- Franz Hoffmann / USA
- Harrison Hughes / USA
- Yvon Martel / Canada
- Bhanu Chowdhary / UAE
- Abdallah Oihabi / FAO
- Jose Ignacio Cubero / Spain
- Mohamed Ben Saleh / Oman
- Zougari Baulheina / Tunisia
- Ibrahim Saqer Mssallem / KSA
- Salah Eddine Zaid / USA
- Mukarram Bel Haj Faraj / UAE
- Sajed Maqsood / UAE
- Amin Mridha / Bangladesh
- Abdul Jaleel Cheruth / UAE
- Samir Al Shakir / UAE

Thursday – 22 March 2018

I. Post Conference Tour (*)

08:30	:	Departure from Abu Dhabi.
10:00 – 11:00	:	Visit to Emirates Date Factory (Al Saad).
11:30 – 12:30	:	Visit to Al Foah Farm.
12:45 – 13:30	:	Visit to UAE University – Date Palm Tissue Culture Laboratory.
13:30 – 14:30	:	**LUNCH / Rotana Hotel**
14:30 – 16:00	:	Travel to Dubai.
16:00 – 17:30		Visit to International Center for Biosaline Agriculture.
17:30	:	Travel back to Abu Dhabi.

(*) - Participation in this Post Conference Tour is on a voluntary basis and free of charge. It will take the full day (Thursday, 22 March 2018).

- **Coordinator: Mr. Taj Elsir Musa (050 - 7302314).**

II. ABU DHABI – LOUVRE visit (*)

10:00	:	Departure from hotels.
11:45 – 12:30	:	Visit to AD – Louvre.
12:30	:	Return to hotels.

(*): To buy in advance the tickets, participants are kindly invited to visit (https://www.louvreabudhabi.ae/) and ticket price is 63 AED.

PRESENTATIONS

ABSTRACTS

Room A
SESSION 1

Genetic Engineering and Biotechnology / Tissue Culture

Metabolomic approaches applied on the analysis of fruits and products of the date palm *Phoenix dactylifera* L.

H. S. M. Ali[1], A. S. Al-Khalifa[1], **H. Brückner**[2]
[1]Department of Food Science and Nutrition, College of Food Science and Agriculture, King Saud University, Riyadh 11452, Kingdom of Saudi Arabia [2]Department of Food Sciences, Research Center for BioSystems, Land Use and Nutrition, University of Giessen, D-35392 Giessen, Germany
Hans.Brueckner@ernaehrung.uni-giessen.de

Abstract

The acronym metabolomics is defined as the methodology for the entire profiling of low molecular compounds occurring in organisms, including plants. If applied on raw or processed foodstuffs the approach has been coined 'foodomics'. We have analyzed fruits of the date palm of different cultivars at varying ripening states as well as date fruit-derived foodstuffs such as date paste, date syrup and date vinegar. Besides high-resolution chiral and non-chiral gas chromatography-high resolution mass spectrometry of derivatives, hydrophilic interaction liquid chromatography combined with positive and negative ion electrospray-ionization mass spectrometry was used for the analysis of the aforementioned foods. Based on retention times and diagnostic fragment ions we could characterize metabolites such as betaine, choline, glucose and sucrose isomers, deoxy-fructose diastereomers of proline, C16 and C18:2 fatty acids and citric acid as well as proteinogenic and non-proteinogenic amino acids like GABA and *trans*-5-hydroxypipecolic acid (5-OH-Pip). Since 5-OH-Pip is very rare in edible fruits, this non-metabolizable amino acid is proposed as reliable authenticity and dietary biomarker for date fruits and products. Metabolomics based on high-resolution mass spectrometric approaches are considered as the most advanced analytical methods for the comprehensive metabolite profiling of date fruits and foodstuffs made thereof.

Genetic diversity analysis of various date palm cultivars in the Kingdom of Bahrain using RAPD-based molecular cloning

Malabika Roy Pathak, Muhammad Farooq, Abdulaziz M. A. Mohamed
Department of Life Sciences, Arabian Gulf University, Manama, Kingdom of Bahrain
malabikarp@agu.edu.bh ; amamohamed@agu.edu.bh

Abstract

Date palm (*Phoenix dactylifera* L.) is an important fruit crop mainly cultivated in the Near East and North African Region. Date palms are playing a central part of the rich heritage of the Kingdom of Bahrain since Dilmun civilization to recent time. Despite small land area, currently, a large number of indigenous and introduced cultivars are of rich genetic resources of date palms in Bahrain and playing a big role in combating desertification and conserving biodiversity. Identification and analysis of genetic diversity are important for molecular identification and authentication of the cultivar. Presently six economically important cultivars of date palm having differences in fruit ripening time in the Kingdom of Bahrain (Muwaji, Gharrah, Khelas, Khunaizi, Selmi, and Hilali) has been selected for the study of RAPD-based sequence characterized amplified region (SCAR) based molecular marker development program. The sequence-based markers are stable and improved as it is based on advanced cloning technology. We analyzed RAPD using different primers and obtained polymorphism which will be a track in next step for the development of authentic SCAR markers to differentiate the cultivars at the molecular level.

Microsatellites usage for standardizing cultivar identification in Date Palm

Salah E. Zaïd & Harrison G. Hughes
Department of Horticulture & LA, 301 University Ave.
Colorado State University, Fort Collins CO 80523-1173, USA
zaid@alumni.colostate.edu

Abstract

Selected microsatellite markers were evaluated for their potential in the fingerprinting of date palm cultivars in an attempt to standardizing identification procedures. Clonally propagated crops such as date palm, *Phoenix dactylifera* L., require that specific cultivars be correctly identified when initiating mass propagation. Periodic checks on the validity of the identity and their clonal trueness-to-type as they move through the micropropagation procedures of multiplication, acclimation and shipping in commercial propagation facilities is important for successful date palm propagation. Recent work has been successful in the sequencing of two cultivars within the date palm genome and various procedures that facilitate "fingerprinting" of specific genotypes. Simple sequence repeat (SSR) panels, accessible microsatellites in multiplex PCR, was used to successfully identify date palm cultivars. Four primer pairs, amplifying loci represented as primer sequences with appropriate multiplex 5' modification, were used to fingerprint 56 date accessions representative of important globally commercial available cultivars. These accessions were subjected to evaluation and demonstrated sufficient polymorphism to distinguish among 54 of the cultivars. A total of 38 (33 females and 5 males) could be confirmed in their identity by the trilateral confirmation system through experts and morphological characteristics, the remaining 18 represented cultivars that were new and potentially different. Results suggest that much greater intra-varietal diversity exists within the collected populations as allelic composition was well conserved among the varietal sub-groups. Further microsatellite markers or SNPs will be required to fingerprint the remaining 18 genotypes and others from a genetically more variable array. Additional motifs for the detection of multiple polymorphic fragments will be needed to cover larger panels and populations of diverse backgrounds among date cultivars. These results
show that a relatively few microsatellites can be used to confirm large numbers of specific cultivars and thus provides a valuable and affordable tool for verification of genotypes in the mass propagation of date palm for commercial purposes.

Keywords: Cultivar, Identification, Date palm, Simple sequence repeats, Palmàprinting, Laboratory quality control, Fingerprinting, P. *dactylifera* L.

Sex determination in Iraqi date palms based on DNA markers

Shatha A Yousif, Attallah I . Alwan, Laith A. Hatem and Hamza A. Ibraheem
Agricultural Research Directorate,
Ministry of Science & Technology, P.O. Box 765, Baghdad-Iraq
yousifshatha@yahoo.com

Abstract

Date palm tree (*Phoenix dactylifera* L.), is a dioecious monocotyledonous plant, with separate male and female trees and it is impossible to distinguish tree gander at an early stage of development until it reaches a reproductive age, at the time of first flowering, which takes around 5–10 years. Date palm trees are propagated either from seed or vegetative off shoots. Propagation with seeds is unsuitable for commercial production because half of the progeny are males, so early sex identification at seedling stage (differentiation of young seedlings into males and females) is an economically desirable objective, which will significantly increase the profits of seed based cultivation and could enhance breeding programs for genetic improvements of the date palm. There have been numerous attempts to use the biochemical and molecular markers at early stage to discriminate among male and female trees in date palm.

Here, we tested sex-specific PCR-based markers that can helping in early gender determination in Iraqi date palm trees. 4 male varieties (Ghnami Ahmer, Ghnami Akhdhar, khkry and khkry-Semesmy) and 4 female varieties (Breem, Khadrawi, Maktom and Tebrzal) were subjected to PCR amplification using 7 random amplified polymorphic DNA (RAPD) and 10 Simple Sequences Repeats (SSR) primers to identify sex-linked markers.

4 SSR and 2 RAPD markers exhibited differential fragments between males and females which indicated that these fragments are the promising candidate marker to detect the sex in date palm seedlings at early stage. These differential fragments were gel extracted for subsequent sequencing analysis.

Effects of palm dates on expression of target genes of ppar alpha in the liver of rabbits

Shibani M[1], Karfahk O[2]
[1]Food Sciences Departement/ Tripoli University/ Tripoli – Libya
[2]Biotechnology Center/ Tripoli - Libya.
msal1975@yahoo.de

Abstract

In mammals, several nutrients act as activators of target genes of PPAR alpha in the liver, and thereby influence hepatic lipid catabolism and synthesis. The aim of this study was to evaluate the effects of date palm extract (Degla-typ) on genes involved in lipid homeostasis of Rabbits as an animal model. Thirty New Zealand rabbits were fed diets containing: (500 mg/kg/day) of Degla extract (group 1), (300 mg/kg/day) of Degla extract (group 2) or (0.00 mg/kg/day) of Degla extract (control-group) for 5 weeks. rabbits 500 mg/kg/day had a higher expression of some PPAR alpha target genes and a lower nuclear concentration of SREBP-2 in the liver and lower concentrations of cholesterol and TAG in plasma than control rabbits. Nuclear concentration of SREBP-1 and its target genes involved in lipogenesis were not altered in rabbits fed (300 mg/kg/day, of Degla extract. Rabbits fed (0.00 mg/kg/day) of Degla extract had increased concentrations of TAG and cholesterol in the liver. However, their mRNA levels of PPAR alpha target genes and nuclear concentrations of SREBP-1 and SREBP-2 as well as mRNA levels of their target genes in the liver were largely unchanged. In conclusion, the results of this study suggest that (500 mg/kg/day) of Degla extract cause a moderate activation of PPAR alpha and lower cholesterol synthesis but do not impair fatty acid synthesis in the liver of rabbits.

Fingerprinting of Omani date palm cultivars

Marwa Al Hinai , Abbas Al Lawati, Alghaliya Al Al Mamari and Yousuf Al Raisi
Ministry of Agriculture & Fisheries,
Directorate General of Agricultural & livestock Research, Oman, AlRumis,
research@omantel.net.om

Abstract

The numbers of known date palm cultivars that are distributed all over the world are approximately 5,000, out of which about 250 are found only in Oman. It is a dioecious, perennial, monocot plant, and its heterozygous form makes its progeny strongly heterogeneous. Most of these cultivars were described using morphological markers such as fruit and vegetative traits, but these are greatly affected by the environment and are also complex. In general, the identification and evaluation of genetic diversity between the cultivars on the basis of morphological markers is difficult. Recently DNA markers have been used to provide the information on the relatedness of date palm varieties that are difficult to distinguish morphologically. Microsatellites (SSR) have been used widely in date palm genetic studies. In this study, the genetic diversity of twenty-three of Omani date palm cultivars were studied by using 17 microsatellite markers. Mature leaves samples of all cultivars, five replicates per cultivar, were collected from five governorates of Oman from south and north Al-Batinah (Sohar and Barka), Al-Dahirah (Ibri), Al-Dakhilia (Wadi Quriate, Nizwa), Al-Sharqiya (Samad Al Shan, Al-Kamel & Al-Alwafi) and Al-Burymi (Mahadah, Al-Buraymi). A total of 205 alleles was scored with average of 12.0 alleles per locus. It was ranged from 4 alleles/locus for mPdCIR 57 to 20 for locus mPdCIR 10. The polymorphic information content (PIC) average was 0.668. There was genetic diversity within and among the selected cultivars and were assessed by using microsatellite markers.

Genetic structure and diversity of commercially important date palm cultivars (*Phoenix dactylifera* L.) using phylogenetic relationships and simple sequence repeats (Microsatellites)

Salah E. Zaïd & Harrison G. Hughes
Department of Horticulture & LA, 301 University Ave.
Colorado State University, Fort Collins CO 80523-1173, USA
zaid@alumni.colostate.edu

Abstract

Phoenix dactylifera L. (the date palm) is the notable palm which produces a nutrient – rich edible fruit (the date), well known for its unique attributes of medicine and healthy energy. It is a species that has been cultivated since early civilizations in the fertile crescent and later in the Middle East. It is typically cloned with many cultivars. An investigation into their genomes and origins should provide valuable information for their maintenance and potential improvement of superior genotypes. Phylogenetic relationships amid commercial date cultivars are poorly understood, despite their importance. Here we report on the investigation of 20 selected, commercially important date palm cultivars consisting of 18 females and 2 males which are grown throughout the world. The knowledge of relationships among cultivars is needed, although the date palm genome has been mostly sequenced (90.2 %) with 41,660 gene models representing 82,354 scaffolds, remains unclear. Presently, the information on the characterization of these cultivars requires an assessment to better understand the relationships among the superior genotypes. The use of microsatellites, due to their accuracy and high polymorphic capability, have led to fine scaled phylogenies. The phylogenetic relationships were determined using neighbor joining un-rooted trees correlated with genetic clustering. Primer selections were achieved from evaluation of 14 nuclear Sample SSR loci isolated from P. *dactylifera* L. as reported by Billotte et al. Although one would anticipate a concentrated domestication because of clonal propagation, results revealed a high degree of polymorphism observed in the 20 cultivars with fewer common alleles than anticipated. Within the cultivars studied, a broad heterozygosity across bp amplification data has led to an understanding of limited inbreeding accounting for possibly adaptation to environmental changes. Population structure analysis suggests a large genetic boundary between Northwest
African and the Middle East with 6 subpopulations that represent divergences and fragments of admixture in cultivars present in these regions. The possible selection of potential and good quality parents is achievable for improving cultivars by generating population and structure maps. This analysis documents patterns of relationship and provides genetic structure and cultivar specificity for this unique tree crop which should permit analysis of evolutionary relationships and information relative to population genetics.

Keywords: Microsatellites, *Phoenix dactylifera* L., Simple sequence repeats, Phylogenetics, Genetic structure, Date palm

A three-tier approach can differentiate gender in immature date palm trees

Ahmed Al-Harrasi[1]*, Abdul Latif Khan[1*], Adil Mohammed Adrees, Noor Abdulkareem, Fazal Mabood[2]*, Ahmed Al-Rawahi[1]
[1]Chair of Oman's Medicinal Plants & Marine Natural Products,
University of Nizwa, Nizwa, Oman
[2]Department of Biological Sciences & Chemistry,
University of Nizwa, Nizwa, Oman
aharrasi@unizwa.edu.om

Abstract

Gender differentiation in date palm (*Phoenix dactylifera* L.) has remained enigma for thousands of years. Breeding projects will benefit a great deal if a simple methodology to distinguish the gender of this long-lived tree obstructed by dioecy is developed. A robust new infrared spectroscopy (Near-Infra Red absorption spectroscopy-NIRS and Fourier transform infrared attenuated total reflectance-FTIR/ATR) coupled with multivariate & NMR spectroscopy and chemometrics supported by molecular methods is developed to solicit the gender differentiation from the leaves of date palm in immature stage. It was found that both techniques supported by the two vibrational spectroscopic methods showed a clear separation among the male and female gender of the date palm leaf. NMR spectroscopy and chemometrics was employed to further validate the clear discrimination between male and female date palm trees. The ^{1}H-NMR signals of the principal mono/disaccharides were found to be mostly responsible for this differentiation. To further confirm this identification in leaf samples, sex-specific genes and molecular markers (12 primers) obtained from lower half of LG12 chromosomes and previous reports were assessed for their transcription on quantitative real-time PCR. The transcript and amplification analysis revealed that mPdIRDP52, mPdIRDP50 and PDK101 were significant enough to discriminate the male date palm leaf samples. The three robust analyses provide an alternative tool to differentiate gender in date palm tree, which offers a solution to the long-standing challenge of dioecy and could enhance the *in situ* propagation programs of the trees.

Differential expression profiling of date palm stem to identify proteins modulated in the date palm stem infested with red palm weevil

Khawaja Ghulam Rasool, Abdulrahman S. Aldawood and Muhammad Tufail
Economic Entomology Research Unit (EERU), Plant Protection Department, College of Food and Agriculture Sciences, P.O. Box 2460 Riyadh 11451,
King Saud University, Riyadh, Kingdom of Saudi Arabia.
gkhawaja@ksu.edu.sa

Abstract

Differential proteomic analysis was performed to characterize peptides modulated in the date palm stem associated with red palm weevil (RPW) infestation using a cutting-edge proteomic approach, Matrix Assisted Laser Desorption/Ionization-Time of Flight (MALDI TOF). Our analyses revealed 32 differentially expressed peptides associated with RPW infestation in date palm stem. To identify RPW infestation associated peptides (I), artificially wounded plants (W) were used as additional control beside uninfested plants, a conventional control (C). A constant unique pattern of differential expression in infested (I), wounded (W) stem samples compared to control (C) was observed. The upregulated proteins showed relative fold intensity in order of I > W and downregulated spots trend as W > I, a quite interesting pattern. This study also reveals that artificially wounding of date palm stem affects almost the same proteins as infestation; however, relative intensity is quite lower than in infested samples both in up and downregulated spots. All 32 differentially expressed spots were subjected to MALDI-TOF analysis for their identification and we were able to match 21 proteins in the already existing databases. Relatively significant modulated expression pattern of a number of peptides in infested plants predicts the possibility of developing a quick and reliable molecular methodology for detecting plants infested with date palm.

Detection of two candidate DNA markers associated with date palm fruit skin texture using single locus association analysis

Hussam S.M. Khierallah and Hadeel D. Azhar
Date Palm Research Unit, College of Agriculture,
University of Baghdad,
P.O. Box, 47054 Baghdad, Iraq
khierallah70@yahoo.com

Abstract

Date Palm (*Phoenix dactylifera* L.) fruit characterization is crucial in evaluating the commercial value of any variety. Here, we used Using Single Locus Association Analysis to combine 14 morphological markers and 18 Inter Simple Sequence Repeat markers (ISSR-PCR) of 44 well-known varieties grown in some date palm stations belonging to the Ministry of Agriculture in five different regions of Iraq. Results of morphological markers analysis indicated that 4.2 alleles were found for all varieties. Shoot tip shape had 7.0 alleles while fruit shield separation had only 2.0. Major allele frequency ranged from 0.3 for fruit shape to 0.825 for fruit texture. Gene diversity was also ranged from 0.296 for fruit texture suggesting lowest polymorphism information content (PIC) value (0.265) to 0.771 for shoot tip shape suggesting highest polymorphism information content (PIC) value (0.742). Total number of ISSR fragments obtained was 7343 the number of polymorphic fragments were 219 (86.87%). Primer DPISR-3 gave the highest number of fragments reached 696 and the highest efficiency (8.59%), while the primer DPISR-5 gave the lowest number of fragments (293) and less efficient (3.99%). The primers DPISR-4, DPISR-12, DPISR-16, DPISR-17, DPISR-22 gave the highest polymorphism (100%) while the primer DPISR-15 gave less (63.16%). Results of the F test of the single locus using association analysis between phenotypic markers and molecular ones revealed of a highly significant correlation between DPISR-16_{2027bp} fragment and fruit skin separation on the level of probability of 0.0003 as well as fruits texture found to be associated with the fragment DPISR-1_{2433bp} high-link with level of probability of 0.0006. These two markers can be candidate markers associated with these two traits.

Keywords: *Phoenix dactylifera* L., Inter simple sequence repeats, Single Locus Association Analysis.

Date palm (*Phoenix dactyliferous* L.) genetic diversity and conservation under the climate change

S. Mohan Jain, Department of Agricultural Sciences,
University of Helsinki, PL-27, Helsinki, Finland,
mohan.jain@helsinki.fi

Abstract

Date palm (*Phoenix dactyliferous* L.) is an economically important tree species, grown in the arid and semiarid regions of the Middle East and North Africa. Recently, its cultivation has expanded to Australia, Southern Africa, South America, Mexico and the southwestern USA. Date fruits are highly nutritive, versatile tree byproducts, and diverse medicinal properties. There is an increase in demand of dates worldwide and requires to enhance date production by producing new improved cultivars, conservation, prevention, and utilization of spontaneous and induced date palm genetic diversity. Induced genetic diversity is caused by radiation and chemical mutagens. Climate change is a greater challenge on date production, e.g. water availability, soil quality, insect and pests. Date palm genetic diversity is conserved by cryopreservation (somatic embryos, embryogenic cell cultures), cold storage (seed and in vitro shoots) and in vivo (field gene banks), establish germplasm website for exchange and utilization. Filtration of genes for specific traits from the large gene pool collection can be done with molecular tools, e.g. QTL, bioinformatics and microarray. Plant regeneration from somatic embryos and embryogenic cell suspension is necessary for applying cryopreservation by using liquid nitrogen. In cold storage, shoot cultures are preserved at 4-5^{0}C, however subcultures are needed even though their number is reduced. In cryopreservation subculture is not needed and cultures are stored for longer period. Seed banks are commonly used in most of the seed crops. All 11 CGIAR institutes maintain seed banks (seeds for life) by preserving over 595,000 seed samples of different crops. Field gene bank is alternate to in vitro conservation, and is being widely used, however has risk of insect and pest attack. This approach could be best applied under controlled conditions in plastic house. We will discuss the importance of different approaches of date palm gene pool conservation, climate change, and setting up of germplasm pool bank.

Production of single cell protein from some date by-products

A. E.Mehani[1*] , M. ASorour[1]; B.R. Ramadan[2] and Naglaa Abdel-Sabour[3]
[1]Food Sci. & Nut. Dept., Fac. of Agric. Sohag University, Egypt.
[2]Food Sci.& Tech. Dept., Fac. of Agric. Assiut University, Egypt
[3]Food Sci. & Dairy Dept., Fac. of Agric. South Valley Univ., Egypt
amehanni@gmail.com

Abstract

The single cell protein produced has a good source of essential amino acids. This study aimed to utilize some date by-products such as date flesh to produce single cell protein. The flesh of dates from unknown cultivars and three varieties are used to produce a single cell protein by *Saccharomyces cerevisiae ATCC64712* under different conditions (different sugar concentrations in the extract media, different temperature and different pH). The results showed that the optimum production of the biomass (42.85g/l) was produced from date extracts media at 18% sugar, 30˚C and pH values 4.5. To reduce the nucleic acid content in the biomass, heat shock was used. The effect of heat shock on protein content and nucleic acids percentage for studied yeast strain was 75.83%, and the maximum reduction of nucleic acids was observed at pH4 and 60°C for 30 sec with 20.88% loss of its protein content. The present study provides evidence that the date by-product is a great source for single cell protein that can be used in variable fermentations.

Keywords: Single cell protein, date by-products, *Saccharomyces cerevisiae ATCC64712*and amino acids.

