International Conference

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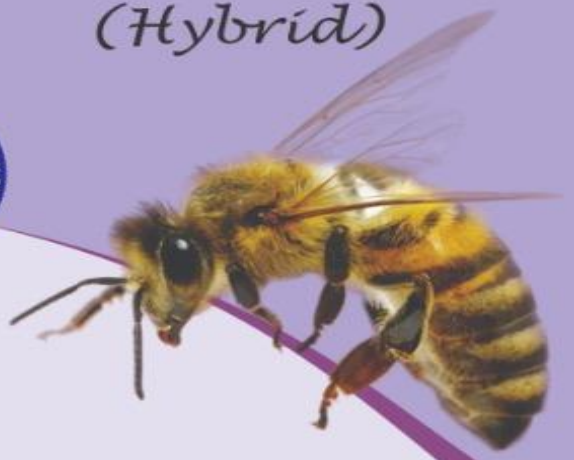

Bee Pollination & Conservation

Theme:

Bee engaged - Build back better for bees

May 20, 2022

Institute of Plant Protection

MNS University of Agriculture, Multan

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Theme − Bee Keeping

IC-BKG-101

Incidence of Nosemosis on honeybee (*Apis mellifera*) in relation to environmental factors in different areas of Pakistan

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ABSTRACT

Introduction: Honeybees play an important role in the pollination of different valuable crops. Honeybee colonies are reducing in many parts of the world. Beekeepers are facing tremendous challenges in maintaining healthy colonies which are capable of agricultural pollination. Several parasites and pathogens have drastic effects on bee colonies. Nosemosis is a disease produced by a microsporidian now considered a fungus that causes adult honeybee disorder. It infects the honeybee population and ultimately reduces the honey production.

Methodology: Samples of honeybee were collected from 25 different apiaries located in the areas of the Potohar region (Attock, Jhelum, Rawalpindi, and Chakwal) and Khyber Pakhtunkhwa (Mardan, Peshawar, and Malakand). Then we examine the midgut of the honeybee under a light microscope.

Results: High nosema infection rates were detected in Malakand (66.6%), Peshawar (58.3%), Nowshera (58.3%), and Mardan (58.3%) due to high humidity in those areas during 2020-21. Higher percentage of nosema infestation was found in apiaries of Jhelum (20.8%), Islamabad (18.6%), Chakwal (18.3%), Rawalpindi (8.3%) and Attock (8.3%). Seasonal infection of Nosema was high in Autumn because of high humidity, Nosema infection in winter and spring seasons is medium while low infection rate was reported in the summer season.

Conclusion: The reasons may be high temperature and low humidity, which are regarded as unfavourable for Nosema growth. The present studies indicate the first documented report of Nosemosis in Pakistan.

Keywords: *Apis mellifera*, *Nosema* spp., Apiaries, Colonies, Humidity

IC-BKG-102

Effect of artificial pollen substitute diets on diets consumption, brood area and colonies strength of *Apis mellifera* colonies during dearth period

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ABSTRACT

Introduction: Honeybees play a good role in the production of valuable products and pollination of different plants. Pollen diets are one of the most important ingredients for honeybees to develop and build up colonies. Many honeybees colonies are lost due to nutritional stress.

Methodology: We check the effect of four different pollen diets (D1, D2, D3, and D4 50g each D5 is the control colony) on brood and colonies strength in honeybees *Apis mellifera*.

Results: Results indicated that mean consumption of diets was D1, D2, D3, and D4 (38.47g, 49.53 g, 33.60 g, and 46.0 g) and brood area was (1357.0 cm^2,1567.3 cm^2, 1251.8 cm^2,and 1456.3 cm^2) respectfully, and good effect on population increasing in selected colonies about 50%, 60%, 46%, and 50%. And control colony D5 remained the same brood area and frame population before and after treatment.
Conclusion: Pollen substitute diets can be effective in stimulating honeybee colonies to rear brood. All tested diets were not equally effective in brood rearing. Our results showed that the artificial pollen diets had significant effect on honeybees health and increased colonies strength.
Keywords: Pollen diets, honeybee, brood area, colonies, population

IC-BKG-103

Fluvalinate injection: an effective management tool for controlling the ecto-parasitic mites of the honeybee, *Apis mellifera*

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ABSTRACT
Introduction: Honeybees play important role in the production of honey and other valuable products as well as in pollination of plants. In Pakistan, there are four different species of honeybees, i.e., *Apis dorsata*, *A. cerana*, *A. florea*, and *A. mellifera*. The most common species used in Pakistan is *A. mellifera*. Each year, many of the honeybee colonies are affected by ecto-parasitic mites, i.e., *Varroa destructor* and *Tropilaelaps clareae*. In this study, we identified the control of these two ecto-parasitic mites.
Methodology: The experiment was conducted on 10 honeybee colonies of *A. mellifera* located at Honeybees Research Institute, National Agricultural Research Centre Islamabad (HBRI, NARC) in July and August 2019. It was observed that six of the honeybee colonies crossed the economic threshold level, which was 10 mites per colony. To control these two ectoparasitic mites, we used fluvalinate injection mixed with 1.5 litres of water and sprayed on the covered brood of each frame of colonies. We used 10ml/hive formic acid at a 60% concentration for the knockdown.
Results: The result showed that the efficacy percentages of *V. destructor* and *T. clareae* were 91% and 95%, respectively. It can thus be concluded that fluvalinate injection is an effective agent for controlling the ectoparasitic mites of *A. mellifera*.
Conclusion: From the results, it can be concluded that fluvalinate injection is an effective and promising agent in controlling ecto-parasitic mites, which can be incorporated into an integrated mite management model for honeybees.
Keywords: Honeybees, colonies, *Varroa destructor*, *Tropilaelaps clareae*, Fluvalinate injection.

IC-BKP-104

Effect of larval age on acceptance of grafted larvae and morpho-metric characteristics in *Apis mellifera* queens

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ABSTRACT

Introduction: The research was conducted at honeybee Research Institute, NARC, Islamabad during queen breeding season 2020 and 2021. In this experiment, one breeding colony that included queen reared from grafting Apis mellifera Linguistica queen, the exotic honeybee in Pakistan. Nine cell starter hives were used. As primer substrate fresh royal jelly was used during larvae transfer. A cell digital calliper with 0.01 mm sensitivity was used to measure the length and width of wings, thorax, head, and total body length. Shimadzu TW423L sensitive scale was used to measure the body weight of the queens.
Methodology: About 270 young larvae of worker bees (90 larvae per distinct age) were taken and grafted into nine grafting frames (30 larvae each). 10 larvae of each age (treatment) in each grafting frame and nine replications were observed. Overall nine cell builder colonies were prepared 2 hrs prior to grafting process. On 3rd day of grafting of each age larvae were observed for acceptance and data recorded. On 8th, 9th and 10th days of grafting matured queen cells were removed from grafting bar/frame and shifted individually in queen nursery cages along with 2-3 nurse bees having 10 gram candy (1:4 Ratio Honey: Sugar powder). On the 12th day, all adult (emerged) queens were caged individually and shifted to Queen rearing laboratory to evaluate morphometric characteristics.
Results: The best acceptance rate was calculated in three-day-old larvae group as 85.15%. There were found a statistically significant effect of the number of grafted larvae on body length and head width of queen. However, there were any effects on weight, head length, thorax width, thorax length, wing width, wing length, and acceptance rate of larvae. Age of grafted larvae did not have a statistically significant effect on head width, head length, wing width and acceptance rate of larvae. On the other hand, age of grafted larvae had a statistically significant effect on queen weight, body length, thorax width and length, and wing length of queen. If bee breeders wish to improve their stock, they should graft one-day-old larvae for rearing better queen bees. The results showed that age of the grafted larvae had a significant effect on larval acceptance during the queen raising periods in 2020 and 2021. (α=0.05, P ≤ 0.00). The data recorded on the acceptance of the larvae revealed that the mean larval acceptance rate was statistically highest (24.3±1.2 and 24.3±0.88) when 24 hours aged larvae were grafted during 2020 and 2021, respectively, followed by 48 hours larvae grafted group where mean larval acceptance was 10.3±0.8 and 12±0.57 during the 2020 and 2021 respectively. Significantly (α=0.05, P ≤ 0.00) least larval acceptance rate (2±0.57±2.3±0.88) was recorded in third group of 72 hours aged larval grafted group (control).
Conclusion: Physical characteristics have a significant correlation with the fertility and reproductive success of queen bees. For this reason, in this research, the effects of the age of grafted larvae on the morphometric characteristics of queen bee were investigated.
Keywords: Age, larvae, Grafting, acceptance, *Apis mellifera* L.

