Abstracts of the First International Conference on Plant Protection (ICPP)

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Overview

Plant Sciences Department, College of Agricultural and Marine Sciences, Sultan Qaboos University organized "First International Conference on: Plant Protection (ICPP)" on 5-7 December 2022, and this event was take place at Conference Hall, SQU. The conference speakers represented Algeria, China, Egypt, Finland, India, Iran, Iraq, Libya, Morocco, Sudan, Syria, Tunisia, Pakistan, Poland, Itlay, UK and researchers the GCC (Saudi Arabia, UAE, Qatar and Oman) nationals.

The main objective of the ICPP was to disseminate the latest scientific advances in all aspects of plant protection and encourage collaboration between researchers. This conference was an important event to exchange knowledge and the latest research findings on pests of economic importance, fungal, viral, phytoplasma and bacterial diseases, post-harvest diseases, pests and mycotoxins, integrated pest and disease management, insect-host-pathogen interactions, biological control, quarantine and phytosanitary measures, and weeds and their management. All particiapant of the conference were agreed and willing to share their research findings that will generate more innovation, and lead to greater productivity and contribution towards resolving challenges facing agriculture. All national and international participants benefitted from this conference and convinced to establish fruitful collaborations. Each of the institutions and researchers that participated were involved in high level and strong research in themes relevant to the conference and thus the conference provided a valuable and novel opportunity for interaction in relation to research.

Overall, the ICPP conference was very successful in terms of organization, management, implementation, selection of topics and participants and all the guests have thoroughly enjoyed talks and learn new things from from different speakers working in diverse areas.

Keynote Presentations

Nano-enabled approaches for sustainable crop protection

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Abstract
Agriculture is the most important sector providing food and different raw materials to the growing global population. In the last few decades, biotic and abiotic environmental stresses affect the production and quality of agricultural food worldwide. The extensive use of traditional preventive measures comprising toxic chemicals has become more problematic due to severe ecotoxicological challenges. The global population is predicted to increase from 7 to 9 billion by 2050, highlighting the need to increase agricultural food production to achieve global food security. Nano-enabled approaches have recently attracted attention as a sustainable platform to improve crop nutrition and protection. Engineered nanomaterials (ENMs) have gained enormous consideration due to their unique physical and chemical properties, *viz*., small size, high surface area to volume ratio, superior efficiency, and supply of micronutrients to plants. The targeted use of ENMs has tremendous potential for improving the efficiency of agricultural systems with low biodiversity effects, which contributes to the improvement and maintenance of food security. Several recent studies have revealed that ENMs enhanced plant biotic and abiotic stress resistance by improving plant growth, physiological parameters, photosynthetic capacity, nutrient content and phytohormone profile. Overall, previous studies demonstrated that ENMs application has great potential as a novel strategy for crop biotic and abiotic environmental stress management.
Keywords: Agriculture; crop protection; ENMs; nanotechnology, stress resilience

Plant viruses, their impact and control strategies

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Abstract

Phytopathogenic viruses are a major biotic constraint to agricultural productivity and, throughout the warmer parts of the world, many of the most devastating diseases of crops are caused by arthropod-borne viruses of the family Geminiviridae. The symptoms caused by these viruses include enations, leaf curling and stunting, which resemble developmental abnormalities. Family Geminiviridae has recently been expanded from nine genera (Curtovirus, Mastrevirus, Turncurtovirus, Becurtovirus, Grablovirus, Eragrovirus, Capulavirus, Topocuvirus and Begomovirus) to 14 genera by the addition of the genera Citlodavirus, Maldovirus, Mulcrilevirus, Opunvirus and Topilevirus. Whitefly-transmitted begomoviruses, the biggest genera of this family are a major limiting factor for the production of numerous dicotyledonous crops throughout the world. With the increasing concerns over the use of insecticides as well as the adoption of agricultural practices that favor the build-up of both vector and virus populations including, for example, widespread monoculture and overlapping cropping seasons, as well as the lack of suitable sources of natural resistance (so-called host-plant resistance) in many crop species the problems due to these viruses are increasing. Transgenic approaches paved the way to a virtually unlimited source of virus resistance for application in agriculturally significant plant species. Several transgenic approaches have been used for the development of resistance against geminiviruses including pathogen-derived approaches e.g. RNA interference. The recent advancements in targeted genome engineering via Clustered regularly interspaced short palindromic repeats (CRISPR) and CRISPR-associated Cas (CRISPR/Cas) have unprecedented potential to develop virus resistance and crop improvement.
Keywords: *Geminiviridae*, begomoviruses, resistance, RNAi, CRISPR

Building resilience to vector-borne plant pathogens via studying insect vectors

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Abstract

Sap-feeding insects of the order Hemiptera, such as aphids, psyllids, leafhoppers and spittlebugs/froghoppers, are vectors of a wide range of plant pathogens, including viruses, phytoplasmas, *Liberibacter* species and *Xylella fastidiosa.* These pathogens are spreading globally and are threats to global agriculture and landscapes. Research on mechanisms involved in plant-pathogen interactions has shown that the pathogens have evolved sophisticated mechanisms to modulate plant development and immunity, including the suppression of plant defences to their sap-feeding insect vectors. However, it is equally important to gather knowledge on the insect vectors. For example, genome sequence data of leafhoppers were essential for revealing a phytoplasma Achilles' heel and obtaining increased plant resistance to the phytoplasma and its insect vector. To improve our knowledge on insect vectors, the past few years my lab and I made use of recent advances in low-input next generation sequencing technologies and generated genomic and transcriptomic resources for ±40 mostly small hemipteran insect species. One of these species is the *X. fastidiosa* insect vector *Philaenus spumarius,* known as the meadow spittlebug, which is one of the most common insects in the UK. Our data gave insights into how *P. spumarius* dispersed globally. Moreover, we found that the *P. spumarius* populations that occur in the *X. fastidiosa* outbreak regions of southern Italy belong to a different haplogroup and have higher migration rates, distinct phenology and different plant host preferences compared to UK populations. This research has provided key information that will help to reduce the likelihood of arrival and potential impacts of *X. fastidiosa* outbreaks in the UK and elsewhere.

Keywords: Aphids, psyllids, leafhoppers, *Liberibacter* species, *Xylella fastidiosa*

Scent of a Killer: Microbial volatilome and the biological control of postharvest fungi

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Abstract
The use of synthetic fungicides represents the most common strategy to control postharvest pathogens. However, the long-term application of chemicals is responsible for increased levels of environmental pollution and favours the selection of fungicide-resistant mutants. Consequently, an increasing number of research efforts have been devoted to exploring the use of biological control approaches to reduce the incidence of diseases during the postharvest stages. Among the various mechanisms exerted by microbial biocontrol agents, the production of volatile organic compounds (VOCs) represents a most promising tool, especially when direct contact between the pathogen and its antagonist is not feasible. Their potent bioactivity, the absence of residues on fruit and grain commodities, and the ease of application in different agricultural systems make the use of VOCs a sustainable and effective alternative to synthetic fungicides in the management of plant pathogens in closed environments. In this review, we shall focus on the most recent literature available on microbial volatilome and its role in the biological control of postharvest pathogens of fruit, vegetable and grain, including mycotoxin-producing fungi.

Keywords: Volatile organic compounds, chemical, postharvest, mycotoxin

Invited presentations

Improving seed treatment methods: A key factor to reduce the risk to Honey bees and other pollinators to maintain biodiversity

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Abstract
Bees are one of the reasons, for the possibility of human development on earth, which otherwise would have been very different and the conditions for human development may not have existed. Pollinators support the reproduction of nearly 85% of the world's flowering plants. However, these important species are endangered through the use of pesticides. Highly specialist techniques should be used when treating seeds with Plant Protection Products. This study was conducted to to reduce the drift generated from seeds by drilling, hence saving pollinators, as well as reducing the risks to people. The study investigated the amount of drift generated from seeds of two varieties of cotton using two formulations of the neonicotinoid insecticide imadocloprid through measuring the fine dust particles from various treatments using the Heubach methods. The increase in drift generated through Heubach Meter through tested formulation of imadocloprid relative to the control treatment were in the range of 336-378% and 221-287 for the Water dispersible powder formulation (WS) for Hamid and Barakat cotton varieties, respectively. For the Flowable Concentrate (FS) formulation, the percentage increase in the drift over the control was ranging 82-95% and 15-445 for Hamid and Barakat varieties respectively. The values for the FS formulation ranged between 7-8.8 and 2.64-14.7 for Hamid and Barakat, respectively. The Flowable concentrate formulation for seed treatment is better than the Water dispersible powder formulation in reducing the drift generated from pesticide treated seeds and can play important role in improving seed dressing technology to save various pollinators.
Keywords: Seed treatment, pollinators, biodiversity, pesticies and insecticies

Cryopreservation and in vitro conservation of virus free plant genetic resources and species tolerant to biotic and abiotic stresses

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Abstract
Biotechnology plays a major role not only in the production of plants tolerant to biotic and abiotic stresses, but also in the conservation of plant genetic resources to establish Gene Bank. In this investigation, cryopreservation by encapsulation –dehydration technique of Grape virus-free plants and *Iris aurantica* has been established for the first time in Syria. Factors affecting different stages of cryopreservation (pre-freezing, capsulation, dehydration, and freezing stage) have been studied to improve the survival rate of virus-free plants after re-freezing. The use of cryopreservation technology is the only way to ensure the long-term preservation of virus-free grapes and Iris by storing shoot apex in liquid nitrogen (-196^{o}C) and storing them at very low temperatures, such as the freezing point of CO_2 (-80^{o}C). *In vitro* preservation was conducted to develop a technology for short-term conservation and relieve of growth and increase the period between transfers of *Iris aurantica*. In this study, the best osmotic agents for in vitro conservation was sucrose compared to mannitol and sorbitol, and the best medium concentration was 1/10 MS. The cultured stored at (3°C) gave the highest survival (93.33%) and lengthened the time period between transfers up to 6 months.
Keywords: Stresses, tissue culture, fruit plants, vegetable plants

Flyash and biochar induce defense response activation against bacterial leaf spot in chili pepper

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Abstract
Biochar plays an important role in improving the plant growth and activating defense mechanisms against biotic and abiotic stresses. In our study, the focus was on the effect of biochar made from rice straw and flyash on plant growth and development of *Xanthomonas campestris* pv. vesicatoria causing bacterial leaf spot in chilies. Chilli pepper plants were grown in different substrate compositions containing either only soil or amended with rice straw biochar (RSB) /and flyash at the rate of 3%, each. All of the soil substrate compositions received compost at the concentration of 20% as an organic nutrient source. Rice straw biochar had a positive effect on plant growth, in the form of increased root and shoot weight as compared to plants grown in flyash and only soil treatment. Moreover, RSB had shown a significant *in vitro* inhibitory effect on different pathogenic fungi and bacteria accounting for more than 50%. Disease severity and incidence were significantly minimized among the plants grown in RSB containing substrate as compared to other substrate compositions. Overall, our findings indicated a positive effect of RSB amendment on plant health, as well as by inducing a defense response in chilli plants against bacterial leaf spot. Biochar addition in soil not only improves its fertility but also helps in achieving long-lasting C sequestration goals. The ability of biochar to influence plant growth and defense pathways contributes towards its ability of disease suppression.
Keywords: Environment protection, disease management, organic soil amendment, Biochar

Impact of conservation tillage and residue management on soil biological indicators in rice-wheat cropping system of Pakistan

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Abstract

Intensive tillage practices and burning of the residue decline the soil quality dynamics especially the soil biotic health along with other parameters. Conservation tillage and residue management are the promising sustainable strategies for improving the soil quality. A study to evaluate the impact of different tillage and residue management strategies on soil biotic health such as microbial biomass carbon (MBC) soil organic carbon (SOC) and metabolic quotient (qCO_2), etc., were started in 2014 with the scenarios i) rice/wheat residue was burned and removed, ploughing of field 3–4 times and planked (SC-1); (ii) rice/wheat residues were chopped with straw chopper incorporated by disc plow, ploughing of field 2–3 times and planked (SC-2); (iii) rice residues were retained and wheat was planted with zero till (ZT) at 3–5 cm depth, whereas wheat residues were removed for non-puddled direct seeded rice sowing (SC-3); (iv) rice residue was retained and wheat was planted with ZT at 3–5 cm depth, while wheat residues were removed for transplanting puddled rice sowing (SC-4); (v) rice/wheat residues were retained and wheat/rice were planted with ZT drill at 3 to 5 cm depth (SC-5) in rice wheat cropping systems.The results indicated that MBC, BSR, SOC and qCO_2 increased by 24.6%, 13.98%,4.1% and -4% (negative value showed good efficiency) under conservation tillage whereas conventional tillage showed reduction i.e. 18.94% 10.3% 2.1%, 7.1% on the uppermost soil surface and decreased along with soil depth in all tillage and residue management practices. In conclusion, conservation practices have significant impact on soil biotic health. The adaption of climate smart technologies i.e., conservation tillage is need of time for sustainability of soil and environmental health of rice wheat cropping system.

Keywords: Intensive tillage, soil quality, conservation tillage, soil microbial carbon, metabolic quotient and sustainable soil health

Production virus free plants of grapes and potato by meristem culture from infected plants

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Abstract
In this study, more than 30 viruses infect potato and potato virus virus Y (PVY) is one of the most common and destructive viruses. Meristem length 300 micrometer were exised from infected potato plants of Binella cultivar, and cultured on solidified MS medium. Virus infection in *in vitro* plantlets was determined by (DAS-ELIZA). The result showed a good rate of virus free plants. The rate of PVY elimination was improved after Chemotherapy (37C for 40 days) and Chemotherapy (20mg/l of Ribaverin) combined with meristem tips. The virus (GLRav-3) Grapewine leafroll-associated virus is the most common and destructive viruses found in grapes in the south of Syria. Meristems length 300 micrometer were exised from infected grape plants of Halwany cultivar, and cultured on medium containing 1/2MS plus 30g/l sucrose, 0.5mg/l BAP. The virus status of *in vitro* plantlets were detected by (DAS-ELIZA). Several treatment were tested in order to improve the virus elimination percentage. The best rate (87%) of the virus elimination was obtained by using Ribaverin (20 mg L^{-1})combined with meristem tips.
Keywords: Ribavirin, tissue culture, grape wine, chemotrheropy

Cultivation of Pleurotus ostreatus on different agricultural residues

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Abstract
Edible mushrooms have been used for their nutritional and commercial value since ages. Among 3000 edible mushrooms, *Pleurotus oystreatus* is one of the most cultivated in Asian countries due to the suitability of the environment and easy cultivation techniques using different agricultural waste materials. In this study, we used three agricultural wastes as substrates viz., rice, wheat and cotton straw in 9:8:7 ratio along with four supplements *viz*., bread waste, tea waste, banana peel and biochar in 1:2:3 ratio, with the control of rice, wheat and cotton straw without supplements. Fresh and dry weight of mushrooms was calculated to check the moisture content of mushroom bodies being produced on any of the used substrates. Among the used supplements in three substrates, all of the supplements provided a good source of nutritional add up to mushroom bodies by giving the growth in each cultivation bag with no significant difference. The moisture content of mushrooms collected from these combination series also gave positive results with fluctuating readings in first, second and third flushes. However, in the substrates without addition of supplements, rice remained on the top for having high fresh and dry weight of cultivated mushroom. For moisture content, cotton without supplements provided the lowest reading for retention of moisture content which is the ultimate goal of storage of mushrooms.
Keywords: Organic waste, mushroom production, eco-friendly, oyster

The role of allelopathy in organic weed management in field crops

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Abstract
Continuous and excessive pesticide usage is posing severe environmental threats and health hazards for humans. This is also causing changes of weed flora and development of herbicide resistant weed biotypes in field crops. Managing the emergence of new of new weed biotypes requires innovative tools. Allelopathy, a naturally occurring phenomenon in agricultural ecosystems, has been evaluated as a possible alternative to chemical weed management and growth promotion. We have extensively explored the potential allelopathic plants including sunflower, sorghum, mulberry, rice, maize, brassica, eucalyptus and moringa for organic weed management and growth enhancement in field crops in a series of studies. Allelopathy has been employed through intercropping, crop rotations, mulching and plant water extracts for weed management and plant water extracts for growth promotion. We have proved that, if wisely planned, allelopathy offers a pragmatic option for weed management and growth promotion in field crops. In agricultural systems, crop rotations are practiced to reduce the ill effects of monocultures, but the subsequent crop may be affected by the allelochemicals released by the preceding one. Therefore, allelopathic nature of the crops must be considered while making the crop rotations.
Keywords: Allelopathy, crop rotation, weed management, agriculture crops

A distinct strain of Chickpea chlorotic dwarf virus isolated from begomovirus infected cotton induced downward leaf curling leading to cup shape structures in Nicotiana benthamiana

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Abstract
Cotton leaf curl disease in the Indian subcontinent is associated with several distinct begomoviruses that interact with a disease-specific DNA satellite named Cotton leaf curl Multan betasatellite (CLCuMB). However, we isolated the distinct strain (L) of leafhopper transmitted chickpea chlorotic dwarf virus, CpCDV-L (genus *Mastrevirus*, family *Geminiviridae*) from cotton plants affected by leaf curl disease in a small number of plants. The question as to whether CpCDV-L contributes to the development of disease symptoms such as leaf curling and enations remains to be answered. Standard methods were used to produce partial direct and tandem repeat constructs of CpCDV-L for *Agrobacterium*-mediated inoculation in the binary vector pBIN19. The role of CpCDV-L in the induction of typical disease symptoms was studied by *Agrobacterium*-mediated inoculation of the partial repeat construct into *Nicotiana benthamiana*. CpCDV-L induced downward leaf curling leading to cupping in *N. benthamiana*.
Keywords: *Geminiviradae*, Mastrevirus, betasatellite, CpCDV

Comparative toxicity of biorational insecticides against the red flour beetle Tribolium castaneum and the rusty grain beetle Cryptolestes ferrugineus

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Abstract
Increased environmental pollution and hazards to public health associated with the use of conventional insecticides necessitate the need to explore biorational insecticides for the management of insect pests. Thhis study was conducted to evaluate the relatively safe biorational insecticides against two notorious pests of stored grains, the red flour beetle *Tribolium castaneum* and the rusty grain beetle *Cryptolestes ferrugineus*, to determine their susceptibility to selected chemicals. The toxicity of eight biorational insecticides Abamectin, Emamectin Benzoate, Imidacloprid, Acetamiprid, Thiamethoxam, Indoxacarb, Fipronil and Spinosad was reviewed by diet incorporation method. All insecticides were evaluated for their toxicity at various concentrations. Mortality of the insects was dose-dependent, and Spinosad was proved to be the most effective insecticide against *C. ferrugineus*, with 100 percent mortality at the lowest concentration of 1 ppm. Thiamethoxam displayed maximum mortality against *T. castaneum* at 4 ppm. Overall results affirmed the less susceptibility of *T. castaneum* as compared to *C. ferrugineus* against most of the insecticides used in the current study.
Keywords: Toxicity, pesticides, beetles, chemicals

Molecular approaches associated with resistance in crop plants: Markers and transcriptome - proteomics strategies and applications

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Abstract
The steady growth of the worldwide population necessitates a substantial increase in crop productivity. Improvement of disease resistance in crops has great potential to increase productivity by preventing the huge losses caused by the plant pathogens. On the other hand, the most modern varieties, which have been selected for enhancement of yield values, are relatively more susceptible to pathogens under high fertilizer inputs. In addition, new pathogen variants often cause an increased threat to crops. Thus, the level of understanding reached in the genetics and molecular mechanisms of plant pathogen interaction and stress response, as well as the variety of new approaches tested and biotechnologies discovered, have made the past two decades of research and development a very exciting period in the field of plant biotic stress control. Success stories like the production and commercialization of resistant plants, and today's availability of powerful molecular techniques, such as genomics and proteomics, have elicited studies that pursue their final objective of increasing plant stress resistance by investigating the plant stress response. While less work has been done on the dual role of particular genes covering resistance to more than a disease at a time. However, the stress control methods which have been investigated or postulated to date are, in most cases, of general significance and could be readily applied to commercial plants in the near future. This talk briefly reviews some of the most interesting molecular approaches to controlling biotic stresses, with particular attention to fungal pathogens and cereal cyst nematodes. Additionally, investigation of the alterations in transcript activity of the defense-related genes and enzymes opens a new trend in research on defense signaling pathways and crop defense responses. Further, the molecular basis of crop resistance and shed new light on the interaction and overlap between different forms of biotic stress.
Keywords: Molecular markers, fungi, nematodes, wheat, pepper

