

ABSTRACTS

44th

PAKISTAN CONGRESS OF ZOOLOGY (INTERNATIONAL)

OCTOBER 6-8, 2026



AT
DEPARTMENT OF ZOOLOGY
HAZARA UNIVERSITY, MANSEHRA

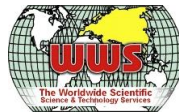
44th

PAKISTAN CONGRESS OF ZOOLOGY (INTERNATIONAL)

October 6-8, 2026

**DEPARTMENT OF ZOOLOGY
HAZARA UNIVERSITY, MANSEHRA**

ABSTRACTS





CONTENTS

-	PLENARY LECTURES	1-11
-	SHORT TALKS	13
SECTION I:	CELL BIOLOGY, MOLECULAR BIOLOGY, PHYSIOLOGY, BIOCHEMISTRY, GENETICS AND TOXICOLOGY (CBGP-1 to CBGP-84)	15-74
SECTION II:	PESTS AND PEST CONTROL	75-95
	(PC-1 to PC-31)	
SECTION III:	ENTOMOLOGY	97-122
	(ENT-1 to ENT-39)	
SECTION IV:	PARASITOLOGY (PAR-1 to PAR-7)	123-127
SECTION V:	FISHERIES, ECOLOGY, WILDLIFE, FRESHWATER BIOLOGY, MARINE BIOLOGY (FEWFM-1 to FEWFM-81)	129-186
SECTION VI:	POSTERS	187-203
	Late received abstracts	205-210
	Author Index	211-214

PLENARY LECTURES

PLENARY LECTURE-1



NEW STRATEGIES FOR THE DEVELOPMENT OF INFLUENZA VACCINES

Weiheng SU

*National Engineering Laboratory for AIDS Vaccines, School of Life Sciences,
Jilin University, Changchun 130012, China*

*Corresponding Author: suweiheng@jlu.edu.cn

Influenza viruses continuously circulate among humans, aves, swine and other animals, triggering annual seasonal epidemics and sporadic zoonotic spillover events that impose heavy public health burdens and massive agricultural economic losses worldwide. Vaccination is the primary intervention to mitigate influenza-related morbidity and mortality in both human and veterinary populations. Current licensed vaccines, including inactivated influenza vaccines and live attenuated influenza vaccines (LAIVs), are widely deployed globally. Nevertheless, persistent bottlenecks restrict their protective performance: frequent antigenic drift and shift cause annual vaccine strain mismatches; conventional vaccines only induce strain-restricted humoral immunity with negligible cross-protection against divergent subtypes; and veterinary vaccines face extra challenges of low mucosal immunogenicity and short protection duration in livestock and poultry. Multiple cutting-edge vaccine platforms have been developed to address these limitations, such as mRNA vaccine platforms, conserved antigen-based vaccines, etc. My group developed new strategies for both seasonal and universal influenza vaccine. Firstly, we optimized cold-adapted human LAIVs by precisely regulating viral propagation to generate low-DIP vaccine stocks. Excess DIPs in traditional LAIVs impair viral replicative capacity and blunt mucosal immune activation; our low-DIP LAIV exhibits robust upper respiratory replication, elevated mucosal IgA and cross-reactive neutralizing antibodies, and achieves full survival protection against heterologous H1N1 and H3N2 lethal challenges in mouse models. Secondly, we engineered antigens of mosaic HA and conserved epitopes, presenting in forms of DNA, mRNA and live attenuated vaccine, to induce durable cross-neutralizing responses, which bypass the strain-specific limitations of seasonal vaccines. Collectively, these strategies provide feasible technical routes to improve the potency of current human seasonal influenza vaccines and accelerate the translational development of universal influenza vaccines for both human and animal applications.

PLENARY LECTURE-2**THE PROTECTIVE ROLE AND MECHANISM OF AND-1 IN
CHOLESTATIC LIVER INJURY****Yongming Li**

*School of Medicine, Jiangsu Collaborative Innovation Center of Chinese Medicinal Resources Industrialization
(JCICCMRI), Nanjing University of Chinese Medicine, Nanjing 210023, China*

**Corresponding Author: lym-569@njucm.edu.cn*

Hepatic injury-induced liver diseases represent a significant global public health challenge, highlighting the critical need for novel and effective therapeutic strategies. Hepatocyte death represents the core mechanism governing the pathological progression of liver injury. Acidic nucleoplasmic DNA-binding protein 1 (And-1), a highly conserved protein participating in DNA replication, DNA repair and cell cycle control, remains uncharacterized with respect to its functional involvement in liver injury pathogenesis. In the present study, we demonstrated elevated hepatic And-1 expression in patients with biliary atresia and mice with cholestasis-induced liver fibrosis. Hepatocyte-specific And-1 deletion (And-1^{hep}-/-) aggravated cholestatic liver injury by promoting hepatocellular DNA damage, apoptosis and necroptosis, while simultaneously activating the cGAS-STING axis to amplify inflammation and promote hepatic stellate cell (HSC)-driven fibrosis. Conversely, And-1 overexpression in hepatocytes mitigated liver injury and fibrosis through preservation of genomic integrity and suppression of DNA damage/apoptosis. These findings establish And-1 as a critical regulator of cholestatic liver injury and fibrosis, with potential therapeutic implications.

PLENARY LECTURE-3**BIO- AND GREEN VALORIZATION OF FOOD INDUSTRY WASTE INTO VALUABLE FUNCTIONAL PRODUCTS****E.G. Kovaleva***Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies,
Ural Federal University, Yekaterinburg, Russia***Corresponding Author: e.g.kovaleva@urfu.ru*

Food-industry side streams are increasingly recognized not as waste requiring disposal, but as renewable feedstocks rich in proteins, carbohydrates, carotenoids, polyphenols, fibers, and other biologically active compounds. This work presents an integrated approach to the bio- and green valorization of food and related agro-industrial residues through environmentally benign extraction, enzymatic hydrolysis, microbial conversion, and formulation of functional products. Natural deep eutectic solvents (NADES), ultrasound-assisted extraction, supercritical carbon dioxide, and biotransformation by microorganisms were evaluated as alternatives to conventional solvent-intensive processing. Their combined use supports selective recovery of target compounds under comparatively mild conditions while reducing hazardous solvent consumption and enabling the reuse of complex secondary raw materials. Several case studies demonstrate the practical potential of this strategy. Astaxanthin, a potent antioxidant carotenoid, was recovered from crayfish shells using different extraction systems; a choline chloride–citric acid NADES provided the highest yield among the tested solvents, reaching 3513.32 µg/g. Green extraction technologies were also applied to spent green, black, and matcha tea leaves. Ultrasound-assisted NADES extraction and supercritical-fluid extraction showed high efficiency for catechin recovery, while spectrophotometric and HPLC data displayed strong agreement, with Pearson coefficients above 0.9. Birch-bark residues served as a source of betulin, which was subsequently converted by fungal biotransformation into betulonic and betulinic acids, expanding the spectrum of products with antioxidant and potential antidiabetic activity. In microbial valorization, soy molasses was used as a carbon-rich substrate for L-lysine production by *Corynebacterium glutamicum* and *Brevibacterium linens*, with the best media yielding 90.2 and 100.5 g/L, respectively. Poultry-processing residues were converted into feather-meal hydrolysates by acid and enzymatic treatment and used as nitrogen sources for cultivation of *Bacillus subtilis*, producing digestible protein–probiotic concentrates for animal nutrition. The recovered compounds can be incorporated into functional foods, antioxidant-enriched oils, feed additives, fermented powders and beverages, natural colorants, and active biodegradable packaging. Overall, coupling green extraction with biocatalytic conversion creates a flexible biorefinery platform that transforms heterogeneous food-industry waste into high-value ingredients. This approach reduces environmental burden, improves resource efficiency, and supports zero-waste manufacturing and the transition to a circular bioeconomy.

PLENARY LECTURE-4**APPROACHES TO IDENTIFY CELLULAR TARGETS OF NATURAL COMPOUNDS****Stefan Zahler***Center for Drug Research, Chair of Pharmaceutical Biology,
Ludwig-Maximilians-Universität, Munich, Germany.***Corresponding Author: stefan.zahler@cup.uni-muenchen.de*

Natural compounds (compounds produced by organisms) are an indispensable source of lead structures for drug development. One of the bottlenecks in natural compound research is the identification of target structures and modes of action in human cells. In my talk I will give examples for strategies and recent technical developments in our lab to overcome this hurdle (e.g. proteomics approaches and microscopy-based high-content-screening).

PLENARY LECTURE-5**ROLES OF CHLORIDE CHANNELS IN HEALTH AND DISEASES****Chatchai Muanprasat***Chakri Naruebodindra Medical Institute, Faculty of Medicine Ramathibodi Hospital,
Mahidol University, Thailand*Corresponding Author: chatchai.mua@mahidol.ac.th

CFTR (Cystic Fibrosis Transmembrane Conductance Regulator) and TMEM16A (Anoctamin-1) are key chloride channels that regulate epithelial ion transport, fluid homeostasis, and tissue function in multiple organs. CFTR is a cAMP-regulated chloride and bicarbonate channel that controls fluid secretion in the intestine, airways, pancreas, and other epithelia. While defective CFTR causes cystic fibrosis, excessive activation of CFTR plays a critical role in secretory diarrheas, including cholera and enterotoxigenic *Escherichia coli* infection, leading to massive chloride and water secretion into the intestinal lumen. TMEM16A is a calcium-activated chloride channel involved in epithelial secretion, airway hydration, smooth muscle contraction, vascular tone regulation, and sensory signaling. Aberrant TMEM16A activity has been implicated in respiratory diseases, hypertension, stroke, and several cancers, where increased channel expression contributes to abnormal cell proliferation and disease progression. TMEM16A also participates in epithelial chloride secretion and may act synergistically with CFTR in pathological fluid secretion. Because of their central roles in disease pathogenesis, both channels have emerged as attractive therapeutic targets. Our research group has focused on the discovery and characterization of small-molecule and natural-product inhibitors of CFTR and TMEM16A. These inhibitors effectively suppress epithelial chloride transport and intestinal fluid secretion in experimental models, supporting the development of channel-targeted therapies for cholera and other secretory diarrheal diseases. Collectively, these studies highlight the importance of CFTR and TMEM16A in health and disease and demonstrate their potential as targets for novel pharmacological interventions.

PLENARY LECTURE-6**BUILDING RESILIENT LIVESTOCK POPULATIONS UNDER CLIMATE CHANGE: LESSONS FROM AFRICAN INDIGENOUS ANIMAL GENETIC RESOURCES****Takalani Judas Mpofu***Department of Animal Sciences, Tshwane University of Technology, Pretoria 0001, South Africa***Corresponding Author: MpofuTJ@tut.ac.za*

Climate change has emerged as one of the most significant challenges confronting global livestock production, with profound implications for food security, biodiversity conservation, rural livelihoods, and the sustainability of agricultural systems. Rising temperatures, changing rainfall patterns, increased frequency of extreme weather events, expanding disease and parasite ranges, and growing pressure on water and feed resources are reshaping the environments within which livestock populations must survive and perform. In many developing regions, particularly across Africa, these challenges necessitate a strategic re-evaluation of livestock breeding, management, and conservation approaches. African indigenous animal genetic resources represent an invaluable reservoir of adaptive diversity that has been shaped by centuries of natural and human selection under often harsh and unpredictable environmental conditions. Indigenous cattle, goats, sheep, and poultry possess unique traits associated with heat tolerance, disease and parasite resistance, reproductive fitness, longevity, and the efficient utilization of marginal feed and water resources. These attributes position indigenous livestock not merely as genetic resources for conservation, but as critical biological assets for the development of climate-resilient and sustainable livestock systems. This paper will examine current advances in the characterization and utilization of indigenous animal genetic resources, drawing on research conducted across Southern Africa. Particular attention will be given to the application of genomic technologies, phenotypic evaluations, and environmental adaptation studies in identifying resilience-associated traits and understanding the biological mechanisms underpinning adaptation to climatic stressors. Emerging evidence demonstrates that indigenous livestock populations harbour genetic signatures that can contribute substantially to future breeding programmes aimed at improving resilience without compromising productivity. This paper will further highlight the growing role of predictive modelling as a decision-support tool in livestock research and development. The integration of genomic information, phenotypic records, environmental variables, and production data through predictive analytics provides unprecedented opportunities to forecast animal performance, disease and parasite susceptibility, adaptation potential, resource-use efficiency, and future responses to climate-related stress. Such approaches are increasingly facilitating evidence-based breeding and management strategies capable of enhancing both productivity and resilience under changing production environments. Beyond genetic improvement, this paper will discuss the importance of conserving animal genetic diversity as a foundation for long-term agricultural sustainability and food system resilience. The successful integration of indigenous knowledge systems, community-based breeding programmes, conservation initiatives, and modern scientific technologies will be highlighted as a critical pathway for safeguarding adaptive genetic variation while meeting the growing demand for animal-source foods. This paper concludes by exploring future opportunities arising from the convergence of genomics, artificial intelligence, predictive modelling, and precision livestock technologies. Lessons derived from African indigenous animal genetic resources offer valuable insights for developing livestock production systems that are productive, environmentally sustainable, and resilient to climate change, while simultaneously conserving biodiversity and strengthening global food security.

PLENARY LECTURE-7**INVESTIGATING PROGNOSTIC GENE SIGNATURE LANDSCAPE FOR IDENTIFYING HIGH-RISK PATIENTS WITH PROGRESSIVE PROSTATE CANCER IN ACTIVE SURVEILLANCE****Yaser Gamallat***Department of Molecular Oncology, Moffitt Cancer Center, Tampa Florida, USA**Department of Pathology, Oncology, Cumming School of Medicine,**University of Calgary, Alberta, USA.***Corresponding Author: Maidzaman@uoh.edu.pk*

Prostate cancer (PCa) is a significant global health issue among men with an estimated 1.5 million diagnosed annually and about 360 thousand deaths each year globally. In this study we used 1119 patient samples diagnosed with prostate cancer who underwent transurethral resection of the prostate (TURP) as part of their treatment assembled into 4 tissue microarrays (TMA). Our cohort include benign, incidental, advanced and castrate resistant prostate cancer (CRPC). Individuals who had received treatment prior to TURP and showed advanced local disease with urinary obstruction while on androgen deprivation therapy (ADT) were classified as castrate-resistant prostate cancer (CRPC). We also correlated the data with common lethal genomic aberration such as ERG and PTEN genomic status and clinicopathological features including Gleason score and patients' outcome. Additionally, expression assessment using TCGA prostate adenocarcinoma (TCGA-PRAD) to explore the potential differentially expressed genes and pathways associated with protein overexpression in PCa patients. Finally, we validated our results by performing in vitro experiments using siRNA targeting over-expressed candidates in our data using a panel of prostate cell lines. We found that high expression of multiple biomarkers significantly associated with poor overall and cause-specific survival. High expression was also significantly associated with high Gleason score, PSA abundance, pathological T category, and common genomic aberrations in PCa such as PTEN loss, ERG-gain, mutant TP53, or ATM. Our data indicates that high SRRT, LAMTOR4, CD2AP, ARPC1B and BAP1 protein expression were significantly associated with poor overall survival and unfavorable cause-specific survival. Additionally, substantial risk identified when high expression combined with PTEN-loss cases (score 0), as we observed significantly poorer OS and. Furthermore, these outcomes become more severe when patients have ERG-gain. We further implementing more data analysis models to make risk model for identifying patients at risk and predict patients who may develop advanced diseases.

PLENARY LECTURE-8**STUDYING BATS AND BAT-ASSOCIATED VIRUSES IN PAKISTAN****Muhammad Ali***Department of Biotechnology, Quaid-i-Azam University, Islamabad***Corresponding Author: alibiotech01@gmail.com; muhammad.ali@qau.edu.pk*

The scarcity of genetic data hinders bat species identification in Pakistan. Despite more than 1480 bat species worldwide, morphology-based identification remains challenging due to the similarity in physical characteristics and the lack of distinct morphological features among many species. We have been studying DNA barcoding (cytochrome b) to identify bat species non-invasively from fecal samples, collected samples without harming the bats, across various regions of Pakistan. In addition, we have detected and characterized bats-associated influenza viruses, corona viruses, flaviviruses and insect-borne viruses from bat's fresh feces samples collected from different regions in Pakistan. In the current presentation, we will be discussing our results with special focus on pandemic prevention & risk mitigation, bats-identification & conservation.

PLENARY LECTURE-9**A 20-YEAR JOURNEY IN CAPTIVE WILDLIFE WELFARE ASSESSMENT AND MITIGATION THROUGH BEHAVIOURAL SCORING, NON-INVASIVE BIOMARKERS, AND EVIDENCE-BASED ENRICHMENT IN PAKISTAN****Bushra Nisar Khan***Institute of Zoology, University of the Punjab, Lahore-Pakistan***Corresponding Author: bushra.zool@pu.edu.pk*

Captive wildlife welfare remains a largely overlooked yet critical conservation concern in developing nations, where zoological facilities face resource constraints and limited scientific assessment protocols. This presentation synthesizes two decades of pioneering research on captive wildlife behaviour, stress assessment, and welfare mitigation across major zoological and safari facilities in Pakistan, including Lahore Zoo (the third oldest zoo globally) and Safari Zoo Lahore. Our comprehensive research program has systematically evaluated stress responses in diverse taxa including big cats (*Panthera leo*, *Panthera tigris*), primates (*Pan troglodytes*), bears (*Ursus thibetanus*, *Ursus arctos*), ungulates, and other captive mammals. For the first time in Pakistan, we introduced standardized behavioural scoring systems quantifiable ethogram-based tools that objectively measure stereotypic behaviours including pacing, aggression, abnormal grooming, head shaking, and unusual vocalizations. Behavioural scoring has proven fundamental for identifying stress-susceptible individuals and evaluating management interventions. Our findings demonstrate that visitor presence significantly elevates stereotypic behaviours, with pacing increasing by 40% and aggression by 62% in male tigers (from 1.6% to 2.6%), while natural behaviours like sleeping and grooming decline markedly. Validation through non-invasive faecal glucocorticoid metabolite assessment via ELISA confirmed behavioural indicators, revealing species-specific cortisol concentrations, with highest levels in Punjab urial (0.644 ± 0.03) and tigers (0.606 ± 0.01). Importantly, we extended stress assessment to molecular biomarkers, demonstrating NR3C1 gene expression upregulation as a novel stress indicator in captive ungulates—a first for Pakistan's zoo research. Evidence-based sensory enrichment interventions, including aromatherapy with essential oils (lavender, eucalyptus, peppermint, lemon), frozen treat blocks, scatter feeding, and prey-associated odours, significantly reduced stereotypic behaviours and cortisol concentrations. Lavender oil proved most effective, reducing cortisol from 82.6 ± 0.927 to 46 ± 0.707 in Asiatic wolves. Bears exhibited complete stereotypy suppression with frozen enrichment, demonstrating species-specific efficacy. This research establishes that behavioural scoring serves as a practical, cost-effective early-warning tool for compromised welfare, while integrated non-invasive diagnostics enable objective welfare assessment without additional animal stress. The implementation of evidence-based enrichment protocols, including aromatherapy and environmental modifications, offers humane, non-invasive stress mitigation strategies. Moving beyond subjective impressions toward systematic, quantifiable welfare assessment represents a paradigm shift in captive wildlife management, with profound implications for conservation, animal welfare policy, and species management under human care in Pakistan and beyond.

PLENARY LECTURE-10

**WHY BE RED-LISTED? THREATENED SCHIZODACTYLOIDEA SPECIES IN PAKISTAN
AND IMPLICATIONS FOR THEIR CONSERVATION**

Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro, Pakistan

*Corresponding Author: riffat.sultana@usindh.edu.pk

The ongoing biodiversity crisis, characterized by accelerating rates of species decline and extinction, underscores the need for evidence-based conservation strategies. Red Lists of threatened species provide an objective framework for assessing extinction risk, identifying conservation priorities, and guiding species and habitat management. The present study assessed the diversity, distribution, habitat occurrence, taxonomic status, and conservation concerns of *Schizodactylus* in Pakistan. A total of 317 specimens were recorded from surveyed localities across the country. Among non-protected localities, the highest abundance was recorded from Hussainabad, Hyderabad, Sindh, with 41 specimens (12.93%), followed by Sukkur with 39 (12.30%), Madeji, Shikarpur with 35 (11.04%), and Islamkot, Tharparkar with 26 (8.20%). Larkana and Bahawalpur each contributed 19 specimens (5.99%), Umerkot and Layyah 14 each (4.42%), Chak-140 12 (3.79%), Dera Ismail Khan 10 (3.15%), Sanghar and Harappa 9 each (2.84%), Wali Tangi Dam, Quetta 7 (2.21%), and Hanna Lake, Sui, Jhelum, and Dilawar 5 each (1.58%). Overall, 43 specimens (13.56%) were recorded from protected areas (PAs), including Lal Suhanra National Park, Bahawalpur, Punjab (27 specimens; 8.52%) and protected wildlife areas (PWAs) of the Cholistan Desert, Punjab (16 specimens; 5.05%). Four nominal species of *Schizodactylus* have previously been reported from Pakistan; however, the present survey consistently recovered only three morphologically supported species: *Schizodactylus monstrosus* (Drury, 1773), *S. minor* Ander, 1938, and *S. hesperus* Bey-Bienko, 1967. Notably, *S. minor* was first recorded from Pakistan in 2013 from the Indus River region, when the female was also described for the first time globally. Although *S. sindhensis* Channa & Wagan, 2022 was subsequently described from Pakistan, the present investigation found insufficient morphological evidence to support its recognition as a distinct fourth species. Several diagnostic characters overlap substantially with *S. hesperus*, particularly the long and ovoid frons, steeply sloping vertex, reduced wing condition, and hind-leg armature, suggesting that *S. sindhensis* may represent a morphological variant or possible junior synonym of *S. hesperus*. Representative specimens have been submitted to iBOL, Canada, for DNA barcoding to resolve this taxonomic uncertainty. Pending molecular confirmation, the present evidence supports the occurrence of three valid *Schizodactylus* species in Pakistan. These habitat-specialist dune crickets are increasingly threatened by road construction, overgrazing, rising temperatures, prolonged drought, and degradation of sand-dune and riverine ecosystems. These threats may be particularly serious for *S. hesperus* because of its apparently restricted distribution and specialized habitat requirements. The findings highlight the need for taxonomic reassessment, molecular confirmation, long-term population monitoring, habitat protection, and formal Red List evaluation of Pakistani *Schizodactylus*. Priority conservation measures are therefore recommended to safeguard these ecologically specialized dune crickets and their fragile habitats. Financial support was received from IUCN under the SSC Internal Grant for Asia.

PLENARY LECTURE-11**HIDDEN BIODIVERSITY OF PAKISTAN: REDISCOVERING THE FORGOTTEN WORLD OF TERMITES****Maid Zaman***Department of Entomology, Faculty of Physical and Applied Sciences,
The University of Haripur, Khyber Pakhtunkhwa- Pakistan***Corresponding Author: Maidzaman@uoh.edu.pk*

Termites are highly diverse eusocial insects, which are distributed predominantly across tropical and subtropical regions, with ~3,100 described species in thirteen families. Despite their ecological importance as decomposers and ecosystem engineers and their economic significance as agricultural and structural pests, termite diversity and distribution remain poorly documented in many parts of South Asia. Pakistan is particularly understudied, with available information dispersed across historical literature, collections, and isolated recent records. Recent investigations of Pakistani termites using integrative taxonomy, combining morphometric, molecular, and ecological data, have revealed overlooked diversity and distributional records, including the documentation of the cryptic species *Heterotermes gertrudae*. These findings highlight the limitations of relying on historical and geographically fragmented records for assessing termite diversity and distribution. The development of the Pakistan Termite Information System (PTIS) provides a framework for consolidating taxonomic, molecular, distributional, host-association, ecological and management information into an accessible national biodiversity resource. Distributional knowledge is particularly important because changes in climate, vegetation and host availability may alter termite ranges and consequently modify agricultural and ecological risks. Species distribution modelling of *Odontotermes obesus* indicates potential changes in habitat suitability under future climatic conditions, emphasizing the need to incorporate environmental change into termite risk assessment. An accurate understanding of termite diversity, distribution and ecological associations is therefore fundamental to effective Integrated Termite Management within a One Health framework. Termites should not be viewed solely as pests; their contrasting roles as agricultural and urban pests and as essential ecosystem engineers demonstrate the need for management strategies that recognize both their economic impacts and ecological functions.

SHORT TALKS

SHORT TALK-1

GLOBAL WARMING AND INSECTS WITH EMERGING CHALLENGES FOR PAKISTAN

Imran Khatri

Department of Entomology, Sindh Agriculture University, Tandojam

*Corresponding Author: ikhatri@sau.edu.pk, imrankhatri.agri@gmail.com

Climate change is impacting insect biology in two ways which are linked, but occur at different speeds: (i) changes in the mean temperature and seasonality of climate; and (ii) sudden extremes like heatwaves, droughts, flooding and fire. This review aims to present the global evaluation of Harvey et al. (2023) and the recent evidence for Pakistan. Insects are ectothermic which means temperature and moisture directly control their metabolism, development, reproduction and movement. Developing at temperatures below the optimum may result in accelerated development, increased number of generations and extended activity seasons, whereas performing above the optimum reduces performance in a non-linear fashion and may lead to sublethal damage before death. The range shifts, changes in diapause and phenology, host natural enemy mismatches, disruption of symbioses, and loss of pollination, biological control, decomposition and food-web support are all organismal responses to range shifts. Aquatic insects are further constrained by the fact that when water is warmer, the needs for oxygen for metabolism are greater and the amount of oxygen available is reduced. There is no evidence in support of the simple forecast that insect populations (or pests) will rise. Winners and losers vary depending on life stage, timing of events, exposure length, mobility, habitat connectivity and interacting pressures like pesticides, habitat loss, and invasive species. The effects of extremes can be great enough to cause short-term physiological shock and long-term demographic impacts, and when the pollinators and natural enemies of crops are lost, even some herbivores can cause impacts to crop protection. The threat here is immediate and inequitable for Pakistan. According to the Pakistan Economic Survey 2025, it was Pakistan's second warmest year in 65 years with annual mean temperature of 23.9°C (+1.09°C above 1961–1990). Malaria cases increased from approximately 0.506 million during 2021 to 4.3 million in 2023, reflecting the impact of floods on vector habitat creation, and the interruption of health services. Modelling of climate envelopes for *Apis dorsata* indicates a northward and upslope shift in suitable habitat and a projected 40-79% reduction by 2070 under SSP5-8.5. These signals point to a significant national lacuna that Pakistan has no standardized long-term monitoring of insect/microclimate relationships on agro-ecological areas of the country. A national insect climate observatory should be based on the integration of taxonomy, standardized trapping, microclimate, phenology, crop and public-health surveillance; climate-informed integrated pest and vector management and protection of refugia, native floral resources, riparian shade and landscape connectivity. Minimal use of pesticides for control, and a simplification of habitat will allow insect communities to remain and sustain critical ecosystem processes in a warmer climate.

SECTION - I

CELL BIOLOGY, MOLECULAR BIOLOGY, GENETICS, PHYSIOLOGY, TOXICOLOGY, VIROLOGY

- 1. HERBAL MEDICINE, BIOCHEMISTRY, AND BIOTECHNOLOGY**
- 2. CELL AND MOLECULAR BIOLOGY, CELL BIOLOGY, GENETICS**
- 3. MICROBIOLOGY**
- 4. PHYSIOLOGY**
- 5. TOXICOLOGY**
- 6. PUBLIC HEALTH**

1. HERBAL MEDICINE, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOINFORMATICS

CBGP-1

Biotechnology

ACID SOLUBLE COLLAGEN EXTRACTION FROM DIFFERENT MARINE EDIBLE FISH SCALES: PROCESS AND YIELD

Nimrah Ahmed¹ and Afshan Yasmeen^{*1,2}

¹Department of Zoology, Jinnah University for Women, Karachi.

²Centre of Excellence in Marine Biology University of Karachi, Karachi-75270

*Corresponding Author: afshan.yasmeen@juw.edu.pk, afshan968@hotmail.com

Fish processing industries produce a remarkable quantity of waste that includes fish scales. Fish skin is protected by mineralized plates called fish scales, which cover the dermis layer of the epidermis. Collagen is a fibrous protein that pays as a key structural protein in the connective tissue roughly 30% of animal. Due to its remarkable biocompatibility and bioactivity collagen has gained attention for its use in various industries such as pharmaceutical, biomedical field, and cosmetic industries. The present study aimed to extract collagen from scales of different fish species. Fish scales collagen was extracted by demineralization and acid hydrolysis. Extracted collagen from fish scale may vary with species to species and the size of their scales. Extraction method and the duration of acid hydrolysis also effect on the total yield of collagen. Fish collagen is referred to as vital biomaterial because of its extensive array of biological characteristics, comprising notable biocompatibility, high levels of cell adhesion. Collagen yield varies with specie to species. Extracted collagen from may use for medicinal purpose and in cosmetic industries.

CBGP-2

Public Health

Herbal medicine

NEPETA GLUTINOSA BENTH.: AS A SOURCE OF NATURAL BIOACTIVE: PHYTOCHEMICAL AND THERAPEUTIC INSIGHTS

Saima Perveen¹ and Afshan Yasmeen^{*1,2}

¹Department of Zoology, Jinnah University for Women, Karachi

²Centre of Excellence in Marine Biology University of Karachi, Karachi-75270

*Corresponding Author: afshan.yasmeen@juw.edu.pk, afshan968@hotmail.com

Synthetic and herbal medicines have played a vital role in the search for effective therapies; each provides different approaches to treat ailments. Synthetic medicines are produced by the synthesis of targeted chemicals. These chemicals tend to alter specific biochemical pathways, which give rapid result and a uniform doses nonsteroidal anti-inflammatory drugs (NSAIDs) and analgesics are the examples.

Furthermore, they cause negative effects on health like stomach discomfort, which frequently reduces their efficacy over time. On the other hand, herbal medicine comes from natural sources. They consist of various bioactive compounds such as tannin, phenols and flavonoids etc. These compounds have synergistic remedial effects. These natural products are commonly considered harmless and available mainly in handling chronic disorders such as inflammation and pain. Still, problems such as variable dosage, limited standardization, and poor clinical testing make it difficult to integrate in modern pharmaceutical standards. This study aims to determine the secondary metabolites (tannins phenols and flavonoids) and evaluate the anti-inflammatory and analgesic activities of *Nepeta glutinosa* Benth, Methanol extracts of *N. glutinosa* were used for the analysis of secondary metabolites and analgesic activity were evaluated by tail immersion method. Anti-inflammatory activity was carried out by carrageenan induced rat paw oedema method. The phytochemical examination of methanol extract showed that the phenols were found at high concentration followed by flavonoids and tannins. Results showed significant $p < 0.01$ anti-inflammatory activity from 1st to 5th h as compared to standard drug. Analgesic activity obtained from tail immersion method shows highly significant effect till 180 min. *Nepeta glutinosa* has high concentration of secondary metabolites that exhibits strong anti-inflammatory and analgesic effects, which additionally promotes its conventional use and potentially use in pharmaceutical medicine to cure inflammation and pain.

CBGP-3
Public Health
Toxicology

**SYNTHESIS AND BIODEGRADATION OF NATURAL POLYMER-BASED BIOPLASTIC
 AS A SUSTAINABLE ALTERNATIVE TO CONVENTION**

Tanzeel Ashraf¹ and Afshan Yasmeen^{*1,2}

¹Department of Zoology, Jinnah University for Women, Karachi

²Centre of Excellence in Marine Biology University of Karachi, Karachi-75270

*Corresponding Author: afshan.yasmeen@juw.edu.pk, afshan968@hotmail.com

The accelerating environmental catastrophe caused by the persistent accumulation of petroleum-based plastics has increased the global demand for sustainable alternatives. This study focused on the synthesis of a biodegradable bioplastic derived from renewable agricultural resources. The main objective was to synthesis an eco-friendly thermoplastic film through a simple, cost-effective, and scalable process using natural polymers. The process comprised the controlled gelatinization of a natural polysaccharide matrix, followed by acid-mediated modification and plasticization. The mixture was subjected to thermal processing, resulted in molecular reorganization and upon drying, the formation of a cohesive, transparent biofilm. The resulting bioplastic exhibited advantageous physical properties, such as flexibility, moderate tensile strength, and complete biodegradability under typical environmental conditions. Water absorption and soil burial tests verified its biodegradability, distinguishing it from conventional non-biodegradable plastics. The process operates at lab scale with minimal energy input and utilizes low-cost, locally accessible raw materials, yielding a low per-unit production cost. This research offers a green chemistry approach for biodegradable packaging that replaces single-use plastics, reduces pollution, and promotes circular economy goals.

CBGP-4**Cell & Molecular Biology****TYR RS7129973 IS ASSOCIATED WITH VITILIGO SUSCEPTIBILITY IN THE PAKISTANI POPULATION: A CASE-CONTROL STUDY****Sehresh Murtaza*, Nasir Masood, Maleeha Azam and Muhammad Ajmal***Translational Genomics Laboratory, Department of Biosciences, Faculty of Health Sciences, COMSATS University Islamabad, Islamabad-45550**Corresponding Author: sehreshmurtaza4@gmail.com

Vitiligo is an acquired depigmenting disorder in which melanocytes are lost from the epidermis. Genetic, immunological and environmental factors contribute to the disease, and both immune-regulatory and melanogenesis genes have been proposed as susceptibility loci. The aim of the current study was to determine whether the inducible nitric oxide synthase (*iNOS*) rs2297518 and tyrosinase (*TYR*) rs7129973 polymorphisms are associated with vitiligo in a Pakistani population. A case-control study was conducted in patients with vitiligo and healthy controls. Genomic DNA was extracted from peripheral blood, and both SNPs were genotyped by tetra-primer amplification refractory mutation system PCR (T-ARMS-PCR). Genotype and allele frequencies were compared using the χ^2 test in SPSS v22, and odds ratios (ORs) with 95% confidence intervals (CIs) were calculated under codominant, dominant, recessive and allelic models. The distribution of *TYR* rs7129973 genotypes and allele frequencies differed significantly between patients and controls ($p < 0.05$). For *iNOS* rs2297518, genotype and allele frequencies did not differ between the two groups under any of the models tested (all $p > 0.05$). The data analyzed in this study indicate that *TYR* rs7129973 is associated with vitiligo in this Pakistani sample, whereas *iNOS* rs2297518 is not. With 110 individuals per group the study has limited power to detect small effects, so the absence of an association at *iNOS* should not be read as exclusion of that locus. Replication in larger, independently ascertained cohorts, together with functional work on how rs7129973 affects *TYR* expression or enzyme activity, is required before the variant can be used as a susceptibility marker in this population.

CBGP-5**Cell and Molecular Biology****FIRST DNA BARCODING INITIATIVE FOR *SCELIO* SPECIES (HYMENOPTERA: SCELIONIDAE) FROM THE THAR DESERT, PAKISTAN****Jeram Das and Riffat Sultana***Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan**Corresponding Author: jeramdas28@gmail.com, riffat.sultana@usindh.edu.pk

DNA barcoding provides a powerful molecular approach for accurate species identification and for resolving morphologically similar and cryptic taxa. The present study employed mitochondrial cytochrome *c* oxidase subunit I (COI) barcoding to investigate the molecular diversity of *Scelio* species, important egg parasitoids of grasshoppers, from the Thar Desert of Sindh, Pakistan. Extensive surveys

conducted in Umerkot, Chachro, Dahli, Mithi, Islamkot, Nagarparkar, and Diplo yielded a total of 1,869 specimens. Morphological examination identified nine species: *Scelio aegyptiacus* Priesner, 1951; *S. hieroglyphi* Timberlake, 1932; *S. mauritanicus* Risbec, 1950; *S. oviphagus* Mukerji, 1953; *S. poecilopterus* Priesner, 1951; *S. tristis* Nixon, 1958; *S. serdangensis* Timberlake, 1932; *S. pakistanensis* Siddiqui, Mushtaque & Zafar, 1983; and *S. popovi* Nixon, 1958. Selected specimens were subjected to DNA barcoding using the mitochondrial COI barcode region. Sequence alignment, genetic-distance analysis, and maximum-likelihood phylogenetic reconstruction revealed clear genetic differentiation among the studied taxa and supported their molecular discrimination. Phylogenetic analysis further recovered distinct genetic lineages corresponding to the morphologically identified *Scelio* species. The findings demonstrate the effectiveness of COI DNA barcoding as a complementary tool for the accurate identification and molecular characterization of *Scelio* species. This study establishes an important molecular reference for future taxonomic investigations, biodiversity assessments, and biological control research involving grasshopper egg parasitoids in Pakistan.

CBGP-6

Cell and Molecular Biology

MITOCHONDRIAL COI-BASED IDENTIFICATION AND PHYLOGENETIC ANALYSIS OF *SCELIO* SPECIES

Furqan Al Hussain and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan

*Corresponding Author: furqanalhussain28@gmail.com, riffatsultana@usindh.edu.pk

The genus *Scelio* (Hymenoptera: Scelionidae) comprises important egg parasitoids of locusts and grasshoppers (Orthoptera: Acrididae) and plays a significant role in their natural population regulation. Accurate identification of *Scelio* species is essential for understanding their diversity, host associations, evolutionary relationships, and potential application in biological control. In the present study, mitochondrial cytochrome *c* oxidase subunit I (COI) sequences of 11 *Scelio* species were analyzed to assess their molecular diversity and phylogenetic relationships. COI sequence analysis revealed clear genetic differentiation among the studied taxa and supported the molecular identification of morphologically related species. Among the examined taxa, *Scelio hieroglyphi*, *S. mauritanicus*, and *S. aegyptiacus* were particularly important because of their close associations with economically important acridid hosts. Phylogenetic analysis demonstrated distinct evolutionary lineages among the studied *Scelio* species, highlighting the usefulness of mitochondrial COI as a molecular marker for species recognition and assessment of genetic diversity. DNA barcoding also provides an effective complementary approach for detecting cryptic diversity and resolving taxonomic uncertainties among morphologically similar species. As *Scelio* females parasitize concealed grasshopper and locust eggs within egg pods, their activity can substantially reduce successful host emergence and contribute to the natural suppression of pest populations. The present study provides a COI-based molecular and phylogenetic framework for *Scelio* and emphasizes the importance of integrating molecular data with morphological and ecological information for reliable species delimitation. These findings may contribute to future taxonomic studies and facilitate the evaluation of *Scelio* species as potential biological control agents for sustainable management of locusts and grasshoppers.

CBGP-7

Cell and Molecular Biology

PREVALENCE, ETIOLOGY AND ASSOCIATED RISK FACTORS OF MANDIBULAR CARCINOMA AT NUCLEAR INSTITUTE OF MEDICAL AND RADIOTHERAPY (NIMRA), JAMSHORO**Areeba Anjum Akhter¹ and Tahira Jabeen Ursani²***Department of Zoology, University of Sindh, Jamshoro**Corresponding Author: areeba.anjum2312@gmail.com¹ | tjchandio65@gmail.com²

Mandibular carcinoma is a severe form of oral cancer originating in the oral cavity and invading the underlying mandible. This study evaluated the prevalence, demographic distribution, major risk factors, and clinical treatment outcomes associated with mandibular carcinoma. A structured, questionnaire-based, cross-sectional survey was conducted among n=30 oral cancer patients. Demographic details, medical history, lifestyle habits, clinical symptoms, treatment, and side effects were documented. Out of 30 total oral cancer cases evaluated, mandibular cancer accounted for 53.33% (n=16). The majority of affected individuals were male (n=20, 66.67%) compared to female patients (n=10, 33.33%), with the highest clinical incidence observed in the 41–50 age group. Hypertension was found to be the primary co-existing medical condition. Tobacco products represented the primary etiology, contributing to 73.33% of cases, followed by chronic alcohol consumption and betel nut chewing. Radiotherapy served as the primary treatment. Patients reported severe physical side effects caused by the treatment, such as severe alopecia, nausea, vomiting, dysphagia, and respiratory discomfort. While current cases affect older adults, the growing popularity of products like vapes and hookah among young adults poses a dangerous threat that could lead to a future rise in cancer cases. Targeted public health interventions, tobacco control strategies, and early diagnostic screening programs are urgently needed across the local population.

CBGP-8Public Health
Herbal Medicine**RESVERATROL-INSTIGATED MITIGATION OF 6PPD-Q INDUCED TOXICITY IN REPRODUCTIVE AND HEPATO-RENAL SYSTEMS OF FEMALE RATS****Sawaira, Qurat Ul Ain*, Moazama Batool, Sajida Mushtaq and Sadia Maalik***Government College Women University, Sialkot, Pakistan***Corresponding Author: sawairanaz50@gmail.com; quratul.ain@gcwus.edu.pk

6PPD-Q, a transformation product of the tire rubber preservative 6PPD, is an emerging environmental pollutant that has drawn attention from all around the world due to its persistence, potential bioaccumulation, and proven toxicity. While Resveratrol (RES) is a naturally occurring polyphenolic antioxidant with strong anti-inflammatory, anti-apoptotic, and metabolic regulating properties. This study was designed to examine the harmful consequences of 6PPD-Q on reproductive and hepato-renal systems of adult rats, and to assess resveratrol's potential for mitigation. For this purpose, animals were divided into four groups; one control group and three treated with 6PPD-Q (50mg/kg), RES (20mg/kg) and 6PPD-

Q+RES (50mg/kg+20mg/kg) orally for 30 consecutive days. At the end of experiment, animals were sacrificed, blood and different organs were collected to assess antioxidant enzymes status, oxidative stress markers, histopathology and reproductive hormone profiling. Results showed that 6PPD-Q exposure caused reduction in antioxidants activity (CAT, SOD, POD) and increase in oxidative stress markers (TBARS and ROS) in the organs studied. Additionally, histopathological alterations were marked by the degenerated granulosa layer, vacuolation and congestion in ovaries; circular bundles of smooth muscle cells along with extracellular matrix deposition in uterus; sinusoidal dilation and central vein congestion in liver; and glomerulus atrophy with increased capsular space in kidney tissues. Furthermore, hormonal profile revealed significant elevation in estrogen and progesterone levels in 6PPD-Q exposed group. However, resveratrol administration significantly protected 6PPD-Q induced alterations using its antioxidant potential. Conclusively, these findings revealed that resveratrol mitigated 6PPD-Q instigated oxidative, histological and biochemical alterations in rats, suggesting further mechanistic validation for translational relevance.

CBGP-9

Public Health

MULTI-OMICS INSIGHTS INTO THE TRANSGENERATIONAL IMPACT OF MATERNAL MICROPLASTIC EXPOSURE

Muhammad Tariq Zahid^{1*}, Ghulam Mustafa², and Byong-Hun Jeon²

¹Government College University Lahore

²Hanyang University, Seoul, South Korea

^{**}Corresponding Author: mtariqzahid@gcu.edu.pk

Environmental microplastics (MPs) have raised significant concerns regarding their potential risks to human health. Although the broad toxicological impacts of maternal MP exposure on living organisms are widely recognized, the transgenerational implications remain understudied. In the present study, female rats were exposed to 5 µm polystyrene MPs for 28 weeks, with their first and second progenies born at weeks 13 and 26, respectively. Maternal MP exposure significantly altered alpha and beta diversities in both progenies. There was an increased relative abundance of important bacteria, including *Lactobacillus acidophilus*, whereas some minor taxa were suppressed in both progenies. The liver transcriptomic analysis indicated an upregulation of programmed cell death, apoptotic processes, and receptor-mediated MAPK and FoxO signalling in the first progeny, whereas the second progeny indicated a trend towards long-term metabolic accommodation, upregulating inner mitochondrial membrane components, oxidative phosphorylation, steroid hormone biosynthesis, and pathways linked to systemic carcinogenesis. LC-MS/MS to identify fecal metabolites also supported the multi-omic trajectories. First progeny suffered from higher luminal primary bile acid shock, marked by an increased accumulation of taurocholic and glycolithocholic acid-sulfates due to disrupted microbial deconjugation. In the second progeny, there was an accumulation of acetylneuraminic acid, indicating altered mucosal carbohydrate degradation. Similarly, both progenies exhibited increased essential amino acids in faeces, signifying impaired nutrient absorption. Overall, these findings demonstrate that chronic maternal exposure drives distinct, generation-specific toxicological, microbial, and metabolic shifts in offspring.

CBGP-10Physiology
Biochemistry**NEPHROPROTECTIVE POTENTIAL OF RAW HONEY AGAINST DIETHYL PHTHALATE, INDUCED RENAL PATHOLOGY IN MALE MICE.****Faiza Yaseen^{1,4}, Chaman Ara¹, Asmatullah¹, Nageena Ramzan¹, Shaukat Ali ²,
Hafiz Abdullah Shakir¹, Muhammad Khan¹, Shagufta Andleeb³, Francesca Guida⁴,
Livio Luongo⁴ and Sabatino Maione⁴**¹*Institute of Zoology, University of the Punjab, Lahore, Pakistan*²*Applied Entomology and Medical Toxicology Laboratory, Department of Zoology,
Government College University, Lahore, Pakistan*³*Department of Zoology, University of Education, Bank Road Campus, Lahore, Pakistan*⁴*University of Campania Luigi Vanvitelli, Italy*

*Corresponding Author: fiza.yasin95@gmail.com

Phthalates are plasticizing chemicals and leading environmental contaminants. Diethyl phthalate (DEP), a principal member of this family, has been identified as a potent endocrine disruptor and carcinogen in both animal models and humans. Now a days, it is more concerned about the nephrotoxic and renal dysfunction effects in research. The present study aimed to evaluate the renal damage induced by DEP and to assess the nephroprotective potential of raw honey in male albino mice. Fifty four-week-old male mice were randomly and equally divided into five groups: (A) control group, administered 0.1 ml distilled water; (B) vehicle control, administered 0.1 ml corn oil; (C) DEP toxicant group, administered DEP (3 mg/g body weight) in corn oil; (D) honey control, administered 0.2 mg/g/day honey; and (E) DEP plus honey group, administered DEP and honey (3 mg/g/BW/day and 0.2 mg/g/BW/day, respectively). Following a six-day acclimatization period, mice were treated via oral gavage for 54 consecutive days and subsequently dissected. The antioxidant potential and total phenolic content of the honey were determined using the FRAP and Folin–Ciocalteu assays, respectively. Morphological, morphometric, histological, renal function, and tissue antioxidant capacity analyses were performed using blood and kidney samples collected from the mice. Mice exposed to DEP exhibited a significant increase in body weight, kidney mass, and reno-somatic index. Renal function tests further revealed elevated blood uric acid levels accompanied by decreased creatinine levels. Histopathological examination revealed mild pathological changes, including tubular dilation, vascular congestion, and mild glomerular atrophy. No significant differences were observed between the DEP and control groups with respect to kidney-to-body-mass ratio, kidney length, or kidney width. Notably, these pathological alterations were ameliorated in the honey-cotreated group, consistent with the antioxidant capacity and total phenolic content of honey. These findings indicate that raw honey possesses antioxidant properties capable of effectively mitigating DEP-induced renal anomalies in male mice.

CBGP-11

Microbiology

COMPARATIVE STRUCTURAL AND FUNCTIONAL ANALYSIS OF PETASE-LIKE CUTINASES FROM *STREPTOMYCES* SP. SM14 AND *PSEUDIDEONELLA SAKAIENSIS* REVEALS CONSERVED CATALYTIC FEATURES FOR POLYETHYLENE TEREPHTHALATE BIODEGRADATION

Muhammad Tausif Chaudhry and Raheela Chaudhry

National Metrology Institute of Pakistan (NMIP), Ministry of Science and Technology, 16-H/9, Islamabad

*Corresponding Author: tausif_chaudhry@yahoo.com, raheela.nmip@gmail.com

Polyethylene terephthalate (PET) is one of the most extensively used synthetic polymers, and its persistence in the environment has created an urgent need for efficient biological degradation strategies. Members of the α/β hydrolase superfamily, particularly PETases and cutinases, have attracted considerable attention due to their ability to hydrolyze PET and related polyesters. Despite their structural similarity, the evolutionary relationship and functional divergence between environmental cutinase-like enzymes and PET-specific hydrolases remain incompletely understood. In the present study, a comparative in silico analysis was conducted to investigate the structural and functional characteristics of a putative PETase-like cutinase from *Streptomyces* sp. SM14 (DAC80635.1) and a PETase from *Pseudideonella sakaiensis* (GAP38373.1). Protein sequences were analyzed using established bioinformatics tools for physicochemical characterization, signal peptide prediction, conserved domain identification, sequence alignment, structural modeling, active-site analysis, and molecular docking with PET-related substrates. Both proteins exhibited conserved α/β hydrolase architecture, including the characteristic Ser–Asp–His catalytic triad and glycine-rich nucleophilic elbow, indicating a shared catalytic mechanism. Comparative structural analysis suggested that the PETase possesses an enlarged substrate-binding cleft and flexible surface loops that may facilitate accommodation of bulky PET substrates, whereas the *Streptomyces* enzyme retained a more compact cutinase-like active-site architecture consistent with broader substrate specificity. Docking analysis further indicated stronger predicted interactions between the PETase and PET degradation intermediates than those observed for the SM14 enzyme. Collectively, these findings support the hypothesis that PETases evolved through structural specialization of ancestral cutinase-like hydrolases and identify the SM14 enzyme as a promising candidate for future experimental characterization and protein engineering aimed at enhancing polyester biodegradation.

CBGP-12

Microbiology

RURAL–URBAN VARIATION IN THE ARCHITECTURAL DYNAMICS OF TREE ANT COMMUNITIES

Jaweria Batool¹, Sumera Afsheen^{1*}, Dr. Bakhtawar¹, Rukhshanda Saleem²

¹ *Department of Zoology, University of Gujrat, Gujrat 50700, Punjab, Pakistan*

² *Department of Zoology, University of Sialkot, Sialkot 51310, Punjab, Pakistan*

**Corresponding Author: sumera.afsheen@uog.edu.pk

The formicid fauna is the relatively largest group of insects in Pakistan in terms of taxonomy. The current study's goal was to find the effect of urbanization on tree ants species in each tehsil of the

district Gujrat, Punjab, Pakistan. Specimens were randomly selected from various locations, including tree trunk, tree bases, residential areas and grassy areas, during the sampling period, which contended from Fall-2024 to Spring 2025. A total of eighteen species i.e. *Monomorium pharaonis* (Linnaeus, 1758), *Monomorium minimum* (Buckley, 1867), *Camponotus modoc* (Brown, 1950), *Camponotus compressus* (Fabricius, 1787), *Camponotus atriceps* (Smith, 1858), *Phiedole navigans* (Forel, 1909), *Phiedole megacephala* (Fabricius, 1787), *Paratrechina longicornis* (Wetterer, 2017), *Solenopsis invicta* (Hedges, 1997), *Solenopsis richteri* (Forel, 1909), *Solenopsis geminata* (Fabricius, 1804), *Cataglyphis setipes* (Forel, 1894), *Lasius grandis* (Forel, 1909), *Crematogaster scutellaris* (Olivier, 1792), *Messor galla* (Mayr, 1904), *Formica pallidefulva* (Latreille, 1802), *Aphaenogaster subterranean* (Latreille, 1802) and *Pogonomyrmex rogosus* (Emry, 1895) belonging to twelve genera and two Subfamilies (Myrmicinae and Formicinae) of family Formicidae. *P. rugosus*, *A. subterranea*, *C. compressus*, *C. modoc* and *C. setipes* were found to be the most abundant species in investigation and *Monomorium pharaonis* was the least abundant specie. From all recorded species *P. aratrchina longicornis* was only found from tehsil Gujrat and absent from other tehsils of district Gujrat. Pictorial documentation of architectural dynamics shows significant structural differences in tree ant nest construction between rural and urban areas were illustrious. These results demonstrate how ants alter the width, height, depth, and entrance sites of their nests to maximize living circumstances and survival.

CBGP-13

Cell and Molecular Biology

LIFESTYLE INTERVENTION AND CANCER PREVENTION: A CALL-TO-ACTION LIFESTYLE INTERVENTION AND CANCER PREVENTION: THE YIN AND THE YANG

Muhammad Khan

Institute of Zoology, University of the Punjab, Quaid-e-Azam campus Lahore

*Corresponding Author: mkhan.zool@pu.edu.pk

Cancer remains the second leading cause of death worldwide, with approximately 20 million new cancer cases and 10 million deaths in 2024. The incidence of cancer cases is predicted to reach 34 million by 2050. Modern research has shown that only about 5-10% cancers are genetically inherited while remaining 90-95% cancers are driven from environment and lifestyle. The lifestyle factors include tobacco smoking, diet, alcohol consumption, sun exposure, sleeping pattern, environmental pollutants, infections, stress, obesity and sedentary lifestyle. The research evidence has shown that about 30-35% cancers are linked to diet and about 20-25% are due to tobacco consumption. Thus, diet and tobacco consumption remain the major preventable risk factors for cancer. Compelling evidence from a plethora of research reports have proved lifestyle interventions as powerful medicines for cancer prevention. The healthy lifestyle comprised of balanced diet, quality sleep, regular exercise, stress management, positive social connections, and avoidance of harmful habits represents the “balanced of the yin and the yang”. Moreover, here we discuss that an individual personal lifestyle acts as “double edged sword” because it can either trigger cancer induction or protect the body against cancer.