IC-BKP-105

Parasitic mites associated with indigenous bumblebee of district Poonch, Azad Jammu and Kashmir

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ABSTRACT
Introduction: Insect pollinators contribute 85 percent to crop pollination where bumblebees are considered the most important pollinators in both wild and managed cropping systems due to their Buzz Pollination Phenomena. They have ability to pollinate in all adverse climatic conditions. The bumblebee population is declining day by day due to many biotic and abiotic constrains, among biotic parasitism is the most important factor.

Methodology: Present study was designed to explore the parasitism rate in *Bombus haemorrhoidalis* of district Poonch, Azad Jammu and Kashmir. Alive bumblebee specimens were collected from different locations of study area for parasitism studies.
Results: Maximum parasitism rate was recorded in queens (33.75 %) followed by workers (16.25 %) and males (8.75 %). At high altitude like Tolipeer the parasitism rate was minimum (10.43 %) and at low altitude at Hajira that was maximum (28.45 %). All bumblebee castes showed different parasitism ratios on their different body parts. Queens showed maximum (47.5 %), percentage on legs workers showed on thorax (31.25 %) and males also on thorax (13.33 %).
Conclusion: This study will be helpful in future conservation program for this important pollinator for this region and also contribute to parasitism studies of different bumblebee species of the world.
Keywords: Bumblebee, *Bombus haemorrhoidalis*, Parasitic Mmites, Buzz pollinator, Parasitism.

IC-BKP-106

Gut potential of Asian honey bee (*Apis cerana* Indica), Lahore using culture dependent method

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ABSTRACTS

Introduction: The bacteria residing in the gut of honey bees (HB) has demonstrated a significant role in protecting bees against various pathogens, production of honey and wax. However, no information exists about the antibacterial potential of bacterial isolates from gut of Asian HB, *Apis cerana* Indica F. (Hymenoptera: Apidae), against human pathogens. This study investigates the antibacterial and multienzyme potential of aerobic bacteria from A. cerana gut using a culture-dependent approach.
Methodology: A total of 12 HB gut bacteria were characterized morphologically and biochemically. These strains were further screened for their antimicrobial activity against pathogenic human microorganisms *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Bacillus licheniformis* and *Bacillus subtilis* using cross streak (primary screening) and agar well diffusion methods (secondary screening). Preliminary characterization of cell-free supernatant (CFS) of two promising isolates was performed by measuring lactic acid concentrations, enzymatic digestion of antimicrobial compounds, stability over a range of temperature, pH and amplification of spaS (subtilin) and spoA (subtilosin) genes.
Results: In primary screening, among 12 HB isolates, eight strains showed statistically significant highest zones of inhibition ($p \leq 0.05$) against *E. coli*, *K. pneumoniae* and *P. aeruginosa*. 16S rRNA sequencing revealed that these isolates belong to Bacillus genus, identified as *B. tequilensis*, *B. pumilus*, *B. xiamenensis*, *B. subtilis*, *B. amyloliquefaciens*, *B. safensis*, *B. licheniformis*, *B. altitudinis* (Accession numbers: MT186230-MT186237). The secondary screening revealed that among eight isolates, *B. subtilis* and *B. amyloliquefaciens* showed statistically significantly strong inhibition ($p \leq 0.05$) against all tested pathogens. Antibiotic susceptibility testing revealed that both isolates were resistant to antibiotics and possesses proteolytic, lipolytic and cellulolytic activities. The nature of the compound causing inhibitory activity was found to be proteinaceous and showed stability over a wide range of temperature as well as pH. PCR study confirmed the presence of bacteriocins by successful amplification of important antimicrobial peptide biosynthesis genes spaS and spoA.

Conclusion: These results suggest that the HB gut is a home to bacteria that possess antimicrobial activity and important enzymes with antimicrobial potential. To our knowledge, this is the first report demonstrating the antimicrobial potential of bacteria isolated from gut of HB (*A. cerana*) against human pathogens.
Keywords: honey bees; gut microbes; antimicrobial activity; *B. amyloliquefaciens; B. subtilis; A. cerana*

IC-BKP-107

A Comparison of product obtained from *Apis mellifera* and *Apis cerana*

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ABSTRACT
Introduction: Beekeeping or apiculture is a process of maintenance of colonies of honeybee. The bee keeping process acts as a pollination source for nearby cultivated crops and provides honey as well. In world honey production is 1.77 million tonnes in 2020 and in Pakistan honey production is about 15,750 metric tonnes. Small honeybee (*Apis cerana*) and large honeybee (*Apis mellifera*) are two basic types of honeybee. *Apis cerana* (small honeybee) is mostly found in Southern Asia, while *Apis mellifera* (large honeybee) are mostly found in the United States.

Methodology: The data for current review is obtained from research and review articles.
Results: *Apis mellifera* and *A. cerana* are similar biologically, both make their coms in a dark place in parallel positions. The performance of these honeybee species may differ in different geographical areas and various agro-ecosystems. Mostly *A. cerana* is reared in hilly areas whereas *A. mellifera*in plains. According to quality analysis moisture content (17.38%) of honey produced by *A. cerana* is higher than moisture content of honey produced by *Apis mellifera*. Honey of *A. cerana* has sucrose (3.33%) and H2O2 (201.92mg/kg) higher than honey of *Apis mellifera*. However, acidity (36.32mg/kg) and Phenolic content (82.40mg/100g) are higher in *Apis mellifera* honey than *A. cerana*. According to a study, taking 1.14g/kg of *Apis cerana* honey for 6 weeks once a day in breakfast is more effective in lowering the concentration of blood lactate and increasing agility of t-test (Agility T-Test is a test commonly used to assess athletes/individuals' ability to move forwards, backward, and side to side) performance in futsal athletes compared to 1.14g/kg of *A. mellifera* honey.
Conclusion: By product of honey bee are important, and production of honey bee should be promoted.
Keywords: *Apis cerana*, *Apis mellifera*, Blood lactate, sucrose, phenolic content.

IC-BKP-108

Detection of Adulteration in Honey based on Electronic Nose System

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ABSTRACT
Introduction: Pure honey is an excellent source of nutrition to boost immunity and relieves congestion. Unscrupulous vendors are adding different substances to food products to increase their profit and this practice is common in developing countries. Honey is usually adulterated

with high fructose syrup, corn syrup, sucrose syrup, glucose syrup, and inverted syrup. This article reviews the adulteration detection in honey using an electronic nose system.
Methodology: The electronic nose system consists of different gas sensors that collect odor and store data. The data is then fed to a machine-learning algorithm to train a model that is proven beneficial for detecting adulteration in honey. Machine learning models that were commonly employed in the detection of adulteration in honey are Support Vector Machine, K nearest neighbour, Random Forest and Artificial Neural Network.
Results: Studies have shown an accuracy of 88.7%, 98% using the Latent Dirichlet Allocation (LDA) and Principal component analysis (PCA) method.
Conclusion: Electronic nose is a powerful and rapid technique that can detect odors without any specific sample preparation and is quite impressive in results when compared with high-pressure liquid chromatography, gas chromatography, spectrophotometer and enzyme-linked immunoassay.
Keywords: Honey, Adulteration, Artificial Intelligence

IC-BKP-109

Willingness to adopt beekeeping as a full-time business in Khyber Pakhtunkhwa, Pakistan

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ABSTRACT
Introduction: Midway through the 19th century, beekeeping was transformed from a cottage business to a commercial one because of breakthroughs in apicultural research and new technology, but the beekeeping industry in Pakistan is still in a developing phase and young farmers' involvement in this sector is necessary. This study is intended to analyze the adoption behavior of young farmers for honeybee farming.
Methodology: Data collection was done from 150 farmers in Khyber Pakhtunkhwa (District Dera Ismail Khan) by a random sampling technique. A semi-log regression model was used for analyzing the data in SPSS.
Results: Results of this study revealed that farmers' education, farming experience, contact with agriculture officers, and the price of honey have a significant positive effect on willingness to adopt honeybee rearing. While the age of a farmer has a significant negative impact on their willingness to adopt beekeeping. Farm size has a positive but non-significant relationship with the willingness to adopt apiculture.
Conclusion: Policymakers should focus on educated, young and experienced farmers to promote the beekeeping business in Pakistan.
Keywords: Beekeeping, young farmers, business, Pakistan

Theme − Bee Biodiversity

IC-BBD-201

The iDigBees Network: Towards a Global Knowledge of Native Bee Biogeography.