Management of fruit flies through chemosterilant bait and microbial natural pesticides

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Abstract
Fruit flies are harmful economic pests that infect a broad range of fruits and vegetables across the world due to their high reproductive capacity, polyphagous nature, host range, mobility, and environmental adaptability. Traditional management methods are no longer viable due to the massive fly populations, pesticide resistance, pest outbreak, environmental risks and health hazard residues. This study was conducted to evaluate the chemosterilizing and mortality factors by using a combination of exclusion experiments. Infection through chemosterilant and entomopathogenic fungi has also been demonstrated to reduce fruit fly fecundity, fertility, adult emergence and mortality that can contribute to fruit fly suppression in the long-term. Pyriproxyfen, novaluron, lufenuron, buprofezin, and flubendiamide (50-300 ppm/ 5 mL diet) were tested in oral bioassays against the newly emerged *Beauveria zonata* under lab conditions. The results showed that fecundity and adult emergence is higher at low doses and vice versa. Among the investigated chemicals, lufenuron induced the lowest fecundity 31.05% and the lowest adult emergence rate of 19.85% at 300 ppm/5 mL of treated diet. Whereas in crosses between treated males with treated females, lufenuron treatment resulted in the lowest fecundity (45.52%) and adult emergence rate (51.73%) as compared to other crosses. Generation-wise reduction percentage observed in G1, G2 and G3 was 54.69, 24.47 and 11.51% respectively. Pathogenicity of *B. bassiana* showed 4-6% larval mortality and the pupal survival was reduced by 87-92% on the sand substrate and caused malformation.
Keywords: Chemosterilant technique, pathogenicity, induced sterility, fecundity, adult emergence

Genome-wide identification and characterization of WRKY transcription factor gene family in Citrus reticulata and its response against various biotic and abiotic stresses

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Abstract
WRKY is an important group of transcription factors (TrFs) gene family and was identified primarily in plants. WRKY TrFs play vital roles in modulating gene expression during several biotic and abiotic stresses, senescence and different hormone responses. The DNA-binding domain of these proteins is a conserved hepta-peptide sequence WRKYGQK. Although the Mandarin Citrus (*Citrus reticulata*) genome has been published but functional studies are still necessary to understand Mandarin Citrus. The mining of *C. reticulata* genome identify 46 CrWRKY genes that are classified into three main groups (G1-G3) with five subclasses (IIa–IIe) in G2, and all were present on 29 different scaffolds representing numerous segmental duplication (100%) events. Through multiple sequence analysis, it is predicted that WRKYGQK domain and metal chelating zinc-finger motif C2H2 is present in 45 genes while WRKYGQK domain is replaced with WRKYGKK only in CrWRKY20. Comparative relationship of CrWRKY with other plant species using dual synteny analysis revealed that the divergence between C. reticulata and C. grandis occurred after the divergence of C. clementine, C. sinensis, C. medica and *C. ichangensis*. Cis elements of CrWRKY genes provide information about their significant role in cold stress in C. reticulata. The transcriptome analysis from previously generated RNA seq data, indicated that CrWRKY gene play critical role in different organs and tissues of plants under various biotic as well as abiotic stresses.
Keywords: Characterization, transcription factors, biotic factors, abiotic factors

Food webs and date palm agro-ecological community characteristics

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Abstract
Understanding the inter-organism interactions in ecological communities allows assessment, and even prediction, of how communities respond to natural and anthropomorphic impacts. The trophic interrelationships of invertebrates within a community often form an extensive feeding web composed of several trophic levels. Food webs, or trophic webs, can be constructed directly from empirical field studies or, alternatively, by using literature records to map all the trophic interrelationships in natural and agro-ecosystems. For terrestrial communities, this includes the plants, herbivores and the complex of natural enemies associated with these herbivores. The food webs that were recently constructed for coconut palm and date palm agro-ecosystems infer large-scale community ecology consequences of shared and non-shared natural enemies, such as the relative importance of direct and apparent competition. The plant-insect community characteristics of date palm agro-ecosystem can be explained with emphasis on the prospects of better pest management strategies against Lesser Date Moth, *Batrachedra amydraula* Meyrick.
Keywords: Date palm, agro-ecosystems, pest management, *Batrachedra amydraula*

Effect of aqueous extract of hanzal (Citrullus colоynthis L.), senemeka (Senna alexandrina Mill) and ummjelajel (Aristolochia bracteolate L.) on the leaf miners (Liriomyza spp.) on the snake melon crop

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Abstract
Due to ecological imbalance and hazards caused by insecticides use, plant products or plant extracts were suitable alternative to pesticides. This study was conducted to evaluate the effect of water extracts of Hanzal (*Citrullus colоynthis* L.), Ummjelajel (*Aristolochia bracteolate* L.) and Sennameka (*Senna alexandrina* Mill) on vegetable leaf miners (*Liriomyza spp*.) infesting snake melon. Snake melon plots were sprayed weekly with water extracts of hanzal, sennameka and ummjelajel at 10% concentration (w/v) and control was sprayed by water with molasses and gum Arabic. The infestation percentage on leaves and mean number of active mines were counted twice weekly. The aqueous extracts of hanzal, sannemeka and ummjelajel reduced the infestation and number of active mines significantly compared to control. No significant differences between hanzal, sannameka and ummjelajel. Hanzal had lower mean percentage leaf infestation followed by sannameka and ummjelajel (season one). Hanzal recorded lower number of active mines in season two followed by Sannemeka. Also Hanzal recorded the least number of active mines than Sannameka, season two. From this study it is recommended to use Hanzal at 10% w/v for control of leaf miner species on snake melon crop.
Keywords: Aqueous extract, Ccitrullus colоynthis, senemeka, ummjelajel, snake melon.

Arthropod diversity as protection against outbreaks of insect pests

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Abstract
Arthropods comprise a speciose and diverse group of organisms. In recent years, there has been increasing awareness that many arthropod taxa have declined dramatically during the Anthropocene. In many parts of the temperate region in particular, there is considerable concern that declines in insect and arthropod diversity are already having a negative impact on the provision of essential ecosystem services, such as pollination in particular. One possible impact of declining insect diversity is an increase in outbreaks of pest species, many of which also benefit from global warming. In some sectors, there have been large-scale initiatives to enhance biodiversity at local levels, to improve the provision of ecosystem services and Nature-based Solutions. Agro-ecology, for instance, has brought the introduction of beetle banks and wildflower strips in agricultural environments. The purpose of these is to provide supplementary habitat for pollinating insects, ensuring provision of pollination to crops, and also to maintain populations of predatory arthropods, to control phytophagous pests and prevent outbreaks. Ecosystem homogeneity tends to increase vulnerability to pest outbreaks, whereas heterogeneity and ecological complexity, such as presence of communities of parasitoids and hyperparasitoids should enhance resilience to pests. Unlike most of the temperate region, Oman represents a biodiversity hotspot, with diverse assemblages of arthropods and plants. The high level of biodiversity should ensure the potential to maintain a high level of resilience. At locations affected by ecological homogenization, there should be good potential for supporting beneficial taxa for the provision of biocontrol.**Keywords**: Anthropocene, biocontrol, ecosystem services, nature-based solutions.

Efficacy of green synthesized silver-based nanomaterials against early blight of tomato caused by Alternaria Solani

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Abstract
Tomato production is significantly harmed by the interruption of fungal diseases. *Alternaria solani* is responsible for substantial yield losses in tomato crops grown in greenhouse and field conditions. Silver based green synthesized nanomaterials (AgNMs) are reported as best performers in various agricultural applications and proposed to be best alternatives in plant disease management. Two green based AgNMs at three different concentrations were evaluated against the incidence of *A. solani* and on the components of antioxidant defense system of tomato plants. Results of current study indicated that the application of green based AgNMs reduced the disease incidence of *A. solani* with significant increase in tomato production, ascorbate (ascorbic acid), photosynthetic pigments, flavonoids and antioxidant activity in the leaves of inoculated plants as compared to healthy ones. It is concluded that the application of green based AgNMs may be a viable approach for the management of early blight of tomatoes.
Keywords: *Solanum lycopersicum*, early blight, nanotechnology, management

Estimation of green synthesized silver and copper nano-particles for the management of leaf spot caused by Curvularia Lunata on brinjal

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Abstract

Plant-derived nanostructures have revolutionized the arena of nanotechnology and "green" synthesis of nanostructures with strong characteristics is great challenge for researchers. In the present study, CuNPs and AgNPs along with their complex utilizing *Moringa oleifera* plant extract as reducing and stabilizing agent were synthesized. Different concentrations (0.25, 0.50 and 0.75%) of these nanoparticles were applied using Poisoned food technique to evaluate antifungal activity against *Curvularia lunata in vitro*, as well as *in vivo* to check the efficacy of exogenously applied nanoparticles to control against Curvularia leaf spot of brinjal for better outcomes and eco-friendly management. Under *in vitro* conditions, [Cu-Ag] NPs complex expressed maximum inhibition (13.862) comparatively to CuNPs with growth inhibition (21.809) and AgNPs with minimum growth inhibition (23.315); however, control showed maximum fungal growth (38.647). Under field conditions, spray with [Cu-Ag] NPs complex expressed determined reduction in disease intensity at different days' interval (7, 14, 21) with infection index value (16.183, 13.217 and 10.657) followed by CuNPs with infection index value (27.717, 24.740, 20.907) and AgNPs with infection index value (33.147, 29.153, 25.743) as compared with control showed maximum fungal growth with infection index value (35.243, 38.393, 40.750). The present research aimed to highlight the biosynthesized CuNPs and AgNPs as biological control against Curvularia leaf spot of brinjal.

Keywords: Green nanotechnology, *Curvularia lunata*, nanoparticles, *Moringa oleifera*

Evaluation of chemicals and plant defense activators against red rot of sugarcane caused by Colletotrichum Falcatum

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Abstract
Red rot of sugarcane (*Saccharum officinarum* L.) caused by *Colletotrichum falcatum* is considered as the most destructive disease in many sugarcane growing countries. *C. falcatum* may decrease weight of cane by up to 29% and sugar loss by 31%. In this study, nine commercial fungicide formulations were tested in lab conditions: Shincar exhibited minimum fungal growth (4.13) followed by Nativo (15.62), Amister Top (26.19), Topsin M (37.64), Ridomil Gold (45.19), Allite (52.49), Score (59.44), Antracol (67.71) and Rovral (76.81) as compared to control. In green house Salicylic acid + KH_2PO_4 exhibited minimum disease incidence (10.40) followed by Salicylic acid spray (13.92) and KH_2PO_4 spray (20.25) as compared to control. In field Carbendazim spray exhibited minimum disease incidence (10.10) followed by Salicylic acid spray (21.60), carbendazim + Salicylic acid+ KH_2PO_4 drench (32.17), KH_2PO_4 spray (43.62), Carbendazim drench (51.19), Salicylic acid drench (58.49), KH_2PO_4 drench (65.52), Coragen (Chlorantraniliprole) drench (74.297) and micro-nutrients spray (82.854) as compared to control. Under lab conditions, shincar showed best result while in green house Salicylic acid+ KH_2PO_4 and in field condition carbendazim showed the best results.
Keywords: Incidence, destructive disease, salicylic acid, fungicides, biofuel

Antifungal potential of essential oils for the management of early blight of potato (Alternaria Solani L.)

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Abstract
Potato is the most important vegetable crop grown worldwide. One of the most destructive foliar potato diseases in the world is early blight incited by *Alternaria solani*. Although it has been shown that a variety of chemicals can effectively manage the disease, ongoing use of these agrochemicals for disease control may result in toxicity to those organisms which are not the primary targets. This this study, the essential oils like black seed, carom, cinnamon, clove, lemon, and linseed oils at different concentrations (200, 400, 600, 800, and 1000 µg/L) were used check the growth inhibition of *A. solani*. Black seed oil reduced fungal growth by 73, 52, 38, 25 and 12 percent, respectively. Linseed has reduced the fungal growth by 80, 61, 45, 26 and 9 percent, respectively. Lemon oil has reduced the fungal growth by 66, 48, 35, 21 and respectively. Clove oil has reduced the fungal growth by 73, 59, 46, 28 and 10 percent, respectively. Carom oil significantly reduced the fungus growth by 75, 59, 49, 30 and 10, respectively. Cinnamon oil reduced fungal growth by 72, 48, 38, 23 and 9 percent, respectively. This study proved that control of this plant pathogen is possible through the use of essential rather than chemicals. This strategy can also help to decrease number of fungicides used, so lowering risks and dangers to environment and human health, particularly when used on vegetables grown for fresh consumption.
Keywords: Early blight of potato, essential oils, fungicides

Mushroom biodiversity in Oman

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Abstract

Mushrooms are a diverse group of macrofungi that possess unique sporocarps. Approximately, more than 30,000 species of mushrooms have been reported worldwide. Most of these species belong to Agaricomycotina, a subphylum in Basidiomycota. During the macrofungal exploration in the year 2018, about 100 samples of mushrooms were collected in different regions of Dhofar, located in the south of Oman. These samples were characterized morphologically and phylogenetically, representing 30 species, belonging to 22 genera and 15 families of Agaricomycotina. Among these mushrooms, some are economically important edible mushrooms such as *Termitomyces schimperi* and *Pleurotus opuntiae*. Other mushrooms, like *Ganoderma mbrekobenum*, *Coriolopsis caperata*, and *Lentinus tigrinus* have proven industrial applications. Similarly, five species are reported and described as new to science. It seems that southern and northern Oman where considerable rainfalls occur during summer and spring could influence the emergence of various mushrooms. These mushrooms could be utilized in different industries such as food, medicine, nutraceuticals, biofertilizers, etc.

Keywords: Agaricaceae, agaricus phylogeny, desert mushrooms, taxonomy

Establishment of two Sudanese isolates of Beauveria Bassiana in date palm seedlings as a prerequisite for prophylactic protection against pests and diseases

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Abstract
Endophytic fungi, which live within host plant tissues asymptomatically, are important mediators of plant-herbivore interactions. We tested the ability of two isolates of *Beauveria bassiana*, an entomopathogenic fungus, to colonize the seedlings of date palm (cv. Mejdhool) using fungal spore suspensions applied as foliar spray, injection and soil drench. The two isolates of *B. bassiana* successfully established inside the aforementioned seedlings via all colonization techniques which were used. Mean of recovery was calculated by cutting the leaves of the treated plant and culturing it on selective media. The mean of establishment of the three colonization techniques for recovery after 6 months were as follows 95.00±9 and 100.00±0.00 in case of spray method for isolate E and M, respectively. For injection, the records were 75.00±17.73 and 87.50±14.88 for E and M, respectively. For drench, 40.00±15.12 and 60.00±18.52 for E and M, respectively.In all treatments, the uninoculated control registered 0.00±0.00. The study was continued for one year recording declining in establishment in second half of the year in all treatment and all protocols. Scanning electron microscope (SEM) images of the treated leaf surface revealed that numerous conidia were present inside the plant tissues. SEM images of inner surface of treated leaf epidermis showed the spores and hyphae of the fungus. This work was carried out to establish the fungus in the plant hoping that this fungus would protect the plant against pests and diseases.
Keywords: Date palm, *Beauveria bassiana*, endophyte, pests

Natural increase of pectobacterium soft-rot disease by Pseudomonas Azotoformans, a carrot endophytic bacterium

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Carrot is one of the main agricultural crops in northwest Iran. In recent years, the bacterial soft-rot disease has gradually become a big issue for carrot production in this region. The current study was conducted to find the main causal agent of this disease. Suspected soft-rot tuber samples were collected from the infected farms and warehouses. After bacteria isolation and purification, the isolates were examined by biochemical and molecular assays. In total, over 50 bacterial isolates with soft-rot capability were isolated and stored. The results confirmed that *Pectobacterium carotovorum* subsp. *carotovorum* is the main and prevalent causative agent for this disease in the area. But all severe *P. carotovorum* infections were associated with infection with a *Pseudomonas azotoformans* strain with low pectolytic capability. In the *in vitro* assay, severe soft-rot symptoms could be seen in the synchronous inoculation with both *P. carotovorum* and *Pseudomonas* strains while single inoculation with *P. carotovorum* strains had moderate disease severity. It seems that this recent rising soft-rot epidemy in the region is the result of an association or mix-infection between *P. carotovorum* and *P. azotoformans*.
Keywords: Potato, mix infection, epidemy, warehouse, northwest Iran

Pathogenicity and genetic diversity of Pythium species associated with damping-off of cucumbers in Oman

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Abstract
A total of 166 isolates of *Pythium* spp. were recovered from 282 soil and root samples collected from cucumber roots and rhizosphere soil of 10 Governorates of Oman, from July 2019 to July 2020. Based on ribosomal DNA (rDNA) internal transcribed spacer (ITS) regions, 4 species of *Pythium* were identified. *Pythium aphanidermatum* was the most abundant species (86.75 %), followed by *P. spinosum* (10.24 %), *P. myriotylum* (1.2 %) and *P. splendens* (0.6 %). Pathogenicity to cucumber of 34 isolates including *P. aphanidermatum* (26) *P. spinosum* (8), *P. splendens* (1) and *P. myriotylum* (1) was tested. *P. aphanidermatum*, *P. spinosum* and *P. myriotylum* developed symptoms of damping-off with a range of 86.7 to 100%, while *P. splendens* was avirulent. Tolerance tests of 15 isolates of *P. aphanidermatum* to hymexazol (0, 10, 100 and 1000 µL L^{-1}) revealed that this species could grow in the presence of up to 100 µL L^{-1}hymexazol while growth was inhibited at 1000 µL $L^{-1}$with *P. aphanidermatum* Br010 from Al Buraimi, exhibiting the highest level of tolerance followed by Br013. Phylogenetic analyses were conducted based on the sequences of internal transcribed spacer (ITS) and COI (cytochrome c oxidase subunit I) genes. *Pythium* species were separated into different clades based on similarities to ITS and COI. Amplified fragment length polymorphism fingerprinting among 93 strains of *P. aphanidermatum* produced 93 genotypic features and 781 polymorphic loci. Overall, genetic diversity of *P. aphanidermatum* populations in the country was low (H=0.1101). Analysis of molecular variance (Fst= 0.11435) revealed gene flow and a moderate level of genetic variability among *P. aphanidermatum* populations. It is concluded that *P. aphanidermatum* is the most prevalent species, mainly involved in damping-off disease of cucumbers in the greenhouses in Oman. Most of these isolates exhibited differences in susceptibility to fungicide and showed no resistance to hymexazol.
Keywords: *Cucumis sativus*, damping-off, *Phythium* spp., genetic variability, hymexazol

Isolation, identification, and application of actinobacterial strains for controlling sudden decline syndrome of date palm in UAE

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Abstract
Date palm is a traditional tree in the United Arab Emirates (UAE) and the Arabian Gulf region. These trees suffer from serious diseases, including sudden decline syndrome (SDS). The fungal pathogen *Fusarium solani* was associated with SDS on date palms in the UAE. This study was carried out to isolate and identify native actinobacterial strains isolated from the rhizosphere of date palm and evaluate their potentiality to produce antifungal metabolites, cell-wall degrading enzymes (CWDEs) and 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase (ACCD). Two most inhibitory isolates in virto, namely Streptomyces tendae UAE1 (St) and Streptomyces violaceoruber UAE1 (Sv), were determined as promising biocontrol agents (BCAs). Both isolates showed antagonism under greenhouse conditions, the ACC deaminase-producing Sv were significantly more effective in reducing the incidence and severity of SDS compared to ACC deaminase-non-producing St. The severity of symptoms in infested date palm seedlings were extremely reduced by Sv compared to St. On a scale of 5.0, the estimated disease severity indices in *Fusarium solani*-diseased seedlings were significantly ($P < 0.05$) reduced from 4.8 to 1.5 and 0.5 by St and Sv, respectively. The ACC levels of both the root and shoot tissues were significantly reduced in Sv + *Fusarium solani* seedlings to comparable levels of healthy seedlings. The ACC levels greatly increased in planta grown in soils infested with the pathogen alone or edited with St prior to *F. solani* infestation (St + Fs). This is the first findings demonstrate the effectiveness of rhizosphere actinobacterial BCAs in protection against SDS on date palm in the UAE and the other arid land.
Keywords: Date palm, *Fusarium solani*, rhizosphere, sudden decline syndrome

