Muhammad Nawaz Shareef
University of Agriculture
Multan

# Smart Plant Protection

## 4th International Conference

**Oct 30-31, 2024**

**Institute of Plant Protection**
**MNS University of Agriculture, Multan**

# 4th International Conference on Smart Plant Protection

October 30-31, 2024

Institute of Plant Protection

Muhammad Nawaz Shareef University of Agriculture,
Multan, Pakistan

INTRODUCTION TO

# Institute of PLANT PROTECTION

The foundation of teaching and research in Entomology and Plant Pathology in Southern Punjab was laid with the establishment of the MNS-University of Agriculture Multan in 2012. Based on Plant Pathology, Entomology and Weed Science, Institute of Plant Protection (IPP) was established in 2019. We owe to our distinction, the dedication to excellence in research and teaching, therefore attracting many students at undergraduate as well as postgraduate and doctoral levels. The main thrust of IPP is the application of plant protection measures and techniques in identification, characterization of newly emerging and reemerging pests and to devise their management strategies for food security. The Institute has inherited ties with local research institutes like CCRI, CRS, MRI, AMRI, Agri. Extension, Pest Warning and Quality Control of Pesticides etc. These links will pave the path in grooming the students at the Institute in a professional and practical way. Several research projects have been submitted to renowned funding agencies of National and International like USAID, Higher Education Commission (HEC), Pakistan Science Foundation, Pakistan Agriculture Research Board (PARB), International Foundation for Science (IFS), ACIAR and JICA. Moreover, five research projects have been funded by PARB, HEC and IFS on Cotton Whitefly and Pink bollworm, Mango Fruit and Shoot Borer and Mango Fruit Fly, and viruses of onion, garlic, and cucurbits respectively. Currently, active programs are B. Sc. (Hons.) Agriculture (Entomology & Plant Pathology), M. Sc. (Hons.) Entomology, M. Sc. (Hons.) Plant Pathology, Ph. D Entomology and Ph. D Plant Pathology.


Developing an integrated system of research and outreach for plant protection.

Mission of Institute of Plant Protection

Uplifting the agricultural community through enhancing agricultural productivity by minimizing losses caused by insect pest complex and diseases using modern and environmentally friendly measures, stabilizing the natural ecosystem.


**Goals of Institute of Plant Protection**

- Development of human resources equipped with modern innovative technologies to manage and control insect pests and disease-causing organisms.
- Introducing eco-friendly approaches for effective management of biotic stresses.
- Offer diagnostic services to public and private sector organizations and farming communities.
- Ensuring sustainability of the natural agro-ecosystem promoting biological control of insect-pest complexes and diseases.


# BACKGROUND OF SMART PLANT PROTECTION

Everyday a plant faces plenty of challenges of biotic factors including insect pests, diseases, competition of weeds and several abiotic stresses. Smart Plant Protection is critical to secure and maintain crop productivity. Pesticide-dominated control strategies are threatened by the widespread evolution of resistance in many major crop pests, whilst regulation to limit the unintended environmental and human health impacts of pesticides is reducing control options therefore there is an urgent need for innovation in crop protection.

The Smart Plant Protection conference is designed to address these challenges by bringing the latest technology to bear on improved detection, monitoring, prediction, and control of biotic threats. We focus on understanding the mechanisms, genetics, ecology, evolution, and management of crop-pest interactions. The SPP platform would highlight the need for crop protection strategies that enable more targeted interventions, using a systems-based approach that integrates chemical, genetic and agroecological approaches. The participants would develop a vision to reduce pesticide use, limit evolution of pesticide resistance and to design integrated and evidence-based approaches that deliver innovation in crop protection, limit unintended negative environmental impacts and secure the long-term productivity of agroecosystems.

# THE CONFERENCE AIMS AND OBJECTIVES

The International Conference will provide insight into innovations and advances in Plant Protection, aiming to protect the plant resources from the invasion and infestation of insect pests, plant pathogens and weeds. The conference would provide a collection of innovative ideas and recent research undergone by students, academia and industrialists, world over. A pool of thought-provoking opportunities would enable networking and provide opportunities for collaborations and alliances on plant protection; stimulate and facilitate discussions and dialogues between stakeholders like scientists, researchers and practitioners including policy makers, business, civil society, and farmers.

# CONFERENCE THEMES

1. INSECT PEST MANAGEMENT
    1. IPM - Integrated Pest Management
    2. Migratory Pests and Biosecurity
    3. Pesticide application and Management
    4. Biopesticides/Microbial/Natural pesticides
    5. Biodiversity of pests
    6. Conservation of beneficial insects
    7. Innovative techniques in Plant protection
    8. Climate change and insect pest management
    9. Resistance
2. PLANT DISEASE DIAGNOSTICS AND MANAGEMENT
    1. Innovative techniques
    2. Population's genetics
    3. Induced Plant Immunity
    4. Invasive and Emerging Plant Diseases under changing climate
    5. Plant-microbe interactions
    6. Recent trends in Plant Disease Management
    7. Role of Plant Pathology in Global Economy
    8. Disease modeling
    9. Resistant sources
    10. Postharvest pest management
3. WEEDS MANAGEMENT
    1. Weeds as risk to food security
    2. Alien invasive weeds
    3. Weeds role in conserving pathogen and insects
    4. Weedicide Resistance
    5. Allelopathic weeds
4. BIOTECHNOLOGY FOR PLANT PROTECTION
    1. Biotechnological tools for pest management
    2. Endophytes and plant protection
    3. Genome editing
    4. Innovative approaches for plant protection
5. REGENERATIVE AGRICULTURE
    1. Resource management
    2. Alleviating climate change
    3. Nutrient cycling
    4. Water Quality
6. ARTIFICIAL INTELLIGENCE IN AGRICULTURE
    1. AI based pest detection and monitoring
    2. AI in resource management
    3. AI based disease monitoring

# SESSION CHAIRS

Dr. Ghulam Ali
Campus Director, Air University Multan

Prof. Dr. Abdur Rehman Bhatti
Chairman, Department of Plant Pathology, UAF

Dr. Naveed Malghani
Professor and Chairman Department of Plant Pathology, IUB

# ORGANIZERS

Patrons

| | | |
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| Prof. Dr. Ishtiaq A. Rajwana | Vice Chancellor | Patron in Chief |
| Prof. Dr. Shafqat Saeed | Dean FA&ES | Patron |

Core Organizing Committee

| | | |
|---|---|---|
| Prof. Dr. Muhammad Ashfaq | Director IPP | Convener |
| Prof. Dr. Shafqat Saeed | Dean FA&ES | |
| Dr. Unsar Naeem-Ullah | Associate Professor | |
| Dr. Rana Binyamin | Associate Professor | |
| Dr. Akhtar Hameed | Assistant Professor | |
| Dr. Farrukh Baig | Assistant Professor | |
| Dr. Mirza Abdul Qayyum | Associate Professor | Secretary |

Industrial Partner Lead:

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|---|---|
| Mr. Ghulam Farid | CEO RiseAG |
| Mr. Asif Majeed | CEO Evyol Group of Companies |
| Mr. Altaf Sarwar | Technical Manager, Allahdin Group |

Communication and Media coverage Committee:

Responsibilities: Invitation of national and international participants and dissemination of information for wider reach to public. Designing of Publishing material (brochures, invitation cards, folders, and other relevant material)

| | | |
|---|---|---|
| Dr. Unsar Naeem-Ullah | Associate Professor | Convener |
| Dr. Rana Binyamin | Associate Professor | |
| Dr. Amar Matloob | Associate Professor | |
| Dr. Abdul Razzaq | Director, IT | |
| Dr. Muhammad Ishtiaq | Assistant Professor | |
| Dr. Hasan Riaz | Assistant Professor | |
| Dr. Akhtar Hameed | Assistant Professor | |
| Dr. Fawad Zafar Ahmad Khan | Assistant Professor | |
| Mr. Mahr Riaz Ahmad | Deputy Registrar | |
| Dr. Mirza Abdul Qayyum | Associate Professor | Secretary |

Venue management and discipline Committee

Responsibilities: To keep the venue prepared for the event, maintain the discipline, arrange souvenirs and other necessary items.

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|---|---|---|
| Dr. Hasan Riaz | Assistant Professor | Convener |
| Dr. Mudssar Ali | Assistant Professor | |
| Dr. Asif Farooq | Assistant Professor | |
| Dr Mirza Abid Mehmood | Director Student Affairs | |
| Dr. Akhtar Hameed | Assistant Professor | Secretary |

Registration Committee:

Responsibilities: Registration of national and international participants, designing, printing and issuance of certificates and bags.

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|---|---|---|
| Dr. Nadeem Ahmed | Assistant Professor | Convener |
| Dr. Nadir Naqqash | Assistant Professor | |

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|---|---|---|
| Ms. Hafiza Tahira Gul | Lecturer | |
| Dr. Arslan Khan | Lecturer | Secretary |

Technical Session & Peer Review Committee:
Responsibilities: To arrange tools (software and hardware) and facilitate for online activity on the day of conference. To review the technical material (Abstracts etc.) for conference and design and print the Abstract Books.

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|---|---|---|
| Prof. Dr. Shafqat Saeed | Dean FAES | Convener |
| Prof. Dr. Muhammad Ashfaq | Director, IPP | |
| Dr. Unsar Naeem-Ullah | Associate Professor | |
| Dr. Mirza Abdul Qayyum | Associate Professor | |
| Dr. Rana Binyamin | Associate Professor | |
| Dr. Amar Matloob | Associate Professor | |
| Dr. M. Ishtiaq | Assistant Professor | |
| Dr. Hasan Riaz | Assistant Professor | |
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| Dr. Nadir Naqqash | Assistant Professor | |
| Dr. Akhtar Hameed | Assistant Professor | |
| Dr. Farrukh Baig | Assistant Professor | |
| Ms. Hafiza Tahira Gul | Lecturer | |
| Dr. M. Arslan Khan | Lecturer | |
| Dr. Naeem Iqbal | Assistant Professor | Secretary |

Fundraising and Purchase Committee:
Responsibilities: Arrange the funding and purchase different items for the Conference.

| | | |
|---|---|---|
| Dr. Unsar Naeem Ullah | Associate Professor | Convener |
| Dr. Mirza Abdul Qayyum | Associate Professor | |
| Dr. Naeem Iqbal | Assistant Professor | |
| Dr. Hasan Riaz | Assistant Professor | |
| Mr. Azeem Afzaal | Deputy Director Procurement | |
| Dr. Muhammad Ishtiaq | Assistant Professor | Secretary |

Report/Documentation Committee:
Responsibilities: Documentation/Report writing for the conference

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|---|---|---|
| Prof. Dr. Muhammad Ashfaq | Director, IPP | Convener |
| Dr. M. Nadir Naqqash | Assistant Professor | |
| Dr. Akhtar Hameed | Assistant Professor | |
| Dr. Farrukh Baig | Assistant Professor | |
| Mr. Asif Mehmood | Lecturer | Secretary |

Accommodation and Transportation Committee:
Responsibilities: Documentation/Report writing for the conference

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|---|---|---|
| Dr. Rana Binyamin | Associate Professor | Convener |
| Dr. Mirza Abdul Qayyum | Associate Professor | |
| Dr. Muhammad Wazir | Estate Officer | |
| Dr. Plosha Khanum | Superintendent JC | |
| Ms. Hafiza Tahira Gul | Lecturer | |
| Dr. Farrukh Baig | Assistant Professor | Secretary |

Food Committee

Responsibilities: Arrange meals for the participants

| | | |
|---|---|---|
| Dr. Unsar Naeem-Ullah | Associate Professor | Convener |
| Dr. Farrukh Baig | Assistant Professor | |
| Ms. Hafiza Tahira Gul | Lecturer | |
| Dr. Asif Farooq | Assistant Professor | Secretary |

Cultural Night Committee

Responsibilities: Organizing a cultural event for entertainment of the participants

| | | |
|---|---|---|
| Dr. Unsar Naeem-Ullah | Associate Professor | Convener |
| Dr. Mirza Abdul Qayyum | Associate Professor | |
| Dr. Usman Jamshed | Senior Tutor | |
| Dr. Akhtar Hameed | Assistant Professor | Secretary |

Poster Committee

Responsibilities: collecting and displaying the posters and talks of the participants

| | | |
|---|---|---|
| Dr. Unsar Naeem-Ullah | Associate Professor | Convener |
| Dr. Fawad Zafar A. Khan | Assistant Professor | |
| Dr. Asif Farooq | Assistant Professor | |
| Mr. Asif Mehmood | Lecturer | |
| Dr. Akhtar Hameed | Assistant Professor | Secretary |

Cleanliness and Disposal Committee

Responsibilities: To maintain and conducive environment, clean the venue and disposal off.

| | | |
|---|---|---|
| Dr. Mudssar Ali | Assistant Professor | Convener |
| Dr. Nadir Naqqash | Assistant Professor | Secretary |

Business Session Committee:

Responsibilities: To conduct a discussion session between Industry, Department of Plant Protection, Academia and farmers.

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|---|---|---|
| Dr. Muhammad Ishtiaq | Assistant Professor | Convener |
| Dr. Naeem Iqbal | Assistant Professor | Secretary |

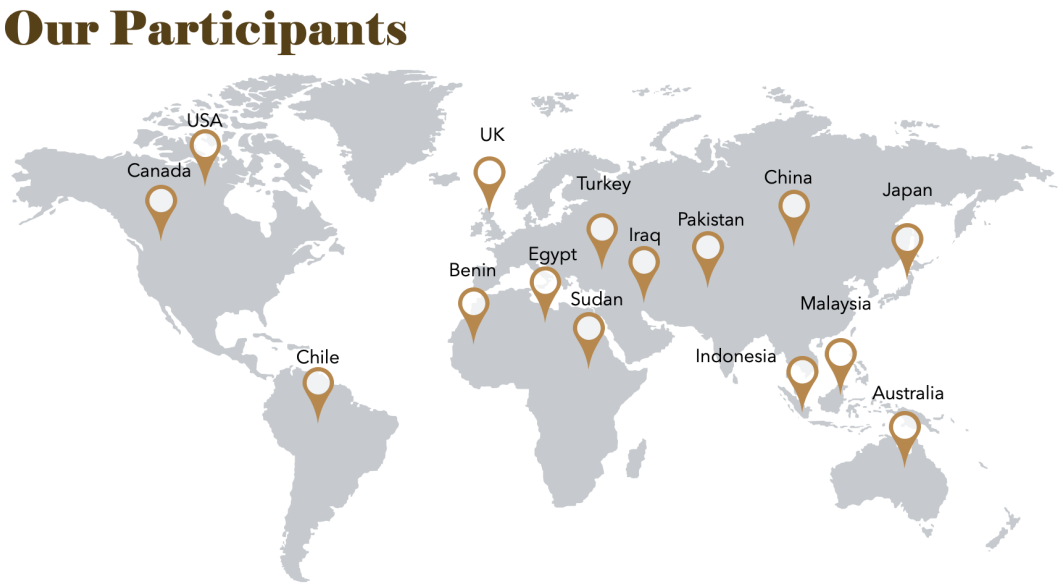
Follow up Committee:

Responsibilities: Weekly follow up of the tasks assigned to concerned committees

| | | |
|---|---|---|
| Prof. Dr. Muhammad Ashfaq | Professor IPP | Convener |
| Dr. Farrukh Baig | Assistant Professor | Secretary |

# CONFERENCE PARTICIPANTS

Participants from 15 different countries i.e. Australia, Oman, Benin, Canada, Chile, China, Egypt, England, Indonesia, Iraq, Japan, Malaysia, Pakistan, Sudan, Turkey, United States of America graced the event physically or online. Organizing Committee of the SPP-2024 is thankful to all the friends for supporting the success of the conference since 2021.



# ACKNOWLEDGMENT TO RISE AG, PAKISTAN

The outstanding contribution of the RISE AG Pesticide Group has been instrumental in the success of the Smart Plant Protection Conference. Since the conference's inception in 2021, RISE AG, under the visionary leadership of its CEO, Mr. Ghulam Farid, has been the premier partner of this event, consistently demonstrating unwavering commitment to advancing scientific innovation in plant protection.

RISE AG's dedication to sustainable agricultural practices and cutting-edge pesticide technologies has enriched the conference's discussions and outcomes. Their invaluable support has enabled the participation of leading experts, facilitated knowledge-sharing platforms, and fostered collaborative solutions addressing global plant protection challenges.

We extend our heartfelt gratitude to Mr. Ghulam Farid and the entire RISE AG team for their ongoing partnership and vision in making the Smart Plant Protection Conference a world-class scientific gathering. Their contributions resonate with the event's mission to promote sustainable and innovative practices in agriculture.

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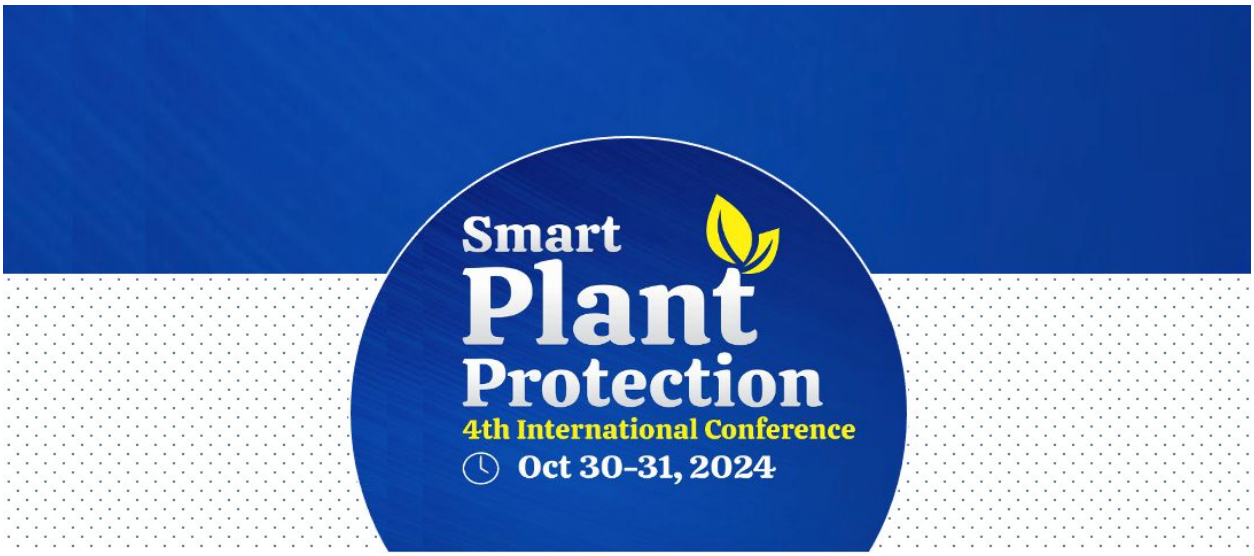


# THEME-1:
## INSECT PEST MANAGEMENT

THEME-1: INSECT PEST MANAGEMENT

SPP-IPM-101

Synergetic effect of plant derivates and its combination with entomopathogens for the sustainable management of red flour beetle, *Tribolium castaneum* (Coleoptera: Tenebrionidae)

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ABSTRACT

BACKGROUND: Red flour beetle (*Tribolium castaneum*) is secondary pest, which can feed on the infested grain dust, both the insect adult and the larvae cannot feed on the healthy grain. The use of insecticides on the food commodities has an adverse effect on the human health.

METHODS: A study was conducted in which leaves of Neem (*Azadirachta indica*), Moringa (*Moringa oleifer*a), lemon grass (*Cymbopogon citratus*), Citrus orange (*Citrus sinensis*) and bulb of garlic (*Allium sativum*) were tested using the filter paper method extracts were prepared with 4 concentrations (25%, 50%, 75%, 100%). The study revealed that extract of the bulb of garlic (*Allium sativum*) and Neem (*Azadirachta indica*) had the most toxic effects on the insects causing the maximum mortality in it.

RESULTS: Highest mortality that was recorded was 68.333% at 100 % of the garlic extract at 72 hours. The synergism of garlic extract with insecticide Acttelic 50 EC. 4 concentrations of the insecticide were made 0.125 mg/l, 0.25mg/l, 0.5mg/l and 1mg/l with 500ppm of the plant derived extract and the highest mortality recorded was 85.000% at (100+0.75 mg/kg) at 72 hours. In the present study diatomaceous earth was used with Acttelic 50 EC at the rate of 0.25, 0.5 and 0.75mg/kg with diatomaceous earth (silico sec) at 100mg/kg at the exposure interval of 24, 48 and 72 hours. The highest mortality recorded after the exposure interval of 72 hours was 92.687 % at (100+0.75 mg/kg).

CONCLUSIONS: It is concluded that diatomaceous earth and essential oils can be combined with entomopathogenic fungus for the economical and sustainable management of *Tribolium castaneum*.

SPP-IPM-102

Enhancing food security in Pakistan through effective plant protection: opportunities and challenges

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ABSTRACT

Pakistan's agricultural sector plays a vital role in ensuring food security for its rapidly growing population. However, plant diseases, pests, and weeds pose significant threats to crop yields, compromising the country's food sovereignty. Effective plant protection strategies are crucial to mitigate these challenges and enhance food security. This presentation explores the impact of plant protection on food security in Pakistan, highlighting opportunities and challenges.

Plant protection measures, such as integrated pest management (IPM), precision agriculture, and biological control methods, have shown promising results in increasing crop yields and reducing pesticide usage. Moreover, adopting climate-resilient crop varieties and leveraging advances in biotechnology can further bolster plant protection efforts. However, challenges persist, including limited access to quality inputs, inadequate farmer training, and insufficient regulatory frameworks.

To address these challenges, collaborative efforts among stakeholders, including farmers, researchers, policymakers, and industry experts, are essential. Investing in agricultural research and development, strengthening extension services, and promoting sustainable agriculture practices can help bridge the gap between plant protection and food security.

This presentation aims to stimulate discussion on the critical role of plant protection in enhancing food security in Pakistan. By exploring opportunities and challenges, we can identify strategic interventions to ensure a sustainable and food-secure future for Pakistan.

Keywords: Plant protection, food security, Pakistan, integrated pest management, precision agriculture, biotechnology, climate-resilient crops.

SPP-IPM-103

# Need for growing non-*Bt* cotton refugia to overcome *Bt* resistance problem in targeted larvae of the cotton bollworm

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ABSTRACT

The effectiveness of *Bacillus thuringiensis* (*Bt*) cotton against target arthropod larvae is decreasing day by day. The comparative effect of *Bt* expression among *Bt* cotton varieties and different plant parts was observed against the cotton bollworms: *Helicoverpa armigera* and *Pectinophora gossypiella* larvae. In the present study, larval mortality of *H. armigera* was higher than *P. gossypiella* among selected *Bt* cultivars. Median lethal concentration ($LC_{50}$) values were 8.91, 13.4, 14.0, and 36.4 for *P. gossypiella*, while 5.91, 4.04, 2.37, and 8.26 for *H. armigera* of FH-142, MNH-886, IR-3701, and FH-Lalazar, respectively. These values depicted that *P. gossypiella* had more *Bt* resistance problem than *H. armigera* larvae. The host range of both targeted insect larvae was different from each other due to the polyphagous feeding nature of the larvae of *H. armigera* that feed on different host plants, but *P. gossypiella* attacked only cotton with monophagous feeding habit. It was also notable from results that *Bt* expression in reproductive parts where the attacked pink bollworm was lower than the American bollworm, so the former had the maximum chance of resistance due to repeated exposure to *Bt*. It was concluded that farmers be advised to follow the practice of growing non-*Bt* as a refuge crop to reduce the problem of *Bt* resistance in the target arthropod species.

Keywords: *Bacillus thuringiensis, Helicoverpa armigera*, *Pectinophora gossypiella,* arthropod larvae, *Bt* resistance, *Bt* cotton

SPP-IPM-104

Evaluation of kaolin, plant extracts and their synergistic effects against Fall armyworm, *Spodoptera frugiperda* (Lepidoptera; Noctuidae) larvae

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ABSTRACT

Maize, *Zea mays*, is a significant cereal crop in Pakistan, ranking 3rd among cereals in terms of its production. It is one of the most important cereal crops in the country, grown for both human consumption and animal feed. Its production is adversely affected by various factors, particularly insect pests cause heavy economic damage to it. One of the most destructive and invasive pests of maize is the fall armyworm, *Spodoptera frugiperda*. Its infestation causes significant economic damage to the crop. Kaolin (5 and 2.5%) and plant extracts (10, 5, and 3%) including neem, tobacco and eucalyptus were used against 3rd instar larvae of S. frugiperda to observe their toxic effect. Different combinations of these plant extracts with kaolin (2.5%) were also evaluated. Mortality was recorded after 12 hours interval for 2 days. The results indicated that 10% neem extract showed the highest mortality (63.33 ± 3.33 %) while its lower concentrations (5 and 3%) showed 40.0 ± 5.77 % and 16.67 ± 3.33 % mortalities, respectively. The second highest mortality (53.33 ± 3.33 %) was recorded in case of kaolin (5%) application after 48 hours of the application. Kaolin (2.5%) alone showed 30% larval mortality and with the combination of neem (3%) it showed (26.67 ± 6.67 %) larval mortality. Tobacco (10%) showed (50.00 ± 5.77 %) mortality after 48 hours of application and at lower concentrations (5%) and (3%) it showed lower mortality rate (26.67 ± 3.33 %) and (20.00 ± 15.28 %), respectively. Eucalyptus (10%) caused a mortality of 33.33 ± 3.33 %. The combinations of kaolin + tobacco (2.5% + 3%), kaolin + eucalyptus (2.5%+ 3%) showed (0.00 %) mortality even after 48 hours of application. According to the findings, neem and tobacco extracts and kaolin caused up to 60% larval mortalities. Neem combination with kaolin was effective while kaolin + tobacco extract and kaolin + eucalyptus extract did not show synergistic effect. So, kaolin, neem and tobacco extracts have the potential to be utilized in managing this pest using an environmentally friendly strategy. These alternatives could be further evaluated for serving as viable options to conventional pesticides.

Keywords: Fall armyworm, Kaolin, neem, tobacco, eucalyptus, mortality, *Spodoptera frugiperda*

SPP-IPM-105

Biodiversity and taxonomy of short horned grasshoppers Acrididae (Orthoptera) from middle Sindh, Pakistan

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ABSTRACT

BACKGROUND: Middle Sindh includes three Districts namely District Dadu, Shaheed abad and Naushero Feroze. These above said Districts possess agriculture field, their temperature is suitable for rapid multiplication of insects, like short horned grasshoppers belonging to family Acrididae and long horned grasshoppers family Tettigonidae. They have economic importance to consider pest of different crops in these districts of Middle Sindh, so that proper diagnosis can be made, because locust is notorious member of the above said family and is a major pest of the various cash crops.

METHODS: Sampling was carried out during the year 2022-23 monthly visit was made in different localities, and samples/Specimens were collected by Insect-nets and by Hand picking method from various agricultural fields of Maize, Rice, Cotton, Wheat, Grasses, Sugar cane and other vegetation from different ecological areas of District Dadu, Shaheed Benazirabad and N. Feroze.

RESULTS: We have collected 2416 specimens from different localities of Districts of Middle Sindh, namely village Qazi Arif, Village Ghulam Hussain Gadhi, Village Phaka, Village Muhammad Ibrahim Panhwar and Village M. Bachal Bouk of district Dadu, village walidad Zardari, village Bux Ali Dahri, village Bandhi , Village Baharo khan Mari and village Sardar Khan Rind of District Shaheed Benazirabad and Village Puran, Gh;Hyder Jesar, Aayal Khan Tunio,Halani and Tharu shah of District Naushero Feroze. We have collected the following 17 species namely *Oxya hyla hyla,* Serville 1831*, 7.28% Oxya fuscovittata,* Marshal 1836 7.98%*, Hieroglyphus perpolita,* Uvarov 1832 7.78%*, Aiolopus thalassinus thalassinus* Fabricius 1781 9.47%, *Aiolopus thalassinus tamulus,* Fabricius 1798 9.97%, *Acrotylus insubricus*, Scopoli 1786 7.16%, *Acrotylus fischeri,* Azam 1901 5.83%, *Locusta migratoria*, Linnaeus 1758 5.75%, *Sphingnostus savingnyi,* Saussure 1884 4.75% *, Trilophidia anulata*, Thunberg 1815 2.11%, *Truxalis eximia eximia* Eichwald 1830, 2.35% *Acrida exaltata*, Walker 1859 5.54%, *Hilethera aeolopoides* Uvarov 1922 5.50%, *Gonista rotundata* Uvarov 1933 4.51%, *Anacridium rubrispinum* Bie Benkio 1948 4.47%,*Oxya velox*, Fabricius 1787 8.27%,*Oxya japonica*, Thunberg 1815 1.20%

Keywords: *Hieroglyphus perpolita, Acrotylus insubricus,* sampling, insects, agricultural fields, Sindh

SPP-IPM-106

*Bacillus thuringiensis* M3-produced surfactins are involved in effective toxicity against grain borer of corn

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ABSTRACT

Pest insects harm the quality of crops as well as the quantity of those crops at the same time. The overuse of chemical pesticides does have significant effects, not only on the environment but also on the safety of the food that we consume. As a result, the execution of efficient management systems that include bio-agents has significant implications for the operations of agriculture. Grain borers, a common pest found in storage facilities, are responsible for significant losses of grains, medicinal materials, and a variety of agricultural and related items that are stored in warehouses. A high amount of toxicity against grain borers has been shown by *Bacillus thuringiensis* M3, which is obtained from corn that has died spontaneously. Following treatment with *B. thuringiensis* M3 fermentation broth, the mortality rate of grain borers was found to be between 90 to 93 % within 48 hours of the application of the broth. According to these studies, the bacterial effluent contains certain compounds that can kill insects through their insecticidal properties. It was determined that the insecticidal chemicals could be extracted from M3 through the utilization of the bioactivity-guided fractionation technique. The discovery of surfactins was ultimately made possible through the application of LC-MS. After analyzing the insecticidal activity and surfactin concentrations of several different strains of *Bacillus* sp., it was discovered that there is a connection between the varied synthesis of surfactins and the reported insecticidal activity across a variety of strains. According to the results of our research, *B. thuringiensis* M3 may offer a unique strategy for protecting plants from pests that are found in agricultural settings.

Keywords: Corn, Grain Borer, LC-MS, Bacillus, Biopesticide, Bioinsecticide, Microbial, Natural pesticides

SPP-IPM-107

Age Preference and Performance of Larval Parasitoids *Microplitis manilae* and *Bracon hebetor* (Hymenoptera: Braconidae) on *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) at Variable Exposure Durations

*Fazlullah[1*], Muzammil Farooq[1], Abdul Rehman[1], Muhammad Naeem Aslam[1], Naeem Zada[1], Khalid Rashid[1]*

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ABSTRACT

BACKGROUND: Fall armyworm, *Spodoptera frugiperda* is an invasive insect pest that damages several crops i.e., rice, sorghum, sugarcane, and vegetables however, feeds preferably on maize crop. The selection of a high-quality biocontrol agent is crucial for any successful bio-control program.

METHODS: In the current study parasitism potential of two parasitoids viz, *Microplitis manilae* and *Bracon hebetor* were evaluated for their parasitism potential against S. frugiperda. Proper host selection is essential for the development of parasitoid progeny. The parasitism capability of *M. manilae* and *B. hebetor* against 2nd and 4th larval instars of FAW across various age group (1, 2 and 3 days old) was investigated by adopting choice and no-choice (1 and 3 days old) conditions. In addition to parasitism potential, number of larvae visited by the parasitoid, punctured host larvae, parasitoid larvae within the host body, mortality induced by the parasitoid in the host, and the sex ratio of emerged parasitoids were also evaluated. The results showed significant variations in the overall performance of the natural enemy when exposed to first, second- and third-day-old host larvae in 2nd and 4th molting stages. Interestingly, after the third day of molting, the parasitoid exhibited significantly superior performance in both molting stages. Surprisingly, the highest number of parasitoid emergences was observed in 4th instar larvae. Furthermore, a greater number of female ratios, specifically *Bracon hebetor*, were found in second molt larvae at 3-day-old age group of *S. frugiperda*.

CONCLUSION: Our findings depicted that host instar and age after molting tend to influence the demographic parameters of the parasitoids. Future IPM strategies against *S. frugiperda* under field conditions can be focused on the mentioned area of interest.

Keywords: Fall armyworm, *Spodoptera frugiperda*, Age preference, Biocontrol, Larval parasitoids, *Microplitis manilae* and *Bracon hebetor*

SPP-IPM-108

Response of six wheat genotypes against red flour beetle, *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae) under laboratory conditions

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ABSTRACT

The major problem restricting the economic storage of wheat in various parts of the world is the red flour beetle, *Tribolium castaneum* (Herbst). In a lab experiment, the resistance of six wheat genotypes including two biofortified (Zincol 2016 and Akbar 2019) and four conventional genotypes (Arooj 2022, Nawab 2021, Dilkash 2021 and Bhakkar Star 2019) were investigated against *T. castaneum*. The main objective of this study was to determine how much local and regional wheat genotypes varies in their ability to resist these harmful biotic constraints. To determine varietal resistance, three diagnostic techniques, the percent infestation, the weight of frass, and the total number of adults that emerged, were to be carefully evaluated.

RESULTS: It showed that, Akbar-2019 and Zincol-2016 was found to be relatively resistant among all the testing genotypes and possessing a good presentation to be incorporated into a future breeding program. In comparison to these resistant genotypes, the pest population was higher in the statistically susceptible cultivars Arooj 2022 and Nawab 2021, which were found sensitive as well. For effective management strategies, plant breeders and entomologists are advised to focus on the utilization of Akbar 2019 and Zincol 2016 as resistant host grains against insect infestation.

Keywords: *Tribolium castaneum*, wheat, bio fortified, varietal resistance

SPP-IPM-109

Population Growth Change in *Trogoderma granarium* on Conventional and Biofortified Wheat

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ABSTRACT

BACKGROUND: The khapra beetle *Trogoderma granarium* (Everts 1898) (Coleoptera: Dermestidae) is a highly destructive pest of storage commodities that causes considerable economic losses.