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ABSTRACT

Introduction: Bees are the most important pollinators in both managed and natural landscapes, and concerns about declines in bee diversity and numbers are growing. Only a small fraction of the ~20,000 known bee species in the world have adequate data to assess the status of species and communities. The iDigBees program addresses this dilemma by increasing depth and breadth of bee biodiversity data for use in a wide spectrum of ecological-evolutionary research. iDigBees incorporates innovations through emerging digitization processes, molecular identification network, phenology and phylogeny plugins, and R-based workflows to promote biodiversity research. Our broader impact goal is to promote biodiversity knowledge of native bee globally.

Methodology: There are four activities, the first, analyzing existing data can also easily include participation from people across the globe from many countries. It will be important to have a critical mass of researchers and institutions from each country. It is desirable for each country to have three areas of expertise covered, taxonomy, ecology, and informatics either

interdisciplinary (one person has more than one area of expertise) or multidisciplinary (one person is primarily an expert in one domain field). The four activities are as follows: 1) Publish existing data to understand the current biogeography of bee assemblages for an area and identify gaps. Every country should plan for strategically inventory a bee fauna in the future. 2) Increase the digitization rate of existing specimens through sharing best practices, providing online database resources, and securing funds for digitization; 3) Initiate new strategic inventories to fill in geographic and taxonomic gaps and integrate emerging technologies (Minion, automated camera traps). This would include trying to direct opportunistic collectors and iNaturalists to taxa and areas through dashboards and public information campaigns. 4) Promote extended specimen research. Integrating data to complement point data will lead to a better understanding of the biogeography of species and bee assemblages. This extended data includes phylogeny, life-history traits, floral hosts, morphology, and environmental layers.
Results: The network currently extends from Canada to Colombia, we hope to have most of the 22 countries in the Americas (South, Central and North) participating by the end of 2022. This program requires a core group working in each of the individual countries as well as people working across national boundaries. The first goal is to recruit as many of the The framework we propose can be applied to any geographic scale, from province/state to country to continent. It is derived from steps created in initial bee projects and covers the assimilation of existing information to conduct future research. Every country will plan to fill knowledge gaps through additional occurrence data (i.e., inventories and plot-level ecological studies).
Conclusion: The process for building a global network has been successful in bringing together countries from North and Central America. We are confident that we can extend this to any country or region in the world.
Keywords: native bees; biodiversity; Anthophila; digitization; completeness.

IC-BBD-202

Ecological notes on subfamily Xylocopinae bees as visitors of various crops in South Kangsabati forest division

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ABSTRACT

Introduction: Bees are the important and efficient pollinator group of economically important crops. Honeybees are not the only significant bee species, native and solitary bees are also important for human wellbeing. Subfamily Xylocopinae includes two solitary bee species – large, robust bee (genus *Xylocopa*) and small, slender bee (genus *Ceratina*). *Xylocopa* is an important pollinator for shallow flower and open mouth flower. *Ceratina* do not produce honey, but they are good crop pollinators. The study conducted in agro forestry ecosystem supports a huge habitat and food preference for wild and solitary bees, but due to excessive uses of pesticides and deforestation, they face threats. The studied area Kangsabati South Forest Division in Purulia, West Bengal, India is characterized by undulating topography with hilly terrain in the western and southern parts which are continuations of the Chotanagpur Plateau, one of the oldest landmasses on the earth. Mixed cropping system is practiced dominantly in the studied This study is aimed to investigate the diversity of Subfamily Xylocopinae bees which is hitherto unknown in South Kangasabati Forest Division, Purulia.
Methodology: The experimental study was conducted in various farmlands from February 2021 – April 2022 in the above-mentioned area. The experimental study conducted in seven plots for each crop. Observation study performed at three-time hour i.e- 8.30-9.30hr, 11.30-12.30hr, 15.30-16.30hr. Some methodologies were followed - 1m transect, 10-time net

sweeping per 10m, 15 mins focal observation in 1m square of flowering area and pan traps were used for passive sampling.
Results: *Xylocopa magnifica, X. fenestrata, X. aestuans* were three Xylocopa bees and *Ceratina smagardula, Ceratina hieroglyphica* encountered in various crops farm like – Pigeon's Pea, Ridge gourd, Sunflower, Brinjal, Sesame, Green gram, Cucumber. The observed result shows that both Xylocopa and Ceratina bees were dominantly encountered in Sunflower. Xylocopa bees were dominantly observed in Pigeon's Pea and Sunflower. *X. magnifica* noticed only in Pigeon's Pea. *Ceratina smagardula* was abundant bee species in almost all crops except Pigeon's Pea and Brinjal. *C. hieroglyphica* was encountered in green gram and Cucumber. Two *Xylocopa* species and one *Ceratina* species were observed in Ridge gourd and Sesame.
Conclusion: Bees were mostly abundant in Sunflower and Pigeon's Pea as farmer avoided using of pesticides in these crops. On Cucumber, pesticides were sprayed every alternate two days, showing less diverse and abundant bee population. Pigeon pea was a long-term intermediate crop, which need long term time management as a result, farmers are now shifted to focus on short term crops, which will be a great threat for genus *Xylocopa* especially for *Xylocopa magnifica* in the above-mentioned area. Local people are not well known about *Ceratina* bees, they don't consider these insects as bees. Seminars need to be conducted to inform local people about identifying wild and native bees and their conservation, along with the importance of organic pesticide need to spread among farmers.
Keywords: Xylocopinae Bees, Crops, Diversity, Agroforestry

IC-BBD-203

Bee Diversity along different elevation gradient in Agricultural crops of Munsiyari, Pithoragarh Western Himalayas, India.

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ABSTRACT

Introduction: "Munsiyari, one of the tehsil in Pithoragarh district comes under Trans-Himalayan.Munsyari has geographical area of 19.68 km sq. and lies between 30°4'2.69"" N,80°14'.82""E. It has an elevation of 2200 m above sea level covered with dense forest on North side. It has variation of temperature due to different attitudinal gradient. Bees (order Hymenoptera: Apoidea) are the most important group of insects pollinators because they play important role in agriculture by pollinating agricultural crops. Approximately 73% of the world's cultivated crops are dependent on pollination, of which 56.5% are pollinated by bees and rest by other group of insects and birds. Barley (*Hordeum vulgare*), Maize (*Zea mays*), Chuwa (*Amaranthus paniculatus*), Mandua (*Eleusine coracana*), Rajma (*Phaseolus vulgaris*), Kalyun/Black peas (*Pisum viridis*), Rai (*Brassica rugosa*) and Potato (*Solanum tuberosum*) are the major crop of the study area.
In this study, the diversity and abundance of bees was investigated in an agricultural area along an different elevational gradient so as to know the change in composition of bees along low to high elevation. Anthropogenic alterations resulted in decline in pollinator abundance and diversity hence affecting pollination service. The current study will serve as a baseline for future flora and fauna conservation programs.
Methodology: Sampling was done by direct method i.e. sweep netting, hand picking method, visual search was performed to know about the diversity and abundance of bee on the study Area. Collected samples were photographed and documented for further Identification. Assessment of diversity was calculated by species richness, diversity, evenness, and dominance.