Association of multiple begomoviruses with leaf curl disease of papaya trees in Kingdom of Saudi Arabia

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Abstract
Begomovirus is the largest genus in family *Geminiviridae* and includes more than 445 virus species. Begomoviruses are characterized by single-stranded circular monopartite or bipartite genome and transmitted by whitefly (*Bemisia tabaci*). Begomoviruses cause severe disease in many economically important crops throughout the world. Typical disease symptoms of begomovirus including severe leaf curling, vein thickening, vein darkening and reduced leaf size were observed in papaya plants in the Dammam district of the Eastern province of Saudi Arabia during the summer of 2021. A total of 10 samples were collected. Total genomic DNAs were isolated from naturally infected papaya tree samples and subjected to PCR amplification using universal diagnostic primers for begomoviruses and associated satellites. Three PCR amplified genomic components of begomoviruses and betasatellite namely P61Begomo (645 bp), P62Begomo (341 bp) and P62Beta (563 bp) were sent for Sanger DNA sequencing to Macrogen Inc. These partial viral genome sequences were submitted to Genbank database and accession numbers ON206051, ON206052 and ON206050 were assigned to P61Begomo, P62Begomo and P62Beta respectively. Phylogenetic analysis and pairwise nucleotide sequence identity studies showed that P61Begomo was identified as Tomato yellow leaf curl virus, P62Begomo was identified as DNA A component of a bipartite begomovirus Watermelon chlorotic stunt virus and P62Beta was confirmed as begomovirus associated betasatellite; Cotton leaf curl Gezira betasatellite. T
Keywords: Papaya, TYLCV, Betasatellite, WmCSV, CLCuGB

Aphid/Whitefly-transmitted viruses-a global threat to cucurbit production

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Abstract
Cucurbit crops are economically important for human nutrition, worldwideVarious plant viruses from different genera are currently threatening cucurbit crop production in the world. Aphid-transmitted viruses (ATVs) and whitefly-transmitted viruses (WTVs) have been expanded throughout the world and cause economically important diseases. *Zucchini yellow mosaic virus* (ZYMV) is a typical example of ATVs in cucurbits. Within a decade, ZYMV spread to all the major cucurbit cultivation areas worldwide. WTVs are also responsible for considerable yield losses and are typical examples of "emerging" viruses. *Bemisia tabaci* complex and *Trialeurodes vaporariorum* are vectors of WTVs. Most damaging whitefly-transmitted viruses (WTVs) include: begomoviruses (*Geminiviridae*), criniviruses (*Closteroviridae*), and torradoviruses (*Secoviridae*). The high rate of recombination may be contributing to the recent emergence of new virus diseases. Changes in the vector populations coupled with polyphagy and long distance movement of *B. tabaci*, may be involved in the emergence and establishment of WTVs in new regions. Climate change and global warming are of great concern to agriculture worldwide and are among the most discussed issues in today's society. Insecticides are frequently used in ATVs and WTVs management programs, however, indiscriminate use has resulted in resistance development, and control failures have been reported from many parts of the world. Relaxation of quarantine regulations, intensification and diversification of agriculture with changes in cropping practices and cultivation of crops in new areas specifically with different climates are factors allowing the successful spread of ATVs and WTVs in the world.
Keywords: Cucurbit crop, plant viruses, ATVs, WTVs

Current status and coat protein-based comparative In silico analysis of Zucchini yellow mosaic virus (ZYMV) infecting cucurbits in Pothwar, Pakistan

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Abstract
Cucurbits are major vegetable crop in Pakistan. *Zucchini yellow mosaic virus* (ZYMV) is one the main limiting factors that causes huge losses and is a menace to cucurbits not only in Pakistan but also worldwide. The present study was conducted to know the spread and variation of ZYMV isolates infecting cucurbits in Pothwar region of Pakistan using molecular techniques. Collected cucurbit samples were subjected to serological detection of tested potyviruses exhibited that ZYMV ranked first with 35.2% disease incidence followed by Papaya ringspot virus (PRSV) with 2.2% and Watermelon mosaic virus (WMV) with 0.5% incidence during 2016. Whereas, ZYMV and WMV depicted higher disease incidence i.e., 39.7% and 2.4%, respectively and PRSV showed lower disease incidence i.e. 0.3% during 2017. Detected ZYMV isolates revealed 95.8-97.0% and 94.6-97.9% nucleotides identities among themselves and isolates retrieved from NCBI, respectively. Phylogenetic analysis revealed that four Pakistani ZYMV isolates clustered with Italian, Polish, and Chinese ZYMV isolates in one group while another isolate clustered with Egyptian isolates. Newly detected ZYMV isolate (MK848239) seems to be a recombinant of Pakistani and Italian isolates *i.e.,* MK848237 and MK956829, respectively with recombination breakpoint between 266 and 814 nucleotide position number as detected by recombination analysis. This study helped us to detect the recombinant viral strain with higher disease incidence across the Pothwar region that may result in colossal losses in the future. Therefore, screening of available germplasm against recombinant viral strain(s) to identify the resistant sources, will be helpful in future breeding programs.
Keywords: ZYMV, WMV, PRSV, coat protein, *in silico*, potyviruses

Identification of tomato brown rugose fruit virus in tomato and current research in Palestine

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Abstract
Tomato, a top cash crop, is infected by a number of viruses that cause drastic yield losses. Recently an unusual viral syndrome that resembled with that induced by tobacco mosaic virus has been observed in Northern Palestine. A study aimed at revealing the cause of the disease, identified the presence of a putatively undescribed tobamovirus. The virus genome was entirely sequenced and shown to be composed of 6391 nucleotides. Sequence analysis indicated that this virus is an isolate of tomato brown rugose fruit virus (TBRFV). This is the first time TBRFV was detected in Palestine on tomato and the name tomato brown rugose fruit virus-Palestinian isolate (TBRFV-Ps) is suggested. Molecular tools were developed for specific detection of the virus. Moreover, 15 different commercial tomato varieties were selected among those commonly cultivated by tomato farmers in Palestine to assess their tolerance to TBRFV infection. Upon inoculation with TBRFV, the typical viral symptoms appeared on all the different varieties. Plant samples were collected at different times during the growing period to assess and quantify TBRFV infection and confirm its sequence by NGS technology. These results will be used to assess the tolerance of the selected 15 tomato varieties to the TBRFV and, consequently, advise the farmers.
Keywords: Tomato, Tobamovirus, TBRFV, NGS

Analysis of volatile organic compounds produced by antagonistic bacteria isolated from biofumigated soil

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Abstract
The bacterial antagonists *viz*., *Pseudomonas aeruginosa* B1-SQU, *Pseudomonas indica* B2-SQU, *Serratia marcescens* B3-SQU and *Pseudomonas brenneri* B4-SQU isolated from biofumigated soil which were found effective against *Pythium aphanidermatum* in *in vitro* dual culture assay were tested for their potential to produce volatile organic compounds (VOCs). The results of two-sealed-base-plates assay revealed that all the tested bacterial strains produced antimicrobial VOCs against *P. aphanidermatum* with the maximum inhibition with *P. brenneri* (B4-SQU) followed by *S. marcescens* B3-SQU, *P. aeruginosa* B1-SQU and *Pseudomonas indica* B2-SQU. The solid-phase microextraction followed by gas chromatography-mass spectrometry analysis revealed that 1-Butanol, 3-methyl- and Disulfide, dimethyl were the major compounds in *P. aeruginosa* B1-SQU. The major compounds detected in *P. indica* B2-SQU were 1-Butanol, 3-methyl-, Disulfide, dimethyl and 1,2-Propanediamine. The major volatile compounds identified in *S. marcescens* B3-SQU were Disulfide, dimethyl and 1,2-Propanediamine. 1-Butanol, 3-methyl-, 1,2-Propanediamine and Disulfide, dimethyl were found as the major compounds in *P. brenneri* B4-SQU. The production of VOCs may be one of the modes of action of antagonistic bacterial strains to suppress *P. aphanidermatum*.
Keywords: bacterial antagonists, volatile organic compounds (VOCs), *P. aphanidermatum*.

Plant nematodes associated with crop plants in Jazan Region, southwest of Saudi Arabia

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Abstract

A survey of plant-parasitic nematodes genera associated with different crops in open fields in the Jazan region, Southwest of Saudi Arabia, including Jazan city and Jazan governorates locations (Abu-Arish, Sabya, Damad, Baysh, Fifa, Samtah, Uhud-Al Masarha) was carried out during the 2021- 2022 growing season. A total of 609 plant roots and rhizosphere soil samples were collected. Samples were extracted in the laboratory using Centrifugal-Flotation method for soil samples, direct examination of plant roots, and extracted nematodes were identified. The most fruit, vegetable and field crops were infected by root-knot nematodes (*Meloidogyne incognita*) and other dominant genra were lesion nematodes (*Pratylenchuszeae*,), citrus nematodes (*Tylenchulus semipenetrans*), stunt nematodes (*Tylenchorhynchus* spp.), spiral nematode (*Helichotylenchus* spp.), lance nematodes (*Hoplolaimus* spp.), needle nematode (*Longidorus* spp.), dagger nematodes (*Xiphinema* spp.), stubby-root nematodes (*Trichodorus* spp.), reneformis nematodes (*Rotylenchulus reniformis*), ring nematodes (*Criconemalla* spp. and *Cricoemiodes* spp.). The previous plant-parasitic nematode genera associated with fruit crops including: mango, papaya, banana, fig, guava and citrus, and vegetable crops including tomato, okra, eggplant, and field crops including maize, sorghum, Rhodes grass and coffee tree. Most of these genera were recorded for the first time on plant hosts in the Governorates of Jazan.

Keywords: Plant-parasitic nematodes, diversity, root, soil

Antifungal activity against Aspergillus flavus and aflatoxin B1 detoxification potential of Omani medicinal plants

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Abstract
Aflatoxins are secondary metabolites produced by *Aspergillus flavus* and *A. parasiticus* and are common contaminants of several food commodities including groundnut, maize, rice, chilli and pistachios. More than 20 different types of aflatoxins have been described. Among them, aflatoxin B_1 (AFB_1) is highly toxic and most frequently found in food products. AFB1 is highly stable and heat-resistant and exhibits carcinogenic, mutagenic, teratogenic and immunosuppressive effects in humans and animals. The aflatoxigenic fungi invade the agricultural commodities at pre-harvest and/or post-harvest stages and secrete aflatoxins under favourable conditions. Several strategies have been employed in order to minimize the levels of AFB_1 in foods and feeds. Among them, detoxification has been considered as a promising strategy to reduce the risk of aflatoxin contamination of foods. Plant products are considered as a source of biologically safe, cost-effective and complementary approach for detoxification of aflatoxins. In an effort to identify medicinal plants for detoxification of AFB_1 we observed that the aqueous extracts and/or essential oils of a few traditional medicinal plants of Oman including *Heliotropium bacciferum, Ocimum dhofarense* and *Zataria multiflora* were capable of degrading AFB_1 *in vitro*. Furthermore, the essential oil of *Z. multiflora* showed direct antifungal activity against *A. flavus*. The alterations in the chemical structure of AFB_1 upon treatment with the medicinal plant extracts/essential oils were elucidated by liquid chromatography-mass spectrometry analysis. The biological toxicity of the degraded products of AFB_1 was determined by using brine shrimp bioassay. The findings of this suggest the potential use of these Omani medicinal plants in detoxification of AFB_1 in foods and feeds.
Keywords: *Aspergillus flavus* and *A. parasiticus,* aflatoxin B1, medicinal plant extracts

Antifungal activity of aqueous extract of Citrus paradisi seeds on Fusarium tricinctum of durum wheat (Triticum durum)

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Abstract
Wheat cultivation is faced with many constraints, including fungal diseases. These are the cause of considerable grain yield loss. The causative agents of these diseases are mostly carried by the seed. The use (in seed treatment) of chemical pesticides is harmful to man and the environment. The use of nonpolluting biofungicides is necessary. This present work concerns the in vitro and in vivo study of the fungicidal effect of the aqueous extract of *Citrus paradisi* seed powder on *Fusarium tricinctum* of durum wheat *Triticum durum*. The in vitro results show that this extract has a strong inhibitory activity at a dose of 20%, 30% and 40% with an inhibition rate of 51.76%, 57.64% and 67.5% respectively. This rate reaches 100% for the concentration of 50%, therefore the antifungal activity of the extract is highly effective. In in vivo mode, the antifungal effect is weak compared to the in vitro test.
Keywords: Fungi, antifungal, leaf extract, wheat

Biological control of fusarium wilt of tomato by the application of Penicillium spp. and Chenopodium murale

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Abstract
Fusarium wilt of tomato, caused by *Fusarium oxysporum* f. sp. *lycopersici*, is an economically important soil-borne disease of tomato especially in warmer regions of the world. Fungicides used to control this disease not only pollute the environment but also cause health hazards. In the present study, this disease was controlled by application of two antagonistic species of *Penicillium*, namely *P. digitatum* and *P. expansum*, and dry biomass of a weed *Chenopodium murale* as soil amendments. The antagonistic fungi and different doses of dry biomass of the weed (1%, 2% and 3%) were applied in pathogen inoculated pot soil either separately or in combinations. The highest disease incidence (100%) was recorded in positive control where only fungal pathogen was applied. While in combination of different treatments of soil amendments reduced disease incidence to 3–23%. The lowest disease incidence (3%) was recorded in 2% *C. murale* biomass + *P. expansum* treatment. All the soil amendment treatments significantly enhanced shoot and root growth as well as fruit yield as compared to positive control. The highest fruit biomass was recorded in 2% *C. murale* biomass + *P. digitatum* treatment. Among physioloagoical parameters, the highest activities of peroxidase (POX), catalase (CAT) and polyphenol oxidase (PPO) were recorded in the positive control. These enzymatic activities were significantly lowered when soil was amended with antagonistic fungi or *C. murale* biomass. Effect was more pronounced where *C. murale* biomass was applied either alone or combined with *Penicillium* spp. In conclusion, application of 2% *C. murale* biomass + *P. digitatum* has the potential to significantly reduce Fusarium wilt of tomato and enhance tomato growth and yield.
Keywords: Biological control, fusarium wilt, tomato, *Penicillium* spp.

Biological control in Oman: Applications and potentials

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Abstract
Biological control, the most important pillar of organic farming, depends on natural organisms that act as agents to control pathogens and diseases. Biological control agents include parasites and predators, microbial pesticides from fungi, bacteria, viruses, nematodes, and protozoa, insect pheromones, pesticides extracted from plants, and plants genetically modified to resist pests. In Oman, the three primary biological control methods were implemented successfully in the field. First, introducing new natural enemies and establishing a permanent population, i.e. classical biological control, in 1984, the parasitoid wasp, Encarsia opulenta Silvestri, imported from USA (Florida) (Hymenoptera: Aphelinidae) was introduced to target the citrus blackfly (CBF) Aleurocanthus woglumi Ashby (Homoptera: Aleyrodidae), and during 1985, the coccinellid beetle, Chilocorus nigritus [Fabricius], was introduced from India in the south to target the coconut scale insect, Aspidiotus destructor Sign., (Homoptera: Diaspididae). Second, conservation of existing natural enemies, e.g. local *Leptomastix dactylopii* (Hymenoptera:Encyridae) is parasitic wasp that target Citrus mealybug. Third, mass rearing and periodic release, on a seasonal basis, e.g. Mass rearing program of Trichogramma that used to control (Lipidoptera) pomegranate butterfly, lesser date moth corn borer and eggplant shot & fruit borer. Notably, local agents are potentially better than introduced ones because of their adaptation to physical factors such as temperature and salinity. For example, Trichoderma asperellum. Therefore, more efforts should be invested in identification of new local agents to control challenging pathogens and diseases.
Keywords: Biological control, parasitoid wasp, *Trichoderma asperellum*

Biocontrol susceptibility of biosurfactants against common plant and food pathogens

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Abstract
Biological surface-tension reducing agents have been recently considered in a context of biocontrol agents of plant-pathogens. In comparison with chemical pesticides, microorganisms are studied as a promising source for antimicrobial compounds which exhibit the advantages of biodegradability and environmentally friendly. ThThis study was conducted to isolate a biosurfactant-producing bacterial strain from local agriculture soil and assess the antimicrobial activity of the produced biosurfactant against some plant and food stuff pathogens. The oil displacement test and Wilhelmy method were utilized to assess the production of biosurfactants in the cell-free culture supernatants. The agar disk-diffusion assay was utilized to assess the antimicrobial activity of the produced biosurfactants by the isolated strain. The hydrophobic moiety of rhamnolipids biosurfactant 3-(3-hydroxyalkanoyloxy) alkanoic acids (HAAs) were detected in the biosurfactant extract by GC-MS. A biosurfactant-producing strain *Pseudomonas* sp. MYSR was successfully isolated from agriculture soil in Bahrain and characterized by sequencing of the 16S rDNA. The MYSR was grown in nutrient broth and the surface tension of the cell-free culture supernatants have been reduced from 73.7 mN/m ± 0.03 to a minimum of 40.1 mN/m ± 0.16 after 6 days of incubation. The application of antimicrobial assay of the produced biosurfactant against common plant and food stuff pathogens by the gram-positive strains such as *Bacillus subtills* and *Staphylococcus aureus* revealed inhibition zone diameters of 1.3 ± 0.22 cm and 1.02 ± 0.1 cm, respectively. This is the first isolation of biosurfactant producing bacteria with antimicrobial susceptibility from agriculture soil in Bahrain.
Keywords: biosurfactants, plant pathogens, biocontrol agents, *Pseudomonas* sp.