CBGP-14**NORMALIZATION OF HUMAN-BEHAVIOR THROUGH
HOMEOPATHIC MEDICINES****G. M; A. Ghani and Slaman-ur-Rahman***Pakistan homeo-clinic, Abubakr Town Dera Ghazi Khan, Pakistan**Corresponding Author: s.khattak300@gmail.com

Human mind possesses special centers that control specific activity. Any derangement in one's mind center activity creates related change in one's behavior. Specific Homeopathic medicine can normalize the physiology of related specific portion of our mind and in turn, normalization of such behavior is observed. As regards the normalization of human behavioral activity, Homeopathic medicines exhibit miraculous and prompt results. Though nearly each homeopathic medicine possesses its positive effects over patient's mind but some elucidate rather pronounced results, a few instances in this aspect of human issues can clearly reveal its efficacy;

Irritable attitude, *Chamomilla*;
Weeping for nothing, *Pulsilla prantensis*;
Psychosomatic shock, *Ignatia amara*;
Suicidal impulses, *Aurum metallicum* &
Foolish passion, *Natrium muriaticum*.

CBGP-15

Cell and Molecular Biology

**TRANSCRIPTOMIC RESPONSES TO INSECTICIDE STRESS AND FUNCTIONAL
CHARACTERIZATION OF THREE GENES ASSOCIATED WITH HOST-FINDING
BEHAVIOR IN *SCLERODERMA SICHUANENSIS*****Sumbul Mureed Mastoi^{1,2}, Yang Hua², Waqar Ali Chandio², Paras Mureed Mastoi³ and Yang Wei^{1*}**¹*Department of Entomology, Sindh Agriculture University, Tandojam, Pakistan*²*College of Forestry, Sichuan Agricultural University, Chengdu, China*³*College of Plant Protection, Sindh Agriculture University, Tandojam, Pakistan**Corresponding Author: ywei218@aliyun.com

The female parasitoid wasp *Scleroderma sichuanensis* (Hymenoptera: Bethyilidae) relies on a range of behavioral responses, including host detection, learning, and memory, to locate suitable hosts and ensure successful reproduction. In this study, RNA-Seq analysis under sublethal insecticide stress was used to identify differentially expressed genes potentially associated with host-finding behavior. Three genes, SsORS5, SsGRIN2B, and SsPDE8A, were selected for further functional analysis based on their predicted involvement in olfactory perception and neural signaling. SsORS5 encodes an odorant receptor that may contribute to the detection and localization of host-associated odors. SsGRIN2B encodes an NMDA-type glutamate receptor involved in neuronal communication and synaptic plasticity, whereas SsPDE8A is

associated with cAMP signaling and may influence processes related to learning and memory. To examine their roles in host-finding behavior, RNA interference (RNAi) was performed in adult female wasps using dsRNA doses of 0.5, 1, and 3 μ L, and gene expression was evaluated at 12, 24, 48, and 72 h after treatment. The strongest gene-silencing effect was observed at the 3 μ L dose. Subsequent behavioral assays using a Y-tube olfactometer showed that silencing SsORS5 markedly reduced host attraction, whereas knockdown of SsGRIN2B and SsPDE8A produced comparatively moderate effects. These findings suggest that the three genes contribute to host-finding behavior through different aspects of olfactory and neural regulation. Overall, the results indicate that insecticide-induced changes in gene expression may interfere with the sensory and neural mechanisms involved in host location and provide further evidence for the potential use of behaviorally important genes as targets in RNAi-based parasitoid-pest management strategies.

CBGP-16

Environmental Pollution

Toxicology

SPATIAL VARIATIONS OF MICROPLASTICS IN DIFFERENT ENVIRONMENTAL MATRICES OF NULLAH BEIN, SHAKARGARH, PAKISTAN**Zunaira Afzal¹, Gulzaman William² and Abdul Qadir^{1*}**¹*College of Earth and Environmental Sciences, University of the Punjab, Lahore*²*Department of Environmental Sciences, University of Gujrat, Gujrat.*

Corresponding Author: aqadir.cees@pu.edu.pk

Plastic pollution is a crucial challenge for global environment because of less expense, long-lasting, durable and diverse nature. Microplastics (MPs) are the invisible particles produced as a result of plastic degradation causing complications and disrupting the ecological integrity of ecosystems and retains in sediments, biota for longer time. In the present study, dispersal and presence of MPs in sediments, water and fishes of Nullah Baen: a tributary of Ravi River was investigated. For this purpose, Water (n=8), sediments (n=8) and fish (n=19 species) from eight different sites of Nullah Baen were investigated for MPs assessment. The MPs were quantified under the stereomicroscope, and their polymer characterization was done by utilizing Fourier Transform Infrared (FTIR) spectroscopy. Sediments contained higher MPs content (280–930 MPs/kg DW) than water (11.5 - 49.7 MPs/m³) and fish (0.24–7.79MPs/individual). In fish, the highest concentration of the microplastics was found in *Puntis chola* (6.96±4.00MPs/individual). Overall MPs were reported from all sites with a consistent pattern viz; Fibers > Fragments > sheets, whereas Polyisobutylene (PIB) and polypropylene (PP) and polyethylene terephthalate (PET) were the major polymers found in stream waters. In sediments, PIB, PE, PET and PP were studied in sediments, whereas gastrointestinal tract of fish exhibiting polymers like PET and polyvinyl stearate. The PET and PP polymers were found to be dominant in all samples. These findings demonstrate spatial pattern variations in MP pollution, driven by anthropogenic activities, were considered as major source of MPs pollution and hydrodynamic processes of the stream may be responsible for spatial variations.

CBGP-17**INFLAMMATORY CHANGES IN THE SMALL INTESTINE IN MOUSE FILIAL GENERATIONS EXPOSED TO BISPHENOL S****Maryam Latif*, Hooriya Fatima, Sadia Noreen, Hussna Ahmad and Nadeem Sheikh***Institute of Zoology, University of The Punjab, Lahore***Corresponding Author: maryamlatif00165@gmail.com*

Bisphenol S (BPS) has been used as an alternative to bisphenol A (BPA) and thus increased BPS exposure in human beings. Since BPS comes into direct contact with small intestine contents, it is vulnerable to the toxic effects of BPS. The current study evaluated the histopathological changes and protein expression in Albino mice with transgenerational effects. Mice were administered 40, 400, and 1000 µg/kg/day of BPS orally for 15 days. For histopathological analysis and determination of protein profile changes through spectrophotometry and SDS-PAGE, experimental and control groups were compared. BPS exert dose-dependent changes in the protein profile and morphology of the small intestine. 37, 54, and 18 kDa proteins were upregulated in all exposed groups. While the proteins of 80 and 150 kDa were mainly found in the highest-dose parent and filial groups, showing dose-dependent effects.

CBGP-18**Public health****Animal feed****EFFICACY OF INDIGENOUS MYCOTOXIN BINDERS IN ENHANCING LIVESTOCK FEED SAFETY AND PUBLIC HEALTH PROTECTION IN PAKISTAN****Aneela Zameer Durrani*, Muhammad Aftab, Sadia sanaullah,
Muhammad Usman and Muhammad Rizwan***Department of Veterinary Medicine, University of Veterinary and Animal Sciences, Lahore***Corresponding Author: aneela@uvas.edu.pk*

Mycotoxin contamination in livestock feed is a critical challenge in Pakistan's hot, humid climate, where maize, wheat, and cottonseed cake are prone to fungal growth. Aflatoxins, deoxynivalenol (DON), and zearalenone reduce animal productivity and compromise food safety. Mycotoxin binders offer a practical mitigation strategy, indirectly protecting human health by lowering toxin residues in milk, meat, and eggs. Feed trials were conducted in poultry and dairy systems across Punjab and Sindh. Broiler diets were supplemented with 0.5–1% bentonite, while dairy rations incorporated hydrated sodium calcium aluminosilicates (HSCAS). Combination binders integrating clay minerals with yeast cell wall glucomannans were also evaluated. Adsorption efficiency was measured under simulated rumen and intestinal conditions, alongside performance indicators such as feed conversion ratio (FCR), milk yield, and toxin residue levels. Bentonite inclusion in broiler diets improved FCR and reduced liver aflatoxin residues, achieving 85–95% binding efficiency. HSCAS supplementation in dairy cows lowered aflatoxin M1 residues

in milk by 60–70%, meeting international safety thresholds. Combination binders demonstrated broader efficacy, adsorbing 70–85% of multiple toxins including DON, zearalenone, and ochratoxin, while supporting gut health. The high montmorillonite content of Pakistani bentonite contributed to superior adsorption capacity. Indigenous bentonite and HSCAS binders are effective, low-cost solutions for reducing mycotoxin burden in Pakistan's livestock systems. Their routine inclusion, particularly during monsoon months, combined with improved storage and ensiling practices, enhances productivity and ensures compliance with food safety standards. These findings support integration of binder use into national feed safety and livestock development programs.

CBGP-19**Biotechnology****EVALUATION OF CONOCARPUS A NOVEL HOST PLANT FOR LAC CULTURE: AN INNOVATIVE OPPORTUNITY FOR MARGINAL-LAND UTILIZATION BY LAC PRODUCTION FOR SUSTAINABLE DEVELOPMENT OF FARMS IN PAKISTAN**

Arshed Makhdoom Sabir*, Najaf Awais, Qurban Ali and Humaira Malik

Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad

*Corresponding Author: aneela@uvas.edu.pk

Lac culture, based on the commercial production of natural lac resin by the lac insect *Kerria lacca* (syn. *Laccifer lacca*), represents an important yet underutilized opportunity for diversification of Pakistan's agricultural economy. Despite its high-value resin, wide industrial applications and potential to generate income for rural communities, lac culture remains largely neglected as a commercial cottage industry in Pakistan. The availability of suitable host plants is one of the major factors determining the expansion and sustainability of lac production. The present findings propose the evaluation and scientific reporting of *Conocarpus* spp. as a potential novel host plant for lac insect cultivation, with particular emphasis on its adaptability, abundance, growth characteristics and suitability for supporting lac insect establishment and resin production. The study systematically evaluates lac insect inoculation, settlement, survival, growth, resin encrustation, crop duration, yield and quality on *Conocarpus* in comparison with established lac hosts such as Ber, Dhak and other locally suitable species. Host plant characteristics, insect population development and environmental factors also evaluated to determine the biological and economic feasibility of the host. This study foreseen as an innovative host-plant diversification initiative for revival and modernization of lac culture in Pakistan. Scientific validation of *Conocarpus* as a suitable lac host could substantially expand the available host-plant base, facilitate large-scale demonstration and farmer adoption, and provide a foundation for future commercial lac production, processing and value-chain development. This finding assesses whether an abundant and readily accessible tree resource can be transformed into a high-economic-value biological enterprise, strengthening rural livelihoods while promoting sustainable agriculture, tree-based production and Pakistan's indigenous lac industry.

CBGP-20
Biotechnology

***PARAMECIUM* AS A MICROBIAL CELL FACTORY FOR POLYHYDROXYALKANOATE (PHA) BIOPLASTIC PRODUCTION UNDER NUTRITIONAL AND HEAVY METAL STRESS**

Itrat Zahra^{*1}, Awais Ibrahim¹, Ayesha Liaqat¹, Bushra Muneer², and Farah Rauf Shakoori¹, Abdul Rauf Shakoori³

¹*Institute of Zoology, University of the Punjab, Lahore*

²*Institute of Industrial Biotechnology, Government College University, Lahore*

³*School of Biological Sciences, University of the Punjab, Lahore*

*Corresponding Author: itrat.phd.zool@pu.edu.pk

Synthetic plastics pose severe environmental threats due to their persistence and resistance to natural degradation. Biodegradable alternatives such as polyhydroxyalkanoates (PHAs) offer promising solutions for sustainable bioplastic development. The present study consolidates findings from two investigations employing ciliate protists, *Paramecium multimicronucleatum* and *Paramecium caudatum*, as novel microbial cell factories for PHA biosynthesis under varying nutritional and heavy metal stress conditions. Cultures were grown in Bold Basal medium supplemented with glucose (180 g/L), cadmium chloride (10 g/L), or lead nitrate (23.1 g/L) alongside unsupplemented controls. PHA extraction was performed at 24, 48, and 72 h intervals. In *P. multimicronucleatum*, the highest yield of 0.28 g/L was recorded in glucose-supplemented medium, whereas in *P. caudatum*, lead nitrate stress induced the highest PHA production of 4.8 g/L at 24 h, substantially exceeding both glucose-supplemented (3.8 g/L) and control (1.8 g/L) cultures. Intracellular PHA granules were confirmed via Sudan Black B and Nile Blue A staining. FTIR and GC–MS characterization identified 3-hydroxybutyrate as the dominant monomer, with structural profiles consistent with poly (3-hydroxybutyrate) (PHB), alongside medium-chain-length PHA components. SEM imaging revealed a porous, pseudospherical polymer morphology. These findings collectively establish *Paramecium* spp. as a novel and versatile platform for biopolymer production, with dual relevance to bioplastic manufacturing and heavy metal bioremediation, underscoring the biotechnological value of stress-responsive PHA accumulation in ciliate protists.

CBGP-21
Physiology

STUDY ON THE EFFECTS OF GARLIC SUPPLEMENTS ON ACTIVITIES OF LIVER AND KIDNEY OF BROILER CHICKEN

Safdar Ali Ujjan*, Saheba Bozdar, Faiza Asghar, Kiran Naz Sahito and Abdul Samad Solangi

Department of Zoology, Shah Abdul Latif University, Khairpur

Correspondence: safdar.ujjan@salu.edu.pk

The global poultry sector's rapid expansion faces significant challenges regarding metabolic stress and the restricted use of synthetic growth promoters. This study investigated the efficacy of garlic as a phytochemical additive to enhance the hepatic and renal health of broiler chickens under local field conditions. Ten 15-day-old broiler chicks were randomly divided into a control group receiving basal feed and a treated group supplemented with raw garlic pieces. The experimental period lasted until day 35, followed by laboratory analysis of serum samples collected on day 36 via cardiac puncture for biochemical evaluation. Results

indicated that garlic supplementation positively influenced growth performance and metabolic stability. The garlic-treated group exhibited a notable reduction in serum liver enzymes compared to the control: Alanine Aminotransferase (ALT) was 38 vs. 42 U/L, Aspartate Aminotransferase (AST) was 195 vs. 210 U/L, and Alkaline Phosphatase (ALP) was 300 vs. 320 U/L. Furthermore, kidney function biomarkers showed similar improvements, with the treated group demonstrating lower levels of creatinine (0.76 vs. 0.82 mg/dL), urea (16 vs. 18 mg/dL), and uric acid (5.9 vs. 6.5 mg/dL). These findings suggest that garlic's bioactive organosulfur compounds, particularly allicin, provide hepatoprotective and nephroprotective effects by reducing oxidative damage and enhancing nutrient metabolism. Although growth improvements were moderate due to initial flock health and field conditions, the consistent stabilization of organ biomarkers highlights garlic's potential as a sustainable, cost-effective alternative to synthetic additives. The study concludes that moderate garlic inclusion promotes metabolic resilience and internal organ health in intensive production systems while simultaneously ensuring safety, consumer confidence, and improved bird welfare.

CBGP-22

Cell & Molecular Biology/
Genetics

MOLECULAR GENETIC INSIGHTS INTO HEREDITARY DISORDERS IN THE SOUTHERN KASHMIRI POPULATION

Ansar Ahmed Abbasi^{1,2}, Madiha Shadab¹, Saiqa Khushal¹, Rabiah Shoukat¹, Nadine Krämer,³ Na Li⁴, Tauqeer Ahmed¹, Rameez Nisar¹, Sundas Farooq¹, Lena-Luise Becker⁴, Xiang Fang⁴, Hao Hu,⁴ Barbara Vona⁵, Henry Houlden⁶, Reeza Morifan⁶, Zubair M Ahmed⁷ and Angela M. Kaindal³

1Department of Zoology Mirpur University of Science and Technology, Mirpur-10250

2Department of Zoology University of Azad Jammu and Kashmir Muzaffarabad-13100

3Institute of Cell Biology and Neurobiology and Center for Chronically Sick Children (SPZ), Charité – Universitätsmedizin Berlin, Augustenburger Platz 1, 13353 Berlin, Germany

4Laboratory of Medical Systems Biology, Guangzhou Women and Children's Medical Center, Guangzhou Medical University, Guangzhou, 510623, China

5Institute for Auditory Neuroscience & Inner Ear Lab, University Medical Center Göttingen

6 Department of Neuromuscular Diseases, Institute of Neurology, UCL UK.

7Department of Otorhinolaryngology-Head & Neck Surgery School of Medicine, University of Maryland USA.

*Corresponding Author: ansar.abbasi@ajku.edu.pk

AJ&K (Azad Jammu and Kashmir), nestled in the picturesque Himalayas, is a region of breathtaking beauty and rich cultural heritage. Governed by its own president and prime minister, it enjoys semi-autonomous status within Pakistan. The southern districts of Azad Kashmir include Bhimber, Kotli, and Mirpur. We assessed patients from multiple consanguineous families from Southern Districts of AJK, exhibiting non-syndromal intellectual disability postnatal microcephaly, Hearing loss Hereditary oculocutaneous albinism. With whole exome sequencing (WES) followed by Sanger sequencing and cosegregation analysis. WES analysis identified novel candidate genes, novel mutations in known genes linked with genetic disorders and previously reported mutations in known genes. Thus, our study expands the phenotypic spectrum of the genes linked with hereditary disorders in Kashmiri Population and hence contributed towards better understanding of mechanisms involved in these genetic disorders.

START OF FEE NOT PAID

CBGP-23Public health
Toxicology**MILK QUALITY UNDER THREAT:
A STUDY ON ADULTERATION AND PUBLIC AWARENESS****Umama Pervaiz¹, Beenish Shahid^{1*} and Muhammad Ijaz Khan²**¹*Department of Zoology, King Abdullah Campus, University of Azad Jammu and Kashmir, Muzaffarabad*²*Department of Livestock and Dairy Development, Azad Jammu and Kashmir, Muzaffarabad**Corresponding Author: beenish.shahid@uajk.edu.pk

Milk adulteration is a major public health concern, compromising nutritional quality and posing serious health risks. In Azad Jammu and Kashmir (AJK), data on retail milk adulteration are scarce. This study aimed to detect common adulterants in cattle and buffalo milk sold in Muzaffarabad and Jhelum Valley, compared physicochemical attributes of adulterated with pure milk, and assess consumer awareness of milk adulteration and its health effects. A total of 395 retail milk samples were analyzed at the Milk Testing Laboratory of the Livestock and Dairy Development Department for the presence of water, neutralizers, detergents, cane sugar, skim milk powder, hydrogen peroxide, and formalin. Physicochemical parameters, including fat content, solids-not-fat (SNF), and lactometer readings, were measured against pure milk standards. Additionally, a survey was conducted to evaluate knowledge and awareness of milk adulteration. Results revealed widespread adulteration: in Muzaffarabad, 78% of samples were diluted with water, followed by neutralizers (5.0%), cane sugar (2.5%), detergents (2.1%), skim milk (1.8%), hydrogen peroxide (0.7%), and formalin (0.3%). Jhelum Valley exhibited lower rates: water (37%), neutralizers (1.7%), and detergents (0.8%). Physicochemical analysis indicated significantly reduced fat, solids-not-fat (SNF), and lactometer readings in adulterated samples compared to pure milk ($P < 0.0001$), evidencing nutritional dilution. Consumer survey ($n=290$) revealed universal awareness of milk adulteration but limited knowledge of chemical adulterants (urea: 3.4%, starch: 10.3%, detergent: 6.2%), health risks (31%), and detection methods (lactometer: 17%; >65% unfamiliar). A moderate preference for certified brands (62%) was noted. Widespread adulteration and poor detection capacity mirror findings across Pakistan, where dilution with water is most common and chemical adulterants are also present. These results underscore serious public health risks and a critical need for stronger regulation, public education, and accessible detection methods.

CBGP-24

Toxicology

**INTEGRATED BIOMARKER RESPONSES AND MULTIVARIATE
ASSESSMENT OF POLYETHYLENE MICROPLASTICS TOXICITY IN
THE ENDEMIC FRESHWATER FISH *TOR PUTITORA*****Rehan Ullah, Shehzad Ghayyur, Shams Ul Samad, Sardar Maria Arshad*,
Shahryar Ghayyur, Rasool Shah and Sawera Arif***Department of Zoology, Hazara University, Mansehra**Corresponding Author: mariaarshad549@gmail.com

Microplastics (MPs) in freshwater environments are a significant ecological threat; however, their

toxicological impact on endemic fish species is not well documented. This study aimed to assess the hazardous effects of polyethylene microplastics (PE-MPs) on endemic freshwater fish *Tor putitora* through a comprehensive assessment of integrated biomarkers. Fingerlings of *T. putitora* were exposed to PE-MPs at concentrations of 0, 0.1, 1, and 10 mg/L for 15 and 30 days. The findings revealed significant changes in haemato-biochemical, antioxidant, immunological, and neurotoxic biomarkers in fish exposed to PE-MPs, which varied with time and dosage. There was a notable ($p < 0.05$) reduction in red blood cells, haemoglobin, haematocrit, and platelet counts, whereas total leukocyte counts significantly ($p < 0.05$) increased in fish subjected to PE-MPs. Moreover, the levels of total protein, triglycerides, Fe^{2+} , Na^{+} , and Cl^{-} were reduced, whereas glucose, urea, creatinine, Ca^{2+} , K^{+} , and liver enzymes (aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, and lactate dehydrogenase) were increased in the treated groups. The increase in cortisol and thyroid stimulating hormone levels, coupled with a decline in triiodothyronine, thyroxine and insulin levels, suggests that PE-MPs cause stress in fish. Oxidative stress induced by PE-MPs was demonstrated by decreased catalase, superoxide dismutase, elevated malondialdehyde, and glutathione activities in both gill and liver tissues. The immunological response in fish exposed to PE-MPs is enhanced through the induction of nitric oxide, respiratory burst, and lysozyme activity. Additionally, exposure to PE-MPs reduced acetyl cholinesterase activity, underscoring the neurotoxic effects associated with PE-MPs. Correlation matrix and principal component analyses were employed to explore inter-biomarker relationships and to visualize treatment-specific clustering of responses. The findings indicate that particulate plastic pollution exerts harmful effects on fish, which may subsequently impact human health through the food chain. Future work should aim to enhance plastic waste control and strengthen pollution regulations in freshwater systems, particularly those supporting endemic fish species. Research should examine long-term effects of MPs and interactions with other pollutants like heavy metals and pharmaceuticals using omics tools and field studies.

CBGP-25
Fisheries
Toxicology

**INVESTIGATING THE SYNERGISTIC EFFECTS OF ZINC OXIDE
 NANOPARTICLES AND *ALOE VERA* POWDER ON GROWTH PERFORMANCE
 OF *LABEO ROHITA* FINGERLINGS**

**Maham Iqbal¹, Muhammad Mudassar Shahzad^{*1}, Syed Makhdoom Hussain²,
 Syed Zakir Hussain Shah³, Rana Manzoor Ahmad⁴, Dilawar Hussain⁵, Muhammad Umar¹,
 Sana Amin¹, Fatima Yasin¹ and Samahar Lodhi¹**

¹Department of Zoology, Division of Science and Technology, University of Education,
 Township, Lahore, Pakistan

²Department of Zoology, Government College University, Faisalabad, Pakistan

³Department of Zoology, University of Gujrat, Gujrat, Pakistan

⁴Department of Zoology, Government College University, Lahore, Pakistan

⁵Department of Zoology, University of Central Punjab, Lahore, Pakistan

*Corresponding Author: drmudassarshahzad@gmail.com

Increasing cost of fish meal and reducing supply over time have boosted the use of sunflower meal, although its anti-nutritional factors can harm the performance which can be overcome by functional feed additives. This study evaluated whether zinc oxide nanoparticles (ZnO-NPs) and *Aloe vera* could help

overcome these issues in *Labeo rohita* fingerlings (7–9 g) over a 70-day feeding trial. Six diets were prepared with ZnO-NPs (0, 10, 20, 30, 40, 50 mg/kg) and *Aloe vera* (0–5%), and growth, blood parameters, nutrient digestibility, mineral absorption, and body composition were assessed. Results showed that the highest supplementation level (50 mg/kg ZnO-NPs + 5% *Aloe vera*) gave the best performance, with final weight (30.66 g), weight gain (23.67 g), feed conversion ratio (1.19), specific growth rate (2.11% day⁻¹), protein digestibility (74.58%), RBCs (3.27 × 10⁶ mm⁻³), hemoglobin (8.33 g/100 ml), gross energy (2.37%), calcium (78.55%), potassium (78.55%), and phosphorus (77.24%). Overall, this combination shows strong potential for developing efficient and sustainable aquafeeds.

CBGP-26
Microbiology
Antibiotics

**ECO-FRIENDLY ANTIMICROBIALS ALTERNATIVES:
 ISOLATION OF MILK BORNE PATHOGENS AND EVALUATION OF
 HERBAL EXTRACTS VS SYNTHETIC DRUGS**

Sehrish Naz¹ and Afshan Yasmeen^{*1,2}

¹Department of Zoology, Jinnah University for Women, Karachi

²Centre of Excellence in Marine Biology University of Karachi, Karachi-75270

*Corresponding Author: afshan.yasmeen@juw.edu.pk, afshan968@hotmail.com

Milk is a vital component that provides all the nutrients to the human body. It is valued for its essential components such as protein, vitamins, and minerals. Numerous bacteria and significant sources of food-borne diseases can be found in milk. Multidrug-resistant pathogens have been produced due to the overuse of antibiotics that impairing various challenges on human health. In this regard, searching for an alternate and safe natural source from plant such as herbal remedies and bioactive substances derived from plant offers safe solutions. Plant extract contains various bioactive compounds having antimicrobial and therapeutic potential that can serve as alternative to synthetic drugs. This research aims to evaluation of different extracts of *Nepeta glutinosa Benth.* against pathogenic bacterial strains. Three different solvents were used for the preparation of extract of *N. glutinosa Benth.* Initial antibacterial activity was performed using disc diffusion method different concentration of each three extracts and two synthetic drugs were tested against pathogenic bacteria. Two Gram positive (*Staphylococcus aureus* and *Streptococcus sp.*) and two Gram negative (*Escherichia Coli* and *P. aeruginosa*) were identified. The antibacterial activity was performed against four isolated strains. Results revealed that all extracts potential active against different bacteria in a dose dependent manner. Among these hexane extract found highly active against all isolated pathogens followed by methanol extracts. The chloroform extract was found less active as compared to standard drugs. Research study suggests that the *N. glutinosa Benth.* Herb has a potential to combat pathogenic bacteria that are responsible for various diseases in human such as bovine mastitis, skin infection, pneumonia and diarrhoea etc, these finding suggest that plant is a significant natural alternative for drugs. Further purification and chemical analysis are necessary to enhance their efficacy.

CBGP-27**Public Health****Herbal Medicine****SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES AND THEIR APPLICATION IN ENVIRONMENTAL REMEDIATION****Fabah Bashir¹ and Afshan Yasmeen^{*1,2}**¹*Department of Zoology, Jinnah University for Women, Karachi*²*Centre of Excellence in Marine Biology University of Karachi, Karachi-75270**Corresponding Author: afshan.yasmeen@juw.edu.pk, afshan968@hotmail.com

Nanotechnology is the new gateway in science for development of new products at nanoscale. However, standard physicochemical synthesis causes environmental and health risk, therefore there is a need looking for harmless and greener alternatives. There are three methods to make nanoparticles: physical methods, chemical methods and biological methods. Biological synthesis methods are gaining attraction due to its ecofriendly nature, cost effective and highly productive. Nanoparticles are of substantial attention because of their diverse applications. These are widely used in cosmetics, biomedical and pharmaceutical industries and for bioremediation purposes in the environment. The primary objective of this study is to investigate their application against catalytic degradation of dyes. A green synthesis method for the formation of silver nanoparticles using herb aqueous extract was explored. The formation of silver nanoparticles was confirmed indicated through the colour change of mixture. The biosynthesized nanoparticles were characterized using UV- visible spectroscopy. The absorbance was taken at wavelengths range from 200-700nm at 0 min, 15, 30, 45, 60 minute and after 24h during reaction. The synthesized Ag-NPs were also subjected to photo catalytic activity. This activity was conducted by the photo degradation of carcinogenic dye. These nanoparticles found efficient in degrading carcinogenic dye, underlining their potential in environmental remediation. This approach is adaptable for various industrial applications as well as cost effective and environmentally friendly.

CBGP-28**Cell & Molecular Biology****GENOMIC INSIGHTS INTO THE EVOLUTIONARY HISTORY AND CONSERVATION OF THE ENDANGERED INDUS RIVER DOLPHIN (*PLATANISTA MINOR*)****Aamir Ibrahim^{*1}, Simin Chai², Cuijuan Zhong¹, Kang Jieqiong¹, Ahsaan Ali¹, Sajjad Hussain^{1,3}, Hassan Ali³, Tanveer Hussain⁴, Umer Waqas⁵ and Guang Yang^{1,2}**¹*Jiangsu Key Laboratory for the Biodiversity Conservation and Sustainable Utilization in the Middle & Lower Reaches of the Yangtze River Basin, College of Life Sciences, Nanjing Normal University, Nanjing, China*²*Southern Marine Science and Engineering Guangdong Laboratory Guangzhou, Guangdong, China*³*Wildlife and Parks Department, Lahore, Punjab, Pakistan*⁴*Department of Biological Sciences, Virtual University of Pakistan, Islamabad*⁵*Virtual University of Pakistan, Lahore**Corresponding Author: aamiribrahim9@gmail.com

The Indus River dolphin (*Platanista minor*) is one of the world's most endangered freshwater cetaceans,

with its distribution restricted to the Indus River system. Understanding its genomic architecture is essential for elucidating evolutionary adaptations and informing long-term conservation strategies. In this study, we generated and characterized a draft whole-genome assembly using Illumina short-read sequencing and performed comparative genomic, phylogenetic, and demographic analyses. The assembled genome enabled the identification of genes and gene families associated with freshwater adaptation, including signatures of selection related to immune function, skin differentiation, and sensory evolution. Phylogenomic analyses supported the basal evolutionary position of *Platanista* among extant river dolphins and estimated its divergence from the common ancestor of Delphinidae and Lipotidae at approximately 31.2 million years ago. Demographic reconstruction revealed a pronounced historical population bottleneck during the Late Pleistocene (approximately 40–20 thousand years ago), while genome-wide heterozygosity was remarkably low (0.0218%), indicating reduced genetic diversity likely resulting from historical climatic events compounded by recent anthropogenic habitat fragmentation. These findings provide the first comprehensive genomic perspective on the evolutionary history and adaptive mechanisms of the Indus River dolphin and establish an important genomic resource for future conservation genetics, population monitoring, and management of this endangered freshwater species.

CBGP-29
Public health

**EPIDEMIOLOGICAL STUDY OF INFERTILITY AMONG WOMEN
IN MUZAFFARABAD, AZAD JAMMU & KASHMIR**
Sobia Alam¹, Beenish Shahid^{1*} and Muhammad Ijaz Khan²

¹*Department of Zoology, King Abdullah Campus,
University of Azad Jammu and Kashmir, Muzaffarabad, 13100 Pakistan*

²*Department of Livestock and Dairy Development,
Azad Government of the State of Jammu and Kashmir, Muzaffarabad, 13100 Pakistan*

*Corresponding Author: beenish.shahid@uajk.edu.pk

A major reproductive problem that impacts women worldwide, infertility is influenced by a number of biological, lifestyle, and sociodemographic factors. Determining the prevalence, etiological factors, hormonal profile, and reproductive health awareness of infertile women in District Muzaffarabad was the aim of the current study. Descriptive statistics and Chi-square tests were used to analyze data on the type of infertility, age distribution, education level, body mass index (BMI), hormonal profile, menstrual cycle pattern, psychological stress, etiological factors, sensitivity to ovulation, consanguinity, and contraception in a sample of 515 infertile women of reproductive age. The percentage of primary and secondary infertility was 62.9% and 37.1%, respectively with a significant relationship between age and type of infertility ($p = 0.003$). The largest percentage of infertile women was recorded as the 2630 years age group. The prevalence of overweight status was high (56.1%), and age was significantly related to overweight status ($p = 0.016$). Polycystic ovarian syndrome (PCOS) was the leading cause of infertility (58%), followed by endometriosis (19.2%), fibroids (9.9%), and tubal obstruction (6.7%). There was a significant relationship between age and aetiology of infertility ($p < 0.001$). Overall, these findings suggest that Luteinizing Hormone (LH), Follicle Stimulating Hormone (FSH), Anti-Müllerian Hormone (AMH), and progesterone levels are

significantly associated with age ($p < 0.05$), highlighting their important role in age-related reproductive dysfunction, while **prolactin and thyroid hormones showed no significant age-wise variation**. Menstrual irregularities were very common (84.3%) and differed considerably among the different age groups ($p = 0.007$). The percentage of respondents who had stress related to infertility was very high (68.7%), and age had a significant positive influence ($p < 0.001$). In terms of reproductive health awareness, 71.3% of women were aware of ovulation, 47.9% had knowledge on consanguinity, and 49.5% reported the use of contraceptives which all had significant relationships with age ($p < 0.05$). In summary, the findings indicate that sexual infertility in Muzaffarabad is directly linked to hormonal imbalance, notably PCOS, as well as lifestyle-related concerns (overweight, psychological stress and menstrual cycles). Enhancement of reproductive health education and early screening of hormones and management of lifestyle can play a role in enhancing fertility among this group of people.

CBGP-30

Cell and Molecular Biology

BASED DNA BARCODING AND MOLECULAR CHARACTERIZATION OF TWO *HIEROGLYPHUS* SPECIES (ORTHOPTERA: ACRIDIDAE) FROM SINDH

Muzamil Ali Jakhrani, Riffat Sultana and Santosh Kumar

Department of Zoology, University of Sindh, Jamshoro, Pakistan

Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

*Corresponding Author: muzamilali637@gmail.com; riffat.sultana@usindh.edu.pk

Accurate identification of grasshopper species is essential for taxonomic studies and effective pest management. The present study was conducted to investigate the molecular identification and phylogenetic relationships of *Hieroglyphus oryzivorus* Carl, 1916 and *Hieroglyphus banian* (Fabricius, 1798) using DNA barcoding. A standardized region of the mitochondrial cytochrome c oxidase subunit I (COI) gene was used for molecular characterization and species confirmation. The obtained COI sequences were analyzed and compared to assess genetic divergence and phylogenetic relationships between the two species. DNA barcode analysis successfully differentiated *H. oryzivorus* from *H. banian*, supporting their identification as genetically distinct species. Phylogenetic analysis showed clear separation of the two species into distinct lineages, demonstrating the usefulness of the COI marker for resolving closely related members of the genus *Hieroglyphus*. The molecular findings also supported morphological identification and provided additional evidence for species-level discrimination. The study highlights the effectiveness of DNA barcoding as a reliable supplementary tool for the identification, molecular characterization, and assessment of genetic relationships among economically important grasshopper species. The generated barcode information may also contribute to improving molecular reference databases for *Hieroglyphus* and facilitate future taxonomic, ecological, and pest-management studies.

CBGP-31

Cell and Molecular Biology

SPECIES IDENTIFICATION OF MARINE FISHES WITH DNABARCODING FROM GWADAR, BALOCHISTAN PAKISTAN**Rabia Kausa¹, Asmatullah Kakar^{*1}, Mohammad Shafi² and Faiz Mohammad**¹Department of Zoology, University of Balochistan, Quetta-87300, Pakistan²Lasbella University of Agriculture, Water and Marine Sciences, Uthal-90150, Pakistan³Center of Excellence in Marine Biology, University of Karachi-75270, Pakistan* Corresponding author at: asmardanzai@yahoo.com

For molecular identification of species, DNA barcoding is used as a reliable tool for new species confirmation. For this purpose, mitochondrial DNA cytochrome c oxidase subunit (CO1) gene is widely used for assessing the marine fish species biodiversity and geographical distribution. The present study was aimed to evaluate the genetic diversity of marine ray-finned fish, *Scolopsis taeniata* (Cuvier 1830) (Black streaked monocle bream) from the coast of Gwadar Balochistan. One hundred (100) specimens of *S. taeniata* were collected. Of these, 40 specimens (40%) were morphologically identified. DNA extraction process was done individually, molecularly identified specimens (4/40, 10%) were subjected to the PCR for their authentic identification by using the regular phenol chloroform method. The BLAST analysis of obtained sequences (PP594435, PP594436, PP594437 and PP594897) showed base pair length from 633 to 660. *S. taeniata* showed 99.35 % to 100% identity with related sequences and clustered phylogenetic with their corresponding sequences reported from Bangladesh, Taiwan, Indonesia, Philippines, Singapore and Iraq. *Scolopsis taeniata* species were first molecularly identified from Gwadar, Balochistan. Our result showed that DNA barcode is an accurate, significant and authentic approach in the molecular and phylogenetic study of fish species from the coast of Gwadar, which will be supportive in establishing the DNA barcoding library and genetic diversity of marine fishes in the World. DNA barcoding shall also enhance in forthcoming struggles to attain improved observing of protection and organization of fishes at Gwadar.

CBGP-32

Cell and Molecular Biology

ANALYSIS OF SOME NEWLY RECORDED DIPTEROUS SPECIES (DIPTERA) BASED ON MOLECULAR AND MORPHOLOGICAL CHARACTERS**Qiaser Khan¹, Asmatullah Kakar^{*1} and Zafar Ullah²**¹Department of Zoology, University of Balochistan, Quetta-87300, Pakistan²Department of Zoology, University of Loralai, Balochistan, Pakistan* Corresponding author at: asmardanzai@yahoo.com

The present study describes some insect fauna species recorded first time from agro-ecosystem of Ziarat Balochistan using DNA barcoding technique DNA barcoding was used to explore species diversity of dipterous insects and their distribution in the study area. Samplings were carried out between December 2023 to December 2024 using a Malaise trap. This process involved sequencing the 658 bp Cytochrome

Oxidase I (COI) gene. The family Syrphidae showed the highest representation comprising two genera and two species. The families like the Anthomyiidae, Calliphoridae, Chironomidae, Muscidae, Polleniidae, Sarcophagidae and Tachinidae were represented by only one genus and one species. A unique Barcode Index Number (BIN) was allotted to Tachinidae species i.e. *Gornia ornata*. The results showed that barcoding through cytochrome oxidase I is an effective approach for the accurate identification and genetic studies of Diptera species. This discovery points out the significant diversity of this insect order in study region. Moreover, a comprehensive list of other Diptera species remains hard to find because of difficulties in differentiating them, based on morphology and a lack of professional entomological knowledge.

CBGP-33

Herbal Medicine

**PLANT SECONDARY METABOLITES IN CANCER DRUG DISCOVERY:
AN INTEGRATED IN-SILICO APPROACH TO TARGET IDENTIFICATION,
MOLECULAR INTERACTION, AND THERAPEUTIC POTENTIAL**

Muhammad Jabbar^{1*}, Muhammad Younus¹ and Elena Germanovna Kovaleva¹

¹Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia

****Corresponding Author: mjabbarphd@outlook.com**

Cancer remains a major global health challenge, highlighting the need for novel therapeutic agents with improved efficacy, selectivity, and safety. Plant secondary metabolites constitute a structurally diverse reservoir of bioactive compounds with considerable potential for anticancer drug discovery. This study employed an integrated *in-silico* approach to systematically investigate the therapeutic potential of selected plant-derived secondary metabolites against cancer-associated molecular targets. The computational workflow incorporated target identification, molecular docking, interaction profiling, drug-likeness evaluation, pharmacokinetic and toxicity prediction, and, where applicable, molecular dynamics simulations and binding free-energy analysis. Molecular docking was used to characterize ligand–target interactions, binding affinity, and critical amino-acid residues involved in molecular recognition, while pharmacokinetic and toxicity analyses were performed to assess the drug-development potential of the prioritized compounds. Comparative computational assessment enabled the identification of promising phytochemicals exhibiting favorable target binding, physicochemical characteristics, and predicted pharmacological profiles. The integrated findings provide mechanistic insights into the potential anticancer activities of plant secondary metabolites and demonstrate the utility of computational approaches for accelerating early-stage natural-product drug discovery. The identified candidates may serve as molecular scaffolds for further anticancer drug development and experimental validation. However, the *in-silico* predictions remain hypothesis-generating and require confirmation through biochemical, cellular, and *in-vivo* studies before therapeutic translation.

CBGP-34

Herbal Medicine

**PROTECTIVE EFFECTS OF *VALERIANA JATAMANSI* ROOTS EXTRACT
AGAINST AGE-RELATED OVARIAN DECLINE THROUGH MODULATION
OF NRF2, CASPASE-3, AND BCL-2**

Mehwish Iqbal^{1*}, Dr. Kamran Ullah¹, Khadima¹ and Muhammad Younus^{2*}

¹*Department of Biology, Faculty of Biological & Biomedical Sciences,*

The University of Haripur, Haripur, Khyber Pakhtunkhwa, Pakistan.

²*Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*

*Corresponding Author: mehwishlqbal366@gmail.com

Age-related decline in ovarian function is a major contributor to female infertility and is closely associated with increased oxidative stress, impaired antioxidant defense, excessive apoptosis, and progressive depletion of ovarian follicles. *Valeriana jatamansi*, a medicinal plant rich in bioactive compounds, represents a promising natural approach for protecting ovarian function during reproductive aging. This study investigated the protective effects of *V. jatamansi* methanolic root extract on age-related changes in ovarian Nrf2, Caspase-3, and Bcl-2 protein expression and ovarian follicular architecture in female mice. Roots of *V. jatamansi* were collected from Swat, Khyber Pakhtunkhwa, shade-dried, powdered, and extracted using methanol. Female mice were divided into young control, aged control, aged + low-dose *V. jatamansi* (250 mg/kg), aged + high-dose *V. jatamansi* (500 mg/kg), and standard drug-treated groups. Treatments were administered five times per week for four weeks. Western blot analysis was performed to evaluate ovarian Nrf2, Caspase-3, and Bcl-2 protein expression, while histological examination was conducted to assess primordial, primary, secondary, and antral follicles. Aging markedly reduced Nrf2 and Bcl-2 expression and increased Caspase-3 expression, accompanied by substantial follicular depletion. In contrast, *V. jatamansi* treatment enhanced Nrf2 and Bcl-2 expression, reduced Caspase-3 expression, and preserved ovarian follicles, with the high-dose treatment showing pronounced protective effects. These findings indicate that *V. jatamansi* may protect aged ovarian tissue by strengthening antioxidant defense, reducing apoptosis, and maintaining follicular integrity. The study highlights the potential of *V. jatamansi* as a natural candidate for further investigation in the management of age-related ovarian dysfunction and preservation of female reproductive potential.

CBGP-35

Herbal Medicine

**COMPARATIVE ANALYSIS OF FSH, LH AND OVARIAN ANTIOXIDANT ENZYMES
BETWEEN AGED AND YOUNG FEMALE MICE: ASSESSING THE
REPRODUCTIVE BENEFITS OF *VALERIANA JATAMANSI***

Khadima^{1*}, Kamran Ullah¹, Mehwish Iqbal¹ and Muhammad Younus^{2*}

¹*Department of Biology, Faculty of Biological & Biomedical Sciences,*

The University of Haripur, Haripur, Khyber Pakhtunkhwa, Pakistan

²*Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*

*Corresponding Author: myounuskhan636@gmail.com

Female reproductive function declines with advancing age and is associated with disturbances in

gonadotropin secretion and increased oxidative stress within ovarian tissue. The present study investigated age-related changes in serum follicle-stimulating hormone (FSH), luteinizing hormone (LH), and ovarian antioxidant enzyme activities, and evaluated the potential reproductive benefits of *Valeriana jatamansi* methanolic root extract in aged female mice. Female mice were divided into five experimental groups: young control (YC), aged control (AC), aged treated with a low dose of *V. jatamansi* extract (250 mg/kg; AT-LD), aged treated with a high dose of extract (500 mg/kg; AT-HD), and aged treated with the standard drug clomiphene citrate. Treatments were administered orally five times per week for four consecutive weeks. Serum FSH and LH levels were determined using enzyme-linked immunosorbent assay (ELISA), while ovarian antioxidant defense was evaluated by measuring catalase (CAT), peroxidase (POD), and superoxide dismutase (SOD) activities. Aged control mice exhibited significant alterations in serum FSH and LH levels and marked reductions in ovarian CAT, POD, and SOD activities compared with young controls ($p < 0.001$), indicating age-associated reproductive and antioxidant disturbances. Treatment with *V. jatamansi* significantly improved serum FSH levels and enhanced the activities of CAT, POD, and SOD in aged mice compared with untreated aged controls ($p < 0.05$). These effects were more pronounced at the higher dose, demonstrating a dose-dependent response. In contrast, LH levels showed only a modest and statistically non-significant improvement following *V. jatamansi* treatment. The standard drug produced greater improvements in hormonal and antioxidant parameters than the plant extract. Nevertheless, the treated aged groups did not reach the levels observed in young controls. Overall, the findings indicate that *V. jatamansi* methanolic root extract partially improves gonadotropin regulation and strengthens ovarian antioxidant defenses in aged female mice. Its antioxidant and potential reproductive-supportive effects suggest that *V. jatamansi* may have promise as a natural candidate for mitigating age-associated ovarian dysfunction. Further molecular, histological, long-term safety, and dose-optimization studies are required to clarify its mechanisms and therapeutic potential.

CBGP-36

Cell and Molecular Biology

GENOME-WIDE IDENTIFICATION, EVOLUTIONARY ANALYSIS, AND FUNCTIONAL CHARACTERIZATION OF THE PI3K GENE FAMILY IN CHICKEN

Muhammad Mujeeb Ullah^{1*} and Muhammad Younus^{2*}

¹*Department of Breeding and Genetics, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

²*Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*

*Corresponding Author: m.mujeebullah620@gmail.com

Phosphoinositide 3-kinases (PI3Ks) are evolutionarily conserved signaling molecules that play essential roles in cell growth, survival, metabolism, immunity, development, and reproduction. Despite their biological importance, the complete genomic organization and evolutionary characteristics of the PI3K gene family in chicken remain insufficiently characterized. This study aimed to comprehensively identify and functionally characterize the PI3K gene family in chicken and investigate its evolutionary conservation across representative avian species. Genome-wide identification was performed using BLASTP and HMMER-based homology searches, followed by conserved domain, motif, gene structure, phylogenetic, subcellular localization, and duplication, selection-pressure, and mutation analyses. A total of **16 PI3K-related genes** were identified in the chicken genome, comprising catalytic and regulatory subunits belonging to Class I, Class II, and

Class III PI3Ks. Comparative phylogenetic analysis involving chicken, quail, guinea fowl, mallard duck, and swan goose revealed strong evolutionary conservation of PI3K genes, with members clustering according to their functional classes. Ten conserved motifs were identified, while conserved catalytic and regulatory domains further supported their functional classification. Gene structure analysis demonstrated variation among PI3K members but greater structural conservation within related classes. Duplication analysis identified limited duplication events, while Ka/Ks analysis indicated predominantly purifying selection, suggesting strong evolutionary constraints on these genes. Mutation analysis identified several amino acid substitutions, insertions, and deletions that may affect protein stability and function, including potentially deleterious variants in **PIK3C2G** and **PIK3CD**. Overall, this study provides a comprehensive genomic and evolutionary characterization of the chicken PI3K gene family and establishes a valuable foundation for understanding PI3K-mediated regulation of growth, immunity, metabolism, and reproductive functions in poultry.

CBGP-37

Physiology

EVALUATION OF CHITOSAN NANOPARTICLES (CSNP) AS IMMUNE ADJUVANT IN PESTE DES PETITS RUMINANTS (PPR) VACCINE

Shafeeq Ur Rehman^{1*}, Minal Hussain and Muhammad Younus^{2*}

¹Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur.

²Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia.

*Corresponding Author: shafeequrrehmanbhutta@gmail.com

Peste des Petits Ruminants (PPR) is a contagious disease that affects small ruminants worldwide, causing economic losses and food security issues. Although the Nigeria 75/1 PPR vaccine is available, improved immunization strategies, particularly for mucosal immunity, are crucial. Mucosal vaccination is a promising approach to prevent PPRV infections, as it prevents virus shedding and transmission to susceptible hosts. Accordingly, this study was designed to evaluate the immune response induced by the Chitosan nanoparticle (CSNP)-based PPR vaccine through intranasal (IN) and ocular routes in goats. The CSNP was synthesized by the Ionic gelation method, confirmed sterile by sterility test, and the CSNP-based Nigeria 75/1PPR vaccine was prepared by mixing CSNP and Nigeria 75/1PPR vaccine in equal ratios. Groups (G) G1 and G2 were administered with standard PPR vaccine through IN, and ocular routes, respectively, but G3 and G4 were administered with CSNP-based PPR vaccine also via IN and ocular routes, respectively. WBC counts peaked around Day 21 post-vaccination, reaching mean values of $14.60 (\pm 0.86) \times 10^3/\mu\text{L}$ in the group receiving the CSNP-based vaccine intranasally (G3) and $14.46 (\pm 0.55) \times 10^3/\mu\text{L}$ in the CSNP ocular group (G4), compared to lower peaks of $13.23 (\pm 0.44)$ and $13.03 (\pm 0.44) \times 10^3/\mu\text{L}$ for the local vaccine intranasal (G1) and ocular groups (G2), respectively. These elevated WBC counts were significantly higher than the unvaccinated control group (G5), which showed a mean of $8.16 (\pm 0.57) \times 10^3/\mu\text{L}$ at Day 21 ($p < 0.001$). Statistical analyses revealed significant differences between vaccinated groups and controls from Day 7 onward to Day 60 ($p < 0.05$), with the CSNP vaccine groups consistently showing stronger and more sustained responses ($p < 0.01$) compared to local vaccine groups. Antibody detection via c-ELISA further confirmed this trend, as all vaccinated groups seroconverted by Day 7 and maintained elevated antibody levels through Day 60, whereas the control group remained negative ($p < 0.001$). At day 0, all groups were

negative for c-ELISA, but a significant rise in antibodies in G2-G4, were observed except G1 that was negative with PI value of 26.0 at day 7 (G2-80.5, G3-80.5, G4-67.8), at day 21 (G1-82.8, G2-79.5, G3-87.8, G4-81.9) and day 60 (G1-78.5, G2-82.4, G3-91.7, G4-91.6) respectively. The results indicated that the CSNP-based PPR vaccine had greater cellular and humoral immune responses than the conventional vaccine and thus has the potential to offer better vaccination to goat.

CBGP-38

Public Health

EVALUATION OF ANTIBACTERIAL ACTIVITY OF BACTERIOPHAGES AGAINST RESISTANT *ESCHERICHIA COLI* (*E. COLI*) ISOLATED FROM HEALTHCARE WORKERS

Minal Hussain^{1*}, Shafeeq Ur Rehman and Muhammad Younus^{2*}

¹Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

²Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia

*Corresponding Author: minalhussain972@gmail.com

The increasing prevalence of antibiotic-resistant *Escherichia coli* (*E. coli*) in healthcare settings has become a global public health concern. Among the most significant threats posed by multidrug-resistant (MDR) bacteria is their presence in environments like hospitals, where the risk of transmission and infection is heightened. Healthcare workers, including sweepers, often act as vectors for pathogen transmission due to their frequent interaction with contaminated surfaces and equipment. Environmental samples (n=110) like mobile phones, cleaning equipment (mops), and surfaces of high-touch objects such as door handles and bed rails were collected from high-risk areas within hospitals like the Gynae ward, Urology ward, Operation theatre, and medical ward. Eosin Methylene Blue (EMB) and MacConkey agar plates were used to inoculate all of the collected samples, which were then incubated for 24 hours at 37°C. Following incubation, the plates were examined, and colonies exhibiting distinctive morphology, such as pink colonies on MacConkey agar or metallic sheen on EMB agar, were chosen and subcultured in order to isolate pure cultures. 25% (n=28) samples were *E. coli* positive and confirmed by Polymerase Chain Reaction (PCR), Gram staining, and various biochemical tests (IMViC tests), including Catalase, Indole, and Methyl Red (MR) tests, which were positive for *E. coli*. According to the Antibiotic Susceptibility Test (AST), the observed zones of inhibition (measured in millimeters) were as follows: Amikacin (7 mm), Amoxicillin (8 mm), Erythromycin (0 mm), Levofloxacin (7 mm), Streptomycin (8 mm), Enrofloxacin (0 mm), and Gentamycin (6 mm) to all isolates of *E. coli*. Isolation of DNA was performed using the chemical method with a commercial Thermo Scientific Genomic DNA extraction kit, and PCR was performed using universal primers. The presence of a strong, specific band near 1300 bp in both E1 and E2 samples indicates successful and specific amplification, while the absence of bands in the no-template control (NTC) confirms that there was no contamination in the PCR process. Bacteriophages were extracted from environmental samples (n=50) and evaluated for their ability to suppress the proliferation of resistant *E. coli* isolates using the overlay agar technique. After 24 hours of incubation at 37°C, an average plaque size of 4-6 mm and a phage titer (plaque-forming units, PFU) of approximately 1×10^8 PFU/mL, indicating strong lytic activity against the resistant *E. coli* isolates.