Results: This study investigated the diversity and abundance of bees in an agricultural area along an elevational gradient in Munsiyari, Western Himalayas India. Bees were collected from April to October 2021 with the help of sweep net in agricultural crops at different elevation. Sampling was done from 08:00 am to 12:00 pm. Species diversity was determined using the Shannon–Wiener diversity index. We identified 244 individuals from 12 species of bees belonging to 5 families. The family Vespidae was predominant, with 5 species, while only 1 species was found from each of Formicidae and Halictidae.
Conclusion: This baseline study will provide the researcher with information about plant and pollinator interactions, and hence managing and applying conservation strategies.
Keywords: Diversity, Bee, Hymenoptera, Pollinator, Western Himalayas

IC-BBD-204

Diversity of native pollinator species in *Medicago sativa* L. in Punjab, Pakistan

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ABSTACT
Introduction: Lucerne (*Medicago sativa* L.) is a cross-pollinated crop and requires entomophilous pollination for tripping of flowers and subsequent pod and seed set. A variety of wild pollinators, in addition to honeybees, contribute to lucerne pollination.
Methodology: The diversity and abundance of native pollinator species for lucerne were measured in seven locations in Punjab, Pakistan. Pollinator species were sampled from March to June of 2019 and 2020 by using a quadrant (1m2) for five-minute observation with three hours intervals from 8:00 AM to 5:00 PM.
Results: Overall, 14744 pollinator species were recorded. Among orders, Hymenoptera was the most abundant (57.30%) followed by Diptera (28.38%) and Lepidoptera (14.32%). Among Hymenoptera, Apidae and Halictidae were the most species-rich families with 10 species (5496 and 668 specimens), followed by 5 species of Megachilidae (1388 specimens). Among Diptera, Syrphidae was the most abundant family with 4 species (3525 specimens), followed by Muscidae (1 species, 490 specimens) and Calliphoridae (1 species, 170 specimens). Among Lepidoptera, Erebidae was the most abundant family with 2 species (1102 specimens), followed by Nymphalidae (2 species, 702 specimens) and Pieridae (1 species, 307 specimens). Pollinator species abundance varied significantly among all the locations. Multan has the maximum species richness (39 species), whereas Bahawalpur had the lowest (24 species). Diversity t-test and diversity profile using Renyi index suggest no significant difference of Shannon- wiener index in both the years. Across the observation weeks in both years, there was a substantial positive association (R2=0.052, p=0.000) and a significant negative relationship (R2=0.047, p=0.000) between pollinator abundance and ambient temperature and relative humidity, respectively.
Conclusion: In lucerne, pollinator species diversity lives in different habitats, most of them are unknown and have not been systematically studied. Some wild bee species of this study have not been recorded as alfalfa pollinators before, such as *Amegilla* sp., *Nomia* (*hoplonomia*) sp., *Eucera* sp., *Megachile cephalotes* and *M. hera*, etc. More research is needed to investigate the links among various pollinator species and their foraging and nesting requirements.
Keywords: Diversity, Medicago, Solitary bees, Honeybees, Syrphid flies

Theme − Crop Pollination

IC-CPN-301

Pollination deficit in rapeseed, buckwheat and bitter gourd and its impact in crop production at different agro-ecological sites of Chitwan, Nepal

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ABSTRACT

Introduction: Pollination is crucial for increasing its yield, ensuring food security and improving livelihoods. Biodiversity provides a ecosystem services that are critical to human well-being. In this context, pollinators perform key ecosystem services for ecosystem functioning, global food security and biodiversity conservation have been well established (Sluijs and Vaage, 2016; Ollerton et al., 2011; Klein et al., 2007; Kevan, 1999; Buchmann & Nabhan, 1996). Pollination usually leads to some degree of outcrossing and thus promotes and maintains genetic variation in populations, which in turn allows species to adapt to new and changing environments (Wilcock and Neiland, 2002).To understand pollination deficit studies, such as farmers survey, monitoring the bee flora availability and role of pollinators on production of rapeseed, buckwheat and bitter gourd were conducted in three different agro-ecosystems, namely– semi-natural (Megauli), organic (Fulbari) and intensive agriculture (Jutpani) of Chitwan from 2012/13 to 2014/15.

Methodology: To quantify the response of honeybee on rapeseed, buckwheat and bitter gourd yield attributes, field studies were conducted at three agro-ecological sites (Semi-natural, organic and intensive agriculture) of Chitwan, Nepal during 2013-2014 and 2014-2015. The experimental design randomized complete block design (RCBD) in each crop separately with four treatments (i. open pollination; ii. plants caged with honeybees (*Apis mellifera* L); iii. hand pollination iv. plant without pollinators) was replicated four times. Data on different yield attributing characters were recorded, measured and analyzed.

Results: The pollination treatments were replicated four times: i) open pollination; ii) plants caged with honeybees (*Apis mellifera*L.); iii) hand pollination; and iv) control (plots caged without pollinators). There were different levels of pollinators in semi-natural, organic and intensive agriculture sites, however deficit in pollination noticed in intensive agriculture field resulting in lower yield. The dominant pollinators were Hymenopterans, mostly honeybees (*Apis mellifera*L., *Apis cerana* F., *Apis dorsata* F. and *Apis florea* F.) followed by Dipteran mostly syrphid flies (*Syurphus* sp., *Eristalis* sp. and *Musca dometica* L.). and some Coleopteran and Lepidopteran pollinators. A study on diversity and abundance of pollinators in different distances from forest (natural habitat) showed a decreasing trend of pollinators basically Hymenopteran and Dipteran as the distance increased from the natural habitat. Sweep net monitoring in rapeseed field showed the increased abundance of pollinators (especially Hymenopteran) in seminatural agro-ecosystem by 139%, 130.51% and 14.56%; buckwheat pollinators by 135.41%, 87.23% and 35.39% and bitter gourd pollinaotrs by 61.23%, 35.56%, 12.75%, respectively in 500m, 1000m and 2000m far from forest compared to 3000m far from forest. Impact of pollinators on each agroecosystem resulted in significantly increased crop yield compared to no pollination in seminatural, organic and intensive agroecosystems.

Conclusion: The abundance of pollinators was gradually declined in intensive agro-ecosystem and distance away from the natural habitats, which clearly indicated the need to integrate managed pollination and pollinators' conservation to sustain rapeseed buckwheat and bitter gourd production in Chitwan through biodiversity-based ecosystem services.

Keywords: Pollination, Pollinators, Honey bee, semi-natural agro-ecosystem, intensive agriculture

IC-CPN-302

Impact of pollination types on yield and oil contents of *Brassica napus*

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ABSTRACT

Introduction: There is a great deficiency of canola yield and edible oil in Pakistan, leading to the millions of dollars import of edible oil to meet the daily requirements. *Brassica napus* is self-pollinating crop but many pollinators like bees, wasps, flies and butterflies are attracted due to eye appealing color of its flowers. Pollination by these pollinators can increase the yield up to 15%. To check the impact of pollination types on yield and determination of insect pollinator diversity in the field of brassica will be the main objectives of this experiment.

Methodology: The experiment will contain 3 treatments: (1) flowers of all plants will be available only for self-pollination covered by tunnel of plastic sheet, (2) flowers of all plants will be available for air pollination covered by tunnel of muslin cloth and, (3) flowers of all plants will be available for insect-air pollination by keeping them open. The insect pollinator data will be taken on weekly basis. The insect-air pollination will increase the yield and produce high quality of edible oil. The number of pod/plant, seed/pod, weight of thousand seeds and germination of seed will be increased by insect-air pollination as compared to both self and air pollination. Diversity and richness of insect pollinators will be analyzed. This study determines the importance of insect pollinators as yield and quality enhancer of the brassica crop.

Results: Open pollination i.e. insect pollination has significantly high numbers of pods, number of seeds per pod, oil contact and germination rate other than self-pollination and wind pollination.

Conclusion: It is concluded that insect pollination plays a vital role in crop yield, and it is also found that insect pollination crop has more yield than all other methods

Keywords: Brassica, crop pollination, insect diversity, yield.

IC-CPN-303

Effect of Pollination of Honeybee on Cucumber plant

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ABSTRACT

Introduction: Honey plants provide additional food for bees, allowing them to survive through the winter and resume pollination in the Spring. Honey plants also aid in the conservation of biodiversity and environmental protection. Cucumber (*Cucumis sativus* L. cucurbitaceae), also known as "Khira" is native to Asia and Africa. Monoecious cucumbers rely on honeybees for pollination because the blooms open for one day only. The goal of this trial was to assess the pollinators effect on cucumber yield and to identify the potential pollinators.

Methodology: The pollination effect of honeybee (*Apis mellifera* L.) on cucumber yield was investigated in the field. Three treatments were used in the trial, which were set up in a full randomized complete block design as follows; first was plants caged with bees, the second was plants caged without bees-control and the third was open visits of bees. We assessed fruit set percentage, weight per fruit, length and yield per plant.