Sodium alginate coating incorporated with pomegranate peel extract extending the shelf life and keeping quality of strawberry

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Abstract
Since the synthetic fungicide application to control postharvest decay caused by fungi may bring potential risks to consumers, the use of alternative strategies such as natural compounds and plant extracts for decay control and extending shelf life of strawberry is required. In the present study, the effect of pomegranate peel extract and sodium alginate on the quality of strawberry fruit was investigated, solely or in combination, for up to 16 days. The results showed that the utilization of pomegranate peel extract and sodium alginate coating significantly maintained the strawberry fruit´s quality during the storage period. Moreover, fruit treated with pomegranate peel extract and sodium alginate exhibited optimal postharvest quality during storage. Results of the sensory indices also demonstrated that pomegranate peel extract and sodium alginate at concentrations of 1.5 g/L and 10 g/L, respectively, preserved significantly fruit quality during storage. Generally, the optimum values for quality traits were recorded at 1.5 g/L of pomegranate peel extract. Therefore, sodium alginate + pomegranate peel extract 1.5 g/L treatment could be a promising strategy to improve the quality of strawberry fruits during the storage period, which could provide a perspective for a natural alternative to synthetic plant protection products.
Keywords: Fungal decay, sensory evaluation, shelf life, rot

Fruit Flies and their Management in Oman: Research Experience since 2003

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Abstract
Fruit fly species in Oman were investigated via sampling of fruits from cultivated and wild plants and hanging traps. A total of 13 species of tephritids were identified using morphological and molecular techniques. Three unidentified species could be new to science. Moreover, 2-3 species of braconid parasitoids and one figitid species, mostly associated with fruit fly infested Ziziphus fruits, were collected. A new lure for female fruit flies, consisting of a combination of urea and watermelon seeds, exhibited effectiveness on par with commercial lures such as torula yeast and Ceratrap. In terms of physical barriers, row covers significantly reduced zucchini fruit damage even when applied as a wall around the planting line. An experiment, involving combining growing melon in the greenhouse with a honeybee hive for flower pollination, proved successful in producing a large number of undamaged fruits. In terms of biological control, we managed to set up a system for rearing of major pestiferous fruit fly species and their parasitoids. We currently have two active cultures of *Bactrocera zonata* and *B. dorsalis*, and one active culture of *Diachasmimorpha longicaudata* (DL), a braconid parasitoid imported from Kenya. We hope in the future to produce large numbers of DL wasps for augmentative release in Oman. Fruit fly cultures have served as stock for testing plant extracts as repellents against female *B. zonata* and *B. dorsalis* and for testing *Beauveria bassiana* formulations for control of adults and larvae of *B. zonata*. Studies of Fruit fly population dynamics and height of flight have shown that yellow sticky traps, set at different heights from 0.5 to 3.5 m, captured significantly more males than females. Additionally, most fruit flies were captured at 2m and lower. The population of male *B. dorsalis* in ME traps was highest from April to June, and lowest from November to January. Conversely, the population of male *B. zonata* in ME traps peaked from September to December, and dropped to its lowest levels from April to July.
Keywords: Fruit flies, yellow sticky traps, *B. dorsalis*, *B. zonata*

Metarhizium anisopliae compatibility and synergistic interactions with insecticides against different aphid species

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Abstract

In this study, single and combined effects of eight insecticides and the entomopathogenic fungi, *Metarhizium anisopliae* (Metschin.) against cabbage aphid and cotton aphid species under *in vitro* conditions were evluated. Six of the insecticides tested were found to be highly compatible (flonicamid, imidacloprid, nitenpyram, dinotefuran, pyriproxyfen and spirotetramat), showing positive integration with the fungus and were selected for bioassays. The combination mixtures (1:1 ratio of *M. anisopliae*: insecticide) were significantly more toxic to aphid species than individual treatments. Maximum mortality of cotton aphid (91.68%) and cabbage aphid (88.36%) was recorded with the combination of flonicamid and *M. anisopliae* (2.4×10^6 cfu/mL) 72 h after application. While minimum mortality 17.08% and 16.66% was observed with the individual treatment of *M. anisopliae* (2.4×10^6 cfu/mL) against cotton aphid and cabbage aphid respectively. The results indicates that *M. anisopliae* has the potential to control cotton aphid and cabbage aphid within a short period of time when combined with insecticides. The combined insecticide *M. anisopliae* were consistently more toxic than individual treatments. The present study utilized co-toxicity coefficients and synergy factors to calculate the efficacies of different insecticides + *M. anisopliae* formulations. The toxicity of insecticides, based on their LC50 and LC90 values increased when mixed with *M. anisopliae*. In addition, the synergy factor (SF) and co-toxicity coefficient (CTC) values indicated synergistic interactions at different time intervals. The high values of co-toxicity coefficients, which were accompanied by insect mortalities > 90% for some treatments, illustrate the effectiveness of this dual-attack method of insect pest control. The synergistic efficacy revealed the potential of fungus-insecticide integration against sucking insect pests.

Keywords: Entomopathogenic fungi, insecticides, synergistic interaction, *M. anisopliae*

Discovery of novel small molecule inhibitors against Helicoverpa armigera Sterol-Carrier Protein-2(Hascp-2) through computational and biological methods

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Abstract
Insects lack important gene encoding enzymes in the *de novo* cholesterol synthesis pathway and are dependent on exogenous cholesterol provision by host plants for two important functions; to form structural components of cells and tissues, and precursors for steroid hormones. This external cholesterol uptake is mediated by an interplay of SCP-2, a Sterol Carrier Protein-2. SCP-2 takes up cholesterol molecules from the plasma membrane and shuffles them to the metabolic pathways. Therefore, potential inhibitors that could be capable enough to block the function of SCP-2 can downregulate the cholesterol uptake in insects and this can be achieved by identifying novel small inhibitor molecules by adopting in silico computational techniques followed by *in vitro* validation of screened inhibitors. In this study, a pharmacophore-based virtual screening approach was employed to screen 68 million compounds containing different databases. Hits of Pharmacophore- based VS were further passed through EON-based virtual screening which gave 106 hits. Moreover, FRED and GLIDE based virtual screening finally gave 8 potential hits and their binding modes were verified by molecular dynamic simulations. Cloned and purified HaSCP-2 protein was used to validate the binding trend of selected hits with receptor HaSCP-2 by probe based, fluorescent binding and displacement assay, and their IC_{50} values were calculated. Cytotoxicity assay was carried out by cell-based assay. Insecticidal agent toxicity assay of molecules in insect SF9 cell line showed that the percentage of cytotoxicity in cells is positively correlated with tested concentrations of small inhibitor molecules. In conclusion, hierarchical virtual screening followed by *in-vitro* binding assay and cell-based assay yielded a novel scaffold to block the function of HaSCP-2Further optimization can lead to a better and more active insecticide-like small molecule.
Keywords: Insecticide, toxicity, protein, conventional and biological methods

Prospects for microbials based IPM of red palm weevil: From laboratory to date palm orchards

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Abstract

Red palm weevil (RPW) damages more than 29 different palm species in economic trade zones of date palm, particularly in South East Asia, the Middle East and Africa. As an invasive pest for the last 30 years, its infestation has been recorded in half of the date producing countries. Synthetic insecticides and fumigants have remained the mainstay of date palm growers for decades to combat this pest. However, chemical control is challenging due to the cryptic nature of RPW. Moreover, chemical insecticides have had negative effects on the environment and human health, and pests has developed resistance against many of these chemicals. The urge to explore more effective, sustainable and environmentally friendly alternatives to control RPW has revealed the potential of microbial control agents in the integrated pest management (IPM) of this invasive insect pest. Microbial pest control relies on use of pathogens such as entomopathogenic fungi, nematodes and bacteria and they have a high degree of host specificity. Entomopathogenic fungi and nematodes are the best promising agents to be included in an IPM program against this pest. Their incorporation with other control approaches has a number of benefits including being safe, cheap, lacking non-target effects and self-perpetuation. This talk will underpin an analysis of pathogen mode of contact and infection, auto-dissemination potential and the spread mediated by infected adults, endophytic behavior of some strains, and use in combination with other agents (new-chemistry synthetic insecticides) for the control of RPW. The pros and cons of microbes will be highlighted, with an emphasis on the work of a leading research team that has spearheaded projects in Pakistan.

Keywords: Entomopathogens, synthetic insecticides, IPM, red palm weevil, date palm

Effect of communication towers on the performance and behavior Apis mellifera L. (Hymenoptera: Apidae) (the internal activities) in Baghdad, Iraq

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Abstract
Beekeeping is one of the most important branches of agricultural investments, and bees represent 80% of pollinating insects of cultivated crops. Many factors affect their activities, including electromagnetic radiation. This study was conducted to investigate the effect of the radiation emitted by communication towers on honey bee communities. The first location was 500 m, the second was 150 m from the telecommunication tower and the third transaction was placed directly under the tower. The height of the tower was 30 m and the amount of radiation emitted from it was 925 MHZ. The results of the internal activity, measuring the activity of the queen in laying eggs, showed that the highest rate of activity in the first treatment, followed by second treatment while the lowest rate was recorded on the third treatment. The area of the closed brood was highest in the first treatment followed by the second treatment and the lowest rate in the third treatment. The results showed that the highest drone brood of the third treatment was 6.76 inches, and the first and second treatments recorded 4.48 and 14.1 inches, respectively. As for the results of pollen area, there were significant differences for the first and second treatments, while the third treatment recorded the lowest rate. The measurement of the speed of achievement of wax foundation showed significant differences between the two treatments, where the second treatment surpassed the rest of the transactions within four days, followed by the first treatment and the third transaction recorded the lowest. The highest rate of density of bees was recorded in the first treatment and the lowest rate for the third treatment. In conclusion, the communication towers have negative effect on the internal activities of *Apis mellifera*.
Keywords: *Apis mellifera*, insect, pollination, communicaiton

Impact of the type of vegetation and soil physicochemical characteristics on the abundance of mole cricket crop pests

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Abstract
Mole crickets are burrowing insects known to be serious crop pests because of their feeding on the root system. Successful mole cricket management requires knowledge of their bio-ecology. This study was conducted to assess the impact of habitat characteristics on the abundance of mole crickets in three agro-ecological zones of Cameroon. In each area, four types of vegetation, namely forest, agroforestry, fallow land, and a crop field, were surveyed. In each type of vegetation, mole crickets were collected through pitfalls and soil characteristics such as pH, humidity, and sand content were evaluated. The results show that mole crickets were affected by the type of vegetation and soil characteristics. Mole crickets were more abundant in crop fields and grassy fallows than in agroforestry and forests. The abundance of mole crickets was higher in soils with a pH range of 5-6 and was very low in soils with a pH range of 3-4 (07 individuals). The abundance of mole crickets was higher in soils with a moisture content of between 5% and 20% (150 individuals), while it was very low between 20% and 35% (02 individuals). The abundance of mole crickets was higher in soils whose sand content was between 40% and 55% (94 individuals) and very low between 25% and 40% (15 individuals). These results will aid in implementing sustainable management of mole crickets in Cameroon.
Keywords: Pests, mole cricket, vegetable crops

Spatio-temporal distribution patterns of pest species (Lepi-doptera: Noctuidae) affected by meteorological factors in an agroecosystem

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Abstract
Knowing pests' spatio-temporal distribution patterns is essential for forecasting population outbreaks and designing control tactics or long-term management plans. The family Noctuidae is one of the biggest families of the Lepidoptera order. The noctuid's moths are well represented in all zoogeographic regions in various habitats and have innumerable ecological and economic importance. Despite extensive studies on the species' ecology, knowledge is rare about noctuid moths' spatial and temporal distribution patterns in an agroecosystem. Therefore, in this study, the spatial and temporal fluctuations in abundance of *Spodoptera litura*, *Hadena tripoli*, *Helicoverpa armigera*, *Hadena Jahangiri*, *Spodoptera exigua*, *Hadena stigmosa*, *Spodoptera furgiperda*, *Agrotis ipsilon*, *Aletia l album*, *Callopistria placodoides*, *Callopistria repleta*, *Earias insulana*, *Agrotis cinerea*, *Mythimna loreyi*, *Earias vitella*, *Lacanobia oleracea*, *Euplexia conducta*, *Helicoverpa platigera*, *Mamestra brassicae*, *Leucania venalba*, *Diarsia hoenei*, *Ctenopulsia albostriata*, *Chrysodeixis furthatai* and *Aletia decisissima* were determined. Yellow light traps were mounted in 11 different selected localities of district Multan. The maximum species abundance was observed in September but declined in December, January, and February. The spatial contour maps were used to determine the species' dissemination over space. Meteorological factors such as temperature and humidity showed a significantly positive correlation while rainfall showed a significantly negative correlation with species richness. Maximum species abundance was recorded in crop areas as compared to forest areas. This study provides a scientific basis for developing and timely applying control strategies for localized pest control.
Keywords: Spatio-temporal, lepidoptera, noctuidae, genitalia, abundance

Repellent and oviposition deterrent effects of some wild plants against peach fruit fly, Bactrocera zonata (Saunders)

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Abstract
Bactrocera zonata Saunders is a polyphagous and devastating pest of fruits and vegetables. Due to the resistance development in insects against synthetic insecticides, there has been a shift in interest to develop plant-derived, eco-friendly chemicals compatible with integrated pest management (IPM). This study evaluated the efficacy of essential oils of *Curcuma longa*, *Mentha spicata*, *Chenopodium ambrosioides*, *Origanum vulgare*, *Ocimum basilicum*, *Origanum majorana*, *Mentha longifolia*, *Eucalyptus globulus*, *Lepidium apetalum*, *Azadirachta indica*, *Parthenium hysterophorus*, *Syzygium aromaticum* and *Conyza canadensis* on adult repellence, oviposition deterrence, and pupal recovery of *B. zonata*. Fruits were treated with 0.01%, 0.1% and 1% concentrations of essential oils with five replications for each treatment. In multi-choice bioassay, total of eight bananas including control were used. Seven bananas treated with seven different essential oil while the control was treated with ethanol were placed in front of the 24 h starved *B. zonata* females (20) in single replication. Moreover, oviposition deterrence and repellency were observed for 5 h from the onset of experiments. Essential oil of *M. spicata* and *O. vulgare* proved very effective as a repellent, and oviposition deterrent followed by *C. longa*, *C. ambrosioides*, *O. basilicum*, *O. majorana*, *M. longifolia* against *B. zonata*. The results suggested that we can control the pest using plant based essential oils without harming the environment.
Keywords: Repellency, oviposition deterrence, fruit fly, chemicals, essential oils

Characterization of fruit flies (Diptera: Tephritidae) present in Oman

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Abstract
Fruit flies are important pests of fruits and vegetables. They cause significant economic losses to farmers. This study was conducted to determine the fruit fly species present in Oman, their distribution and host plants. Fruit samples were collected from different locations around Oman during 2019 and 2020. Fruits were kept in jars with sand until larvae emerged and pupated. Fruit flies were identified morphologically using characteristic features on the thorax, abdomen, and wings and molecularly via DNA extraction, PCR, and sequencing procedures. There were nine fruit fly species in Oman. The polyphagous *Bactrocera dorsalis* and *Bactrocera zonata* were collected from fruits of different trees (mostly cultivated fruit trees), while *Dacus ciliatus* was collected from cucurbit fruits (cultivated and wild cucurbits such as *Citrullus colocynthis* or Handhal). *Bactrocera cucurbitae* was collected from fruits of cultivated cucurbits. *Carpomiya vesuviana* and *Carpomiya incompleta* were collected from fruits of *Ziziphu*s species (wild and cultivated). *Dacus persicus* was collected from the wild plant, *Calotropis procera* (Sodom's apple or Shakhar). *Bactrocera oleae* was collected from fruits of wild olive (*Olea europea*) in AlJabal AlAkhdhar area. *Capparimiya savastani* was collected from flower buds of wild *Capparis* species, mostly from *C. cartilaginea.* Except for *B. cucurbitae* (not found so far in Dhofar) and *B. olea* (found only in Addakhilyyeh governorate), most fruit fly species were found in all of the surveyed governorates. Both *B. dorsalis* and *B. cucurbitate* have been recorded only on cultivated host plants. The most widely distributed fruit flies were *B. zonata* and *D. ciliatus*. Two species, *C. savastani* and *B. olea*, are confirmed to be present in Oman for the first time. Molecular fingerprinting allowed the correct identification of *Dacus persicus,* as specimens from Oman were previously known in error as *D. longistylus*, a closely related species found in Africa.
Keywords: Tephritidae, diversity, distribution, *Dacus persicus*, *Bactrocera oleae.*

Chitinase of Trichoderma longibrachiatum for the control of Aphis gossypii

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Abstract
Chitinase-producing fungi have now attracted attention as potential agents for the control of insect pests. In the present study, entomopathogenic fungi were used for the control of *Aphis gossypii*. *Chit1* gene family 18 glycosyl hydrolases were isolated, amplified and characterized from the genomic DNA of *Trichoderma longibrachiatum*. The amplified *Chit1* was closely related to family 18 of glycosyl hydrolyses. Fungal chitinase (*Chit1*) was expressed in the cotton plant for transient expression through Geminivirus-mediated gene silencing vector of Cotton Leaf Crumple Virus (CLCrV). Transformed cotton plants showed greater chitinase activity than control, and they were virulent against nymphs and adults of *A. gossypii*. About 38.75 % and 21.67% mortality of both nymphs and adults were recorded by using Chit1 of *T. longibrachiatum*. Thus, *T. longibrachiatum* has the potential to control aphids through fungal chitinase and can be used as an effective approach in the future.
Keywords: Entomopathogenic fungi, chitinases, transient expression, *Trichoderma longibrachiatum, Aphis gossypii*

Understanding Pyrenophora tritici-repentis - Wheat Pathosystem in Algeria for Best Management Strategy Involving Host Resistance under an Integrated Disease Management Strategy

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Abstract
Tan spot, caused by *Pyrenophora tritici-repentis*, is a serious disease of wheat in Algeria. In the integrated disease management program, focus on the development of host resistance, besides other management practices aimed to control tan spot disease, is an important component of the overall strategy. Understanding the biology and population structure of the pathogen is essential to reach this aim. For this purpose, several isolate collections sampled across wheat growing areas in Algeria for several seasons were studied. Pathogen populations showed a wide range of morphological and physiological variations. Races population structure analysis, using a modified differential host set, highlighted the presence of races 1, 4, 5, 6, 7, and 8, and a new virulence pattern was discovered. Amplification of ToxA and ToxB , the main virulence genes, showed the genome of isolates sampled from Algerian fields harbored both genes, their distribution through growing wheat areas have been established. Additionally, fluorescent Amplified Fragment Length Polymorphism, revealed high genetic diversity. Accordingly, deployment of resistant cultivars has been conducted and available germplasms of wheat, (116 genotypes) mainly from the national program of wheat improvement, were evaluated against races 1 and 5. The reaction was initially evaluated under controlled conditions at the seedling stage, and then the observed resistant genotypes were evaluated in the field with and without fungicide treatments. Altogether, 13 genotypes showed resistant or moderately resistant reactions to race 1, while 23 genotypes, showed resistant responses to race 5. However, only 1 landrace and 6 cultivars were resistant to both races 1 and 5. Based on these results, we recommend cultivation of some of these resistant cultivars, and use of these resistant sources in the breeding programs.
Keywords: *Pyrenophora tritici-repentis*, wheat, pathogen variability, resistance

Use of epiphytic bacteria for the control of major citrus foliar fungal diseases

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Abstract
Citrus spp. is an important fruit crop for the Tunisian economy. However, they are affected by several in field and postharvest fungal diseases. *Alternaria* spp. and *Colletotrichum* spp. are the causal agents of alternaria and anthracnose diseases. *Phyllosticta citricarpa* that was recently detected in Tunisia is the plant pathogenic fungus that causes citrus black spot. The development of these fungi in the presence of multiple applications of copper per year to manage citrus diseases warrants an investigation into the effects of copper on growth of the isolates. The effect of copper on the reduction of the growth of the isolates in media amended with different concentrations of $CuSO_4$ (0, 4 - 3, 6 μM) was evaluated and radial colony growth was assessed. *Colletotrichum* sp. and *Phyllosticta* sp. showed to be resistant to the highest tested concentration of $CuSO_4$ (3, 6 μM). However, *Alternaria* sp. was moderately sensitive with a reduced radial growth from 61, 3 mM for the negative control to 24, 3 mM for a copper concentration of 3, 6 mM. Biological control of these plant diseases with antagonistic bacteria from the citrus phyllosphere was tested and determined as a promising biological control strategy.
Keywords: *Alternaria* sp., *Colletotrichum* sp., *Phyllosticta* sp., copper resistance, biological control, antagonistic bacteria

Neem oil encapsulated chitosan nanoparticles on the toxicity, feeding and reproductive physiology of cotton bollworm Helicoverpaarmigera

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Abstract
Nanobiotechnology is among the emerging fields and its applications in agriculture are attracting the scientific community. In this study, the influence of neem oil encapsulated chitosan nanoparticles (NO-ChNPs) on the feeding, growth and reproductive performances of polyphagous insect pest *Helicoverpa armigera* in the cotton ecosystem was evaluated. The nanoparticles treated insects showed growth deformities with extended larval and pupal durations and reduced fecundity and it may be due to the hormonal impact on the growth and reproduction. The treatment with nanoparticles considerably affected the feeding performances on the amount of food consumed and efficiency of conversion of ingested and digested food values. There was strong evidence from the experimental results that the decreasing trend of digestive enzymes and lesser faecal pellet egestion, which implies that the nanoparticles bind the gut receptors and hindered the feeding regulations of insect species. The parasitisation (larval parasitoid, (*Campoletischlorideae*) of as well as the survival of the earthworm (*Eudriluseugeniae*) population does not affected by neem oil encapsulated nanomaterials. Hence, these formulations can be used for the integrated management of *Helicoverpa armigera* in the agro-ecosystem. Overall, this research highlights the potential of NO-ChNPs for the development of newer control tools against control of cotton bollworm; also highlighting some risks concerned the employ of nanoparticles in aquatic/terrestrial environments.
Keywords: Crop Insect pest, neem, biological control, neem molecule, parasitoid, earthworm, plant protection.