CBGP-39Public Health
Herbal Medicine**BIOACTIVE PEPTIDES FROM *CHLORELLA SOSROKINIANA* FOR ANTI-DIABETIC APPLICATIONS: IN VITRO EVALUATION AND NANO-ENCAPSULATION****Muhammad Younus^{1*}, Santosh Kumar² and Elena G. Kovaleva¹**¹*Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*²*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur**Corresponding Author: myounuskhan636@gmail.com

The increasing prevalence of type 2 diabetes mellitus has stimulated the search for natural bioactive compounds with potential applications in diabetes prevention and management. Microalgae represent a sustainable source of proteins and bioactive peptides with diverse physiological activities. This study focuses on the discovery and evaluation of bioactive peptides derived from *Chlorella sosrokiniana* for potential anti-diabetic applications. Microalgal biomass is processed for protein extraction and enzymatic hydrolysis to generate peptide fractions, followed by bioinformatics-assisted screening to identify promising peptide candidates. Selected peptides are evaluated for their potential inhibitory activities against key diabetes-related targets, particularly dipeptidyl peptidase-IV (DPP-IV) and α -glucosidase. In vitro assays are proposed to validate the anti-diabetic activity of the most promising peptide candidates and to establish their functional potential. Furthermore, nano-encapsulation is explored as a delivery strategy to improve peptide stability, protection, and potential bioavailability under food and physiological conditions. Nanostructured peptide formulations are characterized using appropriate physicochemical and morphological approaches to evaluate particle size, stability, and encapsulation efficiency. The integration of microalgal biotechnology, bioinformatics, in vitro validation, and nanotechnology provides a multidisciplinary strategy for developing natural peptide-based approaches for diabetes-related applications. This work highlights the potential of *C. sosrokiniana* as a sustainable source of functional peptides and demonstrates how nano-delivery systems may overcome limitations associated with the direct application of bioactive peptides. The study may contribute to the development of innovative peptide-based functional ingredients and future nutraceutical strategies targeting metabolic health.

CBGP-40Public Health
Biotechnology**GREEN EXTRACTION AND DUAL BIOACTIVITY OF SPENT COFFEE GROUNDS: ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL FOR FOOD PRESERVATION****Bouchra Ikram Adja^{1*}, Muhammad Younus^{1*}, Elena G. Kovaleva¹ and Kinan Darkazanli¹**¹*Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia**Corresponding Author: ikramadja7@gmail.com

The global coffee industry generates approximately 6–8 million tons of spent coffee grounds (SCG)

annually, most of which are disposed of in landfills, contributing to methane emissions, groundwater pollution, and resource loss. However, SCG contains valuable bioactive compounds, including phenolic acids, flavonoids, caffeine, and melanoidins, which possess antioxidant and antimicrobial properties and may serve as natural food preservatives. This study investigated green extraction strategies for SCG valorization using ultrasound-assisted extraction (UAE) and natural deep eutectic solvent (NADES) extraction. UAE was performed using 50% aqueous ethanol at 68°C for 90 min, a 1 :40 solid-to-liquid ratio, and 4000 W ultrasound power. NADES extraction employed choline chloride (1 :2 molar ratio) with 20% water at 65°C for 120 min, using a 1 :20 solid-to-liquid ratio and 70% NADES concentration. Extracts were evaluated for total phenolic content (TPC), total flavonoid content (TFC), antioxidant activity using DPPH and ABTS assays, and antimicrobial activity against *Escherichia coli* and *Salmonella* spp. UAE and NADES extracts showed high TPC values of 537 and 524 mg GAE/g extract, respectively ($p > 0.05$), while TFC reached 51.2 mg CE/g extract. Both extracts exhibited dose-dependent antioxidant activity, with strong correlations between TPC and DPPH activity ($R = 0.94$, $p < 0.001$). SCG-NADES extracts produced inhibition zones of 11.6–13.3 mm against *E. coli* and 13.3–14.5 mm against *Salmonella* spp., while untreated SCG powder showed stronger activity (14.8–17.6 mm). Overall, UAE and NADES demonstrated effective green extraction potential for recovering bioactive compounds from SCG, supporting its valorization as a natural antioxidant and antimicrobial food-preservative ingredient within a circular bioeconomy framework.

CBGP-41

Public Health
Biotechnology

GRAPE POMACE WITH SOLID STATE FERMENTATION FOR ENZYME PRODUCTION AND RELEASE OF POLYPHENOL WITH ANTIOXIDANTS ACTIVITY

Md. Zakir Hassan^{1*}, Muhammad Younus^{1*} and Elena G. Kovaleva¹

¹Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia

*Corresponding *Corresponding Author: zhtitas@outlook.com

The valorization of agro-industrial by-products through biotechnological processes represents a pivotal strategy for sustainable development. Grape pomace, the major solid waste generated from winemaking, is rich in structural polysaccharides and bioactive phenolic compounds, yet its recalcitrant nature limits direct utilization. Solid-state fermentation (SSF) has emerged as a powerful and cost-effective technology to transform this biomass into high-value products. This objective was SSF of grape pomace for microbial enzyme production and as a matrix for releasing bound polyphenols with enhanced antioxidant activity. *Bacillus subtilis* strain fermentation conditions included moisture content (55–70%), incubation temperature (37–40°C), pH, and duration (1–3 days) were optimized with RSM - D optimality to enzyme production and release of phenolic followed to TPC, TFC and antioxidant activity determination. However, HPLC-MS for identification for phenolic and statistical analysis was done sequentially.

CBGP-42

Public Health
Biotechnology

**MICROBIAL FERMENTATION OF *CHLORELLA SOROKINIANA* FOR SUSTAINABLE
PRODUCTION OF ANTIOXIDANT PEPTIDES AND THEIR APPLICATION
IN OAT-BASED PLANT YOGURT**

Memoona*¹, Muhammad Younus*¹ and Elena G. Kovaleva¹

¹*Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*

*Corresponding Author: memoonashafique07@gmail.com

The growing demand for sustainable functional foods has accelerated interest in microalgae-derived bioactive compounds with proven health-promoting properties. *Chlorella sorokiniana*, a protein-rich microalga, represents a promising source of antioxidant peptides that can be released through microbial fermentation. This study explores the sustainable production of antioxidant peptides from *C. sorokiniana* using *Bacillus subtilis* fermentation and evaluates their potential application in oat-based plant yogurt as a functional food ingredient. Compared with conventional enzymatic hydrolysis, microbial fermentation provides an environmentally friendly and cost-effective strategy for generating diverse bioactive peptides while preserving their biological activity. The fermented biomass undergoes peptide extraction, purification, antioxidant evaluation using DPPH, ABTS, and FRAP assays, followed by peptide identification through LC–MS/MS analysis. Bioinformatics tools are employed to predict peptide bioactivity, physicochemical characteristics, toxicity, and allergenicity, enabling the selection of promising candidates for food applications. The identified peptides are incorporated into oat-based plant yogurt to assess their effects on antioxidant capacity, physicochemical properties, and storage stability. The integration of microalga biotechnology, microbial fermentation, analytical characterization, and functional food development provides a comprehensive strategy for producing natural antioxidant ingredients. This work highlights the potential of fermentation-derived peptides as sustainable alternatives to synthetic antioxidants while supporting the development of innovative plant-based foods with enhanced nutritional and health-promoting value. The findings are expected to contribute to future research on functional ingredients, sustainable food processing, and the commercialization of microalgae-derived bioactive compounds.

CBGP-43

Public Health
Biotechnology

EVALUATION OF NATURAL DEEP EUTECTIC SOLVENTS FOR BIOACTIVE COMPOUND RECOVERY FROM RED GRAPE POMACE

Riya Laskar^{1*}, Md. Zakir Hassan¹, Muhammad Younus^{1*} and Elena G. Kovaleva¹

¹Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia

*Corresponding Author: riyalaskar2001@gmail.com

Grape pomace, a by-product from the wine industry, is a valuable source of phenolic compounds, flavonoids and natural antioxidants. This study was directed at preparing and checking Natural Deep Eutectic Solvent, NADES, systems for recovering those bioactive compounds from red grape pomace with ultrasound-assisted extraction, UAE. Made nine ChCl-based, NADES systems using hydrogen-bond donors such as organic acids, sugars, urea, glycerol and propylene glycol. Then, extraction results were judged via extraction yield, total phenolic content, TPC, total flavonoid content, TFC, and antioxidant activity measured with DPPH and ABTS assays. The results showed that the composition of NADES considerably influenced extraction performance. Among the investigated systems, ChCl: lactic acid (1:2) demonstrated the best overall performance achieving an extraction yield of 0.438 g/g, TPC of 224.20 mg GAE/g, TFC of 100.89 mg QE/g DPPH inhibition of 83.84% and ABTS inhibition of 97.48%. The improved extraction performance can be associated with interactions between the NADES components and phenolic constituents of grape pomace together with enhanced mass transfer provided by ultrasound. Overall ChCl: lactic acid (1:2) was identified as a green solvent for the recovery of antioxidant-rich bioactive compounds, from red grape pomace supporting the sustainable valorization of winery by-products.

CBGP-44

Public Health
Biotechnology

OPTIMIZATION OF FLAVONOID-RICH SYRUP EXTRACTION FROM ORANGE PEEL (CITRUS SINENSIS) WASTE AND CHROMATOGRAPHIC CHARACTERIZATION

Muhammad Irfan^{1*}, Muhammad Younus^{1*} and Elena Germanovna Kovaleva¹

¹Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia

*Corresponding Author: drkkhan374@gmail.com

Orange peel (*Citrus sinensis*) is a widely available waste byproduct of agro-industries and an abundant source of flavonoids that can be recovered and used in food industries for nutraceutical applications. This work aimed to optimize the production of a flavonoid-rich syrup from orange peel by examining how solvent

composition interacts with particle-size effects and by identifying the main flavonoids in the best extract. The dried orange peel was split into three particle-size groups (125–600 μm , 600 μm –1 mm, and 1–2 mm), then defatted with n-hexane; after that, it was run in a Soxhlet setup using ethanol, ethyl acetate, water, plus a set of binary and ternary solvent mixtures. Overall, extraction efficiency was mostly driven by the solvent composition, which changed the syrup recovery quite strongly ($p < 0.0001$), while particle size did not reach statistical significance for the conditions used. The best syrup outcome was 3.7 g from 12 g of dried peel, so about 30.8% extraction yield, and it came from ethanol at 80:20 (v/v) using the 1–2 mm fraction. The factorial model that was developed showed really good prediction quality, with $R^2 = 0.9245$ and adjusted $R^2 = 0.8889$, while the predicted R^2 was 0.8299. For the chromatographic characterization of the optimized extract, hesperidin was the primary compound found in the crystallized portion; it reached 94.4% relative abundance. In the remaining mother solution, there was mainly neohesperidin, along with narirutin and naringenin. Taken together, these results suggest that hydroethanolic Soxhlet extraction works well to isolate flavonoid-rich fractions from *C. sinensis* peel, highlighting orange peel waste as a sustainable starting material for useful citrus flavonoids.

CBGP-45

Public Health

Biotechnology

HESPERIDIN-ENRICHED CITRUS PEEL EXTRACT FOR IMPROVED MECHANICAL AND BARRIER PROPERTIES OF STARCH-BASED EDIBLE FILMS**Zaheer Ali*¹, Muhammad Younus*¹ and Elena G. Kovaleva¹**

¹*Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*

*Corresponding Author: zaheeralibot24@gmail.com

The increasing demand for sustainable food packaging has stimulated interest in biodegradable edible films derived from renewable resources. Starch-based films are promising alternatives to conventional petroleum-derived packaging materials; however, their relatively poor mechanical strength and limited barrier properties restrict their wider application. Citrus peel, an abundant agro-industrial by-product, contains valuable flavonoids, particularly hesperidin, with antioxidant and functional properties that may improve the performance of starch-based packaging systems. This study investigates the synergistic effects of hesperidin-enriched citrus peel extract on the mechanical, barrier, and functional properties of starch-based edible films. The citrus peel extract is incorporated into a starch-based film-forming matrix at different concentrations to evaluate its influence on tensile strength, elongation at break, water vapor permeability, moisture resistance, and film stability. The incorporation of bioactive citrus-derived compounds is expected to modify the polymeric network and improve the functional performance of the resulting films. In addition to their packaging properties, the developed films may provide antioxidant functionality, creating an active packaging system capable of offering additional protection to food products. This approach simultaneously valorizes citrus processing waste and reduces dependence on non-biodegradable packaging materials. The study highlights the potential of hesperidin-rich citrus peel extracts as multifunctional additives for starch-based edible films and provides a sustainable strategy for developing biodegradable and bioactive food packaging materials. Such systems may contribute to the advancement of circular bioeconomy principles and next-generation active packaging technologies.

CBGP-46

Public Health
Biotechnology

BIOTECHNOLOGICAL VALORIZATION OF WASTE BIRCH BARK FOR SUSTAINABLE ANTI-IRRITANT COSMETIC INGREDIENTS

Ishfaq Hussain^{*1}, Muhammad Younus^{*1} and Elena G. Kovaleva¹

¹Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia.

*Corresponding Author: Ishfaqhussain1023@email.com

The cosmetic industry is increasingly adopting sustainable biotechnological approaches to develop effective and environmentally friendly skincare ingredients. Waste birch bark represents an abundant renewable biomass containing valuable triterpenoids and phenolic compounds with antioxidant, anti-inflammatory, and skin-protective properties. This study investigates the microbial biotransformation of birch bark as a green strategy to improve the biological performance of its natural constituents and generate enhanced anti-irritant cosmetic ingredients. Microbial enzymes modify the chemical structures of bark-derived metabolites, potentially increasing their bioavailability, stability, and biological activity. The resulting extracts are characterized using advanced analytical techniques to identify newly formed bioactive compounds and evaluate changes in their chemical composition. Biological activities are assessed through antioxidant capacity, anti-inflammatory potential, and cellular compatibility assays relevant to skin health. The transformed extracts are further evaluated for incorporation into topical cosmetic formulations aimed at reducing skin irritation and improving product functionality. This biotechnology-driven approach contributes to the sustainable utilization of forestry by-products while reducing environmental waste and dependence on synthetic cosmetic additives. By integrating microbial biotechnology, natural product chemistry, and cosmetic science, the study highlights an innovative pathway for producing high-value bioactive ingredients from renewable resources. The outcomes support the advancement of sustainable cosmetic formulations and reinforce the role of microbial bioprocessing in the circular bioeconomy and future green skincare technologies.

CBGP-47

Public Health
Biotechnology

ENZYME-ASSISTED EXTRACTION OF BIOACTIVE COMPOUNDS FROM POMEGRANATE PEEL WASTE WITH ANTIOXIDANT POTENTIAL

Muhammad Ali Hussain^{1*}, Md. Zakir Hassan¹, Muhammad Younus^{1*} and Elena G. Kovaleva¹

¹Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia

*Corresponding Author: malihussain25@gmail.com

The escalating disposal of pomegranate peel waste (approximately 40-50%) from the juice industry poses a significant ecological threat to terrestrial and aquatic ecosystems globally. This agro-waste,

however, remains a natural reservoir of bioactive polyphenols with proven antioxidant, antimicrobial, and anti-inflammatory properties. This research aimed to develop a green and optimized extraction process using a synergistic cocktail of cellulase and pectinase enzymes to efficiently recover these high-value compounds. Using Response Surface Methodology (RSM), we optimized key extraction parameters including enzyme concentration, temperature, pH, time, and solvent ratio to maximize extraction yield, total phenolic content (TPC), total flavonoid content (TFC), and DPPH free-radical scavenging activity. The optimized enzymatic approach is expected to significantly outperform conventional solvent-based methods, yielding extracts with superior antioxidant potency under milder and more eco-friendly conditions. By effectively converting a major environmental pollutant into a functional bioactive ingredient, this study presents a sustainable circular bio-economy model. It is rich in bioactive compounds like polyphenols such as punicalagin, ellagic acid, gallic acid, flavonoids, and tannins. It acts as a powerful antioxidant and antimicrobial agent. However, the pomegranate peel extracts have direct applications in functional food, bioactive packaging materials, zoology and animal sciences, particularly as natural alternatives for effective integration into commercial products, synthetic antibiotic growth promoters in poultry and livestock feed, and as novel therapeutic agents for managing oxidative stress in human health and infectious diseases in veterinary practice, ultimately promoting improved animal welfare and environmental sustainability.

CBGP-48

Public Health
Biotechnology

OPTIMIZATION OF FERMENTATION CONDITIONS FOR RECOVERY OF BIOACTIVE COMPOUNDS FROM POMEGRANATE PEEL AND THEIR APPLICATION IN CHEESE

Dania Rafique^{1*}, Md. Zakir Hassan¹, Muhammad Younus^{1*} and Elena G. Kovaleva¹

¹*Laboratory of Biotransformation Technologies and Food Chemistry, Research, Educational and Innovation Center of Chemical and Pharmaceutical Technologies, Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia*

*Corresponding Author: daniarafique609@gmail.com

Pomegranate (*Punica granatum*) peel is an important agro-industrial by-product containing valuable phenolic compounds, flavonoids, tannins, and other bioactive constituents with antioxidant and functional properties. However, substantial quantities of pomegranate peel are discarded during fruit processing, creating an opportunity for sustainable valorization through biotechnological approaches. This study focuses on the optimization of fermentation conditions for enhanced recovery of biologically active compounds from pomegranate peel and evaluates their potential application in cheese production. Fermentation can facilitate the breakdown of complex plant matrices and improve the release and accessibility of phenolic and other bioactive compounds. Key fermentation parameters, including temperature, pH, fermentation time, inoculum concentration, and substrate conditions, are considered for optimization of bioactive compound recovery. The fermented extracts are subsequently evaluated for antioxidant activity and total phenolic and flavonoid contents. The optimized bioactive extract is incorporated into cheese to investigate its influence on physicochemical characteristics, antioxidant potential, and overall product quality. The approach aims to develop a functional cheese product enriched with naturally derived bioactive compounds while simultaneously reducing agro-industrial waste. The

integration of fermentation technology with food product development provides a sustainable strategy for converting pomegranate peel into a value-added functional ingredient. This study may contribute to the development of innovative functional dairy products and demonstrate the potential of fermented fruit by-products as natural sources of bioactive compounds for food applications.

CBGP-49

Biotechnology

FROM TRADITIONAL PRACTICE TO SMART APICULTURE: A NATIONAL SURVEY OF THE BEEKEEPING IN PAKISTAN**Ishrat Aziz***Department of Biological Sciences, Kala Shah Kaku campus, Virtual University, Pakistan**Corresponding Author: ishrat.aziz@vu.edu.pk

Pakistan has different ecological zones which offer favorable conditions and support various apiculture practices. Although apiculture has now emerged as an important livelihood and source of pollination and production of hive products, detailed information on beekeeping methods, knowledge of the beekeepers and adoption of modern technologies is limited throughout Pakistan. The objective of the present study was to describe the beekeeping practices and evaluate the knowledge, management strategies and constraints of beekeepers in various ecological zones of Pakistan. A total of 150 beekeepers from a wide geographical and ecological distribution were sampled. Relevant data was collected on beekeeper profile, migration habits, bee species preference, colony management, disease detection and management, organic and synthetic control measures, adoption of modern techniques, and knowledge about production of honey, pollen, and bee venom. This survey showed the patterns of management practices and migratory beekeeping across ecological zones. Organic treatments were more likely to be preferred over synthetic treatments for the purpose of maintaining colony health. Many respondents were professional beekeepers reflecting that beekeeping is an established livelihood and specialized occupation in several areas. The survey revealed a knowledge-technology gap in modern apiculture management, disease management, value added hive products and modern beekeeping technologies. The overall beekeeper knowledge of the practical and field-based was very high and had been acquired through years of experience, however there is limited access to formal training, modern scientific knowledge and technological innovations among Pakistani beekeepers. The recommendations revealed the necessity of region-specific training, extension services, disease management programs, technology enabled apiculture and capacity building for the better health of the colonies, productivity, diversification of products and sustainability of beekeeping in Pakistan.

CBGP-50

Physiology

**ANALYZING THE EFFECTIVENESS OF CHAMOMILE (*MATRICARIA CHAMOMILLA*) IN
RELIEVING DYSPEPTIC SYMPTOMS AMONG PATIENTS RECEIVING
OMEPRAZOLE (RISEK) IN DISTRICT HARIPUR**

Nayab Gul, Sadia Javed, Alisha Bibi and Rabia Jadoon

Department of Zoology, Govt, Postgraduate College for Women, Haripur

*Corresponding Author: rjadoon90@gmail.com

Dyspepsia refers to pain or discomfort centered in the upper abdomen, including epigastric pain or burning, postprandial fullness, or early satiety. Omeprazole, or Risek, is frequently prescribed to treat symptoms; nevertheless, prolonged use of this medication may have negative side effects, necessitating the search for less costly and safer herbal therapy. Therefore, Chamomile is a traditional herbal medicine with α -bisabolol, a compound known for its anti-inflammatory and gastrointestinal benefits. A total of 50 dyspeptic patients aged ≥ 15 years were recruited among participants in this study from Haripur (32% male and 68% female). All recruited patients were clinically diagnosed as dyspeptic patients. The study duration was 6 months. It was a questionnaire-based research work and informed consent were taken from patients prior to data collection. Chamomile tea bags (Vital) were used that are commercially available and primarily contained dried flowers, which are a natural source of flavonoids, terpenoids, and α -bisabolol that have anti-inflammatory properties and also contain other antioxidant compounds. All recruited participants were Risek users, among them 4% <1 month, 30% 1-6 months, 14% 6-12 months, and 52% >1 year. Risek was rated as very effective by 42%, somewhat effective by 44%, and slightly effective by 10%. After one month of intervention with chamomile tea, 32% of Risek users reported moderate improvement, and 58% reported significant improvement in their symptoms. Overall, 90% reported a moderate to considerable improvement in their symptoms. For Risek, mean values $\pm$ SD were 3.43 ± 0.83 , which is slightly lower than that for Chamomile (Mean $\pm$ SD = 3.43 ± 0.82). The paired sample t-test showed statistically significant improvement in overall dyspepsia symptoms ($P < 0.0001$). Chamomile is a safe, affordable, cost-effective herbal treatment with minimal side effects, showing potential as beneficial for the management of dyspepsia. Further, biochemical investigation is needed to find the underlying mechanism of chamomile action.

CBGP-51

Physiology

**COMPARATIVE STUDY ON COMPLETE BLOOD COUNT AND LIVER FUNCTION
TEST OF BROILER AND INDIGENOUS CHICKEN BREEDS GOLDEN MISRI
(*GALLUS GALLUS DOMESTICUS*) OF KHAIRPUR CITY**

**Faiza Asghar, Safdar Ali Ujjan*, Kiran Naz Sahito,
Saheba Bozdar and Wali Muhammad Mangrio**

Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh

*Corresponding Author: safdar.ujjan@salu.edu.pk

This comparative study evaluated the complete blood count (CBC) and liver function test (LFT) parameters of commercial broiler and indigenous Golden Misri chickens (*Gallus gallus domesticus*) in

Khairpur City, Sindh, Pakistan, to address the scarcity of local avian physiological reference data. Blood samples were collected from ten apparently healthy chickens, comprising five broilers and five Golden Misri chickens, for comprehensive CBC and LFT assessments. The hematological analysis revealed that both breeds maintained standard reference ranges for red blood cell count (RBC), hemoglobin concentration (Hb), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC), though minor variations were observed. However, significant differences were identified in packed cell volume (PCV), white blood cell count (WBC), and eosinophil proportions, with broilers exhibiting hyper-leukocytosis. Furthermore, while monocytes, lymphocytes, thrombocytes, and heterophils remained within normal ranges, these parameters were consistently higher in broilers than in Golden Misri chickens, reflecting increased physiological stress associated with rapid growth rates and intensive management. The comparative biochemical evaluation demonstrated normal liver function across both breeds, but with notable physiological distinctions. Golden Misri chickens displayed superior protein metabolism, as evidenced by higher levels of total protein (4.1 g/dL), albumin (1.85 g/dL), and globulin (2.25 g/dL) compared to broilers (3.7 g/dL, 1.64 g/dL, and 2.06 g/dL, respectively). Conversely, broiler chickens exhibited higher hepatic enzyme activities, including aspartate aminotransferase (AST: 220 U/L vs. 198 U/L), alanine aminotransferase (ALT: 13 U/L vs. 11 U/L), and alkaline phosphatase (ALP: 185 U/L vs. 165 U/L), alongside slightly elevated total bilirubin (0.20 mg/dL vs. 0.18 mg/dL). These findings conclude that while Golden Misri chickens demonstrate greater health resilience and superior protein synthesis under local conditions, broilers experience elevated metabolic strain and liver enzyme activity, emphasizing the necessity for breed-specific management and health monitoring strategies.

CBGP-52

Herbal Medicine

EFFECT OF HERBAL DISINFECTANT ON PATHOGENIC BACTERIAL LOAD OF HATCHING EGGSHELLS TO ENHANCE THE HATCHABILITY RATIO OF CAPTIVE WILD BIRDS

Mah Noor Fatima¹, Muhammad Azhar² and Bushra Nisar Khan^{1*}

¹*Institute of Zoology, University of Punjab, Lahore, 54590*

²*Lahore Zoo Safari, Lahore*

*Corresponding Author: bushra.zool@pu.edu.pk and bushrank2007@gmail.com

This study was conducted to determine whether the disinfection of peafowl and pheasant eggs by spraying with three natural ethanolic extracts (*Mangifera indica*, *Coriandrum sativum*, *Syzygium cumini* L.) affects hatching performance. To confirm the presence of bacteria in spreading infections to peacocks and pheasant's eggs, bacteria (*E. coli*, *Klebsiella Pneumonia* and *Pseudomonas*) were identified by 16S ribotyping with accession number (PP737881, PP75763, PP737883) registered on NCBI GenBank. A total of 1400 peafowl eggs and 1480 eggs of pheasants were used for analysis of incubation characteristics. The study consisted of four treatment groups: chemical disinfectants (D, control); (A, *Mangifera indica*); (B, *Syzygium 11 cumini* L.); (C, *Coriandrum sativum*). The most effective one treatment group for total bacteria was B, *Syzygium cumini* L. By using GCMS (Gas chromatography and mass spectroscopy) it was determined that

chemical components of natural extracts Jamun's (*Syzygium cumini* L) are caryophyllene oxide, n-Hexadecanoic acid and squalene and *Mangifera indica*, *Coriandrum sativum* have 9,12-Octadecadienoic acid (Z, Z) -, ethyl gallate, hexadecenoic acid and these compounds have high antibacterial activity. In case of both birds the highest hatchability percentage gave by jamun ethanolic extract 85% and 89% with the lowest embryonic mortality 5% and 3%. In case of peacocks, the hatchability of mango was 60% and coriander was 56%. In case of pheasants, the hatchability of mango was 60% and coriander was 47%. Control group, D (chemical disinfectant) shows 76% hatchability in both birds, and their mortality ratio of peacock was 13% and pheasants was 14%.

CBGP-53

Physiology

IMPACT OF REPEATED DRUG ADMINISTRATION AND ANESTHESIA ON PHYSIOLOGICAL INTEGRITY, IMMUNE FUNCTION, AND ANTIMICROBIAL PEPTIDE ACTIVITY IN CAPTIVE *RANA TIGRINA*

Minahal Fatima¹, Aneeb Ullah¹ and Bushra Nisar Khan^{1*}

¹Institute of Zoology, University of Punjab, Lahore, 54590

*Corresponding Author: bushra.zool@pu.edu.pk

Amphibian skin secretions contain a high number of antimicrobial peptides (AMPs) and other bioactive compounds that have enormous biomedical potential. The effects of the extended captivity and repeated pharmacological manipulation on the physiology of amphibians and the composition of their secretome are unknown. The present study examined the effect of multiple doses of ketamine anaesthetic and several harvesting practices involving harvesting of the secretion via norepinephrine on the physiological integrity, immune function and the AMP profile of the Indian Bullfrog, *Rana tigrina*. The design was comparative with captive frogs being kept in the laboratory for two months and wild frogs being collected directly from their natural habitat. Morphometric, hematological, serum biochemical, corticosterone, histopathological, antimicrobial, GC-MS and LC-MS analyses were performed. Captive frogs had increased corticosterone concentrations, heavy leukocytosis, high neutrophil/lymphocyte ratios and hepatic and renal dysfunction. Histopathology findings include hepatocellular degeneration, vacuolation, inflammatory infiltration and renal tubular damage. Volatile profiles revealed by GC-MS indicated that the volatile emission of captive frogs was more complex and comprised of more alkaloid and phenazine compounds, while volatile emission of wild frogs was simpler and more dominated by terpene compounds. LC-MS also revealed that captive frogs had less diversity of peptides, which may be due to either less synthesis of AMP or replenishment. In general, prolonged captivity and repeated pharmacological treatments significantly impaired the physiological homeostasis, immune resistance, organ integrity and the composition of skin secretome of *Rana tigrina*.

CBGP-54

Microbiology

Wildlife

**GENOMIC CHARACTERIZATION OF MDR BACTERIA FROM AVIAN FECES IN
URBAN LAHORE AND IN-VITRO EFFICACY OF AGRO-WASTE DERIVED
PHYTOCHEMICAL EXTRACTS**

Arshia Mukthar¹, Kiran Saleem², and Bushra Nisar Khan^{1*}

¹*Institute of Zoology, University of Punjab, Lahore, 54590*

²*Lahore Zoo Safari, Lahore*

*Corresponding Author: bushra.zool@pu.edu.pk

Rapid urbanization in cities such as Lahore, contributes to the growth of synanthropic birds and their role as vectors of multidrug-resistant (MDR) enteric pathogen that carries high antimicrobial resistance (AMR) burden and significant public health risks with poor sanitation. In this work, the presence of clinically important MDR bacteria in avian feces from Lahore was studied. The bacterial isolates were identified molecularly by 16s rRNA sequencing as *Salmonella enterica*, *Shigella flexneri* and *Staphylococcus aureus*. The antibiotic susceptibility showed significant resistance pattern, such as 100% resistance to tetracycline and ampicillin for *S. enterica*, and ofloxacin resistance for *S. flexneri*. Apple peels, mango kernel and jamun seeds were used to extract phytochemicals, which are characterized using GC-MS and identified by specific bioactive compounds. The antibacterial activity of the extracts was determined using well diffusion assays where apple peel and mango kernel extracts exhibited good broad-spectrum activity (mean zone of inhibition 24 – 32 mm). The Two-way ANOVA indicated that bacterial type × extract type interaction significantly affected the results ($p < 0.05$). The DPPH assays also indicated high antioxidant activity, mango kernel extract having the highest radical scavenging activity ($67.74 \pm 1.14\%$). These results showed the importance of the role of birds as reservoirs of MDR pathogens in the urban setting of Lahore and pointed out that agro-waste valorization can be used as an effective method for producing low-cost natural antimicrobial agents. The applied approach is a locally applicable solution to reduce AMR and manage agricultural waste in resource-limited conditions in Global South.

CBGP-55

Physiology

**EVALUATING ON-FARM BI-PLATE CULTURE FOR SELECTIVE TREATMENT OF
CLINICAL MASTITIS IN A DEVELOPING DAIRY PRODUCTION SYSTEM**

**Muhammad Naveed Malik¹, Muhammad Avais^{1*}, Muhammad Hassan Saleem¹,
Muhammad Asad Ali² and Rai Khuda Dad¹**

¹*Department of Veterinary Medicine, University of Veterinary and Animal Sciences, Lahore.*

²*Institute of Microbiology, University of Veterinary and Animal Sciences, Lahore.*

Livestock and Dairy Development Department, Government of Punjab, Pakistan

*Corresponding: mavais@uvas.edu.pk

Antimicrobial overuse in dairy cattle is a growing global concern, with clinical mastitis (CM) treatment accounting for up to 80% of total on-farm antibiotic use. This randomized controlled field trial

evaluated a bi-plate on-farm culture (OFC) system for guiding selective intramammary antibiotic treatment in CM cases across 16 commercial dairy farms in Lahore and Narowal districts of Pakistan. A total of 105 lactating Holstein-Friesian × Sahiwal crossbred cows diagnosed with CM were randomly allocated to a positive control treatment (PCT; n=57) group receiving immediate intramammary (IMM) antibiotic (ceftiofur), while culture-based treatment (CBT; n=48) group therapy was guided by bi-plate OFC performance. The bi-plate system categorized CBT cases as Gram-positive (43.8%), no growth (41.7%), mixed (8.3%), or Gram-negative (6.2%). On the basis OFC system, IMM antibiotic treatment was directed only to Gram-positive and mixed-infection cases (52.1%), while no-growth and Gram-negative cases (47.9%) were withheld from treatment, resulted significant reduction ($P < 0.001$, 47.9%) in IMM antibiotic usage compared to the PCT group. The clinical cure rates between groups were statistically insignificant (CBT: 79.2% vs. PCT: 71.9%; $P = 0.26$), which favors non-inferiority of selective therapy. The CBT group had much higher post-treatment reduction in SCC (92.8 vs. 88.6; $P < 0.001$) and mean post-treatment SCC was lower than 100,000 cells/mL udder health threshold (97.2 vs. 141.3×10^3 cells/mL). There were no differences in mean days to clinical cure (PCT: 5.0 ± 1.2 vs. CBT: 4.7 ± 1.3 ; $P = 0.269$), and new intramammary infection rates were lower in the CBT group (8.3 % vs. 15.8 %; $P = 0.39$). These results justify the use of the bi-plate OFC system as a viable antimicrobial stewardship intervention in Pakistani dairy herds, which can significantly decrease the use of antibiotics without affecting clinical performance.

CBGP-56

Microbiology

CLIMATE-MICROBE FEEDBACK LOOPS: EMERGING MICROBIAL DRIVERS OF CLIMATE CHANGE AND ECOSYSTEM RESILIENCE

Muhammad Moazam Jalees¹, Abdul Rehman¹, Omer Naseer², Firasat Hussain¹, Muhammad Nauman⁴, Muhammad Arif¹, Umaina Nadeem¹, Abdullah Nadeem³, Rais Ahmed¹ and Faisal Siddique¹

¹*Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

²*Department of Veterinary Medicine, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

³*Department of Pathology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

⁴*Institute of Continuing Education & Extension, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

***Corresponding:** mmoazamjalees@cuvvas.edu.com

Climate change is acknowledged as both a cause and an effect of shifts in microbial ecosystems. Because of this, environmental microbiology considers climate-microbe feedback to loop important frontiers. Current research shows that increasing temperatures are speeding the thawing of permafrost. This exposes dormant microorganisms and viruses and begins the microbial breakdown of frozen organic carbon, leading to the release of carbon dioxide and methane. Methane-cycling microorganisms also include methanogenic archaea and methane-oxidizing bacteria. Since these microorganisms regulate methane levels in the atmosphere, they serve as climate levers. Because of this, warming has the potential to impact the emission of greenhouse gases that these microorganisms regulate. In marine ecosystems, caused by an increase of CO₂ in the atmosphere, the acidification of oceans is changing the diversity, composition, and function of microbial ecosystems. This has further impacted on the flow of different

nutrients and the stabilization of marine ecosystems. Recent technological innovations have improved the response of climate-sensitive microbial ecosystems and discovered that microbial responses are part of Earth's feedback systems. The role of microbes in climate regulation has redirected research funding to the microbial-climate nexus and opened large investigations on microbial ecosystems. Research in microbial ecology will also help predict climate risks and improve possible remedies. Because of this, the integration of microbial ecology and climate models is essential for improving the understanding of the function of different ecosystems. In response to the global challenges posed by climate change, it will be foundational to understand climate-microbe feedback loops.

CBGP-57

Cell & Molecular Biology

UNLOCKING MICROBIAL DARK MATTER: METAGENOMIC MINING AND FUNCTIONAL PREDICTION OF CRYPTIC BIOSYNTHETIC GENE CLUSTERS IN UNCULTURABLE SOIL MICROBIOTA

Firasat Hussain^{*1}, Santosh Kumar², Syed Qaswar Ali Shah², Kashif Rahim³ and Momina Malik¹

¹*Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur.*

²*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

³*Cannabischem Lab, Hutchinson, Minnesota 55350 USA*

^{*}Corresponding Author: firasathussain@cuvas.edu.pk

Although soil microbiota is a rich source of novel secondary metabolites with antimicrobial, antitumor and industrial applications, the vast majority of soil microorganisms cannot be cultivated using conventional laboratory techniques and thus their biosynthetic potential is largely untapped. The purpose of this study is to investigate the unculturable soil microbial communities for the culture-independent metagenomic techniques to explore the unculturable area of microorganism genome. Metagenome-assembled genomes (MAGs) will be assembled using high throughput shotgun sequencing and long-read technologies from a variety of soil ecosystems, with the aim of computational mining for cryptic biosynthetic gene clusters (BGCs) for polyketides, non-ribosomal peptides and terpenoids using antiSMASH, BiG-SCAPE and other tools. New BGCs will be given priority based on their phylogenetic novelty, similarity to known clusters and predicted chemical scaffolds. Heterologous expressions in model cells and systems will be used to induce silent pathways in selected candidates and to characterize the functions of metabolites produced. Combining the power of genomic prediction and experimental validation, this is a truly integrative approach that overcomes the "unculturability bottleneck" in natural product discovery. Results will highlight previously unknown chemical diversity, broaden the known biosynthetic spectrum of soil microorganisms and facilitate the discovery of new bioactive compounds useful in antibiotic design and biotechnology.

CBGP-58

Microbiology

BIOREMEDIATION OF PETROLEUM HYDROCARBON-CONTAMINATED SOIL BY *PSEUDOMONAS PUTIDA*: ASSESSMENT OF DEGRADATION EFFICIENCY AND SOIL QUALITY IMPROVEMENT**Atiya Rehman¹, Firasat Hussain^{*1}, Rais Ahmed¹, Abdullah Saghir Ahmad², Syed Qaswar Ali Shah³ and Momina Malik¹**¹*Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*²*Department of Parasitology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*³*The Cholistan Institute of Biological Sciences (CIBS),**Cholistan University of Veterinary and Animal Sciences, Bahawalpur*^{*}Corresponding Author: firmasathussain@cuvass.edu.pk

The presence of hydrocarbon compounds in the soil poses great threat to the fertility of the soil due to their persistence and toxicity in nature. This study was conducted with the aim of assessing the biodegradation efficiency of *Pseudomonas putida* (*P. putida*) in cleaning petroleum contaminated soils. The soil contaminated with crude oil was collected from various locations and was analysed microbiologically. The bacterium was cultured, characterized using morphological, biochemical and molecular methods and then it was applied in the contaminated soil under controlled environment. The biodegradation efficiency was assessed in terms of total petroleum hydrocarbons (TPH), soil pH, moisture, microbial biomass and organic carbon after specific intervals. It was found that the soil treated with the bacterium showed significant reduction in hydrocarbon concentration along with the recovery of soil physicochemical parameters. Improved microbial activity and fertility of the soil were noticed after the application of bacterium. Degradation of petroleum hydrocarbons was facilitated by the metabolic abilities of *P. putida* in utilizing the hydrocarbon compounds as source of carbon and energy. The study has proved that *P. putida* acts as efficient biological agent in cleaning the hydrocarbon contaminated soils.

CBGP-59

Microbiology

MOLECULAR TARGETING OF MULTIDRUG RESISTANCE GENES IN *VIBRIO CHOLERAE*: MECHANISMS, MOBILE GENETIC ELEMENTS, AND EMERGING GENE-EDITING STRATEGIES**Momina Malik¹, Firasat Hussain^{*1}, Rais Ahmed¹, Kashif Prince², Kashif Rahim³, Syed Qaswar Ali Shah⁴ and Alishba Zahid¹**¹*Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*²*Department of Medicine, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*³*Cannabichem Lab, Hutchinson, Minnesota 55350 USA*⁴*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*^{*}Corresponding Author: firmasathussain@cuvass.edu.pk

Cholera's causative agent *Vibrio cholerae* has become a powerful multidrug-resistant (MDR) pathogen by acquiring mobile genetic elements (MGEs) containing clustered antimicrobial resistance

genes (ARGs). This study provides an overview of the molecular analysis of MDR mediated by integrative and conjugative elements (ICEs) of *V. cholerae*, IncC plasmids, and class 1 integrons which are responsible for the resistance to the first-line antibiotics used to treat cholera, such as trimethoprim, sulfamethoxazole, tetracycline, chloramphenicol, streptomycin, and increasingly azithromycin and extended-spectrum β -lactams. The functional biology of important resistance determinants floR, strAB, dfrA1/dfr18, sul2, mph(A)/mph(E)/msr(E) and blaPER-7 as well as their genetic environment in horizontally transferable elements were analyzed. It then reviews new molecular strategies that specifically target these resistance genes, including the sequence-specific antimicrobials developed based on the CRISPR-Cas system, anti-conjugation strategies to block the transfer of ICE/plasmids and phage derived tools that exploit fitness trade-offs. Majority of resistance is mobile and self-transmissible rather than the result of chromosomal point mutations, gene-targeting interventions targeting the transfer machinery will likely provide the most sustainable containment solution, not targeted genes. Ongoing genomic surveillance of ICE and of plasmid evolution will be critical to predict development of new resistance sub-lineages in pandemic *V. cholerae* populations in the future.

CBGP-60

Physiology

PROTECTIVE ROLE OF PELARGONIDIN AGAINST AFLATOXIN B1 INDUCED RENAL DAMAGE IN RATS

Naila Ghafoor, Muhammad Zaid Salar and Muhammad Umar Ijaz*

Department of Zoology, Wildlife & Fisheries, University of Agriculture, Faisalabad

**Corresponding Author: umar.ijaz@uaf.edu.pk*

Aflatoxin B1 (AFB1) is a potent mycotoxin in humans and animals. Exposure to AFB1 has been shown to implicate multi-organ toxicity in humans and animals, particularly nephrotoxicity. Pelargonidin (PEL) is a well-known red pigment found in plants and has been reported as having important biological activities that are potentially beneficial for human health. Therefore, the present research was conducted to evaluate the mitigative potential of PEL against AFB1-prompted renal toxicity in albino rats. Forty-eight albino rats were randomly divided into 4 groups, such as a control group, AFB1-treated group (50 μ g/kg), AFB1 + PEL co-treated group (50 μ g/kg and 25 mg/kg, respectively), and only PEL-treated group (25 mg/kg). After 30 days of treatment, it was revealed that exposure to AFB1 significantly reduced antioxidant enzyme levels such as glutathione peroxidase (GPx), glutathione reductase (GSR), catalase (CAT), glutathione-S-transferase (GST), superoxide dismutase (SOD), and glutathione (GSH). However, in AFB1-treated rats, malondialdehyde (MDA) and reactive oxygen species (ROS) contents were significantly elevated. AFB1 exposure also increased the levels of urea and creatinine while reducing creatinine clearance levels. Furthermore, KIM-1 and NGAL levels were also increased in AFB1-intoxicated rats. Moreover, inflammatory indices, i.e., nuclear factor kappa-B (NF- κ B), interleukin-6 (IL-6), tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), and cyclooxygenase-2 (COX-2), increased in AFB1-treated rats. Additionally, it also escalated the levels of pro-apoptotic indices (Bax, caspase-3, and caspase-9) while decreasing the level of the anti-apoptotic marker (Bcl-2). Exposure to AFB1 also instigated significant histopathological damage in renal tissues. Nonetheless, PEL supplementation recovered all these damages due to its anti-apoptotic, antioxidant, and anti-inflammatory nature.

CBGP-61

Toxicology

PROTECTIVE POTENTIAL OF DAIDZEIN AGAINST POLYETHYLENE MICROPLASTICS-INDUCED LIVER DAMAGE IN RATS**Muhammad Zaid Salar, Naila Ghafoor and Muhammad Umar Ijaz****Department of Zoology, Wildlife & Fisheries, University of Agriculture, Faisalabad*

*Corresponding Author: umar.ijaz@uaf.edu.pk

Polyethylene Microplastics (PE-MPs) are ubiquitous environmental contaminants that can trigger deterioration in various organs and cause severe injuries. PE-MPs exposure has been demonstrated to induce liver damage. Daidzein is a naturally occurring isoflavone predominantly found in soybeans and other legumes and is recognized for its diverse biological activities. Therefore, the current study aimed to determine the protective role of daidzein against PE-MPs-induced hepatic damage in male albino rats. The rats were divided into 4 equal groups, viz. control, PE-MPs (1.5 mg/kg), PE-MPs + daidzein (1.5 mg/kg + 30mg/kg), and daidzein (30 mg/kg). PE-MPs intoxication decreased the activities of antioxidant enzymes, including glutathione peroxidase (GPx), glutathione reductase (GSR), catalase (CAT), glutathione-S-transferase (GST), superoxide dismutase (SOD), and glutathione (GSH), whereas escalated the levels of malondialdehyde (MDA) and reactive oxygen species (ROS) in the hepatic tissues of rats. PE-MPs administration significantly elevated liver function markers, including alkaline phosphatase (ALP), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) levels. Additionally, it also escalated the levels of pro-apoptotic indices (Bax, caspase-3, and caspase-9) while decreasing the level of the anti-apoptotic marker (Bcl-2). Moreover, PE-MPs exposure increased the levels of inflammatory markers including nuclear factor kappa-B (NF- κ B), interleukin-6 (IL-6), tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), and cyclooxygenase-2 (COX-2). Furthermore, administration of PE-MPs also induced histological damage in the liver. However, the supplementation of daidzein restored all the PE-MPs-instigated hepatic injuries. The outcomes revealed that daidzein may ameliorate PE-MPs-induced hepatotoxicity due to its antioxidant, antiapoptotic, and anti-inflammatory nature.

CBGP-62

Physiology

Toxicology

DAIDZEIN MITIGATES POLYETHYLENE MICROPLASTICS-INDUCED RENAL TOXICITY IN RATS VIA REGULATING BIOCHEMICAL AND HISTOLOGICAL PROFILE**Muhammad Umar Ijaz^{1*}, Mehrab Khalil¹ and Muhammad Zaid Salar¹**¹*Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad, Pakistan*

Corresponding Author *Corresponding Author: umar.ijaz@uaf.edu.pk

Polyethylene microplastics (PE-MPs) are emerging environmental contaminants known to induce systemic toxicity and oxidative stress, with the kidneys being particularly vulnerable to toxic accumulation. Daidzein (DDZ), a natural isoflavone found mainly in soybeans, demonstrates a broad array of pharmacological properties. Therefore, this study was designed to assess the potential protective role of DDZ

against PE-MPs-induced nephrotoxicity in male albino rats. 48 male rats (*Rattus norvegicus*; albino strain) were divided into four equal groups, including a control group, PE-MPs group (1.5 mg/kg), PE-MPs + DDZ co-treated group (1.5 mg/kg + 30 mg/kg), and only DDZ (30 mg/kg) group. The experimental period lasted for 30 days. After administration via oral gavage, biochemical, apoptotic, and kidney injury markers were determined alongside histopathological observations. Results revealed that PE-MPs intoxication disrupted the biochemical profile by decreasing antioxidant enzymes activities (SOD, GSR, GST, GPx, CAT and GSH) while elevating MDA and ROS levels. Furthermore, PE-MPs exposure notably elevated inflammatory markers, including NF- κ B, TNF- α , IL-6, IL-1 β , and COX-2 along with renal function parameters such as urea and creatinine while reducing creatinine clearance. Moreover, PE-MPs treatment decreased the level of anti-apoptotic marker Bcl-2 while augmenting apoptotic markers (Bax and Caspase-3). In addition, PE-MPs induction caused severe histopathological impairments in renal tissues. However, co-administration of DDZ displayed curative effects against PE-MPs-induced renal toxicity, restoring all parameters to the normal levels. Therefore, it was concluded that DDZ could potentially protect against PE-MPs-instigated nephrotoxicity due to its antioxidative, anti-inflammatory, and anti-apoptotic potential.

CBGP-63

Toxicology

HEPATOPROTECTIVE POTENTIAL OF PELARGONIDIN AGAINST AFLATOXIN B₁-INSTIGATED HEPATIC DAMAGE IN RATS

Mehrab Khalil, Muhammad Umar Ijaz* and Muhammad Zaid Salar

Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad, Pakistan

Corresponding Author: umar.ijaz@uaf.edu.pk

Aflatoxin B₁ (AFB₁) is a potent mycotoxin known to pose severe health hazards to humans and animals by inducing systemic multi-organ dysfunction, particularly hepatic damage. Pelargonidin (PG), a natural anthocyanin derivative, is a polyhydroxylated flavonoid renowned for its potent antioxidant and anti-inflammatory properties. This research was performed to assess the potential protective role of PG against AFB₁-induced hepatotoxicity in male albino rats. Forty-eight male albino rats were divided into four equal groups; including control, AFB₁ (50 μ g/kg) group, AFB₁ + PG (50 μ g/kg + 25 mg/kg) co-treated group, and only PG (25 mg/kg) group. After the administration of AFB₁ and PG via oral gavage for 56 days, biochemical and hepatic serum markers were evaluated alongside histopathological observations. Results showed that AFB₁ exposure disrupted the biochemical profile by decreasing the activities of antioxidant enzymes (catalase, superoxide dismutase, glutathione peroxidase, glutathione reductase and glutathione content), while elevating the concentration of reactive oxygen species and malondialdehyde. Furthermore, AFB₁ intoxication notably elevated the levels of hepatic serum enzymes (alkaline phosphatase, alanine aminotransferase and aspartate aminotransferase) along with inflammatory markers, including nuclear factor kappa-B, tumor necrosis factor- α , Interleukin-6, Interleukin-1 β and cyclooxygenase-2. Moreover, AFB₁ exposure decreased the level of anti-apoptotic marker (Bcl-2) while augmenting apoptotic markers (Bax and Caspase-3). Besides, AFB₁ induction caused histopathological impairments in hepatic tissues. Nonetheless, PG co-administration remarkably ameliorated all damage induced by AFB₁ intoxication. Therefore, it was concluded that PG could potentially cure AFB₁-instigated hepatotoxicity, attributed to its antioxidative and anti-inflammatory potential.

CBGP-64

Cell and Molecular Biology

GC-MS ANALYSIS, MOLECULAR DOCKING AND PHARMACOKINETICS STUDIES OF BIOACTIVE COMPOUNDS OF *WITHANIA SOMNIFERA* AS POTENTIAL CARBONIC ANHYDRASE IX INHIBITORS**Arfa Shafiq Sidhu and Muhammad Khan***Institute of Zoology, University of the Punjab, Quaid-e-Azam campus Lahore**Corresponding Author: mkhan.zool@pu.edu.pk

Carbonic anhydrase IX (CAIX) is frequently overexpressed in human cancers and its expression has been implicated in cancer progression and metastasis. CAIX is considered as a promising drug target for cancer drug development. *Withania somnifera* (*W. somnifera*) is a locally available medicinal plant with well-established anticancer effects. The present study was designed to identify major bioactive molecules of *W. somnifera* as potential CAIX inhibitors. Gas chromatography–mass spectrometry analysis (GC-MS) of the root extract showed 60 peaks and compounds were tentatively found by comparison with the NIST23 library. Molecular docking and virtual screening (VS) were performed on 60 compounds, and 24 compounds were selected based on their binding energies. Among the docked complexes, α -amyrin showed lowest binding energy of -8.7 kcal/mol. After evaluation of their physicochemical properties, the top six compounds were selected for visualization using PyMol, BIOVIA Discovery Studio (DSV) and LigPlot++. ASN62, GLN67, GLN92, HIS94, VAL121, VAL143, LEU198, THR199, THR200, TRP209 were main interaction residues that are present within the CAIX catalytic pocket. The screened compounds demonstrated good intestinal uptake and fulfilled Lipinski criteria. However, further in vitro and in vivo validation is necessary.