METHODS: In the current study, we investigated the potential of zinc-biofortified wheat as an eco-friendly and sustainable approach to mitigate khapra beetle infestations. A controlled laboratory study was carried out to investigate the effect of conventional and biofortified wheat on khapra beetle populations and damage assessment alone and in integrated manners.

RESULTS: The results revealed that zinc-biofortified wheat significantly impacted the khapra beetle's life cycle and population dynamics. The weight loss of zinc-biofortified wheat grains was remarkably lower compared to conventional wheat. Moreover, the moisture content of zinc-biofortified wheat remained relatively stable throughout the experiment, while conventional wheat exhibited a significant increase in moisture content. Frass production was notably reduced in zinc-biofortified wheat.

CONCLUSION: This suggests that khapra beetles found the zinc-biofortified wheat less palatable and significantly affected its growth. Furthermore, the larval and adult populations of khapra beetles were significantly lower in zinc-biofortified wheat compared to conventional wheat. This suggests that the nutritional attributes of zinc-biofortified wheat may negatively affect the development and survival of khapra beetle life parameters. Further research is warranted to explore the underlying mechanisms behind the observed effects and to assess the long-term implications of using zinc-biofortified wheat in integrated pest management programs.

Keywords: Khapra beetle, Economic losses, Zinc, Biofortified wheat, Frass production

SPP-IPM-110

Assessing nine kabuli chickpea genotypes for their resistance to *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) in relation to biotic and abiotic aspects

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ABSTRACT

The chickpea pod borer, *Helicoverpa armigera* (Hübner), is an important insect pest of the chickpea crop, causing significant losses worldwide. Host plant resistance is one of the key components of integrated pest management for managing this pest. Field experiments were conducted to investigate the effect of biotic (physio-morphic characters) and abiotic factors on pod borer infestation and population buildup on nine kabuli chickpea genotypes during two cropping seasons (2020-21 and 2021-22) in Central Punjab, Pakistan. Results revealed that the *H. armigera* larval population and percent pod damage differed significantly among the genotypes. The genotype Noor-2019 had the lowest larval population (0.85 and 1.10 larvae per plant) and pod damage 10.65 and 14.25% during 2020-21 and 2021-22, respectively. The highest larval population was recorded on genotype DG-2017 (1.37 and 1.70 larvae per plant, respectively), with pod damage (22.90 and 26.94%, respectively) for both years. Pod trichomes density, pod wall thickness, and chlorophyll contents of leaves also differed significantly among the tested genotypes. Pod trichome density and pod wall thickness was negatively correlated with larval infestation, while chlorophyll contents of leaves exhibited a positive correlation. On the other hand, the larval population was positively correlated with the minimum and maximum temperature, while relative humidity exhibited a negative correlation with the larval population.

Keywords: Chickpea, physio-morphic characters, trichomes, pod wall thickness, chlorophyll contents, abiotic factors

SPP-IPM-111

Effect of ZnO and $AgNO_3$ nanoparticles using plant extracts against *Spodoptera litura* (Fabricius) under laboratory conditions

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ABSTRACT

Armyworm *Spodoptera litura* (Noctuidae: Lepidoptera) is a notorious pest of different horticultural and agronomical crops. Synthetic insecticides are commonly used to control *S. litura*, but overuse of pesticides has negative effects on environmental pollution, human health and the emergence of insecticide resistance in the pest. Therefore, a novel strategy should be developed to manage the *S. litura* population. Nanotechnology is the most affordable approach for farmers and effective for sustainable farming to reduce this problem. In the present study, the bio-efficacy of eight green synthesized nanoparticles along with two different zinc oxide and silver nitrate was evaluated. Nanoparticles dissolved in distilled water and ethanol with different concentrations, viz. 3, 5, and 7 ml and apply by leaf dipping method against the *Spodoptera* larvae. Data were recorded after 24, 48 and 72 hours. The results showed that maximum larval mortality 98% in *C. citratus* silver nitrate nanoparticles, while 90% in zinc oxide *C. citratus* nanoparticles dissolved in ethanol solvent was recorded against the third instar larvae of *S. litura*. LC50 values were evaluated for silver nitrate at 3.13 ppm, while 3.39 ppm for zinc oxide with *C. citratus* nanoparticles. The effect of silver nanoparticles with ethanol showed long-lasting and toxic effects against *S. litura* as compared to zinc oxide nanoparticles. This technique is a valuable device in the integrated pest management strategies.

Keywords: *Spodoptera litura*; Zinc oxide; Silver Nitrate Nanoparticles; Ethanol; Distilled Water

SPP-IPM-112

Comparison of Two Natural Oils and Aqueous Leaf Extracts Against Two-Spotted Spider Mites (Tetranychidae) and Aphid (Aphididae) in Laboratory Conditions

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ABSTRACT

Two-spotted spider mites and aphids are the most significant sucking pests that are responsible for yield losses in horticultural and agronomic crops. These pests induce severe losses in crops by sucking the sap from the tender stems and leaves resulting in distortion of the outgrowths, decreased yield and spoiled crops. The main purpose of this study was to compare the effectiveness of two natural oils and two aqueous leaf extracts of neem (*Azadirachta indica*) and eucalyptus (*Eucalyptus globulus*) against mites and aphids under laboratory conditions. To evaluate the mortality and repellency of plant extracts against aphids and mites, four replications having five treatments were used. Different concentrations for essential oils (2, 1.5, 1. 0.5% & control) and plant aqueous extracts (10, 5, 2.5, 1.25% & control) were used. The research work was conducted in the Acarology Research Laboratory, Department of Entomology, University of Agriculture, Faisalabad. Mortality of mites and aphids was observed after 24, 48, 72, and 96 hours of application of different extracts. The statistical program (Minitab) was used to analyze the data. Neem oil showed the highest rate of mortality against both mites 79% and aphids 68.5% after 96 hours of application. Eucalyptus oil killed 68.5% mites and 65% aphids. Aqueous extracts of neem and eucalyptus also proved to be effective in controlling mites and aphids. The repellent effect of these extracts was also evaluated and observed after 12 and 24 hours. The results showed that neem oil has maximum repellency against both mites 73.3% and aphids 63.3% whereas the least repellent effect was recorded against both mites 56.7% and aphids 46.3% in case of eucalyptus aqueous extract. The results revealed that all these extracts can be used as an effective tool against mites and aphids in IPM tactics.

Keywords: Tetranychidae, Acari, plant oils, aqueous extracts, two-spotted spider mites, aphids.

SPP-IPM-113

Compatibility of *Beauveria bassiana* (Bais) with plant extracts for the control of *Rizopertha dominica* (F) under laboratory condition

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ABSTRACT

Wheat, (*Triticum aestivum* L) is the most important staple crop of Pakistan and cultivated in almost every part of the country. Economically, wheat contributes 8.9% to the agriculture and 1.6% towards Gross Domestic Production (GDP) of Pakistan. The area under wheat cultivation was 9.17 million hectares with an average production of 2721 kg/ha during 2020-21. Post-harvest losses due to stored grain pests in developed countries are almost 9% while 20% or more in developing countries. It is estimated that almost 8-10% damage to grains is observed in which insects cause a loss of 13 million tons and poor management of storage causes a loss of 100 million tons of grains. The present investigation ascribes the insecticidal potential of three plant extracts i.e. *F. cretica*, *C. melon* and *C. colocynthis* and entomopathogenic fungus (EPF) *B. bassiana* against the lesser grain borer *R. dominica*. In an effort to gain a comprehensive insight, time dependent effect was also studied. Moreover, their synergistic effects were also considered contextualizing previous research findings. The plant extracts including *F. cretica*, *C. melon* and *C. colocynthis* were subjected to insecticidal evaluation. The extracts from *F. cretica* was the most potent extract by inducing the highest mortality across the studied time intervals (7, 14, and 21 days). *B. bassiana* was also explored at varying concentrations. Markedly, the mortality of *R. dominica* increased with the increase in concentrations of *B. bassiana.* This bioassay develops a synergistic relationship between the plant extracts and EPF, with mortality rates being significantly enhanced through their combined application. It was worth noting that the combination of *F. cretica* plant extracts with *B. bassiana* at $4.43\times10^8$ concentration elicited the highest mortality rate against *R. dominica.*

Keywords: Wheat, Plants extracts, *B. bassiana, R. dominica,* Bioassay, mortality

SPP-IPM-114

Evaluation of entomo-toxicity of green synthesized zinc nanoparticles using *Ammi visnaga* against wheat aphids in comparison to imidacloprid

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ABSTRACT

Wheat *Triticum aestivum* (L.) is a healthy, convenient, and economical dietary source. It provides 20% food calories to 40% of the world population. Wheat Aphid, *Sitobion avenae* is a serious wheat insect pest causing significant yield losses in wheat crop globally. The insecticidal activity of chemically and green synthesized zinc nanoparticles (ZnNps), having different sizes RK1 (40 nm), RK2 (50 nm), RK3 (65 nm) and RK4 (79 nm), using aqueous extract of *Ammi visnaga*, was evaluated against the second instar nymphs of *S. avenae* under laboratory conditions by applying concentrations of 5, 10, 20, 40 and 80 ppm. Their results were compared with Confidor® (Imidacloprid). The mortality and fecundity data were recorded. Statistical analysis indicated that Confidor® was the most effective candidate against the nymphs of wheat aphid by causing 96.67±3.33 % mortality after 48 hours of the treatment. Among green synthesized zinc nanoparticles, RK2 (50nm) sized nanoparticles caused significant mortality (90.00±5.77 %) at a concentration of 80 ppm while the lowest aphid mortality (46.67±3.33 %) was given by RK3 (65 nm) treated aphids at 10 ppm concentration. The other sized ZnNPs caused intermediate mortalities in treated aphids. Plant extract and inorganic ZnNPs were found least effective against wheat aphids as they caused 43.33±8.82 % and 46.67±3.33% mortality at their 80 ppm concentrations. It was also noted that nymphal mortality was concentration dependent in all the treatments. The progeny development in survived wheat aphids was highly suppressed after their exposure to different concentrations of green synthesized zinc nanoparticles, plant extract of *A. visnaga*, and chemically synthesized ZnNPs. Nanoparticles prepared through *A. visnaga* extract showed significantly higher mortality than inorganic zinc nanoparticles. So, they can be potential nano-pesticides to be integrated in pest management as an eco-friendly approach after future evaluations.

Keywords: Wheat aphid, Bioassay, *Ammi visnaga*, Zinc nanoparticles, plant extracts, Imidacloprid

SPP-IPM-115

Larval Toxicity of Different New Chemistry Insecticides against House Fly (Muscidae: Diptera)

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ABSTRACT

*Musca domestica*, the housefly is one of the most prevalent insects that are closely related to human settlements. House flies annoy cattle in rural settings which reduces their productivity in several ways. They also infiltrate cities and cause a great deal of annoyance in apartment buildings and commercial complexes. Flies are disease-carrying vectors that spread germs, viruses, protozoa, and metazoan parasites. They also feed on decomposing debris, human waste, and food. Due to unsanitary conditions including farm manures, improper disposal and areas where people defecate in public dairies typically contribute significantly to the breeding of flies. Every one of these locations is known to provide house flies with food and nesting grounds. House flies are managed and controlled using integrated house fly control biological control, sanitation, screening techniques, traps, and insecticides for the purpose. Since it is easy to apply and can be done quickly chemical control is the most popular strategy. Lufenuron, Dinotefuron, Pyrifluquinozon, Afidopyropen and Neem oil used for larval toxicity. Four concentrations (causing mortality 0-100 %) of each insecticide with four replications were prepared in distilled water. Ten healthy 2$^{nd}$ larval instar of house fly released in prepared media for 48 hours. After 24 hours data recorded. The mortality data was recorded by using Abbot Formula. The lethal concentrations were estimated by Probit analysis using SPSS 23v. Pyrifluquinozon and Neem oil cause larval mortality (90 and 80%) respectively. Dinotefuron and Afidopyropen toxicity against house fly larvae (70 and 60%) respectively. Lufenuron is less toxic for larval mortality.

SPP-IPM-116

Monitoring of resistance in cotton whitefly against selected insecticides

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ABSTRACT

BACKGROUND: The cotton whitefly (*Bemisia tabaci*) is a significant cotton pest that feeds on the surface of the leaves to extract vital nutrients. Viral infections and other diseases are spread by whiteflies.

METHODS: Adult whiteflies were gathered from three distinct locations in the districts of Lodhran and Multan. At the Cotton Research Institute in Multan, whitefly colonies were raised in glass houses with semi-lab conditions. Clip-cage bioassays for nymphs were used in conjunction with the leaf dip bioassays approach to assess resistance to commercially available pesticides. Insecticides that are often used, such as pyriproxyfen, spirotetramat, buprofezin, diafenthiuron, and pyrifluquinazon, have been evaluated against whitefly resistance monitoring. Values for $LC_{50}$ were computed. The $LC_{50}$ values of tested strains were divided by the reference strain's $LC_{50}$ values or the lowest values previously reported from the same location to produce the resistance ratio comparison of $LC_{50}$ values of various populations. The research aids in the development of cotton whitefly resistant control measures. Using Standard Bioassay techniques on both adults and nymphs, several field populations of whiteflies were observed for pesticide resistance.

RESULTS: Bioassay results against adults of whitefly showed resistance ratio (RR) compared with SS strain were as buprofezin RR was 39, 49 and 57, for diafenthiuron RR were 58, 80 and 116, for flonicamid RR were in the range of 38, 25 and 30, for pyrifluquinazon RR were 12, 16 and 19, for pyriproxyfen RR were 41, 29 and 52, for spirotetramat 12, 14 and 13, for Multan-I, Multan-II and Lodhran field collected populations respectively. Whereas bioassay results observed after 72 hours exposure, resistance ratio (RR) exhibited by buprofezin were 30, 28 and 35, for diafenthiuron RR were 52, 59 and 84, for flonicamid were 16, 10 and 12, for pyrifluquinazon RR were 8, 7 and 6, for pyriproxyfen RR were 23, 26 and 18, for spirotetramat RR were 8, 10 and 9 for whitefly populations collected from Multan-I, Multan-II and Lodhran respectively.

CONCLUSION: We got to the conclusion that *B. tabaci* acquired varying degrees of resistance to most insecticides, such as moderate to high levels of resistance against buprofezin. The districts of Multan-I and Lodhran should employ resistance management techniques to control whiteflies.

Keywords: Whitefly, *Bemisia tabaci*, Leaf dip method, Insecticide resistance.

SPP-IPM-117

Biodegradation of Plastic by Greater Wax Moth (*Galleria mellonella* L.) and Effect of Co-Diet Supplementation

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ABSTRACT

Plastic polymers are extensively used in industry, agriculture, and our everyday lives due to their convenient and cost-effective properties. However, the pollution resulting from plastic polymers, particularly polyethylene (PE), poses a serious threat to both human and animal health as they accumulate in the environment, resisting easy degradation under natural conditions. Exploring alternative, environmentally sustainable options, such as biodegradation facilitated by insects, is crucial to addressing this issue. Recently, certain insects, notably the larvae of the greater wax moth *Galleria mellonella* (L.), have been recognized as avid 'plastivores'. The aim of this study was to evaluate the feeding efficiency of *G. mellonella* larvae on PE of various densities with co-diet supplementation. The results revealed that the highest weight loss of plastic was observed when larvae were provided with PE alone. A significant reduction in the mass of plastic was also observed when PE was combined with beeswax, while the larvae experienced minimal weight loss. The larvae exhibited a higher consumption of plastics with a thickness of 1mm, indicating that the lower the density of plastic, the greater the consumed area. The biodegradation level was notably higher at 24 hours. In conclusion, these findings suggest that the density of plastic and the supplementation of the co-diet have an impact on plastic biodegradation. Additionally, the utilization of *G. mellonella* for the biodegradation of PE proves effective when conditioned with beeswax, resulting in minimal weight loss of the larvae.

Keywords: Plastic pollution, Greater wax moth, Polyethylene, biodegradation

SPP-IPM-118

Evaluation of liquid formulations of *Beauveria bassiana* and *Metarhizium anisopliae* against *Bactrocera zonata*

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ABSTRACT

BACKGROUND: Fruit flies are global threat to economy and food security because they are causing losses billions of dollars annually. Tephritidae is a large family of fruit flies having more than 4700 species and 500 genera. In Pakistan, especially in Punjab, the fruit fly *Bactrocera zonata* (Diptera: Tephritidae) is a common pest. Currently chemical insecticides are used for control of fruit fly. Environmental concerns related to use of insecticide demand for sustainable Integrated Pest Management (IPM). Entomopathogenic fungi (EPF) such as *Beauveria bassiana* and *Metarhizium anisopliae* are best alternative of pesticide. These fungi have certain limitation regarding their efficacy in regions with high temperature.

METHODS: Conidia of both EPF were embedded in vegetable oils such as Corn oil (*Zea mays*), Groundnut oil (*Arachis hypogaea*), Sunflower oil (*Helianthus Annuus*), Sesame oil (*Sesamum indicum*), Coconut oil (*Cocos nucifera*) and Soyabean oil (*Glycine max*) along with the aqueous suspension. All formulations were prepared by adding conidia in oil-in-water emulsions (W/O/W emulsions; the ratio of oil phase to water phase is 20:80) on the same day. Their efficacies were evaluated on 1$^{st}$ day, 15$^{th}$ day and 30$^{th}$ day after preparation of formulation against two stages (Pupae and adult) of *B. zonata*. To obtain reliable findings, the procedures were replicated three times and one control. The comparison of mean of each treatment was compared using the ANOVA technique under a completely randomized design (CRD). Tukey HSD test was used for means of significant treatment at 5%.

RESULTS: Adult emergence of the pupae and mortalities of adult were recorded. Aqueous suspension of conidia performed better on 1$^{st}$ day of preparation of formulation but lost its efficacy on 15$^{th}$ and 30$^{th}$ day. Evaluation of pathogenicity of the 30-day old formulations of *B. bassiana* showed maximum mortality 84.4% followed by *M. anisopliae* 82.2 % in sesame oil as compared to 2.2 % control. Significant differences were recorded for adult emergencies of *B. zonata* at all intervals. Evaluation of 30-day old formulation showed poor suppression in adult emergence from pupae 15.6 % in sesame oil in comparison to 88.8 % in control.

CONCLUSION: According to study sesame oil and corn oil were found to be more effective in maintaining the viability of the conidia of EPF even up to 30$^{th}$ day. Sesame oil and Corn oil recommended for preparing liquid formulation of Entomopathogenic fungi.

Keywords: Insect pest management, Fruit flies, Biopesticides, liquid carriers, Integrated Pest Management

SPP-IPM-119

Comparative effectiveness of various insecticides against mango fruit borer

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ABSTRACT

Mango production is a major form of income generation from large and small-scale orchards of South Punjab, Pakistan. However, it is confronted with an emerging threat of mango fruit borer, which causes reduction of quality and quantity of marketable fruits resulting to considerable income loss. Hence, there was a need to evaluate insecticides available in the market with the aim to incorporate in IPM program for effective management of this pest. A field experiment was conducted to study the efficacy of four insecticides against mango fruit borer viz., Flubendiamide (Belt 480 SC), Gamma cyhalothrin + chlorpyrifos (Bolton 31EC), Emmamectin benzoate (Timer 1.9 EC) and chlorantraniliprol (coragen 20SC). These insecticides were sprayed on the emergence of mango fruit borer during fruit development stage. After the insecticides application the damaged fruits percentage was note on weekly basis up to fruit harvest. The insecticide residues in mango fruits were also determined. Results revealed that insecticide chlorantraniliprol (coragen 20SC) was most effective in controlling mango fruit borer followed by Flubendiamide (Belt 480 SC), Gamma cyhalothrin + chlorpyrifos (Bolton 31EC) and Emmamectin benzoate (Timer 1.9 EC). Damaged fruits, percent damaged fruits, damaged clusters and percent damaged clusters were very low in treatment where coragen was sprayed followed Flubendiamide, Gamma cyhalothrin + chlorpyrifos and Emmamectin benzoate.

Keywords: damaged clusters, damaged fruits, insecticide residues, mango fruit quality.

SPP-IPM-120

Effectiveness of various botanical extracts against mango hopper

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ABSTRACT

Mango hopper (*Idioscopus clypealis* (Lethierry) (Hemiptera: Cicadellidae) is an important, polyphagous, multivoltine pest of mango in all mango growing areas of south Punjab, Pakistan. The pest may cause serious losses to quantitative and qualitative mango production. According to an estimate about 80-100% losses were reported in mango orchards where this pest was not controlled. Although pesticides are frequently used in mango orchards to control this dreaded pest, however, continuous use of insecticide may deteriorate natural balance of insects in the mango orchards. For this reason, we compared effectiveness of various botanical extracts viz., *Azadirachta indica* (Neem), *Datura stramonium* (Dhatura)*, Nicotiana tabacum* (tobacco)*, Calotropis gigantean* (AK plant)*, and Citrullus colocynthis* (Korhtuma) and their combinations. The experiment was conducted at farmer fields near Multan. Results were statistically analyzed through R. Five percent solution of each botanical extract was prepared. Botanical extracts of each treatment were sprayed on trunk and main branches of trees in conventional grown mango orchards. Percent mortality was determined 24 hrs, 72 hrs, 5 days and 7 days after extracts application. Overall, we found that after 7 days of botanical extracts application, least increase in population of mango hopper was observed as 2.33% in experimental plots where tobacco was sprayed followed by combination of Dhatura + Korhtuma 7.81% and Dhatura. when compared with control, where no plant extract was sprayed.

Keywords: *Azadirachta indica* (Neem), *Datura stramonium* (Dhatura)*, Nicotiana tabacum* (tobacco)*, Calotropis gigantean* (AK plant)*, and Citrullus colocynthis* (Korhtuma).

SPP-IPM-121

Bees on the Brink: The Consequences of Pollinator Decline for Food Security

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ABSTRACT

Bee conservation is directly linked to global food security, playing an important role in agriculture and ecological sustainability. Bees, as major pollinators, enable the reproduction of several plants, including various crops essential for human consumption. The decrease in bee population poses considerable challenges for food security, disrupting both the quantity and quality of agricultural products. Bees pollinate around 75% of the world's crops, including fruits and vegetables which are necessary for a healthy diet. Their contribution in pollination has a direct influence on agricultural production, which affects both food supply and diversity. Without bees, many crops would have decreased yields, resulting in increased food prices and even shortages, increasing food insecurity. Reduced pollination services can have an influence on crop nutritional quality, lowering vitamins and minerals that are vital for human health. Bee decline is an interconnected threat to food security, biodiversity, and ecological stability. To meet the critical requirement of bee conservation, multiple strategies must be applied. Protecting and restoring natural habitats can give bees with the resources they need to survive and reproduce. Promoting organic farming can lead to more bee-friendly ecosystems. Research and monitoring are critical for understanding bee populations and the efficiency of conservation initiatives. Bees are essential to global food security, and their loss threatens agricultural production, biodiversity, and human nutrition. Addressing the causes of bee loss needs habitat conservation, organic farming, and supporting policy. By protecting bees, we maintain the resilience of our food systems and the health of our ecosystems, resulting in a sustainable future for everybody.

Keywords: Bee conservation, Food security, Biodiversity, pollinator, organic farming

SPP-IPM-122

# Insects monitoring, collection and preservation

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ABSTRACT

An individual belongs to *Animalia* and *Insecta* having six legs, and body divided into three parts (head, thorax and abdomen) and usually two pairs of wings, or, more generally, any similar very small animal lying. For instance, dragonflies, beetles, butterflies, and ants. According to classification, insects are members of the class *Insecta* within the phylum Arthropoda. They are further classified into different orders, such as Coleoptera (beetles), Lepidoptera (butterflies and moths), Hymenoptera (ants, bees, and wasps), and Diptera (flies). Each order has its own unique characteristics and features. Where, when, and how we can collect insects from the surroundings. Individuals of *Insecta* can be collected from following locations, on or within plant parts (like root stem leaf) etc. Inside or around human habitats (like clothing). Various sources of artificial light during night. Different aquatic habitats (like pounds, lakes) etc. Body of other insects, birds and animals. Rotting and decaying materials of plant or animal origin. Under stones, bark etc. In soil up to a great depth. The best time to collect insects is summer. Diurnal species can be collected during the daytime e.g., butter fly, Dragan fly, house fly etc. Nocturnal species can be collected during the night cockroaches and moth etc. Crepuscular species can be collected during the twilight of dawn and dusk e.g., beetles, mosquito and firefly etc. The most important thing uses gloves to collect insects. Use ariel net (for flying insects), dip net (aquatic insects), aspirator (to collect small insects), sifter and light trap to collection of insects. After collecting the insects, kill them with potassium cyanide or freeze the insect jar to kill the insects. After killing, the insects should immediately preserve via pinned in box containing naphthalene bolls. They are pinned with pins No.16 (a) true bugs are pinned through the center of the scutellum. (b) Beetles and weevils through the base of the right elytron. (c) Grasshoppers through the middle of the pronotal shield which is also called Natalia. (d) Almost all other insects are pinned though the thorax between the between fore wings. Small and soft body insects: they pinned with No.20 like above method. Minute insects: those insects which are too small to be pinned are either glue on the tips or 80% ethanol water. There are two types of labels. 1- Dry labels: They are made from white stiff paper in rectangular form, each having a size of 1" x 1/2" and, date of collection, Location, Collector's name 2- Wet labels: they are in black India ink or written with lead Pencil and finally placed in the fluid.

Keywords: Insects, collection, preservation, Animalia, Arthropoda

SPP-IPM-123

# Estimation of Biotic stress caused by aphid (*Aphis gossypii)* infestation on different cotton varieties and correlation with environmental variables under open field conditions

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ABSTRACT

BACKGROUND: Cotton, *Gossypium hirsutum* L, known as White Gold, is a fiber-producing crop cultivated in over seventy countries worldwide. Cotton aphid, *Aphis gossypii* being the major sucking insect-pest major caused considerable losses in both quality and quantity of cotton during the past few years in Pakistan.

METHODS: Three cotton varieties viz (FH-333, Tristor, and FH-786) were tested for the population of insect pests. Chlorophyll contents (chlorophyll-a, chlorophyll-b, and carotenoids), and leaf pubescence were recorded. Environmental data including temperature (Max, Min), relative humidity (Morning, evening) pan evaporation (Morning, evening) wind velocity, and rainfall were collected. Correlation and regression analysis between the aphid population and environmental parameters was determined.

RESULTS: Results showed that among the three test varieties (FH-333, Tristor, FH-786), variety $V_3$ FH-786 showed the highest germination (79.22±1.38%) while the lowest (71.66±1.13%) by variety $V_2$ Tristor. While comparing the germination vigor of the same varieties it was found that maximum (80.00±1.44%) germination was recorded during 4$^{th}$ week of April-2023. The population of *A. gossypii* recorded on the same test varieties which declared that Tristor had a maximum (48.59±2.21 aphid/leaf/plant) while minimum (44.22 ±2.02 aphid/leaf/plant) on FH-333. Irrespective of the test cotton varieties (FH-333, Tristor, FH-786), the maximum (74.82±1.05 aphid/leaf/plant) *A. gossypii* population was observed during the 1$^{st}$ week of June-2023 while the minimum (0.53±0.08 aphid/leaf/plant) of *A. gossypii* population during the 2$^{nd}$ week of April-2023. Among the test varieties, variety FH-786 had maximum while FH-333 had minimum chlorophyll contents (chlorophyll-a, chlorophyll-b, and Carotenoids). The highest Pubescence/leaf hairiness (Upper, middle, lower) was determined on FH-333 (222.67±1.56 cm$^{-2}$) while the lowest pubescence (38.00±8.30 cm$^{-2}$) was observed on FH-786. For these results, it was indicated that FH-333 had the highest pubescence which made difficult the insertion of mouthparts for the aphids. The correlation results revealed that a positive significant correlation existed between environmental factors including temperature while humidity 6), wind velocity, and rainfall were negatively correlated with *A. gossypii* population prevailing on the test varieties.

CONCLUSION: The highest rates of germination and chlorophyll content were found in FH-786. This demonstrated which variety is more appropriate and would assist us in planning tactics for managing sucking pests in cotton crops.

Keywords: Cotton, Aphid, Biotic Stress, Sucking pest, Pest monitoring

SPP-IPM-124

Efficacy of *Azadirachta indica* and *Datura stramonium* extract with ethanol against different life stages of *Tribolium castinium*

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ABSTRACT

BACKGROUND: *Tribolium castinium* is a devastating stored grain pest of many cereals. Both the larval and adult stages of insect are considered as voracious feeder of cereals. The adult of *T. castinium* secrete certain type of excretion that give foul smell from grains and make it unfit for consumption.

METHODS: The recent study was conducted in Department of Entomology College of Agriculture Bahauddin Zakariya University, Bahadur sub campus Layyah. Neem (*Azadirachta indica*) L. and Datura (*Datura stramonium*)L. ethanol extracts were tested for their repellant and toxicological effects against the larval and adult stages of *T. castinium* at varying concentrations of 10, 15, and 30ml.

RESULTS: The results showed that *D. stramonium* plant extract recorded highest repellency (86.66%) and the lowest repellency (4.50%) against *T. castinium*. Minimum mortality was reported at 65% in plant extract of *A. indica* after an interval of 24 hours at 10ml concentration, and maximum mortality was recorded (90.69%) in plant extract of *D. stramonium* at 30ml concentration after an interval of 72 hours.

CONCLUSION: The results showed that neem and Datura plant extracts were more effective at repelling and toxicologically acting against *T. castinium*. The larval stage of *T. castinium* was also particularly vulnerable to *D. stramonium* and *A. indica* ethanol extract.

Keywords: Ethanol extract, Neem, Datura, *T. castinium*, stored grain pest

SPP-IPM-125

Optimization of sowing times for management of whitefly, dusky cotton bug and pink boll worm on cotton crop

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ABSTRACT

Manipulation of sowing dates of crops is a significant cultural practice in minimizing damage caused by insect pests by disrupting the synchronization between life cycles of host plant and insects. The present study was conducted to investigate the effect of different times of sowing viz. April, May and June designated as early, intermediate and late sowings on incidence of pests of cotton during 2019 and 2020. The observation of insect pests was recorded at weekly intervals from 1st week of August to Last week of December. The results revealed that in early sowing of cotton population of whitefly is maximum in September while in intermediate and late sowing population of whitefly is maximum in October. Overall, results showed low population of white fly in late sowing of cotton in both years. The results of dusky cotton bug revealed that late sowing has lowest incidence of dusky cotton bug in both years. While Pink boll worm results indicated lowest population of pink boll worm in early sowing in both years. There is a significant difference in pink bollworm population in different time of sowing as compared to dusky cotton bug and whitefly populations in both years. On the basis of study, results showed that intermediate sowing time is best time for cotton to manage pest population and achieve high yield.

Keywords: pink boll worm, Pest management, Cultural control, IPM, Non-Chemical management, Eco-friendly technique

SPP-IPM-126

Effect of fungal volatiles on *Bactrocera dorsalis* (Diptera: Tephritidae)

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ABSTRACT

The present study was conducted to determine the role of fungal volatiles in attraction of the fruit fly, *Bactrocera dorsalis*, which is a key pest of banana, guava and many other fruits. *B. dorsalis* female flies' attraction was observed in a multi-armed olfactometer using fungal fruits. Female flies showed significantly higher levels of attraction to control (solvent) as compared to fungus. In pairwise comparisons between different fungal varieties (*Aspergillus flavus* and *Aspergillus niger*), female's *B. dorsalis* showed significantly greater levels of attraction towards control. In two-choice oviposition bioassays, *B. dorsalis* females made significantly more visits, greater numbers of ovipositions, spent a significantly longer time, and larger numbers of pupae and adults developed on banana fruits compared to fungus. GC–MS analysis of fungal headspace revealed presence of aliphatic and aromatic esters as a dominant group of compounds in both un-infested and fruit-fly-infested fruits, with a higher quantity mostly occurring in fruit-fly-infested fruits. Role of fungal volatiles is discussed in an ecological context of attraction and oviposition behaviors of adult females and fitness of their offspring.

Keywords: Volatiles collection, Attraction and repulsion of fruit flies, Oviposition, Multi-arm olfactometer.

SPP-IPM-127

A review of the approaches to the biological control of whiteflies

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ABSTRACT

Biological control has been successful for some whitefly species. Entomopathogenic fungi (EPF), predators, and parasitoids are some of the natural enemies that may be used to manage whiteflies. A total of 115 whitefly parasitoid species have been documented, spanning 23 genera across five families (Aphelinidae, Azotidae, Signiphoridae, Encrytidae, and Platygastridae). *Encarsia* and *Eretmocerus* are the two most significant genera of parasitoids that are effective against whiteflies. Ladybird beetles, lacewings, spiders, and predaceous bug are a few of the significant predators. Additionally, *Euseious scutalis* and *Typhlodromips swirskii* have been shown to be effective in reducing the number of whiteflies on a single plant. The species such as *Beauveria bassiana*, *Metarhizium anisopliae* and *Verticillium lecanii* are the most common and potential EPF as biocontrol agents for whitefly species. The effectiveness of natural enemies cannot be predicted with any degree of certainty. Nonetheless, there should be fewer host stages in terms of both time and geography, as well as fewer host refuges that are impervious to enemy attack. Plant resistance, specific pesticides, and a variety of natural enemies can be combined to achieve this. To improve our understanding of the essential characteristics of effective natural enemies, comparative analyses of whitefly biocontrol cases that have proven successful are recommended.

Keywords: Whiteflies, Entomopathogenic fungi, Natural enemies, biological control

SPP-IPM-128

Evaluation of different insecticides with different modes of action against *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in maize

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ABSTRACT

Maize *Zea mays* (Family: Poaceae) is a major cereal crop in Pakistan. It contributes about 2.2% of Pakistan's GDP. Maize consists of carbohydrates, proteins, fats, and sugars which are used in livestock and human diet. It is susceptible to many insect pests and diseases. Amongst all these insect pests, *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is a serious pest resulting in economic losses in the yield of maize crops. The younger instars feed on leaves whereas larval instar burrow into maize tassels and ears causing extensive damage. Farmers use pesticides for the sake of their immediate control. This study focused on the evaluation of the toxicity of pesticides having different mode of action. The experiment was conducted on the research farm of the University of Agriculture, Faisalabad. Twenty-four experimental units were arranged under RCBD. Fall armyworm larvae population reduction as followed against different insecticides was observed after the 1,3,5,7and 15 of spray application of Lambda-cyhalothrin 2.5%EC (68.30%), Acetamiprid 20%SP (57.40%), Spinetoram 120SC (86.60%), Chlorpyrifos 40% (72.71%), Emamectin benzoate 1.9 EC (81.88%), Lufenuron 5% EC (76.37%) and thiamethoxam 25%WG (62.55%). Maximum population reduction was observed at 7th day of spray application. Spinetoram results remained highly satisfied.