Results: According to the results of this trial, honeybee visits to flowers are vital for pollination as they impact both amount and quality of cucumber yield. As it improved fruit set percentage, individual fruit weight and yield per plant.
Conclusion: The result suggested that to increase the yield of cucumber, honeybee hives should be introduced into cucumber fields two to three days after blooming begins.
Keywords: Cucumber, Pollination, Fruit set, Honeybees, yield, production

IC-CPN-304

Bee Pollinators Enhances Cotton Production Yield

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ABSTRACT
Introduction: Cotton is the world's most significant non-food crop due to its edible oil, natural fibre and seed cake for the utilization of animals and human beings. It is a good agroecosystem for studying the economic and ecological implications of pollinator functional complementarity. Cotton is one of the most significant agroecosystems in the world. The sector produces about $7 billion every year and employs over 200,000 people. Cotton goods are collected after pollination from its fruit (bolls) for lint and seed which receipts after pollination. Although cotton is not directly dependent on bee pollination, but bees enhanced cotton yield on the organic farm. Because of the abundance of floral and extra-floral nectaries, bees are essential natural pollinators of cotton crops.
Methodology: We conducted research in a conventionally established cotton fields in a study year (2020) at Cotton Research Institute (CRI), Multan. To quantify the pollinator community at different intervals of times 6-9 am, 12, 15, 18am, was observed and also identified the species of bees. We detected the most insect foraging activity within cotton blossoms during these hours. A single collector walked four parallel 50 m × 1 m transects monitoring flowers for visits throughout each one-hour session.
Results: Three major pollinating bee's species, *Allograpta exotica* (Diptera), *Apis mellifera*, and *Melissodes tepaneca* (Hymenoptera), have been reported as effective pollinators in cotton agroecosystems, by more than 12-15% in fiber weight and more than 17-20% in seed quantity in insect-pollinated cotton crops compared to conventional cotton. Pollination efficacy and pollinator diversity may be boosted by altering pollinator habitat, minimizing pesticide usage, and preserving natural flora near cotton-growing regions to provide pollinators with other pollen sources for improved cotton productivity and quality. Honeybee, *Apis mellifera*, was identified to be the most effective pollinator of cotton crop and was identified as frequently visiting pollinator known as "pollen loads". Maximum population of bees was observed during 6-9am.
Conclusion: Small farmers can supplement their income by participating in land use management to boost pollination services.
Keywords: *Gossypium hirsutum*, cotton pollinators, yield, quantity

IC-CPN-305

Role of Insects in cross-pollination and yield attributing components of fenugreek

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ABSTRACT
Introduction: Fenugreek (*Trigonella foenum-graecum*) is a self-pollinated crop, however, insect pollination can improve the seed and fruit setting.
Methodology: The present study was carried out to enlist the pollinator community of fenugreek and their foraging behavior aiming to identify the most efficient pollinator species in terms of plant reproductive success at the research farm of The Islamia University of Bahawalpur.
Results: The floral visitor community of fenugreek was composed of six bee species i.e., *Apis dorsata, A. florea, A. mellifera, Ceratina smaragdula, Sphecodes sp.,* and *Megaachile sp.* four fly species i.e., *Eupeodes corollae, Musca domestica, Ischiodon scutellaris and Episyrphus balteatus,* one moth species i.e., *Helicoverpa armigera* and one butterfly species i.e., *Vanessa cardui*. The highest visitation frequency was observed in the case of *A. florea* (3.86 individuals/meter2/120 seconds), while the highest visitation rate was observed in case of *A. dorsata* (19.90 individuals/flower/120 seconds). The highest stay time was observed in case of *C. smaragdula* (3.94 seconds). The environmental factors (i.e., ambient temperature, relative humidity, sunlight intensity and wind speed) greatly influenced -either positively or negatively- the foraging behavior of the bee species.
Conclusion: In terms of single floral visit, the maximum pod weight, pod length and seed weight were recorded for *C. smaragdula*. Therefore, *C. smaragdula* proved to be the most efficient pollinator of fenugreek in the study area
Keywords: Fenugreek, cross-pollination, yield, pollinators

IC-CPN-306

Impact of different cross-pollination levels on the reproductive performance of mango trees

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ABSTRACT
Introduction: The mango (*Mangifera indica* L.) trees dependent on insects for cross-pollination. The present research was aimed to assess the impact of different levels of cross-pollination on reproductive success of mangos.
Methodology: The experiment was carried out at the research farm of The Islamia University of Bahawalpur (IUB), Punjab, Pakistan. Population dynamic of different pollinator species was recorded throughout the flowering period with three days' time interval. Foraging behavior was also recorded in terms of visitation frequency, stay time and visitation rate.
Results: Comparison between different cross-pollination levels (i.e., 0%, 25% and 75% and 100% cross-pollination) was also performed on three different trees. The maximum fruit weight and diameter were recorded in 100% cross-pollination treatments followed by 75% and 25%. The length of fruits did not differ with cross-pollination treatment.
Conclusion: There was no impact of pollination levels on the percent fruit set however, the minimum fruit dropping was recorded in 100% cross-pollination inflorescence followed by 25% and 75%. The self-pollinated inflorescence produced significantly less number of fruits.
Keywords: Mango, Cross-pollination, Insect pollinators, Fruit set, Reproductive success.

IC-CPN-307

Role of *Apis dorsata* and *Apis florea* in cross-pollination of Onion in Bahawalpur

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ABSTRACT

Introduction: The onion (*Allium Cepa* L.) is a common vegetable, grown and used worldwide for its edible bulbs.

Methodology: In this study, foraging behaviour of *Apis dorsata* and *Apis florea* was studied at two sites i.e. at IUB and RARI in terms of their visitation rate, visitation frequency, stay time on flower, stigma contact events, nectar robbing and pollen grain deposition on stigma and their pollination impact on post-harvest success of onion.

Results: The visitation frequency and pollen deposition of *A. dorsata* was significantly higher with mean value 5.39 individuals per 300 sec. at RARI and 4.975 individuals per 300 sec. at IUB. *Apis dorsata* deposited more number of 168.45 pollen grains than *A. florea* i.e., 150.55. The visitation rate was significantly higher in *A. dorsata* with a mean value of 11.13 floral visits per 120 seconds at IUB and 2.12 floral visits per 120 seconds at RARI than in *A. florea*. However, the post-harvesting of onion in term of no. of seeds per umbel was recorded maximum in open pollination with mean value 922.17 at IUB and 921.7 at RARI followed by *A. dorsata*, *A. florea* and caged onion. Post-harvest in term of seed weight was higher in open pollination with mean value of 11.20 g at RARI and 11.07 g at IUB followed by *A. dorsata*, *A. florea* and caged onion. The maximum number of healthy seeds/umbel were recorded in open pollination with mean value 909.9 at IUB and 909.44 at RARI followed by *A. dorsata*, *A. florea* and caged onion. The higher number of unhealthy seeds were found in caged at RARI and IUB followed by *A. dorsata*, *A. florea* and open. Germination was higher in *A. dorsata* with mean value of 89.41% at RARI and 89.40% at IUB followed by open pollination, *A. florea*, and caged onion. *A. dorsata* showed maximum visitation frequency, including pollen deposition, and less nectar robbing than *A. florea*.

Conclusion: It was concluded that *A. dorsata* gave better results in terms of post-harvest qualities of onion.

Keywords: Pollinators, *Apis dorsata*, *Apis florea*, onion, pollination biology

IC-CPN-308

Study of pollen transfer mechanism by honeybee foragers on citrus plants grown in the citrus orchards of the University of Agriculture, Faisalabad

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ABSTRACT

Introduction: Pollination by insects and other arthropods is a requirement for about 90% of flowering plants. Dominantly bees (Hymenoptera) play an essential role in natural and agricultural ecosystems as pollinators of flowering plants. Foraging Honeybees *Apis mellifera* L. (Hymenoptera: Apidae) are effective pollinators of many crops but are thought to be inefficient in pollinating citrus fruit plants due to their inability to buzz pollinate. Foraging is searching for wild food resources. It affects an animal's fitness because it plays an important role in an animal's ability to survive and reproduce.