CBGP-65

Physiology

STUDIES ON DIABETES MELLITUS IN PATIENTS PRESENTING TO THQ HOSPITAL DOKRI, LARKANA

Asmat Mangi, Dua Fatima Soomro, Farhana Soomro, Mahwish Majid Arain, Maira Dahar, Mashooq Ali Juno, Moomal Sohu, Muskan Brohi, Rasheed U Nisa Zahri, Razia Hoat and Safdar Ali Ujjan

*Department of Zoology, Shah Abdul Latif University, Khairpur Mir's*Correspondence: Safdar.ujjan@salu.edu.pk

Diabetes mellitus is a huge public health problem in the world, and its burden is escalating very rapidly in Pakistan, especially in rural and remote areas. But there is a lack of community/ hospital level data in areas like Dokri, District Larkana, Sindh. This study aimed to find the prevalence and distribution of diabetes mellitus by age and gender in the patients visiting Tehsil Headquarters (THQ) Hospital Dokri. This study was a cross-sectional study conducted in the hospital. The final analysis included 634 patients, and they were divided into 3 age groups: Group A (5-20 years), Group B (21-35 years), Group C (36-50+)

years). A pre-tested structured questionnaire and face to face interview were used to gather the data, and laboratory records were used to collect clinical data such as glucose and HbA1c values. The data obtained was analyzed using Microsoft Excel 2010 by Age, Gender and Distribution on Monthly basis. The results revealed a higher proportion of males (423, 66.7%) compared to females (211, 33.3%) among the diabetic patients. The number of diabetic patients is highest in Group C (36-50+ years) with 370 (58.4%) followed by Group B with 203 (32.0%) and Group A with 61 (9.6%) diabetic patients. For males, 244 cases were in Group C and for females, 126 cases were in the same age group. In general, results showed higher prevalence of diabetes in men and higher age groups, and that it appeared to be more common in older age groups. The study underscores the significant diabetes burden at THQ Hospital Dokri and the need for early screening and health awareness campaigns, lifestyle modifications, and timely preventive measures, especially for older and high-risk individuals. The results can be used locally to reinforce the efforts for prevention of diabetes, screening and management in District Larkana in the region of Dokri.

CBGP-66

Physiology

COMPARATIVE STUDY ON LEVELS OF LIPID PROFILE IN THYROID PATIENTS AND NORMAL PERSONS OF KHAIRPUR CITY, SINDH

Kiran Naz Sahito and Safdar Ali Ujjan

Department of Zoology, Shah Abdul Latif University, Khairpur

Correspondence: Safdar.ujjan@salu.edu.pk

The thyroid gland is main endocrine organ in humans. The follicular cells of the thyroid gland secrete triiodothyronine (T₃) and thyroxine (T₄) hormones to control metabolic activities of body. Thyroid hormones have significant effects on synthesis, mobilization and metabolism of lipids and they are also involved in the regulation of lipid and lipoprotein metabolism. The altered secretions of thyroid hormones generate abnormal conditions known as hypothyroidism and hyperthyroidism. Hypothyroidism is underproduction of the thyroid hormones triiodothyronine (T₃) and thyroxine (T₄) and excess production of T₃ and T₄ is called hyperthyroidism. Both abnormal conditions can have adverse effects on synthesis, mobilization and metabolism of lipids. In this response current research work was designed to compare lipid profile of normal persons and thyroid patients of Khairpur city. The data of thyroid patients and normal people was collected from Kausar Hospital, PPHI (People Primary Health Invite) District Lab Khairpur and Civil Hospital Khairpur. To achieve the goal the data of 209 subjects were collected randomly. The serum samples were analyzed for lipid profile (total cholesterol, high density lipoproteins (HDL), low density lipoproteins (LDL), triglycerides (TGs) and very low-density lipoproteins (VLDL) to evaluate dyslipidemia in thyroid patients. From 209 persons 98 were males and 111 were females. From thyroid patients 52.73% were hypothyroid, 27.27% were hyperthyroid and 20% were euthyroid. This study concludes that hypothyroidism has impact on lipid profile level especially of LDL very high (7%) and VLDL high (69%) in case of hypothyroidism. Triglycerides were observed high in 31% hypothyroid cases and 55% euthyroid cases when compared with healthy group. HDL desirable level was observed in 60% hyperthyroid and 52 % hypothyroid cases.

CBGP-67

Physiology

FACTOR EFFECTING EARLY MENOPAUSAL WOMEN AND THEIR EFFECT ON BRAIN DISEASES (MAINLY ALZHEIMER'S PATIENTS) FROM DISTRICT HYDERABD**Misbah Akram Arain, Tahira Jabeen Ursani and Samina Malik***Department of Zoology, University of Sindh, Jamshoro*

*Corresponding Author: misbah.666222@gmail.com

Early or premature menopause effect 1% of women under the age of 40-year, A premature decline in estrogen put women at a higher risk for cardiovascular disease, Parkinson's, depression, osteoporosis, hypertension, weight gain, mild life, diabetes as well as cognitive disorder like; Dementia and Alzheimer's disease ranging from 65 % to 75 % cases are diagnosed. Premature menopausal women are at higher rate of premature death; increases osteoporosis and infertility. Menopause comes prematurely to 1/250 women under 30 and 1/100 women under 40. Cigarettes smoking are one of the best-defined menace influences for early and premature menopause due to an ant estrogenic effect. Data during this case study suggest that epilepsy effect hypothalamus, to reduce gonadotropin - releasing hormone cell population; by seizures which lead to an ovulatory menses, lower fertility and finally early menopause. Mental retardation leads to dementia and Alzheimer's disease. As estrogen drops it leads to neurodegeneration which cause changing in brain metabolism, inflammation, and protein buildup oftenly these all seen in Alzheimer's patients begin to take place, during data collection among the participants 74.3% experienced peri menopausal symptoms an average four symptoms per person, with hot flashes (88%), and night sweats (70%) being most common. During this case study the number and percentage of premature menopausal patient are 33, And the highest ratio of dementia and Alzheimer's patient were seen, which is 27 having the percentage of (82%) and some other disease factors are also studied; which is stroke, osteoporosis, and diabetes. Out of 33, 6 number of patients are of osteoporosis having menopause and the percentage is (18%), 15 have ischemic heart problems (45%) and 11 suffer from diabetes (33 %). And in case of mental retarded disease highest rate of Alzheimer's disease, People may loss fever or mild part of their memory, which leads toward the sign like brain fog and memory lapses and mood changes. In rural areas sharp estrogen level drops ranges; on average around the age of 36 to 42. Approximately two third about (65 to 70%) of all Alzheimer's patients are young women and according to Alzheimer's association out of 7.4 million, roughly 4.5 are Alzheimer's female of early age. Alzheimer's disease (AD) stands as the prevalent type of dementia, making up 50 -75% of total cases and showing a higher incidence among elder patients. Pakistan is a lower - middle - income country with an estimated 150000- 200000 patients affected by dementia. Finally, the correlation between earlier menopause and dementia still needs to be copiously bare as long as embraces an plenty of possible pathways. Analyzing them in the circumstance of the clinical diversity of patient would ominously rally the prevention, diagnosis and therapy of dementia among women with early menopause.

CBGP-68

Physiology

THERAPEUTIC EFFECT OF *MYRTUS COMMUNIS* LEAVES EXTRACT IN THE TREATMENT OF PSORIASIS USING MOUSE MODEL**Khadija Anjum, Shazia Shamas*, Bushra, Sheeza Khan,
Hafiza Rabia Kanwal and Syeda Hijab Fatima***Department of Zoology, Rawalpindi Women University, Rawalpindi**Corresponding Author: shazia.shamas@ruw.edu.pk

Psoriasis is an immune mediated and chronic inflammatory disease which is characterized by immune dysregulation, epidermal hyperproliferation, erythema and scaling. The current investigation evaluated the anti-inflammatory, immunomodulatory and antipsoriatic potential of *Myrtus communis* leaves extract in an IMQ (imiquimod)-induced psoriasis in BALB/c mouse model. *Myrtus communis* leaves extraction was formulated by using methanol (80%) via maceration. Mice were divided into four groups including control group, only IMQ-induce (negative group), IMQ + clobetasol (positive group), IMQ + extract (extract treated group). IMQ (5%) cream applications were administered for six consecutive days to induce psoriasis. Severity of disease was evaluated by using Psoriasis Area and Severity Index (PASI) score. Control group indicating healthy skin but higher PASI scores were observed in negative group 5.96 ± 3.52 , reflecting the induction of psoriasis. Treated group including positive control and extract-treated group demonstrated reduction in PASI score (3.71 ± 1.85 , 3.01 ± 1.52). One way ANOVA showed statistically significant difference ($F= 19.754$, $p<0.001$) in PASI score. The splenomegaly was observed in the negative group ($0.383 \pm 0.017g$) as compared to the control group ($0.233 \pm 0.017g$), while clobetasol and extract treated group reduced spleen weight ($0.285 \pm 0.013g$, $0.265 \pm 0.0013g$), ($F=72.764$, $p<0.001$). Histopathological examination demonstrated that treatments markedly reduced inflammatory cell infiltration, decreased epidermal thickness. Furthermore, histological examination of kidney and liver section of negative group demonstrated mild tubular dilation and epithelial vacuolation, and hepatocellular swelling and sinusoidal dilation, while clobetasol and *Myrtus communis* leaves treated group preserved morphology. In conclusion, *Myrtus communis* leaves extract exhibited strong immunomodulatory and antipsoriatic potential, supporting its potential as natural therapeutic agent for psoriasis management.

CBGP-69

Cell and Molecular Biology

GENOMIC PREDICTORS AND AI/ML METHODS FOR RESIDUAL FEED INTAKE PREDICTION IN CATTLE: A COMPREHENSIVE SYSTEMATIC REVIEW**Javed Ahmed Ujan and Majeeda Ruk***Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh, Pakistan*Correspondence: javed.ujan@salu.edu.pk

Residual Feed Intake (RFI) is a pivotal bioeconomic trait for enhancing metabolic feed efficiency and

reducing environmental impacts in bovine production. Methods: Following PRISMA guidelines, this systematic review synthesizes a decade of research (2016–2026) across PubMed, Google Scholar, and SciSpace, evaluating 10 high-quality primary studies to trace the trajectory of genomic predictors and artificial intelligence/machine learning (AI/ML) frameworks. Results: Findings reveal a major technological transition from traditional linear parametric models (GBLUP and ssGBLUP) to non-linear deep learning, semi-supervised self-training algorithms (SVM-RBF), and gradient-boosted ensemble architectures (XGBoost). Simultaneously, predictor inputs have evolved from sparse 50K SNP arrays to 700K high-density panels, milk mid-infrared spectroscopy (MIRS), and continuous 3D camera-based phenomics (CFIT). Non-parametric AI architectures systematically outperform linear models, achieving predictive accuracies of $r = 0.62\text{--}0.79$ compared to $r = 0.22\text{--}0.49$ for single-step GBLUP. Conclusions: AI/ML paradigms significantly enhance genomic selection for feed efficiency by capturing non-additive epistatic interactions. However, routine commercial adoption requires overcoming sample size constraints, crossbreed performance degradation, and algorithmic opacity. Future implementation must prioritize explainable AI (XAI) frameworks and multi-environment validation benchmarks to ensure robust selection in commercial cattle herds.

CBGP-70

Physiology

ASSESSMENT OF MICROPLASTICS- INDUCED BIOACCUMULATION, HEMATOLOGICAL CHANGES, AND TISSUE PATHOLOGY IN FRESHWATER MAJOR CARPS

Hanzala Yasin, Sumaira Abbas¹, Asia Iqbal², Yousaf Masih and Muhammad Hammad Noor¹

¹*Department of Fisheries & Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan*

²*Department of Wildlife & Ecology, University of Veterinary and Animal Sciences, Lahore, Pakistan*

*Corresponding Author: sumaira.abbas@uvas.edu.pk

An experimental trail was designed to study the inclusion of Microplastics (MPs) in feed formulation of freshwater major carps. MPs (mg) are mixed with formulated fish feed (kg) during the experiment at concentrations of 200mg (0.2g), 400mg (0.4g), and 667mg (0.6g). The experimental setup consists of four aquaria stocked in three experimental groups (10 fish/aquarium) including (T1, T 2, group T3 and control). The hematological parameters WBCs, blood Platelets, Differential WBCs, RBC's, Hemoglobin (Hb), Hematocrit (HCT), Mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular haemoglobin (MCH), were studied using standard procedures. Hematological parameters showed significant variation in RBCs (0.65 ± 0.03 (T3) to 1.20 ± 0.02 (Control) Million/mm³), hemoglobin (5.0 ± 0.05 (T3) to 7.5 ± 0.02 g/dl) in Control, Haematocrit(%) (16.1 ± 0.01 (T2) to 22.0 ± 0.02) in Control. Whereas platelets (200.0 ± 2.5 (T3) to 300 ± 2.0 thousands/mm³) without additives and WBCs (45.0 ± 1.0 (Control) to 215 ± 2.0 thousands/mm³) (T3) showed a significant decrease to the increasing level of MPs in different experimental groups. At the same time, MCV (116.0 ± 1.5 (T1) to 140.5 ± 0.9 mm³ (Control)), MCH (26.3 ± 0.3 (T1) to 30.0 ± 0.35 pg) in control and T3. MCHC (22.7 ± 0.3 (T1) to $33.20\pm0.2\%$ (Control)) showed an increase to the increasing level of MPs ($p<0.005$). At the end of the trial organs of interest i.e. liver, intestines and brain were removed and preserved in 10% formalin solution for histopathological analysis. The accumulation increased gradually with the increasing concentration of MPs in different organs (intestines, liver and brain). The highest accumulation was seen in the intestines (52.1 ± 3.5) followed by the liver (20.6 ± 1.0) and brain (8.5 ± 0.6). There is no degeneration, inflammation, necrosis and edema in control while Chronic inflammation and edema in T1, Mild chronic

inflammation and edema (T2) and Chronic inflammation and edema and histopathology was observed in T3 respectively. In liver samples necrosis, cell swelling or dilation of sinusoids was absent but mild necrosis, cell swelling and dilation of sinusoids in T1 and T2. Strong necrosis, cell swelling and dilation of sinusoids were observed in T3. The intestines of tilapia in control showed no degeneration of epithelium, villi destruction and necrosis. Mild degeneration of epithelium, no villi deconstruction and mild necrosis in T1 and T2 but moderate degeneration of epithelium, mild villi destruction and strong necrosis (T3). The MPs have adverse effects on the overall health of fish which include damage to organs and alteration in hematological values.

CBGP-71

Biotechnology

STRATEGIC OPTIMIZATION OF MICROALGAE BIOMASS PRODUCTION UNDER PHOTOAUTOTROPHIC AND MIXOTROPHIC REGIMES FOR HIGH-VALUE BIOFUEL APPLICATIONS

Kashif Mehmood, Shehzad Ahmad and Ali Hussain*

Institute of Zoology, University of the Punjab, Lahore, Pakistan

*Corresponding Author: ali.zool@pu.edu.pk

Rapid extension of dairy industry disposes of a huge amount of dairy waste raising environmental concerns related to pollution. Microalgal utilization of bovine manure has already been recognized as good approach to generate microalgal biomass for green-fuel production purpose. This study planned to employ two RSM models of Central Composite Design (CCD) for optimizing process parameters under photoautotrophic and mixotrophic cultivation of microalgae (*Chlorella vulgaris*). The developed quadratic model for photoautotrophic cultivation having 3 factors including pH, temperature and light intensity as independent variables had high F-value of 34.09 and significant $p < 0.001$ along with significantly good R^2 and adj R^2 value 96.84% and 94.00%, respectively indicated model's significance in predicting harmony between actual yield and predicted outcome. In the second model, dry cattle manure was taken as growth substrate for mixotrophic cultivation. The current study also aimed to investigate the effect of manure particle size while optimizing the process using RSM model with four factors including light intensity, temperature, pH and particle size of manure. This model was also significant showing high F-value of 19.69, reduced p-value < 0.001 , R^2 value (94.84%) and adj- R^2 value (90.02%). Microalga was cultivated under model predicted optimized condition. Photoautotrophic optimum cultivation (under pH 9, temperature 38°C and light intensity 5000 lux) yielded 0.6 g/L biomass. Whereas mixotrophic optimum cultivation (under pH 9, temperature 38°C, light intensity 5500 lux and particle size 0.177—0.21mm (US mesh size 70—80 pores per square inch) yielded 1.2 g/L biomass. The study shows that growing *C. vulgaris* under mixotrophic conditions with bovine dung can not only be a sustainable strategy to boost microalgae yield but also a feasible alternative for waste management. This double advantage of strategy emphasizes its potential to promote environmental sustainability and biomass generation.

CBGP-72**EVALUATION OF *SOLANUM NIGRUM* EXTRACTS FOR ANTIDIABETIC ACTIVITY AGAINST ALLOXAN INDUCED DIABETIC MICE****Sharafat Khan¹, Imran Khan², Dua Saleem², Munawar Saleem Ahmad^{1*}**¹*Department of Zoology, University of Swabi, KP, Pakistan*²*Department of Pharmacy, University of Swabi, KP, Pakistan*Corresponding Author: saleemsbs@gmail.com

Diabetes mellitus (DM) is a universal endocrine disorder. Hypoglycemics from natural and synthetic sources are available to care for diabetes. The aim of this study was to induce experimental diabetes mellitus using alloxan monohydrate in common adult Swiss albino mice and to confirm the antidiabetic activity of changes in body weight, food and water consumption, urine volume and glucose level between common and diabetic mice to investigate. *Solanum nigrum* has been shown to be helpful in treating diabetes. The result of methanol and aqueous extract from *Solanum nigrum* leaves was examined under common conditions of glucose loading and alloxan monohydrate-induced diabetic mice. The polyherbal composition shows significant hypoglycemic activity.

CBGP-73**MOLECULAR CHARACTERIZATION OF GRASSHOPPER FAUNA OF MALAKAND REGION PAKISTAN****Abdul Aziz and Munawar Saleem Ahmad***Department of Zoology, University of Swabi, Anbar Swabi, Khyber Pakhtunkhwa, Pakistan*Corresponding Author: saleemsbs@gmail.com

Grasshopper (Orthoptera) is important ecological and agriculture herbivores fauna of Khyber Pakhtunkhwa Malakand Division, the molecular study of Grasshopper fauna of Malakand region Pakistan for the first time from April 2021 to April 2024. Malakand region consists of eight districts; District Buner, Malakand, Bajaur, Swat, Shangla, Dir Lower, Dir Upper and Chitral. During the surveys used aerial nets and hand collection and morphological identification key and comparisons visit to the University of Sindh (Jamshoro) and NARC (Islamabad), for DNA, a leg per voucher processed with the Wiz Prep™ gDNA Mini Kit, the *COXI* barcode amplified with universal primers, chromatograms were curated in Geneious Prime® 2020.2.4, sequences aligned with MUSCLE, conserved/variable sites summarized, base composition (A+T, G+C) and physicochemical descriptors extracted via ProtParam/BioEdit, K2P distances calculated, transition/transversion bias (R) estimated in MEGA 11, and phylogenies inferred by NJ (K2P), ML (MEGA 11; default/best-fit models), and Bayesian inference (MrBayes v3.2.6), with support from 1,000 NJ/ML bootstraps and BI posterior probabilities; BLAST comparisons. Total of 2395 specimens were collected through standardized sweep-netting and hand-collection methods, from 26 different localities of study area, out of which 60 species are identified

morphologically, also validated morphology using *COXI* barcodes to address conflicts in species delimitation and reconstructed relationships via NeighborJoining, MaximumLikelihood, and Bayesianinference under the Kimura 2-parameter model. DNA barcoding was based on *Cytochrome Oxidase 1 (COXI)* gene to confirm the morphological identification of 31 species and solve the problem of conflict between morphological and molecular identification. Six species were submitted to NCBI GenBank for the first time. Phylogenic tree to find out the ambiguity between inter and intra species of Acridadae by using *COXI* gene, Genomic DNA was amplified using polymerase chain reaction by gelelectrophoresis prior to sequencing, out of which AT bias value range from $\approx 60\%$ to 68% , the R-values showed 1.02 to 3.87, genetic distance showed 0.01-0.37, *Acrida*, *Phlaeoba*, and *Truxalis* showed coherence in Pairwise divergence of genetic and *Leva indica* and *Cruciotacris decisa* showed variation on geographic broader. While the Muscle database facilitated the identification of conserved and variable sites across the dataset. Acridadae was found to be more diverse species in the study area. Our study provides model line for the biodiversity and molecular phylogeny of study area Grasshopper which solve the problem of ambiguities in taxonomy for future study.

CBGP-74

Biotechnology

TRANSFORMATION OF RIVER POLLUTED WATER INTO NUTRIENT ENRICHED WATER THROUGH ERATHWORM BASED FILTRATION SYSTEM

Saiqa Andleeb^{*1}, Ghafoor ul Islam¹ and Aisha Nazir³

¹Microbial Biotechnology and Vermitechnology Laboratory, Department of Zoology, University of Azad Jammu and Kashmir, King Abdullah Campus, Chattar Klass, Muzaffarabad, Pakistan

²Department of Zoology, Government College University Lahore, Lahore, Pakistan

³Institute of Botany, University of Punjab, Quaid-e-Azam Campus, Lahore, Pakistan

*Corresponding author: drsaiqa@uajk.edu.pk

The aim of the study was to develop *Eisenia fetida*-based vermifiltration system to transform river polluted water to nutrient-enriched water (vermiwash). The current study was used to transform river polluted water into vermiwash, to evaluate the physicochemical properties, heavy metals, and health risk assessment parameters. The impact of river polluted water on growth, reproduction, behavior, and morphological changes in earthworm species was analyzed. *Eisenia fetida*-based vermifiltration system effectively transformed river polluted water into vermicompost and nutrient-rich vermiwash and reduced the heavy metals contamination from polluted water efficiently. The heavy metals pollution index in polluted water was recorded as 572.03 before vermifiltration, and significantly declined after vermifiltration (85.297 in vermicompost, 141.114 in vermiwash-20, 91.258 in vermiwash-40, and 80.209 in vermiwash-60). The contamination factor was reduced after vermifiltration treatment. Results of FTIR and histology indicated that polluted water had no lethal effect on the morphology, growth, and reproduction of *E. fetida*. Vermifiltration supported healthy earthworm growth, reproduction, and survival, with no toxic effects. *E. fetida* remediates heavy metals via cutaneous or gut-associated processes like biotransformation, bioaccumulation, and biodegradation. The findings highlight the vermifiltration system's offering a practical solution to reduce environmental and public health risks in polluted aquatic ecosystems.

CBGP-75

Cell & Molecular Biology/
Genetics

RECURRENT AND UNPUBLISHED PATHOGENIC VARIANTS IN HEARING LOSS GENES IN THE PAKISTANI POPULATION

Madiha Shadab^{1*}, Afif Ben-Mahmoud², Luis Nicolás Martínez Völter^{3,5}, Ansar Ahmed Abbasi^{1,4}, Sara Iftikhar Abbasi⁴, Bonsu Ku⁶, Ahsan Ejaz⁷, Zahid Latif¹, Vijay Gupta², Daniel Owrang^{3,5}, Mi-Hyeon Jang⁸, Zijin Zhang^{3,5}, Rahema Mohammad⁹, Henry Houlden⁹, Hyung-Goo Kim^{8*}, and Barbara Vona³

¹*Department of Zoology, Mirpur University of Science and Technology, Mirpur*

²*Neurological Disorders Research Center, Qatar Biomedical Research Institute, Hamad Bin Khalifa University, Doha, Qatar*

³*Department of Physics, University of Kotli, Azad Jammu and Kashmir-11100.*

⁴*School of Nuclear Science and Technology, Lanzhou University, Lanzhou, 730000, PR China*

⁵*Gomal Center for Biochemistry and Biotechnology (GCBB),*

Gomal University Dera Ismail Khan, Pakistan

⁶*Institute of Human Genetics, University Medical Center Göttingen, 37073 Göttingen, Germany*

⁷*Institute for Auditory Neuroscience and Inner Ear Lab,*

University Medical Center Göttingen, 37075 Göttingen, Germany

*Corresponding Author: madiha.shadab@hotmail.com

Congenital hearing loss presents a genetic etiology in 80% of cases. The molecular diagnostic rates for hereditary hearing loss are significantly influenced by genetic ancestry, highlighting the importance of population-specific studies. In countries like Pakistan, where consanguineous marriages are prevalent, genetic research has substantially contributed to the identification of autosomal recessive genes, advancing our understanding of molecular mechanisms underlying rare and novel forms of hearing loss. We conducted exome sequencing and bioinformatics analysis, as well as targeted gene sequencing to analyse 27 hearing loss Pakistani families. This approach revealed seven pathogenic, and three likely pathogenic, comprising five nonsense, three missense, one frameshift, and one deep intronic variant, across eight hearing loss-associated genes (MYO15A, GJB2, SLC26A4, TMC1, HGF, TMIE, SLC19A2, and KCNE1) in 21 families, achieving an overall diagnostic rate of 77.8%. GJB2, the most prevalent gene affected, was detected in seven independent families. Nine out of ten identified variants were homozygous. Notably, the variants c.10475dupA, p.Leu3493AlafsTer25 in MYO15A (NM_016239.4, DFNB3) and c.617T>A, p.Leu206Ter in SLC26A4 (NM_000441.2, DFNB4) are documented in ClinVar but remain unpublished. Additionally, this is the first study to associate SLC19A2 with non-syndromic hearing loss, despite its known link to thiamine-responsive megaloblastic anemia syndrome. Our work expands the genotypic and phenotypic spectrum of hearing loss by emphasizing the importance of investigating underrepresented groups to identify unique genetic variants and clinical characteristics. Such efforts deepen the understanding of the genetic diversity underlying hearing loss and lay the foundation for tailored diagnostic and therapeutic strategies in diverse populations.

CBGP-76

Cell & Molecular Biology/
Genetics

**GENETIC ETIOLOGY OF HEREDITARY NEURODEVELOPMENTAL
DISORDERS IN KASHMIRI FAMILIES**

Tauqeer Ahmed Mughal¹, Ansar Ahmed Abbasi^{1,2}, Rameez Nisar¹ and James A Poulter³

¹Department of Zoology Mirpur University of Science and Technology (MUST) Mirpur, 10250 Pakistan

²Department of Zoology, University of Azad Jammu and Kashmir Muzaffarabad, 13100 Pakistan

³Division of Molecular Medicine, Leeds Institute of Medical Research,

Faculty of Medicine and Health, University of Leeds

*Corresponding Author: tamughal05@gmail.com

Neurodevelopmental disorders (NDDs) represent a clinically and genetically heterogeneous group of conditions characterized by impairments in cognition, communication, behavior, and motor function. These disorders typically manifest during infancy or early childhood and often persist throughout life, imposing a substantial medical, psychological, and socioeconomic burden on affected individuals and their families. Common examples include intellectual disability (ID), autism spectrum disorders (ASD), attention-deficit/hyperactivity disorder (ADHD), epilepsy, language impairment, and microcephaly. In present study 6 families affected with hereditary neurodevelopmental disorders were subjected to Whole exome sequencing which revealed the involvement of recurrent variants in recruited families. The Kashmiri population, characterized by a high rate of endogamy and consanguinity, provides a valuable resource for the genetic dissection of hereditary neurodevelopmental disorders. This study will also broaden the mutation spectrum of genes involved in Hereditary neurodevelopmental disorders in Kashmiri population. Moreover, investigating affected families from this region not only aids in delineating the underlying genetic architecture but also contributes to improved diagnosis, genetic counselling, and potential future therapeutic strategies.

CBGP-77

Animal Behaviour/
Physiology

**ECOPHYSIOLOGY AND BEHAVIORAL INDICATORS OF THERMAL
STRESS IN FRESHWATER CRAB *HIMALAYAPOTAMON EMPHYSETEUM*
UNDER EXPERIMENTAL WARMING**

Tenzeela^{1,2*}, Muhammad Adnan¹, Aisha Gul¹ and Sanaullah Khan¹

¹Institute of Zoological Sciences, University of Peshawar, Khyber Pakhtunkhwa

²Department of Zoology, Women University Swabi, Khyber Pakhtunkhwa

*Corresponding Author: tanzeelayousaf@uop.edu.pk

Global warming poses substantial challenges to ectothermic organisms, which depend on physiological and behavioural adjustments to maintain homeostasis under thermal stress. We examined the effects of

experimental warming on oxygen consumption, ammonia excretion, feeding activity, surface activity, burrow retreat, and critical thermal maximum (CTMax) in *Himalayapotamon emphyseteum* Crabs were exposed to three independent experimental temperatures (27, 31, and 33°C), and physiological and behavioural responses were assessed. Oxygen consumption rate increased significantly with temperature, from 1.917 ± 0.192 mg O₂ g⁻¹ h⁻¹ at 27°C to 3.606 ± 0.631 at 31°C and 5.835 ± 0.792 at 33°C ($p < 0.001$). Ammonia excretion did not differ between 27 and 31°C but increased significantly at 33°C ($p < 0.001$). Feeding rate and surface activity decreased significantly with increasing temperature, whereas burrow retreat increased significantly ($p < 0.001$). CTMax was strongly affected by heating rate, increasing from $32.90 \pm 0.88^\circ\text{C}$ at 1°C min^{-1} to $34.10 \pm 0.74^\circ\text{C}$ at $1^\circ\text{C per 30 min}$ and $35.90 \pm 0.32^\circ\text{C}$ at 1°C h^{-1} ($p < 0.001$). Experimental warming elicited pronounced physiological and behavioural responses, while measured upper thermal limits were strongly influenced by heating rate and experimental protocol. Reduced feeding and surface activity, increased burrow retreat, and elevated metabolic rate indicate significant physiological and behavioral responses to warming.

CBGP-78

DOSE-DEPENDENT HISTOPATHOLOGICAL EFFECTS OF MORPHOLINE ON THE LIVER AND KIDNEY OF RABBITS

Khalida Unar¹, Ayaz Ali Unar² and Majeeda Ruk¹

¹Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh

²Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Sindh

Correspondence: safdar.ujjan@salu.edu.pk

Morpholine is a widely used industrial chemical with potential toxic effects following repeated exposure. The present study investigated the dose-dependent histopathological effects of morpholine on the liver and kidney of rabbits. Fifteen rabbits were divided into three groups ($n=5/\text{group}$): control (G-C), low-dose morpholine (G-1; 100 ppm/kg body weight), and high-dose morpholine (G-2; 400 ppm/kg body weight). Morpholine was administered orally for 60 consecutive days, while controlling animals received de-ionized water. Physical condition and behavioral responses were monitored throughout the experimental period. Following treatment, liver and kidney tissues were collected, fixed in 10% formalin, processed, embedded in paraffin, sectioned at $5\ \mu\text{m}$ using a rotary microtome, and stained with hematoxylin and eosin (H&E;) for microscopic examination. Morpholine exposure produced notable histopathological alterations in both organs, with greater severity at the higher dose. In the liver, 100 ppm exposure produced congestion and dilation of the central vein, periportal inflammation, lymphocytic and macrophage aggregation, bile-duct damage, hepatocellular pyknosis and hypotrophy, and compression of sinusoidal spaces. At 400 ppm, these changes were more pronounced and included severe vascular congestion and dilation, inflammatory infiltration, hepatocellular degeneration and necrosis, disruption of sinusoidal architecture, portal-area fatty accumulation, and damage to hepatocytes and Kupffer cells. Renal tissue showed tubular degeneration, vascular congestion, glomerular alterations, pyknosis, and tubular damage at 100 ppm. At 400 ppm, severe tubular degeneration and coagulative necrosis, loss of cellular nuclei, medullary-ray damage, glomerular swelling and edema, and marked vascular impairment were observed. Overall, repeated oral exposure to morpholine induced dose-dependent hepatotoxic and nephrotoxic changes, with the kidney showing comparatively greater susceptibility, particularly at the higher exposure level.

CBGP-79

PROTECTIVE AND PROPHYLACTIC EFFECTS OF INDEPENDENT DIETARY INTERVENTIONS WITH SIDR HONEY AND *MORINGA OLEIFERA* LEAF POWDER AGAINST DICLOFENAC-INDUCED GASTRIC INJURY IN MICE

Salika, Aasma Sharif, Huzaifa Farooq and Soumble Zulfiqar*

School of Biological Sciences, University of The Punjab, Lahore

*Corresponding Author: soumblesbs@pu.edu.pk

Non-steroidal anti-inflammatory drugs (NSAIDs) like diclofenac cause severe gastrointestinal mucosal injury. This study evaluated the prophylactic and protective potential of independent dietary regimens using Sidr honey or *Moringa oleifera* leaf powder (MOLP) against diclofenac-induced gastric damage, comparing their efficacy to the standard clinical drug lansoprazole. Swiss albino adult mice were allocated into five groups (n=8/group): Control, Diclofenac model, Lansoprazole reference, Sidr honey pre-treatment (2 weeks), and MOLP pre-treatment (2 weeks). Gross topological analysis and Hematoxylin and Eosin (H&E) histopathology revealed that while the 3-day diclofenac challenge provoked severe epithelial erosion and structural mucosal damage, lansoprazole successfully promoted tissue recovery. Independent dietary interventions with either Sidr or MOLP honey were comparatively effective, significantly preventing structural degeneration of gastric lining. Relative transcript expression profiling via RT-qPCR showed that the diclofenac challenge significantly altered molecular pathways associated with mucosal injury, oxidative stress, and inflammation, with some genes showing sharp variations and others showing milder shifts. Remarkably, these pathogenic transcriptomic alterations were significantly minimized in both the dietary intervention cohorts and the lansoprazole reference group. Both Sidr honey and *Moringa oleifera* leaf powder may serve as potent, independent functional food regimens that effectively prevent and mitigate NSAID-induced gastric injury, displaying a comparable protective capacity to standard pharmacological therapies.

CBGP-80**Public Health**

URBANIZATION, CLIMATE CHANGE AND EMERGING VECTOR-BORNE DISEASES IN PAKISTAN: AN INTEGRATED ONE HEALTH PERSPECTIVE ON MEDICAL ENTOMOLOGY

Meer Sharib Salal* and Farrukh Baig

Department of Entomology, Muhammad Nawaz Shareef University of Agriculture, Multan

*Corresponding Author: meersalal2r1@gmail.com

Unplanned urban expansion across Lahore, Karachi, and Rawalpindi has created dense networks of water storage containers, construction sites, and drainage inefficiencies that sustain *Aedes aegypti* (Linnaeus) populations across a wider seasonal window than the monsoon-restricted period historically recorded for the species in Pakistan. Dengue outbreaks recorded in Punjab and Sindh over the past decade

have shifted from sharp seasonal peaks concentrated in the post-monsoon period toward a broader transmission window, a pattern consistent with regional warming trends documented across South Asia. This perspective applies a One Health framework to examine how urbanization and climatic warming jointly influence three vector-borne disease systems relevant to Pakistan: dengue transmitted by *Aedes aegypti* and *Aedes albopictus* (Skuse), malaria transmitted by *Anopheles stephensi* (Liston), and leishmaniasis transmitted by *Phlebotomus* sand flies. *Anopheles stephensi*, historically an urban malaria vector confined to South Asian cities, has expanded into East Africa in recent years, illustrating the capacity of urban-adapted mosquito vectors to establish new geographic ranges under favorable climatic and infrastructural conditions, a trajectory with direct relevance to Pakistan's own urban malaria risk. Integrating entomological surveillance, human case reporting, and environmental monitoring under a coordinated framework remains constrained in Pakistan by fragmented data ownership across provincial health departments, municipal vector control units, and academic entomology programs that rarely share standardized datasets. We outline a One Health surveillance model built around three components: routine larval index monitoring in high-risk urban wards using standardized Breteau and House indices, integration of climate and rainfall data from the Pakistan Meteorological Department into early-warning transmission models, and cross-sectoral reporting protocols linking hospital case data to vector density data at the union council level. Sustained reduction in the urban vector-borne disease burden in Pakistan depends on institutionalizing this cross-sectoral data linkage rather than on vector control campaigns implemented in isolation from climate and health surveillance systems.

CBGP-81

Microbiology

APPLE PEEL AS A SOURCE OF PROBIOTIC *LACTOBACILLUS*: A NON-DAIRY ALTERNATIVE

Ali Murtaza^{*1}, Ittrat Zahra², and Bushra Muneer¹ and Ikram-ul-Haq¹

¹Institute of Industrial Biotechnology, Government College University, Lahore

²Institute of Zoology, University of the Punjab, Lahore, Pakistan

*Corresponding Author: alibaloch720@gmail.com

In recent years, the growing interest in functional foods and probiotics has highlighted the need for novel, natural sources of beneficial microorganisms. The growing demand for non-dairy probiotics has shifted interest toward plant-based matrices as alternative probiotic sources. Apple peel is a nutrient-rich byproduct of fruit consumption that serves as an ecological niche for bacteria. Lactic acid bacteria (LAB) were cultured from apple peel and isolated on de Man, Rogosa, and Sharpe (MRS) agar. Their staining patterns and morphologies were studied, revealing Gram-positive, rod-shaped bacteria, which is characteristic of *Lactobacillus* species. Biochemical analysis and 16S rRNA gene sequencing were performed to identify the isolates. The probiotic characteristics of the isolates were evaluated based on their resistance to low pH (pH 2.0), bile salt tolerance (0.3%–1.5%), optimal growth temperature (25°C–50°C), antimicrobial action against clinical and foodborne pathogens, and antibiotic susceptibility profiles. The apple peel isolate showed a high survival ratio under simulated gastrointestinal stress conditions, maintaining viable counts (10^7 cfu/ml) that meet internationally recommended probiotic standards. Its antimicrobial activity was displayed through the generation of organic acids and other antimicrobial metabolites against pathogenic bacteria. Furthermore, the isolates were sensitive to common antibiotics,

implying that they are safe for consumption. These results indicate that plant matrices can be valuable sources of probiotics, serving as a foundation for future research and applications. Apple peel appears to be a viable non-dairy source of probiotic *Lactobacillus*, offering an alternative for lactose-intolerant and vegan populations.

SECTION – I I

PESTS AND PEST CONTROL

PC-1

Pest & Pest Control

CLIMATE-DRIVEN ECOLOGICAL ZONING OF *TELENOMUS REMUS* IN PAKISTAN USING LIFE TABLE PARAMETERS

Kinza Qadeer, Muhammad Asif Gondal and Javed Khan

COMSATS University, Islamabad, Pakistan

*Corresponding Author: kanzaqadeer983@gmail.com

The fall armyworm, *Spodoptera frugiperda*, has become one of the most destructive pests of maize worldwide, creating an urgent need for environmentally sustainable management strategies. Among the available biological control agents, *Telenomus remus* has demonstrated considerable potential due to its high parasitism efficiency against fall armyworm eggs. However, the success of its large-scale production and field application depends on identifying the environmental conditions that maximize its biological performance. Therefore, this study examined the influence of temperature (16, 20, 24, 28, and 32 ± 1°C) and relative humidity (45%, 65%, and 85 ± 5% RH) on the reproductive and parasitic performance of *T. remus*. In addition, life table analyses were conducted to assess population growth parameters under different environmental conditions, and ecological zoning was performed to identify regions suitable for the establishment and field deployment of *T. remus*. Temperature significantly affected parasitoid activity, with the highest parasitism (92.9 ± 0.53%) recorded at 28 ± 1°C, while only 19.0 ± 2.56% parasitism was achieved at 16°C. Thermal performance analysis estimated an optimum temperature (Topt) of 28.14°C for fecundity, although females maintained a relatively high reproductive output of 188 ± 2.56 eggs per female at 24°C, indicating that reproduction remained largely unaffected under moderately lower temperatures. Relative humidity also played a critical role, with 65% RH producing the highest parasitism (93.5 ± 0.45%) and fecundity (247 ± 1.53 eggs per female), whereas increasing humidity to 85% RH resulted in a marked decline in reproductive performance (172 ± 1.23 eggs per female). The net reproductive rate (Ro) was observed highest at 28°C (145.32 ± 0.82) and 65% RH (145.5 ± 0.96). These findings provide valuable information for optimizing the mass rearing of *T. remus* and establishing environmental conditions that enhance its efficiency as a biological control agent in integrated management programs against *S. frugiperda*.

PC-2**Pest & Pest Control****ECOFRIENDLY BIOSYNTHESIS OF SILVER NANOPARTICLES USING SEaweEDS:
A SUSTAINABLE APPROACH FOR STORE GRAIN PEST CONTROL****Jameela Farooq¹ and Afshan Yasmeen^{*1,2}**¹*Department of Zoology, Jinnah University for Women, Karachi*²*Centre of Excellence in Marine Biology University of Karachi, Karachi-75270**Corresponding Author: afshan.yasmeen@juw.edu.pk, afshan968@hotmail.com

Pakistan's economy highly relies on agriculture sector, which contribute significant part to GDP and support income and jobs. Despite sectorial growth post-harvest losses in grain crops are a major concern. Poor storage conditions allow stored grain pests to rapid infestation that cause serious quantitative and qualitative loss. Conventional synthetic pesticides successfully manage these pests but cause serious health problems in human and environment because of their instability, dissolution and persistent toxic byproducts that harm non-target living organism, soil, water and environment. This research aims to develop an ecofriendly and sustainable pest management technique by using silver nanoparticles synthesized by ecofriendly methods from brown seaweed. Aqueous extract of seaweed serves as reducing and stabilizing agent in the formation of silver nanoparticles. The yield and stability of AgNPs enhanced by modifying key parameters such as pH, temperature etc. The formation and characterization of nanoparticles confirm by UV-spectrophotometer and FTIR spectroscopy. Pesticidal activity revealed that seaweed mediated silver nanoparticles exhibit potential efficacy against stored grain pest in concentration dependent manners. These results suggest that the potential of seaweed mediated silver nanoparticles as ecofriendly candidates for store grain pest control.

PC-3**BIO-EFFICACY OF SELECTED ENTOMOPATHOGENIC FUNGI AGAINST
ECONOMICALLY IMPORTANT INSECT PESTS UNDER LABORATORY CONDITIONS****Santosh Kumar^{1*} and Riffat Sultana^{2**}**¹*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*²*Department of Zoology, University of Sindh, Jamshoro**Corresponding Author: santoshkumar@cuvas.edu.pk, riffat.sultana@usindh.edu.pk**

Entomopathogenic fungi (EPF) are promising biological control agents for the sustainable management of agricultural insect pests. The present study was undertaken to evaluate the pathogenic potential of selected entomopathogenic fungi under laboratory conditions and to explore their possible application in integrated pest management programmes in Pakistan. Selected fungal isolates, including species belonging to *Beauveria*, *Metarhizium*, *Cordyceps*, *Akanthomyces*, and *Purpureocillium*, were evaluated against economically important insect pests, with particular emphasis on species belonging to the orders Orthoptera, including grasshoppers and crickets, and Coleoptera, particularly beetles. Laboratory bioassays were conducted with selected entomopathogenic fungi to assess their infectivity, pathogenicity, and mortality effects under controlled

temperature and humidity conditions. Preliminary trials demonstrated variable pathogenic responses among the tested fungi, indicating differences in their effectiveness against the target insect species. Some fungal isolates showed promising potential for the suppression of grasshoppers, crickets, and beetles, while additional fungal isolates, concentrations, host–pathogen interactions, and formulation approaches are currently under investigation. Particular attention is also being given to the influence of environmental factors on fungal efficacy and persistence. The findings generated so far highlight the potential of locally adapted entomopathogenic fungi as environmentally friendly alternatives to conventional chemical pesticides. Continued laboratory investigations and subsequent field validation will help identify effective fungal strains for their possible incorporation into sustainable pest management strategies under the agroecological conditions of Pakistan.

PC-4

BIOLOGICAL CONTROL OF THE PEACH FRUIT FLY *BACTROCERA ZONATA* THROUGH PARASITOID WASPS *DIACHASMIMORPHA LONGICAUDATA* AND *DIRRHINUS GIFFARDII*

Mohammad Attaullah* and Muhammad Naeem

Department of Zoology, University of Malakand, Chakdara, Lower Dir

*Corresponding Author: attaullah.ms@gmail.com

The peach fruit fly (*Bactrocera zonata*) is a key pest of various vegetables and fruits. Chemical control is commonly used for the control of insect pests, but due to associated environmental and health hazards, biological control is preferred as an eco-friendly control measure. The present study aimed to evaluate the host preference of the peach fruit fly *B. zonata* against different vegetables and fruits. The parasitism potential of two different wasp species, *Diachasmimorpha longicaudata* and *Dirrhinus giffardii*, was evaluated on *B. zonata*. The most preferred host was guava, followed by apple and zucchini, while in cucumber, no parasitism was detected. The mean parasitism potential of *D. longicaudata* on *B. zonata* larvae was found to be 43.51%, while the parasitism potential of *D. giffardii* on the pupae of *B. zonata* was found to be 38.88 %. *D. longicaudata* showed a higher rate of parasitism compared to *D. giffardii*. Both wasps parasitized different life stages of the peach fruit fly, *B. zonata*. It is concluded that the larval parasitoid *D. longicaudata* and the pupal parasitoid *D. giffardii* are effective biological control agents for the control of the peach fruit fly *B. zonata*.

PC-5

LABORATORY EVALUATION OF THE ENTOMOPATHOGENIC FUNGUS *METARHIZIUM ANISOPLIAE* FOR THE BIOLOGICAL CONTROL OF *LOCUSTA MIGRATORIA*

Faria Abbasi and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro

*Corresponding Author: fariaabbasi12@gmail.com, riffat.sultana@usindh.edu.pk

Locusts are destructive agricultural pests capable of causing considerable damage to crops and vegetation, resulting in substantial economic losses. The present study evaluated the efficacy of the

entomopathogenic fungus *Metarhizium anisopliae* as a biological control agent against adults of *Locusta migratoria*. Adult locusts were collected from different localities of Hyderabad and subjected to laboratory bioassays. Mortality was considerably higher in the *M. anisopliae*-treated group (92%) than in the untreated control group (48%). Mortality progressively increased during the 7–10-day observation period, indicating the pathogenic activity of *M. anisopliae* against *L. migratoria*. The findings demonstrate the potential of this entomopathogenic fungus as an effective and environmentally compatible biological control agent for locust management. Its use may provide a promising alternative to conventional chemical insecticides and contribute to sustainable pest management strategies. Further studies are underway to evaluate different fungal concentrations, exposure periods, and treatment conditions to optimize its efficacy against *L. migratoria*.

PC-6

INSECTICIDAL IMPACT OF ACEPHATE AND PROFENOFOS ON *COCCINELLA SEPTEMPUNCTATA* (ORDER: COLEOPTERA) IN CROP SYSTEM OF DISTRICT SIALKOT, PAKISATN

Zainab, Sajida Mushtaq*, Sadia Maalik, Moazama Batool, Qurat ul Ain and Naheed Bano**

*Department of Zoology, Government College Women University, Sialkot

**MNS University of Agriculture Multan

**Corresponding Author: Sajida.mushtaq@gcwus.edu.pk

An important sector in boosting a country's economy is agriculture which is main source of income especially in Pakistan. The agricultural ecology benefits economically and aesthetically from its biodiversity especially of Insects, including pollination, nutrient recycling, biological monitoring, seed dissemination, and providing food for different trophic levels. Coleopterans are one of the known natural predators, pollinators, and decomposers. Insect pests' population reaches a certain point and causes economic losses. Pests are managed by using insecticides on the side and these also impact on the beneficial insects. Study was carried out from March to June of 2023 in district Sialkot, Pakistan. By determining the diversity of the order Coleoptera in selected cultivated crops. Specimen (1437) from nine different families of order Coleoptera were sampled. Four crops were selected for the insect sampling viz: wheat, fodder, sunflower, and vegetables. Toxicity of acephate and profenofos against *C. septempunctata* was determined by applying lethal and sublethal concentrations (LC_{50} , 1/3rd, 1/7th). The lethal concentration of Profenofos was 20.00 μ l/L and 10.00 μ l/L for acephate after eight hours of exposure. Nuclear abnormalities were determined through micronuclei assay that was recorded in adult *C. septempunctata*. The statistical results indicated that acephate was significantly more hazardous than profenofos, with comparatively less LC_{50} . Diversity shows the district of Sialkot's agriculture system as a supportive culture system for Coleopteran faunas. In terms of pests control as natural predators, beetles provide a sustainable means of managing undesirable populations through biological control methods. Further if insecticidal application is required profenofos with least quantity will show less impact on natural predators as well as crops. These studies promote farming methods by using least chemical pesticides for sustainable life on land according to fifteenth Sustainability Development Goal.

PC-7

FUTURE PERSPECTIVE OF AI-DRIVEN TECHNOLOGIES FOR RODENT PEST MANAGEMENT

Raheema Tahir^{1*}, Zakia Panhwar², and Asifa Ali Rehmani³

¹*Vertebrate Pest Control Institute, Pakistan Agricultural Research Council
Southern Zone Agricultural Research Centre, University of Karachi, Karachi*

²*Vertebrate Pest Control Institute, Pakistan Agricultural Research Council
Southern Zone Agricultural Research Centre, University of Karachi, Karachi*

³*Department of Zoology, University of Karachi, Karachi*

*Corresponding Author: raheematahir@hotmail.com

Rodent pests pose a major global threat to agricultural productivity, food security, and public health, causing substantial economic losses and transmitting numerous zoonotic pathogens. Traditional management approaches; chemical, biological, and physical controls, are limited by inconsistent efficacy, environmental impacts, resistance development, and difficulties in monitoring nocturnal and cryptic populations. These limitations highlight the urgent need for more precise and sustainable strategies. This review synthesizes current literature on AI and digital technologies for rodent pest management. We examine deep learning and computer vision for automated rodent detection using imaging, machine learning models, GIS/remote sensing for the prediction of population dynamics and disease risks. We also explore how these technologies can be embedded within decision-support systems and IPM frameworks to enable predictive risk assessment, targeted interventions, and automated surveillance. AI-driven technologies offer a path toward more precise, efficient, and environmentally friendly integrated pest management (IPM) systems. Future progress in sensor networks, and advanced AI models promise scalable, species-specific management. However, success depends on high-quality datasets, field validation, interdisciplinary collaboration, and careful consideration of ecological and ethical constraints.

PC-8

EVALUATION OF COLORED STICKY TRAPS FOR MONITORING WHEAT APHIDS (HEMIPTERA: APHIDIDAE) IN WHEAT FIELDS

**Bhai Khan Solangi¹, Sumbul Mureed Mastoi^{1,2}, Sajjad Hussain Rind³, Shafique Ahmed Memon¹,
Azhar Ali Nangor¹ and Imroz Solangi⁴**

¹*Department of Entomology, Sindh Agriculture University, Tandojam, Pakistan*

²*College of Forestry, Sichuan Agricultural University, Chengdu, China*

³*Institute of Plant Protection, Agriculture Research Centre Tandojam*

⁴*Department of Zoology, Government College University Hyderabad, Pakistan*

*Corresponding Author: bksolangi@gmail.com

Wheat aphids (Hemiptera: Aphididae) are among the major insect pests of wheat, causing considerable yield losses by feeding plant sap and adversely affecting crop growth and productivity. This study was carried out during the 2020–2021 cropping season at the Plant Protection Section, Agricultural Research Institute, Tandojam, Pakistan, to evaluate the performance of different

colored sticky traps for monitoring wheat aphid populations. Five trap colors, namely yellow, green, blue, white, and transparent, were tested using a Randomized Complete Block Design (RCBD) with three replications. Significant differences were observed among the trap colors in attracting aphids. Yellow sticky traps recorded the highest mean number of aphids (140.86), followed by green (42.12), white (35.36), blue (34.10), and transparent (19.12) traps. Weekly observations showed that aphid abundance reached its highest level during the fourth week of February, whereas the lowest population was recorded during the fourth week of January. Correlation analysis indicated a positive relationship between aphid abundance and temperature, while relative humidity showed a negative association. The results suggest that yellow sticky traps provide an effective, economical, and environmentally friendly method for monitoring wheat aphids and can be incorporated into integrated pest management (IPM) programs.