Biotechnological studies on the acclimatization of date palm plantlets produced *via* tissue culture techniques; 1- effect of growth regulators

Hegazy, A. E., Ibrahin, I. A. and Abd El-Hamed, S. M.
Genetic Engineering and Biotechnology Research Institute (GEBRI),
Plant Biotech.Dep., Univ. of Sadat City,
P.O. Box 79/32897 Sadat City, Egypt.
adelhegazy477@hotmail.com

Abstract

Date palm (*Phoenix dactylifera* L.) cv. Gondella has a high quality dates but unfortunately its offshoots of short supply since fungal and bacteria diseases and insect infection uncontrolled. In vitro direct embryogenesis formation is considered a good tool for problem recovery and mass propagation. Leaf primordial explants were cultured on MS (Murashige and Skoog 1962) basal medium supplemented with a ascorbic acid (75 mg/L), citric acid (75 mg/L), Polyvinylpyrrolidone (1.5 g/L), NaH2PO4. 2H2O (170 mg/L), activated charcoal (1.5 g/L) and Yeast extracts (1.0 g/L) for 2 weeks. Explants were re-cultured monthly on modified MS medium (MMS) supplemented with 2iP (5.0 mg/L), Kin (0.5 mg/L), BA (0.1 mg/L), NOA (0.25 mg/L), putrescine (50 mg/L), ABA (0.05 mg/L), Glutathione (10 mg/l), asparagine (50 mg/L) a ascorbic acid (75 mg/L), citric acid (75 mg/L), activated charcoal (1.5 g/L) and sucrose (40 g/L) solidified with gelrite (2.0 g/L). Direct embryos were formed on leaf primordial explants cultured on MMS medium after 4 months of incubation under dark/light conditions. MMS medium supplemented with Ca-pantothenate (20 mg/L) affect positively embryos growth characters. Healthy grown shoots individually cultured on basal MS medium supplanted with IBA (0.3 mg/L) , NAA (0.3 mg/L) , spermidine (100 mg/L), sucrose (30 g/L) and solidified with phyto- agar (6.0 g/L), recorded the highest significant values of roots number and roots length after 8 weeks of treatment incubation. A mixture containing residual sugar cane mud and perlite (1:1, v/v) recorded the highest significant percentage values of plantlets survival (67 %) and number of leaves/plantlet (3.1) as well as the highest values of leaf area (15.2 cm2) after 3 consecutive months in acclimatization. Produced saplings from acclimatization showed perfect match and high similarity growth in the greenhouse.

Keywords: *Phoenix dactylifera* L., in vitro, micropropagation, polyamines (PAs). direct embryogenesis, adaptation.

Micropropagation of cv. dhakki a high value date palm cultivar of Pakistan using offshoot and inflorescence explants

Mushtaque Ahmed Jatoi, Adel Ahmed Abul-Soad,
Ghulam Sarwar Markhand and Najamuddin Solangi
[1]Date Palm Research Institute (DPRI), Shah Abdul Latif University, Khairpur, Sindh, Pakistan
[2]Horticulture Research Institute, Agricultural Research Center, Cairo, Egypt
Email: mushtaqjatoi@gmail.com

Abstract

Immature inflorescences and shoot tip explants were used to propagate cv. Dhakki of date palm, a high value cultivar with limited distribution in Pakistan. Surface sterilization of both types of explants was done using immersion with fungicide solution then with 30% $NaOCL_2$ solution, and with 3 g/l mercuric chloride for offshoots only. The outer cover of inflorescences was removed and the spikelets were cut in to the 2-3 cm small pieces, while outer leaves of offshoots were removed and reduced the size and further subdivided into shoot tip, leaf primordial and base explants and subjected to optimize somatic embryogenesis on modified Murashige and Skoog (MS) medium. The somatic embryos were multiplied on large scale using 0.1 mg l^{-1} NAA + 0.05 mg l^{-1}BA. Rooting was achieved using quarter strength MS medium containing 0.1 mg l^{-1} NAA with 3 g l^{-1} Activated Charcoal. The strong rooted plantlets were acclimatized successfully in green house and then transferred to field conditions in nursery. The primary evaluation in terms of morphological and fruit characterization have not showed any somaclonal variation in tissue culture derived plantlets of cv. Dhakki.

Date palm micropropagation and its key role in the current development strategy of date sector in Morocco

Larbi Abahmane
Plant Biotechnology Laboratory
INRA, Regional Centre of Agricultural Research of Marrakech.
PO: 533, Marrakech, Morocco,
abahmanel@yahoo.fr

Abstract

Date palm (*Phoenix dactylifera* L.) of the Arecaceae family is a key plantation crop in the arid zones of many countries in the Middle East and North Africa. Out of the total world production of 7.6 million tons of dates, more than 70% are produced by the Arab countries (FAOSTAT, 2014). The estimated annual production of dates in Morocco is about 100 000 tons. However, date palm cultivation is facing serious constraints that are affecting negatively dates production. In the actual situation, the national demand of dates is partly satisfied by importation of important quantities that can reach sometimes 30 000 tons.

To face this uncomfortable situation, Morocco has started in 2010 a novel strategy to resolve most of the constraints facing date palm sector development. In fact, a plant production program was launched to produce 3 million vitro-plants in the horizon of 2020. This program aims to rehabilitate actual oases (44 000 ha) and the creation of 17 000 Ha of new plantations. Organogenesis is the only technique used in this micropropagation program. Actually, six private laboratories in collaboration with the National Institute for Agricultural Research (INRA) are in charge to produce these amounts of date palm plants. Till now, more than 1.8 million plants are already produced and the remaining amounts will be available before the stated date 2020.

The present paper summarizes the role of micropropagation techniques and the major achievements in the framework of this important date palm multiplication program in Morocco.

Refined and field proven micropropagation technology for commercial-scale date palm plant production

C. Sudhersan, S. Jibi Manuel, L. Al-Sabah and S. Al-Melhem
Biotechnology Program, Environment and Life Sciences Research Center, Kuwait
Institute for Scientific Research, P.O. Box 24885, Safat 13109, Kuwait.
schellan@kisr.edu.kw

Abstract

Micropropagation technology has been extensively applied for the mass clonal plant production in different date palm cultivars worldwide. Organogenesis and somatic embryogenesis are the two methods used for the plant production. These two methods were manipulated by the type of tissue explants and application of exogenous growth hormones during culture initiation. Millions of micropropagated date palms were produced by several laboratories using these two methods and planted in the field since 1989 allover the world. The data collected through field evaluation during the past 25 years revealed the occurrence of several physiological disorders in the micropropagated date palms supplied by few commercial laboratories. Our study confirmed that many of the physiological disorders observed were common in both microrpopagated and offshoot propagated palms occurred due to the environment, pests and pathogens. Some of the physiological disorders such as dwarfing, rosets of leaves, over production of offshoots, delayed flowering, abnormal flowers, pollen incomaptibility and parthinocarpy were *in vitro* culture oriented due to the application of exogenous growth hormones in the culture media. In order ro ovoid these culture oriented physiological disorders, we undertook a research study on date palm micropropagation aiming to minimize or avoid growth hormones at different stages of micropropagation. Using the results obtained from our experimental study, we refined our date palm micropropagation technology. In the refined methodology, growth hormones were minimized at the initiation stage and completely avoided in all other stages of plant production. Somatic embryo desiccation, inverted culture technique, thin film liquid culture process and photoautotrophic culture system were developed and included at different stages of plantlet production instead of growth hormones application. Thousands of plantlets were produced through this refined technology and evaluated in the farms, and proved 100% free form the culture oriented physiological disorders. This refined micropropagation technology can be applied in commercial laboratories to get 100% customer satisfaction that will support the marketing of micropropagated palm trees.

Keywords: *Phoenix dactylifera*, growth hormones, physiological disorders, field evaluation.

Conform and healthy tissue culture propagation of date palm

Catherine Chambo
Cerbiotech - France
R&D Center in plant Biotechnology
Specialized in organogenesis micropropagation
Route de Veynes - F05000 GAP - France
cerbiotech@wanadoo.fr

Abstract

Due to its economic and social importance in many desert areas extending from Western North Africa to India, Date Palm (Phoenix dactylifera) is multiplied by tissue culture in order to eliminate pathogenic agents (fusarium oxysporum f.sp.albedinis, endogenous bacteria …). In vitro somatic embryogenesis methodology, used by a lot of tissue culture laboratories, usually induces specific bacterial contaminants according to the size of the central meristematic zone used to start the embryogenesis callus. Our study consisted in: Preserving as well as possible the true-to-type conformity for microprogation of different date Palm varieties; Obtaining cultures free of endogenous pathogenic agents; and Using a non-destructive process. Tissue cultures were initiated from both axillary meristems and immature inflorescences and micropropagated by organogenesis method. Five types of apex were used and propagated in aseptic conditions during the three stages of micropropagation (initiation, multiplication and rooting). The health status was verified by electron microscopy INRA studies. No bacterial contaminants were observed in tissue cultures obtained by one type of apex and by immature inflorescences, which confirms the possibility to multiply by tissue culture true to type date palm without endogenous pathogenic agents.

Keywords: Date Palm, contaminants, meristem tip culture, *in vitro* propagation, health regeneration.

Enhanced in vitro multiplication and rooting of date palm cv. yellow Maktoum by zinc and copper ions

Zeinab E. Zayed, Maiada M. EL-Dawayati, Fadia A Hussien and Tahani Y Saber
The Central Laboratory of Date Palm Research and Development,
Agriculture Research Center, Giza, Egypt.
zemmz2005@yahoo.com

Abstract

In order to obtain full plantlets with good root system are able to resume their development successfully at acclimatization. The present work was carried out to encourage the in vitro multiplication and rooting stage of date palm cv. Yellow Maktoum by the addition of microelements compounds $ZnSO_4$ or $CuSO_4$ at different concentrations (0, 10, 25. 50. 75. 100Mµ) to MS basal nutrient media. The interval period subculture was studied also after 30 days or 45 days for three subculture during multiplication stage. Results showed that different concentrations of $ZnSO_4$ and $CuSO_4$ nearly increased all studied growth parameters during the two tested culture periods (30 and 45 days) compared with control treatment. All growth parameters increased after 45 days compared with 30 days.

$ZnSO_4$ at 50 and 75 Mµ or 25 or $CuSO_4$ at 50 Mµ in the basal nutrient medium were the best concentrations to improve shoots production at multiplication stage. Whereas, the addition of $ZnSO_4$ at 100 Mµ or $CuSO_4$ at 75 Mµ to nutrient medium gave the best results for all studied growth parameters during rooting stage. In conclusion all shootlets have been received from using $ZnSO_4$ or $CuSO_4$ at the certain best treatments during multiplication stage were accelerated in growth during rooting stage as well as the all plantlets have been received from using $ZnSO_4$ or $CuSO_4$ at the certain best treatment during rooting stage were transferred successfully to green house for acclimatization. Thus our results is promoting the process of date palm micropropagation.

Keywords: $ZnSO_4$, $CuSO_4$, multiplication, rooting, date palm, culture period, *in vitro*.

Cryopreservation of embryogenic cultures of date palm using encapsulation-dehydration technique and assessment of genetic stability

S.A. Bekheet[1]; M.K. El-Bahr[1]; A.D. Shaltout[2]; M.A. Matter[1];
A. Abd El Hamid [2]and A.A. El-Ashry[1].
1- Plant Biotechnology Dept., National Research Center, Dokki, Giza, Egypt.
2- Horticulture Dept., Ain- Shams Univ., Cairo, Egypt.
shawky005@yahoo.com

Abstract

This study aimed to recognize a method for cryopreservation of two Egyptian date palm cultivars i.e., Bartamoda and Sakkoty using encapsulation-dehydration technique. Embryogenic cultures were proliferated on MS medium supplemented with 10 mg/ l 2, 4-D + 3 mg/l 2iP. The cultures were maintained on medium contained high sucrose concentrations. Encapsulation was performed by suspending the cultures with three sodium alginate followed by immersion in calcium chloride. The beads containing cultures were dipped in liquid nitrogen for using cryotubes. Generally, combination of encapsulation and pretreatment with sucrose increased the survival and the recovery percentages for both cultivars. The highest survival percentage was recorded with adding 0.5 M sucrose or 0.7 M sucrose in the pretreatment medium and encapsulated with 4, 5 % sodium alginate. Also, exposing the cultures to desiccation in the air laminar flow for two hours before cryoprservation increased the survival percentage and subsequently the recovery percentages. It was found that Sakkoty cultivar gave higher survival and subsequently the recovery percentages than Bartamoda cultivar. Random Amplified Polymorphic DNA (RAPD) technique has been used to investigate the genetic stability of cryopreserved tissue cultures of the two date palm cultivars. According to RAPD analysis, plantlets derived from cryopreserved cultures were similar to that derived from non cryoprserved cultures and also with the mother plants.

Key Words: Date palm, embryogenic cultures, cryopreservation, encapsulation, RAPD analysis.

Effect of light conditions on germination and conversion of date palm somatic embryos to plants

Mansour Abohatem[1,2]
1. Department of Biology, Faculty of Education and Languages,
Amran University, Amran, Yemen.
2. Plant Tissue Culture Laboratory, Public Corporation for Agricultural Services,
Ministry of Agriculture and Irrigation, Sana´ a, Yemen.
mabohatem@yahoo.com / mabohatem@gmail.com

Abstract

Optimization of date palm somatic embryo multiplication protocols has been the central focus of research, but embryo germination and conversion to plants remains poorly studied in many palm species. In the present study, effect of light or darkness on germination and development of date palm somatic embryos to plants has been studied.
The observed results indicated that darkness was associated with increased proliferation and germination of somatic embryos. Also the darkness significantly stimulated elongation and conversion of somatic embryos to plants.
Incubation in darkness was required one month to occur the germination and elongation of somatic embryo , while incubation in light was required four months. Somatic embryo grown in darkness had more protein than other grown in light.
Our results are beneficial for the efficient and rapid micro propagation protocol of the date palm.

Cadmium and lead-induced genotoxicity in date palm (*Phoenix Dactylifera* L.)

Mohammed H. Abass[1] Jabbar D.Naema[2] Khearallah M.A. Al-Jabary[1]
[1] Date Palm Research Centre; [2] Department of Biology;
College of Sciences; University of Basrah; Basrah 61001, Iraq.
dr.mha24@yahoo.co.uk

Abstract

Genotoxicity of Cadmium (Cd) and Lead (Pb) heavy metals were investigated in date palm (*Phoenix dactylifera* L.) whole plant in laboratory under controlled conditions. The genotoxic effects were evaluated using protein profile and ISSR molecular markers. Two concentrations of cadmium and lead were selected as 3 and 9 mg/kg for Cd; 100 and 276 mg/ kg for Pb. The results clearly showed that the Cd at two examined concentrations and Pb at low concentration (100 mg/kg) did not induce any change in genetic materials in terms of protein patterns and ISSR analysis when compared with untreated date palm plants (control plants). The high concentration of Pb (276 mg/kg) led to appearance of a new protein fragment (18 KDa), as well as, a disappearance of the fragment of 33 KDa which observed in all treatments. ISSR analysis and Dendrogram revealed the separation of Pb at high concentration in one cluster with the highest genetic distance (0.2 according to Nie and Li's index) than control treatment. In addition, results indicated that genomic template stability (GTS) was significantly affected by Pb at high concentration and reduced to 70% which reflects the genotoxicity of Pb at 276 mg/kg. Our results highlight for the first time the genotoxic effects of Pb at high concentration on date palm genome.

A new interspecific date palm hybrid

L. Al-Sabah, C. Sudhersan, S. Jibi Manuel, and S. Al-Melhem
Biotechnology Program, Environment and Life Sciences Research Center, Kuwait
Institute for Scientific Research, P.O. Box 24885, Safat 13109, Kuwait.
lsabah@kisr.edu.kw

Abstract

Crop improvement research in date palm (*Phoenix dactylifera* L.) lags behind due to its slow growth and long life cycle. High quality fruit production in date palms depends on crop management practices such as leaves pruning, removal of leaf spines, pollen dusting, bunch thinning, fruit bagging and harvest. These operations are easy when the palm trees are up to 3 m height and very difficult when the trees grow taller. Climbing on tall palm trees for these operations is difficult and expensive nowadays. Therefore, we undertook a research activity in our laboratory to develop short date palm trees through interspecific hybridization. The tissue culture date palm orchard maintained at the Kuwait Institute for scientific research (KISR) was used for the experimentation Date palm cultivars Barhi, Madjhool and Sultana were used as mother and *Phoenix pusilla* was used as male. Selected female date palm inflorescences were duster with *p. pusilla* pollen carefully and bagged immediately after the pollen dusting to avoid pollen mixing. Normal fruit development, growth and ripening was occurred similar to the bunches pollinated with date palm pollen. However, the seed development was arrested and the embryos aborted at the ripening stage due to the failure in endosperm development during seed formation. Therefore, interspecific hybrid embryos were isolated from the immature fruits and germinated *in vitro*. Rooted hybrid plantlets were produced, acclimatized and planted in the field. The first interspecific date palm hybrid was planted in the field during 2009 and fruiting occurred in 2014. The tree showed stunted growth, and the fruit morphology and seed morphology were differed from both the parents. This is believed to be the first successful trial on interspecific hybridization in date palm.

Keywords: *Phoenix dactylifera*, *p. pusilla*, hybridization, field evaluation.

Date palm: application of molecular markers

A. Guettouchi
Department of Sciences of Nature and Life,
Faculty of the Sciences, University Mohamed Boudiaf,
M'sila 28000Algeria
guettouchi-ah@live.fr

Abstract

Molecular markers are a good way to study genetic diversity in plants, which play importance role in plant improvement programs. In date palm (*Phoenix dactylifera* L.), many molecular markers (RAPD, ISSR, SSR…) have been used for several purposes. The most important of which is the molecular identification of date palm varieties, the study of the genetic convergence between varieties, to identify resistant varieties to Bayoud disease, to verify the genetic compatibility of the vitro-plants obtained from tissue culture, in addition to these uses it was possible to determine the sex of the date palm by molecular markers. More investigations are needed to answer questions such as: Could molecular markers identify all date palm inheritance? Could molecular markers identify danger palm diseases?

Keywords: Date palm, *Phoenix dactylifera*, molecular markers, Bayoud disease, resistance, tissue culture.

Room B
SESSION 2

Red Palm Weevil

Isolation and molecular identification of *Fusarium solani* from the red palm weevil cocoons collected from infested date palms in the Kingdom of Bahrain

AbdulAziz M.A. Mohamed[1], Malabika Roy Pathank[1], Khalid A. Alhudaib[2], Sherif M. Elganainy[2], Muhammed Farooq[1]
[1]Department of Life Sciences, Arabian Gulf University, Manama, Kingdom of Bahrain
[2]Department of Plant Protection, Kind Faisal University, Alhasa, Kingdom of Saudi Arabia
amamohamed@agu.edu.bh / ama_mohamed@hotmail.com

Abstract

The red palm weevil, *Rhynchophorus ferrugineus* associated with the date palm trees in the Kingdom of Bahrain has a limited number of natural enemies. In 2017, while studying the field infestation of date palms by the weevil, some of the collected red palm weevil pupae were naturally infected by *Fusarium* sp., morphological examination and sequence-based identification of the internal transcribed region confirmed that the isolated fungus was *Fusarium solani*. This fungus commonly isolated from agricultural soil, plant, animal, and human. The role *F. solani* on red palm weevil pupal stage as entomopathogenic fungus is currently unknown. This investigation aims to evaluate the pathogenicity of this fungus against different stages of *R. ferrugineus* in the laboratory as well as the impact of the fungus on date palm cultivars and non-target organisms of the date palm ecosystem will be studied.

Comparative susceptibilities of different life stages of the red palm weevil treated by entomopathogenic nematodes

Atwa, A. Atwa[1,2*] and **Esmat, M. Hegazi**[1]
[1] Deanship of Scientific Research, King Abdulaziz University,
Jeddah, Kingdom of Saudi Arabia.
[1] Plant Protection Research Institute, Giza, Egypt.
[3] Department of Economic Entomology; eshegazi@hotmail.com
* Corresponding author; A. A. Atwa, atwaradwan@yahoo.com

Abstract

The red palm weevil (RPW), *Rhynchophorus ferrugineus* (Olivier) (Coleoptera, Curculionidae) has become the most important pest of the date palm trees, in the world. It has been reported in the kingdom of Saudi Arabia since 1987 and in Egypt since 1992. Studies were conducted to compare preferences among RPW life stages for infection by 12 entomopathogenic nematodes (EPNs), under no choice and five stages choice experiments, and curative trials by some of EPNs isolates. All the used isolates proved to be pathogenic except the first instars of RPW larvae that were highly susceptible. However, some of the test EPNs exhibited a preference for larvae over pupae, and a lesser degree of preference for adults. In contrast some strains showed no preference for any stage. The local Egyptian isolates of EPNs were most efficient nematodes against RPW than foreign strains. But were less effective against the RPW in Saudi Arabia than in Egypt. Field assessments using trunk injection resulted in a substantial decline in the population of RPW after two successive applications within three weeks**.** Efficacies ranging 48-88 % was achieved in the curative assay resulting in a significant increase in palm survival compared to the untreated control. In conclusion, there is a great potential for the use of EPNs, in particular the *Steinernema sp.***** (EGG4) against the RPW when injected in the date palm.

RNAi-mediated silencing of vitellogenin gene abolishes egg production in the red palm weevil, *Rhynchophorus ferrugineus* (Olivier)-A highly destructive pest of palm trees

Muhammad Tufail, Khalid Mehmood, Mureed Husain,
Khawaja G. Rasool and Abdulrahman S. Aldawood
Economic Entomology Research Unit (EERU), Plant Protection Department,
College of Food and Agriculture Sciences, P.O. Box 2460 Riyadh 11451,
King Saud University, Riyadh, Kingdom of Saudi Arabia.
mtufail@ksu.edu.sa

Abstract

The recent invasions of red palm weevil (RPW) *Rhynchophorus ferrugineus* (Oliv.) around the sphere including Saudi Arabia has become a global issue of many palm species. Principally, advanced damage results in death of the palm trees. Although, various control tactics have been applied, yet none of them seems satisfactory against this invasive pest species. Hence, exploration of the molecular approaches is awaited. We, thus, focus on silencing of the reproduction control gene vitellogenin (Vg), a major yolk protein precursor critical for oogenesis, based on RNA interference (RNAi) strategy for its possible application to control and manage the RPW population. For this, a complete *RfVg* gene transcript of 1,787 residues was isolated, sequenced and used for RNAi application. The phylogenetic analysis based on known insect Vg sequences suggested that RPW Vg has closer ancestry to other coleopterans than Vgs from other insect groups. *RfVg*-based RNAi revealed a high suppression of Vg gene expression; about 95% on day 15 of post-injection periods, which resulted in dramatically failure of Vg protein expression, atrophied ovaries or no oogenesis and ultimately no hatchability of eggs. These results suggest that knock-down of Vg gene involved in RPW reproduction has a potential to be used as a promising target for RNA-based management of RPW, a highly destructive pest of palm trees.

Determination of imidacloprid against the red palm weevil *Rhynchophorus ferrugineus* in Egypt

Sabbour, M.M.
Department, Pests & Plant Protection; Agricultural & Biological Research Division,National Research Centre. El-Tahrir St. - Dokki, Cairo, Egypt.
sabbourm9@yahoo.com

Abstract

Pam trees are subjected to attack by many insect pest species , the most harmful among them is the red palm weevil *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae). Imidacloprid is a systemic insecticide which decreases the infestations of many insect pests. The present study aimed to evaluate the efficacy of this insecticide against *R. ferrugineus* under laboratory and field conditions. The results obtained showed that the LC_{50} of Imidacloprid on the different larval instars were 100,125, 137, 144 and 156 ppm after 1st , 2nd, 3rd, 4th, and 5th larval instars of *R. ferrugineus* were treated with different concentrations of imidacloprid. Under field conditions, both Imidacloprid declined the rate of infestation by *R. ferrugineus* with the least infestation. The yield of harvested pam fruits increased due to treatment with Imidacloprid with the highest yield.

Keywords: *Rhynchophorus ferrugineus*, Imidaclorprid, Toxicity, Infestation, yield.

Red Palm weevils in Saudi Arabia and efforts to control it using genome wditing with CRISPR/Cas9 technology to produce red weevil resistant (RPW) date palm

Ibrahim S. Al Mssallem[1] and Ardashir Kharabian-Masouleh[2]
[1]Bitechnoogy Dept., College of Agriculture and Food Sciences,
King Faisal University, Hofuf, Alhassa, 31982, Saudi Arabia.
[2] Senior Research Fellow, The University of Queensland,
St. Lucia, QLD 4072, Australia.
imssallem@kfu.edu.sa

Abstract

Biotic stresses are major constraints that limit date palm production in Saudi Arabia and in the Gulf region. Farmers always look for new varieties that can resist environmental stress and pests and produce more yields under biotic constraints such as pests. This project aims to edit/alter tolerance genes against red palm weevil (RPW), a major pest with significant yield loss in Saudi Arabian (or Middle East) date palm production. It is believed that there is a huge variation in Saudi local date palms cultivars.