The efficacy of abamectin insecticide product by Gyah Corporation as a nematicide for root-knot nematodes management

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Abstract
Root-knot nematodes (RKN), *Meloidogyne* spp. with the dominant species, *Meloidogyne javanicaare* is considered as the important plant pathogens of agricultural products globally. In this study, chemical management was carried out RKN, *M. javanica* to investigate the efficacy of Iranian Abamectin insecticide product [acaricideabamectin (Vermectin® 1.8% EC, Gyah Corp., Iran)] verses normal Abamectin available in the market each at the rate of 8 L.ha, on cucumber "Viola" and the controls (infested to RKN and without any chemical pesticides treatments) at the two highly infested-RKN farmer greenhouses in Isfahan, Iran. The results indicated a highly significant reduction in RKN population and increase in biomass parameters at 1% level of significance, respectively. Parameters of RKN in the soil and plant root revealed that the number of nematode larvae, second instar larvae (J2) in the soil was reduced by 95% by the normal Abamectin and 93% by the Iranian Abamectin product in comparison to the initial population, respectively. The number of J2 and eggs in the root was also reduced by 89% in the normal Abamectin followed by 91% in the Iranian Abamectin; gall-index reduction was 56% and 58%; and egg-mass index with 79% and 74% reduction in the roots; and the lowest percentage of reproduction rate was 5.4% and 8.3% in the respective treatments accordingly. The same trend was almost followed for the growth factors parameters (biomass), BGPs. The highest stem fresh and dry weight was recorded in the normal Abamectin followed by Iranian Abamectin. The longest stem and root length and root fresh and dry weight was recorded in the Iranian Abamectin followed by normal Abamectin. In total, the results showed that Iranian Abamectin insecticide is competitive as a nematicide for the management of cucumber RKN compared to normal Abamectin, and is a suitable alternative in RKN management, and could be extended to other agricultural crops accordingly.
Keywords: Biomass, cucumber, egg-mass, gall-index, larvae, root, shoot, soil.

Screening of mango germplasm for resistance Against Ceratocystis Manginecans

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Abstract
The resistant polyembronic mango varieties were evaluated against *Ceratocystis manginecans*, the causal agent of mango decline disease. Three Omani, Zangibari Ahmer, Mascati and Nanat Hamad; two Indian, Benishan and Pairi; twenty-five Australian and fifteen Brazilian mango varieties were included in the inoculation experiment. Mango seeds of the above-mentioned varieties were obtained from the mango gene bank in Sohar Agricultural Research Station, planted in plastic bags containing sandy soils with peat moss and maintained under shade house until inoculation. Artificial inoculation on 8-month-old seedlings was carried out under greenhouse conditions using two isolates of *C. manginecans* (GCC55 & 120). Stems of grafted cultivars were exposed at the mid and were inoculated with a disc of 4 mm diam of *C. manginecans* isolates grown in malt extract agar. The results of the inoculation revealed the sensitivity of varieties Nam Doc Mai 4, Indochinese Late, Carabao Townsville, Cecilia Carvalha 1 to *C. manginecans* infection with average lesion lengths of 34.5, 29.5, 22.7, and 22.45 cm, respectively. On the other hand, several polyembryonic mango varieties including Carabao, Xaoi Boui, Jasmin and K.P were found tolerant to the pathogen. In another experiment six Australian, six Brazilian, two Omani, two Indonesian, two Thai, one Sri Lankan and one Indian varieties were also tested. The results revealed high sensitivity of varieties Paire, Trusso, Vellai colomban, Cecilia Carvalha 2 to *C. manginecans* infection whereas several polyembryonic mango varieties including Dura, Elephants Tusk and Mullimby Gold were found tolerant to *C. manginecans.* Some of monoembryonic mango varieties including Zangibari Ahmer and Banat Hamed showed tolerance to infection.
Keywords: Mango, polyembronic, monoembryonic, *Ceratocystis manginecans*, resistance

Management of Fusarium oxysporum f. Sp. Cubense associated with banana wilt disease in Oman

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Abstract
Panama disease in banana crop caused by *Fusarium oxysporum* f.sp. *cubense* has recently been reported in Oman. Disease survey in banana farms revealed occurrence of tropical race 4 of the disease in farms in Wilayat of North Al Batinah governorate. The goal of this study was to find resistance/tolerant banana cultivars to banana wilt disease to replace the current susceptible banana cultivarsGrand Nain regarded as one of susceptible cultivars and used as control in this trail. Grand Nain plants were planted within all the rows and were as barrier rows between experiment rows. Totally, 1500 tissue culture plants of all cultivars tested were planted in the plot with an area of 1.5 faddan. Disease incidence in the plot was assessed periodically after 6 months of planting and plant samples were collected to confirm presence of the causal agent of banana wilt disease. The results showed that FHIA 3 and FHIA 21 are more tolerant to the disease than the others with 95 and 84%, respectively, of the plants surviving and reaching fruiting stage. Conversely, wilting of Grand Nain and Williams started within 6 months, with percentages of 94 and 84%, respectively. Cultivars of FHIA 18 and B3 were moderate in sensitivity with mortality rate of 42 and 52%, respectively. Diagnosis of the banana wilt disease from plant samples collected from all the banana cultivars planted in the plot were all positive for the presence of banana wilt causal agent.
Keywords: Panama disease; banana wilt, *Fusarium oxysporum* f.sp. *cubense*

Abu Dhabi efforts in date palm trees pests' control

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Abstract
The Abu Dhabi Agriculture and Food Safety Authority (ADAFSA) is implementing an integrated strategy that seeks to maintain agricultural biosecurity in the farms of the Emirate of Abu Dhabi by implementing several programs concerned with the palm tree with the aim of reducing the economic damage caused by pests and preserving the ecosystem from the indiscriminate use of agricultural pesticides. This study was conducted to reduce the spread of the main pests that affect palm trees and control them within the critical economic limit, reducing the chances of environmental pollution where only infected palms are treated, improving the productivity and quality of dates. The results indicated a decrease in the rates of infection in all pests that affect the trunk of the palm since the start of the program in 2016. Where the incidence of red palm weevil decreased by 66%, the incidence of long-horned palm stem borer also decreased by 27%, and the injury to the palm borer decreased by 11%. Moreover, as for the lesser date moth affliction and the dust mites, the indicator fluctuates due to its dependence on weather conditions. Moreover, 363,525 palm trees were uprooted and chopped and more than 2.5 million red weevils were cached through pheromone traps. By Oct. 2022 and since the beginning of the program, 174,582 farms with a total number of 48,034,544 million palm trees have been dealt with.

Keywords: Date palm, insects, control, red palm weevil

Assessment of the toxic effects of neonicotinoid pesticides on honeybees foraging, homing ability and colony growth under field and semi-field conditions

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Abstract
The honey bee (*Apis mellifera*) is one of the most important pollinator groups in the agriculture ecosystem, providing approximately 50% of global crop pollination services. The downturn in honeybee's populations is now a worldwide concern. One of the main factors contributing to the decline in honeybee populations is the impact of agrochemicals, in particular neonicotinoid insecticides. We conducted five independent experiments to study the effects of formulated neonicotinoids *viz*. Imidacloprid, Clothianidin and Thiamethoxam at field realistic doses on the mortality of bees, foraging, colony population, brood termination rate (BTR), and homing time in the field and semi-field conditions. The application of neonicotinoids resulted in an increased number of dead bees during the post-application period in first and second week as compared to third and fourth week. There was a rapid and significant reduction in foraging activity of honey bees in the tunnel that gradually increased as the time passed. Population per colony decreased as the time passed, and showed a significant decrease until day +15, but the mean population started to increase and recovered at day +18. After 30 days' observation of marked eggs, brood termination rate (BTR%) at brood fixing day (BFD) 20 was 27.66% in control group and the neonicotinoids treated group caused a significant reduction in the brood development of marked eggs, resulting in a BTR of 44.33, 52.00 and 60.00%, respectively. The average homing time to hive after release was 4 minutes for neonicotinoids treated groups (Imidacloprid 69.8% and in case of clothianidin 89.8%), which was higher than the untreated group (control 53.3%) as honeybees reached back to hive in 2 min. These results confirm the sensitivity of the test methods and indicate that these three tested neonicotinoids could be used in future, as appropriate toxic reference formulated agrochemicals in field and semi-field experiments.
Keywords: honeybees, neonictoinoids, flight activity, homing ability, colony growth, brood termination rate.

Successful testing and development of a bio-fungicide for the management of mango sudden death disease

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Abstract
Mango (*Mangifera indica* L.) is famous throughout the world for its flavor and unique taste. Due to various biotic factors, the yield and production of mango is greatly affected. Among the biotic factors, the sudden death disease of mango is very destructive and economically important. The present research was conducted to test and formulate an eco-friendly, user-friendly, persistent, sustainable, toxicity-free, and effective bio-fungicide for the management of mango sudden death disease. The testing of bio-fungicide was performed in the laboratory, nursery, and field conditions. Under lab conditions, the dual culture method was adopted to assess the antagonistic effect of bio-control agent against *Ceratocystis fimbriata* and showed 100% inhibition of the pathogen. Under greenhouse, three treatments, i.e. T1 (Bio-fungicide), T2 (Thiophenate methyl), and T3 (Bio-fungicide+chemical fungicide along with control (T0) were used. Six-month old mango plants were selected and decontaminated. Ten-day old culture of *C. fimbriata* was inoculated to the healthy mango plants fifteen days before the application of treatments. The results showed that the mortality in T0 was 81% whereas in plants, treated with T1, the mortality was (19%) followed by T2 (29%). In the combination, T3, mortality was noted (24%). Under field conditions, bio-fungicide was applied to the infected plants. The plants were tagged and treated. The infected plants were recovered and significant results were calculated. Bio-fungicide comprises the biological control agent in liquid formulation along with adjuvants to enhance efficacy. The product is very effective for the treatment of infected mango plants in the nursery as well as in the field.
Keywords: Bio-fungicide, biological management, mango sudden death, mango

Suppressive activities of newly synthesized fungicides against plant pathogenic fungi

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Abstract

Numerous pharmaceutical and biological molecules are composed of heterocyclic subunits such as benzimidazoles. These subunits were reported to have therapeutic applications like antifungal, anticancer and antibacterial agents. Moreover, benzimidazole and its derivatives were also used as fungicides. Here, several newly synthesized compounds containing benzimidazole were tested against plant pathogenic fungi including *Alternaria*, *Cochliobolus*, *Rhizoctonia* and *Fusarium* using the well diffusion method. 100 µL of benzimidazole compounds were added into the well at two different concentrations (1000 ppm and 5000 ppm) and the inhibition zone was measured. At least five of the compounds inhibited fungal growth at both concentrations. Scanning electron microscopy (SEM) images showed different effects of those compounds on the structure of the hyphae like hyphae swelling and bursting. The study shows promising results of some of the compounds on the plant pathogenic fungi. Greenhouse experiments are needed to confirm the applicability of the compounds in the field.

Keywords: pathogenic fungi, fungicides, benzimidazole compounds

Assessment of pre-harvest interval (PHI) of synthetic and bio-pesticides sprayed on solanaceous (potato and eggplant) crops

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Abstract
Pesticides are a concern for sustainability of environment and global stability. In order to avoid their adverse effects on human health, it is imperative to assure maximum residue limits (MRLs) in food commodities. In view of the above concerns, the present study was designed to assess the pre-harvest interval (PHI) of synthetic pesticides and biopesticides sprayed on solanaceous crops *viz*., potato and eggplant. Conventional pesticides such as Imidacloprid and Profenofos, and biopesticides such as Spinosad and biosal (neem compound) were sprayed at the rates of 49.4, 988, 35.5 and 158 g a.i. ha^{-1} respectively. The pesticide residues were analyzed after 0, 1, 3 and 7 days of application using high performance liquid chromatography. Degradation rate constants and half-life were calculated using first order degradation kinetics by fitting on the data obtained. Conventional pesticides were more persistent in the crops (average half-life: in eggplant 2.9, and 2.27 days for imidacloprid and profenofos respectively, while in potato it was 2.64 and 2.82 respectively), whereas, for bio pesticides (Spinosad average half-life: 2.73 and 2.83 in eggplant and potato respectively). However, average half-life of Azadirachtin was observed 0.98 and 1.67 in eggplant and potato respectively. The crops treated with bio pesticides were found safer for human consumption even after few hours of spray when compared with codex and EU MRLs. Whereas profenofos treated crops were not found to be fit for consumption even after 7 days of application, as they were not degraded down to the EU and Codex MRL within usual pre-harvest interval (PHI). Imidacloprid being bio-rational (low risk) pesticide degraded quickly and the crop was also safe for consumption on the next day of application.
Keywords: Pre-harvest interval, synthetic and bio pesticides, MRLs, half life

Impact of invasive plant species on the livelihoods of farming households: evidence from Parthenium weed invasion in Dhofar, Oman

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Abstract
Parthenium weed (*Parthenium hysterophorus* L.) is one of the most problematic invasive plant species worldwide. Since 1998, this weed has invaded the mountains and grazing lands in the Dhofar Governorate. It has disturbed the native flora and biodiversity to a large extent in the invaded areas. Invasive plant species often have negative impacts on agriculture and society in addition to their detrimental effects on biodiversity and the environment. A field survey study was carried out to assess the socio-economic effects of a highly invasive plant species, parthenium weed (*Parthenium hysterophorus* L.) across the Dhofar Governorate of the Sultanate of Oman. The farming communities of reported significant effects of parthenium weed on their crop and livestock production, health, and social well-being. Farmers were well aware of parthenium weed presence, its biology, habitat, and mode of dispersal across the landscape. All the major crops cultivated were infested by varying degrees of weed densities. Parthenium weed also infested the fodder collection and grazing sites affecting livestock production negatively. A significant proportion of farmers also reported negative effects of the weed on animal and human health. Most farmers reported parthenium weed as a very challenging weed to manage. About one-third of farmers were willing while the rest were likely to participate in a potential management program in the future. This situation demands a comprehensive strategy for the integrated management of parthenium weed across the governate.
Keywords: Weeds, parthenium, weed management, adverse effect

Allelopathic activity of Euphorbia hirta against Avena fatua and Rumex dentatus and identification of potential allelochemicals

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Abstract
In the present research, allelopathic activity of *Euphorbia hirta* was investigated against *Rumex dentatus* and *Avena fatua*. *E. hirta* extract was prepared in dH_2O (10 g:100 mL w/v) as 100% extract concentration. Lower concentration (50%) was prepared by adding dH_2O to 100% extract. The allelopathic activity of *E. hirta* was evaluated by growing *R. dentatus* and *A. fatua* either alone or grown side by side with wheat plants in pots. There were 5 treatments *viz*., dH_2O, half dose herbicide, full dose herbicide, 50% plant extract, and 100% plant extract. In *in vivo* bioassays, the effect of 50% and 100% plant extract of *E. hirta* on shoot dry biomass of *A. fatua* and wheat was non-significant in general, while there was 50% and 67% significant decline in shoot dry biomass of *R. dentatus*, respectively, when grown alone. Moreover, when *R. dentatus* was grown side by side with wheat, there was 71% and 86% decrease in shoot dry weight of *R. dentatus* at 50% and 100% extract concentrations of *E. hirta*, respectively. The reference herbicides, Sulfosulfuron, at full dose, significantly inhibited shoot dry weight of *A. fatua* by 14%, while, Fluroxypyr Meptyl + Florasulam + MCPA Isooctyl, completely eradicated *R. dentatus*, when planted side by side with wheat. The Gas Chromatography Mass Spectrometry (GCMS) analysis of *E. hirta* extract depicted the presence of a number of potent allelochemicals, notably quercetin, hexadecanoic acid, methyl ester, β-sitosterol, afzelin, gallic acid, neophytadiene, stigmasterol, trans,trans-2,6- Dimethyl-2,6- Octadiene-1,8-Diol, and 2,3,5-trimethyl-1H-pyrrole.
Keywords: Herbicidal, rumex, avena, allelopathic, weeds

Weed Management in Wheat Using Allelopathic Crop Residue mulches under rice-wheat cropping system

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Abstract

Weeds pose a severe threat to wheat productivity in rice-wheat cropping system (RWCS). Mulching residues of allelopathic crops into soil could be one of the viable organic strategies to manage weeds and sustain productivity. A two-year field experiment was conducted to study the effect of residue mulch of allelopathic crops on the weed population in wheat. The study consisted of three allelopathic crop residue mulch (CRM) treatments (wheat, rice and sorghum) each applied at 4 t ha-1 and three nitrogen (N) sources (ammonium sulphate, calcium ammonium nitrate and urea) each applied at 125 kg N ha^{-1}. Plastic mulch and no mulch were used as controls. Results indicated that all mulches significantly inhibited dry biomass and density of all types of weeds during both growing seasons; however, the highest inhibition of weeds was found with plastic mulch. Among allelopathic mulches, maximum suppression in dry biomass and density of narrow leaved weeds (NLWs), broad leaved weeds (BLWs) and total weeds (TWs) was found in wheat mulch followed by sorghum and rice mulch. Compared with the control (no nitrogen), nitrogen applications generally increased the growth of weeds in terms of thei dry biomass only. The highest grain harvest was recorded in plastic mulch treatments followed by sorghum and wheat mulch. Calcium ammonium nitrate exhibited higher grain yield than other nitrogen sources. A negative correlation was found for grain yield and soil water soluble phenolics with dry biomass and density of weeds. In crux, use of allelopathic CRMs may be a pragmatic approach to manage weeds, improving competitiveness of crop plants with weeds and wheat productivity.

Keywords: Weed dynamics, crop residue mulches, allelopathy, rice-wheat cropping system

Improved crop rotations with dry out periods controlled purple nutsedge under cotton-wheat system

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Abstract
Cyperus rotundus is C4 and fast-growing plant replicated through the extensive underground system and tuber. It is highly competitive and causes a significant reduction in cotton production. In recent times, herbicide and nonchemical methods have been practiced to control this noxious weed species. Field studies were conducted from 2018 through 2020 to determine the influence of crop rotation having dry out periods and the effect of herbicide for the control of purple nutsedge in cotton, maize, sunflower, and mungbean. During this study, crop rotation sequences were included (1) cotton-wheat-cotton-wheat-cotton (2) DO (dry out period) after wheat-maize-wheat- DO -maize-wheat-cotton (3) DO after wheat-sunflower-wheat- DO -sunflower-wheat-cotton (4) mungbean- DO -wheat-mungbean- DO -wheat-cotton. The experimental field layout was RCBD in a split-plot arrangement with four replicates. The crops were grown in main plots, and in the subplot, the weedy check and weed control with herbicide was maintained. Overall, herbicide treatment significantly suppressed the *C. rotundus* growth than weedy check and improved the crop growth and yield. In crop rotations, the maximum weed infestation was recorded in the cotton-wheat system. While the purple nutsedge infestation was suppressed in the rotation having sunflower, followed by maize and mungbean rotations. Fallow tillage (dry out period) might have played a significant role in controlling purple nutsedge in sunflower and maize fields as high temperatures prevailed during May and June months. In 3rd-year cotton, improvement was evaluated in crop rotation field. Crop rotation significantly improved the cotton yield by suppressing the purple nutsedge growth. In conclusion, nonchemical methods such as crop rotation with allelopathic crops having some dry-out period can be included as a reliable approach for controlling *C. rotundus* under the cotton-wheat system.
Keywords: *Cyperus rotundas*, crop rotation, dry out period, cotton, sunflower, maize

Effect of aqueous extract of three plants grown under stress environment on purple nutsedge

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Abstract
Purple nutsedge *(Cyperus rotundus* L.) is one of the top ranked worst weed species with strong competitive abilities which is difficult to control by general herbicides. Research was conducted to investigate the herbicidal potential of three different plant species (*Cymbopogon citratus*, *Tamarix dioca* and *Desmotachya bipinnata*) to control purple nutsedge. The aqueous extract of three plants were applied on tubers of purple nutsedge immediately after tuber's sowing. During pot study, different concentrations of plants extract 25%, 50%, 75%, 100%, crude extract and control were applied on purple nutsedge tubers. The results showed that extracts of highest concentration (100% concentration) of two plants *Cymbopogon citratus* and *Desmotachya bipinnata* completely suppressed the tuber sprouting. *Cymbopogon citratus* proven to the best plant comparatively to *Tamarix dioca* and *Desmotachya bipinnata* against purple nutsedge. Treatments like crude water extract and 25% concentration were unable to control purple nutsedge as their effect was same as compared to control. Aqueous extract of *Cymbopogon citratus* provided complete suppression of purple nutsedgeat 100% and 75% concentrations. Significant reduction in biomass were observed at 50% concentration. *Desmotachya bipinnata* at 75% concentration caused significant reduction in root length, shoot length, root fresh weight, shoot fresh weight, root dry weight, shoot dry weight, and tuber density. While in case of *Tamarix dioca*, only 100% treatment was proven effective to reduce the growth attributes. *Cymbopogon citratus* can be used as bioherbicide as it showed maximum suppressive potential against purple nutsedge.
Keywords: Allelopathy, Herbicide, purple nutsedge, leaf extract