PC-9

TRANSGENERATIONAL EFFECTS OF *EUCALYPTUS CREBRA* ESSENTIAL OIL ON THE BIOLOGICAL AND DEMOGRAPHIC PARAMETERS OF *CULEX QUINQUEFASCIATUS*

Hadia Anjum, Abida Butt and Muhammad Ahmar Khan

Institute of Zoology, University of the Punjab, Lahore

*Corresponding Author: hadia2.res.zool@pu.edu.pk

Culex quinquefasciatus is an important mosquito vector with increasing insecticide resistance. The environmental impacts of synthetic insecticides have stimulated interest in plant-derived alternatives. The present study evaluated the larvicidal, sublethal and transgenerational effects of *Eucalyptus crebra* essential oil (EO) on the biological and demographic performance of *Culex quinquefasciatus*. Essential oil extracted from *E. crebra* leaves by hydrodistillation was chemically characterized using gas chromatography-mass spectrometry (GC-MS). Larvicidal bioassays were performed against fourth-instar larvae to determine lethal concentrations. Parental (F_0) generation was exposed to LC_{20} and LC_{50} concentrations. The subsequent F_1 progeny were assessed for developmental duration, adult longevity, reproductive performance and population growth using an age-stage, two-sex life table approach. GC-MS analysis revealed a chemically diverse essential oil, with eucalyptol (1,8-cineole), α -eudesmol, viridiflorol, terpinolene and α -pinene among the major constituents. The EO demonstrated considerable larvicidal activity, with LC_{20} and LC_{50} values of 86.88 and 192.04 ppm, respectively. Sublethal exposure significantly reduced reproductive performance in the F_0 generation. Fecundity declined from 341.72 eggs/female in the control to 130.17 and 49.50 eggs/female at LC_{20} and LC_{50} , respectively. Parental exposure also induced pronounced effects in the F_1 generation, including prolonged egg, larval and pupal development, reduced adult longevity and decreased fecundity. Age-stage, two-sex life table analysis demonstrated concentration-dependent alterations in population growth parameters, including reductions in intrinsic rate of increase (r), finite rate of increase (λ) and net reproductive rate (R_0), with an increase in mean generation time (T). Population projection further revealed substantial suppression of population growth in lineages derived from treated parents, with the strongest suppression observed at LC_{50} . Overall, *E. crebra* essential oil exhibited significant larvicidal and transgenerational effects against *C. quinquefasciatus*, reducing reproductive and demographic fitness beyond the directly exposed generation. These findings highlight the potential of *E. crebra* EO as a promising botanical component for sustainable and integrated mosquito management.

PC-10**TESTING PUTATIVE FACTORS OF WHEAT GERMPLASAM AGAINST
(*RHOPALOSIPHUM PADI*) AND THEIR IMPACT OF WHEAT YIELD****Shah Alam Khan***Department of Plant Protection, The University of Agriculture, Peshawar*

Corresponding Author: profkhansa69@aup.edu.pk

The current research assessed the population trend of wheat aphid (*Rhopalosiphum padi*) and the resistance mechanism such as antibiosis, antixenosis, and tolerance in 2023-24 under three wheat genotypes (Nawab-21, MY-902 and Sindhi-15). The aphid density was significantly different ($P < 0.05$) between the weekly observations with the highest and the lowest average aphid population of 185.34 and 77.35 on MY-902 and Nawab-21, respectively. The infestation of aphids was highest in the second week of March (539.13 aphids/plant) after which it decreased at the beginning of April. The tests on antibiosis showed minimum progeny production and delay reproduction on Nawab-21 but Sindhi-15 favored maximum progeny and intrinsic rate of increase ($r_m = 0.258$). Antixenosis experiments revealed that aphids gave preference to Nawab-21 seedlings over MY-902 at all-time intervals. Genotypic differentiation was indicated by a tolerance analysis in which the overall index of tolerance indicated that the highest tolerance index of 38.102 was found in MY-902 and highest susceptibility in Sindhi-15. Genotype differences were observed in yield related characteristics where Nawab-21 yielded a longer spike (10.07 cm), a greater number of grains per spike (60.33), higher 1000-grain weight (33.00 g) and better grain yield kg ha⁻¹ (3412.2). When added together, it was shown that Nawab-21 exhibited a greater degree of resistance to infestation by aphids and antibiosis and antixenosis, whereas in infestation Nawab-21 was more tolerant than high-infested MY-902, which is why both genotypes are useful in aphid breeding and breeding programs.

PC-11**MONITORING OF INSECTS ASSOCIATED WITH LEAFY FUNCTIONAL
PLANTS IN THE FIELD****Khalid Hussain Dhilloo, Abdul Basit, and Aneeta Lashari***Department of Entomology, Sindh Agriculture University Tandojam, Sindh*

Corresponding Author: khddhilloo@sau.edu.pk

Plants are not only important for human needs, but also ecologically important for other forms of diversity, such as insects, microorganisms, soil, and the environment. Functional plants are important for improving the fertility of soil. This experiment was conducted at Latif Farm, Sindh Agriculture University, Tandojam, during the rabi season 2025. The trial was conducted using a Randomized Complete Block Design (RCBD) with a net plot size of 50 m² and three replications. The five treatments, such as T1 Sponge guard, T2 Carrot, T3 Mung bean, T4 Kidney bean, and T5 Coriander, were used for conducting experiments. The data were statistically analysed using analysis of variance (ANOVA), and the means were compared using the Least Significant Difference (LSD) test ($P < 0.05$). Correlation analysis showed that temperature had a non-significant impact on insect pests ($r = -0.15$ to 0.51 ; $P > 0.05$), but significantly influenced natural enemies in Carrot, Sponge gourd, and Kidney bean ($P < 0.05$), with the strongest correlation in Kidney bean ($r = 0.8888$; $P = 0.0001$). Humidity, however, showed a predominantly negative and non-significant

correlation with both insect pests ($r = -0.37$ to 0.05) and natural enemies ($r = -0.53$ to 0.01) throughout all crops. One-way ANOVA revealed that functional plants had a highly significant impact on the population density of both insect pests ($F = 13.71$; $P = 0.0001$) and natural enemies ($F = 8.36$; $P < 0.001$). The high F values and low error mean squares (1.90 and 0.66 , respectively) confirm that variations in abundance were due to treatment effects rather than experimental error. The grand mean for pest population was recorded as 2.77 ($CV = 49.73$), while for natural enemies, it was 1.88 ($CV = 43.00$), validating the scientific significance of the functional plant treatments. LSD testing showed that Coriander (4.36 ± 0.3988) and Carrot (4.00 ± 0.2659) hosted the significantly highest insect pest populations, while Kidney bean (1.98 ± 0.3015) had the lowest. Regarding natural enemies, Coriander again supported the maximum population (2.81), followed by Carrot (2.09) and Kidney bean (1.93). In contrast, Sponge gourd (1.41) and Mung bean (1.64) recorded the lowest natural enemy abundance. Overall, Coriander proved to be the most influential plant for attracting both pests and beneficial insects. The study concludes that temperature and humidity had largely non-significant impacts on populations, except for a strong correlation in the kidney bean. Among the tested crops, Coriander emerged as the most effective functional plant, significantly attracting the highest densities of both insect pests and natural enemies. Therefore, it is recommended that these functional plants be planted with the main crops to help them control pests and reduce pesticide usage.

PC-12

FILED EVALUATION OF PROMISING INSECTICIDES AGAINST TERMITES IN *CITRUS LIMON* ORCHARDS AT SAHATI REGION OF CENTRAL SINDH, PAKISTAN

Wali Muhammad Mangrio*¹, Hakim Ali Sahito¹, and Masharab Shaikh¹

¹*Department of Zoology, Shah Abdul Latif University, Khairpur Mir's, Sindh*

*Corresponding Author: wali.mangrio@salu.edu.pk

District Naushahro Feroze is one of the major lemon-producing regions; however, this economically important crop is severely affected by termite infestations, which pose a significant threat to *Citrus limon* production. Agriculture is a major contributor to Pakistan's economy and an important source of livelihood, while wooden structures and constructions are also common throughout the country. Termite species are distributed throughout different parts of the world and live in colonies characterized by a well-organized caste system, in which each caste performs specific functions. The present study was conducted from October 2025 to March 2026 to evaluate the efficacy of three insecticides namely; Blast, Cypermethrin, and Imidacloprid, against termite populations under field conditions in *Citrus limon* orchards. The experiment consisted of three treatments with control, and each was replicated three times. Data on termite population reduction % were recorded after subsequently on the 2nd, 3rd, 4th, 6th, and 8th days. Under field conditions in *Citrus limon* orchards, Blast exhibited the highest efficacy, resulting in a maximum termite population reduction of (79.72%), followed by Cypermethrin (76.72%) and Imidacloprid (71.90%), respectively. To protect lemon orchards from this destructive pest, there is an urgent need to adopt and strengthen advanced agricultural management strategies for reducing termite infestations. Keeping in view the above-mentioned findings, the results of this study may serve as a useful basis for developing effective future termite management strategies for lemon growers in the Sahati region of District Naushahro Feroze, Sindh, Pakistan.

PC-13

HABITAT AND FOOD SELECTION BY THE WOOLLY FLYING SQUIRREL (*EUPETAURUS CINEREUS*) IN AZAD JAMMU AND KASHMIR

Raja Rashid Rasheed¹, Riaz Aziz Minhas^{1*} and Usman Ali²

¹Department of Zoology, University of Azad Jammu & Kashmir, Muzaffarabad

²Department of Zoology, Mirpur University of Science and Technology, Mirpur

*Corresponding Author: riaz.aziz@uajk.edu.pk

The woolly flying squirrel (*Eupetaurus cinereus*), an endangered species endemic to the western Himalayas. It remains poorly understood due to its nocturnal habits in inaccessible high-altitude habitats. This squirrel has been recently discovered in the Neelum Valley of Azad Jammu and Kashmir. However, the lack of detailed information on its habitat preferences, ecological requirements, and spatial distribution limits effective conservation planning. This study was therefore undertaken to assess the distribution, habitat suitability, vegetation associations, dietary composition, and major threats to *E. cinereus* in Neelum Valley. Field surveys were conducted across 15 potential sites to record direct and indirect evidence of *E. cinereus* presence in the area. Habitat characteristics including elevation, slope, vegetation type, and land cover were recorded. Maxent species distribution modelling was applied using environmental, climatic, and edaphic variables to predict potential habitats. Vegetation sampling was carried out using quadrat method to determine forest composition, while diet analysis was performed from fecal samples to identify plant species consumed. The above information and anthropogenic pressures were quantified through field observations and semi-structured questionnaires and community interviews. The results indicated that the species was confirmed at 15 high-altitude sites, primarily within mixed coniferous forests dominated by *Abies pindrow* and *Betula utilis*. Maxent modelling indicated that approximately 59% (2,137.49 km²) of the Neelum Valley constitutes suitable habitat, with 362.52 km² classified as highly suitable zones. Annual mean temperature (bio01) and soil type (pk_soil) were identified as the most influential predictors, reflecting preference for cold climates (−5°C to 0°C) and Solonetz soils. Land cover analysis revealed herbaceous and coniferous forests as the dominant vegetation types supporting the species. Dietary analysis showed specialization on coniferous species (*Pinus wallichiana*, *Abies pindrow*), with seasonal use of *Corylus avellana*, *Betula utilis*, and *Juniperus communis*. Major threats included habitat loss, deforestation, grazing, and human disturbance, highlighting severe anthropogenic pressures on suitable habitats. The study determined that the woolly flying squirrel is only restricted to the Neelum Valley of Azad Jammu and Kashmir with restricted distribution, in highly specialized cold, high-altitude habitats. The population of species is facing threats by habitat loss and human interference. The study underscores the urgent need for community-based conservation and long-term ecological monitoring to conserve this threatened species, its fragile alpine ecosystem.

START OF FEE NOT PAID

PC-14

A NOVEL BAIT FORMULATION OF ZINC PHOSPHIDE FOR THE CONTROL OF WILD BOAR, *SUS SCROFA CRISTATUS* - A FIELD EVALUATION STUDY

Uswah Sehar^{*1}, Irfan Ahmed¹ and Abdul Aziz Khan²

¹*Vertebrate Pest Management Programme, Institute of Plant and Environmental Protection, National Agricultural Research Centre, Islamabad*

²*Ex-Senior Director, Plant Protection, Pakistan Agriculture Research Council, Islamabad*

*Corresponding Author: uswahseharsi96@gmail.com

This study evaluated the effectiveness of 4% zinc phosphide (Zn₃P₂) coated maize grain bait, mixed with animal fat, as a toxicant bait for wild boar control under field conditions. During the poison baiting a total of 497 kg of bait was placed at 18 baiting points, out of which 393 kg was consumed, resulting in an overall bait consumption rate of 79% of the total bait placed. The bait consumption on the first night was highest, that is 93.26%, but it decreased steadily over the next two nights as population of wild boar decreased because of mortality. More than 450 dead bodies were found from the field area. The results of this study demonstrated the effectiveness of zinc phosphide as a toxicant for controlling wild boar populations. The significant decline in bait consumption over the three-day poisoning period, following a successful pre-baiting phase, suggests that a substantial portion of the local population was affected by the toxic bait. Zinc phosphide offers the advantage of rapid action for immediate population control. Further studies are suggested to evaluate long-term impacts, environmental safety, and effectiveness under varying field conditions.

PC-15

Pest & Pest Control

CLIMATE-DRIVEN EXPANSION OF INVASIVE AGRICULTURAL INSECTS IN PAKISTAN: INTEGRATING ARTIFICIAL INTELLIGENCE AND ECOLOGICAL FORECASTING FOR FUTURE PEST RISK ASSESSMENT

Farrukh Baig and Meer Sharib Salal^{*}

Department of Entomology, Muhammad Nawaz Shareef University of Agriculture, Multan

*Corresponding Author: meersalal2r1@gmail.com

Rising winter temperatures across Punjab and Sindh have already shifted the phenology of several invasive pests, including *Spodoptera frugiperda* (J. E. Smith) and *Bemisia tabaci* (Gennadius), toward earlier seasonal establishment and additional generations per cropping cycle. Pakistan's agricultural sector faces compounding pressure from these range shifts because current pest surveillance relies on manual scouting protocols that lag behind the pace of climatic change. This perspective examines how machine learning models trained on remote sensing, meteorological, and historical outbreak data can be coupled with mechanistic degree-day models to forecast invasion corridors for economically significant pests under projected climate scenarios for Pakistan. We synthesize evidence from CLIMEX and MaxEnt niche modeling approaches applied to *S. frugiperda* establishment in South Asia, published degree-day

development thresholds for *B. tabaci*, and recent applications of convolutional neural networks to pest detection imagery, to outline a forecasting framework specific to Pakistan's major agroecological zones: the Punjab cotton belt, the Sindh rice-wheat system, and the Khyber Pakhtunkhwa maize corridor. The proposed framework integrates three data streams, satellite-derived land surface temperature and vegetation indices, ground-truthed pheromone trap catches, and farmer-reported outbreak logs collected through mobile applications, feeding a hybrid model that outputs district-level pest risk maps updated on a weekly basis. Comparable hybrid AI-ecological approaches piloted for *S. frugiperda* surveillance in India and East Africa indicate that combining satellite phenology data with ground trap networks improves early detection relative to scouting alone. Adoption in Pakistan requires resolving three constraints: sparse long-term meteorological station coverage in rain-fed districts, absence of a centralized pest occurrence database at national resolution comparable to CABI's Invasive Species Compendium, and limited extension-level capacity to interpret probabilistic risk output. A phased rollout beginning in the cotton-growing districts of southern Punjab, where *B. tabaci* resistance monitoring infrastructure already exists, offers the most tractable entry point for AI-assisted pest forecasting in Pakistan.

PC-16

Pest & Pest Control

IMPACT OF GLYPHOSATE ON BIODIVERSITY LOSS: A REVIEW

Muhammad Ishtiaq*, Umair Faheem, Mirza A. Qayyum and Muhammad Ashfaq

Department of Entomology, MNS-University of Agriculture, Multan

*Corresponding Author: m.ishtiaq@mnsuam.edu.pk

Glyphosate is the most popular global use of a broad-spectrum herbicide and is used in a significant amount of agricultural weed management in current times. The use of glyphosate in agricultural fields, forests, urban vegetation management and genetically modified herbicide-tolerant crops has sparked serious concerns about their ecological effects and role in biodiversity loss. This current review provides a summary of the effects of glyphosate on terrestrial and aquatic biodiversity with a special focus on its effects on plants, pollinators, agricultural soil microorganisms, aquatic organisms, and agricultural wildlife. Recent research suggests that glyphosate-containing herbicides may substantially impact floral diversity and non-target plants and alter their habitat availability and food sources for insects, birds and other wildlife. Loss of nectar-producing plants can affect pollinator populations indirectly and sublethal physiological or behavioral effects can affect pollinator populations directly. The impact of glyphosate exposure on soil biodiversity is also evident: changes in soil microbial community, nutrient cycling and soil enzymatic activities have been reported. Glyphosate runoff can have adverse impacts on algae, amphibians, fish and aquatic invertebrates in aquatic ecosystems, resulting in ecological imbalance and a decrease in ecosystem resilience. Moreover, glyphosate-resistant weeds are becoming more common, leading to a dependence on herbicides and increased use of chemicals, thus worsening ecological degradation. Glyphosate is reportedly less persistent than other conventional herbicides, but the growing evidence of the long-term and cumulative environmental effects of glyphosate should not be ignored. The review emphasizes the need for sustainable weed management practices, IPM strategies, improved environmental monitoring, and environmentally friendly agriculture. To combat such chemical intensification in agriculture, achieving the diversity of ecosystems is crucial for their long-term ecological sustainability, agricultural productivity and ecological stability.

PC-17

IMPACT OF GLYPHOSATE ON POLLINATORS ESPECIALLY HONEYBEES: A REVIEW**Umair Faheem, Muhammad Ishtiaq*, Mirza A. Qayyum and Muhammad Ashfaq***Department of Entomology, MNS-University of Agriculture, Multan**Corresponding Author: m.ishtiaq@mnsuam.edu.pk

Glyphosate is the most broadly used herbicide globally and is widely used in agricultural, horticultural and urban settings for weed control. The herbicide glyphosate is mainly used on plants, but with its high levels of use, recent scientific studies have shown that there are risks to non-target organisms, especially pollinator species like honeybees (*Apis mellifera* L.). This review provides an overview of existing information on the direct and indirect impacts of glyphosate on pollinator health, behavior and services. Recent research has revealed that glyphosate exposure can impact honeybee gut microbiota, navigation, foraging efficiency, learning capability and physiology. After exposure to sublethal levels, bee memory and orientation may be affected and they are less able to find and return to food sources effectively. Glyphosate's impact on gut microbes can lead to a decline in immunity and vulnerability to pathogens and diseases. Also, the decline in flowering weeds and wild vegetation caused by glyphosate use reduces the amount of nectar and pollen resources which can be indirectly linked to nutritional stress in pollinators and habitat loss. Loss of pollinator abundance and diversity has important ecological and agricultural consequences as bees are key pollinators for many food and forage crops. Pollination efficiency reductions may have negative impacts on ecosystem stability, biodiversity and productivity of crops. In addition, the interference of glyphosate exposure with other environmental factors such as climate change, pesticides, parasites, and habitat fragmentation could intensify the loss of pollinators. This review highlights the critical need for sustainable weed management, limited use of chemicals and adopting methods that are beneficial for pollinators in agriculture. Improving ecological risk assessment, the implementation of integrated pest management and the preservation of floral diversity are critical measures for safeguarding honey bees and global food security and ecosystem resilience.

PC-18

GREEN SYNTHESIS OF SILVER AND ZINC NANOPARTICLES AND THEIR IMPACTS ON SELECTED INSECT PESTS MANAGEMENT IN CROPLAND OF SIALKOT**Sajida Mushtaq*, Tayyaba Zahoor, Rimsha, Sadia Maalik, Qurat ul Ain and Moazama Batool***Department of Zoology, Government College Women University, Sialkot**Corresponding Author: Sajida.mushtaq@gcwus.edu.pk

Agriculture plays an important role in national GDP. Cropland insects play a dual role as beneficial insects, predators, and pollinators; other insects act as destructive pests, economically competing with human resources. Representatives of Order Lepidoptera Orthoptera among insects are major crop pests. Short-term relief from these pests has been taken by use of synthetic chemicals through standard methods. Regular application of these chemicals has resulted in pest resistance, reduction in beneficial insects or

natural enemies, environmental contamination, and ultimately by entering in food chain of the ecosystem threats to human health. After these challenges, innovative, sustainable, eco-friendly approaches are required to manage these pest populations. The research aims to analyze green synthesis of nanoparticles by using regionally available botanical extracts. Among various plants investigated for nanoparticle synthesis and evaluated their insecticidal activity against insect pests. Characterization studies will be performed to investigate the synthesized ZnO and silver nanoparticles using UV-VIS spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM) and Energy-dispersive X-ray Spectroscopy (EDX). Insects were collected from the agricultural land of Sialkot, Pakistan, and the toxicity of nanoparticles and insecticide-treated plant leaves at various doses was evaluated in the mortality bioassay to determine the bioactivity of insects for a comparative toxicity study. The present study evaluated the nano-pesticidal potential of these nanoparticles against selected agricultural pest species and assessed their impact on a few natural predator species by evaluating their impact of growth, survival, and their predatory potential. It promotes biological control through less impact on natural predators, which is another eco-friendly approach to control pest populations.

PC-19

EVALUATION OF LIQUID FORMULATIONS OF *BEAUVERIA BASSIANA* AND *METARHIZIUM ANISOPLIAE* AGAINST *BACTROCERA ZONATA*

**Umer Sharif*, Mirza Abdul Qayyum*, Shafqat Saeed, Muhammad Ishtiaq,
Akhtar Hameed and Unsar Naeem Ullah****

Department of Entomology, MNS-University of Agriculture, Multan

*Corresponding Author: qayyum.mirza@mnsuam.edu.pk; umersharif173@gmail.com**

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 controlling 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 alternatives of pesticide. These fungi have certain limitations regarding their efficacy in regions with high temperatures. Low shelf life is another limitation in commercialization of its products. Current research was conducted to find out certain liquid carriers which can maintain the viability of the conidia of entomopathogenic fungi. 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 efficacy was evaluated on 1st day, 15th day and 30th 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%. Adult emergence of the pupae and mortalities of adult were recorded. Aqueous suspension of conidia performed better on 1st day of preparation of formulation but lost its efficacy on 15th and 30th 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. 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 30th day. Sesame oil and Corn oil are recommended for preparing liquid formulation of Entomopathogenic fungi.

PC-20

ASSESSMENT OF REPELLENT ACTIVITY OF SELECTED ESSENTIAL OIL (CASTOR AND ROSEMARY) AGAINST AVAILABLE STORED GRAINS INSECTS BY USING MICROENCAPSULATION TECHNIQUE

**Samavia Farooq¹, Sadia Maalik¹, Hadia Mir¹, Sajida Mushtaq¹,
Moazama Batool¹, Qurat-Ul-Ain ¹and Naheed Bano²**

¹GC Women University, Sialkot

²MNS Agriculture University, Multan

*Corresponding Author: sadia.maalik@gcwus.edu.pk

Stored grain insects are one of the major threats to post harvest crops. The increase in the world population has raised the demand for the protection of stored grains even more. Previously, the use of synthetic chemicals was in vogue, but their excess use can be harmful to the organism they are meant to protect. Scientists are therefore working to find alternatives to synthetic chemicals that are cheap and safe for humans. For this purpose, plant based essential oils have been explored as potential insect repellent. Among them castor and rosemary oils have shown potential for use against insects. However, these oils are volatile and unstable in nature. To overcome this problem, microencapsulation technique is used to enhance their stability. The present study aims to assess the repellent potential of microencapsulated castor and rosemary oils using chitosan and Arabic gum as wall materials through complex coacervation technique. Microcapsules of lavender oil, peppermint oil, and mixture of both oils for concentrations of 1%, 5%, 10%, 15% and 20% were prepared. Optical microscopy was used to confirm the formation of microcapsules and examine their morphology. The jute fabric was dipped in microencapsulation solution and air dried. FTIR and SEM analysis performed to confirm the successful deposition of microcapsules onto the fiber surface. Repellent efficacy of rosemary oil, castor oil and mixture of rosemary and castor oils against red flour beetle assessed after 10, 20 and 30 washing cycles of microencapsulated fabric. Controlled fabric showed the highest insect landing as compared to microencapsulated fabric. Treated Jute fabric with rosemary oil, castor oil microcapsules solution showed repellency against red flour beetles i.e. 91% and 83% respectively, Mixture of lavender and peppermint oil provide 91%. These findings show that essential oils can be used to provide safe, eco-friendly and plant-based pest management of stored grains.

PC-21

ADVANCED NANOCARRIER DELIVERY SYSTEMS AND BIOGENIC NANOPARTICLES FOR STORED GRAIN PEST MANAGEMENT: A REVIEW OF BIOCHEMICAL AND MECHANICAL CONTROL

**Madiha Mobeen Khan^{1*}, Unsar Naeem-Ullah¹, Hafsah Ghaffar¹,
Mirza Abdul Qayyum¹ and Hasan Riaz²**

¹Department of Entomology, MNS University of Agriculture, Multan, Pakistan

²Department of Plant Pathology, MNS University of Agriculture, Multan, Pakistan

*Corresponding Author: Madiha.mobeen@yahoo.com

Stored-grain insect pests, including *Tribolium castaneum*, *Rhyzopertha dominica*, *Callosobruchus maculatus*, and *Trogoderma granarium*, cause up to 50% loss of stored food commodities globally. The efficacy of conventional synthetic pesticides and fumigants has drastically declined due to widespread pest resistance, environmental contamination, and non-target toxicity. Nanotechnology offers a sustainable alternative by enabling targeted delivery of bio-actives and introducing novel physical modes of action. This review focuses on two emerging nanotechnological approaches for post-harvest pest control: targeted biochemical nanocarriers and resistance-free mechanical bioinsecticides. Encapsulation of defensive plant cysteine proteases (*Albizia procera* and *Populus euphratica*) in graphene quantum dots (GQDs; 13–23 nm) significantly enhances contact and oral toxicity against coleopterans, reducing oviposition by up to 72% and adult emergence by up to 98% via improved midgut peritrophic membrane penetration. Similarly, biodegradable polymeric nanocarriers such as ethyl cellulose extend the residual efficacy of volatile botanicals (e.g., osthole) to 20 days while mitigating phytotoxicity. Concurrently, biogenic hydroxyapatite nanoparticles (HAPNPs) derived from eggshells serve as mechanical biocides; at an LC_{50} of 0.003 mg/6 g seeds, HAPNPs achieve a 90% reduction in *C. maculatus* fecundity by stripping epicuticular waxes to cause lethal desiccation and physically obstructing spiracles to induce asphyxiation without inducing biochemical resistance. Together, these advances highlight the synergistic potential of organic nanocarriers and biogenic mechanical nano-insecticides as vital components of next-generation stored-product Integrated Pest Management (IPM) strategies.

PC-22

SHELF LIFE OF OIL-BASED DELIVERY SYSTEMS OF *BEAUVERIA BASSIANA* AS LARVICIDE AGAINST DENGUE VECTOR MOSQUITO

**Aiman Mohsin^{1*}, Unsar Naeem-Ullah¹, Hafsah Ghaffar¹, Mirza Abdul Qayyum¹,
Akhtar Hameed² and Muneeb ur Rehman¹**

¹Department of Entomology, MNS University of Agriculture, Multan, Pakistan

²Department of Plant Pathology, MNS University of Agriculture, Multan, Pakistan

*Corresponding Author: aimanmohsin19@gmail.com

Dengue fever remains a critical global public health threat transmitted primarily by *Aedes aegypti* and *Aedes albopictus* mosquitoes. The entomopathogenic fungus *Beauveria bassiana* serves as an eco-friendly

biological control agent, but raw conidia suffer from limited field stability and rapid degradation when exposed to environmental stressors. Oil-based delivery systems utilizing vegetable, mineral, or emulsifiable oils are designed to enhance spore viability, protect against UV damage, and promote lipophilic adhesion to larval cuticles. This study evaluates the shelf life and larvicidal efficacy of oil-formulated *B. bassiana* conidia under varied storage temperatures and ambient conditions. Pure *B. bassiana* conidia were suspended in carrier oil formulations (including emulsifiable concentrates and vegetable oil carriers). Formulations were stored under cold refrigeration (4-7°C), ambient room temperature (25-28°C), and elevated tropical temperatures (32°C) over an extended monitoring period. Spore germination rates and colony-forming unit (CFU) counts were evaluated periodically. Larvicidal bioassays were conducted against 3rd and 4th instar dengue vector larvae to determine mortality, median lethal concentration (LC₅₀) and median lethal time (LT₅₀). Storage temperature significantly influenced spore longevity. Refrigerated oil formulations maintained high spore viability exceeding 85% for over 24 to 36 months. Under ambient conditions (25-28°C), formulations maintained viable spore counts and high larvicidal activity for 3 to 6 months before gradual decline. Storage at 32°C led to accelerated loss of germination within 1 to 2 months. Oil formulations significantly lowered the required (LC₅₀) and shortened (LT₅₀) values compared to unformulated aqueous suspensions. Oil-based delivery systems substantially extend the shelf life and bio efficacy of *B. bassiana*. Refrigerated storage yields optimal long-term stability (>2 years), while oil carriers provide sufficient thermal protection for commercial deployment under ambient field conditions. These findings support oil-formulated *B. bassiana* as a viable biopesticide for dengue vector management.

PC-23

MORPHOLOGICAL CHARACTERIZATION AND POPULATION MONITORING OF FRUIT FLY SPECIES EFFECTING VEGETABLES AND FRUITS

Nisha Devi¹, Aalia Shaikh¹, Bhugro Mal², Parvaiz Ahmed² and Mansoor Ali Shah¹

¹Department of Zoology, University of Sindh, Jamshoro

²Pakistan Agriculture council (PARC), University of Karachi, Karachi

*Corresponding Author: nishadevi1825@gmail.com

Fruit Flies are among most important pests of fruits and vegetables. They infest fruits including citrus, guava, cucumber, peach and mango. They cause serious damage by laying eggs on fruits where the maggots (larvae) feed and reduce food quality and yield. This study was carried out in the experimental field and entomology laboratory of SARC, Pakistan Agricultural Research Council (PARC), Karachi, to find the occurrence, identification, population dynamics, and management of economically important insect pests especially fruit flies. During research fruit flies were collected in two treatments by using trapping of Methyl eugenol and Methyl eugenol + Diptrex. Collected flies were examined and identified according to their morphological characters. Four types of fruit flies were recorded in this study, *Bactrocera zonata*, *Bactrocera dorsalis*, *Bactrocera correcta* and *Bactrocera cucurbitae*, among which *B. zonata* is the most common species found in this study. These results highlight the importance of monitoring and management of fruit flies at an early stage to reduce crop losses and fruit quality and yield. Integrated Pest Management (IPM) is one of best ways to control the insects' pests.

PC-24**VARIETAL SUSCEPTIBILITY OF DIFFERENT COTTON GENOTYPES AGAINST COTTON MEALY BUG *PHENACOCCLUS SOLENOPSIS*.****Mansoor Ali Shah***Department of Zoology, University of Sindh, Jamshoro***Corresponding Author: Mansoor.shah@usindh.edu.pk*

Cotton mealy bug *Phenacoccus solenopsis* is a serious pest of cotton crop in many cotton growing countries especially in Subcontinent Indo-Pak. Present study was carried out during cotton season 2025 and 2026 in cotton growing areas of District Matiari. During present Study different cotton genotype (CRIS-682, Triple Gene, SS-32 and NIAB 878) were tested against cotton mealy bug. CRIS 682 was found most susceptible variety followed by SS-32 and NIAB- 878, while Triple Gene found least susceptible variety against cotton mealy bug. Present study revealed that CRIS-682 cultivated on large scale with high yield but increase burden of mealy bug infestation is serious concern for growers of study area.

PC-25**IDENTIFICATION AND MORPHOLOGICAL CHARACTERIZATION OF STORED GRAIN PEST****Aalia Shaikh¹, Nisha Devi¹, Bhugro Mal², Parvaiz Ahmed² and Mansoor Ali Shah¹**¹*Department of Zoology, University of Sindh, Jamshoro*²*Pakistan Agriculture council (PARC), University of Karachi, Karachi***Corresponding Author: sheikhaalia344@gmail.com*

Store grain pest falls in critical category of agricultural pests responsible for considerable post-harvest losses. Their activities lead to substantial reductions in quality, quantity, nutritional content, and market value. Present research was conducted at the SARC Experimental Field and Entomology Laboratory, PARC-SARC during June-July 2026. During present study the five species of store grain pest were found. The rice weevil (*Sitophilus oryzae*), lesser grain borer (*Rhyzoper thadominica*), red flour beetle (*Tribolium castaneum*), khapra beetle (*Trogoderma granarium*), and pulse beetles (*Callosobruchus spp.*). During present it was observed that these insect pest consume grains, pulses, flour, and other stored commodities, leading to reductions in weight, nutritional quality, seed viability, and market value. Minimizing these losses can be achieved through diligent sanitation practices, proper grain drying, maintaining optimal storage conditions, regular inspections, and the application of IPM principles.

PC-26

COMPARATIVE TOXICITY OF THREE TERMITICIDES FOR THE MANAGEMENT OF TERMITE POPULATIONS UNDER LABORATORY CONDITIONS**Masharab Shaikh¹, Wali Muhammad Mangrio^{*1}, and Hakim Ali Sahito¹**¹*Department of Zoology, Shah Abdul Latif University, Khairpur Mir's, Sindh*^{*}Corresponding Author: wali.mangrio@salu.edu.pk

Termites are small sized insects commonly called white ants, “silent destroyers” and are major pest species causing great damage to timber, crops, and vegetation worldwide. This research study was performed during October 2025 to March 2026. The novelty of this study lies in evaluating the efficacy of three insecticides, namely Blast, Cypermethrin, and Imidacloprid, for the effective management of termite populations under laboratory conditions maintained at $25\pm 2^{\circ}\text{C}$ and $65\pm 5\%$ relative humidity. Each treatment was replicated three times to evaluate its efficacy against the termite population reduction percent. Four Petri dishes were arranged for each treatment with 50 termite individuals ($n=50$) placed in each Petri dish. An additional 50 termite individuals were maintained as a control. For the treatment groups, pieces of lemon timber were dipped in the termiticide solutions for 5 minutes, allowed to drain, and then provided to the termites as a food source. The already reared stock collection, the two hours kept hunger termites were subsequently released into the Petri dishes for feeding and exposure. The number of live termites and mortality % was recorded as pre-treatment and subsequently on the 2nd, 3rd, 4th, 6th, and 8th days post-treatment in each replication during data collection. Blast exhibited the highest efficacy, causing the maximum mortality % of termites at (91.78%), followed by Cypermethrin (88.45%) and Imidacloprid (86.00%). Unfortunately, a lack of awareness among local lemon growers contributes to severe economic losses, primarily due to termite infestations. In this regard, the present laboratory-based study provides a reliable and scientifically sound approach for the effective protection of *Citrus limon* against termite infestation in the Sahati region of Sindh, Pakistan.

PC-27

BACTROCERA DORSALIS* (HENDLE) DIVERSITY AND IMPORTANT MANAGEMENT ASPECTS IN SINDH, PAKISTAN*Aiman Amur¹, Nasreen Memon², Abdul Manan Shaikh¹ and Bhojo Mal¹**¹*Department of Zoology, Government College University, Hyderabad*²*Department of Zoology, University of Sindh, Jamshoro*^{*}Corresponding Author: amuraiman@gmail.com

Bactrocera dorsalis (Hendle), a melon fruit fly that mostly depends on host cues for feeding and development, is regarded as one of the primary fruit pests of various fruits worldwide. For its management, appropriate monitoring and host appropriateness are essential. In order to evaluate the

population fluctuations of *Bactrocera dorsalis* and its natural strategies on various host fruit orchards in Hyderabad and Mirpurkhas, the current study was conducted. There are two major orchards in Sindh. Due to their crucial role in the control of *Bactrocera dorsalis*, ten types of mangoes from Sindh, Chunsu, Sindhri, Langira, Alamas, and Dusairy etc were investigated against it and its biological characteristics. According to the obtained data, the district of Hyderabad had the highest population of *B.dorsalis* compared to Mirpur Khas, with comparatively greater *B. dorsalis* populations in 2016 than in 2017. Temperature ($r=0.55$ to 0.74) and relative humidity percentage ($r=0.12$ to 0.26) were found to have a significant ($\pm$ ve) impact on the fruit fly population build-up on the mango varieties in both years. Additionally, two biological parasites, families, were founding the fruit fly pupae collected. It was observed that Hyderabad had a higher natural control population than Mirpurkhas. According to correlation data, temperature had a significant and favorable impact on the *B dorsalis* population detected on a variety of fruits. Relative humidity had a week-to moderate effect on sindhri and chunsu varieties although hyderabad more damage occurs.

PC-28

EFFECTS OF *EUCALYPTUS CREBRA* ESSENTIAL OIL ON THE EXTERNAL MORPHOLOGY AND WING GEOMETRY OF *CULEX QUINQUEFASCIATUS*

Barira Usmani and Abida Butt

Institute of Zoology, University of The Punjab, Lahore

Corresponding Author: barira.res.zool@pu.edu.pk

Culex quinquefasciatus is an important mosquito vector and its increasing resistance to synthetic insecticides has encouraged exploration of plant-derived alternatives. The present study evaluated the larvicidal activity of *Eucalyptus crebra* essential oil (EO) and its effects on the external morphology and wing geometry of *Culex quinquefasciatus*. Essential oil extracted from *E. crebra* leaves was tested against fourth-instar larvae through larvicidal bioassays, and LC_{20} and LC_{50} values were determined using probit analysis. Larvae were subsequently exposed to the calculated LC_{20} and LC_{50} concentrations and surviving adults were assessed for changes in antennal, proboscis, leg and wing measurements. Wing shape variation was further examined using landmark-based geometric morphometrics through Principal Component Analysis (PCA), Canonical Variate Analysis (CVA) and Discriminant Function Analysis (DFA). The EO showed considerable larvicidal activity, with LC_{20} and LC_{50} values of 0.087 and 0.192 mg/mL, respectively. Exposure to both concentrations resulted in concentration-dependent reductions in the lengths of the antennae, proboscis, forelegs, midlegs and hindlegs in both male and female adults, with greater reductions generally observed at LC_{50} . Geometric morphometric analysis revealed treatment-related changes in wing shape, with significant differentiation among treatment groups particularly in females. PCA, CVA and DFA indicated greater wing-shape variation in treated females compared with controls, while the effect was less pronounced in males. Overall, *E. crebra* EO exhibited both larvicidal and sublethal developmental effects on *C. quinquefasciatus*, altering the morphology and wing geometry of surviving adults. These findings highlight the potential of *E. crebra* EO as a botanical insecticide and support its further investigation as an alternative approach for sustainable mosquito control.

PC-29

TOXICITY OF LOCAL ISOLATES OF *BACILLUS THURINGIENSIS* AND CRY2AB PROTEIN AGAINST LEPIDOPTERAN PESTS

Saddam Hussain and Munawar Saleem Ahmad

Department of Zoology, The University of Swabi, Anbar-Swabi, Khyber Pakhtunkhwa, Pakistan

*Corresponding Author: saleemsbs@gmail.com

Vegetables are a vital source of nutrients and are frequently consumed as food. Many lepidopteron species behave as pests and have an impact on crop yield. *Bacillus thuringiensis* isolates were obtained from 15 soil samples taken in the Swabi KPK district. The isolate was further characterised morphologically and biochemically. The goal of the current study was to evaluate the biocidal efficacy of local isolates of *Bacillus thuringiensis* in district Swabi and a reference strain (cry2Ab) against common lepidopteran pests (*Spodoptera litura* and *Helicoverpa armigera*). Vegetable plants were grown in a small field with narrow trails that were covered in field. Similarly, to obtain the most colonies for the formulation of spore/crystal mixtures with varied concentrations (100 µg/ml to 1000 µg/ml), *Bacillus thuringiensis* (Kurstaki species) bearing active cry2Ab were grown under control laboratory conditions using L.B media. Additionally, several pests' larvae were reared in lab settings under strict controls. The findings of the investigation of comparative potencies showed that the local isolate SH-BT-7 exhibits significant potency, causing 90% death in *H. armigera* at 300 µg/ml and *S. litura* at 500 µg/ml. The LC₅₀ of *Bacillus thuringiensis* cry2Ab endotoxins against *S. litura* were 277.27 µg/ml and *H. armigera* were 138.95 µg/ml. The overall findings showed that local isolates of *BT* might effectively and sustainably reduce crop yield losses by eradicating lepidopteran pests. According to the results of our study, *BT* isolates biocidal activity against several lepidopteran pests indicates promising results for pest control in pest management.

PC-30

OLFACTORY RESPONSE IN PINK BOLLWORM *PECTINOPHORA GOSSYPIELLA* SAUNDERS (LEPIDOPTERA: GELECHIIDAE) TOWARDS SEX PHEROMONE UNDER INSECTICIDE CONTAMINATED CONDITIONS

**Shamim Akhtar¹, Arshed Makhdoom Sabir¹, Qurban Ali¹, Muhammad Saad Aslam²,
Fahad Raza², Imran Ali and Usama Bin Tayyab¹**

¹*Entomological Research Institute, Ayub Agricultural Research Institute, Faisalabad*

²*Department of Entomology, University of Agriculture, Faisalabad*

*Corresponding Author: amsabir@yahoo.co.uk

Pink bollworm *Pectinophora gossypiella* (Saunders) is the most destructive pest among the insect pests of cotton and distributed all over the world in cotton growing countries. Massive insecticides are applied for management of cotton insects. The odor of these insecticides contaminates microenvironment that may affect sex pheromone. The present research was conducted to determine the effect of insecticides on olfactory responses of *P. gossypiella* under laboratory conditions. Six insecticides of different types at

5.00, 10.00 and 15.00% concentration were applied on 60-75 days old potted cotton plant. These plants were kept in isolated chamber at temperature $27\pm 2^{\circ}\text{C}$, relative humidity 60-70% and 14:10 (L: D) photoperiod. Pheromone capsules were placed at 3.00, 24.00, 48.00, 72.00 and 168.00 hours of post application of pesticides. Each plant containing capsulated sex pheromone and insecticide application was connected to olfactometer containing male moths of *P. gossypiella* in main chamber. Irrespective of insecticide concentration and post application interval (PAI), maximum adults ($37.12\pm 1.14\%$) were attracted towards the plant having pheromone when treated with Beta cyfluthrin and minimum ($23.45\pm 1.83\%$) for Bifenthrin+Abamectin. Nevertheless, the type of insecticides and PAI, maximum $32.13\pm 1.07\%$ male adults were attracted to the plants where insecticides were applied at 5% concentration and minimum $22.73\pm 1.10\%$ when exposed to 15% concentration. Regardless of type insecticides and concentration, the maximum $38.29\pm 1.06\%$ male moths were attracted to plants where pheromone capsules were placed at an interval of 68.00 hours and minimum $23.55\pm 1.64\%$ after 3.00 hours PAI.

SECTION – III

ENTOMOLOGY

ENT-1

ACOUSTIC BEHAVIOR OF GRYLLIDAE SPECIES FROM PAKISTAN: IMPLICATIONS FOR BIODIVERSITY CONSERVATION

Waheed Ali Panhwar

Department of Zoology, University of Sindh, Jamshoro-Pakistan

*Corresponding Author: waheed.panhwar@usindh.edu.pk

Crickets (Orthoptera: Gryllidae) represent one of the most diverse insect families globally, comprising 3,726 extant species across 22 subfamilies and 528 genera. Their ubiquity across terrestrial ecosystems, from tropical forests to arid agricultural landscapes, underscores their ecological and economic significance. As both agricultural pests and beneficial bioindicators, crickets play dual roles in ecosystems, they damage crops such as cotton, oilseeds, and millets by feeding on seeds and seedlings, compelling farmers to replant multiple times annually, while simultaneously contributing to biological control by preying on insect pests like grasshoppers and grain pests. The family Gryllidae, which includes field crickets, house crickets, ground crickets, and mole crickets, exhibits remarkable adaptability across diverse habitats ranging from grasses and shrubs to burrows and human dwellings. Crickets are significant agricultural pests and bioindicators, yet their acoustic communication remains unexplored in Pakistan. This study provides the first comparative bioacoustic analysis of Gryllidae species. A total of 589 specimens representing four species i-e: *Acheta domesticus*, *Gryllodes sigillatus*, *Gryllodes supplicans*, and *Gryllus bimaculatus* were collected and analyzed for their calling songs using specialized recording equipment and software (Audacity and PRAAT). Each species exhibited distinct acoustic signatures: *A. domesticus* (4,700–4,800 Hz, 2–4 syllables/call), *G. sigillatus* (7.3 kHz, 4 syllables with escalating amplitudes), *G. supplicans* (9.8 kHz, 4–6 syllables/trill), and *G. bimaculatus* (4.5 kHz with secondary peak at 13.3 kHz). Peak calling activity occurred during monsoon months (July–September), with a female-biased sex ratio (1:2.23). Species-specific call profiles enable non-invasive acoustic monitoring, offering farmers an eco-friendly alternative to chemical pesticides through species-specific acoustic trapping. This foundational dataset establishes Pakistan's first bioacoustic library for Gryllidae, supporting sustainable pest management, biodiversity conservation, and agricultural decision-making in arid ecosystems.

ENT-2

INTEGRATIVE TAXONOMY AND SURVIVAL ECOLOGY OF A DARKLING BEETLE (COLEOPTERA: TENEBRIONIDAE) FROM THE CHOLISTAN DESERT, PAKISTAN

Muhammad Waseem^{1*}, Santosh Kumar^{1} and Riffat Sultana²**

¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

²Department of Zoology, University of Sindh, Jamshoro

Corresponding Author: dr.waseemcivas@gmail.com, santoshkumar@cuvas.edu.pk**

Arid ecosystems harbor poorly documented insect lineages whose taxonomic identities and natural histories remain unresolved. Field surveys conducted from April to September 2022 across four sandy

localities in the Cholistan Desert, Pakistan, yielded 331 specimens, comprising 162 males and 169 females, of a small, globose darkling beetle (Coleoptera: Tenebrionidae). Preliminary morphological examination revealed a striking resemblance to *Eusattus*, a genus primarily known from North America, raising an intriguing taxonomic and biogeographical question. Under laboratory conditions, captive adults survived for at least one month, oviposited, and successfully produced larvae. Feeding on grasshopper and seed-bug tissues was also observed, although active predation has not yet been experimentally confirmed. An integrative investigation is being undertaken to resolve the taxonomic placement of this enigmatic beetle. External morphology, morphometrics, male and female genitalia, and other diagnostic characters will be compared with regional Tenebrionidae, original species descriptions, type material, and verified reference specimens. Selected mitochondrial and nuclear markers will also be analyzed using phylogenetic and species-delimitation approaches. Additional standardized sampling will assess spatial distribution and seasonal activity, while replicated laboratory experiments will investigate development, feeding behavior, and tolerance to food and water deprivation. The study will determine whether the Cholistan population represents an overlooked regional lineage, an introduced or geographically disjunct taxon, or potentially a species new to science. By integrating taxonomy, molecular evidence, and natural-history observations, this research will help clarify the identity and ecological adaptations of an unusual desert beetle and contribute to a better understanding of the poorly explored insect diversity of the Cholistan Desert.

ENT-3

SPECIES DIVERSITY AND HABITAT DISTRIBUTION OF HEMIACRIDINAE (ORTHOPTERA: ACRIDIDAE) IN KHYBER PAKHTUNKHWA

Muhammad Zain ul Abedin^{1*}, Santosh Kumar^{1} and Riffat Sultana²**

¹*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

²*Department of Zoology, University of Sindh, Jamshoro*

Corresponding Author: jamzain037@gmail.com, santoshkumar@cucas.edu.pk**

Hemiacridinae is a diverse subfamily of grasshoppers that plays an important role in terrestrial ecosystems; however, its diversity and distribution in Khyber Pakhtunkhwa (KP), Pakistan, remain insufficiently documented. The present study aims to assess the species diversity, distribution, and habitat associations of Hemiacridinae across selected localities of Khyber Pakhtunkhwa. Grasshopper specimens will be collected from different habitats and during different seasons using standardized field-sampling methods and will be identified based on morphological and taxonomic characteristics. Species richness, relative abundance, frequency of occurrence, and distribution patterns will be analyzed to determine variations among localities and habitat types. Environmental variables, including vegetation type, elevation, temperature, and other habitat characteristics, will also be evaluated to determine their possible influence on species distribution. The study is expected to provide an updated inventory of Hemiacridinae from Khyber Pakhtunkhwa and identify important distribution patterns and habitat preferences. The findings will provide valuable baseline information for future taxonomic, ecological, and conservation studies and contribute to biodiversity monitoring and sustainable management of grasshopper communities in the region.

ENT-4

DIVERSITY AND SEASONAL INCIDENCE OF PRAYING MANTISES (MANTODEA) IN AGRICULTURAL FIELDS OF THE CHOLISTAN DESERT, PAKISTAN

Rana Muhammad Asif^{1*}, Santosh Kumar^{1} and Riffat Sultana²**

¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

²Department of Zoology, University of Sindh, Jamshoro

Corresponding Author: dimondrana3536@gmail.com, santoshkumar@cvas.edu.pk**

The present study investigated the diversity, seasonal incidence, habitat preferences, and environmental factors influencing praying mantises (Order: Mantodea) in agricultural fields of the Cholistan Desert, Pakistan. Mantises are important generalist predators in agroecosystems and contribute to the natural regulation of insect pest populations. However, their distribution and seasonal dynamics in arid agricultural landscapes remain poorly understood. Field surveys were conducted across different agricultural habitats over a complete annual cycle using standard insect collection methods. A total of seven mantid taxa belonging to three families—Mantidae, Empusidae, and Hymenopodidae were recorded. Among these, *Mantis religiosa* was the most abundant species, whereas *Creobroter* sp. showed the lowest abundance. Community analysis revealed moderate species diversity, with a Shannon diversity index (H') of 1.74 and a Simpson diversity index ($1-D$) of 0.79, indicating a relatively diverse mantid assemblage in the study area. Seasonal analysis showed marked fluctuations in abundance, with peak populations recorded during the monsoon season (July–September) and the lowest densities during winter and extreme summer months. Habitat-wise distribution indicated that mantises were most abundant in cotton fields and vegetated field margins, whereas the lowest abundance was observed in disturbed and ploughed fields. Correlation analysis indicated positive associations of mantis abundance with vegetation cover and relative humidity, whereas temperature and pesticide application showed negative relationships. These findings demonstrate that mantid populations in the Cholistan agricultural ecosystem are strongly influenced by seasonal climatic variation, habitat complexity, and anthropogenic activities. The presence of diverse mantid taxa highlights the ecological importance of agricultural landscapes in supporting beneficial arthropod predators. Conservation of field margins and reduced pesticide use may help maintain mantid diversity and strengthen their role as natural biological control agents.

ENT-5

TAXONOMIC DIVERSITY AND HABITAT ASSOCIATIONS OF PRAYING MANTISES (MANTODEA) IN THE CHOLISTAN DESERT, PAKISTAN

Muhammad Tanveer^{1*}, Santosh Kumar^{1} and Riffat Sultana²**

¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

²Department of Zoology, University of Sindh, Jamshoro

Corresponding Author: anjumtanveer721@gmail.com, santoshkumar@cvas.edu.pk**

The Cholistan Desert, an extension of the Thar Desert in southern Punjab, Pakistan, is one of the least explored ecosystems in terms of insect biodiversity, particularly predatory insects such as praying

mantises (Order: Mantodea). The present study investigated the taxonomic diversity, habitat associations, morphometric variation, and community structure of mantises occurring in the Cholistan Desert. A total of 934 specimens representing four taxa, four genera, and three families were recorded. *Eremiaphila* spp. was the dominant taxon, accounting for 43.0% of the total collection, followed by *Empusa* spp. (22.6%), *Rivetina baetica* (17.7%), and *Blepharopsis mendica* (16.7%). Habitat analysis revealed that *Eremiaphila* was strongly associated with open desert habitats, whereas *B. mendica* was predominantly recorded from agricultural fringes characterized by the presence of *Calotropis procera*. *Empusa* species showed a preference for sparse scrub vegetation, while *R. baetica* exhibited a comparatively broader habitat range. Morphometric analysis revealed clear sexual size dimorphism, with females generally larger than males. These findings provide important baseline information on the diversity, distribution, habitat preferences, and morphological variation of Mantodea in the Cholistan Desert and contribute to a better understanding of predatory insect diversity in arid ecosystems of Pakistan.

ENT-6

DIVERSITY, HOST ASSOCIATIONS AND SEASONAL VARIATION OF LEAFHOPPERS (HEMIPTERA: CICADELLIDAE) IN THARPARKAR, PAKISTAN”

Azra Naz and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan

*Corresponding Author: soomroazranaz5@gmail.com, riffat.sultana@usindh.edu.pk

Tharparkar represents a unique arid ecosystem characterized by diverse native vegetation, including desert shrubs and seasonal herbs. Leafhoppers (Hemiptera: Cicadellidae) are important phytophagous insects, and many species are associated with economically important plants and may act as agricultural pests. The present study was conducted during 2023–2024 to investigate the diversity, host associations, habitat distribution, and seasonal dynamics of leafhopper assemblages in different localities of Tharparkar, Sindh, Pakistan. Specimens were collected from Umerkot, Chachro, Kantio, Diplo, Chelhar, Nagarparkar, Viravah, Dahli, Kaloi, Islamkot, and Mithi. A total of 19 species belonging to the family Cicadellidae were recorded. Among the collected species, *Cofana unimaculata* (Signoret, 1854), belonging to the subfamily Cicadellinae, was the most abundant, with 577 specimens representing 10.25% of the total collection, followed by *Aconurella prolixa* (Lethierry, 1885) of the subfamily Deltocephalinae, with 557 specimens (9.90%). In contrast, *Grammacephalus pallidus* (Linnavuori, 1978) and *G. indicus* (Viraktamath and Murthy, 1999), both belonging to Deltocephalinae, were comparatively less abundant, with 77 (1.36%) and 109 (1.93%) specimens, respectively. Leafhopper abundance showed considerable variation among host plants, habitats, and seasons. The highest abundance was recorded in rocky habitats, followed by sandy and flat habitats. Population densities increased markedly during the monsoon season, indicating a strong influence of seasonal and environmental conditions on leafhopper occurrence. These findings demonstrate that the diversity and abundance of Cicadellidae in Tharparkar are closely associated with vegetation, habitat characteristics, and seasonal variation. The study provides useful baseline information on leafhopper diversity and ecological associations in the arid ecosystem of Tharparkar and may contribute to future biodiversity conservation and pest-management strategies.