Recent developments in gene editing technology provide a new option for accelerated genetic improvement of the strategic food crops. Advances in genomics is identifying many gene targets that have potential to be efficiently manipulated by gene editing to deliver better adapted and more nutritious crops.

This project will apply gene editing new technology CRISPR/Cas9 system to the manipulation of a range of high priority insect resistant genes in date palm. These will range from minor genetic changes aiming to alter a single nucleotide (SNP) to manipulate a simple trait that is easily measured to much larger edits that target more genetically complex traits controlling phenotypes that are more difficult to measure. The aim is to explore the practical limits of utility of this technology over this range of applications and to identify where further innovation will be required.

Finally, after tackling possible obstacles the RPW candidate genes will be edited to produce nutritionally elite, RPW-resistant date palm cultivars. This project can directly lead to the elite date palms to produce healthier yield and profit for growers under agricultural and climatic constraints and pest epidemic spread. In this project, a handful of high quality popular Saudi Arabian date palm cultivars will be genetically edited to have resistance to red palm weevil (RPW) using CRISPR/Cas9 system.

Flight activity of red palm weevil *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae) in Montenegro

Snježana Hrnčić and **Sanja Radonjić**
University of Montenegro, Biotechnical Faculty
Mihaila Lalića 1,81000 Podgorica, Montenegro
sanja_radonjic@t-com.me

Abstract

Rhynchophorus ferrugineus is a highly invasive, devastating pest of palms with strong economic, environmental and social impact in every area of the presence. It is considered as the most important pest of the date palm (*Phoenix dactylifera*) in the world. *R. ferrugineus* originated from Southeast Asia from where it spread and invaded Middle East. After it was discovered in Egypt (North Africa) in 1992 and for the first time in Europe (Spain) in 1994, it has *spread* widely in the *Mediterranean* region.
The pest was first detected in Montenegro in October 2012 on Canary Island date palm (*Phoenix canariensis*), the most widespread palm tree in the country. It was found in area of the city Ulcinj, placed in the most southern part of the Montenegro seacoast. After the first palm trees with umbrella-like symptom and symptoms resembling drought stress were registered and found infested, visual inspections started immediately along the whole coastal area and has been continued in the following years. Monitoring of adults flight activity has been done since 2015. Aggregation pheromone Rhylure 400 placed in white bucket traps are used. Traps are checked in two week intervals (one during a winter months). Results of three years monitoring showed adults activity during a whole year with a distinct seasonal patterns in population fluctuation. Population density is very low during winter and spring months, increases during a summer (June-July) up to a peak in late summer and autumn (end August- beginning November) and then decline.
Rapid spreading of *R. ferrugineus* on the Montenegro seacoast resulted in devastation anddeath of many palms and extreme changing of our traditional coastal urban landscape.

Pheromone-communication disruption through gene silencing of odorant binding and receptor proteins, a novel approach for controlling red palm weevil, *Rhynchophorus ferrugineus*

Binu Antony*, Jibin Johny and Saleh A. Aldosari
King Saud University, Chair of Date Palm Research,
Department of Plant Protection,
College of Food and Agricultural Sciences,
Riyadh 11451, Saudi Arabia.
bantony@ksu.edu.sa

Abstract

The Red Palm Weevil (RPW) *Rhynchophorus ferrugineus* (Oliver) is the most devastating quarantine pest of palm trees worldwide, was introduced to Middle Eastern countries during the 1980s. RPW has been the major date palm pest in Saudi Arabia causing heavy losses every year and its management has become the central problem for the planters. In RPWs, the perception of the environment – food, prey and mates – is guided mainly by pheromone signals, 4-methyl-5-nonanol (ferrugineol) and 4-methyl-5-nonanone (ferruginone). When RPWs attack a tree, individual insects are generally able to locate the tree and coordinate mass-attack with pheromone signals. We explored the RNA interference (RNAi) techniques to selectively silencing the odorant receptor (OR) and odorant binding proteins (OBPs), thus allowing us to block the pheromone communication in the adult weevil. We constructed libraries of all ORs and OBPs, selected antenna-specific and highly expressed candidates, silenced them through RNAi and sequentially presented aggregation pheromone, ferrugineol to individual RPWs and demonstrated that antenna-specific *RferOBP* and *RferOR* silencing significantly disrupt pheromone communication. The silencing of *RferOBP*, which is responsible for pheromone binding, and *RferOR*; which is responsible for pheromone detection, resulted alters RPW behavior leading to reduced pheromone detection and communication failure, as confirmed through behavioural trials and electrophysiological recordings. Considering that pheromone communication is an important aspect of *R. ferrugineus* attack on the date palm trees, where RPWs use pheromone to coordinate a mass attack that eventually leads to the death of the palm tree, silencing *RferOR* and *RferOBP* is the promising steps for the disruption of pheromone communication in *R. ferrugineus* thereby preventing the coordinated mass attack. More futuristically, the study will facilitate the development of host plant resistance mechanism and might be used to design biosensors for pheromone-based monitoring as promising approaches for controlling palm weevils.

Keywords: Red palm weevil, date palm, olfactory system, pheromone, RNAi, odorant receptor, odorant binding protein.

Preliminary study of red palm weevil and its resistance under Gaza Strip conditions

Mufeed F. Al-Banna
Gaza – Palestine
Omega for Consultation & Development Co
mofeed_albanna@hotmail.com

Abstract

The red palm weevil insect is considered one of the most dangerous pests that threaten the date palm sector in the Middle East, Europe, East Asia and the Arabian Gulf, where it entered the Middle East region since the beginning of the eighties of the last century, especially in the Arabian Gulf countries in Saudi Arabia and the UAE in 86-87 to Iran and Egypt in the beginning of the nineties, until it reached the Gaza Strip mid-September 2011, the first infection was discovered in the Middle Area (Deir al-Balah) and then the Southern Area and spread in high intensity throughout the Gaza Strip, despite of the attempts and procedures used to do so. This insect is still receiving much attention from scientists and specialists in this field to reduce its spread.

This has led to the damage of a large number of the palm trees estimated at about 15% - 18% with different ages in all areas of the Gaza Strip. The estimated infection rate is about 30%-35% of the trees in the region. The estimated area planted with palm trees is about 8,500 dunums - (one dunum = 1000m^2) with estimated 120000-150000 of productive and non-productive palm trees.

This study reviewed the behavior and the spread of the insect and the controls methods implied under Gaza Strip conditions, where the study proved that the behavior of the insect does not depend on the climatic conditions only represented in temperature and humidity, as the insect adapts quickly under any circumstances and change its behavior and spread directly according to the living environment where the insect exists.

The study also showed that the control method used, particularly the fermon traps and the aggregate collection properties of males and females, proved to be ineffective due to misuse sometimes, lack of understanding of the significance of control, or mis application of pesticides, in addition to high costs to farmers and lack of economic feasibility thereafter. This has led to the rapid spread and lack of control the outbreak of the insect in general.

The study relied on the use of alternative methods of control and observations and used of the new mechanism of expulsion not attraction, and depends on changing the temperature mechanism of the insect' living environment, specifically in the core of the palm tree trunk, through using of essential oils as a cheap organic and cost-effective pesticide that works on all stages of the insect directly and indirectly.

The study recommended to proceed on with researches on the means used to increase the temperature levels in the trunk of the palm tree, as well as the use of natural materials as insects' repellent rather than attracting them.

Keywords: date palm product, behavior, insect.

Multi-use ecological biocide formulations: application to red palm weewil.

M'Hamed Elmorabit
Higher Education Professor
Inventor and Expert Consultant
Taha CHAABI, CEO-Phoenix-Cairo
cmp01@gmail.com

Abstract

The use of biocides in agriculture has become a common practice, even essential, to the protection of plants, vegetables and fruits, as well as to the improvement of their yield. Nevertheless, most of the active elements cause collateral damage, which is usually harmful to nature and to animals and plants health. To this end, the development of ecological biocides is crucial to food safety as well as to the preservation of the environment. The challenge remains to be, in addition to efficiency aspect, the high cost that struggles to compete with the standard chemical products. Also, we have chosen to focus our research project on agricultural protection, without any detrimental impact on man or on environment. We have hence succeeded in developing biocide formulations considered effective, and patented under the title: "Multi-usage ecological biocide formulations and process of preparation". Given the intrinsic properties of the preparation method of the ingredients, while having a good quality and cost, these ecological formulations are all indicated for applications against the Red Date Palm Weevil and against multiple families of insects in general, as well as fungi and bacteria.

The formulations produced are made of natural and ecological mineral substances, such as amorphous silica and/or silicoaluminates, having a low density and a high specific surface, such as pozzolan, pyrophyllite and bentonite, etc., mixed up with active vegetal substances among the family of aromatic and medicinal plants, in the presence of other ecological ingredients. The products formulated this way, behave by dehydration, by laceration and/or intoxication or by repulsion of insects and rodents ... etc.

Applied to combat the Red Palm Weevil, many developed formulations were tested by a specialized public laboratory. The results confirmed a total (100%) mortality of weevils at insect and larval stage after 4 to 7 days, which reflects the outstanding efficiency of the formulations, especially since they can be used as curative and/or preventive treatment.

In conclusion, this approach can be considered as an ideal solution, simple and easy to implement, without any negative impact on health and on the environment in general.

Transcriptome analysis of fat body tissues to identify the genes responsible for red palm weevil, *Rhynchophorus ferrugineus* (Olivier), reproduction

Khalid Mehmood, Muhammad Tufail, Mureed Husain,
Khawaja G. Rasool and Abdulrahman S. Aldawood
Economic Entomology Research Unit (EERU), Plant Protection Department,
College of Food and Agriculture Sciences, P.O. Box 2460 Riyadh 11451,
King Saud University, Riyadh, Kingdom of Saudi Arabia.
sirum_mk@yahoo.com

Abstract

In present study, the efforts were made to analyze the fat body transcriptome from the adult females with a goal to explore the genes responsible for red palm weevil (RPW) reproduction, especially the vitellogenin (*Vg*). The fat body is a dynamic tissue involved in multiple biochemical functions, including reproduction. Transcriptome analysis was performed using Illumina Hiseq 2000 next-generation sequencing (NGS) platform which resulted in a total of 43,789 unigenes (with mean lengths of 1172 bp), of which 52.93 %, 28.74%, 42.71%, 37.7%, 21.93%, and 23.52% were annotated with the non-redundant (NR), nucleotides (NT), Swiss-Prot, Kyoto Encyclopedia of Genes and Genomes (KEGG), Clusters of Orthologous Groups (COG), and Gene Ontology (GO) databases, respectively. It was found that 20% of total unigenes were matched up to 80-100% with homologous species mainly, mountain pine beetle, *Dendroctonus ponderosae* (59.9%) and red flour beetle, *Tribolium castaneum* (26.9%). The present transcriptome analysis revealed the genes involved in different physiological functions including the genes responsible for RPW reproduction. Almost twenty-five genes annotated were involved in RPW reproduction including *Vg*, apolipophorin III, very low-density lipoprotein receptor, low-density lipoprotein receptor adapter protein 1, low-density lipoprotein receptor, and the chorion protein. The identification of reproduction control genes, especially *Vg*, will help to understand for the first time, the reproduction mechanism of the RPW at the molecular level. Moreover, the NGS data set would be a treasure for the future molecular studies and will facilitate the exploration of the biotech-based control tactics against RPW; a crucial pest oflm trees worldwide.

Eco-friendly management of red palm weevil (*Rhynchophorus ferrugineus* Olivier) in date palm (*Phoenix dactylifera* L.) - seven innovative approaches

*Mridha, M.A.U. and **F.N. Al-Barakah ,
*Ex-Professor, Plant Production Department and
**Soil Science Department, College of Food and Agriculture Sciences,
King Saud University, Kingdom of Saudi Arabia
mridha52@gmail.com

Abstract

The Red Palm Weevil (RPW) (*Rhynchophorus ferrugineus* Olivier) is one of the most severe and deadly pests of date palms (*Phoenix dactylifera* L.) The Integrated Pest Management (IPM) strategies in controlling the infestation of RPW in date palm throughout the world involves surveillance, cultural control, chemical control, mass pheromone trapping, biological control, mechanical control, quarantine control etc. with limited success. Hence it is imperative to introduce new approaches for better success rates. The first proposed innovative approach may be integrated with existing IPM by covering the base of the stems with insect proof net to avoid the insects from infestation. In next innovative approach, pests and disease resistance stock and /or tissue cultures plantlets may be selected for raising seedlings in substratum in Bio-organic modified with microbial inoculants for developing new plantation to avoid infestation of RPW through good stocks and healthy growth of seedlings under field conditions. In a third approach, modified trap comprising of pheromones, light sources from solar panel fitted with a fan system may be introduced for effective trapping of insects. Yet another integrated approach could be, along with the conventional bio pesticides products, insect repellent trees, herbs and shrubs may be planted in between the rows and the plants to avoid contact of the date palm plants with RPW insects. This also provides leaf biomass through shredded leaves in the soils as well as to kill the harmful insects and pathogens by their insecticidal and antimicrobial activities. They also act as mulches crops and weed suppressive plants. In an effective approach, green cultivation techniques with bio-organic fertilizer (composed of organic fertilizers, green manure mycotrophic plants and microbial inoculants) developed in King Saud University (KSU) may be introduced to provide balanced nutrients, improve water relations, avoid soil borne pathogenic fungi, provide mulches, inoculum for next year crops etc. Another added method is mass production of entomopathogenic fungi (developed in KSU) and adding them with the bio-organic fertilizers to facilitate infection and eliminate the insects. Finally, instead of using pesticides, eco-friendly and cost effective silver nano particles (developed in KSU) may be integrated by spraying the whole plants and in addition injecting the infested plants. We hope and believe that our proposed new approaches will provide useful methods in controlling the RPW, a deadly pest in date palm

Cognitive palm tree utilizing artificial intelligence and internet of things technologies for early detection of red palm weevil in date palm tree farms

Mohamed Abdelrahman Khalil and Khaled Metwally,
The Platform, Dubai knowledge village, Dubai ,UAE
Mohamed.khalil@theplatform.me

Abstract

Cognitive Palm Tree is an innovative autonomous technique that utilizes cutting edge technologies to detect the existence of Red Palm Tree Weevil (RPW) in low cost way. Using Low Power Internet of Things (LPWA IOT) sensor empowered by Artificial Intelligence/Machine Learning, we have built new technique of detecting RPW.
We are relying on acoustic detection as well as acceleration/vibration analysis, both ways are used simultaneously in low cost manner, to maximize the device efficiency. We transfer the data collected from each palm tree to internet based server that collect numerous data samples from all palm trees from different farms. We developed Artificial Intelligence/Machine Learning model that is deployed on IBM WATSON Machine Learning and data science environment "over internet server", that continuously analyze acoustic and vibration samples collected directly from palm tree via cheap LPWA IOT acoustic and vibration sensing device connected to internet via NBIOT/LTEM chipset.
Using this technique, we can provide farmers and government a geographic map that indicate RPW activity with exact infested palm trees locations. This help farmer to identify existence of Red Palm Tree Weevil in early stage.

Implementation of Inesfly paint and some integrated pest management elements for controlling Ephestia spp. in date palm orchards and date warehouses in Iraq

Ayad A Al-Taweel, Ibrahim J Al-Jboory, **Abass AL-Joudi** and Asaad A. Hameed
Al-Asra University College, Dept. of Lab Technology,
Baghdad, Iraq
abas_joudi@hotmail.com

Abstract

Ephestia sp., E p. cautella, E. figulilella and E. calidella are the most serious pests infest dates caused economic losses in the orchards and warehouses in Iraq which produces between 600-700 thousand tons of dates annually. In order to reduce this damage different pest control methods were selected using environmentally sound technologies such as integrated pest management which included, Egg and larva parasitoids, pheromone and mating disruption and Inesfly paint.All the biological and paint experiments have been conducted during 2015-2016. The results showed that Egg and larval parasitoids Trichogramma evanescens and Bracon hebetor either alone or with pheromone and Dismate PE reduced the percentages of infestation to 1.4 after six months of storage compared to 17.9% for the control in the orchard and warehouses. Inesfly 5A IGR NG paint caused highly mortality to Ephestia spp. Adults, larvae and the associated arthropods in the warehouses. Based on the trial results, using one or a combination of the tested measures ensure clean dates without implementing methyl bromide.

Keywords*:* Ephestia, stored dates, Iraq, Inesfly paint, radiation, parasitoids.

Electrap evaluation experiment in Jordan valley

Mona Mohamad Mashal* and **Basil Faisal Obeidat****
*director plant protection consultant /NCARE
** main researcher plant protection /NCARE
Jordan
munammsm@yahoo.com

Abstract

The efficacy of Electrap was evaluated to capture RPW adults under different field infestations, and a comparison of efficiency between the Electrap and the traditional traps was made, We also determined the importance of the traps in controlling management program, and the cause of effectiveness of the traps and determined male - female ratio, the experiment was conducted on 11/Sept/2017 and finished on 11/Jan/2018 (four months).The Electraps and the traditional traps were placed in four sites with high, medium and low RPW infestation, All traps were randomly placed in the middle area between trees, under direct sun light, keeping at least 100 meters or more between each two traps. After two months all pheromones and kairomones capsules were replaced in Electrap and traditional traps by Electrap capsules in site (A), traps' readings were taken biweekly.

Results showed the statistical superiority of the Electrap against the traditional trap under the influence of different infestation percentiles, in the four experimental sites, regardless to the level of RPW field infestation, using Tukey test at .05 and .01 level. Electrap caught up to 6 times more than the traditional trap. On the other hand, traps have an important role in controlling programs as well as Electrap that six Electrap caught 549 adults during four months (89% percentile) Compared to 66 adults caught by traditional trap (11% percentile) in the first experimental site A. Also, the effect of Electrap pheromones and kairomones replacement in both traps didn't significantly improve capturing of traditional trap. Pheromones and kairomones capsules should be renewed after two to three months to keep full action potential, The female- male ratio was detected from 85%-75 %: to 15-25%. Finally, the theoretical calculation revealed that one Electrap may control 732 infestation spots/month, and 22thousand infestation spotz/30electrap/10 hectsres.

Room B
SESSION 3

Pests and Diseases of Date Palm

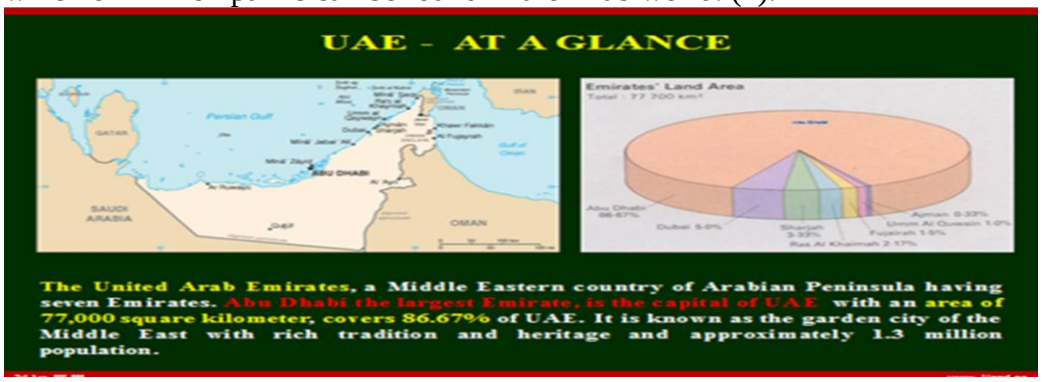
Sustainable date palm production and bio pesticide research

Mohammad Kamil
Head TCAM Research, Zayed Complex for Herbal Research &
Traditional Medicine, Division of Healthcare Licensing & Medical Education,
Department of Health, Abu Dhabi.
mkamil@haad.ae

Abstract

The domestication and cultivation of date-palm started 6,000 to 8,000 years back in Mesopotamia. That might be the first cultivated fruit plant in the world, that is why palm-trees are tightly associated with the development of human culture and civilization. About 3% of the earth's farmland is covered by date palms, producing four million tons a year. It's importance can be revealed from the fact that Date palm are described more than 20 times in holy Qur'an ,8 times the date-palm is mentioned alone; at 12 places it is clubbed with other fruits like olive, pomegranate and grapes, besides dozens of Ahadees for Date palm consumption.

The UAE has been at the forefront of those countries that granted special attention to the agricultural sector and date palm. The UAE Government, within the framework of its development plans, has placed the establishment of a date production industry as one of its important priorities. Under the leadership of His Highness, The President, Sheikh Khalifa Bin Zayed Al Nahyan [Almighty Allah (SWT) protects him], there have been continuous efforts to increase agricultural productivity and to make better use of all available resources.The number of the date palms is about 100 million worldwide, of which 62 million palms can be found in the Arab world. (1).



On the other hand about two million Red Palm Weevil trapped in Abu Dhabi farms during the first half of 2013.

In continuation of our earlier work (2), the present study is a step forward for carrying out the Use of Bio-Pesticide for Sustainable Date Palm Production to identify and evaluate suitable and new plant extracts with eco-friendly activities against endoparasitic Larval Red Palm Weevil, *Rhynchophorus ferrugineus* Oliver found in Date Palm tree (*Phoenix dactylifera* L). Also it deals with morphoanatomical; pharmacognostic studies; physicochemical protocols; phytochemical screening using chromatographic fingerprinting; spectral techniques and the quantitative analysis of inorganic elements present therein the date palm and plant extracts used as bio pesticides for sustainable

date palm production. The following studies were carried out: Preparation of the sample and different plant extracts; acute toxicity studies; serum urea and uric acid analysis; macroscopy; microscopy; chemical constituents; qualitative tests for the presence of following classes of all organic constituents.

As the botanical extracts of two plants have a promising results in the larval Red Palm Weevil i.e. the in vitro studies in the laboratory showed 100% mortality of these larvae. In vivo studies on infected live tree were initiated to reconfirm. Application of these bio pesticides will not affect the taste and behavior of the date palm fruits as it is affected by the application of organophosphorus insecticide/ pesticides earlier. Studies in the laboratory showed 100% mortality of these larvae. In vivo studies on infected live tree were initiated to reconfirm. Application of these bio pesticides will not affect the taste and behavior of the date palm fruits as it is affected by the application of organophosphorus insecticide/ pesticides earlier.

MiSeq analysis reveals high fungal diversity and the presence of new fungal pathogens of date palms

Abdullah Mohammed Al-Sadi, Hamed Al-Nadabi and Ibrahim Al-Amri
Department of Crop Sciences, College of Agricultural and Marine Sciences,
Sultan Qaboos University, PO Box 34,Al-Khod 123, Oman,
alsadi@squ.edu.om

Abstract

Date palm is the most important crop in the Sultanate of Oman, with a total production of 328,000 tonnes. Date palm faces several challenges, with wilt diseases being of an increasing threat. A survey in different farms in Oman showed that wilt is widespread in several date palm cultivars and regions. Isolations from diseased trees followed by identification of the isolated fungi using sequences of the Internal transcribed spacer region of the ribosomal RNA (ITS rRNA) showed that several fungal species are associated with the disease, including species belonging to *Fusarium*, *Lasiodiplodia* and others. In addition, MiSeq analysis was conducted on DNA extracted directly from date palm roots, trunk and leaves, as well as from the rhizosphere of date palms. The analysis showed the presence of a high level of fungal taxa in date palm soil, mostly dominated by saprophytic fungi and some potential biocontrol agents, with the minority of fungi being pathogenic on date palms. Soils from farms suffering from wilt symptoms were found to have higher levels of fungal pathogens, suggesting that the imbalance in the soil microflora could lead to fungal pathogens causing diseases in date palms. Variations were found in the fungal taxa among date palm roots, trunk and leaves, suggesting that each date palm part is affected by different fungal pathogens. This study reports new fungal pathogens on date palms. It also suggests that the rhizosphere of date palms is usually dominated by saprophytic and antagonistic fungi that help minimize the impact of diseases on date palms.