Weed spectrum and management studies in barley-based cropping systems under conventional and conservative tillage practices

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Abstract
Weeds significantly alter the productivity of barley-based cropping systems due to competition for nutrients, moisture and space. Tillage practices and crop rotation seem a viable weed management option with minimal environmental and health hazards. This 2-year field study was conducted to monitor the weed spectrum in barley-based cropping systems under conventional and conservative tillage practices. Barley was sown after maize, cotton, mungbean, sorghum and in fallow field with five tillage practices, i.e., zero tillage, minimum tillage, strip-tillage, conventional tillage and bed sowing. Higher bulk density and soil porosity were noted in zero tillage and maize-barley cropping systems, whereas bed sowing and cotton-barley system had lower bulk density and soil porosity. Zero-tilled barley had more diversity, density and biomass of grassy, broadleaved and total weeds, while bed-sown barley recorded the lowest values of these parameters. Different cropping systems significantly affected weed dynamics. Cotton-barley and mungbean-barley cropping systems recorded the maximum weed infestation, while the minimum was noted in sorghum-barley cropping system. The densities and biomasses of weeds like common goosefoot, bitter dock, fat hen, field bindweed, yellow trefoil, yellow sweet clover, salt marsh, corn spury and Bermuda grass were higher in cotton-barley and mungbean-barley cropping systems compared to the rest of the cropping systems. The densities and biomasses of all weeds except perennial sow thistle, bitter dock, fat hen, and yellow trefoil were suppressed in sorghum-barley cropping system. The bed-sown barley had lower weed flora which resulted in higher allometric traits of barley and ensured more grain yield; while more compacted soil layer and higher weed density under zero tillage yielded opposite results. The conventional tillage with cotton-barley system proved more economical compared to the rest of the combinations. Therefore, sorghum can be rotated in barley-based cropping systems once in every three to four years for better weed control.
Keywords: Cropping system, tillage, weed control, conservation

Management of Phytophthora spp. associated with citrus gummosis by using chemicals and nanoparticles

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Abstract
Citrus is the most valuable fruit industry in the world as well as in Pakistan, due to its different nutritional aspects. But this fruit industry is facing huge losses due to various biotic and abiotic diseases. Citrus gummosis caused by water loving fungus *Phytophthora* species is also one of the major diseases of citrus around the globe. This study was conducted to evaluate five different chemicals (Kasumin, Evito, Cabrio top, Topsin M, Kocide @ 100, 200 and 300 ppm concentrations) and three treatments of plant based nanoparticles (Silver, Copper and their combination @ 0.25, 0.5 and 1% concentrations) against *Phytophthora* spp. under lab conditions through poisoned food technique. Among fungicides, the least mycelial growth was observed by application of Evito at 300 ppm concentration followed Kasumin and Kocide at same concentration, whereas among nanoparticles combination of Silver and Copper nanoparticles was found most effective against the mycelial growth followed by solo application of silver and copper at 1 % concentration respectively.
Keywords: Silver, copper, evito, kasumin, kocide

Regret to inform you: Editor's tips to avoid journal rejection

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Abstract
It is estimated that over 50 percent of manuscripts submitted to peer reviewed scientific journals are rejected. The submission of subpar manuscripts reflects the growing importance of research assessment based on bibliometrics and the "publish or perish" paradigm. As a consequence, a great deal of scientific effort, public funding, and precious time are wasted both by the authors and during the review process. Several common factors contribute to manuscript rejection. In most instances, the problems stem from poor writing and grammar or lack of clarity. This makes it difficult to understand the rationale for the paper, methods used, and conclusions reached. Other major reasons for rejection include poor experimental design, and inadequate replication of treatments. A lack of focus and conciseness is a common theme, especially with less experienced authors. In many instances, submitting authors tend to pad the introduction and discussion with well-established but not directly relevant background information on biological control with which the readership should be familiar. Lack of novelty is another major hindrance to publication: some authors submit "variations on a theme" by reporting substantially similar experiments to prior published research. An increasing proportion of manuscripts are rejected due to unethical behavior of the authors, such as plagiarism or double submission. Finally, let us point out that a rigorous peer review process is the only way to distinguish a respectable journal amidst the increasing panoply of debatable, if not fraudulent, editorial initiatives we are experiencing. For the sake of young researchers' scientific growth, we have an obligation to guide our students and early-career scholars away from predatory pay-to-publish journals. Publishing in respected journals with high reviewing and editorial standards will help the scientific community retain their scientific trustworthiness.
Keywords: Peer review, editorial, scientific journals, ethical publishing, rejection

Efficacy of pre-harvest application of epiphytic yeast Meyerozyma guilliermondii Squcc-33y and Tamarindus indica leaf extract on Alternaria alternata- induced postharvest fruit rot of tomato

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Abstract
Alternaria fruit rot caused by *Alternaria alternata* is one of the major constraints in tomato (*Solanum lycopersicum* Mill) production in Oman. Due to increasing public concern about the harmful effects of chemical fungicides, the use of natural products or naturally existing beneficial microorganisms has been preferred for the management of fruit diseases. The inhibitory effect of methanolic extracts of 10 medicinal plant of Oman on growth of *A. alternata* and the effect of postharvest application of the most efficacious plant extract on suppression of *A. alternata* fruit rot of tomato were evaluated. *Tamarindus indica* leaf extract was very effective against *A. alternata* and produced clear zone of inhibition in the disc diffusion assay. Scanning electron microscopic examination revealed morphological abnormalities in *A. alternata* mycelium. Postharvest treatment of tomato fruits with aqueous leaf extract (1%) of *T. indica* reduced the lesion size of fruit rot by 64.1% when challenge-inoculated with *A. alternata*. Ultra-performance liquid chromatography (UPLC) profiling showed phenolic acids viz., ellagic acid (37.3%), vanillic acid (30.3%), ferulic acid (24.1%) and flavonoid, rutin hydrate (98.1%) as major components of T. indica extract. The effect of pre-harvest application of *Meyerozyma guilliermondii* SQUCC-33Y and *T. indica* leaf extract in controlling postharvest fruit rot was evaluated. Greenhouse and field tests revealed that pre-harvest application of *M. guilliermondii* at weekly intervals starting from fruit set to harvest stage significantly reduced the development of postharvest fruit rot when challenged with *A. alternata*, whereas *T. indica* extract had no significant ($P > 0.05$) effect. *M. guilliermondii* significantly ($P < 0.05$) increased the total soluble solids of tomato fruits compared with control. This study suggests that *M. guilliermondii* may be exploited as a biocontrol agent in the field for the management of Alternaria fruit rot of tomato
Keywords: Leaf extract, fungus, tomato, biocontrol

Role of some safe compounds in controlling root rot and seedlings production of artichoke

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Abstract
Globe artichoke (*Cynara scolymus* L.) is an important export vegetable crop. Seedlings are one of the methods for planting artichoke but root rot hampers the production of healthy seedlings. Artichoke can be affected by many diseases that reduce the number of seedling and quality, particularly root rot diseases caused by *Rhizoctonia solani* and *Fusarium solani*. The present work was conducted to study the efficacy of some eco-friendly compounds (e.g., essential oil, hydrogen peroxide, organic compounds and potassium sorbet) in controlling artichoke root rot diseases. The results indicated that using clove oil, hydrogen peroxide and fulvo copper to treat artichoke seedling led to increase inhibition percentages *in vitro* and efficacy percentages in greenhouse at root rot diseases. Treating with clove oil and fulvo copper exhibited a significant increase in the activity of polyphenoloxidase, peroxidase and chitinase in artichoke seedling compared with a control. The highest plant length, plant weight, number of leaves per plant and SPAD meter were achieved by using clove oil, while using mint oil provided the highest length of roots and plants as well as the highest number of buds.
Keywords: Artichoke, controlling, essential oil, root rot

Efficiency of Citrullus Colocynthis as inhibitor of fungi associated with date fruits and its relation with climate change

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Abstract
This study sought to identify fungi related to date fruit mold. *Rhizopus stolonifer*, *Aspergillus fumigatus*, *A. terreus*, *A. niger*, *A. flavus*, *Alternaria alternata*, *Cladosporium cladosporioides*, and *Penicillium chrysogenum* were found to be the most common species. Twenty-two isolates of *R. stolonifer*, 17 of *A. niger*, 15 of *A. flavus*, 12 of *A. fumigatus*, 10 of *A. terreus*, 9 of *A. alternata*, 6 of *C. cladosporioides*, and 5 of *P. chrysogenum* were discovered in association with palm date fruits. It has also been investigated how the occurrence and spread of these fungcould relate to climate change and the changes of temperature and humidity. *Citrullus colocynthis* utilization under different temperature and humidity results in a reduction in the prevalence of the pathogens. Because dates are rich in nutrients and can support human nutrition and wellness, these associated fungal pathogens are a representation of the potentially dangerous associated microorganisms that seriously harm humans. As a result, there is an urgent need for biological methods to control these diseases of the edible fruits.
Keywords: Biological control, fungus, efficacy, date palm

Pathogenicity of three entomopathogenic Fungi to Aphis fabae Scopoli (Hemiptera: Aphididae)

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Abstract

Aphids (Hemiptera: Aphididae) are one of the most significant threats to agriculture and forests. *Aphis fabae* Scopoli (Hemiptera: Aphididae), known as the black bean aphid, is one of the most important species causing yield losses in several cultivated crops. e.g., beans, tomatoes, potatoes, and tobacco, as well as numerous wild and ornamental plant species; its wide host range includes >200 host plant species throughout the world. The goal of the present study was to investigate the effect of three entomopathogenic fungi (EPF) (*Beauveria bassiana*, *Cladosporium cladosporioides*, and Verticillium *alfalfae*) on *A. fabae*. The selected EPF were isolated from the agricultural soil of the National Institute of Plant Protection (INPV) in Constantine, Algeria, and were tested against the aphid insects that were collected from the same area. *A. fabae* were exposed to each fungal spore suspensions (10^7conidia/ml) for 10 s. Percent mortality was recorded at 1, 3, 5, and 7 days post treatment. Percentage mortalities, 7 days post treatment, were, 98,15%, 97,62% , and 92.92% by *V. alfalfae*, *B. bassiana* and *C. cladosporioides*, respectively. The tested fungal isolatescan be effectively utilized as biocontrol agents against this aphid species. Among them, *V. alfalfae*, was the most promising one, indicating the potentiality of this species as a new resource of biocontrol against *A. fabae*.

Keywords: *Aphis fabae*, mortality rate, *Verticillium alfalfae, Beauveria bassiana, Cladosporium cladosporioides*.

Bioassay of Sudanese and Indian isolates of Beauveria bassiana (Balsamo) Vuillemin to adult stage of Musca domestica (Diptera: Muscidae)

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Abstract
The house fly, *Musca domestica* (L), is a worldwide pest of agricultural and public health importance that has plagued humans throughout recorded history. The insect acts as a vector for many pathogenic diseases to both humans and animals. Development of resistance to chemical insecticides is ongoing concern. *Beauveria bassiana* (Balsamo) Vuillemin is one of the alternatives to chemical insecticides and a potent bioinsecticide. The present study was conducted to evaluate the pathogenicity and bioassay of four *B. bassiana* isolates, namely one Indian isolate, ITCC No 6628, and three local Sudanese isolates. The adult of *M. domestica* were treated using topical application; one group was sprayed and the second group was treated by spores obtained from 15-days old Petri plates cultured in PDA. The four isolates of B. bassiana were found pathogenic to the adults of house flies. The lethal time to 50% mortality (LT50) values were recorded in hours. Powder application registered results as follows: 131 hours for the isolate M, 110 hours for isolate E, 99 hours for isolate S and 108 hours for isolate ITCC No 6628. When the spray method was tested, the LT50 were as follows S= 212, A= 172, E =156 and M=145 hours. The potential of all tested isolates against adult of house flies was proven, with best performance of the indigenous isolate coded M. However, further studies are required to determine LC50 and development of appropriate formulation.
Keywords: house fly, *Beauveria bassiana*, mycoinsecticides, biopesticides.

Identification of Fusarium spp. associated with dry root diseases in Omani lime

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Abstract
The disease incidence of Omani lime decline was reported in a number of governorates in Oman. Disease symptoms of the affected lime trees include vascular discoloration of roots and crown and wilting of infected trees. The aim of this research is to identify the causal agent of this symptom. Samples were collected from affected lime trees from Madha in Musandam governorate; Shinas, Liwa, Suhar and Rustaq in Al Batinah governorates; and Salalah in Dhofar governorate. Plant samples with disease symptoms were cultured in a nutrient medium (Potato Dextrose agar, PDA) to isolate pathogens associated with the disease symptoms. *Fusarium* spp. were isolated from all samples collected after identifying through light microscopy. DNA was isolated from culture of *Fusarium* isolates and PCR amplification of translation elongation factor (TEF) genes were performed and amplified gene regions were sequenced. BLAST search of sequenced *Fusarium* sp. isolates in Gene bank (NCBI) resulted in 99-100% similarity for isolates from lime with *Fusarium solani* isolates in gene bank. Pathogenicity test was carried out on healthy Omani lime seedlings with isolates of *F. solani* to fulfill Koch's postulates. Results of inoculation trial confirmed pathogenicity of *F. solani* in lime seedlings and symptoms of vascular discoloration and wilt of seedlings were observed in inoculated seedlings within six months.
Keywords: dry root rot; *Fusarium*; lime; vascular discoloration

Artificial microRNA-mediated resistance against Oman strain of tomato yellow leaf curl virus

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Abstract
Tomato yellow leaf curl virus (TYLCV) is a global spreading begomovirus exerting a major restraint on world tomato production. In this transgenic approach, an RNA interference (RNAi) based construct consisting of sequences of an artificial microRNA (amiRNA), a group of small RNA molecules necessary for plant cell development, signal transduction and stimulus to biotic and a biotic disease was engineered targeting AC1/Rep gene of Oman strain of TYLCV-OM. The Rep-amiRNA constructs presentan effective approach in regulating the expression of Rep gene against TYLCV as a silencing target to create transgenic tomato plant tolerance against TYLCV infection. Molecular diagnosis by PCR followed by a southern hybridization analysis was achieved to confirm the effectiveness of agrobacterium-mediated transformation in T0/T1 transformed plants. A substantial decrease in virus replication was observed when T1 transgenic tomato plants were challenged with TYLCV-OM infectious construct. Although natural resistance options against TYLCV infection are not accessible, the outcomes of this study advised that transformed plants expressing amiRNA could be an essential approach for engineering tolerant plants against TYLCV infection and conceivably for the inhibition of viral disease against different strains of whitefly transmitted begomoviruses in Oman.
Keywords: RNA interference, agrobacterium-infiltration; artificial microRNA; gene silencing; southern blotting.

Citrus tristeza virus: occurrence in Tunisia orchards and the use of tolerant rootstocks as a mean of control

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Abstract
Citrus is one of the most important horticultural crops in Tunisia. Citrus varieties are traditionally grown on sour orange (*Citrus aurantium*), a rootstock with high degree of susceptibility to citrus tristeza virus (CTV). The presence of this quarantine virus has been reported for the first time by Najar et al (2021). Recent surveys, serological and molecular analysis of collected samples from the Cap Bon region (main citrus area) revealed that virus spreading reached drastic levels. In addition, 7870 samples tested by direct tissue-blot immunoassay (DTBIA), showed that 17% of the tested trees are infected with CTV. This result was confirmed by RT-PCR using total RNA and the universal primer pair PIN1/PIN2. Open reading frame sequences (~409 bp) were obtained from RT-PCR products of seven isolates selected (GenBank accession number MW447905-MW447911) using specific primers T30K17+(5'-GTTGTCGCCTAAGTTCGGCA-3') and T30K17-(5'-TATGACATCAAAAATAGCTGAA-3'; Hilf et al., 2005). Sequence analysis showed high identity across all CTV isolates from Tunisia (98%-99%) and with mild CTV strain N4 from China (MK779711; 98%-100%) and variants KC517490 (96%-100%) and KC517489 (97-99%) from the USA. Taking into account the imminent risk of introducing and dissemination of this quarantine virus, we introduced some tolerant rootstocks since 2005 to select those adapted to Tunisian conditions. As a result of this experimental trial, four rootstocks: *Citrus volkameriana*, *Swingle citrumelo*, *Carrizo citrange* and C-35 gave the best agronomic performances with Tunisian sweet orange "Maltaise demi-sanguine". These rootstocks grafted with different citrus varieties have been planted since 2017 in different farms belonging to various climate regions. Preliminary data revealed the general superiority of *Citrus volkameriana* in growth and yield in different sites with all varieties. On other hand, C-35 performed better or equivalent to the control (Sour orange).
Keywords: Citrus, CTV, DTBIA, RT-PCR, rootstock, agronomic performance

Biological, serological and molecular characterization of Algerian PVY isolates

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Abstract
The high incidence of PVY in all the regions studied and its remarkable symptomatological variability, led to the study of the diversity of PVY populations circulating in potatoes and given the emergence of new strains in the world, especially in Tunisia and neighboring countries. From a panel of 185 samples, serologically confirmed as being only infected with PVY, of which 96.7% belong to the serotype-N, and only 3.2% to serotype-O. A series of 31 PVY isolates were analyzed by biotyping on tobacco and by molecular typing (RT-PCR, sequencing), targeting nucleotide sequence polymorphism in the 5'NTR / P1 region and recombination within the junction of three HC-Pro / P3 (RJ2), VPg / NIa (RJ3) and CP (RJ4). 28/31 serotype-N PVY isolates inducing rib necrosis on tobacco were identified as recombinant PVYNTN isolated for the first time in Algeria. The other three strains were serotype PVY-O, two of which were identified as PVYN-wi inducing rib necrosis on tobacco. This result is of high interest because, to our knowledge, this is the first report of isolated PVYN-Wi in North Africa.
Keywords: PVYNTN, PVYN-Wi, solanaceae, diversity, recombination

First report of four viruses in the genus potyviruses and carlavirus infecting Omani garlic crop

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Abstract
Omani garlic is considered an important crop due to its economic and nutritional value. Viral infections of garlic were reported worldwide associated with garlic crop loss. Despite its importance, little attention was given to investigate viral infection on Omani garlic. This study was conducted to detect the viruses associated with garlic plants. Viral-like symptoms such as yellowing of garlic tips on leaves followed by complete yellowing, mottling or striping were observed on different garlic plants. In symptomatic garlic plants, four viruses were detected, namely Onion Yellow Dwarf Virus (OYDV) and Leek Yellow Stripe Virus (LYSV), which belong to the genus Potyviruses, and two other Garlic Common Latent Virus (GCLV) and Garlic Latent Virus (GLV), belonging to the genus Carlavirus. In addition, the study aimed to map the distribution of the viruses between different governorates. The survey was conducted between 2011 until 2020 and covered six governorates. More than 150 samples were collected from each governorate and screened by serological methods (Double Antibody Sandwich Enzyme linked immunosorbent assay (DAS-ELISA) using specific antisera to each virus. The survey highlighted the presence of three viruses: OYDV, GCLV and GLV in Al Bahatina North, Al Buraimi and Al Dahera. Four viruses were detected in Al Dhakhilia governorate. None of the samples from Dofar governorate was positive. This study reported for the first time the presence of four viruses on Omani garlic. Further studies will be done to investigate the potential role of management strategies in order preventing losses in garlic production.
Keywords: OYDV, GCLV and GLV Garlic Virus, ELIZA, antibody

The Ribosomal Intergenic Spacer (IGS) in the Potato and Tobacco Cyst Nematodes, Globodera Pallida, G. Rostochiensis and G. Tabacum

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Abstract
The potato cyst nematodes *Globodera pallida* and *G. rostochiensis* (PCN), and tobacco cyst nematode (TCN), *G. tabacum*, are the most widespread parasitic nematodes of potato and tobacco worldwide. Ribosomal DNA provides useful molecular data for diagnostics, the study of polymorphisms and for evolutionary research in eukaryotic organisms including nematodes. Here we present data on the structure and organization of a rarely studied part of the intergenic spacer (IGS) region of the PCN and TCN genomes of cyst nematodes. This region has shown potential for diagnostic purposes and population studies in other organisms including nematodes. In nematodes, the ribosomal RNA gene cluster comprises three genes: 5.8S, 18S and 28S rRNA, which are separated by spacer regions: the intergenic spacer (IGS), non-transcribed spacer (NTS), externally transcribed spacer (EST) and the internally transcribed spacer (ITS). The intergenic spacer (IGS) region consists of an external transcribed spacer (ETS) and a non-transcribed spacer (NTS) which is located between the 28S of one repeat and the 18S gene of the next repeat within the rRNA genes cluster. In this study, the first flanking portion of the IGS was amplified, cloned and sequenced from PCN and TCN. Primers were then designed to amplify the whole IGS sequence. PCR amplification of IGS from *G. tabacum*, *G. pallida*, and *G. rostochiensis* yielded respectively: a single amplicon of 3 kb, three amplicons sized 2.5, 2.6 and 2.9 kb, and two amplicons sized 2.8 and 2.9 kb. *Globodera* spp. has more than one variant copy of the IGS, with both long and short repetitive DNA elements. An approximately 400 bp long region without any internal repetitive elements, was identified in a position between the two repetitive regions. This suggests that there is a 5S gene in the IGS of these species.
Keywords: Cyst nematodes, potato, IGS, PCR, 5S gene, 28S gene.