Keywords: Maize, Insecticides, *Spodoptera frugiperda*, Faisalabad, Lepidoptera.

SPP-IPM-129

RNA Interference: Silencing Insect Pests for Sustainable Agriculture

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ABSTRACT

RNA interference (RNAi) is an innovative molecular tool that can play an important role for sustainable insect pest management. RNAi enables gene silencing by degrading messenger RNA (mRNA), preventing the translation of essential proteins that pests need to survive. This technology has gained considerable attention due to its high specificity, environmentally friendly nature, and potential to target a wide range of insect species without harming non-target organisms, including beneficial insects such as pollinators. In agriculture, insect pests pose a major threat to crop yields and food security, traditionally controlled through chemical pesticides. However, excessive reliance on these chemicals has led to environmental pollution, health risks and the development of resistant pest populations. RNAi offers a novel, targeted approach that addresses these challenges. By introducing double-stranded RNA (dsRNA) designed to match specific genes in pests, RNAi can disrupt their biological processes such as growth, reproduction, or detoxification mechanisms. Once the dsRNA is ingested by the pest, it triggers the degradation of its corresponding mRNA, leading to the suppression of essential proteins, which ultimately results in the mortality of pest or reduced fecundity. The development of RNAi in pest management is still facing certain technical and regulatory limitations. Efficient delivery systems, such as spray able formulations or transgenic plants expressing dsRNA, need further refinement to enhance uptake by pests and prolong their activity in the field. The variability in RNAi efficiency among different insect orders, due to differences in their RNAi machinery, remains a challenge. This biotechnological advancement aligns with the goals of integrated pest management (IPM), offering an alternative method to existing methods while reducing the reliance on chemical pesticides. As research continues, RNAi could become a cornerstone of pest control strategies, contributing to increased agricultural productivity, reduced environmental pollution and enhanced global food security.

Keywords: RNAi, Integrated pest management, Food security, biotechnology, Molecular tool

SPP-IPM-130

Efficacy of different insecticides against Cabbage looper in Cauliflower field

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ABSTRACT

*Brassica oleracea*, also known as cauliflower, is one of the major winter vegetable crop of Pakistan. Naturally, white curd of floral meristems is consumed, while the stalk, green leaves, and thick surrounds are either discarded or used in vegetable potage. Since cauliflower has been grown more intensively, there has been a significant increase in pest infestation. The most dangerous and destructive pest is the cabbage looper (*Trichoplusia ni*). Therefore, different insecticides are utilized to overcome its damage. A field study was conducted in the entomology farm of University of Agriculture, Faisalabad in order to check the effectiveness of seven insecticides. Emamectin benzoate 1.9% EC, Acetamiprid 20% SP, Thiamethoxam 25% WG, Chlorpyrifos 40%EC, Sprintrom 120 SC, Lufenuron 5% EC, Lambda cyhalothrin 2.5% EC against the cabbage looper. The experiment was laid out according to RCBD with three replications. An untreated plot with no chemical application was also maintained for contrast. When cabbage looper infestation reached at economic threshold level (ETL) the cauliflower plant was brought in exposure with toxic chemicals. One, three, five, seven, and fifteen days after application, the percentage reduction data was compiled. At 5% probability level, the acquired data were examined using appropriate statistical procedures. Maximum decrease was observed after 15 days of the first and second sprays with sprintrom (84.507% and 89.804%), emamectin benzoate (81.288% and 86.538%), chlorpyrifos (80.195% and 84.373%), lufenuron (77.759% and 81.517%), lambda cyhalothrin (75.448% and 78.336%) and thiamethoxam (72.521% and 75.116%) respectively. While minimum reduction (70.864% and 71.944%) was recorded where acetamiprid was applied.

Keywords: Cabbage Looper, Cauliflower, Insecticides, Chlorpyrifos, Acetamiprid.

SPP-IPM-131

Insect Microbiomes: Innovative Approach to manipulate insect pest behavior

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ABSTRACT

Insect microbiomes significantly influence the behavior, development, and overall fitness of their hosts, making them a promising target for biotechnological interventions aimed at pest management and ecological research. This study explores innovative biotechnological approaches to manipulate insect behavior through the targeted modification of their associated microbial communities. Using a combination of metagenomics sequencing and bioinformatics, this is concluded that microbiomes of various insect species, revealing specific microbial taxa that correlate with behaviors such as feeding, mating, and predator avoidance.

It is necessary techniques including microbial inoculation, gene editing (e.g., CRISPR-Cas9), and synthetic biology to enhance beneficial microbes or suppress those linked to undesirable behaviors. Experimental applications conducted on key pest species, assessing the impact of microbiome manipulation on feeding preferences, reproductive success, and interactions with natural enemies. Preliminary findings indicate that altering the composition of an insect's microbiome can lead to significant changes in behavior, providing insights into how these microorganisms affect host ecology.

Moreover, the study revealed the potential implications of these biotechnological strategies for integrated pest management (IPM), including the reduction of pesticide reliance and the promotion of sustainable agricultural practices. This highlights the critical role of insect microbiomes in shaping insect behavior and emphasizes the need for continued exploration of microbiome manipulation as a viable tool in pest management and ecological restoration efforts

Keywords: Insect microbiomes, behavior manipulation, biotechnology, pest management

SPP-IPM-132

Exploring Fruit Fly Attraction Patterns: A comparative study of peach fruit flies (*Bactrocera zonata*) and Oriental fruit fly (*Bactrocera dorsalis*) across different fruits under laboratory condition

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ABSTRACT

BACKGROUND: Tephritid fruit flies are an economically important insect pest worldwide. They display endophagous feeding behaviour, which reduces both quantitative and qualitative yields. As a result, they represent a serious danger to world fruit and vegetable output. *Bactrocera dorsalis* has been found to infest more than 250 host plant and *B. zonata* consumes over 50 commercial and wild host plants. The oriental fruit fly *B. dorsalis* is a significant pest that causes 5-100 percent loss of various fruits. Annually*, B. zonata* and *B. dorsalis* cause a 25-50% loss in mango fruit. *B. zonata* may lead to 25 to 100% losses in peaches, apricots, guavas, and figs in India, as well as 25 to 50% in guava alone in Pakistan. Fruit flies inflict over $200 million in damage to Pakistani fruit and vegetable producers each year.

METHODS: The current study was conduct to check the preference of *B. zonata* and *B. dorsalis* under laboratory condition on different selected fruits substrate (Mango, peach and guava substrate). For olfactory response twenty pair of each species was released in cage and traps which containing substrate are placed in the cage. For oviposition 11-12 days old twenty pair of each species was released in the cage and cups which containing filter paper (1 inch wide and 3 inch length) dipped in fruits substrate was placed in the cage.

RESULTS: The results showed that after 8 hours, *B. zonata* most preferred peach followed by mango followed by guava. The results showed that *B. dorsalis* most preferred mango followed by peach followed by guava. Results showed that after 24 hours, female of *B. zonata* laid significantly greater number of eggs on peach substrate than mango, guava and control (agar medium). Whereas, females of *B. dorsalis* laid higher number of eggs on mango fruit substrate followed by peach, guava and control.

Key words: *Bactrocera dorsalis, Bactrocera zonata*, Oriental fruit fly, Peach fruit fly, behavioral response, attraction, oviposition

SPP-IPM-133

Arthropod Fauna on Conocarpus Plants in Urban Landscapes

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Abstract

BACKGROUND: The two species *Conocarpus erectus* (Buttonwood) and *Conocarpus lancifolius* (Damas tree) commonly known as Conocarpus are an important part of urban landscaping and reforestation due to their remarkable adaptability to various environmental conditions. These species are mainly found in tropical and subtropical regions and can withstand saline and arid environments.

METHODS: In this study arthropod biodiversity associated with Conocarpus was investigated in urban environments. The study was carried out at different geographical locations of Multan.

RESULTS: A total of 13 distinct taxa of two arthropod classes: Insecta and Arachnida was identified belonging from orders Diptera, Hemiptera, Hymenoptera, Coleoptera, and Araneae. The arthropod fauna of Conocarpus showed multi-trophic structure, including herbivores (e.g., *Myzus persicae*, *Agromyza pseudoreptans*), predators (e.g., *Phidippus* sp., *Colonus* sp.), and parasitoids (e.g., *Lycorina glaucomata, Macrocentrus* sp.).

CONCLUSIONS: The biodiversity of Conocarpus plants suggests that they are valuable resources and habitats for a variety of arthropods in urban environments. The observed complex food chain highlights the significance of urban green areas as refuges for biodiversity in modified environment. This research contributes to urban ecology and can have a significant impact on conservation and urban planning.

Keywords: Arthropod biodiversity, Conocarpus, urban ecology, trophic interactions, Biodiversity conservation

SPP-IPM-134

Urban Pigeons Dietary Shifts, Implications of Transition from Insect Diet to Herbivory

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ABSTRACT

BACKGROUND: Pigeons, once known for their omnivorous diet, are experiencing a noticeable shift toward herbivory, particularly in urban environments. Traditionally, these adaptable birds have eaten everything from grains and seeds to small invertebrates. However, in bustling cities where rapid urbanization is altering the natural landscape, pigeons now rely heavily on plant-based food sources. This shift is largely due to a decline in insect availability, driven by habitat loss and the widespread use of insecticides such as thermal fogging, aimed at controlling disease-spreading mosquitoes.

METHODS: Urban settings, dominated by concrete and human activity, offer fewer insects, pushing pigeons toward plant-based scraps and human-provided feed. These areas should be selected for evaluation.

RESULTS: In areas like China Chock and Mall Road, Lahore, where thousands of pigeons gather, up to 40 kilograms of seed feed are used daily to sustain them. While this shift might seem like a minor adaptation, it could have long-term consequences on pigeon nutrition and health. Insects provide essential proteins, especially during breeding seasons, when pigeons need to feed their chicks. Without this critical protein source, pigeons may face nutritional imbalances, potentially affecting their reproductive success and overall vitality.

CONCLUSIONS: The consequences don't end with pigeons. As urban pigeons adapt to herbivory, the local insect populations they once consumed could flourish and there may be outbreak of insects like mosquitos. This change might disrupt the delicate balance between urban wildlife and their environments. Additionally, the over-reliance on human food sources brings pigeons even closer to urban infrastructure, which is not always a good thing. Considered pests by many, pigeons cause health risks and damage to buildings through their droppings, which corrode surfaces and spread diseases like histoplasmosis and psittacosis. As we continue to shape urban landscapes and use pesticides to combat health crises like dengue, we may need to rethink how these actions affect local ecosystems.

Keywords: Dietary shift; Thermal fogging; Ecosystem impact; Dengue outbreak

SPP-IPM-135

Role of gut symbionts of insect pests: A new goal for insect-pest control in small plant

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ABSTRACT

BACKGROUND: Insects possess beneficial and nuisance values in the context of the agricultural sector and human life around them. An ensemble of gut symbionts assists insects to adapt to diverse and extreme environments and to occupy every available niche on earth.

METHODS: We conducted a meta-analysis of 21 studies on plant symbionts. Microbial symbiosis helps host insects by supplementing necessary diet elements, providing protection from predators and parasitoids through camouflage, modulation of signaling pathway to attain homeostasis and to trigger immunity against pathogens, hijacking small plant pathways to circumvent plant defence, acquiring the capability to degrade chemical pesticides, and degradation of harmful pesticides.

RESULTS: Therefore, a microbial protection strategy can lead to overpopulation of insect pests, which can drastically reduce crop yield. Some studies have demonstrated increased insect mortality *via* the destruction of insect gut symbionts; through the use of antibiotics. Current meta-analysis indicates the various roles played by the gut microbiota of insect pests and some studies that have been conducted on pest control by targeting the symbionts. Manipulation or exploitation of the gut symbionts alters the growth and population of the host insects and is consequently a potential target for the development of better pest control strategies. Methods such as modulation of gut symbionts *via* CRISPR/Cas9, RNAi and the combining of IIT and SIT to increase the insect mortality.

CONCLUSION: In the ongoing insect pest management scenario, gut symbionts are proving to be the reliable, eco-friendly and novel approach in the integrated pest management.

Keywords: host–microbe interaction, microbial detoxification, nutrition, parasitoid, pest control, plant defence, symbiont-mediated

SPP-IPM-136

Functional response of *Chrysoperla carnea* and *Coccinella septempunctata* against *Spodoptera frugiperda*

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ABSTRACT

BACKGROUND: Maize (*Zea mays* L.), wheat, and rice, are Pakistan's three most important cereal crops. Together with other important crops, maize accounts for 3.4% of agricultural output or 0.6 % of GDP. Insect pests and diseases are the major reasons for less agricultural production. *Spodoptera frugiperda* is responsible for the economic loss of maize yield and quality. Insecticides, botanicals, cultural practices, and mechanical controls are used to manage this pest. Increased use of synthetic insecticides creates a huge threat to the environment. The present research work aims to manage *S. frugiperda* through eco-friendly methods by evaluating the functional response of biocontrol agents such as *Chrysoperla carnea* and *Coccinella septempunctata* under laboratory conditions.

METHODS: The functional response of *C. carnea* ($2^{nd}$ and $3^{rd}$ instar larvae) and *C. septempunctata* (adults, $3^{rd}$ and $4^{th}$ instar larvae) against *S. frugiperda* ($1^{st}$ and $2^{nd}$ instar larvae) were evaluated.

RESULTS: The findings of the current investigation revealed that each predator possesses a functional response of type II against *S. frugiperda* larvae. *C. septempunctata* showed a higher attack rate and low handling time than *C. carnea*. The results showed that the maximum daily predation amount, attack rate, and handling time of *C. septempunctata* (adults, $3^{rd}$ and $4^{th}$ instar larvae) on the $1^{st}$ instars of *S. frugiperda* were 0.05 hr day$^{1}$, 0.06 hr day$^{1}$ and 0.08 hr day$^{1}$, respectively and the values on the $2^{nd}$ instars of *S. frugiperda* were handling time (0.0915±0.0062) against *S. frugiperda* ($2^{nd}$ instar) and 0.0496 hr±0.0042 day$^{1}$, 0.0805 hr±0.0084 day$^{1}$ and 0.0915 hr±0.0062S.E day$^{1}$, respectively. Predation rate was found higher in *C. septempunctata* (adult) by *C. septempunctata* $4^{th}$ instar larvae and $3^{rd}$ instar larvae show lower predation rate. The maximum daily predation amount, the sequence of the handling time of *C. carnea* ($2^{nd}$ and $3^{rd}$ instar) on the $1^{st}$ instars o f *S. frugiperda* and on $2^{nd}$ instar of *S. frugiperda* 0.014±0.01 day$^{1}$, 0.10hr ±0.01 day$^{1}$, respectively and the values of attack rate of $2^{nd}$ and $3^{rd}$ instar of *C. carnea* on the $1^{st}$ instars of *S. frugiperda* were 0.96 and 1.11 day$^{1}$, respectively and against $2^{nd}$ instar *S. frugiperda* and 0.14,0.99 day$^{1}$, respectively. Predation rate was found higher in *C. carnea* $3^{rd}$ instar by *C. carnea* $2^{nd}$ instar larvae.

CONCLUSION: These findings support the predatory role of *C. carnea* and *C. septempunctata* in controlling *S. frugiperda.*

Keywords: Maize, fall armyworm, biocontrol agents, functional response, conservation.

SPP-IPM-137

Similar Gut Bacterial Microbiota in Two Fruit-Feeding Moth Pests in Different small plant Host Species

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ABSTRACT

BACKGROUND: Numerous gut microbes are associated with insects, but their composition remains largely unknown for many insect groups, along with factors influencing their composition.

METHODS: We conducted a meta-analysis of 25 studies on the interactions between Two Fruit-Feeding Moth Pests in Different small plant Host Species December 2023 and April 2024.Here, we compared gut bacterial microbiota of two co-occurring agricultural pests, the peach fruit moth (PFM), *Carposina sasakii*, and the oriental fruit moth (OFM), *Grapholita molesta*, in different orchards and host small plant species.

RESULTS: Gut microbiota of both species is mainly composed of bacteria from Proteobacteria, followed by Firmicutes. The two species shared bacteria from the genera *Pseudomonas*, *Gluconobacter*, *Acetobacter*, and *Pantoea*. When we compared two pairs of PFM and OFM populations collected from the same host species and the same orchard, there is no difference in alpha and beta diversity in gut microbiota. When compared gut microbiota of the same species and host plant from different orchards, alpha and beta diversity was different in populations of PFM collected from two pear orchards but not in other comparisons.

CONCLUSION: Current study suggests that the two pests share many features of gut microbiota and environment in orchards is a main factor influencing their gut microbiota.

Keywords: *Carposina sasakii*, *Grapholita molesta*, gut microbiota, host, orchard

SPP-IPM-138

Role of Biopesticides in Maintenance of Ecological Balance

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ABSTRACT

Biopesticides, derived from natural materials such as plants, bacteria, and fungi, play a crucial role in the conservation of ecosystems by promoting sustainable agricultural practices and reducing reliance on synthetic chemicals. These environmentally friendly alternatives contribute to biodiversity preservation, soil health, and the maintenance of ecological balance by minimizing harmful impacts on non-target species, including beneficial insects and microorganisms. By targeting specific pests and diseases, biopesticides help mitigate the risk of resistance development associated with conventional pesticides, fostering a more resilient agro-ecosystem. Additionally, their application supports integrated pest management (IPM) strategies, which emphasize the synergistic use of biological control methods alongside cultural and mechanical practices. This approach not only enhances crop productivity and quality but also reduces environmental pollution, soil degradation, and water contamination. Ultimately, the adoption of biopesticides represents a pivotal step towards achieving sustainable agriculture, safeguarding ecosystem integrity, and ensuring food security for future generations.

Keywords: Biopesticides, Integrated Pest Management, Ecological balance, Sustainable agriculture, Food security

SPP-IPM-139

Pesticides decrease the pollinators activity in Cross-pollinated Crops

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ABSTRACTS

For crops that are cross-pollinated, pollinators are crucial. Additionally, pollinators increase biodiversity and crop output. Pollinators have amazing effects on a variety of crops. One of the many difficulties pollinators have is exposure to pesticides while working in the field. Pollinators are seriously threatened by pesticides. Important pollinators are negatively impacted by pesticides, which change their foraging habits and other vital behaviors. Pollinator toxicity can be altered by pesticide formulation, application techniques, and timing. Bees and other insect pollinators may come into touch with pesticide residues on foliage or flowers, eat contaminated pollen, nectar, or honeydew, or directly spray pesticides used in agriculture or disease vector management. Additionally, a wide spectrum of deadly and sublethal impacts on insect pollinators—particularly bees—have been demonstrated by pesticides. These include the insects' direct death as well as unfavorable non-lethal consequences including poor feeding, decreased brood success, or disrupted homing abilities. It should come as no surprise that insecticides are typically found to put insect pollinators at the greatest danger. However, bees may also be harmed by the use of fungicides and acaricides. Although most herbicides do not directly harm bees, they can have a significant negative impact on pollinators indirectly by removing sources of nectar and pollen or nest sites. The use of pesticides has been ranked as one of the top three global drivers of pollinator loss, along with habitat destruction and intensive land management (agriculture) in nearly every region. Pesticides should only be administered to afflicted plants; they should not be applied during the day, when pollinators are still active, in order to prevent this drop in pollinator populations. *So Choice the least toxic, less persistent pesticide will make possible to minimize risk to pollinators Decrease.* Use products that may not contain a bee hazard warning even if the product is highly toxic to bees

SPP-IPM-140

Efficacy of Entomopathogenic Nematodes Derived Bacterial Isolates against Fall Army Worm Larvae

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ABSTRACT

BACKGROUND: Maize (*Zea mays* L.) is one of the most important staple grain and considered as the 3rd most important crop after wheat and rice in Pakistan that faces serious economic losses due to fall army worm. The fall army worm is one of the most significant maize pest that causes massive destruction by feeding on the leaf epidermis and minimizing yield production with low income. It is a major global challenge to manage its introduction into the field, therefore, bio-control is the best alternate for the management of fall army worm utilizing entomopathogenic nematodes derived bacterial isolates.

METHODS: Fall army larvae were collected and reared in the rearing chamber for second and third instars. Entomopathogenic nematodes were isolated and symbiotic bacteria *Xenorhabdus* and *Photorhabdus* were isolated and multiplied by making their suspension which were used against the fall army worm larvae along a recommended insecticide to check their efficacy against second and third instars of fall army worms.

RESULTS: There were 2 trials with 3 treatments $T_1$ (*Xenorhabdus*), $T_2$ (*Photorhabdus*), $T_3$ (insecticide) and $T_0$ (control) and each trial had the same concentrations of $C_1$ ($1\times10^{10}$/ ml), $C_2$ ($1\times10^{15}$ /ml), $C_3$ ($1\times10^{20}$ /ml) for all treatments. The results of first trial showed the highest mortality rate of 98%, in $T_2$, whereas $T_1$ showed lowest mortality of 93% in concentration $C_3$. The mortality rate of $T_3$ was 100% and $T_0$ showed the lowest mortality rate of 15%. The second trail results showed a mortality percentage of $T_3$ which had the highest mortality rate of 100% while $T_2$ had the mortality rate of 95%. $T_1$ demonstrated the mortality rate of 95% and $T_0$ 15% respectively.

CONCLUSION: Entomopathogenic nematodes derived bacterial isolates *Photorhabdus* and *Xenorhabdus*, play a crucial role in managing fall armyworm populations in maize. These biological agents are eco-friendly alternatives to chemical pesticides, minimizing environmental risks. Their use enhances food safety by reducing harmful residues on crops, contributing to economic stability for farmers by improving crop yields.

Key Words: Bio-control, Entomopathogenic nematode, Derived Bacterial isolates, insecticide, Fall army worm

SPP-IPM-141

Management of dengue vector using cigarette butt waste; a novel technique

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ABSTRACT

More than 400 million cases of dengue are reported every year, with Asia accounting for three-quarters of those instances. Since the beginning of 2024, more than 12 million cases with over 8,000 deaths reported across 86 countries and five WHO regions i.e., Africa, Americas, South-East Asia, Western Pacific and Eastern Mediterranean Region. *Aedes aegypti* and *Ae. albopictus* (Culicidae) are the main dengue vectors in Pakistan and all over the world. So far, for dengue virus, no vaccine is commercially available. So, controlling their vectors is the sole method. In Pakistan, the use of smoking is increasing day by day. More than 22 million people smoke tobacco in Pakistan, out of which 32% are men and 6% are women. The aim of this study was to check efficacy of cigarette butt (CB) extracts by acting as ovipositional deterrent and killing immature stages of dengue vectors. Ovipositional preference and larval mortality were assessed against three different concentrations (1CB, 2CBs, and 3CBs) of Gold Leaf butts and a control (water only). Results showed that control received significantly higher egg numbers than that of all three CB concentration. While, after 24 hours, all larval instars were found dead at highest concentration of CB extract (3CBs). However, at lower concentration, mortality rate had an inverse relation with the developmental stage of mosquito larvae. Using acetone and methanol as solvents, GC-MS analysis of CB extracts showed both qualitative and quantitative variations in the chemical makeup. This study introduces an alternate solution to control ovipositional and larval stages of *Aedes* mosquitoes by using cigarette butt waste.

Keywords: Dengue, Aedes, *aegypti*, *albopictus*, behavior, cigarette butt waste

SPP-IPM-142

Preeminence of Integrated Pest Management (IPM) in Food industry for Food security

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ABSTRACT

BACKGROUND: Integrated pest management (IPM) is a complex process in which various strategies are used to control pests such as chemical, mechanical, physical, cultural, habitat manipulation, resistant varieties and biological management. Successful pest management practices in the food industry are very important as food facilities have large infrastructure which can be vulnerable to pest infestation. Hygiene and safety in food operations are very crucial to maintain by implementing pest management practices. Significant health risks like foodborne illnesses can be caused by eating contaminated food due to pests such as birds, insects and rodents which left their hair, droppings and body parts in food.

METHODS: Four steps are followed in integrated IPM. First step includes indicating a point of action threshold at which pest control practice must be implemented. Second step includes proper monitoring and identification of pests for taking appropriate control. Third step is preventing the food from contamination of pests through implementing pest control methods. Last step includes evaluating the proper control method if the monitoring, identification and action threshold steps indicate that preventive practices have no effect and pest control action is mandatory to prevent health risks.

CONCLUSION: It is a moral obligation to keep the public safe by maintaining the quality of food through following strict regulations and guidelines to control pests. Therefore, these IPM practices are very critical to maintain the integrity and overall safety of the food supply chain and to meet regulatory requirements.

Keywords: Sustainability, industry, foodborne illnesses and food supply chain.

SPP-IPM-143

Assessing the fitness traits of *Bactrocera zonata* (Diptera: Tephritidae) on commercial mango cultivars

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ABSTRACT

BACKGROUND: *Bactrocera zonata* is one of the major agricultural pests that attack more than 50 host plants, mango is one of them. The mango cultivars have a genotypic variation that shows a different response to pests. To understand the host selection variations, it is necessary to assess the fitness traits of *B. zonata* on different cultivars. Different factors influence the fitness and oviposition of adult flies. To find the reasons behind this influence, a life table study is performed. This information helps to understand the life history traits and fitness of pests. Parameters of the life table study include intrinsic rate r, finite rate λ, net reproductive rate Ro, and mean generation time T which are statistically obtained by TWO SEX MS-Chart.

METHODS: For experimentation, the plastic jars were used to expose the *B. zonata* adults to mango cultivars (Anwar Ratol, Dasheri, and Totapuri). For pupal emergence, the third instar larvae were shifted to a separate cage and adults were fed on sugar solution. All biological parameters of the life table study were evaluated through TWO SEX MSChart.

RESULTS: According to the results, maximum growth parameters were observed on Dasheri and a significant difference was observed among Anwar Ratol, and Totapuri. The maximum reproductive rate, and survival rate was observed on Dasheri.

CONCLUSION: In conclusion, this study unveils the strategies for integrated pest management such as the attract and kill lure technique. There is a need to find phytochemicals in mango cultivars that attract *B. zonata*.

Keywords: *Bactrocera zonata*, fitness traits, mango cultivars, attract and kill lure

SPP-IPM-144

Toxicity of selected insecticides on *Apis mellifera* and *Ceratina smaragdula* through laboratory and field assays

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ABSTRACT

Pollinators are essential for agricultural productivity, but their populations are declining due to anthropogenic disturbances including pesticide exposure. The current study tests the acute toxicity of ten insecticides commonly used in cotton systems on honey bee (*Apis mellifera*) and a solitary bee species, small carpenter bee (*Ceratina smaragdula*) using laboratory and field assays. In lab, emamectin benzoate showed the highest toxicity to *C. smaragdula* and *A. mellifera*. Moderate toxicity was noted for flubendiamide and chlorantraniliprole. Field application showed significant differences in bee abundance in treated and untreated plots. Untreated plots had the highest abundance of both bee species, while treated plots had the lowest abundance of bees. This current study calls for further research on long-term pesticide effects on different bee species keeping in view their ecosystem service of crop pollination.

Keywords: honey bee, solitary bee, pesticides, untreated plots, less toxic insecticide

SPP-IPM-145

Evaluation of biocidal activity of different insecticides against whitefly (*Bemisia tabaci*) in tomato

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ABSTRACT

Whiteflies harm plants while feeding and they can increase the susceptibility of plants to illness. Whitefly secrete a sticky substance called honeydew while eating. This substance causes the plant to develop sooty mold when covered with this secretion. Whiteflies are also known carriers of a variety of viruses that can do substantial damage to plants. The field experiment was carried out to study the bio-efficacy of different insecticides against sucking pest whitefly (*Bemisia tabaci*). The studies carried out at the research area of Department of Entomology, University of Agriculture, Faisalabad during winter season 2022-2023 to evaluate the effectiveness of imidacloprid Acetamiprid, Acephate, Flonicamid, Dinotefuran, Diafenthiuron, Clothianidin, Bifenthalen, thiamethoxam and Nitenpyram as foliar application against the whitefly (*B. tabaci*). The treatment of Imidacloprid 20 SL 90% and Acetamiprid 20% SP were found to be more effective for the control of whitefly (*B. tabaci*) on tomato. Imidacloprid had the noticeably largest tomato fruit yield. The experiment layout was Randomized Complete Block Design (RCBD) under three replications. Ten treatments were used (T1, T2, T3, T4, T5, T6, T7, T8, T9, T10. The experimental result revealed that imidacloprid was the most effective treatment with 100% control of pest population at 5 days after spray and also with minimum population at 7 and 15 days after spray.

Keywords: Imidacloprid, tomato, *Bemisia tabaci*, Biocidal

SPP-IPM-146

Comparative Efficiency of Botanical Extracts and Pyrifluqunazon for the Control of *Brevicoryne brassicae* (L.) on Canola and Wheat

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ABSTRACT

BACKGROUND: The wheat aphid, *Brevicoryne brassicae* (L.) is the most destructive insect pest of wheat and canola crops and causes substantial yield losses through sucking cell sap and transferring disease-causing pathogens.

METHODS: The current study was carried out to investigate the effects of three botanical extracts (lemon grass, lupin, and moringa) and Matoi 20 WG (pyrifluqunazon) alone and in integrated manners against *B. brassicae.*

RESULTS: The results revealed that lemon grass + pyrifluqunazon showed the maximum population reduction (96.58% and 91.36%) in wheat and canola, respectively. In the case of natural enemies (Coccinellids, Syrphid flies, and *Chrysoperla carnea),* maximum population reduction was observed in Matoi (95.33%, 91.23%, and 91.66%), while minimum reduction was observed in lemon grass (4.76%, 6.66%, and 11.11%) treatments, respectively. The maximum number of grains (41.33 and 41.00) and grain yield (55.66 and 6.24 g) were recorded for wheat and canola, respectively, in the lemon grass + pyrifluqunazon treatment.

CONCLUSION: Hence, it was concluded that the combination of plant extract and Matoi could be a better option for controlling wheat aphids and conserving natural enemies in the field. This combination could be recommended to the farmers in the integrated management of wheat aphid.

Keywords: *Brevicoryne brassicae,* Botanical extract, Matoi, Natural enemies,

SPP-IPM-147

Comparative efficacy of *Moringa oleifera* and *Eucalyptus globulus* extracts along with their green synthesized Zinc oxide nanoparticles against *Rhyzoglyphus tritici* (Acaridi: Acari) under laboratory conditions

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ABSTRACT

Mites are the most destructive pest of stored grains, plant bulbs, and tubers. These are present everywhere and cause both qualitative and quantitative losses to grains. *Rhyzoglyphus tritici* feed on the germplasm of grain, produce sourness and bad smell in flour, cause itching and allergies in humans. Food that is high in protein and fats are the favorite diet for these mites. Due to high humidity and their attack, these produce fungal spores in the grains. The affected grains remained unable to germinate in the field causing both time and expense losses to the farmers. In this study, mites are controlled by using plant extracts of *Moringa oleifera* and *Eucalyptus globulus* along with their synthesized Zinc oxide nanoparticles. Mites were collected from gains and reared in laboratory under controlled conditions. The research took place in Acarology Research Laboratory, Department of Entomology, University of Agriculture, Faisalabad. Five concentrations of Zinc oxide nanoparticles at 0, 200, 400, 600, and 800 ppm along with *M. oleifera* and *E. globulus* extracts with 0%, 3%, 6%, 9%, and 12% concentrations were applied to *R. tritici* in transparent plastic jars. The mortality data were collected after 7, 14, 21, and 28 days. The highest mortality (92.5%) was caused by Zinc oxide nanoparticles of *E. globulus,* (85%) mortality was caused by Zinc oxide nanoparticles of *M. oleifera*. Similarly, (77.5%) mortality caused by *E. globulus* extract, and the least (75%) mortality was caused by *M. oleifera* extract. ANOVA was used to statistically analyze the data. This study will be helpful in the future for the sustainable management of wheat mites.

SPP-IPM-148

Pathogenic activity of *Beauveria bassiana* against different life stages of *Bactrocera dorsalis*

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ABSTRACT

*Beauveria bassiana* is a good candidate for biocontrol of many important insect pests. Cuticle is the site of attachment of fungal spores after invasion on host body. Cuticle degrading enzyme is one of set of enzymes possessed by entomopathogenic fungi that ensures the successful penetration. The recent study indicated the extraction of crude cuticle degrading enzymes from *B. bassiana* as mixture of mycelium and CDE offers enhanced pathogenicity to its host. Tris-HCL, calcium chloride, potassium hydrogen phosphate, sodium phosphate, magnesium sulphate, zinc chloride and olive oil were mixed in 50ml Erlenmeyer flask to extract CDE from lab strain of *B. bassiana*. After centrifugation of mixture, the supernatant was separated as extracellular enzymes. The media was subjected to SDS-PAGE analysis for characterization of enzymes. Stacking gel (4%) and resolving gel (12%) were carried out with pH of 8.6 for the determination of molecular masses of samples (Enzymes) in kDa. The result showed that after staining and de-staining of gel, different bands of various sizes were appeared. When compared with standard key. The bands were found at 19, 50, 25, 32 and 34.25 kDa confirming the proteases, lipases and chitinase respectively. The extracted CDE can be used with different combinations of mycelial medium of *B. bassiana* or other entomopathogenic fungi for enhanced their pathogenicity against insect pest. The extracted crude enzymes were used against larvae, pupae and adults with concentrations of 5, 10, 15, 20, and 25$\mu$L. The mortality rate in larvae and adult were recorded as 78.50±2.10% and 80±2.15% at 25$\mu$L/mL. At lower concentrations (5$\mu$L/mL), the mortality was 13.33±1.92% followed by control. Low percentage of adult emergence (10±2.63%) from pupae was observed in treated insect and higher adult emergence (65.0±5.77%) in untreated group of insects. The result showed that the mortality and adult emergence from pupae was concentration dependent. Therefore, adding CDE in mycelium of *B. bassiana* enhanced its pathogenicity against different life stages of *Bactrocera dorsalis*.