Susceptibility of date palm dust mites to the entomopathogenic fungus *Beauveria bassiana*

Hussain, A., Rizwan-ul-Haq, M. & **AlJabr, AM.**
Laboratory of Bio-control and Molecular Biology,
Department of Arid Land Agriculture, College of Agricultural and Food Sciences,
King Faisal University, Hofuf 31982, Al-Ahsa, Kingdom of Saudi Arabia.
aljabr@kfu.edu.sa / solvia_aah@yahoo.com

Abstract

Date palm dust mites, *Oligonychus afrasiaticus*, major pest of date palm fruit mainly responsible for the low yield and poor quality of dates. The control of *O. afrasiaticus* primarily relies on the frequent use of synthetic pesticides that deteriorate environmental quality. The use of entomopathogenic fungus especially *Beauveria bassiana* evaluated in the current study is an environmental friendly alternate to control date palm dust mites. In the current study, virulence of three isolates of *Beauveria bassiana* including B7471, B8261 and B8037 was evaluated to report for the first time pathogenicity against date palm dust mites. Our laboratory results showed that the most virulent isolate (B7471) screened in the current study showed the lowest LT_{50} value (9.41 days). On the other hand, B8037 took relative more time to impart 50 % mortality resulting LT_{50} value of 11.80 days. In addition, virulent isolate greatly disturbed the host antioxidant defense related enzymes. In conclusion, isolate B7471 found to be virulent that disturbed the antioxidant defense ultimately lead to the mortality of date palm dust mites enabled us to propose it for future management of *O. afrasiaticus* in date palm plantations.

Management of root rot and wilt diseases by using some biological control agents on date palm under organic farming system

Ahmed, M.F.A
Central Lab. Of Organic Agriculture (CLOA),
Agricultural Research Center (ARC),
Giza Governorate, Egypt. 9, Cairo University St.,
Giza 12619, Giza Governorate, Egypt.
mohamed_faah@yahoo.com

Abstract

The present work aimed to decrease fungicides use in agriculture to produce high quality food in sufficient quantity and to enhance biodiversity system. In addition, an attempt was tried to find out the most suitable bio agent that has the ability to protect date palm cv. Zaghloul against some soilborne fungal diseases. Several soilborne fungi were isolated from root rots of date palm trees from the organic farm which located in El-Beheira Governorate, Egypt including: Fusarium solani, F. oxysporum; Rhizoctonia solani, and Macrophomina phaseolina. These diseases cause economic losses in date palm yield and a wide range of other cultivated plants. Isolates of different antagonists (biotic) i.e. Trichoderma album, T. harzianum, T. viride and T. hamatum isolated from rhizospheric soil of healthy date palm trees. In additional bio commercial preparations (abiotic) "Bio Zeid "T.album 10X106 spores/ml" and Plant Guard (T. harzianum 30X106 spores/ml) were used to study their effect against the causal pathogen of date palm. In vitro testing, the efficacy of biocontrol agents was evaluated against pathogenic fungi, while T. harzianum was the most effective against pathogenic fungi and showed 87.10, 81.55, 77.60, and 68.55% in the reduction growth of F. solani, F. oxysporum, R. solani and M. phaseolina, respectively. Meanwhile, T. hamatum recorded lowest antagonistic affect one. In vivo experiments, all tested biological control treatments (biotic or abiotic) significantly reduced disease severity of root rot and wilt diseases caused by soil borne pathogens. Moreover, increased the percentage of date palm survived trees in both seasons 2016 and 2017. T. harzianum showed the highest efficacy bioagent (82.35 and 86.67%). In additional to all tested biological control agents significantly increased all growth parameters i.e. root numbers / plant; plant height (cm); number of leaves / plant; leaflet number/ leaf; and leaf thickness (cm) of date palm var. Zaghloul compared with control treatment. This trend was true during the two successive growing seasons 2016 and 2017. Key Words: Date palm (Phoenix dactylfera L.); soil borne fungi, root rot; Trichoderma spp., commercial biological control preparations.

Using ginger (*Zingiber officinale*) extract as organic antibacterial source for controlling the endogenous bacterial problem of date palm micropropagation

Zeinab, E. Zayed., **Maiada, M. El-Dawayati** and Hala, M. Anwar.
The Central Laboratory of Date Palm Researches and Development,
Agriculture Research Center, Cairo, Egypt.
maiada_dw@hotmail.com

Abstract

Endogenous bacterial infections are the most critical problem hampers date palm (*Phoinex dactylifera*) micropropagation cycle. The main purpose of this work is to control the appearance of endogenous bacteria of date palm during multiplication stage without effecting on the growth vigor of growing cultures. A comparative study was conducted between using organic source ginger *Zingiber officinale* extract as antibacterial and the ordinary chemical antibiotic compounds Tetracycline or Chloramphenicol. Clean Shoots cluster consists of 3-5 shoot of date palm cv. sewi were used as explants material. (MS) basal nutrient medium supplemented with (0.05 mg/l) BA + (0.1 mg/l) NAA without antibacterial source was used as control treatment. Ginger extract was added at different concentrations. Tetracycline or Chloramphenicol antibiotic was added separately at 100 mg/l. Recorded results showed that**,** Bacterial presence **were** decreased clearly when development shoots cluster cultures were subcultured for 3 times on media containing 8 or 10 mg/l of ginger extract treatments and Tetracycline antibiotic treatment compared with control treatment. Whereas the best results for shoots number, growth vigor were recorded when shoots clusters were subcultured on ginger extract at 8 mg/l, well full rooting plantlets also were received belong to this treatment. Using ginger extract as organic antibacterial source for controlling the endogenous bacterial problem of date palm micropropagation ensures that cultures are kept clean with remarkable good development and avoids the disadvantages of continuously using of other ordinary antibiotics.

Effect of plant extract Ruta graveolens against the date scale, Parlatoria blanchardi Targ., (Homoptera, Diaspididae) at Biskra oasis, Algeria

Tarai N.[1] & Chabaani H.[1]
1. Department of Agricultural Sciences,
Faculty of exact sciences and natural sciences and life.
DEDSPAZA Laboratory, University of Biskra, Algeria
tarainacer@gmail.com

Abstract

The date scale Parlatoria blanchardi (Targ.1868), (Homoptera, Diaspididae) is one of the most devastating pests on date palm. The damages caused at Biskra oasis are considerable. To minimize the side effect of chemical use against date scale, a survey was conducted at Oumache, Oasis of Biskra, by applying plant extract of common rue, Ruta graveolens (Rutaceae). Extracts were sprayed on the first, second and sixth day. Three different extracts were used; seed extract, oil extract from the seed and extract from dry leaves, with three concentrations (0.25, 0.5, 1.0 ml/ml). Extracts were tested on different larval stages and adults under laboratory or field conditions, during the autumn and winter period of the year 2015. Results showed that the mortality level increased with increasing extract concentration, especially on the second and third larval stages. The high cumulative level of larvae mortality was found 72 hours after oil extract treatment, with 83% larvae mortality under laboratory conditions and 70% larvae mortality in the fields.

Keywords: palm-date – scale-Oasis- Biskra- plant extracts.

Biological studies on the acarid mite tyrophagus putrescentiae feeding on stored date palm fruits (Acari: Astigmata: Acaridae)

Mariam A. El -Sanady
Plant Protection Research Institute,
Agricultural Research Centre, Dokki, Giza, Egypt.
marim_elsanady@yahoo.com

Abstract

This research paper is conducted to throw some lights on the effect of feeding a carid mite *Tyrophagus Putrescentiae* (Schrank) on stored date palm fruits. Also, life history and life table parameters of mite was studied under laboratory conditions 25 & 30 ºC and 70 % relative humidity. Mite successfully completed his life span passed through egg, larva, protonymph, tirtonymph before reaching adult. Also, males reached adulthood before females. where was have a shorter longevity than females. The developmental time, oviposition period, adult longevity and life span decreased with increasing temperatures, while daily oviposition rate and fecundity increased with increasing temperatures. Thus this mite species caused a great damaged to date palm fruit in stores. The net reproductive rate R_o (fecundity) for 30ºC higher than 25ºC. Also, the intrinsic rate of natural increase (r^m) Similar trends was observed with the finite rates of increase (e^{rm}).

Keywords: Tyrophagus putrescentiae, Date palm, Biology, Temperatures, food consumption, Life table parameters.

Phylogenetic and pathogenic characterisation of *Mauginiella scaettae* as the causal agent of date palm (*Phoenix dactylifera* L.) inflorescence rot

Messoaud B. Bensaci.[1]*, Fatma Rahmania [2], Stephen Wade[3], Brian Douglas[3], Gareth W. Griffith[3] and Luis A. J. Mur [3].
[1] Ouargla Normal Higher School, Department of Natural Sciences, Ouargla 30000, Algeria.
[2] Faculty of Biological Sciences, Laboratory of Researches on the Arid Zones, BP. 32. El - Alia, University, Haouari Boumediene, Bab-Ezzouar, Algiers, Algeria.
[3] Institute of Biological Sciences, University of Wales, Aberystwyth, Edward Llwyd Building, Ceredigion, Aberystwyth SY23 3DA, Wales, UK.
mbachagha@gmail.com

Abstract

Inflorescence rot is a devastating disease of date palm (*Phoenix dactylifera L.*) but has not been extensively characterised. *Mauginiella scaettae* Cav. 1925 (Pleosporales; Ascomycota), causal agent of this disease, ten strains were isolated from infected inflorescences of date palm both males and females were obtained from different oasis south east of Algeria. Ouargla (OU2,OU3,OU4), Tougourt (TO1,TO2), Hadjira (HA), Oued (OE1,OE2), Biskra (BI). The isolated GA strain of *Mauginiella scaettae* was used to infect healthy mal inflorescence of date palms to satisfy Koch's postulates. Phylogenetic reconstruction using the rRNA locus internal transcribed spacer (ITS) region revealed a close relationship between the Algerian strains and the only previously isolated *Mauginiella scaettae* from Elx Spain (AY965895-NCBI). More widely, *Mauginiella scaettae* was confirmed fall within family Phaeosphaeriaceae closely related to genus *Phaeosphaeria* which includes many pathogenic species. Fourier Transform Infrared spectroscopy (FTIR) metabolite fingerprinting was employed to chemically discriminate the fungal strains between those that originated from male and female inflorescences. Scanning electron microscopy (SEM) characterisation of the infection processes for *Mauginiella scaettae* in male and female inflorescences suggested a preference for stomatal entry. Development of a heterologous pathosystem based on *Arabidopsis thaliana* was used to confirm the virulence of the *Mauginiella scaettae* strains, a preference for host penetration via stomata and a final necrotrophic lifestyle. Our characterisation provides new insights into this inflorescence rot to allow better detection and management of the disease.

Key words: Date palm, Southeast, Algeria, Inflorescence rot, Mauginiella scaettae, ITS, FTIR, Arabidopsis thaliana, SEM.

Promoting the application of ICT tools in management programs of date palm pests in Arab countries

Mohamed El-Said El-Zemaity
Plant Protection Department- Faculty of Agriculture,
Ain shams University, P.O.Box:68 Hadeyk Shoubra, 11241Cairo, Egypt.
mselzemaity@hotmail.com

Abstract

ICT is one of the emerging technologies worldwide, successfully used in many agricultural purposes in general. So, the objective of this paper is to promote the utilization of this technology in the Arab countries for the sustainable development of date palm plantations, particularly with regard to pest management. The paper will provide a brief introduction to available ICT tools and discuss their applicability to support pest management programs in the near future. This discussion will focus on the features, characteristics and forms of services, use and application mechanisms, operational directions for development, challenges/constraints of application, and specific sites of the key players of ICT. Finally, special attention will be given to the application of these technologies in order to demonstrate their potential impacts in: (1) Providing information on the infestation by various pests from specialized sites and databases, (2) Determination the location and extent of infection in certain areas using GPS&GIS, and early detection of some serious pests such as red palm weevils, (3) Exchange of information on the best measurements and control tactics to the pest of concern, (4)Supporting pest management decisions and enhancement the evaluation of the adopted IPM programs, (5) Establishing expert systems for management of date palm pests, (6) Strengthen the communication links between specialized researchers, centers, extension professionals, date palm growers, traders and agro-industrialists, and others (7) Rapidly changing and technology transfer of research and extension information to producers and date palm growers.

Keywords: Date palm, pests, IPM, ICT tools, management decisions.

Ten years of dubas bug control by using biorational insecticides in Yemen

Salem Mohammed Bashomaila[1] , Ibrahim Jadou Al-Jboory[2] and Abdulla Omer Madi[3]
1. AREA.Mukalla, Yemen.
2. University of Baghdad, College of Agriculture ,Baghdad, Iraq.
3. Agriculture Department, Mukalla
smbashomaila@gmail.com

Abstract

Dubas bug *Ommatissus lybicus* Bergevin represents the most important economic pest on date palm in Yemen, especially in the Eastern Coastal Area. The evaluation of eco-friendly botanical and biorational insecticides was started in 2004-2006 showed a promising results when using Neem powder and Neem water extract against sucking insects like white fly, thrips and black watermelon bug. The positive preliminary results encouraged us using them against Dubas bug, therefore set of trials have been conducted implementing biorational insecticides in 2007-2008, 2008-2009 and 2009-2010 seasons in spring generation in Wadi Daowan. Neem seed powder extract at a rate of 100g/l water and the methanolic extract of *Cleome droserifolia* Delil at a rate of 3ml/l water were applied compared with a Decis 2.5 EC and water spray. The results of three seasons confirms that all treatments reduced significantly the nymphs population after treatment, however the Neem extract showed a high efficacy on Dubas bugs. In 2012-2013 a formulation of Biorational insecticide Fytomax N (Azadirachtin 1%) was used at a rate of 3ml/litre of water in spring and in autumn-generation at Hadramout coast. Comparisons have been made with Dimethoate 40 EC, and Desirin 250EC (Deltamethrin). The results revealed that the efficacy of Fytomax N to control nymph and adult stages were extremely promising (92.42, 94.0%) and (94.7,93.74%) one week and two weeks after application respectively. In April 2014, another formulated biorational product extracted from the plant *Sophora flavescens,* Matrixine 2.4 was sprayed at a rate of 2.5ml/l water beside Fytomax N1%. Comparisons have been made with chemical insecticides, Desirin250EC (Deltamethrin) and Lambdachem 5%EC(Lamba-cyhalothrin). One day, one week and two weeks after application revealed that the control of nymph and adults, by Matrixine2.4was (93.5,91.6%), (96.5,87.8%), (97.5,90.8%), while that of Fytomax N was (88.5,92.0%), (98.5,63.8%), (95.0,66.0%) respectively. There were no significant differences observed between Matrixine and the chemical insecticides. This outstanding performance encourage us to recommend inclusion of Matrixine2.4 in Dubas bug National campaign control in Yemen as a green biorational solution.

Pathogenicity of the toxin diketopiperazines from entomopathogenic fungi *Nomuraea rileyi* against the red palm weevil *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae) in Egypt

Sabbour M.M.
Department, Pests & Plant Protection; Agricultural & Biological Research Division,National Research Centre. El-Tahrir St. - Dokki, Cairo, Egypt.
sabbourm9@yahoo.com

Abstract

The diketopiperazines toxin extracted from the fungus *Nomuraea rileyi*. It used against the red palm weevil *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae) under laboratory and field condition. Our results showed that the LC50 recoded, were 121, 125, 155, 160 and 179 PPm, after 1st, 2nd, 3rd, 4th, and 5th larval instars of *R.ferrugineus* were treated with different concentrations of the isolated diketopiperazines of extated from the fungus *N. rileyi*.
Under field conditions the percentage of infestations were significantly decreased to during the successive seasons 2016 and 2017. The yield loss were significantly decreased during the two successive seasons.

Key words: *Rhynchophorus ferrugineus*, diketopiperazines.

Description of chemical and ultrastructural alterations in cell-wall of the date palm leaves affected by the brittle leaf disease

Khaled Latreche and Fatma Rahmania
Research Laboratory on Arid Regions (LRZA). Faculty of Biological Sciences.
University of Science and Technology Houari Boumediene (USTHB).
BP. N° 32. El Alia. 16111. Bab Ezzouar, Algiers. Algeria.
latrechekh@yahoo.fr / frahmania@gmail.com

Abstract

The date Palm, *Phoenix dactylifera* L., has been an important resource in the Arabian Gulf peninsula and North African countries for thousands of years. It is extremely useful in controlling desertification by creating a microclimate which prevents long-term degradation of ecologically weak environments and forms the basis for survival of many indigenous populations. But unfortunately, this wealth is being decimated, especially in Algeria and Tunisia, by a new, lethal disease called the '*Brittle leaf disease*'**.** This pathology is undeniably one of the most destructive diseases of date palm. The impact of this pathology is very serious in North Africa, especially in Algeria and Tunisia where losses are increasing and may be a threat for palm-groves around the world. Currently, more than 40 000 date palm trees have been destroyed in Tunisia and many others have already died and been removed in Algeria. Both biotic and abiotic factors have been suggested to be possible causal agents of BLD. However, the research efforts aimed at identifying the etiology of this disease have still been unsuccessful. The external symptoms of the brittle leaf disease are very typical, but the most characteristic symptom is revealed with the touch. Leaflets break easily when flexed and squeezed, which makes disease identification very easy. The various observations and measurements realized indicate that leaves softening and friability are related to the multiple alterations that affect the cell wall. Indeed, the TEM images show many ultrastructural deformations and serious alterations of the cell wall integrity, mainly in fiber and sclerenchyma tissues. Further investigations using FT-IR have also been fulfilled. Comparison of the second derivative IR spectra of control and BLD-affected leaves reveal many spectral perturbations over the frequency range 800-1800 cm^{-1}. The IR fingerprint indicates several differences in lignin's and polysaccharides functional groups. These modifications mainly affect the angular vibrations of CH groups in cellulose (840, 895 cm^{-1}), as well as, the C-O stretching bands (921, 944, 998 cm^{-1}) and the C–O–C asymmetric bridge stretching vibration in cellulose and hemicelluloses. Spectral analysis also revealed the appearance of two new bands at 1513 cm^{-1} and 1538 cm^{-1} in BLD affected leaves. These bands correspond to aromatic skeletal deformations coupled with δs (C-H), and the valance vibrations ν (C=O) in aromatic structure of lignin. Such modifications severely affect the cell wall integrity and alter the structural rigidity of supporting tissues, leading to the leaves' friability; what gives the "Brittle leaf disease" its name.

Keywords: *Phoenix dactylifera* L., Brittle leaf disease, FT-IR, cell-wall, ultrastructure, Algeria.

Biological control of root rot, wilt diseases complex in offshoot date palm and improvement of growth parameters in new valley governorate, Egypt

Magd E. A. El-Morsi[1)]; Montaser F. Abdel-Monaim[1)*] and Yousef M. S. Diab[2)]
[1)] Plant Pathology Res. Institute, Agriculture Research Center, Giza, Egypt.
[2)] Central Lab. of Date Palm Res. and Development, Agriculture Researches Center.
magd31166@yahoo.com

Abstract

Root Rot and wilt disease complex was detected in different date palm offshoots in nurseries and new orchards in New Valley Governorate. Pathogenicity tests showed that *Fusarium oxysporum, F. solani* and *F. moniliforme* were pathogenic to date palm offshoots (cv. Saidy) but they differed in their pathogenic capabilities. The effect of *Bacillus subtilis* (BSM1), *B. megaterium* (BMM5), *B. cereus* (BCM8), *Trichoderma viride* (TVM2), *T. harzianum* (THM4) as bioagents against root rot/ wilt disease complex of date palm offshoots under natural infection in nursery cultivated in two location (Al-Kharga and El-Dakhla) were studied. The obtained data indicated that all treatments reduced significantly disease severity compared with untreated offshoots (control) in both locations. *Bacillus megaterium* and *T. viride* recorded the highest protection against disease severity, while *B. cereus* and *T. harzianum* gave the lowest ones in this respect. Under laboratory conditions, all bioagents inhibited growth of the pathogenic fungi with different percentages. *Bacillus megaterium* and *B. subtilis* were recorded the highest percentage of inhibition growth, while *T. harzianum* gave the lowest ones. On the other hand, all treatments significantly improved growth parameters of offshoots *viz*. plant height, number of leaves plant^{-1}, leaflet number leaf^{-1}, leaf thickness in both locations. *Bacillus megaterium* and *T. viride* recorded the highest all growth parameters whether in El-Kharga or El-Dakhla, while *B. cereus* and *T. harzianum* gave the lowest ones.
Also, all treatments increase leaves contents from nitrogen (N), phosphorus (P), potassium (K), sodium (NA), magnesium (Mg) and Chlorophyll a, b and carotenoid contents in leaves compared with control in both excremental locations.
Bacillus megaterium recorded the highest levels on N, P, CA contents in offshoot leaves, while *B. cereus* increased offshoot contents from K, Na and Mg in both locations.

Key words: Biological control agents (BCAs), Date palm offshoots, Growth parameters, Root rot and wilt diseases, Mineral contents.

Biology of the major storage pests of dates and their management using tnau probe traps and exposure of insects to carbon dioxide and cold treatments

I.Merlin Kamala and J.S.Kennedy
Dept. of Agricultural Entomology, Tamil Nadu Agricultural University,
Coimbatore – 3, India.
merlinento@gmail.com

Abstract

Phoenix dactylifera L., commonly known as the date palm is a primeval flowering plant species in the family Arecaceae and has been cultivated for its edible fruit. Dates is one of the major food commodity which provides a rich source of carbohydrates, dietary fibres, certain essential vitamins and minerals. Dates contain high amounts of essential nutrients: minerals (Mg, Ca, Fe, K), carbohydrates (total sugars 44–88 %, glucose and fructose 65–80 % of dry weight) vitamins (niacin, B1, B2), dietary fibers (6.4–11.5 %), fatty acids and proteins. They could play an important role in emergency food relief programs. Certain dates cultivars are considered to have several medicinal qualities viz. antifungal, antibacterial, antiulcer, immuno-modulatory and antitumor properties. Also, some date cultivars have antioxidant activity due to phenolic compounds . Fresh dates are perishable and are highly susceptible to losses from damage by stored product insects and causes quantity deterioration between harvest and consumption, leading to loss of quantity, quality and market value. dates may become infested at the processing plant or warehouse, in transit, or at the store. Insect infestation and damage caused by insect feeding on the dates is one of the primary causes of postharvest losses in quality and quantity. The major pests infesting stored dates were, *Tribolium castaneum* (Herbst.), *Oryzaephilus surinamensis* (Linn.), and *Carpophilus hemipterus* (Fab.). With the objective to mange these three pests, studies were undertaken on their biology and management using traps, exposure to Co_2 and cold treatment. The biology of the pests revealed the total development period from egg to adult as 33 to 48 days in *Tribolium castaneum*, 39 to 54 days in *Oryzaephilus surinamensis* and 35 to 45 days in *Carpophilus hemipterus*. TNAU probe traps were found to be excellent tools for monitoring and trapping of *Tribolium castaneum* (Herbst.), *Oryzaephilus surinamensis* (Linn.), and *Carpophilus hemipterus* @1.25, 4.25 and 3.25 / 500 g of samples. Studies on the effect of CO_2 on major stored product insect pest of dates was conducted to study the highest mean percent mortality as a management strategy. The experiment conducted at 8 Hours after treatment in 80 per cent CO_2 was found to be the best for all the test insects where in 100 per cent mortality was achieved. The mortality percent increased with increase in time and increase in concentration of CO_2. Studies on the effect of cold treatments on major stored product insect pests were conducted to study the highest mean percent mortality as a management strategy. The experiments conducted at 6 Days after treatment in 0^oC for all the test insects was found to be the best where in high mean per cent mortality was achieved. The mortality percent increased with increase in time and reduction in temperature levels. To conclude, TNAU probe traps can be used to monitor and trap storage insects in dates. For long term storage treating dates at 80^oC concentration of Co_2 for 8days and storing at 0^oC for days could eliminate the insect infestation.