Methodology: A preliminary study was conducted to understand the pollen transfer mechanism of honeybee from flower to bee to the stigma of other flowers in citrus orchards located at the main campus of the University of Agriculture Faisalabad.
Results: Our data reveals that pollens were present on all body parts of Honeybee workers foraging on citrus plants and the maximum pollens were recorded on the legs (29%) and tarsi (72%) of the Honey bee, further bee behavior was also observed regarding the collection of nectar and pollen by frequent touching of stigmas by the claws, tarsi, or legs, while foraging, grooming, and walking across flower clusters, could result in pollen transfer.
Conclusion: It may be speculated that a single contact between pollinators (Honeybee) the pollen-carrying body parts and a stigma has the potential to transfer significant amounts of pollen. These findings have broad implications for future assessments of the efficiencies of various bee species in pollinating diverse crops and plants.
Keywords: Pollination, Honeybee, Pollen transfer mechanism, Citrus, Foraging

IC-CPN-309

Effect of drought stress on the pollination of cotton via pollinator's visitation

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ABSTRACT
Introduction: Cotton *Gossypium hirsutum* L. is one of the most vulnerable crops to climate change where drought is becoming the most common stress, affecting the growth and yield of cotton over the last two decades, worldwide. Cotton is largely regarded as a self-pollinated crop but it is also a partial cross-pollinated crop. The introduction of plant pollinators into the crop during flowering has resulted in enhancing the quality and quantity of cotton lint. Biotic and abiotic stresses can influence the plant reproductive stage through both direct effects on plant performance and indirect effects on pollinator attraction. The reproductive stage is the most critical stage of cotton during crop growth that is adversely affected by drought stress because it directly impacts seed quality and yield
Methodology: A current study is conducted to evaluate the effect of drought stress on the cross-pollination of cotton in the district Bahawalpur. The cotton variety FH-Lalazar was grown in two blocks and we compared the population of pollinators and cotton yield between drought-stressed and control plants (irrigated). Each block was divided into irrigated and drought (skip row irrigation) with a gap of ten feet. The pollinator's abundance and yield data were compared in both irrigated and drought-stress plants
Results: Results revealed that an abundance of pollinators was found in an irrigated block as compared to a drought stress block. Likewise, yield attributes of the cotton crop such as the number of cotton bolls, cotton yield, and seed weight computed from the irrigated block are increased compared to the drought stress blocks. Finally, drought stress had negative effects on the cross-pollination by plant pollinators eventually reducing plant reproductive success.

Conclusion: Thus, drought stress management is needed to conserve the pollinators for cross-pollination in cotton
Keywords: Drought stress, cotton pollination, pollinator abundance, cotton quality.

IC-CPN-310

Impact of abiotic factors on foraging behavior of *Apis mellifera*

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ABSTRACT

Introduction: The honeybees are found in all countries. They play a vital role in the pollination of many crops; about 67% of pollination is done by honeybee *Apis mellifera*L. Forager bees take pollen, nectar, water and sometime wax from the flowers of different crops. The foraging behavior of honeybees is a special behavior of honeybees. The foraging behavior is a main link between the honeybee colony and the environment. The honeybees get their food and other necessities by their particular foraging behavior under different climatic conditions.

Methodology: The experiment will be designed to study the impact of different abiotic factors on the foraging behavior of honeybee *A. mellifera*. The experiment will be conducted on the research farm of Ghazi University located on airport road Dera Ghazi Khan Punjab, Pakistan. Data will be collected from 14 February to 30 April 2022. For this experiment three German type colonies of *A. mellifera* will be used. The foraging behavior will be checked on weekly basis from 10:00 A.M to 3:00 P.M on the interval of an hour. The number of bees of each colony going out and coming in with pollen will be counted for ten minutes. The Pearson Product-Correlation Coefficient will be used to analyses the correlation of foraging activity of honeybees with different weather conditions during different intervals of time.

Results: Foraging period starts as the sunrises and increases frequently up to 11:00 AM, As the temperature increases foraging activity decreases, for foraging it is mandatory that clear sunny day with low wind velocity, while in cloudy or rainy days there is no activity of foraging of the honeybees. There is no effect of humidity on foraging behaviour.

Conclusion: Foraging activity directly dependence on the temperature, during 16 to 35 ˚C foraging activity was its peak, high wind effect negatively, while in rainy and foggy days there is no foraging activities.

Keywords: abiotic factors, *Apis mellifra*, foraging, Humidity, Temperature crop pollination

IC-CPN-311

Role of Insects in cross-pollination and yield attributing components of fenugreek

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ABSTRACT

Introduction: Fenugreek (*Trigonella foenum-graecum*) is a self-pollinated crop however; insect pollination can improve the seed and fruit setting.

Methodology: The present study was carried out to identify the most efficient pollinator species in terms of plant reproductive success at the research farm of The Islamia University of Bahawalpur.

Results: The highest visitation frequency was observed in case of *A. florea*, while the highest visitation rate was observed in case of *A. dorsata*. The environmental factors (i.e., ambient temperature, relative humidity, sunlight intensity and wind speed) greatly influenced the foraging behavior of the bee species. In terms of single floral visit, the maximum pod weight, pod length and seed weight were recorded for *C. smaragdula*.

Conclusion: Therefore, *C. smaragdula* proved to be the most efficient pollinator of fenugreek in the study area.
Keywords: Fenugreek, cross-pollination, yield, pollinators

IC-CPN-312

Role of insect pollinators on brassica yield and their response to pesticides treated brassica

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ABSTRACT

Introduction: Rapeseed (*Brassica napus* L.) is the member of family Cruciferae, comprises of 338 genera and more than 3000 species. Rapeseed and mustard are the local crops of our country and are cultivated on vast area in all provinces. Cruciferous crops are mostly damaged by insect pests including Diamond back moth, head caterpillars, web worms, butterflies, flea beetles and aphids, which caused high yield losses. Growers use pesticides to eradicate them due to their quick actions and easy market approach.

Out of total pollination, Insects contribute over 80% and among these, bees contribute 80% of the total insect pollination; therefore, they are known as the best agents of pollination. More than 25000 known species of bees have been reported in the world. Bees sustain ecosystem because of their major role in pollination that enhances crops productivity and conserves biological diversity. The current study was performed with the following objectives:

- To identify the insect pollinators and its relative abundance engaged in brassica pollination.
- To find out the correct time of pollinators visiting the plants.
- To study the role of pollinators on brassica yield and 1000 grains weight.

Methodology: The current investigations was carried out at Agriculture Research Institute, Tarnab-Peshawar during 2020-21 to study the insect's role as pollinators on brassica yield, its relative abundance and their response to pesticides treated brassica in Randomized Complete Block Design (RCBD). Experiment consists of four treatments in which two was caged (T1 and T2) while two was kept open (T3 and T4). Pollinators were observed on alternate days at two time intervals i.e. morning and evening during the blooming season. Yield and 1000 grain weight from open, caged and insecticides treated plots were determined through digital balance. Siliqua numbers per plant, numbers of seeds/siliqua, siliqua length and plant height in caged, uncaged, pesticide treated and untreated plots were also recorded.

Results: Fifteen insect species as pollinators were monitored. Eight belongs to order Diptera (*Eristalis tenax, Ischiodan scutellaris, Sphaerophora scripta, Eupeodus bucculatus, Scaeva pyrastri, Calliphora vomitoria, Syrphus ribessi and Episyrphus balteatus , four species (Apis mellifera, Apis florea, Apis cerana and Apis dorseta*) belong to order Hymenoptera and two to order Lepidoptera i.e. *Pieris brassicae and Zizina otis*. Only one species belongs to order Coleoptera (*Coccinella septumpunctata*). *Apis mellifera* was found abundant among all pollinators with a percentage of 21.86 in morning + evening followed by *Episyrphus balteatus* and Eristalis tenax with 18.02% and 12.43% correspondingly, while *Calliphora vomitoria* and *Zizina otis* was observed least with 1.57% each. Percent population *of Episyrphus balteatus, Apis florea, Ischiodan scutellaris* and *Coccinella septumpunctata* were greater in evening as compared to morning. Maximum pollinators density and yield were reported in T3 (plant in open condition treated with imidacloprid) i.e. 55% and 1274.60 kg/ha respectively. Least population density and yield were recorded in T4 (Plants in open condition without treatment of insecticides) with 45% and 906.70 kg/ha. Highest 1000 grain weight, siliqua length,

siliqua/plant and seeds/siliqua was also observed in T3 (plant in open condition treated with imidacloprid).