Top ten plant parasitic nematodes of economic importance in arid and semi arid area, threatening green house and field crops

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Abstract
More than 4000 species of plant parasitic nematodes (PPN's) have been described worldwide. Nematodes are responsible for crop losses of 8.8 to 14.6 % equal to $ 100 to 157 billion USD annually, demonstrating their potential threat to food security. This is a quick review of the most important parasitic nematodes: Soybean cyst nematode *Heterodera glycines*, a major pathogen of soybean (*Glycine max*), causing $1 billion in damages annually in American agriculture. Stem nematodes, including *Ditylenchus* spp., especially in fababean (*Vicia faba*) and pea (*Pisum sativum*), of which 4 M tons of production are produced in Canada, is an aggressive species with the economic threshold level in Europe being 0.8 eggs/g of soil, and complete crop failure at 64 eggs/g of soil. Root-knot nematodes (*Meloidogyne* spp), a cosmopolitan species with a wide host range in almost all crops and capability for producing complex disease and synergism with other pathogens. Root Lesion Nematode (*Pratylenchus* spp), is a serious pathogen in field crops as well as ornamental and fruit trees. This results in yield loss of 58% at 2 specimens/cm^3 of soil. Cereal Cyst Nematode (CCN), *Heterodera trifolii* and *H. avenae*, a pathogen of cereals and grain that can be spread from seeds. Crop losses of $4 million in Europe and $70 million in Australia have been reported by this species. Potato Cyst Nematodes *Globodera pallida* and *G. rostocheinsis*, with the damage threshold of 1 to 2 eggs/g of soil. With the fact that Prairie ranks as one of the main potato producers with about 60,000 acres, special attention has to be given to this nematode. Stubby root nematode *Thrichodorus* spp, and Spiral nematodes *Helicotylenchus* spp are the most common nematodes in corn (*Zea mays*) fields.
Keywords: Soybean, pulse crops, nematodes, control management, arid, semi-arid.

Screening for resistance and genetic population structure analysis associated with wheat to Heterodera filipjevi – Isfahan pathotype

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Abstract
Bread wheat (*Triticum aestivum* L.) is a major staple food for the world's population. The cereal cyst nematode (*Heterodera filipjevi*) is a soil-dwelling phytoparasitic nematode worldwide, which has a wider distribution than the other species globally. In this research, the reaction of a collection of wheat genotypes including promising lines to the *H. filipjevi* were assayed at the field conditions. We also analyzed the genetic variability of the wheat cultivars using seven simple sequence repeat (SSR) primer pairs. The reproduction factor including the number of females and cysts per plant, the number of eggs and second-stage juveniles (J2), were recorded to estimate the reduction and or increase in populations. There was a highly significant effect among the tested genotypes in terms of cyst, eggs and second juvenile numbers, and reproduction factors. The highest number of cysts were in genotypes Pishtaz with 291.33, followed by Pishgham with 272.67, whereas the lowest numbers were in M-90-7 with 108.67 cysts. In terms of eggs and second juveniles, the highest numbers of 7 were in the genotypes Ark; and the lowest one 1.97 in Parssy variety. The reproduction factors revealed that the highest amount (104.52%) was found on the Ark variety, whereas the lowest one (29.45%) was found on Parssy. Five out of seven used SSR primers produced 20 polymorphic bands, of which the number of alleles in each gene locus varied within 3-7 bands. The polymorphism information content (PIC) value also ranged from 0.44 to 0.81, with the mean of 0.65, Shannon Information Index (I) between 0.29 and 0.63 with an average of 0.47 per locus, and Nei's gene diversity (h) value varied from 0.16 to 0.44 with an average of 0.32. The average number of effective alleles was 1.52, ranging between 1.21 and 1.8. The gene locus *Xgwm 140* showed the highest diversity in the population genetic structure.
Keywords: Genotypes, wheat, SSR, PIC, primers, markers.

Surveillance of huanglongbing disease (Hlb) associated with citrus in North Al-Batinah Governorates

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Abstract
Historically Omani acid lime (OL) has been considered as one of the most important economic crop as their fruits were exported to different countries. Witches' broom disease reported since 1970s on OL caused losses on more than 250,000 trees. Therefore, local production covers only 38% of local market. Huanglongbing (HLB) is one of the most serious diseases reported worldwide: this is a bacterial disease, the causal agent being related to Candidatus Liberibacter genus. This study was conducted to evaluate healthy status of mother citrus trees in citrus gene bank in a research station located in the northern Al-Batinah governorates, as well in acid lime farms. During this study, 188 citrus samples were collected from citrus gene bank and 57 samples collected from OL farms in Willayats; Liwa, Suhar, Shinas and Ibri; and from Aljabal Alakhdar province. DNA were extracted by CTAB method. The A2&J5 primer pair was used to amplify β-operon region, while the OI1/OI2C primer pair allowed to amplify 16s-rDNA gene regions by PCR. Amplified DNA was sequenced and restriction enzyme were used. Results of HLB tests showed that 10 positive samples were collected from citrus gene bank and 17 infections from other locations. Furthermore, analysis results reveal concordance of results obtained using either DNA sequencing or cutting amplified gene region through *Xbal* enzyme as both methods identified infected with *Candidatus Liberibacter asiaticus*. This is the first report of HLB disease in the Tahiti lime, sour and Pineapple Orange in Oman. The report also describes for the first time the occurrence of the disease in A'Dhahirah region.
Keywords: HLB; yellow dragon disease; polymerase chain reaction

The effect of potassium chloride on the germination of rice (Oryza sativa L.) seeds

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Abstract
Rice (*Oryza sativa* L.) germinates in a moist environment with an optimal temperature range of 15°C to 30°C. Rapid germination is often achieved when the seed coat, which can inhibit the permeability of gases and water, is removed. Therefore, due to a limited amount of time to carry out this experiment, brown rice, which has its seed coat (hull) removed, was used. The method of germination was adapted from the wet paper-towel procedure. Changes to the procedure were applied to obtain data specific to this experiment. A clear pattern can be observed when analyzing the trend between concentration of KCl and the percentage rate of germination. The trendline has a negative slope—therefore, it corresponds to a negative correlation between the two variables tested. It can be concluded that as the concentration of potassium chloride (mol dm-3) increases, the rate of germination of rice (%) decreases. The experimental data suggested that as the concentration of KCl exceeds 0.001 mol dm^{-3}, the rate of the successful germination of rice decreased significantly. Furthermore, the seeds were able to germinate efficiently in a solution concentration of 0.001 mol dm^{-3}, which was closest to the control (only water). Therefore, it can be concluded that the "delayed" rate of germination due to increasing KCl concentration was likely caused by chemical toxicity. This could have been due to an excessive amount of Cl^-, which causes salinity stress to seeds. Similarly, excess K^+ hampers the overall growth of a plant.
Keywords: Seed soaking, germination, soaking, chemical toxicity

Using bioengineering approaches to express halophyte genes to improve salt tolerance in tobacco

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Abstract
Salinity is a major concern for the agricultural production sector, which limits agriculture sector. Tobacco (*Nicotiana tabacum*) is widely grown as commercial crop, it is sensitive to moderate resistance to salt stress. Producing salt-resistant tobacco plants, *Agrobacterium tumefaciens*-mediatedtransformation was used to overexpress genes from the halophytes, (SpBADH), (McHKT1), (SsNHX1) and (AhBADH). Transgenic lines were evaluated for expression and salt tolerance. This study shows transgenic tobacco over expressing AhBADH6 and SpBADH5 were more salt-tolerant at germination and seedling than wild-type tobacco.Transgenic survived at 200 mM NaCl, wild-type died after a week of treatment. Overexpression AhBADH6 and SpBADH5 transgenic lines accumulated more chlorophyll and proline as single gene transformants used enhanced osmoregulatory capability, which decreased the toxic impact of Na^+. Salt tolerance was assessed in halophytes at 0, 100, 200, and 300 mM NaCl. Halophyte plants treated with NaCl for 4 weeks to evaluate survival. The plant growth and survival at NaCl concentrations of 0 to 300 mM salt had similar effects on all four species, with no detrimental effects on development. Salt had a substantial effect on all parameters. When compared tountransformed tobacco, transgenic plants carrying salt-tolerant transgenes behaved considerably differently to salt stress. Notably, salt stress had a substantial impact on biomass, plant shoot, and plant root, proline and chlorophyll levels in untreated plants, when compared to wild-type. Compared to the other lines, AhBADH6 and SpBADH5 demonstrated a high degree of salt tolerance throughout the germination and seedling stages. As a result, these two lines might be employed to increase the development of plants grown in saline conditions. In conclusion, halophyte salt tolerance genes have promising potential for improving salt tolerance incrops.
Keywords: Bioengineering, biotechnology, tobacco abiotic stresses

New technology and integrative approaches for identification of plant pathogens

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Abstract
DNA-based technology has proven useful for identifying and diagnosing plant pathogens, including species and subspecies of nematodes that cause plant diseases. Traditionally and in many cases, agarose gel electrophoresis is a method of choice for separation of DNA bands. However, it is a challenging step especially when dealing with the limited amount of starting materials used for loading the gel. This is especially true when comparing amplified bands smaller than 50 bp. The newly introduced Capillary Gel Electrophoresis (CGE) with the capability of running only 1-2 µl of PCR (Polymerase Chain Reaction) product can separate amplicons with a few bp difference in length. The second approach is performing melting curve analysis as an additional step at the end of the real-time PCR cycles. Similar to CGE, the generated results are visualized on the computer monitor, which eliminates the time-consuming process of agarose gel preparation and staining. The third technique is Loop-Mediated Isothermal Amplification (LAMP) which is a PCR-free based amplification of the target DNA of the pathogen. Cocktail reaction prepared in an Eppendorf tube, which, after incubation at a certain temperature, will allow us to interpret the results based on color changes. The third approach is Integrative Analysis, by compiling data derived from microscopy and host preference together with phylogenetic and DNA analysis of more than one molecular marker. This approach will enable us to determine the species identity and accurate diagnosis of the target pathogen, especially those closely related to it, thereby planning an effective control management strategy.
Keywords: Molecular diagnostic, nematodes, PCR, electrophoresis

Innovative process of using a metallophyte, Brassica sp., for the Determination of atmospheric pollution in an urban area

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Abstracts
Studies relating to the field of air and the metrology of atmospheric pollutants have been evolved in synergy. Although the physico-chemical measurement of contaminants was efficient and precise, it was often difficult to translate the observed values into the form of potential risks for living organisms and human health. Due to this reason, the monitoring of atmospheric pollution has been supplemented for several decades by the use of bioindicator organisms similar to metallophytes. In the urban atmosphere, metallic trace elements are released in the form of small particles of different sizes in solid and/or liquid state and can negatively affect ecosystems and human health. In order to monitor the air quality and metal trace element levels in the city of Marrakech, two bioindicators *Otala lactea* (snail) and *Brassica* sp. (plant) were used. Two essential elements (Zn and Cu) and two toxic elements (Pb and Cd) were dosed in the tissues of snails and plants exposed for 4 weeks in 5 stations to different sources of pollution (road, industrial, residential, etc.). The determination of these elements was carried out by ICP-MS after mineralization by acid digestion. The assay results showed that snails and plants accumulated more trace elements in areas with high traffic and industrial activity. Snails accumulated more Cd (0.39 µg/g and 4.48 µg/g), Zn (144.32 µg/g and 216.72 µg/g) and Cu (84.09 µg/g and 156.07 µg/g) from the atmosphere, and plants accumulated more Pb (0.84 µg/g - 9.48 µg/g). *Otala lactea* are micro-concentrators of Pb and macro-concentrators of Cd from the air and can thus be used as bioindicators of atmospheric pollution. In addition, plants of the Brassicaceae family, to which *Brassica* sp. belongs, are confirmed bioindicators of air pollution.
Keywords: Metallic trace elements, biomonitoring, bioindicators, atmosphere

New record of Aphanogmus clavicornis Thomson (Hymenoptera: Ceraphronidae) as a larval parasitoid of tomato leafminer (Tuta absoluta Meyrick) in Syria

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Abstract
Tomato (*Solanum lycopersicum* L.) is an important edible and nutritious fruit regarded by nutritionists as a vegetable. It is an important source of vitamins and significantly contributes to economic development. However, the production of tomatoes is heavily affected by climate change, insect pests, disease and the new devastating pest of tomatoes, the tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). This study included a description of *Aphanogmus clavicornis* Thomson, 1858 (Hymenoptera: Ceraphronoidea), a primary parasitoid of *T. absoluta* whose larvae feed on all parts of the tomato plant. It is the first record of *T. absoluta* as a host of genus *Aphanogmus* worldwide and a first record of *A. clavicornis* in both Syria and the Middle East. Description, biology and the taxonomic characters of the new species were provided. The new record of natural parasitism of *T. absoluta* by *A. clavicornis* would add knowledge on biological control of the pest and could become an additional option for the integrated pest management of those crops where *T. absoluta* is a key pest. It would be interesting to investigate if *A. clavicornis* can be produced in large scale under laboratory conditions and test its potential use as a biological control agent within integrated pest management programs.
Keywords: tomato; *Aphanogmus clavicornis*; *Tuta absoluta*; first record; Syria

Iranian tea (Camellia sinensis) seed powder: As potential pesticide/fertilizer products to improve plant growth

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Abstract
Every year, large amounts of seeds are produced in Iran's tea gardens, which currently have no use. Seed powder is the residue of tea seeds after oiling, which is in the form of a cake or powder. It is 60-70% organic matter and more than 15% protein and contains 12-18% saponin. By turning it into organic fertilizer and other plant products, it is possible to help the gardener's economy and better management of the tea garden. Preliminary research has shown the positive and stimulating effects of tea seed products on some plants. Research has shown that consumption of these products, in addition to increasing plant yield, has fungicidal effects and increases plant resistance to other plant pathogens. This powder has no residual harmful effects and is economical and easy to obtain. It is also used on farms as an organic insecticide and does not harm the growth of plants and their roots. Compared to other poisons, it is safer, more efficient, and more convenient. It also can regulate the concentration of heavy metals, improve plant root growth, control and eliminate pests and diseases, and increase resistance to diseases. Considering that a lot of seeds are produced in tea gardens every year, which have already been used to produce tea seedlings. However, with the development of seedling production by cuttings and the introduction of improved cultivars, these seeds are currently of no use. If it is possible to find an application for them, it will help the gardener's economy, and develop and manage the tea garden better.
Keywords: pesticides, *Camellia sinensis*, plant growth

Anti-insects potentialities of the Algerian saharian plant Euphorbia guyoniana (euphorbiaceae) againt Tribolium castaneum (Coleoptera: tenebrionideae)

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Abstract
Superior plants are a diverse source of potent bioactive agents, some of which have significantly contributed to the successful use of natural products in insect's pest management. In order to evaluate the bio-insecticidal potential of an Algerian desert plant: *Euphorbia guyoniana*, a study was conducted on *Tribolium castaneum*: red flour tribolium. A crude ethanolic extract was prepared and then tested in the laboratory during the adult stage. Five different doses were tested. The results of the phytochemical study showed that the plant is rich mainly in flavonoids, gallic tannins, alkaloids, saponosides and glucosides. The plant does not present anthocyanins, leuco-anthocyanins, catechins, coumarins and iridoids. For the insecticidal activity, the repulsive of the extract at a dose of 700 µg/is low, it is 33.33 ± 23.09%. According to the percentages ranking of McDonald et al. (1970), the extract of this plant is classified in the 2nd class. The extract of this plant proved toxic against the adults of this insect, and the total mortality (100%) was reached 48 h after treatment with the highest dose (700 µg/insect). The LD_{50} obtained at the shortest time (6 hours after treatment) is 169.82 µg/insect. The extract of this plant did not inhibit the AChE activity on the tested adults. The results suggest that this plant does not have a neurotoxic effect on the triboilum. The encouraging results obtained with the extract of this plant suggest the possibility of the use of metabolites of this plant for the formulation of botanical bio-pesticides.

Keywords: *Euphorbia guyoniana, Tribolium castaneum*, toxicity, crude extract.