Room A
SESSION 4

Technical Practices of Date Palm

Date value chain in Saudi Arabia: major obstacles to the international date marketing

Abdallah Oihabi
International Date Palm Expert, KSA
oihabi@gmail.com

Abstract

The Kingdom of Saudi Arabia is the second world date producing country with a total production of around 1.3 million tons which represents about 14.5% of the total world production. Of the 400 existing date varieties produced in the Kingdom, some figure among the best and most famous in the world and thus, present a high potential for taking the lead in the international date market.

Unfortunately, this not yet the case since less than 10% of the total dates exported by Saudi are commercialized on the international market, and most of these exportations are to Arab countries with limited quantities directed to the most profitable markets in Europe and North America.

This study aims to present some of the major obstacles facing the international marketing of the Saudi dates and discuss ideas on how to contribute to overcoming these challenges.

Architectural study and simulation of three Algerian date palm (*Phoenix dactylifera* L.) cultivars palms

Fadlaoui S [a], **Bedjaoui H** [a], Benziouche SH [a], Bennaceur M [b], Lecoustre R [c]
[a] Agronomy department. Mohammed Khider University. Biskra. Algeria.
[b] Department of biology. Faculty of science of nature and life.
University of Oran1 Ahmed Ben Bella. Oran. Algeria.
[c] UMR AMAP, botanique et modélisation de l'architecture des plantes.
Cirad. Montpellier. France.
bedjaoui.hanane@gmail.com

Abstract

Architectural parameters were used to describe, simulate and visualize the architecture of palms of three Algerian date palm cultivars 'Deglet Nour', 'Mech-Degla' and 'Ghars'. Biometric and geometric parameters were measured in the field on four different palms per cultivar using the Principes network protocol. The simulation was carried out by the Xplo software developed at UMR-AMAP-CIRAD, simulator of architecture and plant growth, which contains the Palm Principes model.
The symmetry study of the left and right sides of palm rib allowed to highlight a slight difference in terms of number and length of pinnae and frequency of their grouping. However, the dissymmetry was more marked by the rotation and axial angles which revealed a localized heterogeneity at 10 and 90% of the palm. Also, the results revealed that the virtual form (3D structure) of the simulated palms was comparable to the actual ones. Indeed, the parameters characterizing the palms of different cultivars appear clearly on the simulated palms namely the lengths of the petiole, the spine and pinnae parts, the number of both leaflets along the rib and spines and also the rotation angles.

Key words: date palm, architecture, symmetry, simulation, characterization, cultivars.

Enhancement the production of agro-biodiversity of date palm (*Phoenix dactylifera* L.) in Siwa Oasis

Sherif F. El Sharabasy[1] and Reda M. Rizk[2*]
[1]The Central Laboratory of Date Palm Research & Development,
[2]National Gene Bank (NGB), Agricultural Research Center, Giza, Egypt
sharabasydates@yahoo.com

Abstract

To generate essential information of the identification, description and documentation the agro-biodiversity of date palm cultivars in Siwa Oasis, taxonomical relationships of fifteen date palm cultivars growing in Siwa Oasis were addressed based on one hundred and three morphological attributes of trunk, crown, leaves, fruits and seeds. The most important attributes are arranged according to their taxonomic significance. Fruit and seed attributes are still the most important criteria to distinguish among date palm cultivars, but the blade, spine and crown attributes are useful in delimitation some cultivars.

The main objective of the study is identification of Siwa's date palm varieties according to internationally standardized to combat commercial fraud during offshoots exchange and trade, as well as the ability to apply a certificate of origin for the date palm offshoots / seedlings during exchange and trade.

In order to protect farmers rights and investors in the field of agricultural production of date palm as well as effective sustainable production of date palm, the positive management action must be associated with legislation reform of agribusiness.

Predicting farmers' willingness to adopt liquid pollination and polycarbonate drying house technologies: a case study from the date palm growers in the Sultanate of Oman

Boubaker Dhehibi[1] Mohamed Ben Salah[2] Aymen Frija[3] Aden Aw-Hassan[4]
[1]Sustainable Intensification and Resilient Production Systems Program (SIRPSP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
P. O. Box 950764 – Amman 11195, Jordan
[2]International Center for Agricultural Research in the Dry Areas (ICARDA)
Directorate General of Agriculture & Livestock Research
Rumais, Barka, Muscat, Oman
[3]Sustainable Intensification and Resilient Production Systems Program (SIRPSP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
3, Rue Mahmoud Ghaznaoui, Menzah IV, 1082, Tunis, Tunisia
[4]Sustainable Intensification and Resilient Production Systems Program (SIRPSP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
P. O. Box 950764 – Amman 11195, Jordan
b.dhehibi@cgiar.org

Abstract

The aim of this research paper is to assess the adoption level of the two technologies (liquid pollination and polycarbonate drying chambers) in the Sultanate of Oman with emphasis on identifying influencing factors of the adoption process and exploring resulting policy implications. The methodological framework used in the current study is based on the implementation of the ADOPT (Adoption and Diffusion Outcome Prediction Tool) tool in two localities of the Sultanate through focus groups discussion (FGD's). In the FGD we streamlined 22 discussion questions around four categories of influences on adoption: characteristics of the innovation, characteristics of the target population, relative advantage of using the innovation and Learning of the relative advantage of the innovation.

Empirical findings obtained from the assessment of the LP technology indicate that peak adoption rate for liquid pollination technology in "North Al Batinah" is high and predicted to be around 95% (of the total population) after a period of 14.5 years. The predicted adoption level after 5 and 10 years from introducing the technology in the region is expected to be 46.9% and 91.5%, respectively. The assessment of the rate of adoption of the PDH technology and the identification of factors affecting the peak and adoption levels, and constraints that limit the adoption process and widespread of such technology among the date palm growers of Oman indicates that peak adoption rate for PDH technology in the target study region is predicted to be 95% after a period of 21 years. The predicted adoption level after 5 and 10 years is expected to be 23.5% and 72.9%, respectively.

The presented results suggest that sustainable increase in date palm productivity in the Sultanate of Oman can be achieved if farmers are encouraged to adopt the liquid pollination and polycarbonate drying chambers technologies. However, the adoption of such technology needs to be accompanied by a supporting extension system and an enabling policy environment to ensure the scaling-up and widespread use of these promising and profitable technologies.

Key words: Adoption, liquid pollination, polycarbonate drying chambers, date palms, FGD's, ADOPT, Oman.

Drying dates using solar energy under polycarbonate house- new promising technology to dry dates in Oman

Mohamed Ben Salah[1], Youssif Al-Raisi[2], Khaled Al-Shoaily[3]
[1]International Center for Agricultural Research in the Dry Areas (ICARDA)
Directorate General of Agriculture & Livestock Research
Rumais, Barka, Muscat, Oman
[2]Date Palm Research Centre, Directorate General of Agriculture and Livestock Research, Rumais, Ministry of Agriculture and Fisheries, Sultanate of Oman.
P.O. Box 50, Postal code 121 Seeb
[3]Date Palm Research Centre, Directorate General of Agriculture and Livestock Research, Rumais, Ministry of Agriculture and Fisheries, Sultanate of Oman.
P.O. Box 50, Postal code 121 Seeb
m.ben-salah@cgiar.org

Abstract

The project "Development of Sustainable Date Palm Production Systems" in GCC countries aims to use of proper agro-management techniques, and to develop proper post-harvest techniques to reduce losses, and improve marketing.
Drying dates by solar energy under Polycarbonate Drying House (PDH) is developed by the project. The PDH is a drying chamber cover by polycarbonate sheet equipped by exhaust fan. The polycarbonate sheet has superior properties in terms of transparency, transmissivity, property, anti-corrosion, tensile properties, tear-resistant, anti-puncture, water and moisture proof.
Principal advantages on using the PDH technology are the following: (1) Improves the quality of the dates, especially in humid areas; (2) Avoids the contamination of dates by insects, birds, dust, and rain; (3) Accelerates the drying process and (4) Reduces the loss rate.
The implementation of this improved technology can have positive socioeconomic impacts on local income generation, food security and consequently a sustainable date palm farming system.
Economic evaluation of the polycarbonate drying houses in Sultanate of Oman reveal the high profitability of the polycarbonate drying system, even when it is not subsidized by the government. At a real discount rate of 5%, the net present value (NPV) is positive and very high in all cases. The estimated Internal Rate Return (IRR) was higher than the current interest rate in the Sultanate, which could encourage both date palm growers and private investors to invest in polycarbonate drying houses.
Adoption and Diffusion Outcome Prediction Tool (ADOPT) was used to focus groups of date palm growers in Al Batina region in Sultanate of Oman to predicts the proportion of a target population that might adopt an innovation over time. The assessment of adoption of the (PDH) technology reveal that 95% of the farmers in Al Batina region would adopt the innovation after 21 years. However, the predicted adoption levels in 5 and 10 years from start is 23% and 73%, respectively.

Key words: Date palm, dates, Drying, DPH, Economic evaluation, ADOPT, Oman.

Liquid pollination technology as new technology to ameliorate date palm pollination and facilitate date palm field operations

Mohamed Ben Salah[1] , **Youssif Al-Raisi** [2] and Brahim Al-Boussaidi [3]
[1] International Center for Agricultural Research in the Dry Areas (ICARDA)
Directorate General of Agriculture & Livestock Research
Rumais, Barka, Muscat, Oman
[2] Date Palm Research Centre, Directorate General of Agriculture and Livestock Research, Rumais, Ministry of Agriculture and Fisheries, Sultanate of Oman**.**
Rumais, Barka, Muscat, Oman
[3] Date Palm Research Centre, Directorate General of Agriculture and Livestock Research, Rumais, Ministry of Agriculture and Fisheries, Sultanate of Oman.
P.O. Box 50, Postal code 121 Seeb
yousufm68@yahoo.com

Abstract

Pollination of date palm is normally carried out by hand in almost all date palm groves in Oman. Farmers mostly use various hand pollination techniques. Dry pollination, using a hand and motorized duster with no effect on fruit yield, despite the larger pollen volumes when dusters were used and no well distribute the pollen when the date palm in high tall.
With le liquid pollination (LP) female trees flowers are sprayed with pollen water solution, using a hosepipe. LP is much quicker, cheaper and equally effective. In addition, the use of this technology contribute to save time, reducing cost, and consequently, reduces the risk of climbing accidents to laborers.
LP was evaluated economically versus the traditional manual method for Fardh and Khalas cultivars based on the data collected from researchers from the Date Palm Research Center in Wadi Quriyat in Oman.
The reduction in pollination cost using LP in comparison with traditional manual pollination is about 89% and, consequently, a reduction in the total variable costs per hectare against those for manual pollination of about 42-56%.
Economic indicators showed that LP will be highly profitable for Omani farmers. The Net Return (NT) using liquid pollination was very high (+ 674%). The benefit-cost ratio (BCR) is three times higher when using liquid pollination.
ADOPT (Adoption and Diffusion Outcome Prediction Tool) tool was used to focus groups of date palm growers in Sultanate of Oman to predict the proportion of a target population that might adopt an innovation over time.
The empirical findings obtained from the LP technology assessment indicates that peak adoption rate for the technology in Al Batinah is predicted to be 95% after a period of 14-16 years. The predicted adoption level in 5 years and 10 years from start is expected to be 35-47% and 86-91%, respectively.
However, the adoption of such technology needs to be accompanied by a supporting extension system and an enabling policy environment to ensure the scaling-up and widespread use of this promising and profitable technology. The main constraints of LP are the cost of extraction device which small-scale farmers cannot afford.

Key words: Date palm, pollination, LP, Economic evaluation, ADOPT, Oman.

Rooting the off-shoots of "Shahani" date palm

Abdolhossein Aboutalebi Jahromi and Abdolhossein Mohammadi jahromi
Department of horticulture, Jahrom Branch,
Islamic Azad University, Jahrom, Iran
aa84607@gmail.com

Abstract

This research aimed to study the effect Indole 3-Butyric Acid (IBA) on rooting of "Shahni" date palm off-shoots with different weights. For this reason the experiment was performed as a completely randomized design consisted of four treatments and four replications on two groups of date palm off-shoots on the basis of weight (3-6 kg and 7-10 kg). The treatments include the application of IBA at four concentrations (0 as control, 1000, 2000 and 3000 mg/l). After the pruning, cleaning and washing the base of the off-shoots, they were treated with IBA for two minutes and then cultured in the pots containing a composition of soil, sand and peat moss. The pots were stored in a greenhouse (15-30 ºC and 60-80 % RH) for six months. At the end of experiment rotting percentage, the number length, weight and diameter of the roots were measured. Results showed that 3000 mg/l IBA significantly provides highest root number, length, diameter, weight and rooting percentage (78 %) on the off-shoots with weight 3- 6kg and 7-10 kg. Therefore, low weight (3- 6 kg) "Shahany" date palm off-shoots produce the highest root by IBA can be used effectively for propagation and developing cultivated area.

Keywords: Propagation, IBA, Rooting, Date Palm.

Improvement of the culture in the oasis agro-ecosystem by the development of appropriate biofertilizers: case of date palms and underlying crops

Meddich Abdelilah
Laboratory of Biotechnology and Plant Physiology,
Faculty of Sciences Semlalia,
Cadi Ayyad University, PO Box 2390,
Marrakech, Morocco.
a.meddich@uca.ma

Abstract

The oases play multiple socio-economic and important environmental roles. Nevertheless, they remain fragile and undergo permanently impacts of human and/or natural origins such as the Bayoud, drought, salinity, erosion and the poverty of soil's fertility related to the low contents of organic matter and nutrients. In order to partly overcome these problems, multiple researches were undertaken and/or are in progress and which are innovative approaches oriented. Among the practices likely to optimize biomass and crop tolerance to biotic and abiotic constraints are the methods of valorization of telluric microorganisms such as arbuscular mycorrhizal fungi (AMF) and bacteria PGPR (Plant Growth Promoting Rhizobacteria). Moreover, the valorization of organic wastes by composting has the double interest of mitigating their environmental impacts and of recycling these deposits of organic matter in large natural cycles. This work aim at the improvement of the biomass of the date palm trees and the subjacent cultures via the enrichment of soil by setting up an efficient biological protocol integrating the indigenous AMF, PGPR and fertilizers resulting from the composting of plants, animal and agro-industrial wastes. Several composts were used, among which; the composting of the grass scrap alone, of dead grass-sheets, of olive cakes olive mill wastewater and Garbage and phosphate-grass sludge. The majority of the prepared mixtures have reached maturity and stability after 3 months of composting. In addition, the role of the mycorhizae in presence or absence of the composts was assessed on the growth of the date palm trees and other subjacent cultures. The increase of the compost dosage decreases the colonization intensity of the root system of plants by AMF. For the date palm trees, the combination of AMF and 2/3 grass scrap alone compost appeared to be interesting for the improvement of the biomass and of the mineral nutrition of *Phoenix dactylifera*. For the other composts, the combination of low dose (5%, 10% and 20%) and indigenous AMF are clearly beneficial for the growth of subjacent cultures. Concerning the experiments carried out in the field, it confirmed the advantages of the combination of indigenous AMF-PGPR and compost in improvement the yield for leguminous (*vicia*, *alfalfa*), vegetable crops (lettuce, garlic, onion, tomato, leek) and cereals (wheat). The tripartite combination AMF-PGPR-compost was more efficient in increasing the yield of underlying crops. The efficacy of this tripartite combination depends on the plant itself, the nature and dose of the compost, and the mycorrhizal and bacterial isolates tested.

Keywords: Mycorrhizae, compost, PGPR, growth and yield improvement, date palm and underlying crop.

A growth analysis of the young date palm root system

Mimoun Asmaa[a,b], REY Hervé[c], Lecoustre René[c], Jourdan Christophe[d],
Bennaceur Malika[a,b]
[a]Department of Biology, Faculty of Natural Sciences and Life, University of Oran 1 Ahmed Benbella, P.B.1524, ElM'Naouer, 31000 Oran, Algeria. [b]Laboratory of Research in Arid Areas, P.B. 32, El Alia, Bab Ezzouar, 16111 Algiers, Algeria.
[c]AMAP-CIRAD /BIOS ,Avenue Agropolis , 34398 Montpellier France.
[d]CIRAD-Eco/Sols, Avenue Agropolis, 34398 Montpellier France.
asma.mimoun@gmail.com / bennaceurmalika@gmail.com

Abstract

Architectural traits were used to describe the structure and development of the date palm (*Phoenix dactylifera* L.), root system. To characterize root system architecture, two parallel experiments were conducted: one in a rhizotron whereby root growth was measured over time and one in a nursery bags from which roots were sampled regularly. These roots were sectioned and examined under a light microscope in order to determine how the anatomical structure of roots changes as they age. Double staining was performed on roots at different ages and from diverse root zones. The topology (arrangement of axes relative to each other) and typology (classification of different root axes based morphological and functional criteria) of root systems was measured in the first rhizotrons. Root diameter and root elongation were measured regularly on seedlings grown from seed (0 to 6 months). RhizoDigit software (©CIRAD) was used to digitize root observations and to compile data for statistical analyses. Results showed that during this developmental period, the root system architectural unit comprises seven root types having distinct characteristics and spread over three different topological orders (primary, secondary and tertiary). The establishment of different types of root axes evolves over time and depends on the root category. Root growth was variable depending on the root type and branching order of the diameter according to its class. There was an absence of both radical mortality and the arrest in growth of short secondary roots during this period. The anatomies of the radical and adventitious roots were typical of monocotyledonous roots. Radical anatomy also had a characteristic spatial and temporal development during the juvenile stage. We will use these results to develop three-dimensional models for use in agricultural management.

Keywords: *Phoenix dactylifera* L., seedling, growth and development, architecture, rhizotron, anatomy.

Impact of pollination by pollen-grain-water suspension spray on retained, bunch weight, yield and fruit quality of Segae date palm cultivar (*Phoenix dactylifera* L.)

Soliman. S. S[1, 2]**,** A.I.Alebidi[1], A.M. El-Saif[1],Al-Obeed .R.S[1], and A.N Al-Bahelly [1]
[1]Plant Production Dept., College of Food & Agric.Sciences, King Saud Univ.
[2]Department of Horticultural Crops Technology,
National Research Centre,Cairo,Dokki, Egypt.
Box 2460, Riyadh 11451, Saudi Arabia.
E-mail: said_soliman@hotmail.com

Abstract

This study was carried out for both successive seasons (2015 and 2016) at Riyadh, Kingdome of Saudi Arabia. The impact of pollen grain-water suspension spray at different concentrations on fruit retained, bunch weight, yield and fruit quality were examined on Segae date palm cultivar. Spray pollination at 2 g pollen +3 g sugar / liter followed by spray pollination at 2 g pollen / liter gave higher physical properties and lower fruit retained. Spray pollination at 2 g pollen +3 g sugar / liter followed by traditional pollination (control) gave the highest bunch weight and yield compared to the application other treatments in both seasons. Spray pollination at 3 g pollen + 2 g sugar / liter followed by spray pollination at 2 g pollen / liter and spray pollination at 2 g pollen +3 g sugar / liter followed by spray pollination at 2 g pollen / liter treatments were significantly increase total sugar percentage compared to other treatments and control in the first and second seasons, respectively. Acidity percentages were significantly increased with spray pollination at 2 g pollen / liter followed by spray pollination at 3 g pollen / liter compared to other treatment and control in the second season. Moisture content percentages were significantly increased with traditional pollination (control) as compared to other treatments in both seasons. Spray pollination at 2 g pollen +3 g sugar / liter treatment produced highest fruit quality and could be considered as a recommended treatment in such experiment.

Keywords: Date palm, pollination, pollen grain, water, fruit quality.

Effect of leaf pruning without chemical application on Sayer (Istamaran) date production infected by leaf spots

Esmaeil Rahkhodaei
Horticultural Science Research Institute, Date Palm and Tropical Fruits Research center, P.O. Box 61355-16, Ahwaz, Iran.
Rahkhodaei@gmail.com

Abstract

Most of the leaflets of date palm especially on old leaves in date plantations of Iran are affected by a sort of rectangular necrotic leaf spots. They have different sizes and colors. They are often gray and dark brown with orange margins. The spots may cause some problems in photosynthetic and respiratory system in dates and also, they make suitable condition for secondary date palm pathogens. The conditions can decrease of date palm quantity and quality production. Then the effects of leaf pruning of infected leaves on production of Sayer (Istamaran) date cultivar was studied in Arvandkenar region of Khouzestan province of Iran for two years. The examination was carried out in randomized complete block design with 4 treatments including control (without leaf pruning), leaf pruning once a year at the beginning of autumn and leaf pruning twice a year (once at the beginning of autumn and other, one month after pollination). Yield of treatments were compared using Duncan‘s Multiple Range Test. The results showed that leaf pruning twice a year with a yield of 51.81 kg per one date was significantly better than leaf pruning once a year with a yield of 36.37 kg and control with a yield of 43.19 kg .

Key words: Sayer (Istamaran) date, Leaf spot, Khouzestan province

Desert adaptive strategies in date palm revealed by high resolution imaging technologies

Ikram Blilou[1], Ting Ting Xiao[1], and Malcolm Bennett[2]
[1]BESE, KAUST, Thuwal, KSA
[2]Brian Atkinson, School of Biosciences,
University of Nottingham, UK
ikram.blilou@kaust.edu.sa

Abstract

Desert plants are confronted by harsh environmental conditions and have therefore adapted various perseverance strategies to survive the hostile environment. Despite being considered as a landmark for desert, date palm" *Phoenix dactylifera*" growth is linked to high water supply for the root system and high temperature in the shoot. To unravel the underlying mechanisms of date palm adaptation to desert conditions we conducted a detailed analysis of date palm anatomy during different stages of development from germination to adult plants. Using the art of state imaging technologies, we unraveled new developmental mechanisms in date palm occurring during germination, plant growth and development. MicroCT Xray imaging technology combined with high resolution microscopy revealed that date palm roots bear structures that have not been previously described. Some of these structures are conserved only among desert palm species. In addition, a comparative studies of date palm cultivars originated from different geographical habitat, Tunisia, UAE and KSA and having distinct levels of tolerance to soil salinity revealed substantial differences in root system architecture.

Effectiveness of the arbuscular mycorrhizas in the protection of date palm against dry conditions of arid lands

Benhiba Laila, Essahibi Abdelatif, **Qaddoury Ahmed***
* Plant biotechnology and agrophysiology of symbiosis LAB,
Faculty of sciences and techniques PO Box 549 gueliz Marrakech Morocco.
qadahmed@gmail.com

Abstract

Date palm (*Phoenix dactylifera* L.) is considered crucial to the oasian ecosystem as it protects the surrounding vegetation against desert influences and provides adequate microclimate to the under storey crops. During the last decade, date palm plantations were subjected to severe environmental constraints such as nutrient-poor soil, long term drought, high temperature, and desertification. These constraints cause not only reduction in the production of dates, the principal food of humans and animals in the desert, but also accentuate the fragility of this ecosystem that is no longer able to buffer the effects of climate fluctuations. Date palm Culture depends on groundwater, the main source of water for agriculture in arid and semi-arid areas. However, the limited precipitation and the huge increase in agricultural land have put pressure on groundwater usage, since demand for fresh water in this region is in growing. Although date palm is thought drought tolerant, water is required to fully realize growth and productivity performance, thus its yield and productivity can be negatively affect by water shortage. Date palm adaptation to water scarcity is mostly the result of existing intrinsic traits. However, mycorrhizal symbiosis is widely believed to provide complementary characteristics that improve host plants protection against the deleterious effect of drought. Mycorrhiza refers to a mutual association between plants and soil borne fungi that colonize the cortical tissue of roots during periods of active plant growth. The ability of the root systems to establish beneficial symbiotic relationships with arbuscular mycorrhizal (AM) fungi (AMF) represents one of the most successful strategies that land plants have developed to cope with abiotic stresses imposed during the colonization of terrestrial ecosystems. The multiple benefits gained from AM symbiosis can be characterized agronomically by increased growth and yield, physiologically by improved nutrients status and water relations, and ecologically by improved ecosystem stability and preservation. Mycorrhiza performances are more pronounced under harsh conditions including poor soil, water scarcity and soil salinity. As a result, mycorrhizal plants are often more competitive and better able to tolerate environmental constraints than are non-mycorrhizal plants. In this presentation, we will compile and discuss our recent results concerning arbuscular mycorrhizas effectiveness in increasing date palm performance in terms of growth, nutrition and protection against the detrimental effect of drought. In short, the contribution of AM fungi to improve date palm tolerance to water stress was attributed to: (1) enhanced water status and nutrient acquisition under short-term drought, and to (2) enhanced protection against oxidative stress induced by long-term drought stress as evidenced by the increased antioxidant enzyme activities and the alleviation of H_2O_2 and MDA accumulation in mycorrhizal plants subjected to long-term drought.