Conclusion: From the experiment, it is confirmed that more insect pollinators belongs to family Syrphidae of order Diptera, followed by the Apidae family of order Hymenoptera. *Apis mellifera* and *Episyrphus balteatus* were key agents of pollination of Brassica in Peshawar. Maximum numbers of pollinators visited in the morning than evening. Highest pollinators density and yield were reported in the treatment where plant is in open condition treated with insecticide (imidacloprid) before the blossoming stage. Small size insect pollinators were abundantly present in the field at evening time such as Apis florea, Episyrphus balteatus, while the pollinators large in size such as *Apis dorsata* and *Apis mellifera* mostly present during morning. Systemic insecticides sprayed before blossoming stage in early plant growth have no impact on pollinator's abundance in brassica and maximum population of pollinators was observed in the fields in which insecticides were applied.

Keywords: Pollinators

IC-CPN-313

Fidelity of Native Pollinators in Fennel and Carom Seed

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ABSTRACT

Introduction: Pollination through Insect accounts in pollinated crops about 90%. In nature only 5% flowers are self-pollinated other 95% needs pollination through animal, insects and wind. Fennel crop is mainly cross-pollinated. Fennel and Carom seed have vital spice and medicinal value like fennel leaves and seed are used in flavoring fish, cure of eye-sight, Stomach-ache problems, cure of chronic cold and reducing cholesterol level and blood pressure. In these crops seed set is low in self-pollination so these are insect pollinators dependent crops.

Methodology: Two sites were selected for fennel and carom seed for open and self-pollination for self-pollination 10 fennel umbel and 10 carom flowers were caged and 10 were tagged for open pollination. Quality and yield investigated using two modes of pollination like open pollination and without insect pollinators. Fruit set in two different pollination treatments open and caged fennel umbel, carom flower and floral visitor was recorded.

Results: Fennel and carom seed quality, weight, size was greater in open pollination than self-pollination. The highest fruit set percentage was obtained in open pollination treatment. Similarly in carom, seed yield and weight were compared at harvest. Seed yield/m2 area in open pollination achieved 82.18g and in self-pollination 60.58g. Test weight in open pollination achieved 2.15g and in self-pollinated 1.54g.

Conclusion: Fennel and Carom seeds are open pollinated crops and pollinators have effect on seed rate and weight. In both crops yield obtained is low in pollination without insect than open pollination.

Keywords: Declining Pollinators, Caged flowers, Seed Production, Self-Pollination, Seed Quality

IC-CPN-314

Effectiveness of Native pollinators in Bell Peppers

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ABSTRACT
Introduction: Native pollinators strongly contribute to world's economy, seed production, natural ecosystem and food we eat. Seed plants approximately 90% depends on cross-pollination and fruits and seed produced by pollinated plants are approximately 25% part of diet. Native pollinators are also effective for Bell pepper's plants. Bell peppers are high in Vitamin C and Vitamin A, mostly used in cooked dishes and salads.
Methodology: The percentage of seed setting per fruit was evaluated by conducting experiment with two cultivars (Bardenas and Vergasa) of bell peppers. In four gardens three were visited with native pollinators like bumblebees. Number of bee visits was strongly related with the seed set per fruit percentage.
Results: Seed set per fruit were 40.7% (Vergasa) and 49.8% (Bardenas) on pollination treatment whereas, control treatment gave 25.7% and 27.5% average respectively. Flowers visited by native pollinators produced larger fruits than non-visited flowers.
Conclusion: External diameter of fruit, weight and length are highly dependent on seed set, the use of native pollinators is required to obtain fruit with better quality. Due to declining, encouraging and protecting pollinators have become critical. We needed to grow more native plants that have more bloom time to provide nectar and pollen to native pollinators. We needed to protect and create water sources, limit pesticide use, and identify non-native invasive plants. We should create native pollinator sites/insect hotel. Monitoring programs should be implemented on a global scale to observe the decline of pollinators.
Keywords: Bumblebee, pollination, bell pepper, fruit setting, seed production.

IC-CPN-315

Role of Pollinators & Nitrogen in production Canola (*Brassica napus* L.)

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ABSTRACT
Introduction: Insect pollinators provide many ecosystem services, resulting in continuity of ecosystem and sustainability in yield. Fruit and seed setting of many crops mainly depend 75% on pollinators. Pollinators play important role in supplying nutrients and contribute 35% to global food. Canola (*Brassica napus* L.) has mainly flower capable of both self and cross pollination. The open pollination rate is 12 to 47% depending on crop. The flower of B. napus has an open structure that can be mostly eat by all pollinators.
Methodology: The experimental design was RCBD split plot with two factors, Nitrogen and Pollination. There are different levels of nitrogen N0kgha-1, N50kgha-1, N100kgha-1, N150kgha-1. The second factor was pollinators. 20 plants were selected randomly in each experimental unit out of them 10 were tagged as self-pollination caged and other 10 were tagged as cross pollination.
Results: Seed rate, seed weight, and seed quality were investigated at harvesting caged and open flowers. Quality of seed, rate and weight percentage is greater in open pollination than self-pollination. In self-pollination yield is low because pollinators are inhibited to pollinate flowers.
Conclusion: The data shows that cross pollination results are more significant than the self-pollination. As well as the yield of low dose plot is less, normal dose plot yield is more than the less and higher dose plot yield is more as compared to other treatments.
Keywords: Ecosystem, Pollination, Nitrogen levels, Yield, Quality

Theme – Bee Conservation

IC-BCN-401

Susceptibility comparison of bumblebee and honeybee to acetamiprid and imidacloprid

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ABSTRACT

Introduction: Imidacloprid and acetamiprid are neonicotinoid insecticides introduced in the market to control insect pests in crops, but unfortunately, these insecticides are causing harmful effects on non-target organisms, including honey and bumblebees. Insecticides of this group affect acetylcholine nicotinic receptors. *Apis mellifera*, the European honeybee, and *Bombus haemorrhoidalis* are important pollinators for wild and managed crops, but unfortunately, their population is declining day by day at an alarming rate.

Methodology: This study was designed to find out the susceptibility level and susceptibility comparison between *A. mellifera*and *B. haemorrhoidalis* to acetamiprid and imidacloprid under controlled laboratory conditions by using contact and oral exposure methods.

Results: The results of the oral method by using sugar solution showed that honeybee is more susceptible than bumblebee to both insecticides. Maximum mortality, i.e., 20%, 35%, and 66%, was seen in honeybees and bumblebees exposed to acetamiprid and imidacloprid for 3 hours, 6 hours, and 24 hours, respectively. Similar susceptibly results were found on pollen and contact method.

Conclusion: Overall results demonstrate that both neonicotinoid insecticides are toxic for bumblebees and honeybees, and honeybee workers are more susceptible than bumblebee workers at the company-recommended field-realistic dose.

Keywords: Neonicotinoid, Bumblebee, Honeybee, Susceptibility

IC-BCN-402

Wild bee conservation near natural fisheries resources: effects of management

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ABSTRACT

Introduction: Across aquatic and land environments, vegetated habitats provide refuge for biodiversity. Gardens (designed for food crop production) and nurseries (designed for ornamental plant production) are agricultural habitats with high richness of plant species but may vary in their ability to support wild pollinators, particularly bees. In gardens, pollinators are valued for crop production. In nurseries, ornamental plants rarely require pollination; thus, the potential of nurseries to support pollinators has not been examined. We may suggest how

these habitats vary in their ability to support wild bees, and what habitat features relate to this variability

Methodology: 9 gardens and 14 nurseries were selected near fisheries resources, we compared how local habitat and landscape features affected wild bee species abundance and richness. We estimated floral richness and measured ground cover as proxies for food and nesting resources to assess local features, respectively. To assess landscape features, we measured impervious land cover surrounding each site.

Results: Results showed that differences in floral richness, local habitat size, water resource and the amount of land cover impacted garden wild bee species richness. moreover, floral richness and the proportion of native plant species impacted wild bee abundance and richness.

Conclusion: we conclude that differences in water areas, floral richness, local habitat size, and the amount of land cover impacted garden wild bee species richness. We suggest management guidelines for supporting wild pollinators in both habitats.