Keywords: *B. bassiana*, *B. zonata*, characterization, CDE, SDS-PAGE

SPP-IPM-149

Comparative efficacy of granular insecticides versus new chemistry foliar formulations against *chilo partellus* swinhoe and Entomophagous arthropods in maize

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ABSTRACT

Maize (*Zea mays* L.) is one of the most important cereal crops in the world. Maize grains are being used as many human food products and rich source of feed for livestock and poultry birds. One of the important constraints responsible for low yield is undoubtedly the attack of various insect pests particularly the maize borer. *Chilo partellus* which has gained major importance by inflicting crop loss up to 4-45%. This research project was conducted for the evaluation of granular versus foliar application of new insecticides against *C. partellus* and their effect on the natural enemies of the focused pest. The chemicals for test include few granular insecticides (Carbofuran 30. Cartap 3G and Monomehypo 5G) as well as some new chemistry foliar formulations (Coragen 20SC, Regent 80WG, Tracer 240SC and Belt 48SC). The crop was sown under Randomized Complete Block Design (RCBD) replicated thrice. The data regarding number of larvae per plant, length of tunnel in the stem, number of dead hearts, holes on leaves and the populations of associated entomophagous arthropods was collected. The results showed that among all granular insecticides carbofuran 3G and among new chemistry foliar formulations on insecticides Regent 80WG was best in reducing borer infestation and these both also cause the maximum mortality of natural enemies like spiders and coccinalids at 3,7 and 14 days post treatment period. Effect of both granular insecticides and new chemistry foliar formulation was non-significant in reducing leaf holes, dead heart formation and stem tunneling in maize. New chemistry foliar formulations also showed the satisfactory results along with granular insecticides. So in spite of granular applications, insecticidal sprays can also be recommended to manage insect pests in maize.

Keywords: Maize, *Chilo partellus,* new chemistry & Granular insecticides, Entomophagous Arthropods, Efficacy, Foliar application.

SPP-IPM-150

Incidence of Nosema disease affecting honey Bee (*Apis mellifera* L.) colonies in the Pothohar region of Punjab, Pakistan

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ABSTRACT

BACKGROUND: Nosemosis, a parasitic disease affecting adult honey bees (*Apis mellifera*), is caused by two microsporidia species, *Nosema apis* and *Nosema ceranae*. This globally prevalent disease leads to substantial losses in honey production. Despite reports of its presence in Pakistan, a lack of scientific evidence prompted this study. The objective was to identify and determine the incidence of the microsporidia fungi (*N. apis* or *N. ceranae*) in honey bee colonies across Pakistan, utilizing molecular techniques.

METHODS: A total of 55 suspected samples of older forager bees were collected from bee colonies in the Pothohar region, Punjab, Pakistan. The incidence of *N. apis* or *N. ceranae* was assessed through both light microscopic examination and Polymerase Chain Reaction (PCR). Specific Primers 321*APIS*-FOR, 321*APIS*-REV, 218MITOC-FOR, and 218MITOC-REV were employed for precise identification. Microscopic observations revealed the presence of oval to sausage-shaped spores with a thick wall in 15 out of 55 samples, confirming the existence of *N. apis* or *N. ceranae*.

RESULTS: District-wise analysis demonstrated varying disease incidences, with the highest recorded in Chakwal district (35.29%), followed by Rawalpindi district (28.57%). Jhelum district exhibited the lowest disease incidence at 16.66%. Overall, the Pothohar region recorded a disease incidence of 27.27%. Further molecular analysis identified *N. apis* as the dominant species in 15 samples (27.27%), while *N. ceranae* was detected in 03 samples (5.45%). This study stands as the first molecular-based confirmation of the presence of *N. apis* and *N. ceranae* in Pakistan.

CONCLUSION: In unveiling the molecular basis of Nosemosis in Pakistani honey bee colonies, this study addresses a critical gap in our understanding of bee diseases. Confirming the presence of *Nosema apis* and *Nosema ceranae* in the Pothohar region sheds light on the diversity of *Nosema* species and emphasizes the significance of molecular tools in disease diagnosis. The district-wise variation in disease incidences underscores the need for targeted monitoring and management efforts, with Chakwal district displaying the highest prevalence. The identification of *N. apis* as the dominant species and the detection of *N. ceranae* contribute valuable insights. This research serves as a foundation for future studies and informs apicultural management strategies, crucial for sustaining honey bee health and mitigating the economic impact of Nosemosis on honey production in Pakistan.

Keywords: *Nosema apis* · *Nosema ceranae* · honey bees · Incidence ·

SPP-IPM-151

Impact of biofertilizer application for the host plant resistance of chickpea (*Cicer arietinum*) and lentil (*Lens culinaris*) on different insect pests

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ABSTRACT

The rhizosphere microorganisms usually categorized into plant growth promoting microorganisms that directly promote the plant growth and biological control agents which ultimately contribute to plant yield by controlling the crop pests. The present research project was carried out to investigate the impact of a two formulations/mixtures of bio fertilizers i.e. for-1 (consisting of three strains of plant growth promoting rhizobacteria (pgpr) i.e. j, jh. and by) and for-2 (consisting of four strains of plant growth promoting rhizobacteria (pgpr) ie. llr), lc), cb, and lc.) On the productivity of two pulses (lentil and chickpea) and incidence of insect fauna (both beneficial and pest insects). The experiment was laid out in rcbd having four treatments which was for-i ($t_1$), for-2 (t2) and synthetic fertilizer application (t3) and control (t4), replicated thrice. The data regarding population density of insect fauna was collected at week intervals. Population of insect was less in pgpr inoculated plots as compared to synthetic fertilizer's applied plots and control plots. Ladybird beetle population was recorded less in pgpr inoculated plot than synthetic and control plots due to less host insects. nitrogen, phosphorus and potassium (npk) % was analyzed more in plants of inoculated plots as compared to plants of synthetic and control plot. The contribution of nitrogen was recorded maximum in chickpea and lentil crop straw in inoculated plots as compared to synthetic and control crop straws. Phosphorus contribution was recorded maximum in chickpea and lentil crop grains in inoculated plots as compared to synthetic and control crop grains. It was concluded that that inoculated plots showed better results than synthetic and control plots.

Keywords: Bio-fertilizers, Micro-organisms, Host Plant Resistance, Insect Diversity, Chickpea and Lentil Crop

SPP-IPM-152

Persistence of different insecticides formulations against mustard aphid, (Lipaphis erysimin kalt.) (Homoptera: Aphididae)

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ABSTRACT

A laboratory experiment was conducted to find out the effectiveness and relative persistence of different insecticides formulations at their field recommended doses against mustard aphid, *Lipophis erysimi*. Different insecticides viz., Profenophos 500 EC (@500ml/acre), Acetamiprid 20 SL. (@125ml/acre), Mospilon 20 SP (@125g/acre) and Diafenthiuran 500 SC (@200ml/acre) were sprayed on the mustard leaves (*Brassica juncea*) with the help of knapsack sprayer till run off. However, control plants were left unsprayed. Leaves were collected from each insecticide treatment after 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 days of application. The treated leaves were cut into leaf dices according to the diameter of petri- dish and placed in a petri-dish over a moistened filter paper. Twenty wingless adult mustard aphids were transferred on the treated leaf dices in the petri-dish with the help of camel hair brush and allowed to feed. For each time a single leaf was placed in the petri- dishes and twenty adult aphids were transferred on the leaf. Efficacy was assessed by counting the aphid mortality after 24 hours. Adult aphids which were not responding to touching with needle were considered as dead. The percentage mortality was calculated on the basis of dead and alive specimen. Foliar residues were decreased over time and the mortality was decreased gradually. The results obtained showed that all the tested insecticides were effective against *Lipaphis erysimi*. The insecticide which was found to be most effective was Acetamiprid (83%) followed by Mospilon (74%), Profenophos (70%) and Diafenthiuran (64%) which gave least effective results when tested.

Keywords: Mustard Crop, Aphid (*Lipaphis erysimi*), Persistence, Insecticides, Bioassay, Mortality.

SPP-IPM-153

Laboratory bioassay of some indigenous botanical extracts against *Bactrocera correcta* (guava fruit fly)

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ABSTRACT

The research was performed to assess the laboratory efficacy of three indigenous botanical extracts, garlic (*Allium sativum*), ginger (*Zingiber officinalis*) and niazboo (*Ocimum*) against the different life stages of guava fruit fly. Mainly two experiments were performed in lab using completely randomized design (CRD). Five concentrations of each botanical extracts were formulated and assessed for their affectivity using three replications and compared 10 control treatments Two control treatments including methanol and water were used. In free choice method, guava fruits treated with different concentration of each botanical extract were placed in same cages but in no choice method these treated fruits of three extracts were placed in different cages. Among three extracts, garlic extract has performed efficiently as it caused significant decrease in number of fruit flies settled on treated guava fruits. Maximum repellency and oviposition was calculated in case of garlic extracts followed by ginger and niazboo. Results of ginger were better than niazboo but lower than garlic. Then different parameters of larvae biology were assessed for estimating the possible effect of botanical extracts Results had declared the efficiency of garlic extract higher than other two botanicals. Garlic extract at its higher concentration caused the maximum mortality at both larval and pupal stages. It also caused the increase in larval and pupal period and decreased the adult longevity, pupal length and pupal weight were also decreased by these extracts with the maximum decrease in case of garlic extract. No. of eggs laid per female were also significantly reduced by garlic followed by ginger and niazboo.

Keywords: Guava Fruit fly, Botanical Extracts, Repellency, Oviposition Rate, Biology.

SPP-IPM-154

Applications of Acoustics Communication to Control Diptera Flies

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ABSTRACT

BACKGROUND: The Peach Fruit fly, *Bactrocera zonata* is native to South and South-East Asia where it attacks a wide variety of soft fruits including mango, guava and peach. The melon fruit fly, *Bactrocera cucurbitae* is widely distributed in temperate, tropical and sub-tropical regions of the world. It has been reported to damage 81 host plants and is a major pest of cucurbitaceous vegetables, particularly the bitter gourd and musk melon. Mosquitoes are important to transmit serious diseases including yellow fever, dengue and malaria. In line with other techniques, acoustic communication could be one of the management strategies against fruit flies and mosquitoes.

METHODS: In this study, the experiments were performed in laboratory conditions by releasing fruit flies and Aedes mosquitoes in an artificial sound-producing anechoic setup with different frequencies ranging between 100-1000 Hz.

RESULTS: Results indicated that fruit flies maximum attraction, repelled and wing movement behavior was observed at 500-700 Hz. In the case of mosquitoes, the study reported, that for the lower frequency ranges the frequency of variable Hz identified was highly significant for all the parameters involved in the study while for higher frequency ranges the frequency of 18-19kHz was the most desired one.

Conclusion: It can be concluded that both males and females showed maximum attraction behavior at lower frequency Hz. In conclusion, acoustic communication could be an eco-friendly strategy for the management of fruit flies and mosquitoes.

Keywords: artificial sound, anechoic setup, acoustic communication, Diptera Flies, control

SPP-IPM-155

Biodiversity of Termites associated with urban Trees and damage assessment from different localities in Faisalabad, Punjab, Pakistan

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ABSTRACT

Termites are social insects that form colonies and are widespread globally, particularly in tropical regions, where they play a crucial role as decomposers. Despite their ecological importance, only a small percentage of termite species, about 3%, are considered significant pests causing damage to agriculture, forestry, and structures. In Pakistan, the diverse ecological conditions make it conducive for termites to thrive across the country. One of the major challenges in urban areas is the loss of urban trees due to high termite infestation, which contributes to the deterioration of urban landscapes. However, research on the biodiversity, feeding preferences, and damage assessment of termites in urban tree plantations in Pakistan is limited. Our study focused on biodiversity associated with mango and citrus trees planted at the University of Agriculture, Faisalabad. Various areas within the university, including horticulture squares 9 and 32, the botanical garden, plant pathology research areas, and mango and citrus orchards, were selected for the survey. Samples were collected and identified with the help of available taxonomic literature and found that a total of eleven termite species were recorded, mainly including *Odontotermes obesus, Odontotermes guptai, Odontotermes gurdaspurensis, Odontotermes horai, Odontotermes assmuthi, Microtermes mycophagus, Microtermes unicolor, Microceroterms championi, Microtermes obesi, Coptotermes heimi,* and *Heterotermes indicola*. Termite infestation, diversity, and damage were assessed on both living and dead-standing trees. Simpson and Shannon diversity indices were calculated to evaluate species richness, evenness, and dominance. The highest percentage of termite activity was observed in August, particularly in horticulture square No. 9. The overall diversity values were 90% on the Simpson scale and 88% on the Shannon scale. The highest diversity was recorded in September (78% on the Simpson scale) and in April (99% on the Shannon scale). This preliminary data provides valuable insights that can contribute to the development of sustainable termite management strategies in urban ecosystems.

Keywords: Termite, Biodiversity, Damage assessment

SPP-IPM-156

Evaluation of the Sub-lethal Effects of Cypermethrin and Lambda-Cyhalothrin to Quantify the Behaviour of *Apis mellifera* L. Under Laboratory Conditions

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ABSTRACT

*Apis mellifera* (L.) the European honey bee is a commercially significant bee species which not only provides pollination services but is also used for honey production on a larger scale. The use of pesticides in agriculture has been greatly threatening the social behavior, foraging behavior, and navigation of *A. mellifera*. The current study was designed to investigate the comparative residual effectiveness of two commonly used insecticides including Lambda Cyhalothrin and Cypermethrin on the social and individual behaviors of *A. mellifera* under laboratory conditions. Worker bees of *A. mellifera* were exposed to the insecticide solution (0 ppm, 250 ppm, 500 ppm, 750 ppm, and 1000 ppm) by soaking and drying the filter paper in different serial dilutions of both insecticides. Antennation and mutual interaction of honeybees observed were included in social behaviors and flight ability, locomotion, buzzing, hiding tendency, and feeding behaviors were included in the individual behaviors of honeybees. In insecticidal treatments, honeybees showed clear deviation in their social and individual behaviors as compared to the control. The study revealed that cypermethrin had more toxic effects on the studied behaviors of honeybees as compared to lambda-cyhalothrin. Even lower dosages of both insecticides deviated bee's behavior compared to the control. Deviations in the studied behaviors of honeybees are thought to be the main causes of colony collapse disorders. So, excessive use of these insecticides will badly affect the contribution of honeybees to pollination and ultimately crop production.

Keywords: *Apis mellifera*, lambda-cyhalothrin, cypermethrin, social behaviors, individual behaviors, residual effects.

SPP-IPM-157

Effect of temperature on the functional response of *Coccinella septempunctata* on two different aphid species

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ABSTRACT

BACKGROND: *Coccinella septempunctata* (Linnaeus), is known to be most important predator of aphids, including *Aphis nerii* (Fonscolombe) and *Lipaphis erysimi* (Kaltenbach). In this study, we investigated the effect of two temperature on the Functional response of *C. septempunctata* praying on two different hosts.

METHODS: The experiment was performed at two different temperatures (15 and 25°C) and with 6 different prey densities (4, 8,16, 32, 64, and 128 aphids). Each experiment was replicated for 5 times. To determine the type and parameters of the functional response, logistic regression and Roger's random predator models were used.

RESULTS: Results showed that at both temperatures, larvae, and adults of *C. septempunctata* exhibited type II functional response against tested aphids. The attack rate of fourth instar was maximum as compared to other predatory stages against both aphids. The attack rate was increased as temperature was increased. The attack rate recorded for the fourth instar at 15 °C was 1.314 $h^{-1}$ and 1.959 $h^{-1}$ against *A. nerii* and *L. erysimi* respectively. The attack rate of $4^{th}$ instar at 25 °C, against *A. nerii* and *L. erysimi* was 1.747 $h^{-1}$ and 1.321 $h^{-1}$, respectively. The handling time was varying with the stage of the predator and by the change in the temperature. The handling time of the later predatory stages decreases as the temperature increases. These results indicate that the later predatory stages are good predators. At 25 °C, *C. septempunctata* performed well.

CONCLUSION: Thus, it can be concluded that, the later predatory stages are effective predators and can be used in any biological control program of aphids in greenhouses or in field.

Keywords: Functional response, Temperature, Feeding potential, Predator

SPP-IPM-158

Comparative efficacy of plant extracts and green synthesized zinc oxide nanoparticles against larvae of the house fly *Musca domestica* (Diptera: Muscidae)

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ABSTRACT

The *Musca domestica* (Diptera: Muscidae) is a global health pest that poses significant threats to both humans and animals, as it is responsible for spreading many diseases. Although chemical pesticides can quickly reduce insect populations, the residues left behind by these chemicals can have detrimental effects on food, the environment and non-target organisms. Nanotechnology is a novel approach to controlling insect pests. The objective of this study was to assess the comparative effectiveness of plant extracts (*Eucalyptus globulus*, *Syzygium aromaticum* and *Cinnamomum verum*) along with their zinc oxide nanoparticles, against *M. domestica* larvae. To synthesize the zinc oxide nanoparticles, a solution of 1mM concentration was prepared by adding 0.082g of zinc oxide and 10ml of plant extracts to 1000ml of distilled water at room temperature. The confirmation of nanoparticles was clarified using UV spectrometry. The efficacy of botanical extracts and ZnO Nps was assessed by using dip method. Four concentrations of plant extracts (60, 30, 15 and 7.50%) and green synthesized ZnO Nps (600, 450, 300 and 150 ppm) were used with three replications. The research trials were conducted under a Completely Randomized Design. In petri dishes, 10 houseflies were released and exposed to the biopesticide. Mortality data was collected after (24, 48, 72 h) of treatment. The results indicated that the extracts of *S. aromaticum*, *C. verum* and *E. globulus* exhibited the highest mortality rates of 50, 40 and 32.33%, respectively, at a concentration of 60% after 72 hours. The ZnO nanoparticles derived from *S. aromaticum,* C. *verum* and *E. globulus* demonstrated mortality rates of 66.67, 50.67 and 40% at 600 ppm, respectively, after 72 hours of exposure to *M. domestica*. The $LC_{50}$ values of the zinc oxide nanoparticles of *S. aromaticum*, *C. verum* and *E. globulus* against *M. domestica* were determined to be 27.66, 75.33 and 108.96 ppm, respectively, after a 72-hour exposure. In comparison, the $LC_{50}$ of the plant extracts from *S. aromaticum*, *C. verum* and *E. globulus* against *M. domestica* were found to be 65.04 ppm, 462.84 ppm, and 579.78 ppm, respectively, after a 72-hour exposure period. These findings indicate that the synthesized nanoparticles are highly effective in controlling houseflies while posing no harm to the environment or human health.

Keywords: *M. domestica,* Zinc oxide nanoparticles, *S. aromaticum*, *C. verum*, *E. globulus*

SPP-IPM-159

Changing Climates: The link between Global Warming and Fruit Fly Infestations

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ABSTRACT

Climate change is significantly impacting ecosystems and agricultural systems worldwide. Among the numerous consequences, the increased prevalence and outbreak of pests, such as fruit flies, present a significant challenge for global food production. One of the main effects of global warming on fruit flies is the increase in temperature, which directly influences their life cycle. Fruit flies widely spread in hot climates, where higher temperatures speed up their development. In high temperature Fruit fly (*Bactrocera zonata*) reproduces faster and attains greater numbers. Hot conditions lead to shortened developmental periods for eggs, larvae, and pupae, resulting in more generations of fruit flies in a single season. This phenomenon, known as “generation turnover,” amplifies fruit fly populations and intensifies infestations, especially in regions with already infestation of fruit fly. Global warming also plays a significant role in expanding the geographic range of fruit flies. As winters become milder and summers become longer, fruit flies can survive in areas where they were once limited by low temperatures. The interaction between fruit flies and their natural enemies is also affected by global warming. Predators, parasitoids, and other biological control agents that help regulate fruit fly populations may not adapt as quickly to changing temperatures. This imbalance in the ecosystem can reduce the effectiveness of natural pest control, leading to unbalance fruit fly population growth and more frequent outbreaks. Global warming is raising the frequency and geographic spread of fruit fly infestations. Rising temperatures accelerate fruit fly reproduction and disrupt the balance between pests and their natural enemies. As climate change continues to reshape global ecosystems, agriculture faces growing threats from fruit fly outbreaks and creating need for adaptive pest management strategies.

Keywords: Climate change, Global warming, Fruit fly infestation, Population outbreak, Generation turnover

SPP-IPM-160

Advanced monitoring techniques of termites: A Review

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ABSTRACT

Termites (Blattodea: Isoptera/termitodae) are eusocial insects that have common ancestors with Cockroaches and distinct reproductive division of labor. Termites are major insect pests in many regions of world. Termites attack cellulose related material in fields and buildings. The major economic losses which occur due to termites are crop roots and timber of the orchards in the field. Termites are an essential part of an ecosystem. Damage caused by termites to structures is a significant concern in many tropical and subtropical countries. Population density. Studies aimed at measuring termite density may seek to estimate either the population within a single colony or the total abundance of all species encountered in a unit area of habitat. Species composition. Studies aimed at investigating the species composition of an assemblage in a local area but without estimating population density. Termite activity. Studies aimed at investigating activity such as foraging range, food preference and rates of consumption, or alate swarming. This will hopefully help professional pest inspectors to select suitable termite monitoring methods. This review also highlights the need for continued research to develop and evaluate detection strategies and tools that may be utilized before implementing any termite control measures.

Keywords: Termites, Monitoring, population.

SPP-IPM-161

Evaluation of solid carriers of *Beauveria bassiana* and *Metarhizium anisopliae* for managing *Bactrocera zonata*

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ABSTRACT

Tephritid fruit flies (Diptera: Tephritidae) are economically important in Pakistan and considerable barrier to mango exports. *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) is the most devastating, and abundantly found fruit fly species in different regions of Pakistan. Entomopathogenic fungi (EPF) *Beauveria bassiana* and *Metarhizium anisopliae* are preferred to use against *B. zonata* due to no residues in mango and their ecofriendly nature. Different solid carriers can maintain the efficacy of these EPF over the time without deterioration. Present study was designed to evaluate these solid carriers. Ten different formulations were prepared (by using ten different solid carriers including boiled rice, talc, wheat bran, reused potatoes, sugarcane bagasse, clay, crushed sorghum, butter whey, maize crumb and carrot whey) along with a commercial product as control. All formulations were prepared on same day but their efficacies were evaluated on 1$^{st}$ day, 15$^{th}$ day and 30$^{th}$ day after preparation against different stages (pupae and adult) of fruit fly. Difference in the adult emergence of the pupae and mortalities of the adults was recorded. Experiment was replicated three times by using complete randomized design (CRD) under lab conditions. Different solid carriers have different effects on maintaining the efficacy of the product. Wheat bran followed by Talc was found most effective among all these formulations. According to this study wheat bran and talc are recommended to prepare solid formulations of *B. bassiana* and *M. anisopliae* for managing *B. zonata*.

Keywords: Solid carriers, integrated pest management, Entomopathogenic fungi, Fruit fly, Microbial management

SPP-IPM-162

Quantification of pesticide residues in honey through (GC-MS) Gas Chromatography-Mass Spectroscopy

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ABSTRACT

Pesticides are very important in ensuring food safety by controlling and targeting pests, against various organisms like weeds, animals, insects, fungi, and prions. But overdose of pesticides has drastic impacts on non-targeted organisms as well as they contribute to the bioaccumulation The Maximum Residue Limit (MRL) is a guideline for the acceptable level of pesticide residues in food, usually expressed in mg/kg. Determining MRL involves field trials and toxicological risk assessments. These trials adhere to Good Agricultural Practice guidelines dictating trial procedures and result evaluations. For this purpose, recently a research on honey was conducted in MNS University of Agriculture, Multan. Twenty-three honey samples were collected from South Punjab. Out of these samples 26% samples were contaminated with different types of pesticide residues including Acetamiprid, Nitenpyram, Tebuconazole, MCPA, Chlorpyrifos and Buprofezin when observed under GC-MS (Agilent technology). The honey samples contaminated with Buprofezin were 39.1%, Tebuconazole contaminated samples were 34.7% and samples containing Acetamiprid, Chlorpyrifos, MCPA, Nitenpyram were 4.34% each. The presence of the pesticide residues in different honey samples is an important reason why we must strictly watch over and enforce the laws and regulations. Standards at both local and international levels are very helpful towards ensuring safe food as well as preventing any potential danger that may befall man through this channel. It is necessary that honey along with other food items should be continually checked for pesticide residues presence so that once there is a breach some necessary measures are taken.

Keywords: Honey, South Punjab, pesticide residues, GCMS, Insecticides, Fungicide

SPP-IPM-163

Effectiveness of plant-based repellents against stored grain pests

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ABSTRACT

*Tribolium* species are the most common type of pest that is kept in storage all over the world. The use of synthetic pesticides to control this pest results in an even greater number of serious health risks. The purpose of this study was to determine whether *Withania coagulans* provides effective protection against adults of the red flour beetle. The plant *Withania coagulans*, when combined with methanol and paneer, is used to create a composition that possesses the ability to repel insects. Understanding traditional repellents that are derived from plants provides a valuable foundation for the development of new natural alternatives to synthetic repellent chemicals. On the grains that were contained within the five Petri plates, the solution of methanol and paneer was applied with the assistance of stray to create a gape in the middle of the petri plates. After that, insects were released onto the petri plates to evaluate the effectiveness of the mosquito repellent. On each petri plate, a total of 15 red flour beetles were released. When the insects were released, 90 percent of them preferred to feed on grains that had not been treated, so the results were satisfactory. Considering that there was a clear observation, and the results demonstrated that 90 percent of insects avoided the treated grains, it is possible that this can be useful in preventing the damage that stored grain pests cause.

Keywords: Red flour beetle, pesticides, repellents, *Withania coagulans,* natural control

SPP-IPM-164

Determining feeding behavior of honeybee on contaminated honey

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Abstract:

The feeding behavior of honeybees *Apis mellifera* in response to honey samples contaminated with different pesticides from all over South Punjab was investigated. The experiment involved recording the number of honeybees visits to various honey samples over the period to determine their preference. Initial observations showed no significant difference among the honey samples. However, over the period of time, a decline in visits to contaminated samples was observed, indicating the bees ability to detect and avoid pesticide contaminated honey. Statistical analysis using ANOVA confirmed significant differences in visitation rates ($p < 0.05$). Further analysis with Tukey's post-hoc test revealed that honeybees significantly avoided pesticide contaminated honey. These findings highlight the acute sensitivity of honeybees to pesticides and the potential risks related to pesticide toxicity such contaminants on honeybee mortality and disturbed pollination resulting in lower production. The results emphasize the need for sustainable agricultural practices and strict pesticide regulations to protect honeybees as pollinator populations, which is crucial for ecosystem stability and agricultural productivity.

Keywords: *Apis mellifera,* honey, pesticide residues, feeding behaviour

SPP-IPM-165

Screening of pesticide residues in honey using FTIR spectroscopy and their impact on honeybee feeding behavior

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Abstract

Honey is a natural sweetener produced by the honeybee (*Apis mellifera*) and is an important part of human consumption and economy. However, the widespread use of pesticides in agriculture poses a serious threat to bee colonies and honey quality. This study aimed to determine pesticide residues in honey samples from different districts of Southern Punjab using Fourier transform infrared (FTIR) spectroscopy. Analysis of 23 honey including 6 marketed and 17 wild type showed the presence of different types of pesticides. Literature review followed by analysis through FTIR Spectroscopy revealed the presence of different functional groups out of which several functional groups are associated with 16 type of pesticides particularly organochlorines, organophosphates, aldrin and dieldrin. Additionally, studies on the feeding behavior of bees showed that bees avoid honey samples with high pesticide concentrations and prefer honey samples with low pesticide concentrations. Six follow-up observations at 30-minute intervals revealed a significant relationship between the pesticides and the honeybee feeding behavior. It was also observed that 13 bees died after being exposed to the contaminated honey. The results of this study highlight the importance of monitoring pesticides in honey and their effects on bee colonies. Honeybees play an important role in pollination, and their decline could have a major impact on global food security. Honey is consumed by most of the people including children and aged people, presence of pesticides may affect their overall health and can lead to chronic diseases. Additionally, understanding the relationship between honeybees and pesticide usage is important for developing strategies to reduce the impact of pesticides on bee colonies.

Keywords: Honeybee, honey samples, Spectroscopy, pesticide residues, Contamination, feeding preferences

SPP-IPM-166

Population dynamics of insects on cauliflower in relation to pesticides residues from Punjab and Baluchistan

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Abstract

Cauliflower (*Brassica oleracea* L) is one of the most preferable, traditionally grown winter vegetable, requires cold and moist climate and is less hardy than cabbage. A wide range of pesticides are being applied to the vegetables which creates a biodiversity gradient. For the assessment of biodiversity in relation to pesticide application four different field were selected from different areas of district Lorlai Balochistan and Multan Punjab, taking data on weekly bases from twenty different plants using RCBD statistical analysis, environmental factors as well as fertilizers, pesticides application and irrigations were also recorded. Major insect-pest recorded were cabbage aphid, cabbage butterfly, diamond back moth, flea beetles, cabbage head borer, cabbage white fly, caterpillar, cabbage looper and cabbage fly. The damage was caused to cauliflower by insect both direct and indirect, cabbage aphid causes 35-75 percent yield losses. The cauliflower cultivation started in the last week of May and start of June in the nursery with rare insects. At the start of july the seedlings were transferred to the fields. Temperature, RH, precipitation and UV index change occur during the season of cauliflower cultivation. The aphid population were less in number in the nursery and increases at the start of july and decreases at the end of july. The diamond back moth population was high at the end of july but become normal after july till harvesting as compared to the population of other insects on cauliflower. The sowing of cauliflower in Punjab in nursery at the start of September and transferred to field at the end of September. Cabbage whitefly population were high in the nursery and in two weeks in the field. The crop is irrigated 18 times till harvesting at different intervals and pesticides were applied 9 times in total while fertilizers were applied four times. Twelve samples were collected from Balochistan four different fields randomly. In this research the possible outcome will be determined the comparison of insect biodiversity on cauliflower on different environmental conditions of Punjab and Balochistan. The different pesticides residues will be determined which is applied in Balochistan and Punjab.

Keyword: *Brassica oleracea,* pesticide application, insect pest population, biodiversity, pesticide residues, Baluchistan, Punjab

SPP-IPM-167

# Field Population and Infestation Rates of Red Palm Weevil Across Various Local Date Palm Varieties

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ABSTRACT

The date palm, or *Phoenix dactylifera* L., is a valuable fruit crop and source of income for many nations. It is a member of the Arecaceae family of palm trees. Red palm weevil (RPW), *Rhynchophorus ferrugineus* (Olivier, 1790) is an invasive pest that causes damage to palm trees worldwide by eating their stems inside. The objective of this study is to identify susceptible and resistant varieties among as well as identify the population dynamics of *R. ferrugineus.* Our results showed that most affected variety was Khurma in both age date palm e.g., five-ten old plants and in eleven-fifteen years old. While most superior least effected variety was Begum Jangi among Zhaidi, Aseel, Begum Jangi, Haleeni, and Shamran with no population. The most vulnerable date palm variety is Khurma. For both immature and mature *R. ferrugineus*, January through March and October through December are the ideal months to execute management measures. According to recent research, the Bahawalpur region needs to introduce resistant date palm varieties.

Keywords: *Monitoring, Phoenix dactylifera, Rhynchophorus ferrugineus, RPW. Date Palm*

SPP-IPM-168

A New Frontier in Citrus Greening Control: MicroRNA Technology

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ABSTRACT

Fruit cultivation is a cornerstone of global agriculture, with citrus playing a prominent role due to its widespread cultivation and consumption. Pakistan stands as the 16th largest citrus producer worldwide, notably renowned for its Kinnow mandarin oranges, particularly cultivated in Punjab province. Huanglongbing (HLB), or citrus greening disease (CGD), is a severe disease that is found all over the world. In Pakistan, the incidence rates of CGD are 22% for Kinnow, 25–40% for sweet oranges, 15% for grapefruit, 10% for sweet lime, and 2% for lemons, making it a common and concerning disease in the Punjab and KPK regions. *Candidatus Liberibacter*, the pathogen linked to Citrus Greening Disease (CGD), has been recognized and categorized. The principal vector of the disease is the Asian citrus psyllid (ACP), which feeds on phloem tissue and pierces the skin with its mouthparts to transfer the infection. MicroRNAs (miRNAs) have the potential to help control citrus greening by targeting specific genes involved in the disease's development and transmission. miRNAs could be engineered to silence the expression of key genes in citrus plants that are targeted or exploited by the bacterium. By regulating these host genes, it could reduce the bacterium's ability to infect or spread within the plant. miRNAs can be designed to target genes essential for the development or reproduction of the psyllid insect that transmits the bacterium. This would reduce the population of the insect vector, lowering the transmission rate of citrus greening. miRNAs represent a promising tool for both improving plant resistance and controlling the spread of the insect vector. Genetic engineering, combined with biotechnological applications such as RNAi, could be crucial in future citrus greening management strategies.

Key words: Citrus, Citrus Greening, Huanglongbing, miRNAs, Disease Management

SPP-IPM-169

# Population Estimation of *Coptotermes heimi* through Mark-Recapture and Contestant Removal Methods

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ABSTRACT

Termites are social insects that live in a variety of climates including dry deserts and tropical rainforests. They have received attention for their contribution to the environment as well as their pest status. Termites also contribute to the ecosystem services that includes increasing the soil fertility, breakdown of the organic matter, dung removal and greenhouse gas emission. These tasks highlight their importance in the ecosystem. In addition to this, termites destroy crops, important timber resources, and wooden structures costing billions of dollars every year. Effective pest control and reducing financial losses depend on having a clear understanding of their feeding habits and population estimation. In this study, monitoring stations were installed in the field to attract *Coptotermes heimi* (Blattodea: Rhinotermitidae). Subsequently, termites from these stations were utilized to estimate the population using standard mark recapture and constant removal protocols. The results indicated that the foraging activity of termite was increased with the passage of time and maximum population per trap was observed at SRI Library on November 16, 2023 (3896.8 ± 977.9 termites per trap). The colony population varies from 34122-54751 individuals (regression method), 22840-33682 individuals (Maximum Likelihood method/ Moran - Zippin Method) and 557284-717999 individuals (mark-recapture method). The study will be helpful to understand the biology of termites.