ENT-7

CONSERVATION ASSESSMENT OF ORTHOPTERAN INSECTS IN THE NARA DESERT USING BIODIVERSITY AND COMMUNITY STRUCTURE ANALYSES

Versha Kumari and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro

*Corresponding Author: versha.makhija@gmail.com, riffat.sultana@usindh.edu.pk

The Nara Desert of Sindh, Pakistan, is an ecologically important arid ecosystem with limited information available on its orthopteran diversity. This study assessed the biodiversity, community structure, and conservation status of Orthoptera across representative desert habitats through seasonal field surveys. Standardized sampling methods, including sweep-netting and hand collection, were employed to document species diversity and distribution. Community structure was evaluated using ecological diversity indices and similarity analyses. The results revealed distinct seasonal and habitat-related variations in orthopteran assemblages, with vegetation and habitat characteristics strongly influencing species composition. Several species exhibited restricted distributions, highlighting their potential vulnerability to habitat degradation and climate change. This study provides important baseline information for the conservation of orthopteran insects in the Nara Desert and emphasizes the need to incorporate insect biodiversity into sustainable management and conservation strategies for Pakistan's arid ecosystems.

ENT-8

CICADIDAE DIVERSITY AND MICROHABITAT PREFERENCE IN ZIZIPHUS MAURITIANA HABITATS OF SINDH, PAKISTAN

Nazish Gull Khattak¹, Riffat Sultana¹ and Imran Khatri²

¹*Department of Zoology, University of Sindh, Jamshoro, Sindh*

²*Department of Entomology, Sindh Agriculture University, Tandojam, Sindh*

*Corresponding Author: gulnazish719@gmail.com, riffat.sultana@usindh.edu.pk

Cicadas (Hemiptera: Cicadidae) are important components of terrestrial ecosystems, but their diversity and host-plant associations in Sindh, Pakistan, remain poorly documented. The present study investigated the taxonomic diversity and microhabitat preferences of cicadas associated with *Ziziphus mauritiana* and other thorny scrub vegetation in selected areas of Sindh. Field surveys were conducted across different vegetation types to record cicada abundance, distribution, and plant associations. Specimens were identified using diagnostic morphological and morphometric characters, including male opercula, pygofer morphology, and forewing venation. Species diversity was assessed using the Shannon–Wiener and Simpson diversity indices. Field observations indicated a strong association of cicadas with *Z. mauritiana* and other thorny vegetation, likely due to their dense canopy, woody branches, thick bark, and favorable microhabitat conditions. The findings provide useful baseline information on cicada diversity, taxonomy, and host-plant associations and highlight the ecological importance of *Z. mauritiana*-dominated scrub habitats for Cicadidae in Sindh.

ENT-9**DIVERSITY, MORPHOLOGY AND MORPHOMETRIC VARIATION OF ACRIDIDAE (ORTHOPTERA: ACRIDOIDEA) IN SINDH, PAKISTAN****Shafique Hyder¹, Riffat Sultana¹, Santosh Kumar²**¹*Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan*²*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur**Corresponding Author: 2k23-p-zoo-9@scholars.usindh.edu.pk; riffat.sultana@usindh.edu.pk

Acrididae represents one of the most diverse and ecologically important families of Orthoptera, occurring across a wide range of terrestrial habitats. The present study was conducted to investigate the diversity, morphological characteristics, and morphometric variation of acridid grasshoppers collected from different habitats and localities of Sindh, Pakistan, during 2024–2026. A total of 483 specimens representing 24 species belonging to eight subfamilies were collected and examined using diagnostic morphological and morphometric characters. Among the recorded subfamilies, Oedipodinae showed the highest species richness with six species, followed by Acridinae (4 species), Oxyinae (3 species), Eyprepocnemidinae (3 species), Cyrtacanthacridinae (3 species), Catantopinae (2 species), Hemiacridinae (2 species), and Gomphocerinae (1 species). Considerable variation was observed in morphological and morphometric characters among the examined taxa, providing useful diagnostic features for species identification and differentiation. The observed variation reflects the morphological diversity of Acrididae inhabiting different ecological conditions of Sindh. The present findings provide valuable baseline information on the diversity, morphology, and morphometric characteristics of acridid grasshoppers and contribute to future taxonomic, ecological, and evolutionary studies of Acrididae in Pakistan.

ENT-10**COMPARATIVE ANALYSIS OF LIFE HISTORY AND REPRODUCTIVE STRATEGIES OF THREE CRICKET SPECIES (ORTHOPTERA: GRYLLIDAE) FROM LOWER SINDH, PAKISTAN****Shamshad Ali Talpur and Riffat Sultana***Department of Zoology, University of Sindh, Jamshoro, Pakistan**Corresponding Author: shamshadtalpur@gmail.com; riffat.sultana@usindh.edu.pk

The present study compared the life history and reproductive strategies of three cricket species, *Gryllus bimaculatus* De Geer, 1773, *Callogryllus ovilongus* Saeed, Saeed & Yousuf, 2000, and *Teleogryllus occipitalis* (Serville, 1838), from Lower Sindh, Pakistan. Particular emphasis was placed on mating behavior, egg production, nymphal survival, and adaptability to environmental conditions. *G. bimaculatus* exhibited a high reproductive output, characterized by longer and more frequent male calling activity and the production of a greater number of eggs per clutch. In contrast, *C. ovilongus* produced shorter mating calls and fewer eggs per clutch, suggesting greater investment in reproductive efficiency rather than fecundity. *T. occipitalis* showed greater flexibility in response to environmental variation, with shorter calling activity and a relatively shorter developmental

period, indicating its ability to reproduce successfully under a wider range of climatic conditions. The mean duration of the egg stage was 18 ± 3 days in *C. ovilongus*, 14 ± 3 days in *G. bimaculatus*, and 11 ± 1 days in *T. occipitalis*. The mean number of eggs per clutch was 16 ± 3 in *C. ovilongus*, 32 ± 5 in *G. bimaculatus*, and 26 ± 3 in *T. occipitalis*. Temperature, humidity, and other ecological factors were also found to influence reproductive success, developmental duration, and survival. These findings demonstrate distinct reproductive and life-history strategies among the three cricket species and provide useful baseline information for understanding their adaptation and ecological success under the environmental conditions of Lower Sindh, Pakistan.

ENT-11

DIVERSITY, DISTRIBUTION, AND HABITAT ASSOCIATION OF *GRYLLOTALPA* SPECIES (ORTHOPTERA: GRYLLOTALPIDAE) IN SINDH, PAKISTAN

Bubal Mahar and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan

*Corresponding Author: babulmahar786@gmail.com, riffat.sultana@usindh.edu.pk

The genus *Gryllotalpa* (Orthoptera: Gryllotalpidae) comprises burrowing insects commonly known as mole crickets, which are important components of soil fauna and are frequently associated with agricultural ecosystems. In Sindh Province, Pakistan, mole crickets occur mainly in moist, loose, and cultivable soils that facilitate their fossorial lifestyle. They are commonly found in crop fields, irrigated areas, orchards, gardens, forests, and semi-desert habitats. Their burrowing and root-feeding activities may cause considerable damage to crops, particularly by feeding on roots, tubers, and other underground plant parts. The present study was conducted to investigate the diversity, distribution, and habitat association of *Gryllotalpa* species in different districts of Sindh. A total of 139 specimens were collected during field surveys from Mirpur Khas, Khairpur Mirs, Ghotki, Tandojam, Matiari, Kotri, and Jamshoro. Three species were identified: *Gryllotalpa orientalis* Burmeister, 1838, *Gryllotalpa africana* Palisot de Beauvois, 1805, and *Gryllotalpa kimbasi* Baccetti, 1992. Higher numbers of specimens were recorded from Tandojam, Mirpur Khas, and Matiari, which may be attributed to abundant vegetation, cultivated fields, and favorable soil-moisture conditions. In contrast, Jamshoro showed the lowest abundance, probably due to relatively sparse vegetation and drier soil conditions. The findings indicate that vegetation cover, soil moisture, and agricultural activity strongly influence the distribution and abundance of mole crickets in Sindh. This study provides baseline information on the diversity and habitat preferences of *Gryllotalpa* species and may contribute to their future taxonomic, ecological, and pest-management studies in Pakistan.

ENT-12**INTEGRATIVE ASSESSMENT OF ENSIFERA DIVERSITY IN LOWER SINDH, PAKISTAN USING DNA BARCODING AND ECOLOGICAL NICHE MODELING****Fatima Anum and Riffat Sultana***Department of Zoology, University of Sindh, Jamshoro, Pakistan****Corresponding Author:** fatimaanum.leo@gmail.com; riffat.sultana@usindh.edu.pk

Ensifera, a diverse suborder of Orthoptera comprising crickets, katydids, camel crickets, and allied taxa, represents an ecologically significant component of terrestrial ecosystems. Despite their ecological importance and potential utility as indicators of habitat quality and environmental change, the diversity, taxonomy, genetic variation, and distribution of Ensifera in Pakistan, particularly in Sindh Province, remain inadequately characterized. Morphology-based identification alone may overlook closely related or cryptic lineages, creating challenges for reliable species delimitation and accurate assessment of biodiversity. Therefore, the present study proposes an integrative framework for assessing Ensifera diversity and biogeography across Sindh by combining systematic field surveys, morphological taxonomy, mitochondrial DNA barcoding, and ecological niche modeling. DNA barcoding will complement conventional taxonomy by providing molecular validation of species identities and may help reveal previously unrecognized or cryptic diversity among morphologically similar taxa. The study is expected to produce a validated inventory of Ensifera in Sindh, generate molecular reference data for selected taxa, and provide spatially explicit predictions of suitable habitats and potential distribution patterns. The integration of morphological, molecular, and ecological approaches will enhance taxonomic resolution and provide a stronger baseline for understanding species richness, genetic diversity, and biogeographical patterns. Ultimately, the findings will contribute to biodiversity assessment, conservation prioritization, ecological monitoring, and future evaluation of environmental and climate-change impacts on Ensifera in Pakistan.

ENT-13**BIODIVERSITY OF PHANEROPTERINAE (ENSIFERA: ORTHOPTERA) FROM TANDO JAM, SINDH, PAKISTAN****Syeda Laraib and Riffat Sultana***Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan****Corresponding Author:** syedalarai542@gmail.com; riffat.sultana@usindh.edu.pk

Tando Jam, an important agricultural area of Sindh, supports diverse vegetation, including cereals, cash crops, vegetables, fruits, and fodder crops, providing suitable habitats for a variety of insect fauna. The present study was conducted to investigate the biodiversity and abundance of Phaneropterinae (Ensifera: Orthoptera) across five selected localities of Tando Jam. Extensive field surveys resulted in the collection of 1,013 specimens, representing different phaneropterine species. Among the collected

specimens, *Phaneroptera roseata* Walker, 1869 was one of the dominant taxa, comprising 235 specimens (23.19%) of the total collection. The occurrence and relative abundance of this species indicate the suitability of the diverse agricultural vegetation of Tando Jam for phaneropterine insects. The present findings provide baseline information on the diversity and distribution of Phaneropterinae in the region. Further investigations are underway to document additional species, their habitat associations, seasonal occurrence, and ecological importance in agricultural ecosystems.

ENT-14**INTRASPECIFIC MORPHOLOGICAL VARIATION IN THE SPERMATHECA OF THE PAINTED GRASSHOPPER *POEKILO CERUS PICTUS* (ORTHOPTERA: PYRGOMORPHIDAE)****Raheela Shah and Riffat Sultana***Department of Zoology, University of Sindh, Jamshoro**Corresponding Author: raheela@scholars.usindh.edu.pk; riffat.sultana@usindh.edu.pk

The spermatheca is a specialized sperm-storage organ in female insects and represents an important morphological character in taxonomic studies. During a morphological examination of the female reproductive system of the painted grasshopper, *Poekilocerus pictus* (Orthoptera: Pyrgomorphidae), noticeable intraspecific variation was observed in the spermatheca. Other internal female reproductive structures showed relatively consistent morphology, whereas the spermatheca exhibited distinct variation in size and shape among individuals. The spermatheca comprised a single, elongated, tubular seminal receptacle. Its length ranged from 1.103 to 1.426 mm, with noticeable variation in overall size and shape among the examined individuals. These observations demonstrate intraspecific morphological variation in the spermatheca of *P. pictus*. Since spermathecal morphology can provide useful taxonomic characters, recognition of variation within a species is important when using this structure for species identification and discrimination. The present findings provide baseline information for future comparative morphological and taxonomic studies of Pyrgomorphidae.

ENT-15**STUDY ON THE MORPHOLOGY AND DISTRIBUTION OF EARWIGS (DERMAPTERA) FROM SINDH, PAKISTAN****Barkat Ali Bughio, Zeenat Bughio, Hifsa Bughio, and Riffat Sultana***Department of Zoology, University of Sindh, Jamshoro, Pakistan**Corresponding Author: barkatali2009@gmail.com

Earwigs (Dermaptera) constitute a relatively small but ecologically important group of insects occurring in a wide range of terrestrial habitats. The present study was conducted to investigate the morphology, diversity, and distribution of earwigs in agricultural habitats of Sindh, Pakistan. Field surveys were carried out during 2023–2024, particularly in the months of May, June, July, and August, from

different representative localities of Sindh. Major crops cultivated at the surveyed sites included cotton, rice, wheat, sugarcane, chilies, tomatoes, onions, and potatoes. A total of 150 earwig specimens were collected from agricultural fields and associated habitats and examined on the basis of morphological and taxonomic characteristics. The collected specimens were identified into 10 species, including *Forficula auricularia* (Linnaeus, 1758), *Labidura riparia* (Pallas, 1773), *Anisolabis maritima* (Bonelli, 1832), *Euborellia annulipes* (Lucas, 1847), *Forficula senegalensis* (Serville, 1838), *Chelidura forfex* (Latreille, 1825), *Forficula maculata* (Gené, 1832), *Forficula flavipes* (Fabricius, 1793), *Labidura truncata* (Kirby, 1903), and *Spania maculata* (Burmeister, 1838). Among the collected material, Forficulinae was recorded as the dominant group. Earwigs are generally omnivorous, feeding on small insects, plant material, and decaying organic matter. Some species may also cause damage to agricultural crops by feeding on vegetative tissues, flowers, grains, and fruits, whereas others may play beneficial roles as predators and scavengers. The present study provides useful baseline information on morphology, diversity, and distribution of earwigs in Sindh and contributes to a better understanding of their occurrence and ecological importance in agricultural ecosystems. Further studies are required to evaluate their seasonal abundance, crop associations, economic importance, and potential role in agroecosystem management.

ENT-16

PRELIMINARY OBSERVATIONS ON THE MORPHOLOGY, EPIPHALLUS, AND SPERMATHECA OF FIVE TAXA OF THE GENUS *ACROTYLUS* (ACRIDOIDEA: ORTHOPTERA) FROM SINDH, PAKISTAN

Zeenat Bughio. Barkat Ali Bughio, Hifsa Bughio and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro

*Corresponding Author: barkatali2009@gmail.com

The study of Acridoidea is important for the taxonomy and systematics of grasshoppers. Orthoptera comprises insects with paurometabolous development and includes grasshoppers, crickets, and locusts. In the present study, five species and subspecies of the genus *Acrotylus* were examined: *Acrotylus humbertianus* (Saussure), *A. insubricus insubricus* (Scopoli), *A. patruelis* (Herrich-Schäffer), *A. longipes longipes* (Charpentier), and *A. longipes subfasciatus*. Attention was given to external morphology and the diagnostic structures of the male epiphallus and female spermatheca. The spermatheca plays an important role in insect reproduction by storing spermatozoa received during copulation and making them available for subsequent fertilization. Although information on the external morphology of *Acrotylus* species is available, comparative information on their genital structures remains limited. The present observations highlight useful diagnostic characters of the epiphallus and spermatheca that may assist in accurate species identification. The epiphallus is characterized by a moderately broad bridge, narrow ancorae, and bilobate lophi, whereas the spermatheca consists of a coiled duct of ectodermal origin that varies in size and shape among taxa and expands into a sac-like structure for sperm storage. These genital characters provide additional taxonomic information for distinguishing closely related taxa of *Acrotylus*. The present study provides useful baseline information for future taxonomic and systematic investigations of Acrididae in Pakistan.

ENT-17

PRELIMINARY STUDY ON COLOR POLYMORPHISM OF THE COMMON GREEN GRASSHOPPER (ORTHOPTERA: ACRIDIDAE) OF SINDH, PAKISTAN

Hifsa Bughio , Riffat Sultana, Barkat Ali Bughio and Zeenat Bughio

Department of Zoology, University of Sindh Jamshoro Pakistan

*Corresponding Author: barkatali2009@gmail.com

To describe grasshopper (Orthoptera: Acrididae) species composition, diversity, abundance. Generally, grasshoppers are either green or brown with the exception of a few being brightly coloured found to live either on grass or on bald land areas. Some species live on short Plants too and a few grasshoppers are capable of change body colour resembling their background. One of the basic features of insects is the body colour specific to species with a definite pattern of pigment distribution but this definitive colour pattern of insects is also variable due to influence of several factors (Gilbert and Epel, 2009). Cryptic coloration is an adaptative defensive mechanism against predators. Color patterns can become cryptic through background coloration-matching and disruptive coloration. One of the fundamental features of insects is the body colour specific to species. Changing body colour by an insect to match the background is one of the strategies evolving for survival. Abiotic factors responsible for bringing variations in morphological colour include temperature, humidity and food resource, due to these pigments responsible for thermoregulation (Forsman, 1997) and microhabitat utilization (Ahnesjo and Forsman, 2005) are developed. These surveys of Genus *Acrida*, acrididae were conducted from July to September 2024 in Sindh. During survey that was carried out from June to September 2024 in the agricultural field. In this study we have collected the specimens of acrididae and furthermore sorted out into three species that include *Locusta migratoria manilensis*, Meyen, 1835, *Patanga succincta* Johannson, 1763, *Schistocerca gregaria* Stal, 1873. It was observed that most dominant species of the family acrididae is *Locusta migratoria manilensis*, having bluish color polymorphism Whereas other species were found as greenish, with black spots or yellow spots. In this study we have observed and recorded the occurrence of exclusively green coloured morphs during rainy season when the grass is lush green and light yellowish brown coloured, dark brown pigmented grasshopper morphs of these two species during winter when the grass was either totally dry with straw colour or partly dry with grey colour with dark patches on the with ring grass blades. It has also been recorded, that the different body colour morphs of these two species of hoppers with seasonal changes in the environment in their natural habitat. The study was carried out at different locations.

ENT-18

A REVIEW OF THE SUBFAMILY GRYLLINAE (ORTHOPTERA: GRYLLIDAE) FROM SINDH, PAKISTAN

Naila Bhanger¹, Riffat Sultana¹, and Santosh Kumar²

¹*Department of Zoology, University of Sindh, Jamshoro*

²*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

*Corresponding Author: nailaqurban89@gmail.com

The subfamily Gryllinae (Orthoptera: Gryllidae) represents an important component of cricket diversity in Sindh, Pakistan. Members of this group occupy a wide range of terrestrial habitats,

including agricultural fields, grassy areas, herbs, shrubs, leaf litter, and moist soil. The diverse natural and agricultural landscapes of Sindh provide suitable habitats for several grylline species. Previous taxonomic studies have contributed substantially to the knowledge of Gryllinae in the region through descriptions, identification keys, illustrations, and comparative morphological characters. Important genera reported from Sindh include *Acheta*, *Gryllus*, *Gryllodes*, *Callogryllus*, and *Teleogryllus*. Species recorded from the region include *Acheta domesticus* (Linnaeus, 1758), *Gryllus bimaculatus* De Geer, 1773, *Gryllus campestris* Linnaeus, 1758, *Gryllodes sigillatus* (Walker, 1869), *Gryllodes supplicans* (Walker, 1859), *Teleogryllus occipitalis* (Serville, 1838), and *Callogryllus saeedi* Malik, Soomro, Ursani, Baloch & Wagan, 2013. Identification of Gryllinae is primarily based on morphological characters such as body size, coloration, and the structure and markings of the head, pronotum, wings, and other diagnostic features. Their distribution in Sindh is influenced by habitat type, vegetation, moisture, and other ecological conditions. This review summarizes the available taxonomic information on Gryllinae from Sindh and highlights their diversity, distribution, diagnostic characters, and habitat associations. Further systematic surveys and integrative taxonomic studies are needed to improve knowledge of the diversity and distribution of this important cricket group in the region.

ENT-19**DIVERSITY OF BUTTERFLY(LEPIDOPTERA) AND MOTH FAUNA IN LOCAL FIELD OF TEHSIL RAZZAR DISTRICT SWABI**

Abdullah Sher and Munawar Saleem Ahmad
Department of Zoology, University of Swabi, Swabi
Corresponding Author: saleemsbs@gmail.com

The study deals with the abundance, distribution, and diversity of the Lepidoptera (Butterflies and Moths) in Tehsil Razar, District Swabi in Khyber Pakhtunkhwa province of Pakistan. In this case, field surveys were carried out in four different habitat types, which were agricultural fields, riverbanks, grasslands, and forested areas. In total, 56 specimens of the order Lepidoptera were collected in the localities during the study. Seven species of Lepidoptera, four butterflies and three moths, were found. The highest number of species and abundance was recorded in agricultural areas. The study revealed that agricultural fields become important habitats for diurnal butterflies, while forest areas serve as good habitats for nocturnal moths. There was seasonality, with spring being the most active month for Lepidoptera activity. The result shows the importance of sustainable farming techniques and forest conservation to maintain Lepidoptera. Future research suggestions comprise long-term monitoring, habitat recovery and policy formulation to safeguard the crucial Lepidoptera sites in the area.

ENT-20

IDENTIFICATION OF SOME WATER PREDATORY BUGS (HETEROPTERA) FROM LOWER SINDH, PAKISTAN

Abida Parveen Soomro^{*1}, Imran Khatri², Agha Mushtaque Ahmed³ and Zubair Ahmed⁴

^{1,2,3}Department of Entomology, Sindh Agriculture University, Tandojam

⁴Department of Zoology, Federal Urdu University of Arts, Science & Technology, Karachi

*Corresponding Author: abidaparveenento@gmail.com

Aquatic and semiaquatic heteropteran bugs are important components of freshwater ecosystems, where many species function as active predators and contribute to the regulation of aquatic invertebrate populations. Their specialized morphological adaptations, including raptorial forelegs, piercing-sucking mouthparts, respiratory siphons and water-repellent body surfaces, enable them to exploit distinct ecological niches in ponds, irrigation channels, slow-moving waters and other freshwater habitats. Despite their ecological importance, information on the taxonomy and distribution of predatory water bugs in Pakistan remains limited. The present study was therefore conducted to identify and describe selected predatory water bugs from Lower Sindh, Pakistan, with emphasis on their diagnostic morphology, male genital structures, material examined and distribution. Three taxa representing different ecological and taxonomic groups were studied: *Laccotrephes sindhiensis* sp. nov. (Nepidae), *Lethocerus indicus* (Lepeletier & Serville, 1825) (Belostomatidae), and *Aquarius paludum* (Fabricius, 1794) (Gerridae). Specimens were collected from localities in and around Tandojam, Hyderabad, including agricultural farms, village habitats and the Horticulture Garden. Morphological examination was based on external diagnostic characters and male genital structures, supported by illustrated habitus and genitalic plates. *Laccotrephes sindhiensis* sp. nov. was characterized by a dark brown to blackish, dorsoventrally flattened body, a broad pronotum expanded posteriorly, a strongly developed prosternal keel, enlarged raptorial forelegs and a respiratory siphon shorter than the body. The male measured 18.5 mm in body length, excluding the 12.0 mm siphon, and the species was recorded from Tandojam, Sindh. *Lethocerus indicus* was represented by a large-bodied belostomatid, with the male measuring 63 mm in length and 22 mm in width. It was distinguished by a strongly triangular head, broad pronotum, robust raptorial forelegs, triangular scutellum and characteristic male genitalia. Specimens were collected from Malir Farm and villages near Tandojam, while the species is known more broadly from central and eastern India and Southeast Asia. *Aquarius paludum*, a semiaquatic water strider, measured 12 mm in the male and was recognized by its predominantly black body with whitish and ochraceous markings, long slender legs, quadrangular head, short rostrum and distinctive male genital structures. The species was collected from the Horticulture Garden, Tandojam. The occurrence of representatives of Nepidae, Belostomatidae and Gerridae in the study area reflects the ecological variety of aquatic and marginal habitats in Lower Sindh. The study provides updated morphological documentation of predatory aquatic Heteroptera from the region and adds *L. sindhiensis* sp. nov. to the known fauna. The diagnostic descriptions and illustrations presented here will facilitate reliable identification of these ecologically important predators, reduce confusion among morphologically similar taxa and provide baseline taxonomic information for future faunistic, ecological, biodiversity and freshwater conservation studies in Pakistan. These records also strengthen the taxonomic foundation needed for documenting aquatic insect diversity and understanding the role of predatory true bugs in freshwater food webs of Sindh.

START FOR NOT PAID

ENT-21**Molecular Biology****MOLECULAR CHARACTERIZATION OF LADYBIRD BEETLE (COLEOPTERA: COCCINELLIDAE) OF MALAKAND REGION PAKISTAN****Kausar Saeed***Department of Zoology, University of Buner, Khyber Pakhtunkhwa, Pakistan***Corresponding Author: Kausarsaeed@yahoo.com*

A ladybird beetle belongs to the family Coccinellidae which includes a variety of ladybird beetles; it consists of about 6,000 species with 360 recognized genera. The Coccinellidae family is one of the most diversified ladybird beetle's family. Further, it consists of six subfamilies including Chilocerinae, Coccinellinae, Coccidulinae, Scymninae, Sticholotidinae, and Epilachninae. The Malakand region has the most diverse fauna of ladybird beetles; therefore, their conservation is very important for a sustainable environment. This study aimed to find out the molecular characterization of ladybird beetles document the spatial distribution, and seasonal occurrence of the ladybird beetles, and construct the phylogenetic tree of the collected species of the Malakand region of Pakistan. Between April 2022 and April 2024, the present study was carried out on the ladybird beetle fauna of the Malakand region of Pakistan. The 2715 specimens collected from the study area belonged to the Subfamilies Chilocerinae, Coccinellinae, and Epilachninae. The specimens that were gathered were labeled and kept in insect boxes. For morphological identification of ladybirds beetle, the special keys of Rafi *et al.* (2005), Kapoor (1958), and Purani (2004) were used. The seven districts that make up the Malakand region are Swat, Upper Dir, Lower Dir, district Buner, Shangla, Malakand, and Chitral. The current study examines Mitochondrial *Cytochrome c oxidase* gene especially codons within subunit 1 (*COXI*) of 34 species, 21 genera and 3 subfamilies of ladybird beetles. The Quigen mini kit was used to extract DNA from the species' legs, and the primers LCO1490 and HCO2198 were then used for PCR amplification. Sanger sequencing was carried by MacroGen Inc. Seoul, Korea. The good sequences were trimmed, checked with BLAST and employed in the procedure of phylogeny rebuilding with MEGA 11. The *COXI* sequences of all species had a K2P distance of 0.059474-0.63328 which represented intra species and interspecies divergence in the Malakand fauna. The variable sites were 176, the parsimony-informative 96, the conserved sites 200, the singletons 18. The UPGMA tree created using the Maximum Composite Likelihood model was created with the optimal tree having a total length of 0.359. The Kimura 2-parameter model ML tree log likelihood was -1650.25. The topologies of NJ and ME methods gave similar results with 0.341 and 0.342 as the sum of the branch length. Substitution matrices showed a bias of transition/transversion of $R = 2.39$, maximum substitution rates between G/A and G/T, which are typical of insects. The Gamma of the rate dispersion between sites was estimated to 0.17. Phylogenetic patterns were also confirmed by analyses of the Tamura-Nei model based on discrete Gamma distribution. During the study we find out the distribution, diversity, morphology, seasonal occurrence and host plants of ladybird beetle fauna of Malakand region. The study investigated that *Coccinella septempunctata* (PQ465997) and *Harmonia demediata* (PQ469586) were found abundant while *Illeis confusa* (PQ178170) and *Illeis cincta* (PQ476007) were found rare in the study area. From the study we documented the species *Illeis confusa* (PQ178170)(Mulsant, 1850), for the first time to NCBI database with accession no KY841053. All of the polymorphic locations that contribute to species differentiation and phylogenetic signal in the dataset are represented by these positions, which are the precise nucleotide sites in the alignment where variations occur among the ladybird beetle species. The species *Parexochomus nigromaculatus* (PQ893893), *Illeis cincta* (PQ476007), *Angelies cardonii* (PQ476006), *Propylea japonica* (PQ859280), *Propylea quattuordecimpunctata* (PQ466189), *Psyllobora vigintiduopunctata* (PQ476002), *Subcoccinella*

vigintiquatuor punctata (PQ476000), are new to our study area. In the study, it was noted that the richness of ladybird beetles in Malakand was high, and morphological plus *COXI*-based phylogenetics can identify species at the species level and make the relationship among Coccinellidae clearer.

ENT-22

CLIMATE CHANGE AND BUTTERFLY DIVERSITY IN MIANI FOREST SINDH PAKISTAN

Bhojoo Mal*, Abdul Manan Shaikh, Aiman Amur and Abdul Waheed

Department of Zoology, GC University Hyderabad

*Corresponding Author: dr.bhojoo.mal@gcu.edu.pk

Butterflies are widely recognized as sensitive bioindicators of environmental change due to their rapid response to habitat modification and climatic fluctuations. Miani Forest, one of the ecologically important forests of Sindh, supports a diverse assemblage of flora and fauna. However, information regarding its butterfly diversity remains scarce. This study aims to evaluate the diversity, abundance, and seasonal distribution of butterflies in relation to climatic variables in Miani Forest. Monthly field surveys were conducted using standardized line transects and sweep-net sampling across different habitats. During the study, seven species belonging to the family Pieridae were recorded, namely *Catopsilia pomona*, *Colotis amata*, *Colotis danae*, *Colotis etrida*, *Colotis protractus*, *Colotis vestalis* and *Catopsila florella*. Meteorological parameters, including temperature, relative humidity and rainfall were recorded to assess their influence on butterfly assemblages. Species diversity was quantified using the Shannon–Wiener and Simpson indices, while correlations between climatic factors and butterfly diversity were analyzed using appropriate statistical methods. Preliminary observations indicate marked seasonal variation in species richness with higher diversity during favorable temperature and humidity conditions and reduced abundance during periods of extreme heat. The findings highlight the vulnerability of butterfly communities to climate variability and emphasize the importance of conserving riverine forest ecosystems as biodiversity refuges. This study provides baseline information for long-term butterfly monitoring and contributes to the development of evidence-based conservation strategies for insect biodiversity in Pakistan.

ENT-23

CLIMATE-INDUCED DECLINE OF BEE POLLINATORS AND ITS CONSEQUENCES FOR FOOD SECURITY

Mirza A. Qayyum, Umair Faheem, Muhammad Ishtiaq*, and Muhammad Ashfaq

Department of Entomology, MNS-University of Agriculture, Multan

*Corresponding Author: m.ishtiaq@mnsuam.edu.pk

Bee pollinators play a key role in biodiversity, ecosystem stability and agricultural productivity. Bees are the most effective pollinators and are responsible for more than 75% of the world's food crops are

dependent at least partially on animal pollination. But climate change has become a big issue for bees and their populations have been threatened across the globe, which has an impact on food production and sustainable farming. This study points out the main drivers of pollinator decline due to climate change and their impacts on crop production and human health. Climate stressors that are significant to bee populations include: increased temperatures, changing rainfall patterns, phenological shifts between bee activity and flowering plants, habitat fragmentation and the spread of pests and diseases. Together, these factors contribute to bee mortality, foraging inefficiency, reduced reproductive rates and colony strength, which ultimately results in reduced pollination services. The reduction in pollination can affect the yield and quality of pollinator-dependent crops like fruits, vegetables, oilseeds and forage crops. Agricultural, nutritional, ecological and economic impacts are massive due to the loss of bee pollinators. Reduced yields and quality of the crops make reliance on manual pollination by farmers more vital, and consequently raise food cost and lose the livelihoods, especially for smallholder farmers. From a nutritional perspective, availability of pollinator-dependent foods could be reduced, leading to more limited access to key micronutrients such as vitamins, minerals, antioxidants and other nutrients essential for human health. In an ecological context, pollinator loss has the potential to affect biodiversity, food chains, and the resilience of ecosystems. The study highlights the need for conservation and mitigation measures such as habitat restoration, pollinator-friendly agriculture, pesticide reduction, crop diversification, integrated pest management, and increased research and policy support to overcome these challenges. The preservation of bee pollinators is crucial to maintain agricultural systems, global food security and create resilient ecosystems in the context of climate change.

ENT-24

DIVERSITY AND NUTRITIONAL POTENTIAL OF EDIBLE INSECTS IN MIDDLE SINDH, PAKISTAN

Iqra Qazi and Riffat Sultana

Department of Zoology, University of Sindh, Jamshoro, Pakistan

*Corresponding Author: iqra.qazi@scholars.usindh.edu.pk

Edible insects are gaining global attention as sustainable sources of protein that may help address food insecurity and environmental challenges. Approximately 2,205 edible insect species have been documented across 128 countries worldwide. Asia has a particularly rich diversity of edible insects, with about 932 recorded species. However, in Pakistan, insect consumption is limited, and baseline information on the diversity and nutritional potential of edible insects remains scarce. The present study was conducted to document the diversity of edible insects and evaluate the nutritional potential of selected species across nine districts of Middle Sindh, Pakistan. Insects were collected from agricultural fields, vegetable markets, and peri-urban areas from March to June 2026 using hand collection, sweep nets, and light traps. A total of 11 edible insect species belonging to five orders and seven families were recorded. Orthoptera was the dominant order, represented by four species of crickets and grasshoppers. The most frequently encountered species were *Acheta domesticus* (house cricket), *Gryllus bimaculatus* (field cricket), and *Oxya* sp. (grasshopper). Local vendors and farmers reported the occasional use of these species as poultry and aquaculture feed and in some cases, as traditional snacks. Proximate analysis of the three most

abundant species showed crude protein contents ranging from 59.4% to 67.2%, crude fat contents from 13.1% to 20.3%, and ash contents from 3.9% to 5.4% on a dry-matter basis. Among the analysed species, *Acheta domesticus* exhibited the highest crude protein content. The findings indicate that Middle Sindh supports a diverse range of edible insects with considerable nutritional value. Sustainable harvesting and mass rearing of these insects, particularly crickets, could provide local farmers with low-cost, high-quality protein sources while supporting organic waste recycling, income diversification, and sustainable food and feed production. Further studies are recommended to assess the safety, digestibility, nutritional efficacy, and economic feasibility of incorporating these edible insects into fish and poultry feed formulations.

ENT-25

DIVERSITY OF BUTTERFLIES OF THE FAMILY NYMPHALIDAE (ORDER: LEPIDOPTERA) IN MIANI FOREST, SINDH, PAKISTAN

Abdul Waheed* and Bhojoo Mal

Department of Zoology, GC University Hyderabad

*Corresponding Author: abdulwaheedmb39@gmail.com

Butterflies are important bioindicators of ecosystem health due to their sensitivity to environmental changes and habitat quality. The present study was conducted to investigate the diversity of butterflies belonging to the family **Nymphalidae** (Order: Lepidoptera) in Miani Forest, Sindh, Pakistan. Field surveys were carried out using standard butterfly sampling techniques, including visual observations and sweep net collections, across different habitats within the forest. Species identification was performed using standard taxonomic keys. A total of 45 specimens were collected from the Miani Forest. Five species were identified, namely *Junonia almana*, *Junonia hierta*, *Junonia lemonias*, *Junonia orithya*, and *Vanessa cardui*. Among the recorded species, members of the genus *Junonia* were the most dominant, indicating their successful adaptation to the prevailing environmental conditions of the study area. The occurrence of *Vanessa cardui*, a well-known migratory species, further reflects the ecological significance of Miani Forest as a suitable habitat for butterfly diversity. The findings demonstrate that Miani Forest supports a representative assemblage of Nymphalid butterflies despite increasing anthropogenic and climatic pressures. This baseline information contributes to the understanding of butterfly biodiversity in southern Sindh and provides valuable data for future ecological monitoring, conservation planning, and biodiversity management. Continued surveys covering different seasons are recommended to document additional species and assess the long-term effects of habitat alteration and climate change on butterfly communities. The authors gratefully acknowledge the financial support provided by the Pakistan Science Foundation (PSF) under Research Project No. PSF/Res/S-GCU/Bio (692) entitled "*Effects on the Diversity of Butterflies (Insecta: Lepidoptera) due to Climate Change in Miani Forest*".

ENT-26**THE PENTATOMIDAE OF PAKISTAN: A NATIONAL ASSESSMENT OF DIVERSITY, DISTRIBUTION, AND ECOLOGICAL ASSOCIATIONS****Seemab Aftab², Maid Zaman^{1*}, Asma Ul Husna² and Aziz Ullah²**¹*Department of Entomology, Faculty of Physical and Applied Sciences, The University of Haripur, Khyber Pakhtunkhwa- Pakistan*²*Department of Biology, Faculty of Biomedical Sciences, The University of Haripur, Khyber Pakhtunkhwa-Pakistan**Corresponding Author: Maidzaman@uoh.edu.pk

The family Pentatomidae (Hemiptera: Heteroptera) comprises economically important phytophagous pests and predators. Pakistan's unique biogeographic location at the junction of Oriental and Palearctic regions makes it biodiversity hotspot with poorly known diversity and distribution of Pentatomids across all agro-ecological zones of Pakistan. Therefore, collection for Pentatomids was done from sixty-two locations across Pakistan and stored. All stored specimens were then identified through available taxonomic keys for different morphological characters which resulted into fifteen genera, and two subfamilies (Pentatominae and Asopinae). The most extensively dispersed genus was *Eurydema*, when compared with other genera including *Halyomorpha*, *Piezodorus*, and *Udonga* (lowest). Highest richness of 21% was recorded for Zone VI (Wet Mountains) while lowest of 2% was recorded for Zone X (Sulaiman Piedmont). Data on percent host attacked by various genera showed substantial association with agriculture, forest/wood, ornamental plants/weeds and predators from 100% phytophagous to 100% predators. Similarly, agriculture landscape was predominantly attack in comparison to forest, and as a predator, respectively. The presence of both phytophagous (Pentatominae) and predatory (Asopinae) demonstrates the dual ecological roles of Pentatomidae in Pakistan's agro-ecosystems, providing a baseline information for future biodiversity, taxonomic, and integrated pest management research.

ENT-27**DIVERSITY AND FORAGING BEHAVIOUR OF DIFFERENT TERMITE SPECIES ACROSS THREE HABITAT IN MULTAN DISTRICT, PUNJAB, PAKISTAN****Ali Amir¹, Naeem Iqbal^{1*}, Nauman Sadiq¹, Shafqat Saeed¹ and Muhammad Ashfaq²**¹*Department of Entomology, Muhammad Nawaz Shareef University of Agriculture, Multan*²*Department of Plant Pathology, Muhammad Nawaz Shareef University of Agriculture, Multan**Corresponding Author: naeem.iqbal@mnsuam.edu.pk

Termites are eusocial insects that play both beneficial and detrimental roles in natural ecosystems. They are found in a wide variety of habitat with different foraging activity pattern. In the current study, foraging behaviour of different termites was assessed with respect to different food resources and habitat types. The study was conducted during October-November 2025 in three ecologically contrasting areas of District Multan, Punjab, Pakistan including tree plantation (closed-canopy arboreal habitat), floodplain

area, and park (managed urban green space). Three sizes of in-ground bait stations (small, medium, and large) were installed in each habitat type, with 15 stations of each size per habitat. The data of total contact, new contact, continuous contact, abandoned contact, no contact, and forager population for each termite species were recorded weekly for six weeks. The results revealed five termite species including *Odontotermes obesus*, *Microtermes mycophagus*, *Coptotermes heimi*, *Amitermes* spp., and *Microcerotermes championi*. The termite species and its numbers varied according to the habitat. The forest habitat exhibited the highest species diversity and foraging abundance, with *O. obesus* and *M. mycophagus* being the dominant species. *M. championi* was restricted to park habitat as predicted by its arboreal nesting habits. Large stations had the highest contacts and forager population, with approximately 130 individuals per trap, substantially exceeding the forager populations recorded at medium and small stations across all habitat types. The findings will be helpful for effective termite monitoring and baiting programs.

ENT-28

PRELIMINARY SURVEY OF AQUATIC INSECT FAUNA AND THEIR ROLE IN ENHANCING BIODIVERSITY AT HEAD PANJNAD

Malaika Zahid^{1*}, Santosh Kumar^{1} and Riffat Sultana²**

¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

²Department of Zoology, University of Sindh, Jamshoro

Corresponding Author: malaikamaya95@gmail.com, santoshkumar@cuvas.edu.pk**

The present study investigated the diversity, seasonal abundance, and ecological significance of aquatic insect fauna at Head Panjnad, Punjab, Pakistan. A total of 1,486 individuals representing seven orders of aquatic insects were recorded during the study period. Odonata was the most dominant order, comprising 32.5% of the total collection, followed by Hemiptera (23.8%), Coleoptera (18.4%), Diptera (13.7%), Ephemeroptera (7.6%), Trichoptera (3.0%), and Plecoptera (1.0%). Considerable spatial variation in species richness was observed among sampling sites. Site III exhibited the highest richness with 34 species, whereas Site V showed the lowest richness with 18 species, possibly reflecting differences in habitat quality and anthropogenic disturbance. Seasonal fluctuations were also evident, with the highest abundance recorded during spring (391 individuals), followed by summer (357 individuals), while the lowest abundance occurred during the monsoon season (216 individuals). Diversity analysis showed that Site III had the highest Shannon–Wiener diversity index ($H' = 3.12$), Simpson diversity index ($1-D = 0.91$), and evenness ($J = 0.89$), indicating a diverse and relatively well-balanced aquatic insect community. In contrast, Site V exhibited the lowest diversity values ($H' = 2.04$, $1-D = 0.76$, $J = 0.69$), suggesting comparatively greater environmental stress and habitat disturbance. The occurrence of both pollution-tolerant and pollution-sensitive taxa, particularly members of Ephemeroptera, Trichoptera, and Plecoptera, demonstrated the ecological value of aquatic insects as indicators of freshwater ecosystem condition. Aquatic insects also contribute substantially to nutrient cycling, decomposition, food-web dynamics, and energy transfer to higher trophic levels. These findings highlight the importance of Head Panjnad as a habitat for aquatic insect diversity and emphasize the need for regular biomonitoring and effective conservation measures to maintain freshwater ecosystem health.

ENT-29

FEEDING PREFERENCES OF *POEKILOCERUS PICTUS* (ORTHOPTERA: PYRGOMORPHIDAE) UNDER NATURAL AND CONTROLLED CONDITIONS**Zainab Alam^{1*}, Santosh Kumar^{1**} and Riffat Sultana²**¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur²Department of Zoology, University of Sindh, Jamshoro*Corresponding Author: zaynabalam352@gmail.com*, santoshkumar@cuvas.edu.pk**

The present study investigated the feeding preferences of *Poekilocerus pictus* (Orthoptera: Pyrgomorphidae) under natural and controlled conditions. *P. pictus* is a phytophagous and polyphagous grasshopper commonly occurring in arid and semi-arid regions, where it feeds on a variety of wild and cultivated plants. Understanding its feeding preferences is important for assessing its ecological role and potential pest significance. Field observations were conducted in natural habitats to record host-plant utilization, while laboratory experiments under controlled conditions evaluated feeding preferences by offering different plant species as food sources. Feeding behaviour was assessed on the basis of consumption rate, feeding frequency, and plant preference. The results revealed clear variation in host-plant selection, with higher feeding activity on certain plant species commonly available in arid environments. Under natural conditions, feeding patterns were influenced by plant availability, accessibility, and habitat characteristics, whereas under controlled conditions, host selection appeared to be more strongly associated with palatability and nutritional suitability. Despite its polyphagous nature, *P. pictus* exhibited distinct selective feeding behaviour. Comparative analysis further indicated differences between field and laboratory feeding patterns, suggesting that plant diversity, microhabitat conditions, and other environmental factors influence host selection under natural conditions. The findings provide useful baseline information on the feeding ecology and host-plant preferences of *P. pictus* and may contribute to understanding its ecological interactions and potential impact on vegetation in arid ecosystems.

ENT-30

FIRST SYSTEMATIC ASSESSMENT OF MOLE CRICKETS (ORTHOPTERA: GRYLLOTALPIDAE) FROM THE CHOLISTAN DESERT, PAKISTAN**Shamsa Kanwal^{1*}, Santosh Kumar^{1**} and Riffat Sultana²**¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur²Department of Zoology, University of Sindh, Jamshoro*Corresponding Author: kshamsa811@gmail.com*, santoshkumar@cuvas.edu.pk**

The insect family Gryllotalpidae, commonly known as mole crickets, comprises fossorial orthopterans of considerable ecological and agricultural importance. Despite extensive studies in various regions, the mole cricket fauna of extreme arid environments such as the Cholistan Desert, Pakistan, remains poorly documented. The present study provides the first systematic assessment of Gryllotalpidae from this desert ecosystem. The objectives were to establish a taxonomic inventory of mole crickets, provide reliable identification based on detailed morphological characters, and

assess their spatial distribution and habitat associations. Field surveys conducted across representative habitats revealed that all collected specimens belonged to the genus *Gryllotalpa*. Two morphologically distinct forms, provisionally designated as *Gryllotalpa* sp. A and *Gryllotalpa* sp. B, were recognized. Their distributions showed clear associations with local environmental conditions. *Gryllotalpa* sp. A was primarily associated with interdunal plains characterized by loamy-sandy soils and grass cover, whereas *Gryllotalpa* sp. B was predominantly restricted to microsites with relatively higher soil moisture. These findings confirm the occurrence of *Gryllotalpa* in the Cholistan Desert and provide the first baseline information on the taxonomy, distribution, and habitat preferences of mole crickets in this region. The study also highlights the importance of soil moisture and suitable microhabitat refugia for their persistence under arid desert conditions.

ENT-31

ULTRAVIOLET LIGHT AND FERMENTATION ODOURS ENHANCE ADULT *Aedes* CAPTURE IN A LOW-COST SUCTION TRAP

Rana Zain Khizar and Farrukh Baig

Department of Entomology, MNS University of Agriculture, Multan, Punjab, Pakistan

*Corresponding Author: farrukh.baig@mnsuam.edu.pk

Dengue-vector management in Pakistan relies mainly on insecticides, highlighting the need for affordable and environmentally safe tools for capturing adult mosquitoes. This study developed and evaluated a locally fabricated visual–olfactory suction trap for *Aedes aegypti*. Indoor and outdoor prototypes were constructed using PVC pipe, a 12-V computer fan and light-emitting diodes. Laboratory dual-choice experiments were conducted under controlled conditions using 100 mixed-sex, 7–10-day-old adults per replicate. Blue, ultraviolet (UV), and combined blue–UV lights were initially compared. The most effective light treatment was subsequently evaluated with three inexpensive lures: a jaggery–yeast fermentation mixture, beetroot–peel extract and Bermuda-grass infusion. Each experiment comprised five replicates, with trap positions rotated between replicates. The best-performing trap–lure combination was then deployed overnight in residences and university hostels. Mean percentage catches were compared using paired t-tests at a 5% significance level. UV light attracted significantly more adults than blue light ($t = -5.17$, $df = 4$, $P = 0.0067$) and combined blue–UV light ($t = 20.71$, $df = 4$, $P = 0.0001$). The jaggery–yeast fermentation lure was the most effective attractant, increasing mean adult capture from approximately 18% in unbaited traps to 62% in baited traps ($t = -16.83$, $df = 4$, $P = 0.0001$), with females comprising most of the catch. Field-deployed UV–fermentation traps captured both *Ae. aegypti* and *Ae. albopictus*, demonstrating operational feasibility under residential conditions. The findings indicate that combining UV light with fermentation odours offers a promising, inexpensive and pesticide-free approach for *Aedes* surveillance and targeted adult-mosquito management. Larger field trials are required to determine lure longevity, optimal trap density, species specificity and population-level effectiveness.

ENT-32**EFFECT OF CLIMATE CHANGE ON THE BIODIVERSITY AND MOLECULAR CHARACTERIZATION OF TROPICAL ODONATA FROM DISTRICT KHAIRPUR, SINDH, PAKISTAN: A REVIEW****Summaya Shaikh and Javed Ahmed Ujan****Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh, Pakistan***Corresponding Author: javed.ujan@salu.edu.pk*

Tropical Odonata (dragonflies and damselflies) serve as vital bioindicators sensitive to thermal and hydrological shifts, making them ideal models for assessing ecosystem health in hyper-arid agricultural microclimates like District Khairpur, Sindh, Pakistan. Accelerated climate change, manifested through soaring ambient temperatures, prolonged droughts, and erratic seasonal water availability, severely disrupts canal-dependent aquatic habitats and threatens local dragonfly biodiversity. While heat-tolerant species within the family Libellulidae currently dominate the local fauna, specialized aquatic taxa face population declines and localized range shifts due to habitat desiccation. Integrating DNA barcoding using the mitochondrial cytochrome c oxidase subunit I (COI) gene provides a robust molecular tool for accurate species identification, overcoming morphological limitations associated with cryptic species complexes and unidentifiable larval stages. However, regional molecular repositories for Sindh's entomofauna remain underrepresented, underscoring the urgent need for systematic DNA barcoding initiatives. Combining molecular characterization with climate-impact monitoring is essential to establish accurate biodiversity baselines, map vulnerable populations, and formulate targeted conservation strategies for freshwater insect communities in southern Pakistan.

ENT-33**BIODIVERSITY AND PHYLOGENETICS OF CATERPILLARS:
AN INTEGRATIVE REVIEW****Zeesshan Ujjan and Javed Ahmed Ujjan***Department of Zoology, Shah Abdul Latif University, Khairpur***Corresponding Author: shanthe great2@gmail.com*

Caterpillars, the larval stages of butterflies and moths (Lepidoptera), represent an exceptionally diverse and ecologically important component of terrestrial ecosystems. Their biodiversity encompasses remarkable variation in morphology, behavior, host-plant associations, feeding strategies, and defensive adaptations. This review synthesizes current knowledge of caterpillar biodiversity and phylogenetic relationships, emphasizing the integration of classical taxonomy with molecular approaches. Morphological characteristics, including body segmentation, setae, prolegs, coloration, and defensive structures, have traditionally provided the basis for identification and classification. However, substantial morphological similarities among unrelated taxa and considerable variation within species can complicate

accurate identification. Recent advances in DNA barcoding, particularly mitochondrial cytochrome c oxidase subunit I (COI) analysis, together with nuclear markers and genome-scale sequencing, have substantially improved species delimitation and reconstruction of evolutionary relationships. Caterpillar–host plant interactions also provide important ecological and evolutionary information, influencing diversification, specialization, and geographic distribution. Molecular phylogenetic studies have revealed both conserved and rapidly evolving lineages, contributing to a better understanding of Lepidopteran evolution and diversification. Integrating morphological, molecular, ecological, and genomic evidence provides a robust framework for documenting caterpillar biodiversity, resolving taxonomic uncertainties, identifying cryptic species, and understanding evolutionary patterns. Continued integrative research is essential for biodiversity assessment, conservation planning, and monitoring ecosystem health.