Keywords: natural water resources, wild bee, population, landscape, habitat

IC-BCN-403

Nesting site selection by stingless bees in Urban Areas of Rahim Yar Khan, Punjab, Pakistan

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Introduction: The Meliponiculture, beekeeping with stingless bees is being practiced from centuries in different parts of the world. They are found in wild and kept by beekeeper for pollination and higher medicinal values. These bees are found generalist with regard of nesting site selection. Like honey producing bees' nests, they make nets in stone or mud walls, tree trunks, crevices and other similar concealed places. The major components of their nests are insulation and the nests inside the tree trunks or underground are well insulated. Due to their tremendous natural services, conservatory purpose and because a little information regarding their nesting site selection is present, current surveys were conducted from different localities of Rahim Yar Khan district was caried out during 2021-2022.

Methodology: Multiple localities of urban areas of district Rahim Yar Khan were targeted and surveyed with vegetation influenced with agriculture, pasture and urbanization on farming areas. During survey, "All out search method" was used to track the nests of stingless bees and the residents, beekeepers and farmers of the study area

Results: About 196 located nests, 78 were found inside the wall crevices (62 mud walls, 16 plastered), 34 in the cavities of tree trunks, 24 inside the electric pipes, and 26 located underground in soil cavities.

Conclusion: The current research work provides a baseline and will be supportive for the conservation of the stingless bee populations. Moreover, it will be helpful through uplifting of

the bee species pollination services in the better crop yields in the current study areas of the southern Punjab areas of Pakistan.
Keywords: Stingless bees, nesting site selection, Pollination, conservation, Biodiversity, Rahim Yar Khan.

IC-BCN-404

Trophic Niche Breadth and Overlap in a Guild of Bees in a subtropical Forest

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ABSTRACT
Introduction: Agonistic relationships in plant-pollinator assemblages are poorly understood as compared to mutualistic relationships.
Methodology: We evaluated year-long patterns of trophic niche overlap for six frequent bee species in a small sub-tropical planted forest of five hectares at the Baghdad-ul-Jadeed campus of the Islamia University of Bahawalpur.
Results: The maximum niche breadth was recorded for *Ceratina smaragdula* and *Halictus* sp. during May, *Lasioglossum* sp. during July, *Ceylalictus* sp. during June, *Apis dorsata* during April and *Apis florea* during March. A total of 1304 interactions of six bee species were recorded on 82 flowering plants species. *Apis dorsata* and *A. florea* comprised the maximum proportion of total pollinators' abundance i.e. 36.57% and 34.50%, respectively. The niche overlap between *Ceratina smaragdula* and *A. florea* and between *A. doreata* and *A. florea* was recorded for the maximum number of months (i.e. 9) followed by *C. smaragdula* and *Lasioglossum* sp i.e. 8 months. The maximum pairwise niche overlap was recorded in the month of March with 100 percent overlap between Halictus sp. and *A. florea* followed by *Ceylalictus* sp.-*Halictus* sp. and *Ceylalictus* sp.-A. florea i.e. 99 percent overlap in both cases. Overall, *C. smaragdula* exhibited the maximum niche overlap with other five bee species followed by *A. florea* and *A. dorsata*.
Conclusion: Present study gives an in-depth overview of how the most abundant bee species compete for floral resources in terms of niche overlap for the first time under sub-tropical conditions. These findings can support future conservations programs in the region.
Keywords: Niche overlap, sub-tropical climate, plant-pollinator interactions

IC-BCN-405

Preference of Bees for different nesting materials under different Landscapes and Directions

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ABSTRACT
Introduction: Pollination is vital for the reproduction of plants (angiosperms) and many insects taxa, especially bees, play in shifting pollen from one plant to another. Pollinators add billions of US dollars in world agriculture economy. There are 20,000 total bee species out of which 70% are solitary in nature that have high foraging capacity and visitation rate. Many crops have a high dependence on solitary bees compared to social bees like alfalfa, almonds, and in orchards. Solitary bees are facing constant decline due to loss of habitat and nesting places. Man-made artificial structure like trap nest can be used to facilitate bees in nesting.

Success of these structures to attract bees for nesting depends on many biotic and abiotic factors like length and diameter of cavity direction of the nest landscape in which trap is installed. Not much work has been done to investigate the factors that influence bees to nest in artificial cavities.
Methodology: For this purpose, a study was designed in which preference of bees for nesting on the basis of direction of nest and landscape in which it was installed was be studied. Trap nest were installed in different natural (Lal Suhanra Forest and Cholistan desert), semi-natural (Alfalfa, strawberry fields and phalsa orchard) and urban (residential colony) landscapes. Four traps were installed at each location in such a way that one trap was facing each direction (East, West, North, South). Four different kinds of nesting materials were placed in every trap, including Mud blocks with a total of 21 cavities, 40 Bamboos, 90 paper tubes, and wooden blocks with 24 cavities in each trap. The diameter of these cavities ranges from 6 to 8 mm.
Results: Higher nesting occupation occurs in traps that were installed in natural Landscape and were facing south and north direction, while bees preferred Bamboo and Wooden blocks for nesting.
Conclusion: Nesting preferences of bees vary from species to species so providing them with a number of nesting options is most suitable.
Keywords: Pollination, Taxa, Solitary, Social, Foraging capacity, Trap nests, Cavities

IC-BCN-406

Convolutional Neural Network based Approach to save Honeybees

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ABSTRACT
Introduction: Honeybees not only produce sweet and sticky treat, but also plays a significant role in crop production. Crops need help from bees to carry pollen so they can bear fruits and seeds. Therefore, honeybee is the most common crop pollinator to domestic agriculture. There is a global decline in insects, but the loss of biodiversity is certainly going to impact pollination, and this is a big threat specifically for human food security and wild animals. Honeybee colony collapse disorder is really big challenge which is affecting the honeybee industry now a days. And the main factor for decimation of the bees is parasite which is only one millimetre in size. It's really important to measure the level of infestation in sighted beehive. If we do nothing bees will die within a year, so it's critical to understand the level of infestation.
Methodology: In this research, we proposed machine learning algorithm based smart monitoring system to save honeybees. The proposed smart monitoring system use the convolutional neural network (CNN) to learn the characterization of the colony collapse disorder of the beehive. The proposed model has twin branches of neural network that share the weights of learned characterizations.
Results: The major issue in this area is the unavailability of some standard dataset therefore we also took help by transfer learning algorithm and compare the results with benchmarks.
Conclusion: Ecologists, entomologists, evolutionary botanists, fruit/vegetable growers, and seed producers can use this monitoring system, which will assist them to better understand bee behavior and pollination.
Keywords: Machine Learning, Neural Networks, Smart Monitoring, Ecologists, Beekeeper

IC-BCN-407

Monitoring pesticide residues in Honey for bee conservation − A global review.

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ABSTRACTS

Introduction: Market value of honey is based on characteristics like its nutritional components and purity, but these characteristics are determined by the number of pesticide applications in the agro-ecosystem being used for feeding of bees. No crop or vegetation has exception from the application of pesticides or honey bee visits, leading to the production of contaminated honey.

Methodology: This review focuses on the residual analysis of pesticides in honey carried out using solid-phase extraction (SPE)/ QuEChERS for sample preparation and UHPLC, GC-MS and GC-ECD for analyses. Samples were collected from commercially available honey from the market and from the forests.

Results: Screening of honey samples against different pesticides from different groups indicated that 92 pesticides were detected from the samples collected from 27 countries. Most commonly found pesticides detected in honey samples were imidacloprid, Lambda-cyhalothrin, bifenthrin, difenoconazole and glyphosate. Analysis of samples collected from different commercially available honey brands and the different forest areas showed 27% samples contaminated with pesticide residues, from which almost 16% samples exceeded the maximum residual limits. The pesticides which exceeded the maximum limits are fipronil, cypermethrin, chlorpyrifos, perfenofos, carbofuran, deltamethrin and endosulfan.

Conclusion: Screening honey for pesticide residues can be useful as an environmental indicator tool and monitoring non-target pesticide application regardless of the health hazards raised by the consumption of pesticide-contaminated honey.

Keywords: Honeybee, Agro eco-system, Pesticides, Honey, Pesticide Residues