Keywords: Termites; Mark Recapture Technique; Foraging Behaviour; Maximum Likelihood method; Moran - Zippin Method

SPP-IPM-170

Knowledge, Attitude and Practices of People about House Fly and its Management

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ABSTRACT

*Musca domestica L*. (Muscidae: Diptera) is a harmful insect pest on both large farms and households globally. It is a major source of many dangerous food borne infections in human environments, which represent its poisonous characteristics. House fly significantly spread the cholera, salmonellosis and other severe foodborne diseases. Dairy farming is important to Pakistan's economy as it provides milk, meat, wool, hide, blood, bones and farm animal dung. Pakistan is an agricultural country. The dairies usually play a significant role in the breeding of flies due to poor hygiene conditions in the form of farm manures, poor disposal and open defecation places. All such places are recognized as potential feeding and breeding places for house flies. The management and control of house flies using sanitation, screening procedures, traps, insecticides, biological control and integrated house fly control have been put into place. The current study is aimed at the evaluation of botanical as well as insecticides along with a survey was conducted from (meat shop, dairy farmers, poultry farmers, and household people). The no. of male was higher belonging to age group 30-40 years old having primary level education along with had own business and married were greater in number. Mostly people had idea about the breeding sites of house flies along with rearing of buffalo. Storage of farmyard manure, availability of latrines in their compound, people defecate in latrines and had idea about the house fly were greater while lower no. of people those defecate in open field. Most of the people had idea about the breeding material of the house fly is kitchen waste and breeding season is winter along with day is the active time of the house flies. Higher number of people think that house fly causes the nuisance to human and interference in milking process along with cause the diarrhea by causing the contamination in food and water. Numerous of the people had idea that was house fly preventable and can be prevented by insecticides.

Keywords: House fly preferences, Meat shops, Poultry manures, Insecticidal management

SPP-IPM-171

**Off-Season Management Using Novel Pheromone Dispensers: A Breakthrough Strategy for Year-Round Pink Bollworm Control**

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ABSTRACT

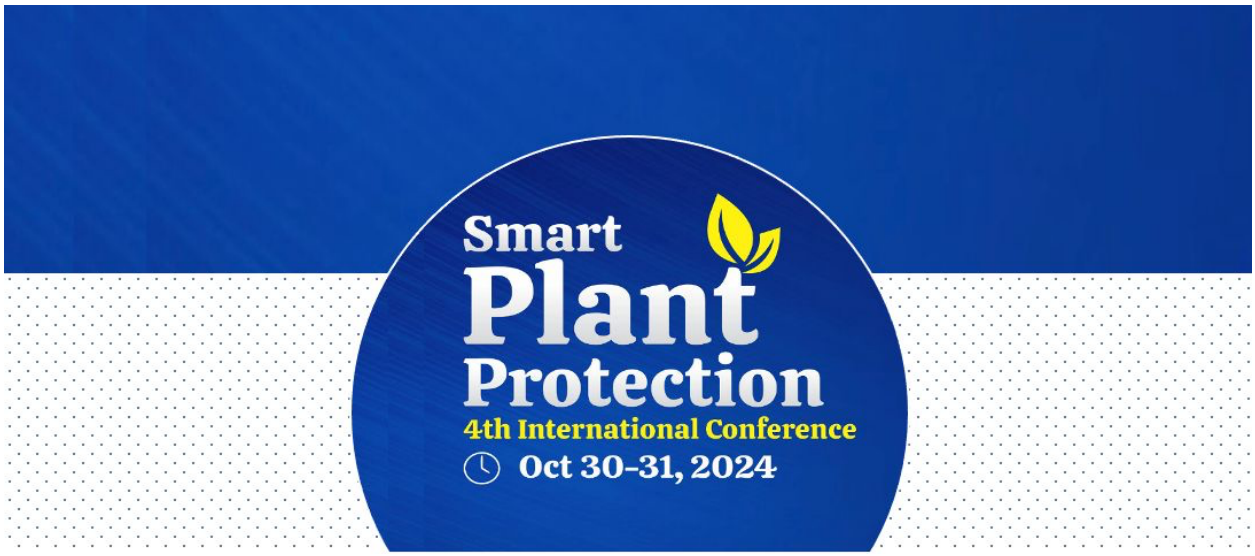
The pink bollworm, *Pectinophora gossypiella*, (Lepidoptera: Noctuidae) is a persistent pest in Pakistan's cotton industry, has contributed to a drop in the nation's global cotton production ranking from 5th in 2019-20 to 7th in 2022-23. Traditional control measures rely on pheromone ropes or capsules, which provide an eco-friendly management solution but lack durability in local climatic conditions. To address these limitations, our study introduces a novel pheromone dispenser optimized for extended PBW management in both off-season and on-season applications.

This research involved the preparation of pheromone strip dispensers, which were installed at experimental field sites at MNS-University of Agriculture Multan and the Cotton Research Institute. Comparative trials indicated that these dispensers outperformed conventional methods, particularly in off-season trapping. Continuous off-season trapping disrupts the pest's reproductive cycle, reducing overall PBW populations and preventing infestation build-up before the main cropping season.

Results demonstrated that strip dispensers effectively provided long-term, season-spanning control, which is critical for managing PBW populations sustainably. The study concludes that integrating these novel dispensers into off-season management practices offers a proactive approach to cotton protection, supporting both ecological balance and economic viability for cotton farmers.

We recommend widespread use of strip pheromone dispensers in off-season management programs to break the pest's life cycle effectively. This innovation aligns with sustainable agriculture principles, offering an eco-friendly solution to PBW control while helping to stabilize and potentially enhance Pakistan's cotton yield.

Keywords: Pink Bollworm, cotton, pheromone dispenser, off-season management, sustainable pest control




# THEME-2
# PLANT DISEASES AND DIAGNOSTICS

## THEME-2: PLANT DISEASES AND DIAGNOSTICS

SPP-PP-201

# Hemp (*Cannabis sativa*) as a natural nematicide against root-knot nematodes (*Meloidogyne incognita*)

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Abstract

Because of being costly and pernicious to the environment and human health, the use of nematicides has become prohibitive in many countries and the management of plant parasitic nematodes using antagonistic plants can be a very attractive alternative. In the present studies the effectiveness of aqueous extracts of *Cannabis sativa* at different concentrations viz. S, S:1, S:5, S:10, S:25, S:50 and S:100 was assessed on hatching, mortality and infectivity of *Meloidogyne incognita*, the most devastating root-knot nematode responsible for colossal yield losses in cucumber. The extracts had significant effects on juvenile mortality and hatching inhibition in a dose-dependent manner. Time duration also affected mortality and hatching inhibition significantly. Significant inhibition in invasion of *M. incognita* juveniles on cucumber cv. Royal Sluis was observed by different treatments with extracts. *M. incognita* juveniles exposed to 'S' extracts of *C. sativa* for 24 and 48 h caused no infection. Exposure for 12 and 6 h caused more than 95 and 90% reductions in infectivity of *M. incognita* juveniles respectively. Similarly, soil drench and root dip treatments also caused significant reductions in infection. The efficacy of leaves of *C. sativa* was also evaluated by incorporating in the soil at the rate of 0, 2, 4, 6, 8, 10 and 20 g per kg of soil. *C. sativa* significantly reduced nematode infestations and enhanced plant growth criteria compared to the untreated check. The maximum reductions in number of galls, egg masses, nematode fecundity and build up were recorded with 20 g dosage. The results of the studies showed that *C. sativa*, commonly found locally, possess high potentials for the control of root-knot nematodes and could be the possible replacement for synthetic nematicides.

Keywords: root-knot nematodes, *C. sativa,* nematicides, infection

SPP-PP-202

A New Leaf Spot Disease of Rubber Trees: Identification and In Vivo Pathogenicity Test of the causal pathogen(s)

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ABSTRACT

BACKGROUND: A novel leaf spot disease of rubber trees has been discovered in five rubber-producing countries: Indonesia, India, Malaysia, Thailand, and Sri Lanka, with affected leaves displaying a circular spot with a brown necrotic lesion. However, no research has yet established the disease's real cause pathogen(s). The goal of this study was to identify the fungal pathogen(s) responsible for leaf spot symptoms on mature rubber leaves using morphological, molecular identification and in vivo pathogenicity assay.

METHODS: Isolated fungal isolates were subjected to morphological and molecular identification. In addition, six treatments were designed for in vivo pathogenicity test. A disease severity scale was created to assess the severity of the disease in the pathogenicity test.

RESULTS: As early as five days after inoculation, the wounding approach caused necrotic lesions on the leaves' surfaces. *Colletotrichum siamense* spores caused the longest mean lesion length (7.90 mm ± 0.06a), whereas *Pestalotiopsis jesteri* spores caused the smallest lesion (1.30 mm ± 0.04b) on day six following inoculation. According to the findings, *P. jesteri* may be the opportunistic pathogen that infects damaged rubber plants and is associated with *C. siamense*.

Conclusion: In conclusion, we may infer that *P. jesteri* is the secondary pathogen, whereas *C. siamense* is the primary causal pathogen of this new complex leaf spot disease in rubber trees.

Keywords: rubber, disease, Complex Circular Leaf Spot (CCLS) disease, *Colletotrichum siamense*, *Pestalotiopsis jesteri*

SPP-PP-203

Evaluation of the *Bacillus thuringiensis* M3 isolated from *Echinacea* spp. as well as their performance under both irrigated and non-irrigated conditions

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ABSTRACT

In the current research, the bacterial endophyte *Bacillus thuringiensis* M3 was isolated from the drought-resistant plant *Echinacea* spp. and studied for its involvement in the promotion of plant growth. *B. thuringiensis* M3 was shown to be a powerful endophyte among the bacterial species. It produces Indole Acetic Acid (IAA) and 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase, as well as solubilize phosphate. Furthermore, it has been demonstrated to produce siderophore. A measurement of 92.37 µg/mL was obtained for the production of IAA, 79.35 µg/mL was the phosphate solubilization. Both irrigated and non-irrigated environments were used in the *In vitro* plant treatment research with *B. thuringiensis* M3. The results demonstrated that the bacteria enhanced plant development in both situations to control them. The fact that *B. thuringiensis* M3 exhibited substantial variations in most of the growth metrics under endophyte-treated irrigated and non-irrigated environments is indicative of the fact that their plant growth promotion is dependent on stress management. The current findings will add to the exploration of endophytes that operate as plant growth-promoting endophytes and increase plant growth in situations that are not typically favorable to plant growth.

Keywords: *Bacillus*; IAA; drought stress; growth promote; biomass

SPP-PP-204

Comparative Effect of Seed Coating and Biopriming of *Bacillus aryabhattai* Z-48 on Seedling Growth, Growth Promotion, and Suppression of Fusarium Wilt Disease of Tomato Plants

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ABSTRACT

BACKGROUND: Beneficial plant microbes can enhance the growth and quality of field crops. However, the benefits of microbes using cheap and efficient inoculation methods are still uncommon. Seed coating with biocontrol agents can reduce the amount of inocula along with having the potential for large-scale application.

METHODS: The comparative potential of tomato seed coating and biopriming with *Bacillus aryabhattai* Z-48, harboring multiple plant-beneficial traits, to suppress Fusarium wilt disease along with its beneficial effect on seedling and plant growth promotion was analyzed. Common biomarkers of induced systemic resistance include total phenolic and activities of the phenyl propanoid pathway enzymes were quantified. GC-MS analysis was performed to obtain a comprehensive view of the perturbations in the plant metabolomic profile under the influence of *Fusarium oxysporum* and *Bacillus aryabhattai* Z-48.

RESULTS: *B. aryabhattai* Z-48 was able to antagonize the mycelial growth of *Fusarium oxysporum* and its application as a seed coating superiorly benefited seedling traits like the germination percentage, vigor index, and seedling growth index along with a reduced germination time. The seed coating with *B. aryabhattai* Z-48 significantly increased the shoot length, root length, dry biomass, and total chlorophyll contents compared with the bioprimed seeds with the same bacterial strain and non-inoculated control plants. The seed coating with *B. aryabhattai* Z-48 significantly reduced the disease index (>60%) compared with the pathogen control during pot trials. Additionally, the seed coating with *B. aryabhattai* Z-48 resulted in a significantly higher production of total phenolics, peroxidase, polyphenol oxidase, and phenylalanine ammonia-lyase enzyme in tomato plants. The GC/MS-based non-targeted metabolic profiling indicated that the seed coating with *B. aryabhattai* Z-48 could cause large-scale metabolite perturbations in sugars, sugar alcohols, amino acids, and organic acids to increase the fitness of tomato plants against biotic stress.

CONCLUSION: Our study indicates that a tomato seed coating with *B. aryabhattai* Z-48 can improve tomato growth and suppress Fusarium wilt disease effectively under conventional agricultural systems.

Keywords: PGPR, *Bacillus aryabhattai*, Seed Coating, Induced resistance, Metabolomic profiling

SPP-PP-205

Green nanotechnology: A sustainable approach for plant disease management

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ABSTRACT

BACKGROUND: In recent years, various types of metal and metal-oxides nanoparticles attained copious interest as an alternate method for the management of plant diseases. Tomato as a perishable crop has become a successful model plant to investigate the initiation of defence pathways after exposure to disease agents which act as a trigger for resistance mechanisms. Indulgence to these mechanisms is a key focus of Plant-pathology to enhance crop protection.

METHODS: The current investigation was aimed at the green synthesis of nanoparticles to induce resistance in tomato plants against fusarium wilt. Green synthesized nanoparticles via MA-AgNPs, CF-CuONPs and BC-IONPs were characterized and used to investigate the *in vitro* and *in vivo* antifungal activity at various concentrations.

RESULTS: *In-vitro* antifungal potential of all three types of nanoparticles expressively inhibited mycelial growth and spore germination of *Fusarium oxysporum* f.sp. *lycopersici* in a dose-dependent manner. The highest percentage inhibition in mycelial radial growth (96.8 ± 0.23%) and decline in spore germination rate (4.67%) was observed at 140 $\mu$g/mL of MA-AgNPs in contrast to the control and fungicide treatment. Monographs of the Scanning electron microscope revealed the ultrastructural changes in fungal hyphae in response to higher concentrations of nanoparticles signifying the detrimental effect of these NPs on the fungal mycelial surface. DCFH-DA fluorescence revealed ROS accumulation in fungal mycelium by showing strong green colour after treatment with studied NPs however, insignificant to very weak fluorescence was observed in control samples. Each type of nanoparticle was further characterized to get information about wavelength range, functional nature, crystallographic structure, size, shape and stability. The microwave-assisted MA-AgNPs showed a peak at 434 nm by using 5 mL of *M. azedarach* leaf extract and 2.5 mM of $AgNO_3$ solution at pH 8, exposed to 30 s of microwave irradiations. MA-AgNPs indicated stability even after six months. Spherical shaped nanoparticles ranged from 12-46 nm were confirmed by XRD, SEM and TEM analysis. MA-AgNPs indicates the negative zeta potential of -22.3 mV. In addition, uptake of these nanoparticles did not show any visible sign of toxicity on plant yield and productivity.

CONCLUSION: The study confirms the potential of green synthesized nanoparticles in reducing fungal disease infestation especially soil borne fungi. Direct effect of synthesized nanoparticles on fungal hyphae and genetic material was observed. Hence application of synthetic pesticides can be decreased through green nanotechnology for sustainable agriculture.

Keywords: fungi, wilt, nanotechnology, plant extracts

SPP-PP-206

# Review on Antifungal Activity of Plant Extracts against Phytopathogenic Fungi Infecting Tomato Crop

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ABSTRACT
Tomato is the second most cultivated vegetable throughout the world. It has been affected by a number of fungal phytopathogens that causes significant economic losses. There is scarce knowledge about the effectiveness of plant extracts and their mode of action, against fungal diseases of tomato crop. The need of time is to summarize and review the previous work. The evaluation of effectiveness of plant extracts against fungal disease of tomato crop is important nowadays. Scientists are working on the development of new techniques for bio-alternatives to control fungal diseases of tomato crop, avoiding the traditional chemical control due to their harmful side effects on human as well as environmental health. This review will provide comprehensive study of previous data and detailed study about the mode of action of different plant extracts. Additionally, offering scientists and researchers a set of work flows covering every facet of environmentally friendly disease control.
Key words: Tomato, Phytopathogen, Plant Extract, Evaluation, Environment Friendly

SPP-PP-207

Mitigation of lead stress in tomato by using *Bacillus* species

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ABSTRACT

Lead stress poses a significant threat to plant health and crop yield. In this study, we have investigated the efficacy of *Bacillus* species to mitigate lead-induced stress in tomato plants. Tomato plants (*Solanum lycopersicum*) were exposed to lead stress, and subsequently treated with a formulation containing *Bacillus* species. The impact of the treatment was assessed through various physiological and biochemical parameters i.e., plant growth, chlorophyll content, antioxidant enzyme activity, and lead accumulation. Our results demonstrated that the application of *Bacillus* species significantly improved the overall growth and development of lead-stressed tomato plants. There was a notable increase in chlorophyll content, indicating enhanced photosynthetic efficiency. Moreover, the activity of antioxidant enzymes, such as superoxide dismutase and catalase, was elevated, suggesting a more robust defense against oxidative stress induced by lead. Interestingly, the *Bacillus* treatment also led to a reduction in lead accumulation in the plant tissues, indicating a potential role in lead immobilization or detoxification. Importantly, we developed a plug-free method for applying the *Bacillus* formulation, which enhances the practicality and scalability of this approach for large-scale agricultural use. This study highlights the promising potential of *Bacillus* species in mitigating lead stress in tomato plants, providing a sustainable and effective solution for farmers facing soil contamination challenges.

SPP-PP-208

# A quick review to explore the ways to minimize the microbial wastage of plant based products

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ABSTRACT

Plant-based foods are popular due to their nutritional values that related them to better health and longevity. A massive wastage of these plant products is being practiced all around the world. The goal of this study is to explore the pathways and mechanisms of the microbes that lead to the spoilage the plant food. One important strategy at the pre-harvest stage is to ensure the microbiological security of all agricultural input. The review study revealed that the exposure of fields to the atmosphere is more prone to microbes and abiotic factors such as wind, rain, temperature as compared to the green house fields and crops. One important strategy at the pre-harvest stage is to ensure the microbiological security of all agricultural input. The technology for routine monitoring of the microbiological quality of product samples is being investigated and the technologies like high hydrostatic pressure, and pulsed electric field plays role in the safety of fresh food from wastage and improves the quality of fruits and fruits. The best strategy could be the awareness campaigns and programs aimed at shifting consumer views that contribute to the waste and spoilage will also be beneficial.

SPP-PP-209

Guarding Crops against Fungal diseases through Alginate-Supplemented Encapsulation of Rhizospheric Bacteria

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ABSTRACT

The threat of root diseases incited by soil-borne sclerotial forming fungi *Macrophomina phaseolina* and *Sclerotium rolfsii*, has prompted novel strategies in agriculture. The encapsulation of biocontrol bacteria with alginate proves to be a groundbreaking option, meeting crucial criteria for biocontrol viability, effectiveness, shelf life, stability, and controlled release. The developed alginate beads of biocontrol bacteria exhibited a remarkable antifungal activity those fungi. Biocontrol beads of bacteria also reduced for disease which resulted in the enhancement of growth, yield, and biochemical attributes in tomato and chili crops. The incorporation of alginate beads with essential metals emerges as a promising solution for sustainable and profitable crop production, providing effective alternatives for disease management in tomatoes and chili plants

Keywords: Alginate beads; Biocontrol bacteria; Root rot

SPP-PP-210

Genotypic characterization of wheat genotypes by using Gel-free KASP assay against leaf rust (*Puccinia recondita* f. sp *tritici*)

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ABSTRACT

BACKGROUND: Wheat (*Triticum aestivum* L.) is the main cereal crop in the world in terms of cultivated area and volume of grain produced. Various biotic and abiotic factors affect wheat production. The fungus *Puccinia recondita* f.sp*. tritici* is the cause of leaf rust, the most prevalent rust disease in wheat. This causes 10% to 40% yield losses in Pakistan. Several leaf rust resistance genes have been reported in wheat germplasm in different countries. Various classes of markers are available that can be used in marker-assisted selection.

METHDOS: The present study was carried out to characterize wheat genotypes phenotypically and genotypically against leaf rust. For the phenotypic characterization screening of leaf rust was done by using modified Cobb's scale in both growing season under normal and drought conditions during 2021-22 and 2022-23. The disease severity (DS), Coefficient of infection (CI) and Average coefficient of infection (ACI) was recorded using Modified Cobb's scale. For genotypic characterization, KASP marker was used to screen the allelic frequencies of the *Lr*34 gene in 255 local wheat genotypes. This germplasm was used to explore the marker trait association (MTA) of *Lr*34-TCCIND.

RESULTS: During 2021-22, among 138 genotypes under normal condition 24 genotypes revealed immune response (O), 20 genotypes exhibited moderately resistant (MR) reaction, 65 showed moderately resistant –moderately susceptible (MRMS), 24 showed moderately susceptible (MS) and 5 genotypes shows susceptible(S) reaction. In drought condition among 138 genotypes, 47 genotypes exhibited immune reaction, 9 exhibited MR and 82 shows MRMS reaction type. In 2022-23, among 138 genotypes under normal condition, 21 genotypes revealed the immune response, 18 exhibited MR, 74 exhibited MRMS, and 20 exhibited the MS and 5 showed susceptible reaction. While in drought condition 44 genotypes showed immune response, 10 exhibited MR and 83 showed MRMS reaction type. Morphological data was also collected of following traits, days to heading, number of productive tillers, spike length, plant height, normalize vegetative index grain per spike and thousand grain weight. The co-dominant marker showed presence of *Lr*34 resistance allele in 45% analyzed genotypes.

CONCLUSION: SNP-based marker was employed using high-throughput and cost effective KASP technique to screen indigenous wheat germplasm. We were able to identify wheat genotypes having rust resistant and rust susceptible allele of *Lr*34 gene. We anticipate that this marker has potential to be used in marker assisted breeding.

Keywords: Wheat, Leaf rust, *Lr*34, phenotyping, Gel-free genotyping, KASP

SPP-PP-211

Evaluation of Bio-efficacy of a Mixture of Rhizobacteria and Poultry Manure in the Management of Fruit Rot in Chili Pepper (*Capsicum annuum* L.)

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ABSTRACT

Shortage of food due to various fungal diseases has become a major issue, leading to the country's huge economic losses. Fruit rot in chili caused by *C. capsici* is the most catastrophic disease worldwide and needs to be cured as it contributes to 50% yield loss worldwide. Treatment with synthetic fungicides is not suitable as they produce toxicity and resistance development. This study tested PGPR strains and poultry manure to assay their efficacy in suppressing chili fruit rot disease and promoting plant growth. All the bacterial isolates were characterized for biochemical attributes and showed positive results for HCN production, catalase, levan production, oxidase, oxidative fermentation, nitrate reduction, and starch hydrolysis and significantly produced IAA with tryptophan (12.41 – 34.48 mg $mL^{-1}$) and without tryptophan (1.8 – 7.3 mg $mL^{-1}$), solubilized inorganic phosphate (62.97 – 106.47 mg $mL^{-1}$), and siderophores (15.60 – 33.63 %). 16 rRNA sequence analysis confirmed these strains as *Bacillus cereus* (RB-1), *Pseudomonas fluorescens* (RB-3), *Bacillus subtilis* (RB-4), and were found to be non-pathogenic to chili seeds and remarkably enhanced seed germination percentage (60 – 100 %) over control. In pot experiment, the combined application of *P. fluorescens* and poultry manure significantly improved the plant growth parameters such as SL (15.96 ± 1.24 cm), RL (30.8 ± 12.15 cm), FLW (1.48 ± 0.17 g), DLW (0.20 ± 0.02 g), FSW (1.68 ± 0.34 g), DSW (0.26 ± 0.01 g), FRW (1.01 ± 0.15 g), and DRW (0.22 ± 0.01 g). *P. fluorescens* and *B. subtilis* along with poultry manure significantly reduced the fruit rot disease incidence up to 100 % on chili fruits. Additionally, under pathogen stress, bacterial isolates enhanced defense enzymes activities i.e., Peroxidase (PO), Polyphenol oxidase (PPO), and Phenylalanine ammonia-lyase (PAL), Total protein content (TPC), and Catalase (CAT) in the chili plant. Also, poultry manure improved N, P, and K uptake along with *B. cereus*, *P. fluorescens*, and *B. subtilis*. These results showed that Indigenous PGPR and poultry manure due to multiple beneficial traits could serve as a sustainable approach to managing chilli anthracnose disease.

Keywords: PGPR, fruit rot, *C. capsici,* poultry manure, anthracnose disease management.

SPP-PP-212

Geographical distribution and digital disease mapping of citrus canker from selected citrus orchards in Pothwar

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ABSTRACT

BACKGROUND: Agriculture is one of the essential sectors for the survival of humankind. At the same time, digitalization touched across all the fields became easier to handle various difficult tasks. Adapting technology as well as digitalization is very crucial for the field of agriculture to benefit the farmer as well as the consumer. Due to adopting technology and regular monitoring, one can able to identify the diseases at the very initial stages and those can be eradicated to obtain a better yield of the crop. In this aspect, automatic recognition and classification of various diseases of a specific crop are necessary for accurate identification. Pakistan confers with a broad range of agro-climatic positions, diverse from tropical to temperate, allowing 20 different types of fruits to grow. Citrus is an important fruit within the economically important family *Rutaceae* and is cultivated in Pakistan on 20.0461 thousand ha with an annual production of 2.29 million tons. The citrus production level in Pakistan is at the 16$^{th}$ level in the production of citrus around the world. Its production is decreasing after 2015 due to some serious Pre and Postharvest diseases. In 2016 CABI give a red alert to Pakistan on Citrus.

METHODS: One of the serious diseases that cause high losses in Citrus production is Citrus canker caused by gram-negative bacteria *Xanthomonas citri.* pv. *citri.* Conventionally methods for plant disease diagnosis using hand lenses till to isolation lab techniques are laborious and not predictive for fungicidal application to control the diseases. Stakeholders in pothowar region can increase citrus production in a number of ways by utilizing digital technologies. Precision agriculture techniques can be implemented, utilizing technologies such as Artificial Intelligence (AI), geographic information systems (GIS), and drones. These tools enable farmers to gather real-time data on fruit health, leading to better decision-making in terms of Disease and Pest control. By applying Artificial Intelligence and taking data of four thousand images of Citrus canker spots from different orchards from different plant parts fruits and leaves from different location at different stages from pothowar. Then resize the images and retain images in a convolutional neural network (CNN) by using python as a computer language.

RESULTS: A Model *Citrus Fruits Detection (Multi Classification). ipynb* (CFD) developed, that detect the Citrus canker disease on Citrus Plant, and also give data about it that is it at the initial stage (Low Infection) or final stage (Severe Infection).

CONCLUSION: Stakeholder and farmer can reduce the losses by using digital method for early disease identification and by applying effective management practices can mitigating the infection

Keywords: Citrus; Citrus Canker; *Xanthomonas axonopodis pv. citri*; Artificial Intelligence; CNN

SPP-PP-213

Application of Green Synthesis for nanoparticle synthesis

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ABSTRACT

Green nanotechnology is a developing scientific discipline that specifically concentrates on the synthesis of nanoparticles by biological mechanisms occurring within living cells. This subject is highly significant in multiple industries, including pharmaceuticals, nuclear energy, fuel and energy, electronics, and biotechnology. Green synthesis approaches are preferable for producing nanoparticles within the size range of 1 to 100 nm, as opposed to alternative methods. The materials exhibit characteristics such as safety, environmental sustainability, non-toxicity, and economic efficiency. Metal nanoparticles are produced using a variety of methods, including physical, chemical, and biological techniques, employing both top-down and bottom-up approaches. Characterization is crucial in confirming the properties of nanoparticles. This is achieved by utilizing a variety of analytical techniques, such as UV–Vis spectrophotometry (UV–Vis), Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction (XRD), atomic force microscopy (AFM), annular dark-field imaging (HAADF), and intracranial pressure (ICP). The main aim of this study is to investigate the practical uses of eco-friendly metal nanoparticles for enhancing biological and environmental processes. This paper thoroughly investigates the techniques and circumstances associated with the production and evaluation of nanoparticles obtained from plants. These nanoparticles consist of silver, gold, iron, selenium, and copper. Moreover, it investigates the wide array of uses for these nanoparticles.

Keywords: Green synthesis; nanoparticle; Environmentally friendly technologies; silver; gold; iron; selenium; copper

SPP-PP-214

# Fungal Pathogens and Their Impact on Dhakki Date Palm Trees: A Study in Tounsa Shareef, Pakistan

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ABSTRACT

Date palm trees, vital for their economic, nutritional, and environmental contributions, face significant threats from fungal pathogens, leading to diseases like Bayoud disease, False Smut, and Thielaviopsis disease. These diseases not only diminish yield and quality but can also lead to the death of trees. Understanding and managing these pathogens are crucial for sustaining date palm cultivation. A recent study aimed to identify fungal pathogens affecting Dhakki Dates trees in Punjab, Pakistan. Samples were collected from the M2H orchard, where trees exhibited unusual drying symptoms. The study involved the preparation and analysis of various plant parts, including stem, leaves, fruit, and root. These parts were meticulously washed and sliced, subsequently, the sliced samples were inoculated onto Sabroud dextrose agar (SDA) plates and placed in an incubator set at 30°C for 5 to 7 days to allow fungal growth. Upon observation of different fungal colonies, sub-culturing was conducted to obtain pure cultures and morphological studies. Microscopy examination under a 40x objective lens was done, using Lactophenol cotton blue techniques was performed to study fungal structures. Out of 54 samples 12 were positive for fungal isolation, with a total of 183 fungi identified. *Thielaviopsis punctulata* emerged as the predominant pathogen, highlighting its significant impact on date palms in the region. Other notable isolates included *Curvularia lunata, Alternaria species, Aspergillus species, Fusarium oxysporum, and Graphiolia phoenic*, all contributing to disease incidence. Efforts to manage fungal infections showed potential, with eight out of 27 infected trees recovering after intervention measures. However, five trees required immediate removal to prevent further spread. This study underscores the importance of identifying and managing fungal pathogens in date palm cultivation. Such efforts are crucial for sustaining economic viability, ensuring food security, and preserving environmental sustainability. Moreover, insights gained from this research advance scientific understanding of fungal-plant interactions, informing future strategies for disease control. Moving forward, continued research and proactive management practices are essential to mitigate the impact of fungal diseases on date palm production.

Keywords: Date palm, Pathogen, Bayoud disease, False Smut, Thielaviopsis

SPP-PP-215

Differences in host-pathogen interactions among Australian *Ascochyta rabiei* and chickpea

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ABSTRACT

The Australian *Ascochyta rabiei* population is diverse in its ability to cause disease on host accessions of differing known levels of resistance, with isolates ranging from low to highly aggressive. In order to strategically manage such a diverse population, information regarding the infection and invasion processes of the pathogen is required. Such knowledge may lead to the biological targeting of specific chemical controls and/or aid in decisions around farming practice changes. To better understand the diversity in A*. rabiei*-chickpea interactions, an in-depth histopathology study was conducted with isolates with varying aggressiveness on the four host genotypes previously used to characterise them based on gross disease symptomology. Highly replicated microscopy observations revealed significant differences in percentages, timings and rates of germinations among all of the isolates and on all of the hosts assessed. In general, the previously characterised highly aggressive isolates germinated and penetrated faster than the low aggressive isolate. However, there were significant differences in these rates, indicating that some highly aggressive isolates can germinate and invade the host much faster than others within the first 12 hours of contact. This difference in rates continued through to the development of disease symptomology, where it appeared earlier and the most in the case of aggressive isolates within PBAHatraick and Kyabra at 3.5 DAI; however, low pathogenic isolate took more time for develop disease symptoms and pycnidia development. All isolates germinated faster and produced longer germ tubes on the susceptible accession (Kyabra) than on the resistant accession (ICC3996).

SPP-PP-216

Screening of cucumber germplasm against cucumber mosaic virus, co-relation of disease with environment and its management

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ABSTRACT

Cucumber (*Cucumis sativus*) is an important vegetable crop worldwide which belongs to family *Cucurbitaceae*. Cucumber contains 14% to 19% of the vitamin K, vitamins B and C along with minerals like copper, phosphorus, potassium and magnesium. Cucumber is attacked by many fungal, bacterial and viral diseases. Cucumber mosaic virus is most common disease of cucumber plant that can cause 10 to 20% of yield loss of cucumber crop. Cucumber mosaic virus is a RNA virus and belongs to *Bromoviridae* family and and genus *Cucumovirus*. It is transmitted by a number of aphid species. Virus is transmitted from infected plant to healthy plant by few minute of feeding of aphid. This study is conduct to evaluate and screen the cucumber germplasm against CMV by using disease rating scale. About 10 varieties of cucumber plant are used in this study through the field trails. At 25 to 30 $^{o}$C disease show more progress. To manage the disease different chemicals such as Imidacloprid, Flonicamid and Acetamaprid applied with concentration of 30ml/L. Imidacloprid show control the vector in most effective way. Disease progress more in those plants treated with zinc (Zn) as compare to boron (B).

SPP-PP-217

Xanthan Gum : A journey from pathogen to industrial product

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ABSTRACT

BACKGROUND: The bacterium *Xanthomonas campestris*, known for its plant pathogenic tendencies, harbors the genetic code for a significant biopolymer - xanthan gum. This high-molecular-weight polysaccharide has evolved beyond its bacterial origins, emerging as a versatile component driving innovation across diverse industries. The unique molecular architecture of xanthan gum, composed of glucose, mannose, and glucuronic acid residues with a distinctive backbone chain and trisaccharide side chains, forms the basis of its exceptional properties.