ENT-34**DISTRIBUTION OF CELLULASE ACTIVITIES THROUGHOUT
THE GUT OF DUNG BEETLES****Maryam Bibi and Muhammad Afzal****Department of Zoology, University of Sialkot, Daska Road, Sialkot**Corresponding Author: muhammad.afzal@uskt.edu.pk

Rising costs and environmental impacts of fossil fuels have renewed interest in insect-derived cellulases as a route to sustainable biofuel production. Dung beetles (*Euoniticellus intermedius*), which naturally degrade fibrous plant material, offer a promising model system for identifying efficient cellulose-degrading enzymes. This study characterized protein content, total cellulase activity, and endoglucanase activity across the foregut, midgut, and hindgut of beetles collected from Sialkot District, Pakistan, using colorimetric protein assays (Biuret) and DNS-based enzymatic assays. Protein concentration declined sharply along the gut axis, from 270.8 ± 50.94 mg in the foregut to 59.0 ± 24.02 mg in the midgut and 45.7 ± 15.58 mg in the hindgut ($p < 0.001$). In contrast, total cellulase activity was lowest in the foregut (0.357 ± 0.226 U) and rose significantly in the midgut (2.144 ± 0.558 U) and hindgut (2.161 ± 0.911 U; $p = 0.02$). Endoglucanase activity peaked in the midgut (9.219 ± 0.622 U), remained high in the foregut (8.634 ± 0.587 U), and dropped in the hindgut (4.976 ± 1.021 U; $p < 0.001$). A moderate positive correlation was observed between protein concentration and endoglucanase specific activity ($r = 0.433$, $p < 0.05$). These results indicate clear functional specialization along the beetle gut, with the midgut serving as the principal site of enzymatic cellulose breakdown and the hindgut likely supplementing digestion through microbial fermentation. Beyond clarifying dung beetle digestive physiology and their ecological role in nutrient cycling, these findings point to the midgut as a promising source for isolating novel cellulolytic enzymes with potential application in sustainable biofuel and organic-waste processing.

ENT-35**MORPHOLOGICAL CHARACTERISTICS OF LADYBIRD BEETLES (COLEOPTERA: COCCINELLIDAE) IN TEHSIL RAZZAR DISTRICT SWABI****Komal Khalid and Munawar Saleem Ahmad***Department of Zoology, University of Swabi, Swabi*Corresponding Author: saleemsbs@gmail.com

Being natural predators of aphids and other crop pests, ladybird beetles (Coleoptera: Coccinellidae) are significantly beneficial insects that are essential to biological pest control and ecological balance. The current study looked at the species diversity and morphological traits of ladybird beetles in specific areas of Tehsil Razzar, District Swabi. Field surveys were used to gather sixty adults from various regions for the investigation. Standard taxonomic keys were used to preserve the specimens and identify them down to the species level. Three species were discovered in the subfamily Coccinellinae: *Harmonia dimidiata*, *Cheilomenes sexmaculata*, and *Coccinella septempunctata*. The most prevalent species in the region was *Coccinella septempunctata*. *Coccinella septempunctata* and *Cheilomenes sexmaculata* species showed notable differences in elytral color patterns and spot arrangements, suggesting the existence of polymorphism. This study offers baseline data on Tehsil Razzar's coccinellidae fauna. The results emphasize the necessity of conducting routine surveys, accurately identifying polymorphic forms, and conducting additional research on the function of these beetles in the area's integrated pest control.

ENT-36**MORPHOMETRIC CHARACTERIZATION OF CORBICULA IN HONEYBEE IN DISTRICT SWABI****Nayab Raza and Munawar Saleem Ahmad***Department of Zoology, University of Swabi, Swabi*Corresponding Author: saleemsbs@gmail.com

Honeybees are important pollinators and their morphological characteristics play a significant role in taxonomic and functional studies. The present study was conducted to investigate the morphometric characteristics of the corbicula (pollen basket) in *Apis mellifera* worker bees. A total of 10 specimens were collected and analyzed using stereo microscopic techniques to measure variations in corbicula length and width. The results indicated that the mean corbicula length was 3.12 mm, while the mean width was 1.20 mm. Both parameters exhibited low standard deviation values (0.09 mm for length and 0.07 mm for width), indicating minimal morphological variation among the examined individuals. Furthermore, the findings revealed that the corbicula length was consistently greater than its width, reflecting its elongated structural morphology. A slight positive correlation between length and width was also observed, suggesting coordinated development of these morphometric traits. The overall low variability in measurements indicates a high degree of morphological stability within the studied population, which may be attributed to genetic uniformity and relatively consistent environmental conditions. The findings of the

study provide useful baseline information for future research related to honeybee morphology, identification, and biodiversity. In conclusion, the results suggest that corbicula morphometric measurements can serve as reliable structural indicators in honeybee studies and may contribute to further taxonomic and functional research on *Apis mellifera*.

ENT-37

CLIMATE CHANGE-DRIVEN FLOOD DISASTER OF 2025 IN DISTRICT BUNER, PAKISTAN: IMPACTS ON HUMANS, WILDLIFE, AGRICULTURE, INFRASTRUCTURE, AND LOCAL LIVELIHOODS

Imad Ali Khan and Kausar Saeed

Department of Zoology, University of Buner, Khyber Pakhtunkhwa Pakistan

*Corresponding Author: Kausarsaeed@yahoo.com, Kausarsaeed@ubuner.edu.pk

The current study was conducted on the recent floods disaster in August 2025 of district Buner Pakistan related to climate change, cloud burst and its impacts on human, wildlife, livestock, agriculture and local business. The data was collected from different sources, like questionnaires, wildlife departments, Agriculture department and livestock departments. During the survey we have reported different effects of climate changes on livestock, Wildlife, Agriculture and local business. The most effected tehsils were Gadezi (Bishuny, Malakpur, Qadar Nagar, Pirbaba, Bhaty Kaly, Bhai Kaly, Sultanwas, Ghaze khany), Tehsil Daggar (Kot Gokand, Bar Gokand, Kuz Gokand, Bagra, Topdara, Hisar Daggar), and Tehsil Gagra (Daggar hospital, Sunigram, Takhtaband, Kalpani, Bajkata, Kulyary, Matwani). We have reported 252 deaths, 290 injured, 55890 acre agriculture land effected, 4405 Livestock perished, 180 house damaged, 980 shops/ markets damaged, 15 mosques damaged, and 250 vehicles damaged.

Fee not Paid

ENT-38

FIELD INCIDENCE AND NEW DISTRIBUTIONAL RECORD OF GUJHIA WEEVIL, TANYMECUS INDICUS FAUST, ON WHEAT IN PUNJAB, PAKISTAN

Abdul Ghaffar*, Arshed Makhdoom Sabir, Qurban Ali, Dilbar Hussain, Humair Malik, Tamsela Nazir, Umer Qasim, Faisal Hafeez*

Entomological Research Institute, *Wheat Research Institute,
Ayub Agricultural Research Institute, Faisalabad, Punjab, Pakistan
Email: ghaffar323@gmail.com*, amsabir@yahoo.co.uk;

Wheat, *Triticum aestivum* L., is one of the major cereal crops and a cornerstone of food security in Pakistan. In recent years, insect pests affecting the early growth stages of wheat have received

considerable attention due to their potential to impair seedling establishment, reduce crop-stand, and ultimately compromise yield potential. During field surveys conducted in wheat-growing areas of Toba Tek Singh District, Punjab, Pakistan, infestations of the Gujhia weevil, *Tanymecus indicus* Faust (Coleoptera: Curculionidae), were observed on young wheat plants. Field assessment combined with quadrant-based sampling were conducted to characterize the pest occurrence, distribution, feeding symptoms, and damage to seedlings. Infested fields exhibited distinct feeding symptoms, including irregular leaf notching, collar-region feeding, severing of young seedlings, and reduced plant density. Adult weevils were frequently observed feeding on emerging wheat plants during the early crop development period. This study provides an important record of *T. indicus* infestation associated with wheat in Toba Tek Singh, expanding knowledge of its host association and distribution in central Punjab, Pakistan. The findings highlight the need for regular field surveillance and further studies on biology, seasonal population dynamics, damage potential and economic importance of *T. indicus* in wheat-growing production system. Development of appropriate integrated pest management strategies will be essential for mitigating the seedling damage and ensuring sustainable crop establishment.

SECTION – I V

PARASITOLOGY

PAR-1

PREVALENCE OF INTESTINAL PARASITES IN SCHOOL CHILDREN OF DISTRICT SHANGLA, PAKISTAN

Wali Khan^{1*}, Wajid Ullah², Muhammad Fiaz Khan²

¹Department of Zoology, University of Malakand, Pakistan

²Department of Zoology, Hazara University Mansehra, Pakistan

*Corresponding Author: walikhan.pk@gmail.com

Intestinal parasites are extensively found in developing countries of the world. Current study was conducted to determine the prevalence of intestinal parasitic infection in school children of district Shangla. Stool specimens were collected in plastic containers, preserved in 10% formalin and transported to laboratory of Parasitology, Department of Zoology, University of Malakand. Samples were examined using Direct Smear Method and Formol Ether Concentration method. A total of 310 fecal specimens were collected. Overall prevalence was 72.90% (n=226/310) including boy's 44.8% (n=139/310) and girl's 28% (n=87/310) of primary school children (P<0.05). Mono parasitism was investigated 51.9% (n=161) as compared to poly parasitism 21% (n=65). *Ascaris lumbricoides* was the most prevalent parasite (34.5%) followed by *Trichuris trichiura* (14.1%), hookworms (6.45%), *Enterobius vermicularis* (5.80%), *Hymenolepis nana* (5.48%), *Entamoeba histolytica* (4.51%) and *Taenia saginata* (1.93%) in order of prevalence. Intestinal parasitic infection in relation to sex of school children was found significantly associated (P>0.05). The current study concluded that school children in district Shangla has a high rate of intestinal parasites due to poor sanitation, use of raw vegetables, and unusual dispose of human feces, unsafe drinking water and poor personal hygiene.

PAR-2

ECTOPARASITIC INFESTATION IN CATTLE OF KARACHI AND ITS SOCIOECONOMIC IMPACT

Samreen Mirza* and Areeba Nadeem

Department of Zoology, University of Karachi, Karachi

*Corresponding Author: smirza@uok.edu.pk

The present study was conducted in Karachi, Pakistan to determine the prevalence of ectoparasitic fauna of cattle. Different farms in four regions of Karachi were randomly inspected from July 2025 to October 2025. A total of 248 cattle were examined, and 164 samples were collected. The microscopic identification of collected ectoparasitic samples shown ticks as the most prevalent ectoparasites with the greatest rate of infestation; around 98.78%. In addition, five different species of ticks were observed, out

of which four appeared hard ticks, identified as *Boophilus* sp. 143.90%), *Amblyomma* sp. (23.17%), *Hyalomma* sp. 18.90%), *Haemaphysalis* sp. (12.20%), and one was a soft tick belonging to genus *Otobius* sp. (0.61%). Along with ticks, one lice species was also found, named *Hematopinus tuberculatus* (1.32%). Furthermore, the chi-square test has been used to determine the association between the species prevalence and collection site ($\chi^2 = 19.2$, and p-value 0.205) which wasn't significant. Further statistical tests were made to find the association between average prevalence rate of infestation and collection site. The results shown significant association ($\chi^2 = 8.1$, and p-value 0.032) and indicated that the collection site can affect the prevalence ratio. Finally, the analysis was made about the prevalence rate with respect to the age of cattle. Results showed that older age cattle had more tick infestation as compared to young age cattle with the prevalence rate of 39.23% and 23.13%, respectively. The statistical analysis indicates significant association ($\chi^2 = 5.06$, and p-value = 0.025) between the age of cattle and prevalence rate of infestation. In this study, higher prevalence rate of ectoparasites was found in cattle from most of the selected regions of Karachi. Cattle farms located at Orangi town site had the highest ratio of ectoparasitic infestation i.e., 56.16% followed by 38.17% from the collection site of Malir town, then 36.02% infestation rate was observed from cattle farms of Surjani town, while cattle farms of Landhi town site had the least prevalence rate i.e., 28.82%, among all the collection sites. It was concluded from the current study that ectoparasitic infestation is not only a major constraint to cattle health, but it also produced severe socio-economic impact for humans. We found several health issues in cattle regarding tick infestation such as, irritation, lesion in ear, lethargic condition, wounds at the tick's attachment site which affected their performance, milk & meat production and created monetary loss for the farmers and also the cattle farm's owner complained of investing extra amount for vaccination and anti-ectoparasitic treatment procedures. In this way, the higher ectoparasitic prevalence rate is negatively impacting on humans.

Start Fee not paid

PAR-3

HELMINTH PARASITIC STUDIES ON DOMESTIC FOWLS *GALLUS GALLUS DOMESTICUS* (AVES: GALLIFORMES: PHASIANIDAE) FROM HYDERABAD DISTRICT, SINDH, PAKISTAN

Muhammad Ali Raza Thaheem, Farheen Shaikh*, Wakeela Gul Mughal, Shafaque Khuwaja and Sandeep Kumar Pahooja

Department of Zoology, University of Sindh, Jamshoro, Sindh

*Corresponding Author: farheen.shaikh@usindh.edu.pk, farheenshaikh1578@gmail.com

Breeding and rearing of hosts in natural environment causes susceptibility of parasites. Helminth parasites are most prevalent in the small and large intestine of hosts. Infection of helminth parasitic diseases in Domestic fowls causes heavy economic losses to the poultry industry to the several thousand crores of rupees annually. It causes significant productivity loss of poultry products, egg and meat production and dairy products. The distribution of helminth parasites is worldwide. Under developing countries are more infected due to lackness of processing and packaging industries. The research work was carried out from November 2024 to October 2025. Four localities two urban and two rural of Hyderabad, Sindh, Pakistan were selected, Latifabad, Hyderabad City, Kotri and Tando Jam for the collection of the helminth parasites. Infected small and large intestines of Domestic fowls *Gallus gallus domesticus* were examined and investigated randomly and washed in saline water. After washing helminth parasites were flattened between two glass slides for 48hours and fixed 70% ethanol. Infected parts of the intestines of *Gallus gallus domesticus* were preserved in 10% Formalin. Presently out of 28 Domestic fowls, 19 host birds were found infected with helminth parasites (Cestoda and Nematoda). Collected specimens of helminth parasites were preserved in 70% ethanol. Currently 168 helminth parasites were collected which are sorted into four species, three of them were cestodes and one species was nematode parasite. The prevalence of helminth parasites was recorded 67.85 %. The species presently were reported as *Cotugnia dignophora*, *Raillietina cesticellus*, *Coanotaenia infundibulum* and *Ascaridia galli* as new host and new locality record from the study area. The present study was designnated for identification of incidence and morphology of economically important helminth parasites from Domestic fowls.

PAR-4

HISTOPATHOLOGICAL CHANGES IN THE INTESTINE OF DOMESTIC PIGEONS *COLUMBA LIVIA DOMESTICA* GMELIN, 1789 INFECTED BY CESTODE *RAILLIETINA TETRAGONA* (MOLIN, 1858) FROM KASHMORE, SINDH, PAKISTAN

Farheen Shaikh*, Sandeep Kumar Pahooja, Wakeela Gul Mughal and Shafaque Khuwaja

Department of Zoology, University of Sindh, Jamshoro-76080, Sindh, Pakistan

*Corresponding Author: farheenshaikh1578@gmail.com, farheen.shaikh@usindh.edu.pk

The aim of the study was to investigate the pathological intestinal lesions in Domestic pigeons *Columba livia domestica* Gmelin, 1789, which were naturally infected by a number of cestode parasites *Raillietina tetragona* (Molin, 1858). The data was collected from four localities Kandhkot, Kashmore, Ghouspur and Buxapur of Kashmore, Sindh, Pakistan during August 2023 to May 2025. Total of 45

specimens were recovered. The prevalence was recorded 66 %. The parasite belongs to (Platyhelminthes: Cestoda: Cyclophyllidae) family Davaineidae. The species was highly pathogenic and were found in different regions of intestines of the hosts. Histopathological slides of intestinal lesions were prepared and observed of total 12 Domestic pigeons *Columba livia domestica* Gmelin, 1789. Major histopathological findings included inflammatory cell infiltration, necrosis, mineralization, pigment deposition, and parasitic infection distortions and dilation of intestinal glands, destruction of the superficial intestinal lining, infiltration of inflammatory cells, macrophages, mononuclear cells, lymphocytes and eosinophils in the lamina propria, destruction and disorganization of muscular layer, destruction of the crypt cells, villus atrophy, damage in the duodenal region with an increase in cellular reproduction of crypt and Brunner's glands. There was severe congestion in the blood vessels. In the intestine of infected Domestic pigeons, the villi, muscularis mucosa, and intestinal glands show necrosis accompanied by mononuclear and polymorphonuclear cells in the necrotized areas. The cestode parasites *Raillietina tetragona* (Molin, 1858) with their histopathological changes were reported for the first time from the study area Kashmore, Sindh, Pakistan.

PAR-5

INTESTINAL HISTOPATHOLOGY OF DOMESTIC PIGEONS COLUMBA LIVIA DOMESTICA GMELIN, 1789 INFECTED WITH NEMATODE ASCARIDIA COLUMBAE (GMELIN, 1790) FROM KASHMORE, SINDH, PAKISTAN

Sandeep Kumar Pahooja, Farheen Shaikh*, Wakeela Gul Mughal and Shafaque Khuwaja

Department of Zoology, University of Sindh, Jamshoro, Sindh

*Corresponding Author: farheenshaikh1578@gmail.com, farheen.shaikh@usindh.edu.pk

The purpose of the study was to examine and identify the pathological intestinal injuries and lesions in Domestic pigeons *Columba livia domestica* Gmelin, 1789, which were naturally infected by a number of nematode parasites *Ascaridia columbae* (Gmelin, 1790). The data sample was collected from four different localities Kandhkot, Ghouspur, Kashmore, and Buxapur of Kashmore, Sindh, Pakistan during August 2023 to May 2025. A total of 08 specimens were recovered. The prevalence was recorded 75%. The parasite belongs to (Nemathelminthes: Nematoda: Ascaridida) family Ascaridiidae. The species was highly pathogenic and were found in different regions of intestines of the hosts. Histopathological slides of intestine were prepared and observed of total 12 Domestic pigeons. Major histopathological findings included necrosis, inflammatory cell infiltration, distortions and dilation of intestinal glands, destruction of the crypt cells, mineralization, pigment deposition, destruction of the superficial intestinal lining, infiltration of plasma cells, lymphocytes, macrophages, mononuclear cells, and eosinophils, destruction and disorganization of muscular layer, atrophy of villi, increase cellular replica of Brunner's and crypt glands and their secretions stopped, the blood vessels were damaged. Occurrence of necrosis in the infected parts of intestine of infected Domestic pigeons like mucosa, villi and intestinal glands and show polymorpho nuclear and mononuclear cells in necrotized zone. The research aim was to identify a greater number of the intestinal species of parasites in hosts with the comparison of their pathology for poultry breeders for maintaining the economy. Nematode parasites *Ascaridia columbae* (Gmelin, 1790) with their histopathological changes were identified and investigated first time from study area Kashmore, Sindh, Pakistan. This kind of study also help in diagnosing the other various types of diseases in Domestic pigeons.

PAR-6**OVERALL DISTRIBUTION OF PARASITIC INFECTION IN GOAT UNDER
CONTINUOUS GRAZING SYSTEM IN DISTRICT GUJRAT****Shamaila Irum, Sana Tanveer, Sundas Jabeen and Kiran Aftab***Department of Zoology, University of Gujrat, Gujrat*

Corresponding Author: shamaila.irus@uog.edu.pk

Gastrointestinal parasitic infections are a main constraint to the health of the goat and productivity, mainly under grazing-based production systems. This study was conducted to determine the prevalence, species composition and intensity of gastrointestinal parasites in goats kept in the constant grazing systems in District Gujrat, Punjab, Pakistan. Sixty goats of different ages and sexes were randomly selected. The fecal samples were collected and examined using standard parasitological. Predominant parasites were gastrointestinal nematodes, which consisted of *Haemonchus spp.*, *Strongylus spp.*, *Ostertagia spp.*, and *Capillaria spp.*, as well as protozoan *Coccidia spp.* Parasitological analysis revealed that *Strongylus spp.* were the most common parasites with 58% of the sampled goats being infected by the parasite, then *Coccidia spp.* (57%) and *Haemonchus spp.* (50%). Other parasites like *Capillaria spp.* (38%), *Ostertagia spp.* (23%) were moderately prevalent, with *Moniezia spp.* (7%) and *Oesophagostomum spp.* (2%) having low prevalence. The quantitative fecal analysis showed that the total mean egg count was 2107.84 ± 1912.11 eggs per gram, with highest mean egg counts of 2874.65 ± 2579.31 for *Coccidia spp.* Statistically significant gender-wise differences in egg counts were detected for the *Capillaria spp.*, *Ostertagia spp.* and *Strongyloides spp.* Mixed parasitic infections were frequently observed, and this meant that goats were always in touch with contaminated pastures. Female goats were observed to be more affected and had more fecal eggs than male goats suggesting that they were more vulnerable. These observations show that continuous grazing systems favor parasite transmission and reinfection. Conclusively, it is important to note that gastrointestinal parasitism is very common in goats in District Gujrat and it is a major problem to goat production. The combination of parasite management plans, such as strategic deworming, enhanced pasture control, nutritional supplements, and education of goat farmers is necessary to decrease the parasite burden and enhance goat health and production.

SECTION - V
FISHERIES, ECOLOGY, WILDLIFE, FRESHWATER BIOLOGY,
MARINE BIOLOGY

1. FRESHWATER BIOLOGY AND FISHERIES

2. MARINE BIOLOGY

3. PALEONTOLOGY

4. WILDLIFE, DIVERSITY AND CONSERVATION

5. ECOLOGY

1. FRESHWATER BIOLOGY AND FISHERIES

FEWFM-1

Paleontology

DENTAL MORPHOMETRIC STUDIES OF *CORMOHIPPARION* SP. FROM THE MIDDLE SIWALIK, PAKISTAN

Kiran Aftab^{*1}, Muhammad Akbar Khan², Adeel Hassan¹ and Noor Muhammad¹

¹Department of Zoology, University of Gujrat, Gujrat, Pakistan

²Institute of Zoology, University of the Punjab, Lahore, Pakistan

Corresponding Author: dr.kiran@uog.edu.pk

New fossil remains of *Cormohipparion* sp. have been recovered from the Dhok Pathan Formation within the Middle Siwalik deposits of Pakistan, contributing to understanding of equid diversity in the Late Miocene of the Siwalik region. The material consists of isolated upper and lower cheek teeth, along with a mandibular fragment preserving m1–m3. The dentition of *Cormohipparion* sp. is generally medium-sized and ranges from mesodont to hypsodont, indicating adaptations to dietary and environmental changes. The upper cheek teeth possess isolated protocones that vary from ovate to elongate-oval in shape. Fossette borders are moderately to highly complex, reflecting advanced enamel folding patterns. A prominent pli caballin is present, typically represented by a single pli in the molars. The lower cheek teeth commonly display well-developed protostylids. These morphological characteristics support the assignment of the material to *Cormohipparion* sp. and provide additional evidence for the presence and distribution of hipparionine horses in the Siwalik region during the Late Miocene. The paleoenvironment of the Dhok Pathan Formation was arid, leading to the development of grassy woodlands. The discovery enhances our understanding of equid evolution, taxonomy, and paleoecological adaptations within the Middle Siwalik deposits of Pakistan.

FEWFM-2

Wildlife

THE SEASONAL VARIATION, DISTRIBUTION AND STATUS OF AVIAN FAUNA WITH REFERENCE TO PHYSIOCHEMICAL PARAMETERS OF WATER AT HADERO LAKE, THATTA.

Karim Gabol, Syed Wajahat Hussain, Rahmat Ullah Khan and Gada Hussain Suhag

Department of Zoology, University of Karachi, Karachi-75270, Pakistan

*Corresponding Author: kgabol@uok.edu.pk

A thorough investigation of the bioecology, variety, and distribution of birds and the physio-chemical parameters of water of Hadero Lake carried out from June 2023 to August 2024. Since the

lake has not been studied in the last two decades as an important Wetland Site (IUCN Category IV) for Migratory Birds and has remained in tranquility for government departments for any conservation measures, this study was crucial and essential in the study region to highlight the biodiversity it supports till date. Although birds are essential to Earth's ecosystems playing beneficial roles for our environment, they face threats from illegal hunting, habitat degradation, trapping, by-catchment, unfavourable ecological resources, and the hydrological features of water bodies which directly and indirectly impact aquatic birds' physiology & biomechanism. Hadaro's varied topography and seasons provide a remarkable chance to research bird species and the habitat, including the variance in the Lake's water quality on a seasonal base, with a view to identify current problems & threats and providing guidance for conservation actions that are crucial to mitigating those threats. During this one-year study, total 120 bird species are recorded belonging to 14 Orders and 39 Families. Most of the birds recorded are of Order Passeriformes (28.33%) comprising of 17 families. The 66 birds are winter visitors & 11 are Passage Migrants, which shows its importance as a wintering site for different Northern and Siberian Birds. Line Transect and Point Transect methods were used to count Birds. Total 10 mammalian species and one *Melanoides tuberculata* (Gastropod) were also documented. Total 06 Plants species were also identified and documented. 03 endangered species of bird were also recorded as Steppe Eagle, Lesser Sand Plover and Black Bellied Tern. The Shannon's Diversity Index 4.2717 and Simpson's Diversity Index 0.97 indicates diverse species abundance and richness. Physio-chemical parameters were measured on monthly basis, the lake early was categorized as Fresh Water Lake in IUCN Directory of Asian Wetland, but the current parameters value reveals that after years of habitat alteration & climate change, it has become Brackish Water Lake with slightly alkaline property. The current parameters still can support vast variety of avian fauna.

FEWFM-3

Fisheries

Nutrition

EVALUATION OF FERMENTED SILKWORM PUPAE MEAL AS A VIABLE PROTEIN SOURCE FOR NILE TILAPIA (*OREOCHROMIS NILOTICUS*)

Muhammad Mudassar Shahzad^{*1}, Samahar Lodhi¹, Fatima Sughra¹,
Syed Makhdoom Hussain², Rana Manzoor Ahmad³, Dilawar Hussain⁴, Fatima Yasin¹,
Sana Amin¹, Maham Iqbal¹ and Samahar Lodhi¹

¹Department of Zoology, Division of Science and Technology, University of Education,
Township, Lahore, Pakistan

²Department of Zoology, Government College University, Faisalabad, Pakistan

³Department of Zoology, Government College University, Lahore, Pakistan

⁴Department of Zoology, University of Central Punjab, Lahore, Pakistan

*Corresponding Author: drmudassarshahzad@gmail.com

Fishmeal is expensive and insufficient due to overfishing and increasing demand. Thus, finding alternative protein sources that are healthy, economically affordable, and environmentally sustainable becomes very crucial. This research focused on the potential of fermented silkworm pupae meal (FSWPM) as a fishmeal replacement in diets of fingerling Nile tilapia (*Oreochromis niloticus*). A total of six diets with replacement of 0%, 20%, 40%, 60%, 80% and 100% fishmeal with FSWPM were formulated and fed

to Nile tilapia for seventy days. Results showed that the highest growth performance, protein efficiency ratio (PER), feed conversion ratio (FCR), and uptake of calcium, sodium, potassium, phosphorous, and magnesium were recorded when fishmeal was replaced by 80% (WG: 22.42 g, SGR: 1.57% day⁻¹, FCR: 1.20, Ca: 74.71%, Na: 77.64%, K: 78.78%, P: 70.57%, Mg: 61.55%). Iron and copper absorption declined as the percentage of FSWPM increased, indicating mineral antagonisms. Haemoglobin, erythrocyte counts, and packed cell volumes were significantly increased at 80% FSWPM inclusion (Hb: 8.20 g/100 ml; RBC: $3.26 \times 10^6 \text{ mm}^{-3}$; Hct: 31.58%). Feed costs were reduced, and higher economic gains were achieved at 80% FSWPM. Conclusively, FSWPM proved to be an effective alternative protein source, with 80% inclusion producing optimal results concerning growth, nutrient absorption, mineral balance, carcass composition, and economic advantages.

FEWFM-4 Wildlife

OCCUPANCY AND ABUNDANCE OF ENDANGERED INDIAN PANGOLIN (*MANIS CRASSICAUDATA*) AT NEWLY ESTABLISHED KHERI MURAT NATIONAL PARK, PAKISTAN

Tariq Mahmood*¹, Zara Batool¹, Tahir Mehmood², Muhammad Sajid Nadeem¹, Muhammad Mushtaq¹, Syed Arif Hussain¹, Faraz Akrim³, Siddiqa Qasim¹, Shehnaila Kanwal¹, Bushra Fatima¹, and Saira Akber¹

¹Department of Zoology, Wildlife and Fisheries, PMAs Arid Agriculture University Rawalpindi

²School of Natural Sciences, National University of Science and Technology (NUST), Islamabad

³Department of Zoology, University of Kotli, Kotli, Azad Jammu & Kashmir

*Corresponding Author: tariqjanjua75@uaar.edu.pk

The Kheri Murat National Park was declared as protected area by the Government of Punjab in the year 2020. However, its mammalian fauna and especially the occurrence of Indian pangolin in the park remains questionable. Therefore, the current study aimed at investigating the occurrence of Indian pangolin in this park and to run species occupancy modeling and estimate its abundance. The study used sign survey methods and camera trapping for data collection in the field. Field visits to different sampling sites of the park were made on monthly basis to record the field signs of Indian pangolin mainly including its burrows and scats, in addition to field sighting the species. In addition, the photographic evidence about occurrence of Indian pangolin was also collected through camera trapping. The field signs as well as camera trapping of Indian pangolin confirmed its presence in the Kheri Murat National park. A scatter plot comparing elevation and distance to road revealed that Active and fresh burrows tend to occur at intermediate elevations and moderate distances from roads, in the park. The estimated abundance of burrows in the park was 16 individuals. A high average detection probability (close to 1) indicates excellent detectability of burrows within the surveyed radius, likely due to distinct and observable features of pangolin burrows. The model suggests that distance to road may have a positive association with burrow abundance (Estimate = 0.0268, $p = 0.105$), though the effect is not statistically significant at the 0.05 level. The current study confirms the presence of Indian pangolin in the Kheri Murat National Park. However, since the species has been categorized as “Endangered” by IUCN and is under high pressure of poaching and illegal killing in the country, therefore, strict Law enforcement is required to protect Indian pangolin in the Kheri Murat National Park.

FEWFM-5
Paleontology

HEMICYONID AND AMPHICYONID REMAINS FROM THE SIWALIK MIDDLE TO LATE MIOCENE DEPOSITS OF PAKISTAN

Khalid Mahmood^{1*}, Muhammad Akbar Khan², Sayyed Ghyour Abbas³, Muhammad Adeeb Babar⁴, Muhammad Asim⁵, Asra Ghaus² and Muhammad Akhtar⁶

¹*Department of Zoology, Faculty of Biological Sciences, Quaid-i-Azam University, Islamabad, Pakistan*

²*Dr. Abu Bakr Fossil Display & Research Centre, Institute of Zoology, Quaid-e-Azam Campus, University of the Punjab, Lahore, Pakistan*

³*Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing 100044, China*

⁴*Department of Zoology, University of Okara, Okara, Punjab, Pakistan*

⁵*Department of Zoology, University of Narowal, Narowal, Punjab, Pakistan*

⁶*Department of Zoology, Minhaj University, Lahore, Punjab, Pakistan*

*Corresponding Author: mkhalid@qau.edu.pk

The family Ursidae and Amphicyonidae are common from Early to Middle Miocene of Eurasia, Africa and North America but it is rare in the Siwalik Group. Recently, after a long gap, we reported hemicyonid and amphicyonid from the various localities of Kallar Kahar, Kanhatti, Sethi Nagri and Dhok Pathan of the Siwalik Group, Punjab, Pakistan. In this paper, we are describing m2 and m3 of *Hemicyon* sp. from the Kallar Kahar belongs to Kamli Formation (middle Miocene) and Dhok Pathan Formation of late Miocene. *Amphicyon palaeindicus* is previously known from the Chinji and Nagri formations but the referred material also includes the specimens from the Dhok Pathan Formation, hence, we are extending the stratigraphic range of this species up to the Dhok Pathan Formation. Also, we are describing the first amphicyonid upper canine from the Siwalik Group.

FEWFM-6
Paleontology

BOVID FAUNA FROM THE PINJOR FORMATION (PLEISTOCENE), MAKWAL, PAKISTAN

Sobia Mumtaz^{*1}, Hassan Mustafa¹, Khalid Mahmood² and Muhammad Akbar Khan¹

¹*Dr. Abu Bakr Fossil Display & Research Centre, Institute of Zoology, University of the Punjab, Lahore*

²*Department of Zoology, Quaid-i-Azam University, Islamabad*

*Corresponding Author: sobiamumtaz504@gmail.com

New fossils containing horn cores were recovered from the Pinjor Formation of the upper Siwaliks, northern Pakistan. The Pinjor Formation of the Upper Siwalik Subgroup in northern Punjab, Pakistan, represents one of the most significant Early to Middle Pleistocene (approximately 2.5–0.6 Ma) vertebrate fossil sequences in South Asia. The fossils comprise broken pieces of horn cores collected from the Pinjor Formation of the Upper Siwalik, Makwal, Punjab, Pakistan. A detailed description of the newly discovered fossils and their taxonomic classification is being provided. The specimens pretty match with

Damalops palaeindicus, average sized taxon of Alcelaphinae, found in the Siwalik Pleistocene. The Pinjor sample adds new information on the morphological variability of *Damalops* and confirms an early distribution of the genus in the Siwalik Pleistocene.

FEWFM-7

Wildlife

FROM HUNTING TO HERITAGE: A REPLICABLE PARADIGM FOR REVIVING DWINDLING MARKHOR (*CAPRA FALCONERI*) AND HIMALAYAN IBEX (*CAPRA SIBIRICA*) POPULATIONS AND TRANSITIONING TO SUSTAINABLE ECOTOURISM IN KHYBER PAKHTUNKHWA, PAKISTAN

Safdar Ali Shah^{1*}, Farooq Nabi^{2} and Umair Safdar^{3***}**

¹Chief Conservator Wildlife (Retired), KP / Additional Director General (Education, Retired), Pakistan Forest Institute, Peshawar, Khyber Pakhtunkhwa

²Deputy Conservator Wildlife / DFO WL KP, Khyber Pakhtunkhwa.

³Centre of Plant Biodiversity, University of Peshawar, Peshawar, Khyber Pakhtunkhwa

Corresponding Author: safdaralishah04@gmail.com, farooqnabi3@gmail.com**, umairsafdar72@gmail.com***

Conventional top-down exclusionary conservation paradigms often trigger socio-ecological conflicts in developing nations by severing rural communities from resource governance. This paper details the historical evolution of wildlife management in Khyber Pakhtunkhwa (KP), Pakistan, by examining the distinct pre- and post-merger dynamics of the Chitral state. Prior to 1969, when Chitral was an independent princely state, the hunting of mountain megafauna was strictly controlled as an aristocratic prerogative of the royal family. Following the state's merger into Pakistan in 1969, a sudden legislative and enforcement vacuum emerged. This institutional gap triggered a destructive era of indiscriminate, free-for-all poaching by common citizens, who engaged in intense retaliatory hunting against past royal restrictions. This sudden transition stripped away the exclusive protective canopy of the royal family and exposed the flare-horned Markhor (*Capra falconeri*) and the Himalayan Ibex (*Capra sibirica*) to the unprecedented degradation, driving them to the absolute verge of local extinction. Early top-down legislative fixes, including the provincial wildlife laws of 1973, failed to plug this gap due to weak departmental administrative control and persistent local hostility. To bridge this management crisis, the Priority Areas for Conservation / Pre-Investment Phase (PRIF) of the biodiversity project was launched, funded by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP), and implemented by IUCN and the KP Wildlife Department. Under this milestone initiative, with the first author serving as the Provincial Coordinator for KP representing the wildlife department, an innovative, "trial-and-error" community-led model was engineered through formalized Village Conservation Committees (VCCs). Tested in the pilot zones of Tooshi-Shasha and Gehrait-Goleen Conservancies in Chitral, and later replicated in the Kaigha Valley of Kohistan, the model successfully aligned community survival with wildlife preservation. This strategic validation initially paved the way for securing an international allocation of 6 CITES trophy hunting permits for Markhor at the 10th meeting of the Conference of the Parties (CoP10) held in Harare, Zimbabwe (1997). To fund the preservation of the more common Himalayan Ibex, the department in consultation with respective VCCs strategically bundled low-market-value Ibex permits with premium Markhor permits. Upon validating undeniable species recovery, operational transparency,

and rural economic uplift, CITES subsequently enhanced the Markhor quota from 6 to 12 permits at CoP12 in Santiago (2002), internationally authenticating the framework's validity and confirming its approach for replication in other areas. Over 25 years (1998–99 to 2023–24), the program generated a cumulative US\$ 8.0 million (PKR 1,168 million) strictly within KP—accrued primarily from Markhor permits—with 80% channeled directly to VCCs. Crucially, this initiative achieved the successful recovery of faunal populations while concurrently paving the way for the extensive restoration of degraded forest and mountain ecosystems, driven by a deep sense of institutional ownership among the custodian communities. To ensure long-term sustainability amidst the challenges of a thin geographic distribution of hunting quotas, this study outlines a forward-looking transition toward non-invasive ecotourism (*sightseeing, birdwatching, and mountaineering*). By leveraging community-developed infrastructure built through their 80% revenue share, this model expands the frontiers of ecotourism into unknown alpine territories, diversifies local livelihoods, protects sympatric wildlife, and funds rural life essentials—providing a globally replicable blueprint for governing severe wildlife management crises.

FEWFM-8

Wildlife

STATUS AND CONSERVATION CHALLENGES OF THE SINDH IBEX (CAPRA AEGAGRUS BLYTHI) IN KIRTHAR NATIONAL PARK, PAKISTAN

Sumiyya Ahmadani

Department of Zoology, University of Sindh, Jamshoro, Pakistan

*Corresponding Author: sumaiyyaahmadani123@gmail.com

The Sindh ibex (*Capra aegagrus blythi*), a wild caprine of the Kirthar mountain range, is one of the most characteristic native ungulates of southern Pakistan and an important flagship species of Kirthar National Park (KNP). The present study assessed the occurrence and conservation status of the Sindh ibex in KNP, with particular emphasis on population persistence and major anthropogenic pressures. Field observations and wildlife monitoring records were compiled during surveys conducted in January 2025, in collaboration with the Zoological Survey of Pakistan and the KNP wildlife team. Direct field observations and available wildlife-monitoring information were used to document the species' occurrence, habitat association, and conservation concerns. The survey confirmed the continued presence of Sindh ibex as a prominent wild ungulate within the protected landscape. Historical evidence indicates substantial population recovery following legal protection and conservation interventions; however, hunting, habitat encroachment, overgrazing by domestic livestock, human disturbance, and potential disease and heat-related mortality remain important conservation concerns. The findings highlight the continued importance of KNP as a major refuge for the Sindh ibex and emphasize the need for systematic population monitoring, health surveillance, habitat protection, regulated grazing, control of illegal hunting, and community-based conservation. Strengthening these measures is essential to ensure the long-term persistence of *C. a. blythi* and the ecological integrity of the Kirthar mountain ecosystem.

FEWFM-9

Wildlife

**BREEDING ECOLOGY OF COMMON MYNA (*ACRIDOTHERES TRITIS*)
IN DISTRICT BAHAWALPUR**

**Bushra Qasim¹, Sangam Khalil², Tanveer Hussain³, Saira Batool⁴, Muhammad Zubair⁵,
Ikram Ullah⁶, Sana Ghaffar⁷, Aqsa Mubeen⁸ and Shiza Asif⁹**

Institute of Forest Sciences, Islamia University of Bahawalpur, 36100

*Corresponding Author: sangam.khalil@iub.edu.pk

This study was conducted to explore the breeding ecology of the Common Myna (*Acridotheres tristis*) in selected habitats of the Bahawalpur region (Pakistan). The goals were to determine nest-site selection, nesting characteristics, breeding chronology, clutch size, egg morphometry, incubation period, hatching success, fledging success, and parental care behavior in comparison to breeding success in various habitats. Six field observation sites were selected, which are Lal Suhanra National Park (LSNP), Patisar Lake, Black Buck Enclosure, Deer Enclosure, Nursery Green Belt and Nursery Site-2. The breeding parameters were determined by standard field methods, and nest locations were established and followed during the breeding season. Common Mynas preferred to nest in tree hollows and cavities, but used air vents, wall crevices, drainpipes and other manmade structures. Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Kikar (*Acacia nilotica*), and Phulai (*Acacia modesta*) were the most common trees found with nests. Clutch size averaged from about 3.9 to 4.3 eggs per clutch at the study sites and incubation periods ranged from 13 to 17 days depending on habitat. Hatching and fledging success varied by site, indicating habitat quality, food availability, and environmental conditions influenced the success of hatching and fledging. Predation, human disturbance, bad weather, and abandonment were the primary causes of nest failure. Successful development of chicks was facilitated through chick-activated parental behaviors such as nest defense, incubation, brooding, feeding and sanitation behaviors by adult birds. The overall results reflect the high adaptability of the Common Myna to the ecological context and suggest that the species is able to reproduce effectively in both natural and altered habitats. This research gives important baseline data on the breeding ecology of Common Myna in southern Punjab and helps to understand the reproductive biology, habitat utilization and adaptation of the bird in fast changing landscapes.

FEWFM-10

Wildlife

**BREEDING ECOLOGY OF INDIAN ROLLER (*CORACIAS BENGHALENSIS*)
IN DISTRICT BAHAWALPUR**

**Aqsa Mubeen¹, Sangam Khalil², Tanveer Hussain³, Saira Batool⁴, Shiza Asif⁵, Bushra Qasim⁶,
Sana Ghaffar⁷, Muhammad Zubair⁸, and Ikram Ullah⁹**

Institute of Forest Sciences, Islamia University of Bahawalpur, 36100

*Corresponding Author: sangam.khalil@iub.edu.pk

Indian roller is a farmer friendly bird due to its insect eating behavior specially against the various pest attack insects in agriculture farms thus playing an important role in agriculture economy and ecology.

In present study, three habitats of Indian roller were selected to find out the breeding activities in Bahawalpur district includes; Forest, Agriculture farms and River side. Results revealed that there is a great fluctuation in the breeding aspect of Indian roller in different ecological habitats. Different seasons are also responsible for the fluctuation in breeding behavior of Indian roller. Peak value of population density was recorded in agriculture lands (159). While highest population density was measured in pre-monsoon season where average numbers of birds were noted as 113. About 40 nests were found where highest numbers of nests were observed in agriculture lands. Both active and dead trees were reported with the nests. Four tree species were documented as the selection site of birds for their nest formation including; *Acacia nilotica*, *Eucalyptus camaldulensis*, *Dalbergia sissoo* and *Tamarix aphylla*. Highest numbers of nests were reported in *Acacia nilotica*. Across the different habitats, birds choose different trees heights where maximum value was recorded in forest where nests are formed on the trees where average tree height was recorded as 15 meters. Highest value of cavity size was measured in forest habitat. Breeding activities include incubation period, clutch size, fledging days and exposure were measured. Results explained that average clutch size is about 5, ranging from 4 to 6, across the habitats. Results also showed that fledging days range between 34-38 days. Incubation period is about 20 days while hatching starts after 15 days. Feather appeared after 20 days while fledging stars after 35 days. These findings are crucial for future perspectives with respect to conservational strategies, behavioral studies and more research initiatives.

FEWFM-11

Wildlife

DETERMINATION OF HABITAT ECOLOGY AND BREEDING BIOLOGY OF BLACK KITE (*MILVUS MIGRANS*) IN ARID ZONE OF SOUTH PUNJAB, PAKISTAN

Sana Ghaffar¹, Sangam Khalil², Tanveer Hussain³ Saira Batool⁴,
Muhammad Zubair⁵ and Ikram Ullah⁶

Institute of Forest Sciences, Islamia University of Bahawalpur, 36100

*Corresponding Author: sangam.khalil@iub.edu.pk

Black kite (*Milvus migrans*), medium sized Accipitridae, found throughout the world and Australasia knows, for its adaptability and resilience. This study determined the habitat ecology and breeding biology of the Black Kite across four districts of the arid zone of southern Punjab, Pakistan Bahawalpur, Multan, Muzaffargarh, and Rahim Yar Khan during 2022–2025. Across a variety of habitats, including urban, highly urban, peri-urban/roadside, agricultural, wetland/green, riverine, and protected/natural regions, sixteen nesting sites were observed. In addition to breeding factors like egg-laying phenology, clutch size, incubation length, hatching success, fledging success and reasons for nest failure, each site's nest height, dimensions, nesting tree species, and nesting material were noted. Nest heights varied from 15 to 60 feet, and they were often highest in crowded urban areas. 54 active nests in the four districts produced a total of 121 eggs, yielding an overall hatching success rate of almost 80% and a fledging success rate of roughly 75%. The breeding season, which varies slightly according on the climate in each district, runs from February to June. ANOVA, Kruskal–Wallis, repeated-measures ANOVA, Tukey's post-hoc test, Chi-square, correlation, and regression analyses were used to evaluate habitat variables, population density, temporal variation, and reproductive success. Hatching success ranged from 73.5–85.4%, while fledging success was much lower in Muzaffargarh and Rahim Yar Khan (52.6–62.5%) and significantly higher in Bahawalpur and Multan (78–84%). In order to improve breeding results for this ecologically significant raptor in Pakistan's arid urban settings, the study emphasizes the necessity of

focused conservation efforts, including insulating electrical infrastructure and regulating solid waste near nesting colonies. In summary, the Black Kite has significant ecological adaptability in arid and human-dominated environments. To reduce risks and improve reproductive success, effective conservation measures are required. By utilizing this study as baseline for further bird studies; we can also improve bird species management and conservation. Eventually, validation above idea will establish black kite as an umbrella species for urban ecology. Nesting height, proximity to food sources, and anthropogenic disturbance were found to have a substantial impact on breeding outcomes, according to statistical analysis.

FEWFM-12

Wildlife

HABITAT STUDY OF INDIAN SCOPS OWL (*OTUS BAKKAMOENA*) IN DISTRICT BAHAWALPUR

Shiza Asif¹, Sangam Khalil², Tanveer Hussain³, Saira Batool⁴, Bushra Qasim⁵, Sana Ghaffar⁶, Aqsa Mubeen⁷, Muhammad Zubair⁸ and Ikram Ullah⁹

Institute of Forest Sciences, Islamia University of Bahawalpur, 36100

*Corresponding Author: sangam.khalil@iub.edu.pk

Indian Scops Owl (*Otus bakkamoena*) is an important nocturnal bird species whose occurrence is closely associated with suitable habitat conditions. The present study aimed to assess the habitat ecology and nesting-site characteristics of the Indian Scops Owl in Bahawalpur, Pakistan, with emphasis on habitat features associated with natural and artificial nesting sites. A descriptive research approach was adopted, and the study was conducted for eight weeks (2 months), providing sufficient time for observation and recording of habitat characteristics. Data were collected through field observations, GPS-based site recording, and assessment of habitat variables including tree availability, vegetation density, water availability, disturbance level, and habitat suitability. The findings revealed that suitable nesting habitats were associated with greater tree availability, dense vegetation, water presence, and lower disturbance levels. Natural nesting sites showed comparatively favourable habitat conditions than artificial nesting sites. The study provides baseline information for understanding habitat requirements and conservation of Indian Scops Owl populations in the study area.

FEWFM-13

Marine Biology

MARINE SCIENCE AND THE PAKISTAN COASTLINE

Munawwer Rasheed

Marine Chemistry Lab, Centre of Excellence in Marine Biology, University of Karachi, Karachi.

*Corresponding Author: rasheed.munawwer@gmail.com, rasheed.munawwer1@gmail.com

About 1058 km long Pakistan Coastline along the Northern Arabian Sea stretches from Sir Creek, Thatta in East (Indian border) to Gabd, Jiwhani in west (Iranian Border), with an Exclusive Economic Zone

of 240,000 square km. Almost 270 km of this is the Sindh coast. On the head of the coin the coastline is rich in flora and fauna and other geological resources while on the tail side the health of our coastline is deteriorating day by day due to anthropogenic involvement and urbanization. The use of the Marine and Coastal resources as food and fodder and local remedies in ailments and in earnings is as old as the Sea but it is not documented and explored scientifically as it should be. The present talk will deliver the work conducted by this research group in last 17 years or so, which is encompassing some thirty-four (34) Research Publications in journals of international repute; Seven (7) M.Phils. and nine (9) Ph.Ds. research dissertations, covering the Marine Chemistry, including Phytochemistry, Zoochemistry, and Environmental Chemistry.

FEWFM-14

Marine Biology

CHARACTERIZATION AND COMPARATIVE ANALYSIS OF FATTY ACID COMPOSITION IN SELECTED CRAB SPECIES *PORTUNUS PELAGICUS* & *PORTUNUS SANGUINOLENTUS* AND ITS NUTRITIONAL SIGNIFICANCE

Shaher Bano^{*1}, Ali Raza¹, Munawwer Rasheed¹, Syed Shafqat Ali Shah² and Muhammad Mohtasheem ul Hassan³

¹Centre of Excellence in Marine Biology, University of Karachi, Karachi

²Liaquat University of Medical & Health Science, Jamshoro Sindh

³Department of Pharmacognosy, University of Karachi, Karachi

*Corresponding Author: shaharbanomarinebiologist@gmail.com

Crabs are an important source of nutrition and are widely consumed worldwide due to their high nutritional value. In the present study, the fatty acid composition of two commercially important crab species, *Portunus pelagicus* and *Portunus sanguinolentus*, was investigated. Gas chromatography–mass spectrometry (GC–MS) was used to analyze the crab n-hexane extracts prepared by Soxhlet method and characterize their fatty acid profiles. Several fatty acids were identified in the samples analyzed. In *P. sanguinolentus*, the monounsaturated fatty acids (MUFAs) palmitoleic acid (C16:1), trans-13-octadecenoic acid (C18:1), and oleic acid (C18:1) were detected. The saturated fatty acids (SFAs) included heptadecanoic acid (C17:0) and octadecanoic acid (C18:0), while the polyunsaturated fatty acid (PUFA) cis-5,8,11,14,17-eicosapentaenoic acid (EPA; C20:5 n-3) was also identified. In *P. pelagicus*, the identified SFAs were tetradecanoic acid (myristic acid; C14:0), n-hexadecanoic acid (palmitic acid; C16:0), and octadecanoic acid (stearic acid; C18:0), while palmitoleic acid (C16:1) and trans-13-octadecenoic acid (C18:1) were identified as MUFAs. No PUFA was detected in the *P. pelagicus* sample analyzed. In addition to fatty acids, several other lipid-related compounds, including desmosterol, cholesta-3,5-diene, campesterol, cholesterol, and cholesterol margarate, were detected. Overall, *P. sanguinolentus* exhibited a greater diversity of fatty acids than *P. pelagicus*, particularly due to the presence of EPA, an important omega-3 PUFA. The findings indicate that both crab species contain nutritionally relevant fatty acids and may contribute to the dietary intake of beneficial lipids. Further quantitative and biological studies are required to evaluate their potential nutritional and health-related significance.

FEWFM-15

Wildlife

**AVIAN ASSOCIATIONS WITH FLOWERING AND FRUIT-BEARING TREES IN
A MODIFIED CAMPUS LANDSCAPE****Saima Hashim*, Sibgha, Kinza Akram and Rehan Ul Haq****Department of Wildlife and Ecology, University of Veterinary and Animal Sciences (UVAS),
Ravi Campus, Pattoki, Punjab, Pakistan**Corresponding Author: saimahashim078@gmail.com*, rehan.haq@uvas.edu.pk**

Flowering and fruit-bearing trees provide food, shelter, perching, and nesting resources for birds in human-modified environments. This study documented avian assemblages associated with red silk-cotton (*Bombax ceiba*) and red mulberry (*Morus rubra*) at the University of Veterinary and Animal Sciences, Ravi Campus, Pattoki, Punjab, Pakistan. Field observations were conducted from 15 February to 15 May 2024, encompassing late winter, spring, and the flowering and fruiting periods of the studied trees. Birds using the trees were recorded during morning and evening surveys, together with their observed feeding, resting, roosting, and nesting activities. Tree height, trunk diameter, canopy cover, and flowering and fruiting condition were also recorded. Species diversity, dominance, and evenness were calculated using PAST software. A total of 1,559 bird observations were recorded on *B. ceiba*. House Crow (*Corvus splendens*) was the most frequently observed species, with 604 records, representing 38.7% of all observations on this tree species. A further 800 bird observations representing 16 species were recorded on *M. rubra*. Frequently observed species included House Crow, House Sparrow (*Passer domesticus*), Common Myna (*Acridotheres tristis*), Jungle Babbler (*Turdoides striata*), and Red-vented Bulbul (*Pycnonotus cafer*). Feeding observations coincided with flowering and fruiting, while observations of nesting and resting indicated that tree structure also provided habitat resources. These findings document the use of the two tree species by birds at the UVAS Ravi Campus during late winter and spring. Maintaining mature flowering and fruit-bearing trees may help retain food and structural resources for birds in campus landscapes.