Keywords: Date palm, Arbuscular mycorrhizas, water stress, complementary characteristics.

Comparative performance of date palm varieties for production of fresh and dry dates under green glass house conditions

Muhammad Mansoor, Shahid Hameed Khan Khalil,
Muhammad Ashraf and Muhammad Arshad Khan
Pakistan Agricultural Research Council, Arid Zone Research Center,
Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan
joyadkpk@googlemail.com

Abstract

The date palm is a premium crop of Pakistan. Traditional methods of open sun drying were initially used for postharvest processing of dates, later on the practice of covering fruit bunches with bitumen paper were employed to protect it from dust storm and monsoon rains. However, the desired quality of the fruits could not be achieved. In order to shield the fruits from adverse factors occurring especially at the stage of ripening and curing the farming community switched over to solar tunnel drying. Temperature and humidity are the two main parameters which affect the date fruit quality. At ripening stage the fruit needs relatively low temperature and high humidity, while during drying it requires high temperature and low humidity. Controlled processing compared to natural ripening may be the best option to overcome the problems caused by long time exposure to climatic pollutants. In controlled ripening the fruits are converted from "Khalal" to "Tamar" stage having reduced chance of skin detachment from its flesh. This research study was carried out at Arid Zone Research Center, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan for early and safe ripening of dates under controlled temperature and humidity levels using most popular varieties of date palm of the area. For ripening of the dates 35^{o}C temperature with 80% relative humidity, and for drying 45^{o}C temperature and 30% relative humidity levels were used as constant factors. The moisture contents were reduced to the recommended water activity level of 23-25% for shelf life stability in all varieties under study. Data depicted that fresh date produce ranged from 39% to 59%with minimum (39%) for cv. Gulistan and maximum for Shakri variety (59%). Similarly, in dry dates the minimum and maximum produce recorded was 32% for Basra and 50% for Zahidi variety. The maximum and minimum size observed was 5.2cm and 2.5cm in case of Dhakki and Basra varieties respectively. As an overview of the study it can be recommended that farmer can fetch more from their produce if processed as fresh rather than dry dates from most of the popular varieties.

Key words: Climate variability, Date Palm varieties, Green Glass House, Fresh and dry dates, temperature and humidity.

Integrated pest management for control the green date palm pit scale insect (*Palmapsis phoenicis Rao.*) (Homoptera: Asterolecaniidae) in Sudan

Mahdi Abdelrahman Ahmed and Daffala E.Yousif
ARC, Sudan
mahdiahmed564@yahoo.com

Abstract

Date palm *(Phoenis dactylifera L.*) in Sudan is an economic and food security crop. Estimated annual date production from 8 million date palm trees is about 431.000 mt which is far below the country's potential. Sudan has been famous in the world for production of dry dates. Six good local commercial cultivars are available and research is coming up with better composition of cultivars by local selection and foreign introduction from tissue laboratories

Sudan is still free from-devastating red palm weevil and the destructive bayoud caused by *Fusarium oxysporum* f.sp. *albedensis.* The green date palm scale insect as an exotic pest appeared in Golid area (1974), Considered in the other palm groves of the world to be of minor or no importance, developed here in a very explosive way. Total number of infested trees is 1200,000. In the past, and due to lack of indigenous knowledge of appropriate control measures adopted to control the date palm green pit scale insect, in Sudan, the treatment control efforts using foliar application of contact insecticides and Mineral oils were not successful (91-1992). Hence the level of infestation steadily increased. Following intensive research an Integrated Pest Management (IPM) was starting with cultural practices or sanitary measures, supplemented with chemical control using systemic insecticides of Neonicotinoid (thiamethoxam & imidacloprid) such as Confidor 200 SL and Actara 25 WG and impact of natural enemies together with plant quarantine legislations. A comprehensive program by Plant Protection Directorate (PPD) has been conducted in infested areas. Sustainable biological control of the green pit scale is very important. Results of survies revealed that many natural enemies associated with insect have been recorded, the nitidulid beetle Predators found in all surveyed areas were Nitidulidae beetle *Cypocephalus dudichi* L., *lady bird Pharoscymnus numidicus, Chrysoperla sp and the* parasitoid *Metaphycus sp. was found in* association with green pit scale insect and the percentage of parasitism was 16% in some areas

Key words: Date palm, green pit scale insect, systemic insecticides, Biological control.

Investigation and determination the best way of bunch thinning on Mordaseng variety

H.Samavi, **A.Davoodian** and Gh. Saeidi
Agricultural and Natural Resources Research Center
of Hormozgan- Iran
Davoodian_atefeh@yahoo.com

Abstract

Suburb of Minab town is one of the most fertile areas for date palm in the country. "Mordaseng" variety is considered as the most productive, high grade and prevailing type in the region. According to different reasons, especially the relative humidity and Moth dates (Batrachedra Amydraula Meyr), noticeable amount of products become spoiled, fall down and are wasted every year. In the most countries, these damages are prevented by different ways of thinning.

This experiment was done in order to observe the influence of thinning the tail of cluster and determination of the best way of thinning for "Mordaseng" variety. For this reason, 16 similar palms of the same age were selected. The template of the experiment was Randomized complete block design, each containing 4 palms. Therefore, each 4 palms were considered as a repetition. In each repetition, the tailing of the clusters were thinned respectively 5, 10, and 15 centimeters. The forth palm was not thinned as the control sample. All the treatment process were operated same as the usual of the region. The products were harvested at the right time and weight.

This plan was repeated for 3 consecutive years. Regarding the statistical analysis and Variance analysis table of this period, a noticeable variance among different treatments of thinning and the productivity were observed. The clusters with no process of thinning were the most productive ones. In other words, thinning in "Mordaseng" variety will lead to less productivity. Although the thinned clusters have larger dates, but this would not fulfill the amount of lost products.

Keywords: Mordaseng , Bunch thinning, Minab.

Use of 5-hydroxypipecolic acid as authenticity and biomarker for date palm fruit-based foodstuffs

Hatem Salama Mohamed Ali[1] , Hans Brueckner [2,3], and
Abdulrahman Saleh Al- Khalifa[1]
[1]Department of Food Science and Nutrition, College of Food Science and Agriculture, King Saud University, P.O. Box 2460, Riyadh 11451, Kingdom of Saudi Arabia.
[2]Research Center for BioSystems, Land Use and Nutrition (IFZ), Institute of Nutritional Science, Department of Food Sciences, Justus-Liebig-University of Giessen, Heinrich-Buff-Ring 26-32, D-35392, Giessen Germany,
[3]Visiting Professor at King Saud University, Riyadh.
haali@ksu.edu.sa

Abstract

Introduction: In previous work [1] we had shown that edible date fruits contain large quantities of the non-proteinogenic amino acid 5-hydroxypipecolic acid (2*S*,5*R*-5-hydroxypipecolic acid or *trans*-5-hydroxypipecolic acid), abbreviated Pip(OH) in the following. Pip(OH) had been detected in in twelve named cultivars of date fruits of different origin.
Results: We hypothesized that Pip(OH) might serve as reliable and specific marker for date fruits and, consequently, date fruit-based foodstuffs. In order to prove this hypothesis we analyzed total hydrolysates of various date fruit cultivars of different maturation stages (*Khalal, Rutab, Tamar*), preparations of various date pastes and date syrups (*Dibis*), and commercially available date vinegars. Automated amino acid analysis based on ion-exchange chromatography was used as well as gas chromatography - high resolution mass spectrometry (GC-HRMS) of *N*(*O*)-pentafluorobutyryl-pipecolic acid-*O*-pentafluorobutyl esters. Complimentary, underivatized Pip(OH) was determined using hydrophilic interaction (HILIC) liquid chromatography (LC) combined with high resolution mass spectrometry (HRMS) performed in the electrospray-ionization mode.
Conclusions: Presence of Pip(OH) was detected in all aforementioned foodstuffs, surpassing or approaching the most abundant protein amino acids in date fruits *i.e.* aspartic and glutamic acid, alanine, proline and leucine. Since Pip(OH) is rare in edible fruits this non-proteinogenic amino acid is proposed as novel authenticity or dietary biomarker for date palm fruit-based foodstuffs in general.
Acknowledgement: Research supported by National Plan for Science, Technology and Innovations (NPST) at King Saud University (project no. 11-AGR1600-02).

Effect of organic fertilizer on mineral nutrition and production of date palm var. Majhoul in Morocco

Bouamri R[1], El kinany S[1, 2]., Aziz L[3]., Faggroud M[4] and Achbani E[5]
[1] Department of Plant and Environment Protection,
National School of Agriculture, Meknes, Morocco
[2] Laboratory of Microbial Biotechnology, Sidi Mohamed Ben Abdellah University,
Faculty of Sciences and Technologies Fez, Morocco
[3] Department of Development Engineering,
National School of Agriculture, Meknes, Morocco
[4] Department of Agronomy, National School of Agriculture, Meknes, Morocco
[5] Laboratory of Plant Protection URPP- National Institute for
Agricultural Research, Meknes, Morocco
rbouamri@enameknes.ac.ma

Abstract

Date palm is an important crop in Morocco, and many other drylands of the world, but its growth is often limited due to the low soil fertility and harsh environmental conditions of oases ecosystems, which can hardly be compensated by the sole application of high dosages of chemical fertilizers. For the first time, we investigated the effects of organic fertilizer application on the mineral nutrition and production date palm (cv. Majhoul). The study was conducted in a completely randomized block design at a modern plantation (156 tree/ha) in Tafilaet date palm grove. The date-palm trees, ,12 years of age, were randomly selected. The organic fertilizer was produced by composting a mixture of agricultural and agro-industrial waste. The results showed increased mineral nutrient contents (N, P, K and oligoelements) Chemical characteristics of fruit and yield for plants amended with organic fertilizer. According to our results, soil enriched with organic fertilizer can be recommended for improving the growth and nutrition of micropropagated date palm plantlets.

Key word: *Phoenix dactylifera* L.; Majhoul, organic fertilizer, yield.

A breakthrough in the processing technology of Dhakki dates

Shahzada A. Saleem, Ambreen A. Saddozai[1]and Ahmad K. Baloch[2]
Agriculture Research Institute, Dera Ismail Khan, KPK, Pakistan
[1] Food Microbiology Labs. NARC, Islamabad, Pakistan.
[2] Department of Food Technology, Gomal University, Dera Ismail Khan, Pakistan
sasdikpk@gmail.com

Abstract

The Dhakki date variety developed locally at Dera Ismail Khan is highly prominent for fruit gigantic size (≥6 x ≥3 cm^2), weight (≥ 35g) and very small pit size (2.4 x 0.76cm^2 weighing 0.68g/fruit). The fruit when ripe has relishing taste and very fine texture with exceptionally high flesh/stone ratio (96%), good appearance, and reasonably longer shelf life and quality. However, being a late variety it suffers enormous losses due to monsoon and bird/ pest damages. The aim of the investigation was to harvest the fruits at Doka (Khalal) stage for artificial ripening instead of Dong (Rutab) for normal ripening so as to avoid monsoon. Accordingly, the effectiveness of sodium chloride and acetic acid is investigated as ripening initiator/ accelerator for Dhakki fruits. Each treatment was applied individually and/ or in combined form at different proportions varying from 0.25 to 3.5 % and 0.25 to 2.5 % for sodium chloride and acetic acid respectively. Dhakki fruits at the Doka stage were immersed in the treatment solutions for 5 minutes and then allowed to ripen/ cure in an aerated incubator at 38 to 40°C. Observing changes in color shade, fruit weight, pulp, texture, total soluble solids, appearance and the extent of ripening assessed the efficiency of the treatment. All of the treatments, whether applied as single treatment or in combined form, tend to induce ripening by causing changes in the selected quality parameters. Treatments with sodium chloride appeared more effective producing 75 % greater ripening than the control, and the salt at 2 % was determined as the optimum for accelerated ripening for quality product. Sodium chloride does not require fruits to attain the Dong stage for ripening initiation; hence the fruits saved 2 to 3 weeks. Damages caused by monsoon and insect/ bird attacks are likely to be reduced considerably thus increasing yield of quality product.

Long-term assessment of the impact of salinity on fruit yield and quality in eighteen date palm varieties from the Arabian Peninsula

Abdullah Dakheel
[1] International Center for Biosaline Agriculture (ICBA),
Dubai, United Arab Emirates
a.dakheel@biosaline.org.ae

Abstract

Date palm (*Phoenix dactylifera* L.) growth and production in the arid regions is adversely affected by increasing soil and water salinities. Although many aspects of date palm nutritional values, physiology, genetics and many more are extensively researched, the evaluation of salinity impact on date palm growth and productivity are limited to short duration studies and focused on seedling stage mostly. A large gap in understanding salinity impact on date palm is therefore very evident. To address the complex issue of the impact of salinity on date palm trees, the International Center for Biosaline Agriculture (ICBA) located in the UAE, established a long-term experiment using eighteen local and regional date palm varieties from the Arabian Peninsula on nearly 2.5 ha in 2001 and 2002 on its experiment station to evaluate the impact of three levels of salinity (5, 10 and 15 dS/m ECW) on date palm productivity. Long-term results showed that fruit yield at Rutab and maturity stages were severely reduced at high salinity based on 8 years of yield data. Rutab fruit yield ranged from 67-146 kg/tree at the low salinity, while at the high salinity (15 dS/m) ranged from 21-98 kg/tree. At maturity, fruit yield reduction at the high salinity (15 dS/m) relative to the low salinity reached 67%. The 18 date palm varieties were widely different in the impact of salinity and yield stability. Regression fitting and Principal Component Analysis led to the identification of four different groups of date palm varieties with relation to salinity tolerance and thresholds. Group 1, including varieties Lulu and Barhi, are high yielding varieties with high salinity tolerance. Average salinity level at 50% yield reduction is 12 dS/m. The second group includes varieties: Khisab, Sukkari, Jabri, Shahlah, characterized by high yielding varieties with sensitivity to increase in salinity, yield decline highly at high salinity. Average salinity level at 50% yield reduction is 10 dS/m. The third group includes varieties: Farad, Um Al-Hamam, Naghal, Abu-Maan, Rhothan, and characterized by Medium to high yield potential under low salinity with moderate salinity tolerance. Average salinity level at 50% yield reduction is 9 dS/m. The fourth group includes varieties: Shagri, Khnizi, Nabtat Saif, Ajwat Al-Madinah, Khalas, Maktoumi, they have low yield potential with low salinity tolerance. Average salinity level at 50% yield reduction is 8 dS/m. The previously reported limits were shown to be higher than the findings of this work. Initial results showed that under irrigation with high salinity water, the actual water use by the plants declined by 40-50%. Such findings have great implications for water management under saline conditions.
The results and findings will help better understand the impact of salinity on date palm and in guiding further work on genetic enhancement and the development of integrated management approaches for date palm under marginal conditions.

Yield and fruit characteristics of "piarom" date palm as affected by trunk injected and soil applied iron in a calcareous soil

J. Saleh[1*], Y. Hosseini[2], A. Shahriari[3], M. Ghoreishi[4],
M. Ahmadi Rad[5], H. Hasanzadeh Khankahdani[6]
[1,2,3,4,5,6]Hormozgan Agricultural and Natural Resources Research Center,
Corner of Tolu Street, Imam Khomeini Boulevard, Bandar-e-Abbas, Iran
j.saleh@areeo.ac.ir

Abstract

We studied the influences of different sources and methods of iron supplementation on yield and some fruit characteristics of date palm variety "Piarom" in a calcareous soil during four years. The experiment treatments consisted of 1- soil application of iron chelate (100 & 200 g Fe-EDDHA per tree), 2- soil application of iron sulfate (1 & 2 kg $FeSO_4$ per tree), 3- trunk injection of iron sulfate solution (0, 25, 50 & 100 g $FeSO_4$ per tree), 4- control. The experimental design was randomized complete blocks, replicated three times. The results revealed that potassium and moisture content of fruits were almost similar in all treatments. On the other hand, trunk injection of 25 grams of $FeSO_4$ resulted in the highest yield, showing significant difference with other treatments. The maximum iron concentration, as well as the highest TSS and reducing sugars content in fruits was also obtained with trunk injection of $FeSO_4$ solution. Localized placement of $FeSO_4$ also caused improved results in fruit yield and quality compared to soil surface application of Fe-EDDHA and the control treatment. Thus, trunk injection could be recommended as an efficient method for iron supplementation in date palm grown in calcareous soils.

Keywords: Date palm, localized placement, reducing sugars, trunk injection, TSS.

Impact of arbuscular mycorrhizal fungi (AMF) and/or Baker's yeast on root rot/ wilt disease and growth parameters of date palm offshoots in New Valley governorate, Egypt

Montaser F. Abdel-Monaim[1)], Magd E. A. El-Morsi[1)] and Hamdy A Mahdy[2)]
[1)] Plant Pathology Res. Institute, Agriculture Research Center, Giza, Egypt.
[2)] Horticlture Res. Institute, Agriculture Research Center, Giza, Egypt.
fowzy_2008@yahoo.com

Abstract

Root rot and wilt was the important diseases in offshoots and new orchards of date palm growing in different Oases in New Valley Governorate. The ability of arbuscular mycorrhizal fungi (AMF) and/or Baker's yeast individually or in combination used as soil drench to induce resistance against root rot and wilt disease complex and their effect on growth parameters and mineral contents in leaves was examined under natural infection in date palm offshoots growing in nursery. The obtained data show that all treatments alone and in combination were able to protect offshoots against root rot /wilt disease complex compared with check treatment (control) in both locations (El-Kharga and El-Dakhla Oasis during 2016 growing seasons. The combination between arbuscular mycorrhizal fungi (AMF) and Baker's yeast were better than used individually of them for controlling root rot /wilt disease severity.

On the other hand, all treatments increased growth parameters *viz*. offshoot height, number of leaves offshoot^{-1}, leaflet number leaf^{-1}, leaf thickness (cm), leaf area (cm^2) and number of roots offshoot^{-1} in both locations. The combination between arbuscular mycorrhizal fungi (AMF) and Baker's yeast were significantly increased all growth parameters compared with used individually. Also, all treatments increase leaves contents from nitrogen (N), phosphorus (P), potassium (K), sodium (Na), magnesium (Mg), calcium (Ca) and Chlorophyll a, b and carotenoid contents in leaves compared with control in both excremental locations.

In biochemical studies, activity of defense-related enzymes, including peroxidase (PO), polyphenol oxidase (PPO), phenylalanine ammonia lyase (PAL) and catalase as well as total phenolic compounds and flavonoids were increased in offshoots treated with arbuscular mycorrhizal fungi (AMF) and/or Baker's yeast individually or in combination in both locations. The combination between AMF and BY recorded the highest all oxidative enzymes, total phenolic compounds and flavonoids compared with AMF or BY alone.

Key Words: Date palm offshoots, Root rot and wilt diseases, arbuscular mycorrhizal fungi, Baker's yeast, Growth parameters, oxidative enzymes, total phenols and flavonoids.

Effect of foliar spray with potassium dihydrogen phosphate and yeast extract on yield and fruit quality of 'Sukkary' date palm (*phoenix dactylifera* l.)

Mahmoud A. Ahmed[1,2] , Alaa El-Din K. Omar[2] and Rashed S. Al-Obeed[1]
[1]Plant Production Department, College of Food and Agricultural Sciences,
King Saud University, Saudi Arabia.
[2] Horticultural Crops Technology Department,
National Research Center, Dokki- Egypt.
[3]Horticulture Dept. (Pomology), Fac. of Agric.,
Kafrelsheikh Univ., Kafr El-Sheikh, Egypt
khider1968@yahoo.com

Abstract

As a natural bio-stimulant, bread yeast has an influence on growth, yield and fruit quality of many crops. This research was conducted during two successive seasons, 2014 and 2015, in order to study the effect of spraying with yeast extract and Potassium Dihydrogen Phosphate (KH_2PO_4) on yield, bunch weight and fruit quality of 15 years old Sukkary date palm cultivar. Five spraying treatments were performed including control (water only), Potassium Dihydrogen Phosphate at 1 and 2%, and yeast extract at 4 and 8%. These treatments were applied once at 4 weeks after pollination or twice at 4 weeks after pollination and repeated after another 4 weeks. All treatments with yeast extract or Potassium Dihydrogen Phosphate twice had a pronounced effect compared with the control fruits during both seasons. Spraying Sukkary date palms twice with Potassium Dihydrogen Phosphate(2%) was effective in improving yield, bunch weight and fruit physical characteristics, while spraying yeast (4 and 8%) improved soluble solids content (SSC), and total and reducing sugars.

Keywords: Date palm; fruit quality; Potassium Dihydrogen Phosphate and yeast extract.

Interaction of Rhizosphere microbial communities in date palm under a biotic stresses

Nadia S. Al-Kaff , Kholoud M. Alananbeh and Nahla A. Bouqellah
Biology Department (Girls Section), Taibah University, P.O.Box 30002 ,
AlMadinah, Al Munawarah, Kingdom of Saudi Arabia
Nahla.b@hotmail.co.uk

Abstract

Characterization of rhizosphere microbial communities associated with soil conditions of date palm (*Phoenix dactylifera* L.) varieties grown at Al-Madinah Al-Munwarah in relation to salinity and drought is the main focus of this study. Soil, leaf, and roots samples were collected from Al-Madinah Al-Munwara date palm farms, microbes were cultured and several bacteria and fungi species were isolated. Molecular based PCR tools including 16S rRNA genes and ITS markers for bacteria of strains endophytic Two. respectively, were used for identificationand fungi he, and tm leavesoother franone was isolated from roots and *cloacae Enterobacter* Fungi such identified. were *Stenotrophomonas maltophilia* izospheric bacteria hthird rBacteria and others were also identified. *Aspergillus*, *Fusarium*, *Penicilium*as Microbes were tested for their ability to promoting growth bacteria. are identified and drought by using Poly tolerate salinity using different concentrations of NaCl The two cultivars. wheat cultivarso Saudi local on twEthylene Glycol (PEG 10,000) Results showed significant. environmentsdifferent ability to tolerate harsh ve haon wheat seedlings *Enterobacter* differences between the two bacteria stains of salt and water shortagef oconditions unfavorable ng under different iwrogl communities and date palm could Understanding the relationship between microbiasystem to improve and sustain date palm -be a part of whole date palm farming eco. hwaraaAlmunh production in Almadina

Use of high hydrostatic pressure as an alternative preservation method for fresh dates

SM Aleid*[1,2], SH Hamad[1], FM Aljassas[3]
[1]College of Agricultural and Food Sciences,
[2]Date Palm Research Center of Excellence,
King Faisal University, Alahsa 31982, Saudi Arabia.
[3]King Abdulaziz City for Science and Technology,
National Center for Agriculture Technologies,
Riyadh 11442, Saudi Arabia.
seid@kfu.edu.sa

Abstract

The effects of high hydrostatic pressure (HHP) treatments on microbial contamination, chemical and physical properties of fresh dates (mature full colored Bisr) was studied. Khalas, Barhi and Hilali cultivars were treated at 200, 250, 300 and 350 MPa using HHP research apparatus. The objective of such treatments was to preserve fresh dates without adversely affecting its properties. Treating fresh dates at 300 MPa for 5 minutes at 40°C reduced microbial contamination in about 2.5 log cycles. Applying 250 MPa was enough to control fresh dates contamination with molds, yeasts and coliforms. Both treatments were enough to reduce fresh dates microbial contamination to acceptable levels. HHP caused no significant effect on fresh dates chemical properties (moisture, sugars, protein, pectin and acidity). However, a slight decrease in moisture contents due to HHP was observed. Fresh dates lightness (L*) significantly decreased due to application of HHP. Only fresh dates treated at 300 MPs gave lower redness (a*) values compared with untreated sample. The effect of 300 MPa on increasing yellowness (b*) was observed for Barhi and Hilali but decreasing for Khalas. Hardness of all fresh dates cultivars significantly decreased as a result of HHP application. In fact, pressure applied at 300 MPa had adverse effect on texture, which may limit its suitability for use in fresh dates preservation.