Methods: The biotechnological transformation from bacterium to biopolymer involves a meticulous interplay of science and technology. Optimizing growth conditions, tailoring nutrient broth compositions, and ensuring efficient fermentation processes are pivotal steps in maximizing xanthan gum production. Post-harvest, separation and purification techniques refine the crude gum into the versatile ingredient recognized for its myriad applications.

Results: Xanthan gum's versatility extends across industries. In agriculture, it enhances water retention in soil, mitigates erosion, and fosters robust plant growth, contributing to a sustainable food system. Within the textile sector, it elevates the feel and drape of fabrics, while in pharmaceuticals, it assumes a crucial role in controlled drug delivery. Ongoing research continues to unveil new applications, promising further exciting chapters in the narrative of this remarkable biopolymer.

Conclusion: Xanthan gum transcends its role as a mere thickening agent; it stands as a testament to the ingenuity of nature and a powerful tool in the hands of innovative minds. Its journey from a bacterial byproduct to an industrial favorite underscore the boundless potential within the microbial world. As we delve deeper into the secrets of xanthan gum and its counterparts, the transformative contributions to our world and the enrichment of our lives are poised to reach unforeseen heights.

Keywords: Xanthan Gum, Biopolymer, Microbial Biotechnology, Industrial Applications, Sustainable Agriculture

SPP-PP-218

Study on isolation and identification of fungi causing panama wilt disease of banana in Shaheed Benazirabad, Sindh, Pakistan

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ABSTRACT

Banana is mainly cultivated in Khairpur, Hyderabad, Thatta, Shaheed Benazirabad, Noshahro Feroz, Sanghar, Mirpur Khas and Badin districts in Sindh, Banana plants holds a significant position in the socio-economic development of Sindh, The most of areas are infected with fungal disease the symptoms are similar panama wilt disease of banana. This disease threats banana industry in the world. The Survey was conducted on fourteen banana farms Taluka Sakrand, Qazi Ahmed and Taluka Nawab Shah, District Shaheed Benazirabad, Sindh Pakistan during July 2023 to estimate the incidence of banana disease. The samples were surfaced sterilized with ethanol and the homogenates were cultured on Potato Dextrose Agar and incubated aerobically at room temperature for 5 days at 25°C. the pure cultures obtained were identified morphologically and microscopically. The investigation revealed that the samples were infected with several fungal species. The Purpose of visit to conduct research on isolate and identify Pathogens associated with the disease. The results revealed that the maximum disease incidence was recorded at the villages of Raja Waseem leghari (50.17%) followed by Sikander Leghari (35.58%), Haji Mahoo Khan Leghari Farms (32.47%), Mushataque Ahmed Leghari (20.27%), Hussain Bux Unar (13.51%), Ali Hassan Zardari (11.01%) as compared to other orchards and incidence was significantly decreased at Faseh Ahmed Shah (0.25%).The disease samples were collected from infected banana of heavy infection areas of (Waseem leghari ), Sikander leghari and Haji Mahoo Khan Leghari to isolate and identify disease causing fungi. The Fusarium spp, *Lasidio theobromae*, *Penicillium steckii*, *Aspergilus niger* and *Penicillium chrysogenium* were isolated from affected banana root. However, *Fusariumspp, Lasidio theobromae, Penicillium steckii, P. citrinum, P. gorlenkoanum, Penicillium hetheringtoniisp Fusarium equstti* was isolated predominantly from infected roots followed by *Lasidio theobromae,* and *Penicillium steckii* whereas *P. citrinum, P. gorlenkoanum, Penicillium hetheringtonii*

Key words: Banana, Panama wilt, fungi

SPP-PP-219

Isolation and Identification of Fungal Pathogens in Dhakki Date Palm Trees in Tounsa Shareef, Pakistan

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ABSTRACT

BACKGROUND: Date palm trees, vital for their economic, nutritional, and environmental contributions, face significant threats from fungal pathogens, leading to diseases like Bayoud disease, False Smut, and Thielaviopsis disease. These diseases not only diminish yield and quality but can also lead to the death of trees. Understanding and managing these pathogens are crucial for sustaining date palm cultivation. A recent study aimed to identify fungal pathogens affecting Dhakki Dates trees in Punjab, Pakistan.

RESULTS: Samples were collected from the M2H orchard, where trees exhibited unusual drying symptoms. The study involved the preparation and analysis of various plant parts, including stem, leaves, fruit, and root. These parts were meticulously washed and sliced, subsequently, the sliced samples were inoculated onto Sabroud dextrose agar (SDA) plates and placed in an incubator set at 30°C for 5 to 7 days to allow fungal growth. Upon observation of different fungal colonies, sub-culturing was conducted to obtain pure cultures and morphological studies. Microscopy examination under a 40x objective lens was done, using Lactophenol cotton blue techniques was performed to study fungal structures. Out of 54 samples 12 were positive for fungal isolation, with a total of 183 fungi identified. Thielaviopsis punctulata emerged as the predominant pathogen, highlighting its significant impact on date palms in the region. Other notable isolates included *Curvularia lunata, Alternaria species, Aspergillus species, Fusarium oxysporum, and Graphiolia phoenic*, all contributing to disease incidence. Efforts to manage fungal infections showed potential, with eight out of 27 infected trees recovering after intervention measures. However, five trees required immediate removal to prevent further spread.

CONCLUSION: This study underscores the importance of identifying and managing fungal pathogens in date palm cultivation. Such efforts are crucial for sustaining economic viability, ensuring food security, and preserving environmental sustainability. Moreover, insights gained from this research advance scientific understanding of fungal-plant interactions, informing future strategies for disease control. Moving forward, continued research and proactive management practices are essential to mitigate the impact of fungal diseases on date palm production.

Keywords: Date palm, Pathogen, Bayoud disease, False Smut, Thielaviopsis

SPP-PP-220

Configuration of leaf microbiota and plant microbial interactions

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ABSTRACT

BACKGROUND: Pathogenic and non-pathogenic microflora coexists in the aerial portion of a plant, called the leaf. The physical and chemical properties of the leaf, with fluctuating and often complex ecological factors, create surfaces that necessitate a high level of adaptation for microbial colonization.

RESULTS: We conducted a meta-analysis of 28 studies on the interactions between plant microbes and leaf microbiota between June 2023 and May 2024. As a result, specific interactive mechanisms for establishing a plant leaf niche have evolved. Little is known about the role of the host immune response in non-pathogenic microbiota colonization of the phyllosphere. These microbes can activate basal plant defenses and benefit the host by priming for increased resistance to pathogens. Extra- or intracellular receptors recognize microbial signals in most disease-resistant responses. It is unclear how these interactions shape leaf microbe communities because they are species specific. Microbe-microbe relationships are also crucial in shaping leaf communities in natural habitats. Plant colonizers have created host manipulation or direct antagonistic strategies to combat rivals and protect resources. Microbes colonizing the phyllosphere react to biotic and abiotic changes, making them valuable sources of protective and adaptive traits.

CONCLUSION: Transferring current knowledge to biotechnological applications, such as plant-protective probiotics, requires understanding the intricate regulatory host-microbe-microbe networks.

Keywords: Leaf microbe interaction, Microbial colonization, Phyllosphere

SPP-PP-221

CRISPER for plant disease management: A holistic approach

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ABSTRACT

BACKGROUND: Plant diseases caused by various pathogens, including fungi, bacteria and viruses, are a major threat to food security and global agricultural productivity. Traditional methods of disease control, such as chemical pesticides, biochemical approaches and conventional breeding for resistant varieties, often have limitations, including environmental harm and time-consuming processes. The CRISPR (clustered regularly interspaced short palindromic repeats) gene-editing technology has emerged as a promising tool for enhancing plant resistance to diseases by enabling precise modifications of plant genomes.

METHODS: CRISPR works by utilizing a guide RNA (gRNA) to direct the Cas9 nuclease to a specific DNA sequence in the plant genome. Once the target site is recognized, Cas9 induces a double-stranded break in the DNA, which can be repaired through non-homologous end joining (NHEJ) or homology-directed repair (HDR). This mechanism allows for targeted gene knockouts, insertions, or modifications to improve disease resistance, particularly by editing susceptibility genes (S-genes) or enhancing resistance (R) genes that play key roles in plant-pathogen interactions.

CONCLUSION: In conclusion, CRISPR offers a transformative approach to plant disease management by enabling the development of crops with durable resistance to pathogens. This technology not only reduces the reliance on chemical pesticides but also accelerates the breeding of resistant varieties, contributing to sustainable agriculture. Further research into the long-term effects of genome editing and regulatory frameworks is essential to fully realize its potential for widespread agricultural use.

Keywords: CRISPER, Plant disease management, crop resistance, agricultural productivity, gene editing

SPP-PP-222

Genome editing tools for plant disease management: A futuristic approach

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ABSTRACT

Genome editing has emerged as a transformative tool in agricultural science, offering precise methods for modifying plant genomes to improve resistance to diseases. The development of genome editing tools like CRISPR-Cas9, TALENs, and ZFNs has revolutionized plant pathology by enabling scientists to enhance plant disease resistance, improve crop yield, and reduce the reliance on chemical pesticides. Among these technologies, CRISPR-Cas9 is the most widely used genome-editing technology due to its precision, ease of use, and adaptability for the management of plant diseases. This system works by targeting specific DNA sequences in the plant genome, allowing for the deletion, insertion, or modification of genes associated with susceptibility to pathogens. Researchers have successfully used CRISPR (clustered regularly interspaced short palindromic repeats) to confer resistance to bacterial, fungal, and viral diseases in crops like rice, wheat, and tomato. TALENs (Transcription Activator-Like Effector Nucleases) and ZFNs (Zinc Finger Nucleases) are also significant tools used for genome editing. Although less commonly applied compared to CRISPR, they offer an alternative mechanism to modify disease-related genes, often in cases where higher specificity offers and reduce off target effects. These technologies have precise solutions for plant disease management. However, challenges remain in terms of regulatory acceptance, potential off-target effects, and ensuring that genome-edited plants meet the demands of agricultural production and food security.

Conclusion: Genome editing is set to play a pivotal role in combating plant diseases, paving the way for more resilient and productive crops that contribute to global food security. CRISPER is a best method of editing genome due to their pierce process, multiple target editing, Knock-out and Knock-in genes.

Keywords: Genome editing, disease management, CRISPR, TALEN, ZFNs

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Combine application of essential oils and gum arabic coating against *Xanthomonas campestris* pv. *Mangiferae indicae*, the causal agent of black spot disease in mango

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ABSTRACT

BACKGROUND: Black spot disease of mango is a serious disease in Pakistan. This disease usually weakens tree vigor, and seriously reduces the cosmetic value, yield, and quality of the produce. A better understanding of the pathogen that causes a black spot disease is important for its control. Thus, the aim of this study was to isolate and identify the pathogen responsible for disease and to explore substances for its biological control

Methodology: Samples with disease symptoms on leaves, twigs and fruits were collected from Shujabad, Muzafargarah, Multan and Rahim yar khan-major mango producing regions of Punjab Province. Antifungal effects of 8% gum arabic (GA), 0.50% clove oil (CLO), 0.25% cinnamon oil (CMO) and their combinations, clove+gum arabic, cinnamon+gum arabic were investigated against isolated fungal pathogen.

Results: It was observed that *Xanthomonas campestris* pv. *mangiferae indicae* is the associated pathogen with black spot disease. Gum arabic alone did not show any promising results while the combination of clove+gum arabic showed effective results in reducing the growth of the tested pathogen.

Conclusion: The results suggest the possibility of using gum arabic in combination of clove oil as a new tool for black spot disease management in mango.

Keywords: Essential oils, gum Arabic, black spot, mango.

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Clove Essential Oil as an Alternative strategy to Control *Penicillium italicum*- A causative agent of citrus blue mold

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ABSTRACT

BACKGROUND: Citrus is an important fruit and is highly popular all over the world due to its sweet, juicy, desirable flavor as well as its abundant nutrition. Among postharvest diseases, blue mold rot, caused by *Penicillium italicum*, is a serious postharvest disease and accounts for up to 20–50% of fruit decay. Natural alternative preservatives for the control of postharvest fungal diseases in citrus fruit during storage, transportation, and marketing are eagerly required as an alternative strategy to synthetic fungicides.

METHODS: The commercially available CEO obtained from *S. aromaticum* L. was obtained from Botany department. The tested pathogen of *P. italicum* was isolated from an infected citrus fruit with the typical blue mold symptoms and grown on potato dextrose agar.

RESULTS: In the present study, CEO treatment inhibited the disease development of blue mold when applied at 0.05% to 0.8% (*v/v*), and with the effective concentration being obtained as 0.4% (*v/v*). Besides its direct antifungal activity, CEO treatment also spurred a rapid accumulation of H2O2 compared with untreated fruits, which might contribute to enhancing an increase in the activities of defense-related enzymes, such as chitinase (CHI), β-1,3-glucanase (β-Glu), peroxidase (POD), phenylalanine ammonia-lyase (PAL), polyphenol oxidase (PPO), and lipoxygenase (LOX) in citrus fruit.

CONCLUSION: The results suggest the possibility of using clove oil as a new tool for controlling blue mold of citrus.

Keywords: clove essential oil, blue mold; induced disease resistance; *Penicillium italicum*

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Morphological and molecular diversity of *Alternaria alternata* associated to tomato *Lycopersicon esculentum* L. fruit from Hyderabad, Pakistan

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ABSTRACT

BACKGROUND: Tomato [*Lycopersicon esculentum* (L.)] member of family soleaneacy abundantly cultivated in tropical and subtropical regions of the world, it is full of numerous essential diet regulating substances. This valuable crop is dangerously affected by several environmental and biotic components among all Alternaria are leading disease causing organism responsible of black-rot of tomato fruit. This present research aimed to isolate, identify and illustrate morpho-molecular diversity among *Alternaria alternata* species from tomato fruit.

METHODS: Local vegetable markets of targeted regions of Hyderabad Sindh, Pakistan were surveyed to collect fungal infested samples of tomato. Tandojam, Hyderabad and Kotri were collection sites. Disease suspected samples were surface sterilized and inoculated by following standard agar plate method. DNA extraction was made by performing CTAB protocol, sequencing and analysis of Internal Transcribed Region was done.

RESULTS: Results revealed the presence of six different fungal pathogens. Amongst them *A. alternata* was prime pathogen dominating with (30.6%) frequency. Variation was observed in morphological characters like difference in conidial length and breath, variation in number of transverse and longitudinal conidial chambers. Diverse pigmentation was noted from surface plate culture fungal colonies were appeared in olive green, lettuce green and gray-green surrounded by white margins moreover, reverse plate culture showed black, brown and dark brown. Texture of surface contained rough white crystals. Besides this for accurate identification one isolate of *A. alternata* were selected from each collection site for sequencing of ITS region. The PCR products showed that 570, 570 and 574 base pairs of nucleotides from the isolates of Kotri, Hyderabad and Tandojam respectively. PCR products were subjected to NCBI blast that confirmed the affiliation of morphological identified species as they shared up to 99% morphological resemblance with *A. alternata*.

CONCLUSION: The phylogenetic investigation consequence from that isolate of Tandojam, Kotri and Hyderabad was matching to the isolate of *A. alternata* KY949585, KX073995, and OQ727509. Sequences were submitted in NCBI geneBank and were allocated accession numbers OQ449453, OQ449567 and OQ451833. This documentation will assist to avoid the misidentification of Alternaria species as well these generated results also facilitate in the making of strategic measures to control this hazardous pathogen of tomato fruit rot disease.

Keywords: Tomato, *Alternaria alternata*, PCR, ITS.

SPP-PP-226

Lemongrass essential oil: A potential seed treatment against brown spot disease of rice

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ABSTRACT

*Cochliobolus miyabeanus* (anamorph = *Bipolaris oryzae* Breda de Hann (formerly, *Helminthosporium oryzae*), the causal agent of rice (*Oryza sativa*) brown spot disease is as important production limitation and occurs in all rice-growing areas of the world. Lemongrass (*Cymbopogon citratus*) essential oil was studied for its antifungal potential against *Bipolaris oryzae* as a seed treatment and for reducing brown spot disease. Different concentrations (1000, 500, 250 and 150 ppm) were evaluated by culture amendment assays and greenhouse studies. In culture amendment assays Lemongrass oil significantly reduced the mycelial growth of *B. oryzae* compared with the control at 500 ppm and completely inhibit fungal growth at 1000 ppm. The pathogen was not detected in *B. oryzae* - infested rice seeds after treatment with Lemongrass oil at 1000 ppm for 1 h. The rice seedlings showed no brown spot symptoms in the greenhouse studies and it did not affect the growth of the plants. These studies demonstrate that Lemongrass essential oil have the potential to inhibit the growth of *B. oryzae* and formulating a bio-fungicide from Lemongrass oil may provide a novel option for controlling seed contamination of *B. oryzae* and reducing risks of occurrence of brown spot of rice.

Keywords: seed treatment, antifungal potential, essential oil, *B. oryzae*

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Recombinational Analysis of Chilli veinal mottle virus (ChiVMV) Isolates

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ABSTRACT

Chilli veinal mottle virus (ChiVMV) is a widespread and one of the most damaging viral pathogens causing quantitative and qualitative losses in chilli worldwide. The current knowledge of the geographical distribution, standing genetic diversity and the evolutionary patterns existing among global ChiVMV population is limited. Here, we employed several bioinformatics tools and comprehensively analyzed the diversity, genomic variability and the dynamics of key evolutionary factors governing the global spread of this viral pathogen. To date, a total of 33 full-genomic sequences of ChiVMV isolates have been reported from 6 countries with most genomes documented from China. Among all ChiVMV -encoded major proteins, V1 and C3 displayed the highest level of nucleotide variability. The highest percentage of mutations was associated with C3 and V1 in the coding sequences. We detected a total of 41 significantly supported recombination events while the most frequently detected ones were associated with ChiVMV genome sequences reported from India. Notably, the distribution patterns of recombination breakpoints across different genomic regions of ChiVMV isolates remained variable. The expected beginning and ending breakpoints were found at positions 2502– 5613nt, the primary recombinant isolate (MT782116.1) linked to this incident was traced back to China, while the major and minor parents were identified as MN508959.1 (India) MT787292.1 (China), respectively. Further analysis revealed that with exception of a few positively selected codons, a major part of the ChiVMV genome is evolving under strong purifying selection. These findings will extend our current knowledge of the ChiVMV geographical prevalence, genetic diversity, and evolutionary factors that are presumably shaping the global spread and successful adaptation of ChiVMV as a destructive chilli pathogen to geographically isolated regions of the world.

Key words: ChiVMV, Geographical distribution, Phylogeny & Recombination, Global diversity

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Morphogenetic characterization of *Xanthomonas citri* pv. *citri* and its management

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ABSTRACT

Pakistan's economy largely depends on citrus cultivation, and citrus fruits generate significant foreign exchange. *Xanthomonas citri* pv. *citri* (*Xcc*) is the primary cause of citrus canker (CC), which poses a significant threat to the industry. The management of disease is made more difficult by the lack of resistant variants against different *Xcc* races. Understanding and addressing *Xcc* are critical for maintaining the industry given the economic reliance on citrus. In order to isolate *Xcc* in a lab, a thorough survey was conducted in the districts of Bahawalpur, Multan, and Dera Ghazi Khan to collect samples showing canker symptoms. Gram-negative bacteria were identified in the isolates by biochemical analysis, and Koch's postulates confirmed *Xcc* as the CC causing agent. DNA extraction and sequencing were used in the molecular characterization, which confirmed the phylogenetic relationship with *Xcc*. Using the disc sensitivity method, nine antibiotics were tested at 300, 500, and 700 ppm concentrations to evaluate CC management. Amoxicillin was found to be highly effective in inhibiting the growth of *Xcc* colonies. The study provided morphogenetic insights and established *Xcc* as the causal agent of CC. All strains matched *Xcc* in molecular characterization, but antibiotic sensitivity testing revealed inconsistent efficacy. Amoxicillin proved to be very effective at stopping the growth of *Xcc* colonies at every tested dosage. This study makes an important contribution to our understanding of *Xcc* and helps the citrus industry develop better disease control plans. Future interventions against citrus canker can benefit greatly from the understanding provided by morphogenetic characterization and antibiotic sensitivity profiles. The discovery of amoxicillin's high efficacy highlights the drug's potential for treating diseases linked to *Xcc*. These results help to protect citrus growing, maintaining the viability of an important industry in Pakistan's agricultural landscape.

Keywords: Antibiotics, Characterization, Citrus canker, Management, *Xanthomonas citri* pv. *citri*.

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# Evaluation of Exotic and Indigenous Chili (*Capsicum annuum* L.) Genotypes for Resistance against Chili Leaf Curl Virus Disease (ChiLCV) its Molecular Detection and Environmental Correlation

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ABSTRACT

BACKGROUND: Chili (*Capsicum annum* L.) is a vegetable crop belonging to the Solanaceae family and has significant importance all over the world as a spicy crop. Chilies are a rich source of vitamins and have much medicinal importance. Many pathogens including viruses are major hindrances in chili production. Chili Leaf Curl Virus Disease (ChiLCV) is one of the devastating diseases of chilies belonging to the family; Geminiviridae, genus begomovirus causes up to 100% yield losses.

METHODS: During the current study, 52 exotic and indigenous genotypes were evaluated against ChiLCV in the field based on the disease severity scale. Different responses were obtained starting from immune to highly susceptible. Further viral confirmation was done through molecular-based detection. Polymerase chain reaction was done by applying the by using bego CP primer of coat protein region. The immune plant gave a negative response to primers due to lack of viral pathogen and the remaining symptomatic plants showed positive responses which were confirmed through gel electrophoresis. The correlations between disease severity and environmental factors were analyzed through SPSS 27 latest software.

RESULTS: Temperature was positively correlated with highly significant results at the confidence interval of 0.05%. Humidity was positively correlated with significant results and rainfall was negatively correlated with disease incidence and gave nonsignificant results. Regression analysis found the intercept ($b_o$) for six varieties (-22.425, -148.579, -16.296, -15.693, -13.585, 11.228) keeping all other variables constant which measures the effect of one unit increase in the independent variable on disease severity. The P-value (0.047, 0.033, 0.051, 0.026, 0.061, 0.007) proved the intercept was statistically significant at the 5% significance level. The finding of this study will help in suggesting suitable genotypes for cultivation and incorporation of resistance genotypes in chili breeding programs for future varietal development.

Keywords: Chili, ChiLCV, Molecular detection, Correlation.

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Nanotech solutions for *Agrobacterium* menace: unveiling the potential of Titanium Dioxide nanoparticles in crop management

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ABSTRACT

BACKGROUND: Titanium dioxide nanoparticles ($TiO_2$ NPs) possess a substantial surface area, unique surface structure, and remarkable photocatalytic antibacterial properties. $TiO_2$ NPs are widely used because they are non-toxic and easily dispersible in solutions. When used in combination with antimicrobial drugs, $TiO_2$ NPs can enhance the effectiveness of these treatments. Additionally, they are stable and simple to produce, making them valuable for various applications in agriculture.

METHODS: In the current study, efficacy of TiO2 NPs coated copper oxychloride formulations were tested for inhibiting the growth of *Agrobacterium tumefaciens, crown gall pathogen*. $TiO_2$ nanoparticles were synthesized using titanium (IV) isopropoxide as the precursor through a "top-down" chemical approach. The nanoparticles were characterized using visible absorption spectroscopy, Scanning Electron Microscopy (SEM), and Dynamic Light Scattering (DLS). An inhibition zone assay was conducted using agar well technique to evaluate the efficacy of the $TiO_2$ nanoparticles combined with copper oxychloride to control bacterial growth.

RESULTS: $TiO_2$ were successfully synthesized and were characterized by DLS and SEM to confirm their properties. Dynamic Light Scattering (DLS) analysis indicated that the $TiO_2$ NPs had an average particle size ranging from 200 to 250 nm. Scanning Electron Microscopy (SEM) further revealed that these nanoparticles exhibited a spherical shape. Notably, the combination of $TiO_2$ nanoparticles with copper oxychloride displayed enhanced synergistic effects compared to their individual applications, improving drug delivery and causing bacterial membrane damage through the generation of reactive oxygen species (ROS) and phototoxic effects.

Keywords: Titanium Dioxide Nanoparticles, Antimicrobial Treatments, *Agrobacterium tumefaciens*

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Molecular detection and management of plant diseases for sustainable agriculture

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ABSTRACT

BACKGROUND: Timely and accurate detection of plant pathogens, which can help minimize crop losses and control the spread of diseases, is one of the main challenges in plant pathology and need of time to overcome food security and ensuring sustainable agriculture. This study examines the use of four diagnostic methods in the identification and treatment of plant diseases namely enzyme-linked immunosorbent assay (ELISA), polymerase chain reaction (PCR), quantitative PCR (qPCR) and reverse transcription polymerase chain reaction (rtPCR).

METHODS: ELISA (Enzyme-Linked Immunosorbent Assay) is a serological method that uses enzyme-labeled antibodies, which change color when bound to the target pathogen, to identify particular antigens or antibodies in plant tissues. PCR stands for polymerase chain reaction, a molecular technique that amplifies particular pathogen DNA sequences to enable the detection of even minute amounts of pathogen DNA. qPCR, or quantitative polymerase chain reaction, is a PCR variant that uses fluorescent dyes to measure the amount of amplified DNA in real time, allowing for the estimation of pathogen load in infected plants. Reverse Transcription PCR, or rtPCR, is a method that can be used to detect RNA viruses or active gene expression in pathogens. It works by first using reverse transcription to convert the pathogen's RNA into DNA, which is then amplified. The use of molecular techniques in integrated disease management strategies is covered in this review, along with their benefits, drawbacks, and useful uses in precision agriculture.

CONCLUSION: Plant disease control requires the use of sophisticated diagnostic techniques such as PCR, ELISA, qPCR, and rtPCR to improve pathogen identification. Their excellent control strategies, precise quantification, and early detection are made possible by their high sensitivity and specificity. In the end, these methods ensure global food security by assisting farmers and researchers in making more informed decisions, reducing crop losses, and enhancing agricultural sustainability.

Keywords: Molecular techniques, pathogen detection, antigen, reverse transcriptase, pathogen quantification

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The Impact of Zinc to Boost Resistance in Rice against Brown Spot Disease

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ABSTRACT

Introduction: Micronutrients play a pivotal role in plant disease management, and zinc (Zn) has emerged as a key element in enhancing plant defenses, particularly in rice cultivation. The current research investigated to assess the effectiveness of using zinc to manage *Helminthosporium oryzae*, the fungus that causes brown spot disease in rice (*Oryza sativa* L.), which may cause yield loss ranging from 30 to 50% where infection is severe. The aim is to evaluate the effectiveness of zinc application in reducing disease incidence and enhancing the physiological and biochemical defense responses in rice plants.

Methodology: The methodology involves both field trials and controlled laboratory experiments, where zinc is applied via soil and foliar sprays at different growth stages. Disease severity is quantified based on lesion size, infection rate, and plant health metrics. Additionally, biochemical assays are used to measure changes in antioxidant enzyme activities, reactive oxygen species (ROS) levels, and lignin deposition.

Results: The study showed that zinc increases the enzymes such as superoxide dismutase (SOD) and catalase (CAT) that lessen the effects of oxidative stress due to the attack by pathogen. In field trial, percentage reduction in brown spot disease was observed to be in the range of 35-40% by the application of zinc and plants with zinc treatments were 20-25% higher yield in comparison with the untreated plants. Enhancement of cell wall integrity also reduces pathogen invasion, thus slow down the transmission of disease.

Conclusion: Prospective studies involve incorporating zinc with other methods of smart farming with an aim of supplementing its function of managing diseases in crops, this include rotating crops, using bio control measures among others. The present study reveals the potential of Zinc for effective control over *H. oryzae* brown spot, which contributes potential advantages to rice productivity and food security from economic and environmental perspectives.

Keywords: Zinc application, Brown spot disease, Rice cultivation, Plant defense mechanism, Disease management,

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Molecular Characterization and *in-vitro* Antibiotic Management of Angular Leaf Spot of Cotton Caused by *Xanthomonas campestris* pv. *malvacearum*

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ABSTRACT

BACKGROUND: Cotton is the most important crop throughout the world which belongs to the *Malvaceae* family. It is an important source of income in poor countries. Surplus lint cotton is commonly exported and for textile industry serve as raw material. Cotton is being infected by a worldwide severe disease known as Angular leaf spot of cotton caused by *Xanthomonas compestris* pv, *malvacearum (Xcm)*.

METHODS: A systematic survey of Multan (CRI and MNSUA) was done for collection of disease samples showing distinctive angular leaf spot symptoms and carried out into lab for isolation of bacterium. Various confirmatory tests using standard protocol such as gram staining and KOH test resulted the bacterial isolate are gram negative bacterium. Koch's postulates were followed and found *Xcm* is the causal agent of angular leaf spot of cotton. Molecular characterization of *Xcm* was performed through DNA extraction and commercially sequenced after identification. Some nearly associated sequences were downloaded through BLAST on NCBI and form a phylogenetic tree. This phylogenetic tree showed the strains examined belong to the *Xcm* strains.

RESULTS: For the management of angular leaf spot of cotton, five antibiotics (Ampicillin, Erythromycin, Streptomycin, Ciprofloxacin, and Clarithromycin) were tested in *in-vitro* conditions to assess their efficacy against *Xcm.* Among the tested antibiotics, maximum inhibition zone (0.75mm) by Ampicillin at a concentration of 150 ppm, followed by Ciprofloxacin (0.72mm), Erythromycin (0.70mm), Clarithromycin (0.56mm), while Streptomycin showed minimum inhibition zone (0.55mm) in preventing the development of *Xcm.*

CONCLUSION: By keeping in view, the results of this study, antibiotic could be included in the future management strategies against the angular leaf spot of cotton.

Keywords: Cotton, *Xanthomonas campestris* pv. *malvacerum,* Antibiotics, Molecular Characterization

SPP-PP-234

Eco-friendly and Innovative Strategies in Managing Plant Pathogens

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ABSTRACT

BACKGROUND: Fungal plant pathogens are the major threats for agriculture sector that cause significant losses in crop yield annually. Conventional practices rely on chemical pesticides, which are dangerous to the environment and human beings.

METHODS: The contemporary study was designed to evaluate the biocontrol agents and nanoparticles as an ecofriendly management strategy against fungal plant pathogens. It included the use of biocontrol agents, for instance, the bioactivators, which contain beneficial microbes, endophytes, and others notably exhibiting biocontrol activities, including species of *Trichoderma* and *Bacillus* through competitors and inducers of systemic resistance to the diseases and pests affecting crops in a holistically sustainable manner. It can be mentioned that *Trichoderma* prevents the fungal diseases through the action such as mycoparasitism, production of enzymes and secondary metabolites that antagonize the fungal pathogens. Mycoparasitism of *Trichoderma harzianum* can successfully suppress the pathogenic impact of *Sclerotinia sclerotiorum* on tomato plants. It suppresses pathogen by breaking down of cell walls through the synthesis of hydrolytic enzymes such as chitinases and glucanases. *Bacillus* inhibits bacterial diseases through direct antagonism through the use of antimicrobial secondary metabolites that act through cell membrane dysfunction and stress induction of systemic acquired resistance in plants. It synthesizes lipopeptides and several other antimicrobial substances that restrain the growth of *Xanthomonas* and at the same time can induce systemized resistance in the plant in relation to the pathogen. Nanoparticles both copper and silver present potential and environmentally friendly mechanisms for managing plant diseases. Nanoparticles have a strong effect on bacterial pathogens, antimicrobial activity on the cell membrane, and high bioavailability they are used to control diseases such as bacterial spot in tomatoes and red root-rot in tea plants.

CONCLUSION: Interactions between these innovative practices show their applicability in diminishing reliance on chemical inputs, improving soil conditions, and increasing crop resistance to diseases. Real-life examples and the latest trials prove that using complex approaches that combine agricultural yields with environmental health is necessary, corresponding to the sustainable development agenda. More effort is thus needed to optimize these strategies and recognize their full potential across broad-based agricultural practices.

Keywords: Biological agents, fungal plant diseases, nanoparticles, sustainable agriculture

SPP-PP-235

Citric Acid-Synthesized Carbon Dots in Mitigation for Plant Bacterial Diseases

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ABSTRACT

BACKGROUND: Plant diseases caused by various pathogens, including fungi, bacteria and viruses, are a major threat to food security and global productivity. Among these issues, bacteria is of the most destructive phytopathogen, which causes the yield losses and poor food quality worldwide. Traditional methods of disease control, such as chemical pesticides, biochemical approaches and conventional breeding for resistant cultivars often have limitations. However, nanotechnology is a specialized field that falls within the realm of technology in various scientific disciplines. Among these, citric acid synthesized carbon dots a sustainable approach that exhibit antibacterial characteristic that could demonstrate effectiveness against the bacterial spot of tomato pathogen.

METHODS: Carbon dots (CDs) are typically ranging from 1 to 10 nanometre-sized carbon-based materials known for their unique properties. CDs gained attention in agriculture due to their potential to enhance plant growth, improve stress tolerance, and act as antimicrobial agents. CDs also activate plant defense mechanism, enhancing resistance to pathogens. Instead of previously used hydrothermal process, quick and facile reflux method employed and synthesize CDs from citric acid. CDs characterize by following techniques Dynamic Light Scattering (DLS) analysis, Zeta potential analysis, UV-visible spectrophotometer, Transmission Electron Microscope (TEM) and Fourier Transform Infrared (FTIR) Spectroscopy. CDs can damage bacterial membranes, leading to cell lysis and death. This mechanism indicating their potential as antimicrobial agents in crop protection. It is important to incorporating carbon dots into sustainable approach for plant disease management.

CONCLUSION: Carbon dots represent a promising bio pesticide a sustainable approach option for managing bacterial spot disease in tomatoes. Their unique properties allow them to enhance plant growth while providing effective protection against pathogens. Further research into optimizing their application methods and understanding their long-term effects on plant health will be essential for integrating carbon dots into sustainable agriculture practices.

Keywords: Carbon dots, Eco-friendly plant disease management, Crop protection and Sustainable agriculture.