New Report of Bacillus thuringiensis Var. Tenebrionis infected apricot stem borer larvae Sphenoptera ahia-ahmedi Cobos in northern of Iraq

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Abstract
In this study, morphological, physiological, biochemical and molecular characteristics were used to diagnose a bacterium isolated from the larvae of the apricot stem borer. The results obtained that all morphological, physiological, biochemical characteristics were typical for the B. thuringiensis cry (crystal protein formation) which is toxic to the insect order coleoptera. The confirm the diagnosis, polymerase chain reaction (PCR) technique carried out using specific primers for the crystal formation strain. The results showed a fragment with the expected size of 461 bp corresponding to the cry3 gene.
Keywords: *Bacillus thuringiensis*, apricot, bacterium, PCR

The presence of tobacco whitefly (Bemisia tabaci Gennadius), and onion thrips (Thrips tabaci Lindquist) on different cucumber plant cultivars in the field conditions

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Abstract
The study was conducted to determine the susceptibility of different cucumber cultivars (Jumbo Green, Ghazeer, Nefer and Sahem) to sucking insect pests; onion thrips *Thrips tabaci* Lind, and tobacco whitefly *Bemisia tabaci* Genn., during the 2018 summer season in the experimental fields of College of Agriculture, University of Baghdad, Iraq. The results showed that the infestation of cucumber cultivars with sucking pest's onion thrips *T. tabaci* and tobacco whitefly *B. tabaci* occurred on all cultivars during the entire month of July. The Nefer and Sahem cultivars were more susceptible to high infestation by the adult of whitefly where the average were 5.21 and 5.05 adults per leaf, respectively, compared with the cultivars of Ghazeer and Jumbo Green where the average were 4.06 and 4.02 adults per leaf, respectively. At the same time, the nymph average of whitefly was 55.80 and 55.20 nymphs per leaf on Ghazeer and Jumbo Green, respectively, followed by Sahem and Nefer cultivars, which were 47.80 and 38.10, respectively. The average of thrips nymphs were recorded on all cultivars, which were 4.52, 3.57, 3.06 and 2.96 nymphs per leaf on Sahem, Nefer, Ghazeer and Jumbo Green, respectively. During July and early August, the green lacewing, parasitoids, and coccinellids were found to be linked with whitefly and thrips pests on all cultivars. In the field trail, no significant differences between oxamthrine and biotrin pesticides compared to eucalyptus extract treatment to control whiteflies and thrips.
Keywords: Whitefly, thrips, mortality, onion, cucumber

Yield losses and economic impact of Pseudococcus viburni (Hemiptera: Pseudococcidae) on Iranian tea (Camellia sinensis): a case study

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Abstract
The tea mealy bug, *Pseudococcus viburni* Signoret (Hemiptera: Pseudococcidae) causes significant reduction of crop yield and it is considered as one of the most important tea pests in northern Iran. In recent years, the population of *P. viburni* increased because of favorable weather conditions, established on tea buds, lateral leaves and other vegetative parts and imposed damages in the form of yellowing of leaves and weakness. The growth of bushes stopped and estensive leave fall occurred. Because of economic importance of tea in Gilan and Mazandaran provinces, it is necessary to reduce the damages in a safe way. Therefore, a plot of garden with an area of five hectares was selected in Korfistan village of Rudsar city to investigate the effect of tea mealybug damage on the yield of green tea leaves. In 2021, the intensity of infection was about 45%. The yield of green leaves decreased from 43,818 kg to 24,382 kg by 44.36% losses when no control measure was taken. Once the control operation using summer oil was done after the first round harvest, the yield of green leaves in the second harvest increased from 29212 kg to 36573 kg, equivalent to 25.2%. The total yield of green leaves decreased from 73030 kg to 60955 kg in two subsequent years, respectively. Failure to comply with garden management or delay in control operations caused a 16.5 percent decrease in green leaf yield in 2021 compared to 2020. Among the control methods, the use of safe methods is of great importance in the production of healthy tea, because the direct use of tea leaves by humans as a daily drink.
Keywords: *Pseudococcus viburni*, tea green leave, summer oil, damage

Status of present and expected future spread of agricultural pests and their management in relation to climate changes

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Abstract
Climate change is correlated with impacts on biodiversity and the productivity of agricultural crops and spread of pests. Well-documented examples include the red palm weevil *Rhychophorus ferrugineus* which is widely spreading in most date palm growing countries. The spread of some pests such as, the Mexican black scale, *Saissetia miranda* was recorded for the first time on fig trees in Iraq. The green pit scale insect, *Palmapsis phoenicis* causes serious damage to palm trees and production in Sudan and Lebia. The unusually warm winter may assist the establishment of invasive pests, such as the fall armyworm *Spodoptera frugiperda* which feeds on wide range of crops, and Tephritid fruit flies. The desert locust are expected to change their migratory routes and geographical distribution. The bacterial disease on olive caused by *Xylella fastidiosa* have become endemic. The Bayoud disease caused by the fungus (*Fusarium oxysporum f. sp. Albedinis* is a limiting factor for palm cultivation in North Africa. The increase of rainfall will lead to an increase in the spread of fungal diseases such as the palm flower rot caused by the fungus *Mauginiella scaettae*. Drought and shortages in freshwater along with increase in salinity and desertification resulted in big decline in suitable areas for cultivation. These factors present serious challenges that require urgent worldwide cooperative action. Successful results of Integrated Management were well documented in different Arab countries. However more efforts are still needed to deal with the ongoing and rising challenges.
Keywords: Agriculture pests, climatic changes, IPM, RPW.

Grasshoppers and locusts species as agricultural pests in Constantine region, Eastern Algeria

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ABSTRACT
The Constantine region is located in the semi-arid bioclimatic stage. Different crops are grown in this region mainly; Cereals (wheat, barley and oats), vegetables (tomato, potato and bean), and fruit trees (apple, pepper and peach). The locust and grasshoppers fauna in this region totals the presence of 43 species. They are divided into five families and eleven sub-families. The species *Ocneridia volximii*, *Praephippigera pachygaster*, *Dociostaurus marocanus*, *Aiolopus thalassinus thalassinus*, *Calliptamus barbarus barbarus* and *Gryllus sp* are species harmful to cereals. *Anacridium egyptium* is reported as important pests of fruit trees. *Thalpomena algeriana* and *Praephippigera pachygaster* species are observed on several vegetables. They can reach the status of potential pests in the region of Constantine if the climatic conditions favor their development.
Keywords: Locusts, grasshoppers, Constantine, cereals, vegetables, pests

Assessment of effective pesticides against tephritid fruit flies (Diptera: Tephritidae) and their increasing invasion potential of in temperate regions of Pakistan

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Abstract
Fruit Flies (Diptera: Tephritidae) are insect pest with great potential of invasion to new host plants in diverse climatic conditions. This pest is invasive in temperate region of Azad Jammu & Kashmir (AJ&K) Pakistan transported via fruits and vegetables of Punjab and Khyber Pakhtunkhawa (KPK) markets. During the current study diversity and distribution of fruit flies along with altitudinal gradient, phylogenetic analysis, their host range and efficacy of various pesticides for its control has been assessed. A total of eleven species of fruit flies *Bactrocera diversa*, *B. scutellaris*, *B. tau*, *B. cucurbitae*, *B. dorsalis*, *B. nigrofemoralis*, *B.zonata*, *B. correcta*, *Dacus ciliatus*, *D. longicornis* and *D. sphaeroidalis* under two genera Bactrocera and Dacus of family Tephritidae were recorded, among which *Bactrocera diversa* and *Dcaus ciliatus* were new records to this area. Species host range, richness evenness and abundance trend was recorded along with altitudinal gradient of selected localities. The susceptibilities of *B. diversa* to different insecticides were evaluated using micro-drop method and mortality was checked after 3, 6, 8 and 24h of exposure. Overall results showed that Cypermethrin is most effective to kill 50% of both larval and adult stage. This study is a baseline for the implementation of future control strategies.
Keywords: Tephritid fruit flies (diptera: Tephritidae), pesticies

Comparing the effects of different types of pesticides on plant growth

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Abstract
Pesticides are chemicals that help protect plants from any external damage caused by insects or parasitic weeds. The research aims to compare different effects of pesticides on plant protection. A quantitative research methodology is used in this research. An experiment was conducted using different types of pesticide that have been tested separately for a given time period. Afterwards, data from each experiment was recorded. It has been shown that each type of pesticide serves a distinct purpose. The results obtained prove that the usage of pesticides has a positive effect on plant growth, which prevents parasites and pests from invading the plant. Pesticides can promote healthy plant growth and many other positive outcomes. Despite this, it has an impact on the surrounding environment and has the potential to contaminate the soil. Recommendations are made for future research to improve plant protection from external damage via the use of organic pesticides.
Keywords: Pesticides, quantitative, weeds, crop system

Management of damping-off disease of chili caused by Pythium aphanidermatum using synthetic chemicals

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Abstract

Chili (*Capsicum annum* L.) is very valuable crop all over the world as well as Pakistan. It is commonly cultivated in subtropics and temperate regions. Damping off disease in chili caused by *Pythium aphanidermatum* is responsible for a potentially serious threat towards seedling mortality in both nurseries and field crop. The present study was designed to determine the pathogen of damping-off of chili and its management through chemicals *in vitro*. For this purpose, the pathogen was isolated from samples shown typical symptoms of damping-off on PDA media, purified and identified on the basis of morphological characteristics. To fulfill the Koch's postulate pathogenicity test was conducted. For the management of Damping-off disease of chili an experiment was designed where six fungicides were used i.e Contaf plus, Flint max, Score, Ellectus super, Fossil, Topsin M with three different concentrations (100, 150 and 200 ppm). to check their efficiency against isolated pathogen by using Poisoned food technique. Result showed that all the chemicals has excellent inhibition effect on growth of *P. aphanidermatum* at different levels, where Ellectus super expressed the best results to inhibit fungal growth (4.11mm) at 200 ppm concentration followed by Flint max (5.11mm) and Score (6.66 mm).

Keywords: Contaf plus, Flint max, Score, Ellectus super, Fossil, Topsin M

Integrated Pest and Disease Management
Tomato blight management with organic soil biochar amendment

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Abstract
Sustainable agriculture deals with the efficient use of resources for the benefit of human and its environment. By this way we can fulfill the requirement of food, feed and fiber efficiently. Application of heavy doses of chemicals like fertilizers or pesticides are not suitable for sustainable agriculture. Biochar usage represents an alternative way to control diseases and to enhance plant growth. This study focuses on the effective use of different concentrations of biochar and composts to promote the growth of plant biomass and nutrients availability like N, P and K in the presence and absence of *Alternaria solani*. Two types of biochars (wood biochar and green waste bochar in 3% and 6%, concentrations) and compost were used as a soil amendment. All different biochar concentrations significantly influenced plant biomass and disease reduction. Among the 6% wood biochar amended soil treatment was found more effective in above and below ground plant biomass development. Under stress condition nitrogen and phosphorus contents were increased in tomato. It was observed that nitrogen content increased by 12.44% and phosphorus content increased by 55.17%. Disease incidence was 90% in tomato plants when they were grown in soil and it was reduced to 40% when they were grown in 6% Green waste Biochar amended soil. Moreover, it was observed that disease severity was reduced to 47% in 6% Wood Biochar amended soil. In conclusion, biochar has positive impact in reduction of early blight in tomato by reducing the incidence of disease and enhancing the plant growth parameters.
Keywords: *Alternaria solani*, biocontrol, carbon sequestration, organic waste

The effects of some Beauveria bassiana isolates and their secondary metabolites on the tea mealy bug, Pseudococcus viburni Sigornet (Hemiptera: Pseudococcidae)

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Abstract
The effects of *Beauveria bassiana* isolates collected from rice fields of Amol (AM-118) and orchards of Tehran (BB3) were investigated on the tea mealybug, *Pseudococcus viburni*. In the study, both conidial exposure and biochemical experiments were adopted to fully understand pathogenicity. The LC50 concentrations of BB3 and Am-118 isolates were determined 2×10^3 and 18×10^5 spore/ml against third nymphal instars while the LT50 values were recorded 3.66 and 6.63 days, respectively. The higher activity of endochitinase in AM-118 was recorded in comparison of the higher activity of exochitinase in BB3. Moreover, the higher activities of fungal proteases namely Pr1 and Pr2 were recorded in AM-118 and BB3, respectively. The secondary metabolite extracted from AM-118 showed the LC_{10}, LC_{30} and LC_{50} values of 0.716, 1.578 and 2.727% while those for BB3 were recorded as 0.333, 0.873 and 1.704%, respectively. The LC_{30} concentration of each isolate led to significant increase duration of egg incubation, nymphal stages and survival of adults. Secondary metabolite of BB3 decreased the activity of ALT after 24 and 48 hrs, AST after 24 h while it increases GGT activity. Similar results were observed in case of acid- and alkaline phosphatases as well as LDH. Secondary metabolites increased the activity of esterase using a-naphthyl and B-naphthyl acetate and GST using CDNB and DCNB after both time intervals. Finally, a formulation of wettable powder of BB3 was prepared with the persistence of 7 days. The formulation caused nymphal mortality 3 days after exposure.
Keywords: Native isolate, *Beauveria bassiana*, *Pseudococcus viburni*, Virulence

Use of a potential probiotic strain as a fermentation starter for the Tunisian olive variety 'Meski'

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Abstract
More than fifty lactic acid bacteria strains were isolated from the brine and the flesh of Tunisian olive varieties submitted to different processes. The isolates were tested for their morphological, physiological and probiotic properties. A potential probiotic strain was then selected to be inoculated as a starter culture during a fermentation process. The olive variety Meski was treated according to the Spanish style. Two trials were attempted: a spontaneous fermentation and a controlled one, and the brines were about 10% (w/v) NaCl. During the days of the fermentation processes conducted, brines and olive samples were analyzed for physicochemical and microbiological parameters. Polyphenols content and antioxidant activities were determined for olives for each trial and in different stages of the process. The population dynamics showed that lactic (acid?) bacteria dominated in the inoculated fermentation reaching 108 UFC/mL on the day 12, coliforms disappeared by the 19th day. Total phenolic content in the olives and the antioxidant activity was higher in the controlled fermentation than in the spontaneous one. Use of selected starters in olive fermentation processes could be a solution for local food producers to provide not only safe artisanal foods but also products of high quality.
Keywords: Table olives, process, lactic acid bacteria, starter, antioxidant activities.

Semiochemical-based strategies as a promising tool for conservation biological control agents

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Abstract
Biological control is an important component of integrated pest management (IPM) that is based on the use of natural enemies, such as predators, parasitoids, and pathogens, to reduce or mitigate the pest populations. In this context, the knowledge of the chemical ecology of natural enemies, herbivores, and host plants is important in the development of an effective IPM program. Moreover, due to the expansion of agricultural fields, landscapes, and habitats, implementing conservation biological control may be necessary to enhance the ecological services provided by natural enemies. The manipulation of the behavior of predators and parasitoids through the use of stimuli that increase their presence in the fields can lead to an improvement in their performance to achieve conservation biological control. Recently, the development of semio-chemical based tools has increased greatly, as they are considered effective for manipulating insect behavior with the objective of enhancing the biological control against herbivores. Therefore, the use of semiochemicals that attract the parasitoid and predators in the proximity of the source can enhance the biological control level to protect the crop.
Keywords: kairomone, pheromones, IPM, parasitoids, predators

Investigation on the Effect of CMC film including thyme essence in packaging for increasing shelf life and postharvest quality of cherry fruit

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Abstract
The aim of this study was to investigate the effect of essence treatments of Thymus L. and carboxymethyl cellulose coating to increase the shelf life and improvement in the quality and organoleptic properties of postharvest cherries (*Prunus avium* L.). The study was laid out in a completely randomized design, with three replications. The effect of carboxymethyl cellulose coating (205 and 305 thickness) and essence treatments of Thymus L. (2 and 4%) alone and in combination was investigated in weekly basis for 3 weeks. Various factors such as the percentage of decay, total soluble solids (TSS%), the reaction juice pH, Vit C, Anthocyanins, Phenols, Antioxidants, percentage weight loss and organoleptic properties of the fruit were measured. The results showed that the effect of essence treatments of Thymus L. and carboxymethyl cellulose coating on TSS%, percentage weight loss, fruit percentage of decay, Vit C, Anthocyanins, Phenols and organoleptic properties fruit were significant at the 1% level. Also, the results showed that the effect of storage duration on fruit percentage of decay, TSS%, Anthocyanins, Phenols, Antioxidants and organoleptic properties of the fruit were significant at the 1% level. Means comparison showed that the carboxymethyl cellulose coating at (305) and essence treatments of Thymus L. (4%) compared to the control increased the TSS%, pH, organoleptic properties of the fruit and decreased the decay percentage. Based on these results, application of carboxymethyl cellulose coating at (305) and essence treatments of Thymus L. (4%) for shelf life improvement of cherries is recommended.
Keywords: Carboxymethyl cellulose, cherries, decay, Thymus L., shelf life.

Nano-emulsified clove oil on fumigant toxicity and as pulse protectant against stored product pest, Callosobruchus maculatus

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Abstract
The cowpea weevil, *Callosobruchus maculatus* Fabr. (Coleoptera: Bruchidae), is a major pest of leguminous grains and other pulse grains in tropical and subtropical countries. Prevention of food losses during postharvest storage without creating environmental problems is therefore of paramount economic importance. Hence, alternative bioinsecticide management of stored product is needed for environmentally sound post-harvest storage. Micro-and nanoemulsions have been intensively investigated due to the easiness of preparation, namely through high-pressure homogenization, microfluidization or ultrasound-assisted processes that can be scaled-up, allowing to potentiate their applicability in several fields. Our findings demonstrated the applicability and efficacy of nanoemulsified essential oil clove, *Syzygium aromaticum* L., in the management of *C. maculatus*. Application at the rate of 20, 40, 60, 80 and 100 ppm of oil and its emulsified concentrations determined significantly lower infestation rates on cowpea (*Vigna unguiculata*). A good fumigant toxicity and reduced population buildup of the beetle and could be achieved. The nano-emulsified concentrates considerably reduced oviposition, increased the adult mortality, presented a good fumigant toxicity and reduced population buildup of the beetle.
Keywords: *Callosobruchus maculatus*, nanoemulsion, esstential oil, pulse protectant, fumigant toxicity

Develop a low cost simple attractants food lure for fruit fly (Bactrocera zonata Saundres)

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Abstract
The fruit fly, *Bactrocera zonata* (Saundres) is a globally dangerous insect pest for most fruit trees. Among the various alternative strategies for managing *B. zonata*, using methyl eugenol traps is the most outstanding alternative. The present study aimed to reach and evaluate a simple and low-cost attractant food lure using different combinations of food odor attractants mixed with para-pheromone methyl eugenol to attract *B. zonata*. Different ratios from food-based synthetic attractants, named as protein hydrolysate, torula yeast, bread yeast, apple vinegar, ammonium acetate, ammonium sulfate, sodium tetraborate, were mixed with different ratios of the para-pheromone methyl eugenol 99%. Eleven treatments were chosen to be evaluated under field conditions represents three orchards for three weeks, each orchard was considered as a replicate. The combination of methyl eugenol (1 ml) + apple vinegar (15 mL) + torula yeast (3.6 g) + water (235 mL) + sodium tetraborate (5 g) were significantly the highest attractive combinations compared with the other treatment (1897.3 flies/ trap). Furthermore, there were addition four promising combinations of food odour attractants, which had no significant differences in flies captured (1596.3, 1130.5, 1440, and 1388.7 fruit flies/ trap), respectively. These findings have opened a new avenue in increasing the efficiency of traps by choosing the most attractive food-based lure formula, which can be adopted by farmers for mass trapping as a main component in the integrated pest management program.
Keywords: *Bactrocera zonata*, methyl eugenol, para-pheromone, attractants, fruit fly

Effect of Aqueous extract of hanzal (Citrullus colocynthis (L.)) Senemeka (Senna alexandrina Mill) and Ummjelajel (Aristolochia bracteolate L.) on the leaf miners (Liriomyza spp.) on the Snake Melon Crop

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Abstract
Due to ecological imbalance and hazards caused by insecticides use, plant products or plant extracts were suitable alternative to pesticides. This study was conducted to evaluate the effect of water extracts of Hanzal (*Citrullus colocynthis* (L.)), Ummjelajel (*Aristolochia bracteolate* L.) and Sennameka (*Senna alexandrina* Mill) on vegetable leaf miners (*Liriomyza spp*.) infesting snake melon. Randomize Complete Block Design (RCBD) with 4 treatments and 4 replications were used. Snake melon plots were sprayed weekly with water extracts of Hanzal, Sennameka and Ummjelajel at 10% concentration (w/v) and control was sprayed by water with molasses and gum Arabic. The infestation percentage on leaves and mean number of active mines were counted twice weekly. The aqueous extracts of Hanzal, Sannemeka and Ummjelajel reduced the infestation and number of active mines significantly compared to control. No significant differences between Hanzal, Sannameka and Ummjelajel. Hanzal had lower mean percentage leaf infestation followed by Sannameka and Ummjelajel (season one). Hanzal recorded lower number of active mines in season two followed by Sannemeka. Also Hanzal recorded the least number of active mines than Sannameka, season two. This study uggesttd recommended to use Hanzal at 10% w/v for control of leaf miner species on snake melon crop.
Keywords: Aqueous extract, *Citrullus colocynthis*, senemeka, ummjelajel, snake melon.

Compost Produced from the Leachate of the Landfill and Alkaline Lime Sludge for Soil Amendment and Plant Protection

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Abstract
In addition to its role as an organic amendment, compost can play a role in plant protection. Due to the high water content and the landfill option in several Arab countries without upstream sorting, household waste generates large quantities of leachate that pose problems. The transformation of this leachate into compost using alkaline lime sludge and the green constitutes a new solution. Two barrels were filled with 100 l of leachate: the lime sludge was added to barrel 2 while barrel 1 was the control. After 24 hours, the green waste was added to the 2 barrels. After homogenization, the contents of the two barrels were dumped to form 2 windrows which were followed for 90 days. The contact time of 24 h allowed reducing the load of faecal streptococci, by 85.7% and the bad odors disappear within the first 3 days. The temperature had shown an increase from the first week: 58.5 °C for the windrow with sludge and 56.6 °C for the control; Humidity was kept around 50-60% by regular watering. The degradation of organic matter is better in the presence of lime sludge (31%). Despite the alkaline nature of the lime sludge, the pH of the final compost remains acceptable for many plants. Within particular 38% DS of organic matter, the final quality of the compost complies with NFU44-051; no toxicity was observed; the final compost could therefore be used as an organic amendment for palm grove as well as for the rehabilitation of degraded sites in Arabic countries.
Keywords: Leachate, green waste, lime sludge, compost, palm groves.