Keywords: high hydrostatic pressure, fresh dates (Bisr), microbial contamination, color, texture.

Room B
SESSION 5

General Topics on Date Palm

Physio-chemical, flavor compounds and sensory properties of some UAE commercial date syrups

Isameldin Hashim, Mona Alharmoudi, Zain Najjar and Hassan M. Hassan
United Arab Emirates University, Al Ain, UAE
ihashim@uaeu.ac.ae

Abstract

Date palm (*Phoenix dactylifera L.*) is the major fruit produced in the United Arab Emirates (UAE). Date is consumed as fresh fruit at different ripening stages. Low quality date is processed to date syrup (Debis) and date paste. Date syrup is produced commercially by extracting and concentrating the simple sugars and other water soluble compounds. Debis is consumed directly or used as sweetener, colorant and flavoring ingredient in different food products. The aim of the study was to investigate the physical (color, viscosity), chemical (proximate composition, sugars and flavor compounds) and sensory properties of five commercial date syrups available at UAE market.

The evaluated date syrups had similar proximate composition but differ on color, sugar, viscosity and sensory properties. One hundred sixty-seven flavor compounds were identified mainly alcohols, esters, aldehydes and ketones. The type, number and amount of the flavor compounds were different on each date syrup. Alcohols percentage was the highest in all date syrup brands followed by esters in some syrups and ketones in the other syrups. Each date syrup had different dominant flavor compounds. Date syrup quality depends on the type of date used. The commercial date syrups were extracted from mixed date varieties not mentioned on the product labels. Results of the study provided the first comprehensive flavor profiles and aromatic volatiles of some commercial Emirati date syrups.

Preventing date palm fraud: towards developing a database for authentication of dates and their geographical origin

Parvez Haris
Faculty of Health and Life Sciences,
De Montfort University, Leicester, LE1 9BH, United Kingdom
pharis@dmu.ac.uk

Abstract

Food fraud is a serious problem that is increasing around the world. To prevent date palm fraud, we are developing a spectral database of date palm fruits from around the world, including from United Arab Emirates, Saudi Arabia, Oman etc. Dates from certain areas are highly valued by consumers. For example, dates from Madinah in Saudi Arabia is very popular amongst some people due to the link of this city to the Prophet of Islam. However, consumers may be paying higher price for dates that actually do not originate from Madinah. This not only misleads the consumers but also deprives the farmers their profits. Hence it is necessary to develop a geographical certification of dates so that food fraud is prevented and the rights of the consumers and farmers are protected. We are using spectroscopic and microscopic methods to analyse different types of dates. Spectriscopic methods being used includes Fourier transform infrared spectroscopy along with multivariate statistical analysis to classify and authenticate dates. Inductively coupled mass spectrometry (ICP- MS) is being used to determine the elemental composition of the dates. It is intended to produce a publicly accessible database of dates that could be used by food authorities around the world to authenticate dates and prevent food fraud. There will be potential for researchers to submit their data and download data for further research for improving authentication of dates for the benefit of consumers and date farmers around the world. Latest progress in our research will be presented.

The date industry in the United States and Mexico

Glenn C Wright
University of Arizona – Yuma Agriculture Center,
6425 W. 8th Street, Yuma, Arizona, 85364, USA
gwright@ag.arizona.edu

Abstract

The date palm (*Phoenix dactylifera* L.) originated in the Arabian Peninsula, and North Africa, then was carried to Mexico and the United States. Planting began in earnest in Arizona and California in the late 1800s and continues today. As of 2016, date production in Mexico and the United States is valued at almost $101,000,000, and comprises about 8500 ha. 'Deglet Noor' and 'Medjool' are the major cultivars, and there are several minor cultivars as well. Modern practices for date palm cultivation include planting, irrigation, fertilization, pollination, thinning the fruit, ringing the bunches, bagging the bunches, and harvest. After harvest, the fruit must be sorted, dried or rehydrated, and graded. Date palms are sometimes sold for landscaping purposes. Current research at the University of Arizona and University of California at Riverside is focused on pollination and thinning practices, improving fruit quality and controlling insects. There are four date palm germplasm collections located in Arizona and California.

Preliminary evaluation of palm date (*Phoenix dactylifera L.*) fruit juice in production of biosurfactant by *Pseudomonas aeruginosa* isolated from fuel-contaminated soil

Djaber Tazdaït *, Samia Mouffok, Fatma Kabouche,
Djura Delhoum, Rym Salah-Tazdaït
Mouloud Mammeri University of Tizi-Ouzou,
P.O. Box 17 RP 15000 Hasnaoua,
Tizi-Ouzou, Algeria
djabertazdait@yahoo.fr

Abstract

Surfactants are amphipathic molecules with both hydrophilic and hydrophobic moieties that partition preferentially at the interface between fluid phases with different degrees of polarity. These molecules reduce the surface tension and interfacial tension and create microemulsions. Biosurfactants are produced by bacteria or yeast from various substrates including sugars, glycerol, oils, hydrocarbons and agricultural wastes. Biosurfactants are of interest because of their diversity, possibility of large-scale production and environmental protection. The choice of inexpensive raw materials is important to overall economy of the process because often, the amount and type of a raw material can contribute considerably to the production cost. There are few reports on biosurfactants production using inexpensive raw materials as substrates. Therefore, the objective of this work was to study the biosurfactant production by *Pseudomonas aeruginosa* using crude juice of dates as carbon source. On the other hand, the biosurfactant produced by the isolate was tested as bio-stimulant for the growth of lentil plant (*Lens culinaris*), and as antimicrobial against two standard pathogen strains (*Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 43300) and against three pathogens (*Escherichia coli*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*). Besides, the crude biosurfactant extract obtained was analyzed using Fourier Transform infrared (FTIR) technique. The crude juice was prepared from ripened dates of low quality called H'Chef. The bacterial strain capable of producing biosurfactants was isolated from gas station soil contaminated with fuel (located in Boumerdès, Algeria) by selective enrichment culture technique. The results showed that the growth of the isolate on medium containing glucose as a sole carbon source gave a foaming value of 4.8 % and cleaning activity of 40 % after 112h of incubation, while the growth of the isolate medium containing date juice, permitted an improvement of both foaming test (36 %), and cleaning activity (100 %). On the other hand, biosurfactant produced by the isolate on date juice showed antibacterial activity against pathogenic bacteria: *Escherichia coli*, *Escherichia coli* ATCC 25922 and *Staphylococcus aureus*, and was capable of stimulating lentil growth. Besides, date juice medium yielded around 6 g/L of biosurfactant in 112 h. However, extensive research is needed to establish the suitability of this low-cost substrate in industrial-level biosurfactant production process. The FTIR analysis showed that the strain produced rhmnolipids in medium.

Evaluation of date palm (*Phoenix dactylifera* L.) production and soil properties in relation to the sources and levels of organic manure application in conjunction with *arbascular mycorrhizal fungi* (AMF) on sandy soils in Amghara area of the State of Kuwait

S. Al-Khabaz*, A. Khalak*, A. Dahrab*, M. Hussain*, S. Daif Allah*, AN. Al Shirazi*, AD. Abdul Raouf**, F. Al Gharib** and M. Ben Salah***
***Department of Soil & Water Research, Public Authority of Agriculture Affairs and Fish Resources, P.O. Box 21422, Safat-13075, Kuwait.
**Department of Date Palm & Fruit Trees, Public Authority of Agriculture Affairs and Fish Resources, P.O. Box 21422, Safat-13075, Kuwait.
*** International Center for Agricultural Research in the Dry Areas (ICARDA). Oman Office. P.O. Box 111 Barka-328, Sultanate of Oman.
a.belgacem@cgiar.org

Abstract

An experiment was conducted at Amghara Station of the State of Kuwait on date palm Barhee cv with ten treatment combinations involving different sources and levels of organic manure application in conjunction with *arbascular mycorrhizal* fungi (AMF) on sandy soils during 3 seasons (2013-2016). The experimental design adopted was RCBD with five replications.

The results showed that the Date palm Tamar fruit yield increased with increasing rates of sewage sludge and compost manure as compared to control. The influence of sewage sludge in conjunction with AMF on the Tamar yield of crop was more pronounced than that of compost manure. Such an increase in the yield may be attributed to the improvement in the fruit yield parameters such as number of fruiting branches and fruits per bunch; weight, length and girth of fruit. This may further be related to the maintenance of higher moisture and availability of nutrients in the soil.

On an average over 3 years, application of 10 t/ha of sewage sludge (71.97 t/ha or 22.57% increase) or compost manure (70.00 t/ha or 19.31% increase) along with AMF over control (58.43 t/ha) could be recommended to date palm crop in order to increase the yield levels and fertility status especially the organic matter content of the soil.

Keywords: Organic manure, **s**ewage sludge, compost manure, date palm, Tamar yield.

Project development of sustainable date palm production systems in the GCC countries of the Arabian Peninsula: objectives, activities and major achievements

Mohamed Ben Salah
International Center for Agricultural Research in the Dry Areas (ICARDA)
Directorate General of Agriculture & Livestock Research
Rumais, Barka, Muscat, Oman
m.ben-salah@cgiar.org

Abstract

The project Development of Sustainable Date Palm Production systems in the GCC Countries of the Arabian Peninsula, is executed in the six GCC countries (Oman, UAE, KSA, Bahrain, Qatar and Kuwait) and financed by the GCC.
The project aims to: Use of Proper agro-management techniques, Develop of proper IPM programs against pests and diseases, Development of proper post-harvest techniques to reduce losses, and improve marketing, Characterize and finger prints the major date palm local cultivars, Reinforce building of national programs in the area of date palm agro-management and Enhance Networking capabilities for the exchange of information, databases, services derived from the project activities.
The project has 4 technical fields in problem-solving research component (Propagation and Crop Management, Integrated Pest Management, Postharvest and processing and Biotechnology and germoplasm conservation). In the Capacity Building component, the project provides specialized training to strength the national agricultural research systems. In the Technology transfer component the project facilitate the transfer and adoption of suitable technologies developed regionally and/or internationally
The major achievements of the project are in Field operations are: Applying liquid pollination to facilitate the operation and maintain good level of fruit set ; Selecting bio-pesticides for controlling infestation by borers and mites and identification of some natural enemies for the control of Lesser date Moth ; Ameliorating the quality of dried dates and reducing the loss and the drying time by using Polycarbonate houses) ; Selecting SSR markers to characterize 60 cultivars from GCC countries (10 major cv from each country).

Keywords: GCC, Date Palm, Competitive advantages, competitiveness indices, market share, revealed comparative advantage, trade balance index, dates marketing, Gulf cooperation council (GCC).

Competitive advantage of GCC date palm sector in the international market: market shares, revealed comparative advantages, and trade balance indexes

Boubaker Dhehibi [1], Aymen Frija[2], Mohamed Ben Salah [3] Aden Aw-Hassan [4]
[1]Sustainable Intensification and Resilient Production Systems Program (SIRPSP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
P. O. Box 950764 – Amman 11195, Jordan
[2]Sustainable Intensification and Resilient Production Systems Program (SIRPSP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
3, Rue Mahmoud Ghaznaoui, Menzah IV, 1082, Tunis, Tunisia
[3]International Center for Agricultural Research in the Dry Areas (ICARDA)
Directorate General of Agriculture & Livestock Research
Rumais, Barka, Muscat, Oman
[4]Sustainable Intensification and Resilient Production Systems Program (SIRPSP)
International Center for Agricultural Research in the Dry Areas (ICARDA)
P. O. Box 950764 – Amman 11195, Jordan
b.dhehibi@cgiar.org

Abstract

In the GCC countries, date-palm sector is strategically important for the economic, social and environmental development. Therefore, markets globalization has had a huge impact on the comparative advantages of date exports from the GCC countries, highlighting a new range of necessary determinants for competitiveness of these countries on the international market of date. The current study is conducted in the framework of the "*Development of sustainable date palm production systems in the GCC countries of the Arabian Peninsula*"; project funded by the Gulf Cooperation Council (GCC) and led by the International Center for Agricultural Research in the Dry Areas (ICARDA), and aims to provide updated estimates of competitiveness indicators of the GCC countries on the international market of dates palm.

The study starts by a summary description of updated figures concerning date's production, yields, consumption trends and patterns of the different GCC countries. This first descriptive part of the paper also includes a presentation of the date trade matrix (destinations of exports and imports) of the considered countries. In a second part of this section, a set of competitiveness indicators were calculated to better reflect on the date trade balances performances of each of the GCC countries. The measures of competitiveness conducted in this paper include: i) the Market Share (MS); ii) the Revealed Comparative Advantage (RCA); and iii) the Trade balance Index (TBI). The Market share indicator was used to identify size advantages and the degree of specialization of a given country on the international market of a given commodity. The RCA has been defined as a measure of performance of international trade competitiveness of a given country for a given commodity. And finally, the TBI is used to analyze whether a country has specialization in export (as net-exporter) or in import (as net-importer) for a specific group of products. Data from both FAOSTAT and UN COMTRADE sources was used for the calculation of these indicators. Empirical findings shown that GCC and North African countries are holding more than 70% of the international market of dates. The sum of market shares of the 6 GCC countries was about 30% of the international date market during 2015. This is showing that these

countries together have strong potential for dominating the international date market. In terms of growth, it was clear that all GCC countries, including the least present on the international market are progressing quite positively with increasing shares from one year to another. In terms of RCA, the highest RCA value was recorded for Saudi Arabia. The RCA index of Saudi Arabia was about 43.5 in 2013, indicating that the country date export share for 2013 is 43.5% higher than its share in total world export of agricultural goods. Finally, TBI results show the existence of structural differences between Saudi Arabia and UAE in terms of dates export and import patterns. These two countries are both the main players in date export in the CC area. However, even though UAE is a net exporter of dates, its TBI is much lower than the TBI of Saudi Arabia, showing that UAE is also importing a higher proportion of its exported dates compared to Saudi Arabia. The date trade patterns among the GCC countries shows that there is a wide scope of coordination between the different trade strategies of these countries, through specialization and division of tasks. This can generate important opportunities for gaining more weight on the world market of dates.

Keywords: Competitive advantages, competitiveness indices, market share, revealed comparative advantage, trade balance index, dates marketing, Gulf cooperation council (GCC).

Evaluation of an off-road light aerial platform for date palm cultivation

Francesco Bonechi [1], Elena Proietti [2] Enrico Bonaiuti
[3] Francesco Garbati Pegna[4] Luca Dini [5]
[1]University of Florence, Dept. of Agricultural,
Food and Forestry Systems (GESAAF) Piazzale delle Cascine n15, 50144 Firenze, Italy
[2] Business Development Manager ERREPPI srl, Bevagna (PG), Italy
[3] Monitoring Evaluation and Learning (MEL)
International Center for Agricultural Research in the Dry Areas (ICARDA)
P. O. Box 950764 – Amman 11195, Jordan
[4] University of Florence, Dept. of Agricultural, Food and Forestry Systems (GESAAF))
Piazzale delle Cascine n15, 50144 Firenze, Italy
[5] R&D Managing Director COMET group, Bologna, Italy
francesco.bonechi@stud.unifi.it

Abstract

Date palm (*Phoenix dactylifera* L.) cultivation is characterized by several operations that need to be performed at the fronds level, that can be many meters above the ground, especially in older groves or plantations. Mechanization in date palm farms is still lacking or inadequate especially in medium and small farms of non-industrialized Countries, and operations at the fronds level are still done manually by climbing up the tree. Working at height without specific equipment is difficult, tiring and risky and many accidents occur to workers when climbing on taller palms with the traditional belt-based climbing system. In large specialized plantations of valuable date varieties aerial platforms are used, generally derived from the construction industry, with or without adaptations to the specific task, but the high purchase and maintenance costs don't allow for their use in smaller farms.

However even medium sized groves, where high value varieties are cultivated, such as the world renowned Medjoul in the Jordan Valley (H.K. of Jordan) could benefit of specialized mechanized equipment if of adequate size and cost, but suitable solutions have been missing until now.

With the aim of proposing a versatile machine for aerial operations in date palm medium-sized farms, in 2016 the Italian manufacturers Xtrux-CO.ME.T. and EREPPI have put on the market a compact aerial platform mounted on an off-road light carrier specifically designed for use in palm plantations.

The objective of this study, is the evaluation of this self-moving aerial platform, named Xiraffe, in terms of cost, timing, effectiveness and general attitude to work along the date palm cultivation process. This analysis is based on observations done and data collected in 2017, during harvesting field trials on Medjool date palms in the Jordan Valley. These trials, carried out on palms of different height and characteristics, aimed at comparing mechanized and traditional manual harvesting, which is still the most common method in the study area. The results showed that this small sized and agile machine proofs to be effective while capable of improving work safety and timing when used to harvest palms between 6 and 10 meters high. However, the manual harvest is still economically more convenient for medium and small farms in the test environment, but some technical improvement to the platform, such as modifying the bucket shape or providing it with specific tools for other operations (e.g. pruning, bagging or pollination), can reduce the gap, opening a completely new scenario in date palm cultivation.

Keywords: Medjoul dates, agricultural mechanization, harvesting, lifting of operators.

GAP and GHP analysis in date small farms in Baharia oases

Kassem, A. Z [1]. and Abdelmeged, A. R. [2]
[1]Lecturer, Agricultural Planning and Development Center,
Institute of National Planning, Egypt
[2]Agronomy specialist,
Central Laboratory for Date Palm Research and Development, Egypt
aly_kasem@yahoo.com

Abstract

This paper aimed at assessing the agricultural practices related to food safety in small date farms in Baharia oases in terms of the food safety hazards biologically, chemically and physically that negatively affect consumers health due to poor agricultural practices in Small Date Farms (SDF). A questionnaire was designed to assess the agricultural practices in Baharia small farms in specific against the applicable requirements of the United States Department of Agriculture (USDA) Good Agricultural Practices (GAP) and Good Handling Practices (GHP) guide. The GAP and GHP practices in 38 date small farms located at Bawity, Mandisha and Zabo areas was evaluated. The descriptive approach was utilized, and some statistical indicators was extracted using the Microsoft excel program, i.e. average, minimum, maximum, standard deviation and variation coefficient. The study reached some major findings, which are: The average dilution of pesticides used in Baharia small farms is estimated at 0.01% (the standard dilution is 0.003%) with a minimum of 0.001 and a maximum of 0.05 with a variation coefficient estimated at 138%,This may attribute to unstandardized manners of dilution. also the pesticide per acre amounts are estimated in average at 2.649 litter (the standard amounts are 1 litter per acre) with a minimum of 0.571 litter and a maximum of 2.649 litters with a minimum of 0.571 litter and a maximum of 2.649 litters, with a variation coefficient of 95.2%. This results may attribute to the arbitrary usage of the pesticide from farmers, where they believe that they need to excessively add the pesticide in order to insure the control and killing of the red palm weevil or making a precaution procedure. Just one farm of 38 SDF surveyed determine the PHI exactly for the pesticide used. Due to the traditional manners of harvesting the mechanical damage loss of date during the harvest stage is estimated at 9% at average with a minimum of 2% and a maximum of 20%, with a variation coefficient of 51,77%. the average loss of date during "Tanshir" –adjusting the moisture content- process is estimated at 10% with a minimum of 2% and a maximum of 20%, with a variation coefficient of 55,46%.

Assessment of selected date varieties in Iraq

M.S.Alattabi* and Samir Alshakir**
* Ministry of Agriculture, Iraq.
** Date Palm Globla Network, (DPGN), UAE.
alattabi2006@yahoo.com

Abstract

The research study is the first scientific cooperation in the field of research & development of Date palm (Phoenix dactylifera) between a scientific institution in UAE and the Agricultural research department in IRAQ. Introduction of any Date-palms to IRAQ was never reported before due to the government strict regulation.
Six major selected commercials varieties of UAE were granted to ministry of Agriculture namely (White Fardih, Khalass, Hilal, Shishi, Khanazi and Bumaan). Total number 12500 Tissue culture plants, produced in UAE university tissue culture laboratory in 2009.
Shipped to IRAQ saved in atmosphere condition in Green houses. Situations in four provinces, Najaf, Samawa, Karbalaa and Ramadi in the middle and south of IRAQ. The objective was to gain information regarding the impact of local Environment on:
Growth and behavior of the plants and its adaption – with local weather conditions.
The second- objective was to study the effect of local agricultural services such as irrigation, fertilization, pollination, infection by various insects, fungi, as well as physical factors on the growth through maturity and ripeness of the fruits, in addition to the quality of the dates at Bisr, Rutab and matured dates, along with productivity of the tree. Post-harvest technologies were also conducted AU result data were analyzed and conclusions were initially documented.

Effect of feeding date palm fruit (*Phoenix dactylifera* L.) on menstrual health in a convenient sample of females

Hiba F. Al-Sayyed[1], Hamed R. Takruri[2], Nawal A. Bakir[1], and Dima H. Takruri[3]
1 Department of Nutrition, Faculty of Pharmacy and Medical Sciences
University of Petra, Amman, Jordan.
2 Department of Nutrition and Food Technology, Faculty of Agriculture,
The University of Jordan, Amman, Jordan.
3 Department of Family Medicine, Faculty of Medicine,
Jordan University Hospital,The University of Jordan, Amman, Jordan.
halsayyed@uop.edu.jo

Abstract

Background and Objectives. It has been found that date palm fruit (*Phoenix dactylifera* L.) affected sex hormone levels in rat model. Thus, this research aimed to study the effect of daily feeding of date palm fruit to adult females on their monthly sex hormonal concentrations in addition to studying other menstrual parameters such as menstrual cycle length and the amount of bleeding. Subjects and Methods. A convenient sample of 36 female volunteers participated in the study. All of the participants were non-smokers who aged 20-30 years old, and filled a consent form for the participation in the study. This research consisted of 2 groups: the experimental group who were fed daily 7 dates of "Barhi" variety for 4 consecutive menstrual cycles and the control group (the group who were not fed the fruit). The hormones measured were: luteinizing hormone, follicle stimulating hormone, 17-β-estradiol, progesterone, and prolactin. Hormone concentration was measured by enzyme linked immunosorbent assay (ELISA) technique. Other menstrual parameters such as menstrual cycle length and the amount of bleeding were also estimated using a mobile phone application that was uploaded on the cell phones of the participants. Additionally, anthropometric changes i,e. weight, body fat mass and percentage, muscle mass and percentage, waist and hip circumferences, and waist/hip ratio were measured using bioelectrical impedance technique (In body®) before and after the feeding trial. Results. Feeding date palm fruit increased all menstrual hormone concentrations significantly ($p<0.05$) compared to the control group. The pattern of change in the hormone concentration differed according to the month of feeding ($p>0.05$). Conclusions. Eating date palm fruit could be promising in improving for menstrual health and fertility.