SPP-PP-236

Exploring the Potential of Plant Derived Compounds for the Management of Plant Diseases

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ABSTRACT

BACKGROUND: Plant diseases present a major challenge to global agriculture, causing a significant reduction in crop yield and quantity. While synthetic chemicals are widely used as traditional method and current agriculture extensively rely on these chemical treatments, bringing about environmental and health concerns. Thus the pursuit of environment friendly alternatives is pressing. Plant derived compounds represent a promising solution as botanical pesticides. These compounds include alkaloids, terpenoids, flavonoids and phenolic compounds that possess antimicrobial, antifungal, antibacterial, antiviral and insecticidal properties.

METHODS: The secondary metabolites in plants prove to be very effective against plant pathogens as they interrupt with the lipid bilayer of the microbial cell membranes, that causes increased permeability and leakage of cellular contents and eventually the death of cell. Moreover, plant extracts inhibit the production of many key enzymes that are vital for the survival of pathogens. Advanced analytical techniques such as Gas Chromatography-Mass Spectrometry (GC-MS) and High Performance Liquid Chromatography (HPLC) play a crucial role in identification quantification and characterization of these compounds.

CONCLUSION: In conclusion, the identification of bioactive compounds present in the extracts will facilitate the correlation between specific compounds and their antibacterial activity. It offers a promising and eco-friendly alternative to chemical control methods. Moreover, this study could help in developing new remedies derived from nature for controlling the bacterial soft rot of potatoes thus reducing the dependence on synthetic pesticides.

Keywords: Plant diseases, botanical pesticides, plant derived compounds, sustainable agriculture

SPP-PP-237

Zinc: Addressing the Growing Fungal Menace to Global Food Security

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ABSTRACT

BACKGROUND: Global food security is threatened by phytopathogenic fungi causing up to 30% crop loss and compromising safety. Current control measures are inadequate, exacerbated by population growth and climate change. Zinc (Zn), a non-toxic micronutrient crucial for plant health, offers a promising solution due to its potent antifungal properties at low concentrations.

METHODS: *In viro* and *In vivo* experiments were carried out by taking different concentrations of Zn to check its antifungal potential alone and in combination with inorganic (NPK), organic (FYM and GM) and bio fertilizers. Zn-nanocomposite with the chitosan were also prepared for assessing their antifungal potential against notorious fungal pathogen.

RESULTS: Zinc, whether utilized independently or in conjunction with various fertilizers, has proven effective in controlling fungal diseases like Macrophomina rot, Alternaria blight, Sclerotium rot, Fusarium wilt, etc. This is achieved by enhancing the biophysical and biochemical traits of plants, providing farmers with a profitable income source. The development and commercialization of zinc nanocomposites offer a comprehensive solution for sustainable and profitable crop production. Implementing site-specific management strategies, aligning zinc demand with crop needs, ensures effective disease management, high yields, and positive impacts on food quality and consumption considerations. Modern biotechnology tools, including the identification and integration of proteins from disease-tolerant plants, hold promise for developing anti-stress strategies in economically important crops globally.

Keywords: Biofertilizers, Charcoal rot, Early blight, Sclerotium rot, Zinc

SPP-PP-238

Identification and Characterization of Non-aflatoxin Producing *Aspergillus* Species

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ABSTRACT

BACKGROUND

Aflatoxins are secondary metabolites formed by Aspergillus species, mostly *Aspergillus flavus* and *Aspergillus parasiticus*. Among the mycotoxins that contaminate agricultural products, AFB1, AFB2, AFG1, AFG2, AFM1, and AFM2 are the most toxic and carcinogenic. Not all species of *Aspergillus* species produce aflatoxins; some strains are atoxigenic. It is estimated that about 1.6 billion dollars of the global food crops are thought to be mycotoxin contaminated. The study aimed to identify non-toxin producing *Aspergillus* species.

METHODS

The survey was conducted in four Tehsils of Multan district. Aflatoxins samples were collected and Potato Dextrose Agar (PDA) was used to isolate and purify the fungus. The fungal isolates were identified on morphological basis and In-vitro UV based screening test was performed on Coconut Milk Agar (CMA) to distinguish aflatoxigenic from the non aflatoxigenic by the exposure of UV light at 365 nm. A selective media (AFPA) and Ammonia Vapor Test were utilized for recognition of aflatoxin generating Aspergillus species by visualizing the color. The molecular characterization of atoxigenic isolates was carried through ITS regions with universal primers (ITS1 and ITS4) and PCR was amplified followed by sequencing of amplicons. The obtained sequences were aligned using ClustalW embedded in MEGA X with existing sequences in the Genbank database followed by pair wise sequence comparisons and phylogenetic analysis.

RESULTS

The survey revealed varying incidence percentage across four tehsils, Tehsil Multan at 26.21%, Tehsil Multan Saddar at 13.45%, Tehsil Shujabad at 16.10%, Tehsil Jalalpur Pirwala at 21.68% and an average incidence of 19.36%. The morphological identification showed two fungal species viz. *Aspergillus flavus* and *Aspergillus niger*. In all three biochemical tests, *Aspergillus flavus* was identified as toxigenic isolates while *Aspergillus niger* as non-toxigenic isolate. The atoxigenic Multan isolate (SS-4) showed 94.2% similarity with *A. niger* isolate reported from Brazil and also clustered with isolates, from Latin America, in phylogenetic analysis.

CONCLUSION

The identification on non-toxigenic producing *Aspergillus* species is essential for developing biocontrol strategy to mitigate aflatoxins contamination in fields.

Keywords: *Aspergillus flavus, Aspergillus niger*, Aflatoxins, Disease incidence

SPP-PP-239

Potential of *Talaromyces* sp. as a Biocontrol Agent of Chickpea Wilt

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ABSTRACT

BACKGROUND

Chickpea is an importance rainfed and cool season food legume crop. Its production is reduced due to the Chickpea wilt, caused by *Fusarium oxysporum* f.sp. *ciceris*. The primary symptom is wilting of both seedlings and adult plants. Affected seedlings exhibit drooping leaves and a pale color compared to healthy plants. *Fusarium* wilt is a significant threat to the annual yield of chickpeas, causing significant losses ranging from 10 to 15%.

METHODS

A comprehensive survey was conducted in Bhakkar district and chickpea wilt disease incidence was recorded. Fungal endophyte *Talaromyces* spp. from mulberry rhizospheric soil and other endophytes *Trichoderma viridae* and *Trichoderma harzianum* were isolated. *In vitro* dual culture and pot experiments were performed to evaluate their association with chickpea plants and their efficacy in controlling chickpea wilt.

RESULT

The survey revealed the highest chickpea wilt disease incidence of 19.03% in Tehsil kallur Kot. The endophytic fungi, *Trichoderma viride* displayed the highest inhibition percentage of 68.21%, *Trichoderma harzianum* 66.67% and *Talaromyces* spp. 39.74% under *In-vitro* conditions. In pot experiment, these fungal endophytes significantly improved plant growth and reduced disease severity.

CONCLUSION

The use of fungal endophytes as biocontrol agents offers an eco-friendly alternative to chemical fungicides by reducing reliance on chemical treatments, minimizing environmental hazards and promoting sustainable agriculture.

SPP-PP-240

Genetic Characterization of Maize Seed Bacterial Endophytes and their Efficacy against Aflatoxin Producing *Aspergillus flavus*

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ABSTRACT

BACKGROUND

Maize (*Zea mays)* is a major staple grain after wheat and rice which is highly sensitive to aflatoxins contamination, produced by the fungal species such as *Aspergillus flavus* and *Aspergillus parasiticus*. These are carcinogenic and fatal for both human and animals. The use of plant's endophytic bacteria in regulation of biocontrol activities, are best competitors against pathogens.

METHODS

The efficacy of bacterial endophytes against *A. flavus* isolated from maize seeds were employed in dual culture technique and *in vitro* screening method by treating the seeds. The confirmation of aflatoxin production of *A. flavus* was done by competitive direct ELISA screening antibody microwell assay test and the endophytes were genetically characterized using MEGA software package and species were identified.

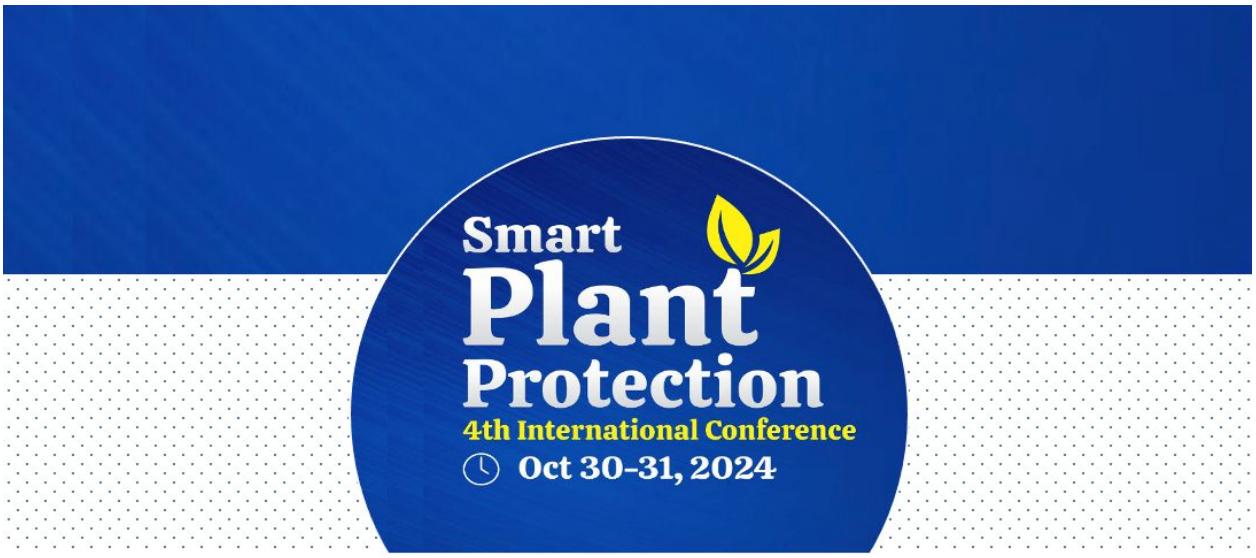
RESULTS

An amount of 17 endophytic bacteria were isolated from the seeds of 17 different maize genotypes. The result of the study revealed that E9 endophytic antagonist exhibited the highest inhibition of 67.5% while E3 indicated the lowest with 23% of inhibition. The endophytes were genetically characterized as *Alcaligenes* genus with a maximum similarity of 71.5% and the phylogenetic analysis revealed that the *Alcaligenes* spp. maize strain is closely related to the *Alcaligenes* isolate (MT180585) from India.

CONCLUSION

By promoting plant health and reducing aflatoxin contamination in maize, bacterial endophytes serve as an eco-friendly alternative to chemical fungicides improving crop safety and yield.

Keywords: Maize, *Aspergillus*, Aflatoxins, Disease incidence, Bacterial endophytes, *Alcaligenes*




# THEME-3:
## WEED MANAGEMENT

## THEME-3: WEED MANAGEMENT

SPP-WM-301

Efficacy of different herbicides on soil inhabiting arthropods in maize field

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ABSTRACT

Herbicides are being exposed to non-target organisms all around the world. Although many herbicides, such as glyphosate, were once believed to be harmless, mounting data shows that these chemicals have significant impact on ecology processes through altered microbial populations and diversity. The performance of plants and animals is impacted by herbicide-altered microbiomes, which can also have an impact on trophic interactions including herbivory and pollination. A study was conducted to check the impact of different herbicides on soil inhabiting arthropods diversity in maize field. The experiment was carried out in Entomological Research Area Youngwala, Department of Entomology, University Agriculture Faisalabad first season from August 19 to September 12. Experiment was laid out in randomized complete block design (RCBD) with three replications and five treatments. Statistical results regarding the abundance of soil arthropods stated that Adingo cause maximum mortality. Treatment wise community structure of soil arthropods suggested that atrazine possessed higher percentage of soil organisms. Shanon index showed the total percentage of arthropod community by Atrazine was 2.13 H', S-Metalochlor 2.11 H', Gengwei 2.09 H', Pendi 2.07 H' and Adingo Xtra 2.05 H'. Adingo is the most effective herbicide for post-emergence weed control but as it caused more mortality then other herbicides. It was concluded that the use of S-Metalochlor is effective to control pre-emergence weed control and hence useful to save biodiversity of arthropods. While for post-emergence weed control Atrazine is considered the best practice to save diversity of soil arthropods.

Keywords: Maize, Arthropods, Herbicides, Adingo, Atrazine

SPP-WM-302

# Aquatic weed management by biological control system

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ABSTRACT

BACKGROUND: Herbicides in ponds creates pollution and cause damage to the life of the aquatic habitat.

METHODS: Basic methods used to control weeds include preventive, mechanical, biological and chemical techniques. Determining which of these techni- ques to use involves consideration of the target weed species, fish production objectives for the pond, secon- dary water uses and the cost of treatment options.

RESULTS: The grass carp is a practical and economical way to control certain types of pond weeds. Grass carp effectively control weeds with tender succulent vegetation such as filamentous algae and duckweed, but are ineffective in controlling weeds that have tough, woody vegetation such as waterlily and cattail. Many states regulate the use of grass carp. Herbicides should be considered as a temporary control method. Depending upon the herbicide selection and the weed species, duration of control can range from a few weeks to several months.

CONCLUSION: Long-term weed control can be achieved by using a combination of recommended aquatic weed methods. For example, use of the proper herbicides followed by grass carp stocking will effectively control and prevent the reoccurrence of most submersed weed problems.

Keywords: aquatic weeds, ducks, grass carp, herbicides, algae

SPP-WM-303

# Weed Control and Sowing Time Affected Productivity of Directly Sown Rice (*Oryza sativa* L.)

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ABSTRACT

BACKGROUND: Sowing food crop like rice directly in field not only saves costs on water, time, labor and fuel etc but also ensures higher production making more food available for masses. Main problem in direct seeded rice was heavy weed infestation. Moreover information on effect of sowing time for direct sowing of rice was also not established.

METHODS: Rice was directly sown under field conditions for two consecutive years to assess the rice yield through use of different options for weed control and sowing times. Seven methods of weed control and three different times of sowing were evaluated.

RESULTS: Amongst weed control methods, penoxsulam followed by hand-hoeing at 30 days after sowing (DAS) reduced weed density as low as ≤ 6 and ≤ 28 plants $m^{-2}$ at 35 DAS and at harvest, respectively during both the years which was comparable with hand-hoeing at 15, 30 and 45 DAS. Number of tillers, kernel weight was higher, while kernel yield in this treatment was 70 and 61% higher compared to non-treated control during year 1 and 2, respectively. A combined foliar spray of sorghum and sunflower water extract at 20 and 40 DAS and sorghum mulch at 6 t $ha^{-1}$ were effective for weed control and secured kernel yield respectively, > 33% and 27% higher compared with the non-treated control. However, they were not as effective as penoxsulam, bispyribac-sodium, and / or hand-hoeing treatments.

CONCLUSION: Penoxsulam would be an additional chemical tool if integrated with hand-hoeing for weed control in rice under direct seeding in first week of June. The findings suggested that seeding in the first week of June reduced weed density and biomass, increased kernel weight and kernel yield compared to sowing rice in the first week of July.

Keywords: Hoeing, herbicide, mulch, rice, sowing time, weed control, weed density, kernel yield.

SPP-WM-304

# Pendimethalin leaching in the soil of cotton-wheat cropping system

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ABSTRACT

The escalating global concern over environmental contamination from agricultural practices necessitates a thorough understanding of herbicide behavior in soil. This study addresses the pressing issue of herbicide leaching, focusing on the leaching potential of pendimethalin ($C_{13}H_{19}N_3O_4$) in a packed column lysimeter within the specific context of a cotton-wheat cropping system. The methodology involved the installation of polyvinyl chloride (PVC) columns filled with layers of soil and sand incorporating silicone ridges strategically to prevent preferential flow. The lysimeter was treated with various doses of pendimethalin i.e., i) control conditions, ii) labeled dose, iii) 2.0x of labeled dose, iv) 4.0x of labeled dose. The application of pendimethalin was carried out as per treatment and 100 ml water was applied to each lysimeter after 24 hours for 10 days and repeated again. Afterwards, the column was cut into 0-15 cm layers for the analysis of pendimethalin. Results revealed a significant concentration trend of pendimethalin with increasing depth in the soil column. The maximum concentration (2.276±0.005 ppm) was observed at 75-90 cm depth for the 4.0x recommended dose, while the minimum (0.003±0.001 ppm) was found at 0-15 cm depth for the 1.0x recommended dose. This concentration variation underscores the critical role of soil properties in influencing herbicide mobility. Adsorption distribution coefficients ($K_d$) and organic carbon partition coefficients ($K_{oc}$) further supported and explained these findings. The higher value of Kd (41.01) was found in a 75-90 cm depth of 4.0x recommended dose, while the lowest value (0.003) was found in a 0-15 cm depth of 1.0x. Similarly, maximum Koc (15855.35 L $kg^{-1}$) values were also found in a 75-90 cm depth of 4.0x, while the lowest pendimethalin Koc (1.34 L $kg^{-1}$) was found in the 0-15 cm depth of 1.0x. The study's outcomes contribute essential insights into the complex interplay between herbicides and soil, shedding light on the factors influencing the leaching potential of pendimethalin.

Keywords: Distribution coefficients, herbicide residue, leaching, lysimeter studies, pendimethalin, soil organic matter

SPP-WM-305

# Assessing Herbicide Carryover in Winter Crops: Implication for Sustainable Agriculture Production

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ABSTRACT

Herbicide carryover poses a significant challenge in sustainable agriculture, especially in the cultivation of field crops where the residue of applied herbicide/s from the previous season may impact the germination and growth of subsequent crops. The current study aimed to evaluate the effect of pendimethalin and s-metolachlor carryover on the winter crops focusing on their soil persistence. A comprehensive pot experiment was conducted employing a completely randomized design (CRD) with 4 replications of each treatment. In this experiment, five different soils i.e., $S_0$= Control soil (without herbicide application), $S_1$= One month-aged pendimethalin residue in the soil, $S_2$=One month-aged S-metolachlor residue in the soil, $S_3$=Season-aged pendimethalin residue in the soil, $S_4$=Season-aged S-metolachlor residue in the soil and seven winter crops i.e., $C_1$= Wheat (Faislabad-2008), $C_2$=Oat (S-2000), $C_3$=Barley (Jau-17), $C_4$=Chickpea (Noor-2008), $C_5$=Lentil (Punjab Masoor 2018), $C_6$=Berseem (Punjab berseem 2019) and $C_7$=Raya (Khanpur raya) were sown in the pots containing herbicide treated and untreated soil to assess the effect of herbicide carryover on germination, growth, and physiological attributes of tested crops. The results of this study indicated varying degrees of herbicide persistence in soil especially in the Season-aged pendimethalin and one-month-aged residue of S-metolachlor. These soils reduced the germination of oat ($S_3$=10%), and raya ($S_2$=25%) at a significant level. These soils averted seedling dry biomass of wheat, oat, barley, chickpea, lentil, berseem and raya to the tune of raya (72%) > barley (44%) > chickpea (41.4%) > berseem (41.3%) > wheat (26%) > oat (23.5) > lentil (11.5%), respectively. Additionally, the other seedling growth and physiological attributes were also negatively affected by these two soils in almost all tested crops. This study suggests the interaction between soil applied herbicides (to cotton) and winter crops necessitating the efforts to mitigate herbicide carryover to sensitive crops following in rotation.

Keywords: Herbicide residue, soil applied herbicides, pre-emergence, pendimethalin, S-metolachlor, winter crop

SPP-WM-306

An Explainable Deep Learning Model for Grass-Weed Detection

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ABSTRACT

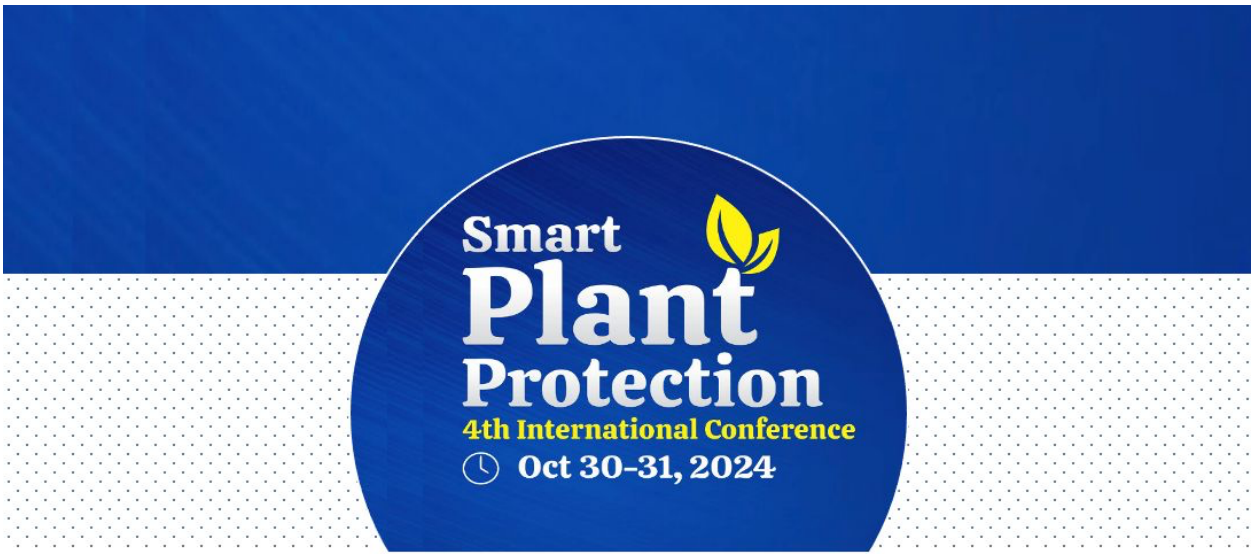
BACKGROUND: Grassweeds pose a substantial issue in agricultural production which can adversely impact crop yields and overall agricultural productivity. Manually detecting grass weeds requires a significant amount of labor and is very time consuming. In recent years, deep learning specifically convolutional neural networks (CNNs), has proven highly effective across various applications, notably in the grass weed detection Therefore, to automate the process of grassweed detection, we present a comparison of various deep learning models that can detect grassweeds in real-time or near-real-time.

METHODS: This research focuses on fine-tuning deep learning models by comparing state-of-the-art architectures, including Residual Network (ResNet) and Inception V3, followed by a comprehensive evaluation. The goal of this study is to provide clear and understandable explanations for the decisions made by these models. Afterwards XAI techniques GRAD-CAM and LIME were applied for explanation of models. The XAI helps farmers and other stakeholders to understand and trust the recommendations and decisions made by the system.

RESULTS: For grassweed identification in this study, we used a Kaggle dataset of manually annotated images. The dataset has 1118 images consisting of six food crops and eight weed species. The evaluation of model performance contains metrics such as accuracy, precision, and F1-Score. ResNet acquired a remarkable 99.72% accuracy 97% precision and 95% F1-score. Moreover, this research implies XAI techniques, including LIME, and Grad-CAM, to interpret model decisions. The findings show that Grad-CAM performed better than LIME in terms of interpretability. The integration of XAI techniques is crucial in assessing the fairness and transparency of the models, providing insights into the decision-making process for practical agricultural applications.

CONCLUSION: In conclusion, this research contributes significantly to the intersection of agriculture and artificial intelligence. The utilization of pretrained models, particularly ResNet, coupled with the integration of XAI techniques, demonstrate a promising avenue for improving weed detection and disease detection in weeds. The results not only highlight the potential of these technologies in sustainable agriculture but also underscore the importance of transparency and interpretability in implementing AI solutions for practical, on-the-ground applications in the agricultural industry.

Keywords: Weed management, agriculture, deep learning, explainable AI




# THEME-4:
## BIOTECHNOLOGY FOR PLANT PROTECTION

## THEME-4: BIOTECHNOLOGY FOR PLANT PROTECTION

SPP-Biotech-401

### Breeding For Horticultural Resilience in the Disease-Climate Nexus

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ABSTRACT

Horticultural crops around the world face an unprecedented threat due to the combination of climate change and escalating plant diseases. In addition to cultural practices and agro ecological methods, a focus on host resistance breeding efforts may develop multifaceted strategies to reduce the effects of diseases and strengthen crops against climate-related threats. This abstract explores the critical role that breeding methods have in protecting horticulture crops against the combined effects of disease stress and climate change. Leveraging conventional breeding methods, advanced genomic tools and marker-assisted selection, scientists can accelerate the development of cultivars that are resistant to climate and evolving pathogens. A key tactic in promoting crop resilience is the integration of several genes that offer resistance to disease along with characteristics that grant flexibility in response to shifting climate conditions. Breeders can prevent diseases brought on by climate change by taking use of the genetic variety seen in plant species. This study emphasizes the conclusive synergy between breeding efforts and climate-conscious disease control, providing a path towards sustainable horticulture production and ensures food security.

Keywords: breeding, sustainable horticulture, resistance, climate change

SPP-Biotech-402

# Tissue culture: a paradigm for disease mitigation in horticultural crops

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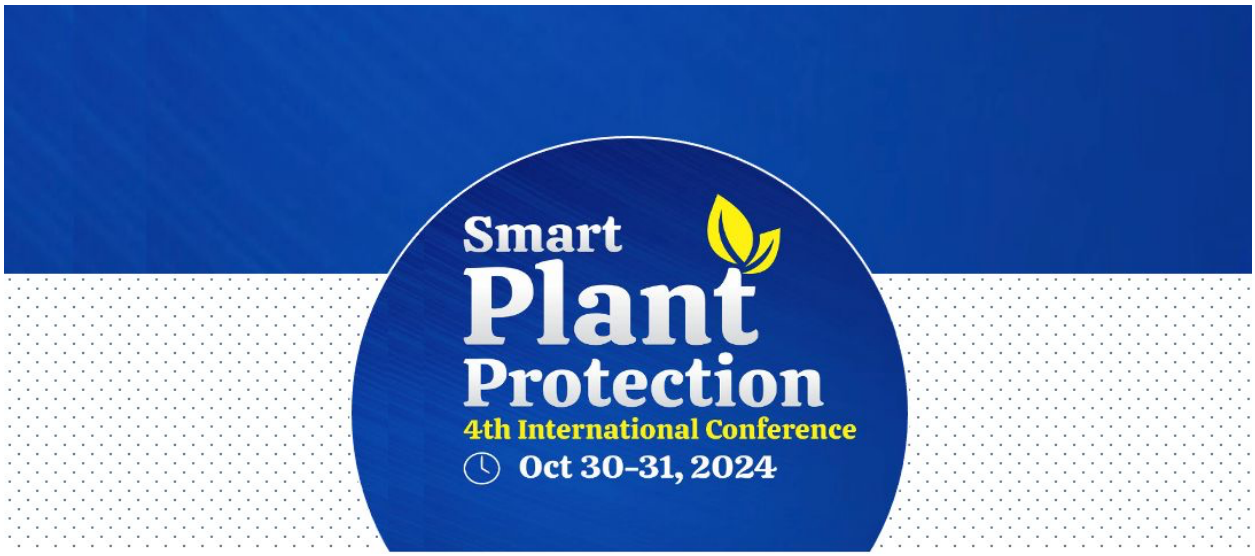
ABSTRACT

Diseases provide a constant threat to vegetative propagated crops used for horticulture, with substantial effects on sustainability, quality and production. Conventional approaches to managing viral diseases frequently fail to offer all-encompassing remedies. On the other hand, the development of tissue culture methods has shown promise in overcoming these obstacles. Numerous advantages come with tissue culture, such as the capacity to quickly multiply disease-free plant material, the possibility of genetic advancement, and the capacity to regenerate entire plants from small piece of tissue or cells. Researchers can develop genetically engineered plants with increased resilience, disease resistant, and disease-free stock by utilizing tissue culture. Starting with sterile explants that are free of pathogens, tissue culture allows the careful selection and multiplication of disease-free plant material. Tissue culture reduces the possibility of disease transmission by maintaining strict culture conditions and vigilant oversight, guaranteeing the development of disease-free and healthy plantlets suitable for field cultivation. This highlights the potential of tissue culture techniques as a potent weapon in the fight against diseases of horticultural crops, emphasizing its ability to transform disease management tactics and guarantee a more sustainable crop output in the future.

Keywords: vegetative propagated crops, tissue culture, disease transmission, disease resistant, horticultural crops




# THEME-5:

## Regenerative Agriculture

## THEME-5: REGENERATIVE AGRICULTURE

SPP-RA-501

# Effects of Reduced Chemical Inputs on Micronutrient Quality in Regenerative Agriculture Systems

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ABSTRACT

Regenerative agriculture strongly emphasizes reducing chemical inputs, which has a big impact on food crops' nutritional value. The results of several studies looking at how lower chemical inputs affect the micronutrient profiles of important crops are summarized in this study. Studies reveal that crops cultivated using regenerative techniques, like organic fertilization and cover crops, have higher concentrations of vital micronutrients. For example, research indicates that organic tomatoes have 20–30% more phenolic compounds and vitamin C than their conventionally farmed equivalents. Regenerative systems can also raise soil organic matter by 1% to 2% per year, which is important for enhancing nutrient availability and retention, according to a meta-analysis. The bioavailability of micronutrients like iron and zinc has significantly increased due to this improvement in soil health; some studies have shown increased concentrations of these elements in crops of up to 50%. These findings have significant ramifications since higher micronutrient content can lead to better human health outcomes, especially in populations where shortages are likely. This analysis emphasizes the need for more investigation to measure these advantages for various crops and geographical areas, thereby bolstering the potential of regenerative agriculture as a sustainable strategy to improve food quality while reducing reliance on chemicals.

Keywords: Regenerative agriculture, nutrient bioavailability, reduced chemical inputs, sustainable agriculture, nutritional quality, food security

SPP-RA-502

Genome-wide identification and evolutionary analysis of biofortification-related *zip* gene family in warm-season food legumes

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ABSTRACT

Legumes have significant importance due to reliable sources of protein, dietary fibers, minerals, carbohydrates, essential amino acids, and vitamins. They are grown as grain and forage for human consumption and animal feed. Plants have developed different adaptive strategies for the uptake of an adequate amount of important micro and macronutrients. Metal transporters play a crucial role in homeostasis by managing the metal outflow through cellular compartments, and membranes. Zinc-regulated, iron-regulated transporter-like proteins (*ZIP*) are essential for the uptake, transportation, and storage of micronutrients in plants. Under stress conditions, plants are unable to uptake or store these nutrients in their edible parts. It causes malnutrition in the population. So, there is a need to reduce these deficiencies by understanding their function for the enhancement of their concentration in seeds and other edible parts of plants. In our study, we identified 23 *ZIP* encoding genes in soybean, 19 in common bean, 17 in cowpea, 12 in azuki bean, 11 in mung bean, and 31 in peanut which are important targets for the biofortification of warm-season food legumes. The evolutionary phylogenetic analysis classified the 143 *ZIP* genes into four groups. The gene structure analysis revealed that the *ZIP* gene family consists of 1-11 introns in selected crops. Motif analysis proposed the presence of functional diversity among groups. The evolutionary divergence process encouraged strong purifying selection. Three-dimensional protein structures support the similarity with ZIP transporter protein. This study is supportive of the understanding of the evolution of the *ZIP* gene family and their potential roles in warm-season food legumes for biofortification and future crop improvement programs.

Keywords: food legumes, ZIP transporter protein, homeostasis , *ZIP* gene family

SPP-RA-503

Morphology based genetic diversity in wheat (*Triticum aestivum L.*) germplasm for drought stress tolerance grown under sub-tropical climate of Pakistan

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ABSTRACT

Genetic diversity is a basic requisite of plant breeding and is very important for development of climate smart cultivars. Wheat is an important staple food of the world and first staple food of Pakistan and keep first place for insurance of food security. But climate change is threatening its production especially is tropical and sub-tropical semi-arid areas due to the threat of drought. To address this challenge a field experiment was conducted in 2018-19 to assess the genetic diversity of wheat genotypes under semi-arid subtropical conditions for yield and related traits. A total of 50 genotypes were used in the experiment with two irrigation levels i.e. normal recommended irrigation and water stress applied by skipping the last irrigation of 75 mm. Data were collected for plant height, number of tiller per plants, spike length, number of spikelets per spike, 1000 grain weight and grain yield per plant. Results revealed highly significant ($p<0.05$) differences for all the traits, grown under normal and water stress conditions but diversity among the traits reduced under water stress conditions. Based on the morphological and yield data, the genotype Galxy proved best for normal irrigation (yield 35 g/plant) and the genotype AAS-11 proved best for drought tolerance (30 g per plant). Although some genotypes performed better than AAS-11 under water stress conditions, but the performance of AAS-11 was nearly consistent under two water regimes for yield other related traits. Presence of morphological based diversity among wheat genotypes describes the potential of these genotypes for breeding drought tolerant cultivar.

Key words: Drought; wheat breeding; morphological traits; Genetic diversity

SPP-RA-504

Optimizing Microclimates for Enhanced Plant Health and Growth

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ABSTRACT

BACKGROUND: Healthy micro-environment for plants refers to the conditions that directly influence their growth and productivity. It involves managing and optimizing influencing actors like soil, water, light, temperature, air circulation, humidity, and pest control to create the best possible environment for the plants and higher productivity.

METHODS: Soil preparation is crucial for creating a healthy growing environment for plants. It begins with soil testing to assess its pH, texture, and nutrient content, ensuring that it meets the specific needs of the plants. Based on these, soil amendments may be necessary to adjust pH levels by adding lime (to increase alkalinity), installing a drip irrigation system ensures that water is delivered directly to the roots, reducing water wastage and minimizing the risk of plant diseases. Applying a layer of organic mulches around plants helps retain moisture, regulate soil temperature, and decrease evaporation, to improve soil structure, aeration, and nutrients management.

CONCLUSION: By systematically implementing strategies like soil testing, drip irrigation, mulching, organic amendments, and integrated pest control, we can create conditions that closely mimic a plant's natural habitat. This not only enhances plant resilience and productivity but also supports sustainable and eco-friendly practices. The continuous evaluation and adjustment of these elements are crucial for maintaining a balanced ecosystem that promotes long-term plant health and growth.

Keywords: Microclimate, Natural habitat, Soil testing, Eco-friendly practices.

SPP-RA-505

# Integrating Modern Science and Traditional Knowledge for Sustainable Plant Resource Management

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ABSTRACT

The dynamic interaction of modern science with conventional ecological knowledge presents a viable path toward the sustainable management of plant resources. To promote actions that support the preservation and sustainable use of plant biodiversity, this study aims to investigate the benefits and difficulties associated with integrating these two knowledge systems. By doing this, we want to create a comprehensive framework that honors and combines indigenous societies' knowledge with the accuracy and insights provided by modern scientific approaches. The management of traditional forest knowledge systems and practices varies based on historical developments, environmental and ecological circumstances, and the social, economic, and cultural traits of the groups. In general, traditional knowledge and its practitioners have received minimal attention from policymakers, planners, scientists working in forestry and agriculture, extension agents, and natural resource managers (including defenders). A lot of work has gone into suppressing this knowledge and replacing it with more scientific methods, especially when it comes to shifting agriculture. The well-being of local and indigenous communities, as well as the sustainability of forests, related ecosystems, biodiversity, and the ability to produce environmental goods and services, have all suffered greatly from the erosion and loss of traditional knowledge and practices. Our vision is to ensure the resilience and vitality of plant ecosystems for future generations by incorporating diverse community knowledge and sustainable practices through mutual respect and collaboration.

Keywords: Approaches, Biodiversity, Collaboration, Cultural, Forestry, Policymakers, Societies


# THEME-6:

## Artificial Intelligence in Agriculture

## THEME-6: ARTIFICIAL INTELLIGENCE IN AGRICULTURE

SPP-AI-601

# Analysis of State-of-the-Art Object Detection Models for Multi-Pest Detection with Emphasis on Small Object Detection

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ABSTRACT

Global agriculture is greatly affected by pest infestations, which cause substantial crop loss and economic impact. The accuracy and efficiency of pest detection is crucial for effective pest management strategies, especially when it comes to small pest species. Traditional manual monitoring methods are labour-intensive and prone to delays in providing critical information, leading to increased crop damage and economic losses. By leveraging Artificial Intelligence (AI) in pest detection, we can significantly enhance the precision of identifying small pest species. As part of the present study, we compare the state-of-the-art object detection models for identifying and classifying five economically significant small pests: Fruit flies (*Bactrocera Cucurbitae*, *Bactrocera zonata*, *Bactrocera dorsalis)*, Pink Bollworm (*Pectinophora gossypiella*), and Fall Armyworm (*Spodoptera frugiperda)*. IoT-based traps were used to collect images of pests, totaling 17290 images, from mango orchards, cotton, and maize fields. By using Roboflow, these images were annotated and serve as the basis for model evaluation. Moreover, a benchmark dataset was set for the detection of small pests, which appear as tiny entities within the images, to highlight the challenges associated with small object detection. YOLOv7, YOLOv8, and Faster RCNN were subjected to rigorous testing to determine their effectiveness in detecting the selected small pests. A variety of performance metrics were used to evaluate the model's detection capabilities, including precision, recall, F1-score, and confusion matrix. The practicality of each algorithm for real-world pest management applications was also evaluated by analyzing its processing speed and resource utilization. This comparative analysis aims to provide insights into the strengths and weaknesses of the latest object detection algorithms, thereby guiding future research and applications in the field of pest detection.

Keywords: YOLO, Single Stage Detector, Faster R-CNN, Fruit flies, Pink Bollworm, Fall Armyworm

SPP-AI-602

# AI in Integrated Pest Management: A Sustainable Approach to Crop Protection

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ABSTRACT

Artificial Intelligence (AI) is rapidly transforming the landscape of agriculture, offering innovative solutions for enhancing the sustainability and efficiency of crop protection. One of the most promising applications of AI lies in Integrated Pest Management (IPM), an environmentally safe approach that combines biological, cultural, physical, and chemical control methods to manage pest populations. Traditionally, IPM has relied on expert knowledge and manual data collection to monitor pest populations, assess crop health, and apply treatments at the right time. These methods are labor-intensive and often lack the precision needed for real-time decision-making. The integration of AI into IPM presents a paradigm shift, enabling more accurate pest monitoring, predictive analytics, and decision support systems that can optimize pest control strategies while minimizing environmental impacts. AI-driven technologies such as machine learning and computer vision sensors are revolutionizing how pest management data is collected, analyzed, and applied. Machine learning algorithms, trained on vast datasets of environmental conditions, pest behavior, and crop health, can predict pest outbreaks with greater accuracy. These predictive models allow farmers to take precautionary measures, reducing the need for broad-spectrum pesticide use and thereby lowering the risk of developing pesticide resistance. AI-powered systems can automate pest monitoring through the use of smart traps and drones equipped with cameras and sensors. Computer vision, a subset of AI, plays a critical role in enhancing the accuracy and speed of pest identification. AI can be integrated with Geographic Information Systems (GIS) to provide spatial analysis of pest populations, helping farmers identify hotspots and allocate resources more efficiently. The integration of AI into Integrated Pest Management represents a sustainable approach to crop protection that balances the need for effective pest control with the preservation of environmental health. By using AI's predictive power, real-time monitoring capabilities, and decision support systems, farmers can implement more targeted, efficient, and environmentally friendly pest management strategies. This technological advancement holds the potential to revolutionize modern agriculture, fostering resilience in farming systems while reducing the ecological footprint of pest control practices.

Keywords: Artificial Intelligence, Integrated Pest Management, Decision-making, Machine learning.

SPP-AI-603

Comparative Study of Transfer Learning Models for Smart Plant Disease Detection

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ABSTRACT

BACKGROUND: Plant diseases pose a significant threat to the agricultural sector, causing substantial economic losses for farmers. The implementation of smart plant disease detection systems represents a crucial advancement for traditional agricultural practices. Timely and accurate detection of plant diseases is imperative to initiate early treatment measures and prevent the major disease outbreak in crops. The traditional manual methods of plant disease detection are inherently complex, time-consuming, and labor-intensive, making them inefficient for large-scale cultivation. These challenges highlight the urgent need for automated solutions in agriculture. Smart plant disease detection systems, leveraging technologies, such as artificial intelligence and deep learning, offer the potential to revolutionize disease monitoring.

METHODS: We employed six transfer learning models, Mobile Net, Inception ModelV3, VGG16, VGG19, ResNet50, and DenseNet121. The models were trained and tested on a dataset comprising over 20,000 images of Bell pepper, Potato, and Tomato plants. This dataset contains 15 classes, 3 of them are healthy classes for each plant. Moreover, this dataset contains images of 12 type of disease affected plants, Bell Pepper Bacterial spot, Potato Early blight, Potato Late blight, Tomato Target Spot, Tomato mosaic virus, Tomato Yellow Leaf Curl Virus, Tomato Bacterial spot, Tomato Early blight, Tomato Late blight, Tomato Leaf Mold, Tomato Septoria leaf spot, Tomato Spider mites Two spotted spider mite. Each model's performance was rigorously evaluated to understand its effectiveness in plant disease detection.

RESULTS: Through extensive experimentation, our study achieved notable accuracy rates: 93% for MobileNet, 92% for Inception ModelV3, 90% for VGG16 Model, 91% for VGG19 Model, 95.6% for ResNet50, and 92% for DenseNet121. These results provide insights into the comparative strengths and weaknesses of different transfer learning models in the context of plant disease detection.

CONCLUSION: The utilization of transfer learning models, particularly MobileNet, Inception ModelV3, VGG16, VGG19, ResNet50, and DenseNet121, showcased their efficacy in handling the complexities of plant disease detection. This research contributes valuable information for selecting an appropriate transfer learning model for automated plant disease detection. The outcomes hold promise for developing early intervention strategies, enabling farmers to address plant diseases promptly and minimize economic losses in the agricultural sector.

Keywords: Transfer Learning, Plant Disease Detection, Smart Agriculture, Deep Learning, Artificial Intelligence.

SPP-AI-604

Advanced Mobile Application to figure out and manage crop problem in Pakistan

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ABSTRACT

BACKGROUND: Asian nations belong to the top producers of crops with an optimal climate change and abundant soil. However, conventional farming techniques remain in use and insufficient attempts have been conducted to fully capitalize on technology.

METHODS: Crop diseases are one of the major issues confronting Pakistan's and other developing nations' agricultural sectors: they are not promptly and effectively recognized. Low production results from the adoption of conventional methods for agricultural disease diagnostics, which are less precise and expensive. This research suggests a smart technique for crop disease diagnosis that may function on Android mobile devices for farmers that suggest to them what the disease was and how to manage them.

RESULTS: The technology is competent enough to help Pakistani farmers to identify agricultural conditions and interact with them in their native Urdu. Government agricultural professionals might benefit equally from it in terms of identifying and mitigating crop illnesses. Using its inference engine, it uses the symptoms of the crops as input and provides ambiguous input, producing an output in the form of a disease diagnosis.

CONCLUSION: The suggested approach can identify the three primary crops in cotton, rice and wheat and can also provide support for them. Measured on an array of Real authentic agricultural problems the suggested system's may help farmers with their crop illness and manage them with right solution.

Keywords: disease management, mobile application, crop illness, agriculture problem

SPP-AI-605

Detection of Rotten Fruits using Artificial Intelligence

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ABSTRACT

BACKGROUND: Efficient detection of rotten fruits is crucial in agriculture, fruit processing, and packaging industries. A significant challenge in agricultural practices lies in accurately detecting defective fruits and distinguishing between fresh and rotten ones. Incorrect classification not only affects productivity but also poses a risk of spoilage to other fresh fruits. Traditionally, this classification task relies on manual labor, which is both time-consuming and inefficient. Additionally, the reliance on manual methods often leads to increased manufacturing costs in the agricultural sector.

METHODS: This study investigates the performance of three pre-trained models for the detection of fresh and rotten fruits. A publicly available dataset containing 3200 images is used which includes sixteen classes of eight fruits (apple, banana, grapes, guava, jujube, orange, pomegranate, and strawberry). Each fruit is systematically categorized as either fresh or rotten, with 200 samples in each class. A comprehensive comparison is conducted among three widely employed pre-trained models—DenseNet, InceptionV3, and VGG16—aiming to develop an efficient classification model for the identification of fresh and rotten fruits. The models are trained for 30 epochs and evaluated on accuracy, precision, recall and F1 score.

RESULTS: Results from comprehensive experiments demonstrate that DenseNet outperforms other models in the detection of fresh or rotten fruit, achieving an accuracy of 84.16%, precision of 88%, recall of 84%, and an F1 score of 83%. In contrast, VGG16 and InceptionV3 exhibit lower performance levels in terms of accuracies that are 71% and 79%, respectively. Notably, VGG16 exhibits average performance in additional evaluation metrics, with precision, recall, and F1 score of 76%, 71%, and 71%, respectively. However, InceptionV3 showcases the worst performance across these supplementary metrics, achieving 16% precision, 8% recall, and 4% F1 score. These results further emphasize the superior performance of DenseNet in the detection of fresh and rotten fruit, highlighting its potential for practical deployment in agricultural and food industry applications.

CONCLUSION: This study presents an automated classification model aimed at differentiating between fresh and rotten fruits, with the primary goal of reducing human intervention, enhancing productivity, and cutting production costs and time. The findings from extensive experiments highlight DenseNet as the most effective model for fresh or rotten fruit detection, surpassing VGG16 and InceptionV3 in terms of accuracy, precision, recall, and F1 score. Consequently, the incorporation of AI-driven automation signifies a notable advancement in fruit classification within the agricultural and food industries.

Keywords: Artificial Intelligence, Pre-trained models, Fruit Segmentation

SPP-AI-606

Sunflower Genotypic Analysis through Flower Count & Distribution with Deep Learning On UAV Multispectral Imagery

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ABSTRACT

BACKGROUND: Being rich in nutrients and providing essential proteins, sunflower seed is a major source of vegetable oil, widely used for cooking and in food processing. Its cultivation holds a unique significance in agriculture, contributing to the edible oil industry and oilseed research programs. Assessment of sunflower genotypes plays a crucial role in optimizing seed yield with high oil content and desired phenotypic characteristics. In this study, we focus on leveraging multispectral UAV imagery and multiple vegetation indices, particularly the Normalized Difference Yellowness Index (NDYI), to estimate flower count as well as their spatial distribution for ranking and classifying different sunflower varieties.

METHODS: Employing a deep learning (DL) approach, a segmentation model is developed for flower detection. The efficacy of different vegetation indices as well as individual multispectral bands for flower identification is assessed. 3 distinct approaches — semantic segmentation, object detection, and chip classification — are employed to assess their flower distinction capabilities within remotely sensed imagery.

RESULTS: The findings reveal that NDYI enhances the accuracy of flower identification, exhibiting an average F1 score of 0.81, outperforming other vegetation indices. Comparing the three DL approaches, semantic segmentation demonstrates notable advantages in delineating flower coverage area. Similarly, object detection proves more advantageous for estimating flower count. Furthermore, flower detection per plot allows us to rank different genotypes in the field, providing critical observations into their distribution. Mean flower density of 3.2 flowers per square meter is observed. The spatial distribution analysis reveals a notable variability in flower density among different genotypes. Moreover, a high correlation between flower count and seed yield per plot is sensed that can estimate the actual seed yield with an average Root Mean Squared Error (RMSE) of 0.57.

CONCLUSION: The results highlight the effectiveness of leveraging NDYI and DL techniques for accurate flower identification in the sunflower crop, offering a robust foundation for genotype ranking and assessment. This approach also facilitates predicting seed yield per plot based on the estimated flower count. The application provides a comprehensive understanding of the spatial distribution of flowers, with quantitative insights into segmentation model performance and genotype-specific flower densities.

Keywords: Sunflower, Multispectral UAV imagery, Normalized Difference

SPP-AI-607

Advancing Plant Disease Diagnosis: Deep Learning for Plant Pathology Assessment

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BACKGROUND: Leveraging cutting-edge technologies such as IoT, artificial intelligence, and data analytics can be a step towards revolutionizing plantation management and fostering a more sustainable, efficient, and environmentally conscious agricultural landscape. Through real-time monitoring, predictive analytics, and autonomous decision-making, smart plantation initiatives strive to optimize resource utilization, minimize environmental impact, and maximize crop yields. Plant pathology is a crucial research area vital for sustainable agriculture. Understanding plant diseases and their causes is imperative for developing effective disease management strategies, improving crop yields, and reducing economic losses.

METHODS: The dataset utilized in the experiment consists of 3642 images that are classified in 4 classes namely scab, healthy, rusty, and multiple diseases. Scab refers to a plant disease caused by various fungi or bacteria that typically results in the formation of crusty or scaly lesions on the surface of leaves, fruits, or other plant parts. The second class named rusty refers to a type of fungal disease that affects various plants, characterized by the appearance of powdery or pustule-like spore masses on the surface of leaves or other plant parts. The rest of the classes “healthy” and “multiple disease” were comparatively broad classes. The images were obtained from a dataset available on Kaggle.

RESULTS: The experiment was carried out by employing transfer learning. Transfer learning is a machine learning technique where a model trained on one task is repurposed or fine-tuned for another related task, typically resulting in improved performance and efficiency due to the reuse of learned features and representations. Three pre-trained models underwent training for 25 epochs, using a 75:25 split for training and testing, respectively. The InceptionNet model outperformed the other two models, achieving an accuracy of 97.91% slightly better than ResNet that achieved the accuracy of 97.21%. Conversely, the VGG-16 model exhibited poor performance, achieving an accuracy of only 74.06%.

CONCLUSION: In summary, our study demonstrates the effectiveness of deep learning techniques in accurately diagnosing plant diseases, with the InceptionNet model outperforming others. This approach not only enhances disease management strategies but also holds significant potential for improving overall plant health and growth. Leveraging these technologies fosters a more sustainable, efficient, and environmentally conscious agricultural landscape, paving the way for increased productivity and food security in the face of evolving agricultural challenges.

Keywords: Plant pathology, deep learning, transfer learning.

SPP-AI-608

# Seeing Beyond the Green: Remote Sensing Paints a Clear Picture of Plant Health

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ABSTRACT
BACKGROUND: Remote sensing offers a valuable approach for analyzing spectral properties of objects from various platforms, spanning ground to satellite-based systems. Traditional manual inspection by experts proves to be time-consuming, expensive, and impractical for large farms, especially considering the significant global spread of plant diseases caused by human activities. Timely detection of affected areas is crucial, reducing reliance on traditional methods, and yielding substantial environmental and economic benefits by enabling targeted responses and minimizing excessive pesticide use.
METHODS: Various spectroscopy and imaging techniques, including visible, infrared, and fluorescence spectroscopy, thermography, hyperspectral, and multispectral imaging, have been explored for monitoring plant diseases and pests. Remote sensing, particularly through imaging sensors, has been identified as a preferable method over non-imaging systems for disease and pest monitoring. The integration of remote sensing technology shows promise in making agriculture safer, more sustainable, and less dependent on excessive pesticide usage for crop protection.
RESULTS: Remote sensing, as a game-changer in agriculture, detects the whispers of disease far before visible symptoms manifest. Its ability to identify subtle changes in vegetation's spectral reflectance weeks or months ahead of human detection provides a crucial head start. This early warning system empowers swift action, deploying targeted interventions to prevent yield losses and potential disasters. Satellites and drones function as vigilant sentinels, providing comprehensive data on plant health across expansive landscapes, leaving no room for undetected threats.
CONCLUSION: The integration of remote sensing into precision agriculture becomes a reality, representing a beacon of hope in the fight against plant diseases. Its ability to detect early, cover vast areas, monitor non-invasively, and empower precision agriculture positions it as a cornerstone of a sustainable future for agriculture, showcasing technology's responsible use for the benefit of the planet and its agricultural abundance.
Keywords: Plant disease management, Remote sensing, Precision agriculture, Early detection, Crop health

SPP-AI-609

# Detection of Plant Species Seedlings using Transfer Learning

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ABSTRACT

BACKGROUND: Seedlings play an important role in the early stages of plant development and require special care to ensure the healthy growth of mature plants and the continuity of plant species development. They are beneficial for early crop establishment, crop monitoring, and production, and higher crop yields, contributing to overall biodiversity and ecosystem productivity. Automatic detection of plant species at different seedling stages is challenging because of their different nature and characteristics such as color, size, shape, growth, etc.

METHODS: This research aims to use transfer learning to automatically identify plant species during the seedling stage of the plant life cycle. Four pre-trained models, namely ResNet50, AlexNet, Inception(v3), and VGG19 are used in this study to classify plant species. Publicly available Plant seedling Classification dataset is used to train and test the model. The dataset contains the images of 4750 plants in 12 plant species at different growth stages. Initially, the images dataset undergoes a preprocessing step where image processing and data augmentation methods are applied to improve the image quality and dimensionality of the input images. Subsequently, four pre-trained models are applied for the automatic seedling of plant species using transfer learning. The most used performance measures of accuracy, precision, recall, and F1 score are chosen in this study to evaluate the performance of pre-trained models.

RESULTS: AlexNet achieved the highest accuracy of 99.69%, precision of 98.79%, recall of 99.76%, and f1-score of 99.24%, specifically performed well on four plant types – sugar beet, small-flowered cranberry, common wheat, and maize. ResNet also performed well, achieving an accuracy like AlexNet, around 99.05%, with 98.73% precision, 99.42% recall, and 99.05% f1-score rates. While VGG19, and Inception v3 achieved accuracy rates of 97.54%, and 95.91%, respectively. These results revealed that substantial performance can be achieved through transfer learning for the identification of different plant species seedling.

CONCLUSION: Detection of plant species at the early seedling stage is effective for agricultural management, farmers' crop production, crop health, sustainable field environment, and conservation of biodiversity. This research compares different pre-trained models that help detect plant species from the analysis of seedling images of different growth stages using transfer learning. By analyzing the accuracy of different models, it was concluded that AlexNet and ResNet performed well with an accuracy of 99.69% and 99.09%.

Keywords: Plant Species, Plant Seedling, Transfer Learning

SPP-AI-610

# Artificial Intelligence Revolutionizes Plant Disease Diagnostics, Nurturing Sustainable Agriculture through Innovation and Precision

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ABSTRACT

BACKGROUND: Plant diseases have always been a source of anxiety and uncertainty in the field of agriculture, much like hidden assassins. The conventional methods of diagnosis, which resemble thorough detective work, are ineffective in combating the rapid proliferation of these quiet invaders, and they are unable to offer the prompt reaction required to safeguard valuable crops and worldwide food security.

METHODS: A groundbreaking force is on the rise in the rich fields of research: Artificial Intelligence (AI), a powerful ally ready to transform the battle against plant diseases. Its array of tools, extensive and diverse, offers unparalleled precision, speed, and accessibility in the quest for robust crops. AI's capacity to analyze enormous volumes of data and recognize patterns is a game-changer in the struggle against plant diseases. Through the utilization of machine learning and predictive modeling, AI can identify early indications of disease, propose targeted treatments, and even forecast outbreaks before they manifest. This degree of accuracy and foresight holds the potential to overhaul agriculture and ensure food security for the generations to come. With AI by our side, the fight against plant diseases has ushered in a new era of ingenuity and optimism.

RESULTS: Artificial Intelligence (AI) leverages Convolutional Neural Networks (CNNs) for image-based diagnosis, functioning akin to a persistent detective. Trained on a multitude of images of ailing plants, these networks empower farmers and non-experts to utilize mobile applications for high-level diagnoses, even in remote locales. Timely identification facilitates swift intervention and averts potential devastation. AI's scope extends beyond human vision, incorporating sensor-based monitoring through satellite sentinels and in-field sensors. These sensors detect subtle changes in plant health, furnishing real-time data for proactive management. This facilitates targeted measures to mitigate crop losses, optimize resource utilization, and safeguard future harvests.

CONCLUSION: AI's predictive analytics enhances foresight, blending weather data, crop growth models, and historical disease patterns into a comprehensive tool. Precision agriculture, the final piece of the AI puzzle, tailors management plans for individual fields and synchronizes strategies with real-time risk assessments. This personalized approach promotes sustainable agriculture, ensuring environmental harmony and unlocking the earth's full potential. Challenges persist, with data quality and quantity acting as formidable gatekeepers. Collaboration serves as the bridge between

Keywords: Artificial Intelligence, Plant Disease Diagnostics, Precision agriculture · Sustainable Agriculture · Innovation

SPP-AI-611

# AI-Driven Predictive Analytics for Enhanced Plant Health and Protection

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ABSTRACT

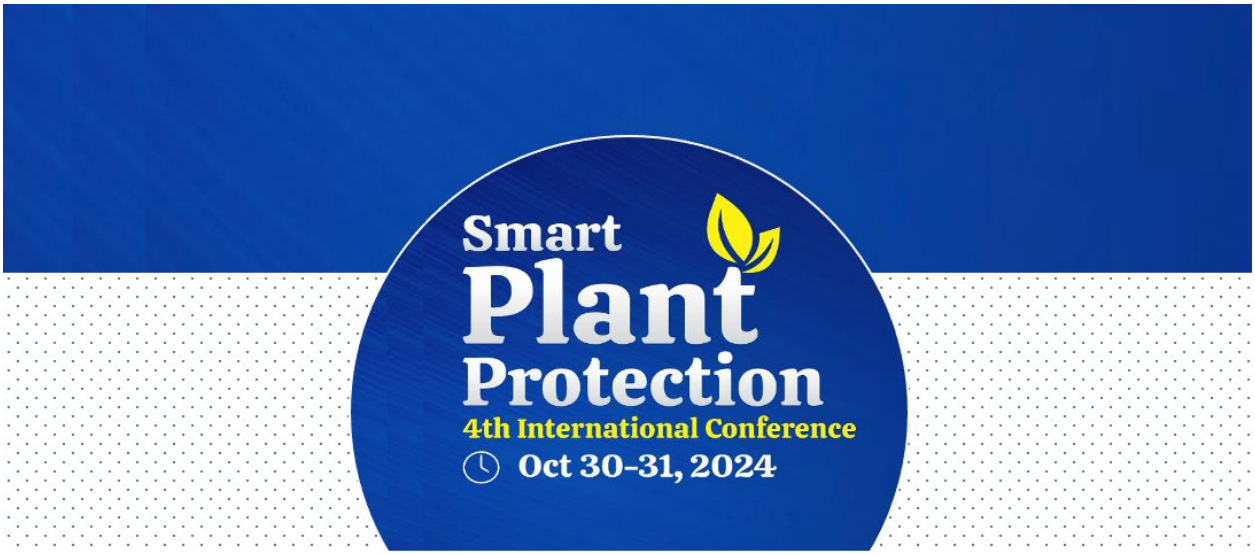
BACKGROUND: Due to increasing global challenges that are because of changes in climate that lead to unpredictability in pest attacks and diseases, use of conventional plant protection is inadequate. Present solutions cannot be flexible to accommodate changes in field environments leading to wastage of resources or limited utilization. The inclusion of the "smart" devices in the plant protection approaches means that when the data from the device indicate that there is a problem, then solution is formulated and administered in a manner that harnesses the yields while minimizing on the resources used.

METHODS: This research work presents the first novel method that involves the use of AI predictive analytics model integrated with IoT sensors in collecting data from multiple agricultural ecosystems. They include measurements of moisture, temperature, humidity, and infestations by pests such as the common bug. The collected information goes to an AI algorithm developed for threat identification and suggested prevention measures. Moreover, using satellite imagery and historical data, this model improves its estimates, providing clients with recommendations that are optimized for specific crops.

RESULTS: The initial field tests seemed to indicate that the model had between 85% – 90% accuracy of detecting pest and diseases before they emerged, allowing management up to 7 days before the conventional methods. Taking this precautionary measure would only helped in reducing pesticide utilization by 40%, and at the same time has maintained environmental conservation besides the crops' yield. The ability of the AI model to work on different types of crops, and in various climate conditions, stellt the model yet another factor that points towards the practical use of AI in the current agriculture.

CONCLUSIONS: Only when predictive analytics works together with IoT in the process of plant protection a new form of solution is offered that differs from the traditional approaches. This model not only helps make crops stronger and more resistant, but also encourages an early warning approach to crop care as well as more sustainable farming.

Keywords: Smart plant protection, predictive analytics, IoT, AI, pest management, sustainable agriculture




# MISCELLANEOUS ABSTRACTS

# MISCELLANEOUS ABSTRACTS

SPP-MISC-701

## Development of smart aquaculture farm management system

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ABSTRACT

The proposed system is intended primarily for solving the problems faced by the aquaculture farming sector by designing a smart IoT-based fish monitoring and control system equipped with different IoT devices to enable real-time data collection; so that fishpond water-quality conditions and other system parameters can be readily monitored, adjusted, and assessed remotely. To predict the growth of the fish, this study also develops a deep learning model (DL) that correlates the different parameters of the smart aquaculture system. Bayesian optimization-based hyper-parameter tuning was employed to find the optimal DL model configuration to produce accurate predictions on the given experimental data set. Based on the results of the experiments, the DL model can be incorporated into the autonomous feeding system, reducing the amount of leftover feed. Thus, aquaculture based on the artificial intelligence of things (AIOT) can assist fish farmers in intelligently controlling and managing different fishpond equipment remotely and assist aquaculture operators in performing professional aquaculture, lowering the industry's entry barrier, and promoting aquaculture.

Keywords: artificial intelligence, Bass, aquaculture, learning model, smart aquaculture

SPP-MISC-702

Comparative analysis of the quality of honey produced by different bee species of the genus Apis in Urban and rural areas of District Faisalabad, Punjab, Pakistan

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ABSTRACT

Honey is a natural sweet substance made by honeybees from either plant nectar or secretions of living plant components. This study aimed to examine the differences in the physical and chemical properties of honey produced by four species of honeybees: *Apis cerana*, *A. mellifera*, *A. florea*, and *A. dorsata*. Honey samples were collected from various rural and urban areas in the Faisalabad district of Punjab, Pakistan. These samples were tested for quality evaluation for various physicochemical properties such as pH, acidity, moisture content, HMF (Hydroxymethylfurfural), electrical conductivity, mineral and trace element content, total sugars, and specific sugars (sucrose, fructose, and glucose) using standard AOAC (Association of Official Agricultural Chemists) procedures. Our data reveals the different values for the physicochemical properties among the honey samples from the four bee species. For instance, the moisture content ranged from 18.67 to 22.32 g/100g honey, electrical conductivity ranged from 0.24 to 0.71 mS/cm, and pH ranged from 3.51 to 3.59. Similarly, acidity and HMF content varied among the species. Additionally, the concentrations of minerals and trace elements differed, with *A. cerana* generally showing higher values compared to the other species. Interestingly, the amount of sucrose was notably higher in *A. mellifera* compared to the other species. These preliminary findings suggest a correlation between the physicochemical characteristics of honey and the species of honeybees producing it. This preliminary research provides valuable insights that could benefit the honey industry in Pakistan by facilitating the export of high-quality honey. This, in turn, could contribute to poverty alleviation and serve as a source of income generation in the country.

Keywords: Apis species, Urban and rural areas, honey, Physicochemical parameters

SPP-MISC-703

Assessment of Artificially Prepared Diets on Brood Area of *Apis mellifera* L. in Field Conditions

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ABSTRACT

Research and various factors support the significance of providing an artificial diet to honeybee colonies to sustain their populations during times of scarcity. Across different countries worldwide, numerous initiatives undertaken to mitigate the loss of honeybee colonies during periods of scarcity by enhancing the nutritional conditions for these vital pollinators. An experimental study addressing this concern was conducted at the Apiculture research area situated within the Department of Entomology at The Islamia University of Bahawalpur (6300), Punjab, Pakistan. This study aimed to investigate and potentially improve the dietary provisions for honeybee colonies, recognizing their critical role in ecosystem health and agricultural productivity. Fifteen best honeybee colonies were selected out of twenty colonies. Four colonies were used as treatments and one was used as a control to compare the effects of an artificial diet on the social behavior of *Apis mellifera* during the time of scarcity. The experiment was replicated three times. The main components of our diet included soy flour, (key source of protein), Date (Basis of protein and carbohydrate), dry Apricot (source of starch vitamins A and C and minerals) sugar and vegetable oil used in different ratios. The diet was prepared with different ratios of ingredients and was placed in the Petri dishes (of size 100mm diameter and 20mm depth) and the Petri dishes were placed into the bee colony under the bottom board of bee frames. We observed the brood area of honeybee colonies using a frame with wire netting and scaling and the observed data were collected and analyzed. The brood area was observed more in T1 followed by T4, T3, T2 and T5. These results emphasize the value of providing artificial diets to honeybee colonies during the dearth period for the better performance of bees in the next honey flow session.

Keywords: *Apis mellifera*, artificial diets, Brood area, Dearth period, Honeybees, Beehive

# RECOMMENDATIONS OF THE CONFERENCE

- Encourage regional data-sharing platform for real-time pest and disease monitoring.
- Expand precision agriculture with drones and remote sensing for efficient pest management.
- Support policies that regulate harmful pesticides and encourage safe alternatives.
- Offer incentives to farmers for adopting eco-friendly, plant-based pesticides.
- Encourage the academia-industry consortia to promote biopesticide research and commercialization
- Implement AI-driven early pest warning systems based on climate and pest patterns.
- Set standards for green pesticides to ensure safety and effectiveness.
- Promote interdisciplinary research for adaptive pest management solutions.
- Development of Industry-Farmer-Academia Consortium
- Increase in share of biopesticide up to 20%
- Provision of import permits for biopesticide
- Joint programs for training farmers in practicing innovative agricultural approaches
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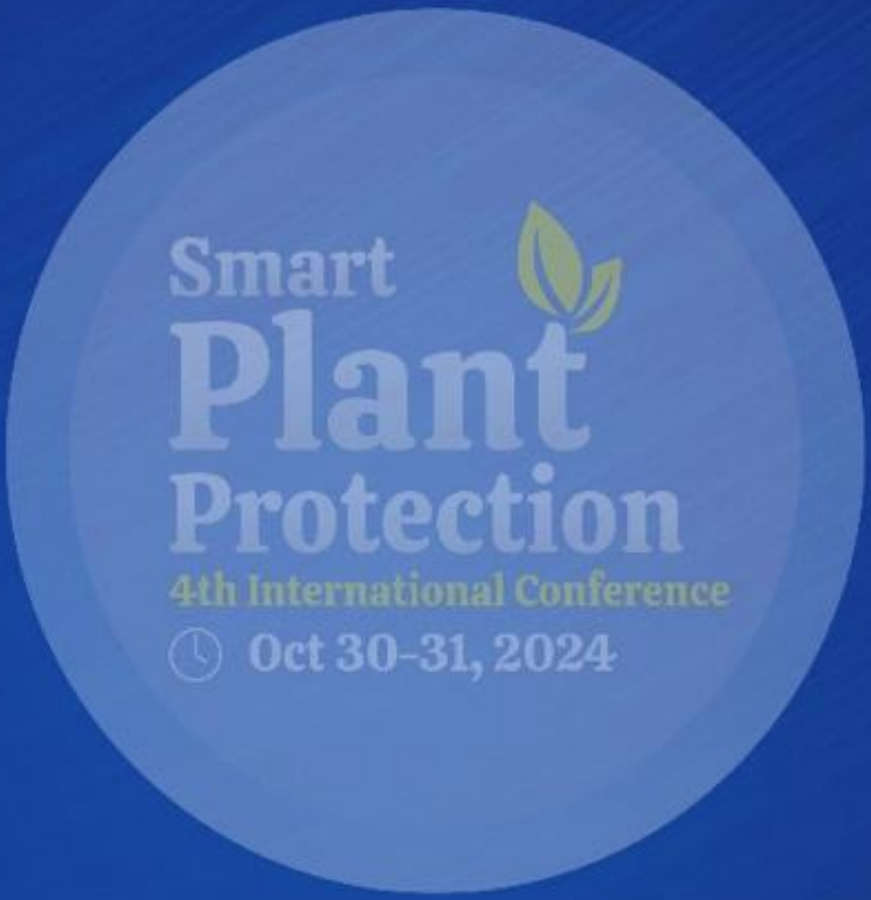
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