Producing vinegar from three libyan date cultivars using double stage fermentation method

Mohamed Abusaa Fennir [(1)], Mohamed Taher Morghem [(2)] and Khalid Mohammed Alsamin [(3)]
(1) Associate Professor,
(2) Research Assistant: Department of Agricultural Engineering, Faculty of Agriculture, Tripoli University, Libya,
(3) Food and Drug Control Center (FDCC), Tripoli, Libya.
mohamed.a.fennir@mail.mcgill.ca

Abstract

Traditionally, date vinegar is produced in single stage spontaneous fermentation methods. However, their efficiency and residual alcohol are always questionable. This work investigated using double stage fermentation method. Sugar solutions were extracted from dates of three Libyan cultivars; "Taleese", "Athwi" and "Hellawi". The first and second cultivars are dry dates while the third is soft. Fruits of dry cultivars were soaked in distilled water at 1:3 (w/w) ratios for 10 hours, and juice was extracted by pressing. "Hellawi" dates were mixed with distilled water at similar ratios, heated at 80°C and continuously agitated for 2 hours and then pressed. Total soluble solids (TSS) of juices obtained from the three cultivars were 16.5, 17.4 and 25.0 °Brix, respectively. However, for comparison, TSS contents were adjusted to 15.2°Brix (±0.58). A volume of 9 liters of solution of each cultivar were fermented in a double stage 15L setup equipped with an airlock. Baker's yeast (*Saccharomyces cerevisiae*) was added at 200mg/L and incubated at room temperature averaged 22°C (±1.5). The process lasted for 9 days, then an aerobic acetic fermentation was carried out by adding virgin date vinegar at 10% (v/v) and kept at same conditions. Weekly measurements of titratable acidity (TA) and alcohol percentage were made. The process lasted for 60 days for "Taleese" and "Athwi", while "Hellawi" took an additional 11 days. The acetic fermentation was ended when alcohol content dropped below 1%. Both fermentations were described by linear models (R^2>0.97). Vinegar of the three cultivars had a titratable acidity (TA) at 6.63% (±0.39), residual alcohol (RA) less than 0.66% (±0.21), pH at (3.03±0.40), and TSS at 7.18 °Brix (±0.92). Also, sensory evaluation showed great acceptability to vinegar of the three cultivars, and products met specifications of Libyan Vinegar Standard (LNS 823: 2015). The study modeled both reactions under conditions applied and demonstrated producing good quality vinegar from low marketing potential dates.

Valorization of fibrillum from palm date by-products by production of transplanting pellets

Khalid Fares-and Nabila Saadaoui
University Cadi Ayyad, Faculty of Sciences Semlalia,
Unit of Biotechnology and Biochemistry of Plants,
PBox 2390, Marrakech, Morocco.
Fares@uca.ac.ma

Abstract

In recent time, problems of shortage of wood, forestry regulation and higher cost of wood materials have encouraged researchers to seek alternative sources of lignocellulosic fibers. However, in Morocco a huge quantity of by products from 4,45 millions of phoenix dactilyfera palm trees is used only for domestic purposes and very few industrial applications is observed. A better understanding of mechanical and physical properties of these by products could open new opportunities for industrial application of these lignocellulosic resources. Four by-products from *Phoenix dactylifera* were used in this study, leaflets, rachis, leaf sheath and fibrillum. The chemical composition (ashes, hydrosoluble materials, cellulose, hemicelluloses, lignin, proteins and lipids) of these by products was determined after drying and grinding. The chemical characterization showed high Neutral Detergent Fiber (NDF) values (between 65% and 91 %). The fibrillum showed the highest content of cellulose (50.6 %) and lignin (31.9%). Mechanical properties were higher for fibrillum and leaflets. These mechanical properties of fibrillum were exploited for the elaboration of green compost and fibrillum transplanting pellets using thermopressing without the addition of water or a synthetic adhesive. The pellets manufactured have a good water retention capacity and a very satisfactory percentage of germination of tomato (78%) even after a certain delay. Beyond germination the organic matter content provided by the compost pellets allows growth of the tomato's stem of the order of 3.2 cm ± 0.7. The pellets manufactured, even if they show properties slightly lower than those of peat pellets marketed, are a novelty in the field of agro materials since green compost was added before thermoporessage. It is also a new way of valorizing the extraordinary mechanical properties of date palm fibrillum.

Date palm value chain development in the Arab countries: key constraints and opportunities

Jozimo Santos Rocha (FAO); Ibrahim El Dukheri (AOAD)**;** Alfredo Impiglia (FAO)
Food and Agricultural Organization of the United Nations (FAO)
Alfredo.Impiglia@fao.org

Abstract

Date palm represents a special icon in agriculture in the Near East and North Africa region. Since its origin is believed to be in the Arab region, dates have a unique historical, religious, economic, and social value. With an estimated production of nearly eight million tons in 2012, dates represent one of the main sources of income and staple food for virtually all countries in the region. The rich nutritional composition of dates, which includes carbohydrates, vitamins, and protein, also highlights its importance to food security and nutrition. Despite significant efforts, the date sub-sector has enormous potential to grow in the region, and efforts should focus on integrated national and regional strategies. The expansion of the date palm sub-sector is dependent on controlling the spread of Red Palm Weevil (RPW), which continues to have a negative impact on productivity and quality; enhancing the quality of date end-products; reducing field and post-harvest losses; formalizing and streamlining market systems; and, developing date value-added products and byproducts. This paper attempts to propose a more holistic, market-driven and inclusive approach to sustainably develop the date palm value chain in the region and at the country level with a focus on increasing competitiveness, access to higher value markets, and expanding growth. The paper also highlights systemic constraints and its opportunities related to core functions along the value chain, the enabling environment, horizontal and vertical linkages, and supporting services. Most importantly, it elaborates around concerted regional strategic integrated efforts needed to address systemic bottlenecks in the date palm value chain. These efforts are analyzed through the lens of a wide value chain and food system approach and consider elements such as food security and nutrition, food safety, reduction in food loss and waste, sustainability on the use of natural resources, contribution to ecosystem functioning and biodiversity, while supporting the potential for income and employment generation.

Impact of the weather conditions on the date palm in Al Qassim region, Kingdom of Saudi Arabia

S. A. Al-Fadda; **R A. Abo Aiana** and A. A. Abdelkhalek
The Agricultural Management,
Saleh Al-Rajhi Endowments Management, Kingdom of Saudi Arabia.
P.O. Box 12111, Burydah 51473, Kingdom of Saudi Arabia
Ramzy200@hotmail.com

Abstract

A field study was conducted to survey the damage of frost on some date palm varieties in Al-Qassim region in Saudi Arabia where the region was exposed to three waves of frost in January 2008, February 2016 and February 2017, where the air temperature was decreased to -4, -2 and -2, respectively and the exposure time were 8, 5 and 5 hours per event, respectively. Where the study was conducted in Al-Batin project in Al-Qassim region, Saudi Arabia (26° 15- E - 44° 9- N). The study evaluated the damages were induced by the frost on the Vegetative parts (the number of damaged fronds per tree), the reproductive parts (number of damaged spathes per tree), the percent of the immature fruits (khlal) and date palm tree productivity, Kg/tree on 15 of main varieties of dates in the region; Sukkary, Khalas, Khodry, Sagae, Hashishi, Nabut Saif, Nabut Ali, Rashudy, Barhi, Rothanah, Burimi, Rezizi, Shaqra, Maktoumi, Male trees.

The results showed that the greater damage were on the vegetative and reproductive parts by decreasing the air temperature below than 0° with increasing in the number of hours of frost exposure, where the first year (2008) was the most harmful to the palm while the third year (2017) is the least harmful. The results indicated that the most of the studied varieties were affected by frost at temperatures dropping to -2 with 5 hours' exposure duration, where the number of affected fronds was 1-12 fronds/tree except the varieties of Nabut Ali, Maktoumi and Rezizi were the most tolerant varieties for frost. In addition, the vegetative parts of the trees of Khalas variety is considered the most sensitive for frost which was affected by an average of 12, 8 and 8 fronds/tree at 2008, 2016 and 2017, respectively.

The early flowering varieties (Sukkary, Hashishi and male trees) were the most affected by frost, where the number of damaged spathes was in average of 0, 3, and 3 in 2008, 2016 and 2017, respectively. The most affected variety by frost was Sukkary where the damages were represented in spathe atrophy, didn't split opened and the most of them infected by fungi.

The results showed also that there was a decrease in the productivity of affected date palm trees by the frost, where the production was decreased by 65%, 40% and 35% for 2008, 2016 and 2017, respectively for Khalas variety which was the most affected by frost.

It could be concluded that the frost has a severe economic damage on date palm trees, which were varied with the amount of decrease in air temperature degrees, as well as the number of hours of decline in temperature and it should be predicted and take precautions before it occurs.

Economic and technical feasibility of investment in date palm sector

AbdulBasit Oudah Ibrahim[1] and Nashwan AbdulWahab AbdulRazzak[2]
[1]Date Palm Horticulture Expert
Directorate of Million Date Palm Plantation Project, Diwan of Royal Court
P O Box 27 Postal Code 105 , Sultanate of Oman
[2]Agricultural Economic Expert,
Agricultural & Fisheries Development Fund (AFDF),
Sultanate of Oman, Muscat, PO Box 3578, PC 111
Date_basra@yahoo.com / abdulbasit1956@gmail.com

Abstract

Date Palm can be a strategic sector for economic diversification and for the post oil era. Date, as an agricultural product, is a source of food security that has economic returns and food benefits. Date palm trees may live in difficult environmental factors such as drought, desertification, salinization and varying heat degrees, in addition to environmental benefits. These criteria make date palm sector is one of the pillars of economic and environmental challenges.

A Date palm can absorb three tons of atmospheric carbon, that million Palm able to capture approximately 1.8 million tons of carbon dioxide which reduces its quantity in the weather by 100 000 tons as equation for photosynthesis.

A ton of dates could produce 280 liters of ethylene, adding that the rate of production per Palm currently ranges between 50-100 kilograms of dates, this can be multiplied by applying several technical practices, and the tree produces approximately 36.5 kg of byproduct (waste pruning, thinning, harvesting, and falling fruits) can be recycled in many industries.

This paper reviews the methodology of transformation from less valuable to the highest value and sustainable cultivation, and the required institutional and structural changes in production and administrative systems in the date palm. The paper answers the questions related to technical and economic feasibility of integrative date production projects which benefit from value added chain for the production and marketing of dates and other date palm products.

Socioeconomic analysis of palm date sector: the case of biskra region (Algeria)

Amine M. Benmehaia[*] and Radhouane Benmehaia [**]
[*] Higher National School of Agricultural Sciences, Algeria
University of Biskra, Algeria
[**] University of Msila, Algeria
amine_benmehaia@yahoo.fr

Abstract

Regarding the importance of palm date sector for local development, this study aims to explore and analyze empirically the main socioeconomic characteristics of palm date sector in Biskra region. The study uses an extensive micro-database containing 21,502 farms. The economic aspect of palm date farm is reflected by two structural features: size and tree density; since the social aspect is reflected by human capital dimension measured by farmer's age and his experience. Our study is mainly explorative and attempts to extract the empirical regularities which would be helpful for policy making.

Keywords: Palm Date, Farm Size, Density, Human Capital, Biskra Region, Algeria.

Stable carbon and nitrogen isotope signature and vegetation indices as indicators of date palm performance under salinity

Abdullah Dakheel[1], Salima, Yousfi[2], Maria D. Serret[2], José L. Araus[2]
[1] International Center for Biosaline Agriculture (ICBA),
Dubai, United Arab Emirates
[2]Section of Plant Physiology, University of Barcelona,
Avda. Diagonal 643, 08028 Barcelona, Spain
a.dakheel@biosaline.org.ae

Abstract

Date palm is frequently cultivated under irrigation with brackish water, which may affect their growth and productivity. Developing monitoring techniques on the effect of salinity on this species may be relevant either in agronomy, informing on the effect of different salinity levels, or for breeding, as a phenotyping tool to select more tolerant genotypes. A set of 16 different elite date palm varieties from U.A.E. and K.S.A. were grown for 15 years under irrigation with three different levels of saline water (5, 10 and 15 dS m^{-1}) at the International Center for Biosaline Agriculture (ICBA) located in the UAE. A range of different vegetation indices, informing on the degree of canopy greenness, were calculated from single tree-top images taken with an RGB camera and using the open-source software Breedpix. In addition, canopy temperature (CT) was measured, as indicator of water status, with an infrared thermometer. Further the carbon isotope composition ($\delta^{13}C$), as time-integrated indicator of water status, and the nitrogen isotope composition ($\delta^{15}N$) and the total nitrogen content (N), were measured with a mass spectrometer and an elemental analyser, in the dry matter of fully developed leaflets and date stones. Irrigation conditions and genotypes exhibited significant effect for all the remote sensing and stable isotope traits evaluated. When the three salinity levels and the set of varieties were combined $\delta^{13}C$ and CT correlated negatively with growth parameters (trunk height and diameter and number of branches) but the vegetation indices correlated even stronger. However, correlations across varieties within a given salinity level were in general weaker but in most cases still significant and N and $\delta^{15}N$ correlated positively with fruit yield and growth within the extreme salinity levels. Moreover, the combination of few traits of different categories (vegetation indices, stable isotopes or N) allowed to predict for most of the growing conditions at least a quarter of the genotypic variability in growth and productivity. In addition, the combination of these different traits through a path analysis allow to draw single empirical models that illustrate the main genotypic physiological features associated with a better performance in terms of growth and productivity within each salinity level.

Characterization of four Moroccan date palm cultivars and assessment of their seeds' oil antifungal activity

Ennahli Said[1], **Hanine Hafida**[2], Kodad Ossama[1], and Essalhi Hanane[1].
Faculty of Science, Beni-Mellal, Morocco.
hafidahanine@gmail.com / ennahlisaid@gmail.com

Abstract

The present study aims to valorize Moroccan dates and their byproducts. Pomological, biocochemical characteristics of four Moroccan varieties (Mejhoul, Boufeggous, Bouslikhène and Admou) were determined. Also, the physico-chemical composition (oil content, acid number, peroxide index, iodine number, saponification index, K232 and K270), antioxidant activity, and the antifungal activity of the seed's oil from the 4 varieties were investigated.

Significant differences were observed among most physical and biochemical varieties. pH varied from 5.14 to 6.41; Titratable acidity varied between 0.064 and 0.192g citric acid / 100g; Total polyphenols ranged from 416.5 to 11884.5 mg EAG / 100g; Total flavonoid content varied between 43.73 and 583.54 mg EQ / 100g and antioxidant activity varied between 12.77 and 40.4%. Seeds analysis showed significant differences among the 4 varieties: Oil content (4.5-7.1%), iodine index (55, 41-56.87g I2 / 100g), peroxide index (1.28-1.41 meq of O_2 / kg), saponification index (246.84-252.45 mg KOH / 100g), K232 and K270 (0.5-0.58 and 0.49-0.59 respectively). However, average total polyphenols, flavonoids and antioxidant activity intervals were respectively 324.09-1305.68 mg EAG / 100 g; 7.78-20.04mg ER / 100g; and 41.56-47.32%. Antifungal activity of the seed's oil showed significant inhibition of *Fusarium oxysporum* as compared to sesame and argane oils. The variety Mejdoul exhibited higher nutritional values, but its seeds had the lowest antifungal activity compared to other varieties. However, regardless of the seed's low oil content, their antifungal activity was higher than sesame and argane oils.

The biodiversity of date palm (*Phoenix dactylifera L.)* in the Sultanate of Oman

Hameed CH.Ali Alkhafaji[1] and Dr. Nadiya Alsaady[2]
[1]Expert of Plant Genetic Resources
[2]Executive Director of (OAPGRC)
Oman Animal and Plant Genetic Resources Center
Muscat –Sultanate of Oman
hamid_chaloub@hotmail.com

Abstract

The Sultanate of Oman has vast biodiversity in the Arabian Peninsula, which uniquely reflects Oman's position between two geographic regions where northern parts closely resemble Asia whereas the southern part has similarity to Africa in its climate and geographic conditions. The date palm is the major crop in the Sultanate of Oman which has been widespread and integrated between environmental and agricultural system. It is of great importance in the life of the Omani people throughout history it is regarded as a pillar of agriculture and the Omani economy. Palm cultivation in Oman has been expanded because of efforts by state institutions, especially the Ministry of Agriculture and Fisheries and has been accompanied by scientific and technological progress, which harnessed all its possibilities towards upgrading livelihood of farmers and Oman economy. The production rate of date palms reached 309,686 tons in 2013 from the area of 24130 hectares. The latest scientific discovery that supports this biodiversity is the presence of date palms in the Sultanate in remote and isolated mountainous locations. These trees have large genetic differences and are distinct from any cultivated species in the Middle East and North Africa. This confirms that the origin of date palms is the Arabian Peninsula region as confirmed by the most studies through the preliminary documents indicating the fact that Arabian Peninsula contains the largest biological diversity of date palm trees where the propagation by seeds (Nawa) resulted in the largest biological diversity. There are more than 3000 varieties of date palm in the world. The Ministry of Agriculture & Fisheries has efforts to preserve the local plant genetic resources through 9 field genebanks (Ex-situ) that have been established across the Sultanate. The date palm varieties in these field genebanks include all those which are present in the the National genebank of Omani in Wadi Quriyat, Wilayat Bahla of Al-Dakhilya Governorate. This national genebank consists of 186 varieties of palm trees. It was established in 1988 in an area of about 40 hectares having more than 7,000 palm trees, and is considered a distinctive genebank not only in the Sultanate but also in the countries of the region involved in palm cultivation. This genebank has 167 female varieties with 3 palms per category, 20 male varieties and other desired commercial date palm species in the Sultanate. The total number of varieties is more than 250 while the number of genetic entries from date palm trees is 4390. The aim of this report is to highlight the biodiversity of the Sultanate of Oman through the available genebanks that form the most important solutions to preserve this genetic resource as well as represent the strategic stocks of the raw genetic material of date palms. This also indicates the ways and means to get benefit from these genebanks in conducting research studies related to the development of date palm varieties.

Insecticidal activity of essential oil from *Citrus sinensis* and *Artemisia herba-alba* against *Ectomyeloisceratoniae* Zeller (Lepidoptera: Pyralidae)

Samah Ben Chaaban[1], Amal Mnaffed[1], Kamel Mahjoubi[1],
Ikbal CHAIEB [2] , Jouda Mediouni[3]
[1]R Regional Research Centre of Oasis Agriculture, Degache, Tunisia
[2] Regional Research Centre in Horticulture and Organic farming, Chott-Mariem, Tunisia
[3] Laboratoire de Protection des Végétaux, INRAT, 2049 Ariana, Tunisia
samah_bchaaban@yahoo.fr

Abstract

Measures of stored pest control are mainly based on application of synthetic insecticides and fumigants. Methyl bromide is usedin post-harvest insect control for dates in Tunisia. However, the use of this pesticide is to bephased out due to human and environmental concerns. Recently, natural pest control methods including essential oils havebeen increasingly explored.

The fumigant activity of essential oil vapours distilled from *Citrus sinensis* and *Artemisia herba-alba* were tested against adults, larvae and eggs of the carob moth *Ectomyelois ceratoniae*.

Results showed that fumigant toxicity depends on oil species, concentrations and exposure time. Aged larvae L5 were more susceptible than young larvae (L4 and L3).

Mortality rate of Larvae (L5) reached 100% and 64% respectively for *Artemisia herba-alba*and*Citrussinensis* at the concentration of 150µl/l air after 24 hours exposure.

The corresponding LC50 for adults values were respectively 2.6 and 0.31 µl/l air for *Citrus sinensis* and*herba-alba*.

The hatching rate of insect decreased with increases in concentration or exposure time to the two oils. The exposure to vapours of essential oils from *Artemisia herba-alba*caused 0% of the hatching rate at the concentration of 150 µl/l air after 48 hours exposure. With the same concentration and time exposition hatching rates was 6,2 % when eggs were exposed to *Citrus sinensis* oil.

Results suggested that the two oils mainly *Artemisia herba-alba* essential oils could be used as an alternative to the synthetic fumigant in postharvest treatment program for the control of *E. ceratoniae.*

Keywords: Ectomyeloisceratoniae, fumigation, Essential oil, biopesticides, Citrus sinensis, E.occidentalus, Artemisia herba-alba, lethal concentration LC50.

Fermentation effect on total flavonoids and some biochemical parameters of date juice obtained from the variety Deglet-Nour

Kheira Zerrouki_and Ali Riazi
Laboratoire des microorganisms bénéfiques, des aliments fonctionnels et de santé (LMBAFS). Université de Mostaganem P.O Box 118 –227.Mostaganem. 27000 (Algeria)
kheira.zerroukidz@gmail.com

Abstract

In this work we tried to extract a date juice from an Algerian date variety Deglet-Nour in order to its use as fermentation medium for the strain *Saccharomyces cerevisiae* (VDH2). The fermentation kinetic was evaluated for various parameters : PH, temperature, biomass, total sugars and total flavonoids. The results have shown a decrease in total sugar from 46± 27,18 (g/l) at initial time (t = 0 h), to 23,11 (g/l) at t= 21 h. Similar results have been registred for the other fermentations (2 and 3). PH values have changed from 4,4 ± 0,03 at t = 3 h to PH = 2,57 ± 0,05 at t = 49 h. Slight changes have been observed ranging from 26 °C t = 0 h at 33,33 °C at the end of fermentation process. Biomass has increased from 0,2 ± 0,02 to 0,6 ± 0,01 in time between (t = 0 h) and (t= 46 h). Total flavonoids have increased from 27,33 ± 0,01 (mg EC/g) at initial time, reaching 110,43 ± 0,02 (mg EC/g) in the end of fermentation. All results obtained are means of three replicate.

Key words : Date juice – Fermentation – *Saccharomyces cerevisiae* – Flavonoids.

Economic efficiency of innovative investment in date palm sector: the case of the Sultanate of Oman

Nashwan Abdul Wahab Abdul Razzak
Agricultural Economic Expert,
Agricultural & Fisheries Development Fund (AFDF),
Sultanate of Oman, Muscat, PO Box 3578, PC 111
nashwan57@gmail.com

Abstract

The paper reviews the economic importance of date palm sector, the role of innovative investment based on sound economic fundamentals and technical upgrading of the sector both in terms of economic and developmental impact; increase its contribution to GDP, diversification and increased employment optimizing resources and sustainability.
The paper is based on the technical and economic feasibility studies and practical examples of leading models of Oman, and other Arab countries, during the past years, and cite the development projects financed by the Agricultural and Fisheries Development Fund (the second place winner, for best development project, of Khalifa International Date Palm Award 2011, the pilot prize and its renewable thinking and practices), in addition to other forms of positive economic and environmental impact.
The paper presents recommendations and proposals based on the strategic directions of the Sultanate of Oman in the agriculture sector in particular, as well as keep up with the expectations of the outcomes of the fourth industrial revolution could be used for further development, sector performance continued in its contribution to sustainable agricultural development, support small and medium-sized enterprises and youth entrepreneurship to achieve the objectives of food security of Arab states.

The trajectory of evolution of the date palm chain in the Ziban region (Algeria), situation and prospects

Benziouche Salah Eddine
Mohamed khider university, Biskra, Algeria
sbenziouche@yahoo.fr

Abstract

Although the date palm sector of Algeria is spread over 17 wilaya across the national territory; nevertheless, the lion's share of this heritage is monopolized by the Ziban region (Biskra in southern Algeria); one of the most important phoenicultural regions in Algeria in production (quantity and quality), especially with the production of the famous variety Deglet Nour. Like the other oasis regions of the country, the study area has benefited a lot from deferent agricultural development programs since 2000 to date. Several studies have shown that the impact of these agricultural programs varies from one sector to another and from one region of the country to another.

Through this intervention, we will try to highlight the reality of this value chain date in the Ziban region and analyze its dynamics of evolution through these programs, and this from an analysis of the main technical indicators and economic upstream and downstream (area, number of date palms, production, yield and exports and also conditioning and valorization). And from a SWOT analysis, present these strengths, weaknesses opportunities and threats.

The results obtained illustrate that the impacts of State actions are very significant in this region, and that the results of the main indicators analyzed are very fruitful and improve from year to year; although the goals are not reaching fully; because of the combination of a series of technical, socio-economic, natural, agricultural and administrative constraints. On the other hand, the SWOT analysis indicates that this dynamic evolution is undoubtedly due to the presence of several assets and strengths of this sector and by the opportunities offered in this region and at national and international level. But also by the effectiveness of the strategies applied to face the different threats, constraints and weaknesses that hinder this sector at all levels that are also numerous.

Keyword: Date chain, techno-economic indicators, dynamics, SWOT analysis, Ziban, Algeria.

Investigation of new cultivars of date palm (*Phoenix dactylifera* L.) raised from seed (pit) germination

Hasan Shabana
UAE
hasanshabana@hotmail.com

Abstract