FEWFM-16

Fisheries

EFFECTS OF NANO PRODUCTS ON PHYSIOLOGICAL REPRODUCTION OF FISH**Naheed Bano*, Sadia Maalik¹, Sajida Mushtaq¹ and Nazia Ehsan²***Department of Zoology, Wildlife & Fisheries, Muhammad Nawaz Shareef University of Agriculture,
Department of Zoology, GCWU, Sialkot
Department of Zoology, UAF, Faisalabad***Corresponding Author: naheed.bano@mnsuam.edu.pk

The rapid advancement of nanotechnology has driven a substantial expansion in the production and utilization of nanoproducts across diverse industries. However, the concomitant increase in nanoparticle entry into the water column has given rise to significant concerns, with mounting

evidence indicating the potential for deleterious effects on the reproductive health of fish. This review assesses the effects of metal oxides, metals, polymers, and quantum dot nanoparticles on key aspects of fish reproductive physiology, including hormonal balance, gonadal development, gamete viability, and embryonic toxicity. A comprehensive analysis of the available literature suggests that nanoparticles disrupt sex hormone homeostasis by interfering with the hypothalamic-pituitary-gonadal (HPG) axis. Accumulation of nanoparticles in the gonads induces oxidative stress, resulting in structural and functional damage to the gonads. Furthermore, nanoparticle exposure exerts significant embryotoxic effects, manifested as elevated mortality rates, teratogenic abnormalities, and reduced hatchability. Mechanistic studies identify oxidative damage and dysregulation of developmental gene networks as primary contributors to these embryotoxic outcomes. The current evidence suggests that the increasing accumulation of nanoparticles in aquatic environments threatens the reproductive function of individual fish and the survival of fish populations in multiple ways. Further research is needed to elucidate the toxicity mechanisms of nanoparticles, transgenerational effects and the molecular drivers of reproductive dysfunction. Addressing these knowledge gaps is critical for mitigating risks to aquatic biodiversity and ensuring the long-term sustainability of fish populations in nanoparticle-contaminated ecosystems.

FEWFM-17

Fisheries

Toxicology

RESTORATION OF SKIN MUCOSAL IMMUNE RESPONSES, CYTO-GENOTOXICITY AND HISTOLOGICAL ALTERATIONS IN ARSENIC EXPOSED *LABEO ROHITA* BY *MORINGA OLEIFERA* SUPPLEMENTATION

Fakhira Khalid¹, Hamda Azmat¹, Noor Khan² and Saima³

¹Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore

²Institute of Zoology, University of the Punjab, Lahore.

³Department of Animal nutrition, University of Veterinary and Animal Sciences, Lahore.

*Corresponding Author: fakhirakhalid6@gmail.com

Arsenic (As) residue is present predominantly in aquatic ecosystem and fishery products globally, which is critically hazardous to both fish and consumer health beyond its permissible limit. Therefore, finding effective ways to mitigate As toxicity has become a priority. Hence, *Moringa oleifera* (*M. oleifera*), a medicinal plant containing several pharmacological properties, was evaluated for reducing adverse effects of sub-lethal concentration of As ($1/3^{\text{rd}}$ of 96 h LC 50 = 6.75 mgL⁻¹) in *Labeo rohita* (Rahu). Briefly, healthy acclimatized individuals of *L. rohita* were allotted into four aquariums and named as T₁, T₂, T₃ and T₄. Each group had three replicates (10 fish in each aquarium). T₁ group served as control, exposed with not As and fed with basal diet. T₂, T₃ and T₄, groups were exposed to As and treated with 0, 2 and 4 % *M. oleifera* leaf extract supplemented diet respectively, for 28 days. Fish exposed to As and fed a diet with 0 % *M. oleifera* leaf extract exhibited increased histological alterations, elevated levels of liver enzymes, cortisol, antioxidant status, and relative expression of the cytochrome P450 gene, while showing significant decreases in skin mucosal immune responses (lysozyme, protease, antiprotease, and peroxidase activities). However, As exposed fish group fed with diets containing 2 % or 4 % *M. oleifera* leaf extract, the histological alterations were reduced, level of liver enzymes, cortisol, upregulation of antioxidant enzyme, relative expression of cytochrome P450 gene and skin mucosal immune responses were normalized, with (4 %) *M. oleifera* leaf extract supplemented diet showing

more prominent effects. These results suggest the protective and therapeutic roles of *M. oleifera* as a feed supplement in *L. rohita* against As induced toxicity.

FEWFM-18

Wildlife

SEASONAL FEEDING ECOLOGY OF THE ASIATIC BLACK BEAR (*URSUS THIBETANUS*) IN THE HINDU RAJ MOUNTAIN RANGE, PAKISTAN: DIETARY COMPOSITION, TROPHIC FLEXIBILITY, AND HUMAN–WILDLIFE CONFLICT IMPLICATIONS

Faizan Ahmad^{1,2}, Gullalay Adil Shah¹, Ammar Hassan¹, Muhammad Rehan^{1,3}, Luciano Bosso⁴, and Muhammad Kabir^{1*},

¹*Wildlife Ecology Lab, Department of Forestry & Wildlife Management, The University of Haripur, Khyber Pakhtunkhwa, Pakistan*

²*Pakistan Forest Institute, Peshawar, Pakistan*

³*Research Center of Digital Mountain and Remote Sensing Application, Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, Chengdu, China*

⁴*Institute for Agriculture and Forestry Systems in the Mediterranean, National Research Council of Italy, Portici, Italy*

*Corresponding author: foresterfaizan@gmail.com; kabir_ajk@hotmail.com

Understanding the trophic ecology of large omnivores is fundamental to conservation planning in human-dominated montane landscapes, where shifting food availability governs both space use and conflict risk. Despite the ecological prominence of the Asiatic black bear as an umbrella species in the Hindu Raj Mountain Range, its seasonal diet remains poorly quantified for this region. We characterised the feeding ecology of the species in the Hindu Raj Mountain Range, Swat, through analysis of 120 field-collected scat samples processed by graded-sieve separation and identified to the lowest taxonomic level using reference collections. Dietary importance was assessed with two complementary metrics, frequency of occurrence (FO%) and volume percentage (V%), and structured through a seasonally weighted occurrence heatmap, a Species Importance Index integrating ecological relevance scores, and Principal Component Analysis of a presence–absence food matrix (32 items). The bear exhibited a generalist, seasonally adaptive omnivorous diet spanning eight functional categories. Soft mast was the most taxonomically diverse group (12 species), with *Diospyros lotus* the most frequent item (FO% = 34), while hard mast dominated the pre-denning period, led by *Quercus baloot* (FO% = 33, V% = 8.71) *Q. dilatata* and *Q. Semecarpifolia*. Bark cambium of *Cedrus deodara* and *Pinus wallichiana* and invertebrates functioned as spring and early-summer fallback resources, whereas maize (*Zea mays*) and livestock remain signalled a pronounced anthropogenic dietary interface from late summer onward. Temporal analysis revealed a clear phenological progression from bark cambium and insect-based spring diets to a fruit-dominated autumn and mast-dependent early winter. PCA indicated a highly multidimensional dietary structure without single-item dominance, consistent with marked individual and spatial foraging plasticity. These findings quantify the bear's dependence on native mast-producing forests and its seasonal reliance on agricultural and pastoral resources, underscoring the need for habitat enrichment, seasonal foraging-hotspot protection, and community-based conflict mitigation in regional conservation strategy.

FEWFM-19**Wildlife****WILL THE MOUNTAINS OFFER REFUGE? ASSESSING CLIMATE CHANGE IMPACTS ON KALIJ PHEASANT DISTRIBUTION IN THE HIMALAYAS**

Abdul Rauf Subhani¹, Sehar Abid¹, Hammad Bin Shoukat¹, Aamish Rafique¹, Muhammad Furqan², Muhammad Farooq³, Siddiqa Qasim⁴, Tariq Mahmood⁴, Jerrold L. Belant⁵ and Faraz Akrim¹

¹*Department of Zoology, University of Kotli, Azad Jammu and Kashmir*

³*Ministry of Climate Change, Pakistan*

⁴*Department of Zoology, Wildlife & Fisheries, PMAS-Arid Agriculture University Rawalpindi 46300, Pakistan*

⁵*Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan, USA*

Corresponding Author: faraz.akrim@uokajk.edu.pk

Climate change is one of the biggest threats to biodiversity, indicating that climate change alone could threaten 15–30% of known species, as increasing temperatures and shifting weather patterns affect the geographical distribution and physiological limits of many species. Pheasants are among the most beautiful and colorful birds in the world and belong to the subfamily Phasianidae in the order Galliformes. The kalij pheasant (*Lophura leucomelanos*) is found in forests and dense areas, especially in the Himalayan foothills from Pakistan to western Thailand. We quantified the current suitable habitat of the kalij pheasant and forecasted future suitable habitat under a changing climate. We used camera traps and trail count methods for data collection. Camera traps were strategically placed in the field, typically along animal trails, near water sources, or in areas with high wildlife activity. We downloaded bioclimatic data for current (1970–2000) and future (2041–2060, 2061–2080, 2081–2100) climate scenarios from the WorldClim database using the Hadley Global Environment Model (HadGEM3-GC31-LL). We used ensemble modeling with the biomod2 package in R software to predict the current suitable habitat and forecast future suitable habitat of the kalij pheasant. We identified forest cover (60.4%) as the primary driver of habitat suitability, with the ensemble model (0.63 evaluation score) providing the most stable spatial projections. Results indicated that currently suitable habitat was highly restricted, occupying only 18.57% of the landscape and showing minimal overlap with the existing protected area network. Future projections revealed a stark divergence: the SSP126 scenario predicted habitat expansion and increased stability, whereas SSP245 and SSP585 led to progressive degradation and severe contraction by 2100. Consequently, while protected area effectiveness improved under low-emission pathways, it declined sharply under high-emission scenarios, threatening long-term species persistence. The study concluded that habitat suitability is primarily forest-dependent and will face severe contraction under high-emission scenarios by 2100. Consequently, it is recommended to strategically realign protected areas toward identified climate refugia to ensure long-term species persistence.

FEWFM-20

Wildlife

**ILLEGAL KILLING AND TRADE OF INDIAN PANGOLIN IN
AZAD JAMMU AND KASHMIR, PAKISTAN****Siddiqa Qasim¹, Tariq Mahmood¹, Muhammad Sajid² and Faraz Akrim³**¹*Department of Zoology, Wildlife & Fisheries, PMAS-Arid
Agriculture University Rawalpindi 46300, Pakistan*²*Department of Wildlife and Fisheries, Azad Jammu and Kashmir, Pakistan*³*Department of Zoology, University of Kotli, Azad Jammu and Kashmir***Corresponding author:** siddiqaqasim@outlook.com; faraz.akrim@uokajk.edu.pk

Our objective was to investigate the illegal killing and trade of Indian pangolin in study area as population of Indian pangolin is declining. We interviewed 958 respondents through questionnaire surveys from the 199 sites of Azad Jammu and Kashmir, Pakistan. The data were collected on demographic, socioeconomic and illegal trade, killing, prices and conservation status of Indian pangolin. Majority respondents knew that pangolin trade is illegal (n = 547, 57.10%). Majority of respondents did not know reason behind killing of pangolins (n = 339, 35.39%) followed by for trade (n = 179, 18.68%). Respondents thought that strengthening law enforcement can help conserve pangolins (n = 520, 54.28%) followed by habitat protection (n = 219, 22.86%) and captive breeding (n = 37, 3.86%). Majority of the respondents believed that pangolin population is decreasing (n = 721, 75.26%) due to illegal killing (n = 569, 59.39%). Most of respondents thought that trained hunters (n = 569, 59.39%) are involved in killing of pangolin followed by farmers (n = 142, 14.82%). The respondents did not know the importance of pangolin parts (n = 551, 57.52%) followed by respondents (n = 303, 31.63%) who believed it is used in medicines. Most of the respondents did not want to conserve the pangolin (n = 538, 56.16%) and had negative perception (n = 545, 56.89%). Respondents did not know about the authorities responsible for pangolin conservation (n = 640, 66.81%) nor did they know about conservation status of pangolin (n = 751, 78.39%). During current study 105 pangolins were reportedly killed while 23 pangolins were rescued and released with the help of Wildlife & Fisheries Department, AJ&K. Illegal killing and trade is the major threat for the species survival, our study provided the baseline data on poaching and killing of pangolin which will be helpful in developing conservation strategies.

FEWFM-21

Wildlife

**SPATIO-TEMPORAL PARTITIONING AND COEXISTENCE OF CARNIVORES
SPECIES IN KALAM VALLEY, SWAT****Ammar Hassan¹, Faizan Ahmad^{1,2,*}, Muhammad Rehan¹ and Muhammad Kabir^{1,†}**¹*Department of Forestry & Wildlife Management, The University of Haripur, Khyber Pakhtunkhwa,*²*Pakistan Forest Institute, Peshawar, Pakistan****Corresponding Author:** ammam.pride1@gmail.com, kabir_ajk@hotmail.com

Carnivore's species form a naturally rare and ecologically significant, used as flagship species in conservation programs. Knowledge on ecological and behavioral characteristics of sympatric carnivores'

species to identify spatio-temporal partitioning is unknown, which is detrimental to wildlife protection and management. Camera trapping technique was used to quantify the spatio-temporal overlap, co-occurrence, and activity pattern of sympatric carnivores' species in Kalam valley from January 2021 to December 2021. The study involved 15 motion-triggered infrared digital trail cameras deployed (each for 9-15 trap nights) across the study area for 261 trap nights and covered 56 grids of 5x5 km². ArcGIS (10.2 ver.) "OVERLAP" and "iNEXT" package in "R" was used to study spatio-temporal pattern of sympatric species. Camera traps recorded eight carnivores species with highest photo-captured (pc) evidence of *Vulpes vulpes* (pc=830, RAI=30.28%) followed by *Martes foina* (pc=336, Relative Abundance Index (RAI)=18.5%), *Ursus thibetanus* (pc=208, RAI=13.94%), *Canis lupus* (pc=147, RAI=5.29%), *Canis aureus* (pc=107, RAI=1.92%), *Prionailurus bengalensis* (pc=30, RAI=1.44%), *Panthera pardus tulliana* (pc=6, RAI=0.48%), and *Felis chaus* (pc=5, RAI=0.48%) respectively. Temporal pattern revealed that bears remained active both at nocturnal and diurnal time period while major part of grey wolf, red fox, Asiatic jackal, stone marten, activity pattern was comprised of nocturnal period. Spatio-temporal co-existence and partitioning analysis highlighted the associations through which intra-guild sympatric intrants can co-occur. Cluster analysis using "Vegan" package in R, grouped species in three clusters frequently (*Vulpes vulpes*, *Martes foina*), moderately (*Ursus thibetanus*, *Canis lupus*) and rarely captured (*Canis aureus*, *Prionailurus bengalensis*, *Panthera pardus tulliana*, *Felis chaus*,). Outcomes provide new vision to understanding of co-occurrence of sympatric carnivore species and will facilitate future studies on the mechanisms shaping resource selection and coexistence in the same ecosystem. Awareness of indigenous community to the spatio-temporal pattern of carnivore species will help to understand the behavior in order to minimize the risks of negative interaction.

FEWFM-22

Fisheries

PROTEIN-SPARING EFFECT OF GRADED DIETARY CARBOHYDRATE AND LIPID LEVELS ON GROWTH PERFORMANCE, DIGESTIVE ENZYMES, HEMATOBIOCHEMICAL PARAMETERS, AND AMINO ACID PROFILE OF *PANGASIANODON HYPOPHTHALMUS*

Sadaf Khadim¹, Mahroze Fatima^{1*}, Syed Zakir Hussain Shah², Noor Khan³, Hamda Azmat¹, Mehwish Khan¹ and Sobia Nisa¹

¹Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan

²Department of Zoology, University of Gujrat, Gujrat, Pakistan

³Institute of Zoology, University of the Punjab, Lahore, Pakistan

*Corresponding Author: Sadafkhadim109@gmail.com

The current research assessed the protein-sparing effect of graded carbohydrate and lipid levels in the diet of *Pangasianodon hypophthalmus* with a particular emphasis on the growth performance, metabolic regulation, digestive enzymes, oxidative stress, and physiological responses. Four isoenergetic diets were formulated with varying amounts of macronutrients (protein P, carbohydrate C, lipid L) (D1, 39P:17C:10L, D2, 35P:19C:11L, D3, 31P:21C:12L and D4, 27P:23C:13L). A total of 12 glass aquaria (300 L volume) were used for feeding trial. Fish fingerlings (16.52±0.01 g) were

randomly stocked in each aquarium (20 fish per aquarium), with triplicate aquaria assigned to each dietary treatment. Fish fed a diet with 39%-35% protein, moderate carbohydrate (17%-19%) and lipid (10%-11%) levels, maintained growth performance and feed efficiency demonstrating a protein-sparing effect. Whole-body and muscle crude protein remained unchanged between the 39% and 35% protein diets, whereas further protein reduction (31-27%) with higher carbohydrate and lipid levels increased crude fat, reduced growth, and increased FCR. Amino acids (lysine, methionine, isoleucine, aspartic acid, glycine, and glutamic acid) and antioxidant enzyme activities were similar in the 39P:17C:10L and 35P:19C:11L groups; however, they decreased at lower protein levels with higher carbohydrate and lipid levels. Digestive enzyme activities were nutritionally modulated with lower protease activity and higher amylase and lipase activities with increased non-protein energy inclusion. Glycolytic enzymes (hexokinase, glucokinase, pyruvate kinase, phosphofructokinase) and glycogen were notably increased by low-protein diets. Furthermore, higher carbohydrate and lipid inclusion increased malondialdehyde, ALT, AST, ALP, triglycerides, glucose, and cholesterol while total protein, albumin, and globulin decreased, suggesting oxidative stress. Overall, these results showed that moderate substitution of protein by non-protein energy sources can achieve protein sparing without affecting growth or physiological status. D2 (35% protein, 19% carbohydrate, and 11% lipid) diet was found to be the most suitable diet for growth performance, protein utilization and metabolic health for *P. hypophthalmus* among the tested diets.

FEWFM-23

Wildlife

ASSESSING THE POPULATION STATUS OF SULAIMAN MARKHOR (*CAPRA FALCONERI JERDONI*) IN KOH-E-SULAIMAN CONSERVANCY, KHYBER PAKHTUNKHWA, PAKISTAN

Manahil Wahab^{1,2} and Muhammad Kabir^{1,*}

¹Department of Forestry & Wildlife Management, The University of Haripur, Hattar Road,
Near Swat Chowk, Haripur 22620, Khyber Pakhtunkhwa, Pakistan

²Khyber Pakhtunkhwa Wildlife Department, Peshawar, Khyber Pakhtunkhwa, Pakistan

*Corresponding Author: kabir_ajk@hotmail.com; manahilwahab96@gmail.com

Wild ungulates play key roles in maintaining the integrity of a balanced ecosystem by controlling plant community structure and diversity and are also an important determinant of carnivore abundance. The Sulaiman markhor (*Capra falconeri jerdoni*) is a subspecies of markhor endemic to the Sulaiman mountain range in Balochistan and the southern parts of Khyber Pakhtunkhwa (KP) provinces of Pakistan. This subspecies of markhor is the least studied, and baseline information is limited to a few protected sites in Balochistan. The Koh-e-Sulaiman Conservancy is a recently established protected area in the Sulaiman markhor range in southern KP. The conservancy is known to support a viable population of Sulaiman markhor; however, no systematic data is available on the species' presence and population, which is vital for making informed management decisions. Therefore, the current study was carried out in Koh-e-Sulaiman Conservancy using the double observer method to estimate population size, demographic structure,

and male group classification. The Sulaiman markhor was sighted at six different locations within the conservancy area. The BBRecapture analysis results in an estimated population of 35 animals (12.24-57.76, 95% CI), with a mean density of 0.05 (0.02-0.09, 95% CI). The Observer: A detection probability was higher than that of observer B. The overall male and young ratios per 100 females were recorded as 32 and 26, respectively. Among the six males, Class I was represented by a single male, while Class II and Class III were represented by 2 and 3 individuals, respectively. This study provides the first comprehensive data on the Sulaiman markhor occurrence and population in Koh-e-Sulaiman Conservancy. This baseline population can be used for species future monitoring and conservation planning. Based on the current study, we recommend that further studies should be carried out in different seasons to determine new recruitment for the population and survival of the population. In addition, the local community should be engaged in the protection of this vulnerable population and its habitat in the area through promoting trophy hunting initiatives.

FEWFM-24

Fisheries

Physiology

EFFECT OF CHITOSAN–VITAMIN E NANOCOMPOSITE SUPPLEMENTATION ON GROWTH, ANTIOXIDANT RESPONSE, AND STRESS TOLERANCE IN *CIRRHINUS MRIGALA*

Shanza¹, Mahroze Fatima¹, Syed Zakir Hussain Shah², Sadaf Khadim¹,
Sobia Nisa¹ and Mehwish Khan¹

¹Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore.

²Department of Zoology, University of Gujrat, Gujrat, Pakistan

*Corresponding Author: Mahroze.fatima@uvas.edu.pk

Climate change poses major challenges to aquaculture by exposing fish to temperature and salinity fluctuations that can impair growth, physiological homeostasis, and antioxidant defense. Nutritional strategies that enhance stress resilience are therefore increasingly important. Although chitosan and vitamin E possess well-established antioxidant properties, limited information is available on the application of their nanocomposite form in *Cirrhinus mrigala*. This study evaluated the effects of dietary chitosan–vitamin E nanocomposites (Ch-VE NCs) on growth performance, antioxidant status, hepatic health, and tolerance to temperature and salinity stress. Fish were fed diets supplemented with Ch-VE NCs at 0, 25, 50, 100 and 200 mg/kg for 90 days and subsequently exposed to acute salinity (2.84 and 4.26 ppt) and temperature (34 and 36°C) stress for 48 h. Dietary Ch-VE NC supplementation significantly improved growth performance, with 100 mg/kg producing the highest final weight and weight gain and the most favorable feed conversion ratio ($P < 0.05$). Supplementation at 100 mg/kg also significantly enhanced the activities of glutathione peroxidase, catalase, and superoxide dismutase while reducing malondialdehyde levels, indicating improved antioxidant defense and reduced lipid peroxidation. In addition, serum ALT, AST, and ALP activities were significantly reduced, suggesting improved hepatic health. Exposure to elevated temperature and salinity increased glucose, cortisol, malondialdehyde, and hepatic enzyme activities, whereas fish receiving 100 mg/kg Ch-VE NCs exhibited attenuated stress responses and enhanced antioxidant protection. Overall, dietary supplementation with 100 mg/kg Ch-VE NCs improved growth performance, antioxidant capacity, and hepatic health and enhanced the resilience of *C. mrigala* to

acute temperature and salinity stress, highlighting its potential as a functional feed additive for climate-resilient aquaculture.

FEWFM-25

Wildlife

TIKTOK AS AN EMERGING MARKETPLACE FOR WILDLIFE TRADE IN PAKISTAN

Aleena Shamshad, Kiran Yasin, Hira Shamshad and Rehan Ul Haq*

Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore

*Corresponding Author: aleenashamshad005@gmail.com, rehan.haq@uvas.edu.pk

Illegal wildlife trade is one of the major threats to biodiversity. The growth of internet and social media has facilitated the shift of wildlife markets to online platforms, where traders can reach large audiences and may operate with greater anonymity and less regulatory oversight. This study investigated the volume and diversity of wildlife advertised for sale on TikTok in Pakistan from 28 Oct 2024 to 19 March 2025. We monitored 75 accounts and reviewed 1133 short videos advertising birds, reptiles, and mammals. In total, we recorded 2012 wildlife individuals representing 105 native and exotic species. Native species accounted for 66% of the recorded individuals, whereas exotic species accounted for 34%. Birds represented both the greatest number of species and the largest proportion of recorded individuals (92.8%), followed by mammals and reptiles. The most frequently advertised native species were the Alexandrine Parakeet (*Palaeornis eupatria*) and Rose-ringed Parakeet (*Alexandrinus krameri*), while the most frequently advertised exotic species were the Grey Parrot (*Psittacus erithacus*) and Sun Parakeet (*Aratinga solstitialis*). Furthermore, 21 of the identified species were threatened with the risk of extinction while eight species were nearly threatened. The results indicate the large volume and diversity of wildlife traded on TikTok in Pakistan and highlight need of rigorous online monitoring to curb illegal wildlife trade on TikTok.

FEWFM-26

Wildlife

ILLEGAL TRADE OF NATIVE PARAKEYETS ON E-COMMERCE PLATFORMS IN PAKISTAN

Hira Shamshad and Rehan Ul Haq*

Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore

*Corresponding Author: hirashamshad1997@gmail.com, rehan.haq@uvas.edu.pk

Illegal wildlife trade poses a major threat to biodiversity. While a variety of native species has been targeted for illicit trade in Pakistan, Parakeets (family Psittacidae) are most at the risk due to their preference as pets. The trade of parakeets is associated with population decline and transmission of zoonotic diseases such as Psittacosis. To assess magnitude, geographic origin and trade value of Parakeets,

we monitored six e-commerce platforms advertising parakeets for trade for 12 months from Jan 1st, 2023, to Dec 31st, 2023. We identified 5,908 posts indicating 12,142 individuals of all the four native species of Parakeets. The highest number of posts were representing Alexandrine Parakeet (*Palaeornis eupatria*) followed by Rose-ringed Parakeet (*Alexandrinus krameri*), Plum-headed Parakeet (*Himalayapsitta cyanocephala*), and Slaty-headed Parakeet (*Himalayapsitta himalayana*). The posts advertising parakeets were found to be uploaded from all administrative units of Pakistan except Gilgit-Baltistan while the highest number of posts advertising highest number of individuals were uploaded from Karachi, Sindh. Furthermore, the total estimated trade value of parakeets was USD 0.76 million, with Alexandrine Parakeet representing the highest value (USD 0.54 million). This study emphasizes the need to thoroughly monitor and curb the illegal trade of parakeets on online platforms in Pakistan.

FEWFM-27

Wildlife

PET MARKETS AS POTENTIAL NODES OF WILDLIFE CRIME IN LAHORE, PAKISTAN

Sania Muqadas¹, Muhammad Umer Raza^{1*} and Rehan Ul Haq^{1*}

Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore

*Corresponding Authors: saniyaamuqadas8@gmail.com; umerraza660@gmail.com;
rehan.haq@uvas.edu.pk

Illegal wildlife trade poses a serious threat to biodiversity, ecological stability, and the survival of protected species. This study assessed wildlife trade and associated potential legal violations in four pet markets in Lahore, Pakistan: Tollington Market, Dharampura Bridge Market, the now-demolished Data Darbar Bird Market, and Shalimar Sunday Bird Market. Surveys conducted between December 2021 and February 2022 recorded species, numbers of animals, and asking prices. Species were assessed using the IUCN Red List, CITES Appendices, and applicable wildlife legislation in Punjab. Overall, 26 native and exotic wildlife species were recorded. Birds represented the largest proportion, comprising 24 species and 8513 individuals. Mammals were represented by 17 rhesus monkeys (*Macaca mulatta*), while reptiles were represented by one Indian Rock Python (*Python molurus*). House sparrows (*Passer domesticus*) were the most frequently traded species, with 5136 individuals, followed by rock pigeons (*Columba livia*) with 1312 and Alexandrine parakeets (*Palaeornis eupatria*) with 981 individuals. The markets contained one Critically Endangered species, four Endangered species, and three Near Threatened species. Several recorded animals were protected under CITES and Punjab wildlife laws. The estimated total value of the observed trade was approximately PKR 8.2 million. Tollington Market accounted for nearly PKR 6 million and contained the greatest diversity of protected wildlife. Animals were primarily sold as household pets or for recreational purposes, although some were traded for charitable release (*sadqa*), medicine, and taming. The findings demonstrate that the pet markets in Lahore facilitate the illegal sale of captured and imported wildlife. Regular monitoring, seller registration, transaction records, import restrictions, and a wildlife-reporting helpline are recommended.

FEWFM-28

Wildlife

**CO-EXISTENCE AND CONFLICT DYNAMICS OF SYMPATRIC APEX
PREDATORS IN KAGHAN VALLEY****Muhammad Azhar***Department of Forestry and Wildlife Management, University of Hairpur, Hairpur.**Corresponding Author: gazhar137@gmail.com

Apex predators play a crucial role in maintaining healthy, balanced ecosystems, though the magnitude of their effects as ecosystem regulators has been immensely underestimated. Assessing spatiotemporal overlap helps to understand the mechanisms of interspecific coexistence and behavioural response of species to environmental conditions. The widespread decline in numbers and distribution of common leopard (*Panthera pardus*) and Asiatic black bears (*Ursus thibetanus*) due to human persecution has led to a loss and reconfiguration of biological diversity in many ecosystems. The present study was conducted in the Kaghan Valley (2023-2024), to understand the coexistence of apex predators and negative interaction over livestock losses and crop damages. Camera traps remained functional for 70 nights and 28 independent capture events were recorded for CL and 20 for ABB. Comparatively trap success rate was higher for CL (41.43%) than ABB (28.57%). Along the altitudinal gradients leopard presence range between 1,360m to 2,680m, whereas the bear presence was restricted between 1,180m-2,611m. Leopard detection rate was more at higher altitude areas locating between alpine and moist temperate zone while bear preferred to live in area with forest habitat. The leopard prominently showed nocturnal behaviour (22%) with peak activity time between 1900 h and 2300 h. While the bear showed a diurnal activity pattern with peak activity recorded between 0400 h and 0600 h. The spatio-temporal overlap analysis showed that both species avoid temporal overlaps but spatially they overlapped only 54.13% of their range of occurrence. The outcomes revealed a significant role interspecific spatio-temporal partitioning in defining coexistence between sympatric species, this could be influenced by difference in spatial distribution of food resources. During the survey 156 respondents reported losses 249 livestock in the last five years and leopard was responsible for 208 and 41 individuals were attacked and killed by bear. The maximum incidence occurred in the evening (53.37%). Medium sized livestock were more vulnerable to attacks with significant numbers ($\chi^2 = 143.6$, $df = 28$, $p < 0.0001$) were recorded in summer. The economic impact of these predation events was significant, amounting to a total of \$31,845.88 over five years, which averages an annual loss of \$204.14 per respondent. Bears inflicted substantial damage on maize crops, resulting in a total economic loss of \$7,935.48 annually. The outcomes revealed targeted management strategies that balance the conservation of apex predators with the mitigation of conflicts related to livestock depredation and crop damage.

FEWFM-29

Wildlife

**IMPACT OF AMERICA–IRAN WAR ON BIODIVERSITY:
A BLESSING IN DISGUISE****Mohsin Qayyum¹, Hafsah Ghaffar², Unser Naeem-Ullah² and Assad Qadir Khan¹**¹*SunWay Agro Chemicals, Multan, Pakistan*²*Department of Entomology, Muhammad Nawaz Sharif University of Agriculture, Multan, Pakistan*

*Corresponding Author: mohsinqayyum08@gmail.com

In the present global scenario, geopolitical conflicts, including the America–Iran war, are influencing international transportation, import–export chains, agricultural input availability, and production costs. Disruptions in global supply chains, increased transportation costs, higher pesticide prices, and reduced availability of pesticides are creating a significant shift in agricultural input-use patterns. A comparative assessment of pesticide import data for January–August 2025 and January–August 2026 indicates a decline in pesticide imports during the latter period. These changes may be influencing farmers to reconsider routine and excessive pesticide use and to place greater emphasis on plant health, balanced nutrition, and preventive crop-management practices. This shift may have an unintended but potentially beneficial ecological consequence. Reduced pesticide application can decrease chemical exposure to non-target organisms, including pollinators, predatory insects, parasitoids, soil microorganisms, and other beneficial fauna. At the same time, increased use of plant nutrients and greater emphasis on maintaining healthy and resilient crops may support integrated approaches to crop protection. Consequently, reduced pesticide pressure could contribute to the conservation and potential recovery of beneficial fauna and agricultural biodiversity. The present situation may therefore represent a “blessing in disguise” for biodiversity, in which global economic and supply-chain pressures unintentionally encourage a transition toward more sustainable agricultural practices. However, this potential benefit should not be interpreted as a justification for pesticide shortages, as inadequate pest control can adversely affect crop productivity and food security. The study highlights an opportunity to transform this temporary global shift into a long-term sustainable agricultural strategy through Integrated Pest Management (IPM), biological control, balanced plant nutrition, habitat conservation, monitoring of beneficial fauna, and rational pesticide use. Further research is required to quantify changes in global pesticide consumption, import trends, pesticide application, beneficial fauna populations, soil biodiversity, and crop productivity during this period of changing agricultural input dynamics.

FEWFM-30

Wildlife

**HUMAN–BEAR CONFLICT AND COEXISTENCE: A CASE STUDY OF ASIATIC
BLACK BEAR IN OAK FOREST, HINDU RAJ MOUNTAIN RANGE, SWAT****Fahad Shah^{*1}, Muhammad Kabir^{**1}, Syed Moazzam Nizami¹ and Faizan Ahmad^{***1, 2}**¹*Department of Forestry & Wildlife Management, The University of Haripur, KPK*²*Pakistan Forest Institute, Peshawar Pakistan*

*Corresponding Author: fahaddsshah@gmail.com

Human–bear conflict is an important conservation challenge for the Asiatic black bear (*Ursus thibetanus*) in northern Pakistan, particularly where forest habitats interface with agriculture, livestock and

human settlements. This study assessed human–bear conflict patterns and examined the coexistence of Asiatic black bears with humans, livestock and free-ranging dogs in the oak forests of the Hindu Raj Mountain Range, Swat. Data were collected through camera trapping, field sign surveys and structured community questionnaires. A total of 1,197 camera-trap nights were used to assess bear activity, temporal overlap and species co-occurrence, while 328 conflict incidents were analyzed using Kernel Density Estimation and Optimized Getis–Ord Gi* hotspot analysis in ArcGIS Pro. Community perceptions and conflict information were obtained from 120 respondents across 47 villages. Bears were primarily crepuscular and nocturnal and showed strong temporal separation from human activity. Conflict hotspots were concentrated mainly around forest–agriculture and settlement interfaces, where human and livestock activity was high. Crop raiding, particularly involving maize and fruit orchards, was a major source of conflict. Spatial analyses also indicated positive co-occurrence of bears with humans, livestock and free-ranging dogs, while temporal partitioning facilitated coexistence. The findings indicate that coexistence is currently supported partly through spatiotemporal segregation, but increasing anthropogenic pressure and habitat fragmentation may threaten this balance. Targeted conflict mitigation, habitat protection, improved livestock management, free-ranging dog management and community-based conservation are recommended to promote long-term human–bear coexistence.

FEWFM-31

Biodiversity

MORPHOMETRIC AND HABITAT ASSESSMENT OF AMPHIBIAN SPECIES IN CHANGA MANGA, DISTRICT KASUR, PAKISTAN

Shaista Razaq, Arshad Javid and Fareeha Imran

Department of wildlife and Ecology, University of Veterinary and Animal Sciences, Lahore

*Corresponding Author: shaistarazraq553@gmail.com

Amphibians are important components of terrestrial and aquatic ecosystems and are considered useful indicators of environmental conditions. However, information on their distribution and morphometric characteristics in several regions of Pakistan remains limited. The present study was conducted to document amphibian species and assess their habitat association and morphometric characteristics in Changa Manga, District Kasur, Punjab, Pakistan. Field surveys were conducted in Changa Manga to record amphibian species and their associated habitats. Three amphibian species, *Euphlyctis cyanophlyctis* (skittering frog), *Bufo stomaticus* (Indus Valley toad), and *Hoplobatrachus tigrinus* (Indus Valley bullfrog), were documented. Morphometric measurements, including snout–vent length, snout length, head length, eye diameter, tympanum diameter, hand length, tympanum membrane length, and foot length, were recorded. Habitat occurrence was also documented for the observed species. *E. cyanophlyctis* was widely recorded and exhibited a mean snout-vent length of 5.86 ± 0.80 , whereas subsequent measurements after 15 days showed a mean of 6.00 ± 0.44 . *B. stomaticus* was recorded from cultivated land, human habitations, and water bodies but was not observed in uncultivated areas. Its mean snout-vent length was 5.64 ± 0.42 initially and increased to 5.98 ± 0.31 after 15 days. *H. tigrinus*, the largest frog recorded during the survey, was represented by 10 specimens collected from Changa Manga. Its mean snout-vent length was 6.80 ± 0.52 initially and 6.14 ± 0.56 during the subsequent measurements. Overall, the observed morphometric variation demonstrated differences among the three species and between measurement

periods. The study confirms the occurrence of three amphibian species in Changa Manga and highlights variation in their morphometric characteristics and habitat utilization. The presence of amphibians across cultivated, aquatic, and human-associated habitats emphasizes the ecological importance of the area. Further long-term surveys incorporating population abundance, environmental variables, and seasonal variation are recommended to assess amphibian diversity and conservation status in the region.

FEWFM-32

Fisheries

DIETARY VITAMIN E AND PHYTOL SUPPLEMENTATION ENHANCES GROWTH PERFORMANCE, ANTIOXIDANT DEFENSE, AND STRESS TOLERANCE IN *LABEO ROHITA* EXPOSED TO MULTIPLE ENVIRONMENTAL STRESSORS

Ayesha Mukhtar*, Mahroze Fatima, Laiba tul Islam, Ayesha Amir and Sadaf Khadim*****

Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore, Pakistan

*Corresponding Author: ayeshaaali43@gmail.com

Environmental stressors such as elevated temperature, ammonia accumulation, and hypoxia can impair growth, physiological homeostasis, antioxidant defense, and survival in cultured fish. Nutritional supplementation with bioactive compounds may enhance fish resilience to such environmental challenges. This study evaluated the effects of dietary vitamin E and phytol, individually and in combination, on growth performance, antioxidant status, hematological and serum biochemical responses, hepatic health, and tolerance to multiple environmental stressors in *Labeo rohita*. Four experimental diets were formulated: a control diet without added vitamin E or phytol; a diet supplemented with 80 mg/kg vitamin E; a diet supplemented with 250 mg/kg phytol; and a diet containing a combination of 80 mg/kg vitamin E and 250 mg/kg phytol. Fish were fed the experimental diets for 60 days and subsequently exposed to temperature stress (32°C), ammonia stress (1 mg/L), and hypoxia (3 mg/L dissolved oxygen) for 48 h. Dietary supplementation significantly improved growth performance, with the combined supplementation of 80 mg/kg vitamin E and 250 mg/kg phytol resulting in the highest final weight and weight gain and the lowest feed conversion ratio. Fish receiving 80 mg/kg vitamin E and 250 mg/kg phytol also exhibited enhanced antioxidant defense, with higher superoxide dismutase, catalase, and glutathione peroxidase activities and lower thiobarbituric acid-reactive substances (TBARS) levels. Hematological responses were also improved, with higher hemoglobin and hematocrit levels, whereas RBC and WBC counts were lower in fish receiving the combined supplementation. Moreover, the combined supplementation resulted in lower alanine aminotransferase, aspartate aminotransferase, and alkaline phosphatase activities, indicating improved hepatic biochemical status. Serum glucose and cortisol levels were also lower, suggesting reduced physiological stress. Following environmental stress challenges, fish receiving 80 mg/kg vitamin E and 250 mg/kg phytol maintained higher antioxidant enzyme activities and lower TBARS, glucose, cortisol, and hepatic enzyme activities, together with improved survival. Overall, dietary supplementation with 80 mg/kg vitamin E combined with 250 mg/kg phytol produced the most favorable effects on growth performance, antioxidant defense, hematological and biochemical status, and tolerance to temperature, ammonia, and hypoxia stress in *L. rohita*. These findings indicate that combined vitamin E and phytol supplementation may serve as a promising nutritional strategy to enhance stress resilience and support sustainable aquaculture production of *L. rohita*.

FEWFM-33

Wildlife

**CAMERA TRAPPING AND SPATIAL ANALYSES REVEAL DISTRIBUTION
AND CONSERVATION GAP FOR THE INDIAN PANGOLIN
(MANIS CRASSICAUDATA) IN NORTHERN PAKISTAN**

Noor ul Huda

University of Haripur, Haripur, KPK

*Corresponding Author: nooruoh001@gmail.com

Climate change vulnerability, coupled with intensifying anthropogenic pressure, places the endangered Indian pangolin at high risk through widespread habitat modification and fragmentation. However, localized data on the species' spatial distribution across Pakistan remain scarce, hindering evidence-based conservation action. To fill this gap, we quantified habitat suitability and functional connectivity for the Indian pangolin using a reproducible workflow that couples tuned MaxEnt habitat projections with connectivity analyses in Linkage Mapper. We also assessed protected-area effectiveness and habitat fragmentation, identifying unprotected priority habitats and connectivity gaps. Current suitable habitat covers 2,668 km² and is concentrated in the northern and central parts of the study area. Only 24% of suitable habitat falls within protected areas, and Murree–Kotli Sattian–Kahuta National Park alone contains 66% of all protected suitable habitat and contributes 82% to network connectivity. We identified 32 linkages among 15 habitat cores, with short corridors of 2.7–5.4 km connecting protected areas to adjacent unprotected patches and longer corridors of 23–39 km linking more distant patches. Pinch points were concentrated in the central and north-eastern sectors, where multiple corridors converge into narrow bottlenecks. Together, these results provide a spatially explicit framework for prioritizing habitat protection and corridor management, revealing that Indian pangolin conservation in northern Pakistan hinges on safeguarding both core habitats and the critical bottlenecks that maintain connectivity across this fragmented landscape.

FEWFM-34

Fisheries

Toxicology

**EFFECTS OF MICROPLASTICS (POLYSTYRENE) ON GUT HEALTH OF TILAPIA
(*Oreochromis niloticus*)**

Sumaira Abbas¹, Yousaf Masih, Asia Iqbal² and Hanzala Yasin

¹*Department of Fisheries & Aquaculture, University of Veterinary and Animal Sciences, Lahore*

²*Department of Wildlife & Ecology, University of Veterinary and Animal Sciences, Lahore*

*Corresponding Author: sumaira.abbas@uvas.edu.pk

Hazardous effect of Microplastics (Polystyrene) on gut health of Nile Tilapia (*Oreochromis niloticus*) was evaluated in three experimental groups (15 fish/aquarium) having MPs inclusion levels of 10 (T1), 20 (T2), and 40 (T3) and 80 mg/l mixed with commercial feed respectively for

one month and one control group. The lowest accumulation was noted in T1 (3.33 ± 0.88 particles/sample), followed by T2 (7.67 ± 0.33) and R3 (10.33 ± 0.88), while the maximum accumulation was noticed in T4 (14.00 ± 0.58 particles/sample). Intestinal tissue in T1 groups exhibits villi shortening, disruption of epithelium and infiltration of inflammatory cells in mucosal layer. In Intestinal architecture congestion and mild degeneration were also observed, showing inflammatory response. However, there are some focal areas of vesicular congestion and slight necrosis also observed in epithelial layer. The epithelial enterocytes exhibit ballooning degeneration characterized by presence of vacuoles within the cytoplasm of the enterocytes in T2, T3 and T4. Catalase (CAT) and superoxide dismutase (SOD) activity declined gradually as concentration of microplastics rose, whereas level of Malondialdehyde (MDA) significantly rises in treatment groups - Experimental groups showed histological changes, including tissue deterioration, injury, and inflammation of normal intestine structure. Furthermore, significant alterations in oxidative stress indicators demonstrated that fish were physiologically stressed by microplastics. The MPs have adverse effects on the overall health of fish which include damage to organs and alteration in hematological values.

FEWFM-35

Wildlife

STUDIES ON CHROMIUM BIOACCUMULATION PATTERNS IN FISH VIZ. LABEO ROHITA, OREOCHROMIS NILOTICUS AND HYPOPHTHALMICHTHYS MOLITRIX WITH RELATION TO WATER AND SEDIMENTS IN RIVER SUTLEJ

Iqra Mukhtar and Hamda Azmat

Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore

*Corresponding Author: iqramukhtar1509@gmail.com

This study investigated chromium (Cr) bioaccumulation in *Labeo rohita*, *Oreochromis niloticus*, and *Hypophthalmichthys molitrix* in relation to water and sediment quality of the River Sutlej. Samples were collected during January–March 2019 and selected physicochemical parameters of river water were analyzed. Cr accumulation was assessed in the liver, gills, and muscle tissues of the studied fish species. The highest Cr concentrations were generally observed in the liver and gills, while comparatively lower levels were detected in muscle tissue. *Hypophthalmichthys molitrix* exhibited relatively higher Cr accumulation than the other examined species. These findings indicate the bioavailability of chromium in the aquatic environment and its tissue-specific uptake in fish. Histopathological analysis revealed pronounced

alterations in gill, liver, and muscle tissues, including epithelial disruption, lamellar damage, sinusoidal dilation, hepatocellular necrosis, and muscle degeneration. These lesions reflect tissue-level pathological responses associated with metal exposure. Overall, the results demonstrate chromium contamination and its bioaccumulation potential in fish inhabiting the River Sutlej. The study provides evidence of potential ecological risks posed by chromium pollution to freshwater fish health.

FEWFM-36**Freshwater Biology****NUTRITIONAL POTENTIAL OF BLACK SOLDIER FLY LARVAE (*HERMETIA ILLUCENS*) AS A SUSTAINABLE PROTEIN SOURCE FOR ROSS 308 BROILERS**

Maleeha Jamil*, Riffat Sultana and Sajjad Ali**

Department of Zoology, University of Sindh, Jamshoro, Sindh, Pakistan

Corresponding Author: maliha4848@gmail.com, riffat.sultana@usindh.edu.pk**

The increasing cost of conventional poultry feed ingredients, particularly fish meal and soybean meal, has created a growing need for sustainable and cost-effective alternative protein sources. Black soldier fly (BSF), *Hermetia illucens*, larvae are rich in protein and other essential nutrients and have considerable potential as an alternative feed ingredient in poultry production. The present study evaluated the effects of BSF larvae supplementation on growth performance, feed utilization, mortality, and general health of fast-growing Ross 308 broilers in comparison with conventional commercial feed. DOC broiler (Ross 308) with an initial body weight of approximately 40–45 g were divided into two groups of 10 birds each. The control group received commercial feed, whereas the experimental group received a BSF-based diet comprising approximately 30–40 g BSF larvae, 50 g grains, and 10 g of an additive mixture, with the dietary composition adjusted according to the age of the birds. After 42 days, broilers receiving the BSF-based diet achieved a final body weight of approximately 3200–3500 g, compared with approximately 2800 g in the commercial-feed group. Mortality was lower in the BSF-fed group (10%) than in the control group (30%). The BSF-supplemented birds also showed better overall growth and feed utilization compared with birds maintained on conventional feed. These preliminary findings indicate that *H. illucens* larvae may serve as a nutritionally valuable, sustainable, and cost-effective alternative protein source for broiler production. However, further studies involving larger sample sizes, standardized diet formulations, nutritional analysis, and statistical evaluation are required to validate their effects on growth performance, health, and welfare.

FEWFM-37
Fisheries, Toxicology

**BIOACCUMULATION OF METALS MIXTURE IN ECONOMICALLY SIGNIFICANT
CARNIVOROUS FISH SPECIES OF PAKISTAN**

Sidra Abbas^{1*} and Muhammad Javed²

^{1*}*Department of Zoology, University of Jhang, Jhang*

²*Department of Zoology, Wildlife and Fisheries, University of Agriculture, Faisalabad*

*Corresponding Author: sidraabbas39@gmail.com

It is imperative to determine the bioaccumulation of metals mixture in economically significant carnivorous fish species of Pakistan, as they are currently facing a population decline in natural freshwater ecosystems. Therefore, the present research was conducted to investigate the bioaccumulation of commonly found metals mixture (Al+As+Co+Ni) in three commercially significant carnivorous fish species viz. *Channa marulius*, *Mystus seenghala* and *Wallago attu* under acute exposure conditions. Three length groups (50, 100 and 150 mm) of each fish species were exposed to metals mixture for 96 h under controlled laboratory conditions, and accumulation was determined in different body organs including gills, liver, kidney, heart, gut, intestine, muscles, bones and skin. The accumulation of metals mixture varied significantly ($p < 0.05$) among fish species, length groups and body organs. The 150 mm length group showed significantly higher bioaccumulation than 100 and 50 mm groups, indicating an increase in accumulation with fish size. Among the three fish species, *Channa marulius* exhibited the highest tendency to accumulate metals mixture, followed by *Wallago attu* and *Mystus seenghala*. Overall accumulation of metals mixture was significantly higher at lethal concentration exposure ($609.57 \pm 164.65 \mu\text{gg}^{-1}$) than at 96 h LC_{50} exposure ($254.44 \pm 78.40 \mu\text{gg}^{-1}$). At both exposure levels, the liver exhibited the highest accumulation, whereas muscles showed the lowest accumulation. The findings demonstrated considerable bioaccumulation of metals mixture in these economically significant carnivorous fish and highlight their potential use as bioindicators of metallic pollution in freshwater ecosystems of Pakistan.

START OF FEE NOT PAID

FEWFM-38
Wildlife**DIVERSITY OF VERTEBRATE FAUNA AT MIANI FOREST
DISTRICT HYDERABAD, SINDH, PAKISTAN****Sajid Siyal¹, Saima Naz², Nadir Ali Birmani², Asma Kanwal Thebo³, Majid Ali Soomro¹, Shaista Jalbani¹, Seema Perveen Memon² and Mir Munwar Laghari¹**¹*Department of Wildlife Management, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand- Sindh, Pakistan*²*Department of Zoology, University of Sindh, Jamshoro, Pakistan*³*Department of Zoology, Govt. Girls Zubaida Degree College Hyderabad, Sindh*⁴*Department of Veterinary Pathology, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand- Sindh, Pakistan*⁵*Department of Fisheries and Aquaculture, Shaheed Benazir Bhutto University of Veterinary and Animal Sciences, Sakrand- Sindh, Pakistan**Corresponding Author: sajid.siyal333@gmail.com

The present study is based on the vertebrate fauna of Miani Forest District Hyderabad, Sindh Pakistan. From June 2025 to March 2026. A variety of wildlife fauna are observed at Miani Forest. To conduct a comprehensive vertebrate wildlife survey that diurnal and nocturnal species. Transect survey, Point count survey, Habitat assessment and wildlife observations. A total of vertebrate fauna at Miani forest including Amphibians, reptiles birds and mammals Sort Out (4) class, (18) orders, (30) Families, (36) Genus and (42) species of including were observed *Bufo stomaticus*, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Lissemys punctate*, *Calotes versicolor*, *Uromastix hardwickii*, *Varanus bengalensis*, *Spalerosphis arenarius*, *Milvus migrans*, *Egretta garzetta*, *Streptopelia decaocto*, *Streptopelia senegalensis*, *Columba livia*, *Coracias benghalensis*, *Merops orientalis*, *Merops persicus*, *Merops philippinus*, *Upupa eppops*, *Vanellus indicus*, *Coturnix coturnix*, *Francolinus pondicerianus*, *Actitis hypoleucos*, *Himantopus himantopus*, *Fulica atra*, *Gallinula chloropus*, *Corvus crow*, *Corvus splendens*, *Saxicoloides fulicata*, *Acridotheres tristis*, *Pycnonotus cafer*, *Pycnonotus leucotis*, *Passer domesticus*, *Prinia inornata*, *Turdoides striata*, *Sus scrofa*, *Herpestes edwardsi*, *Canis aureus*, *Hemiechinus collaris*, *Funambulus pennantii*, *Hystrix indica*, *Rattus rattus* and *Mus booduga*. This study provides valuable insight into the diversity of vertebrate fauna in Miani Forest, district Hyderabad, Sindh, Pakistan.

FEWFM-39
Wildlife**DIVERSITY AND DISTRIBUTION OF CAPTIVE PARROTS (AVES: PSITTACIFORMES)
IN URBAN AREAS OF HYDERABAD, SINDH, PAKISTAN****Wakeela Gul Mughal, Farheen Shaikh*, Sidra Afreen Ansari and Saira Bano Bhatt**
*Department of Zoology, University of Sindh, Jamshoro, Sindh.**Corresponding Author: farheen.shaikh@usindh.edu.pk, farheenshaikh1578@gmail.com

The main objective of this research was to collect maximum number of species of the captive birds from the urban area of Hyderabad, Sindh, Pakistan. All species of captive parrots (Chordate: Aves: Psittaciformes)

were examined in urban areas of Hyderabad, Sindh, Pakistan. A survey was conducted between April 2017 and February 2018. The species belonged to the large parrot family Psittacidae. Captive parrots from both subfamilies Arinae and Psittacinae were included and identified from five study sites. This was the first research study on captive parrots conducted in the urban areas of Hyderabad and described three species from the subfamily Psittacinae and three from Arinae. The identified species were Blue and Yellow Macaw *Ara ararauna* (Linnaeus, 1758), Red and Green Macaw *Ara chloropterus* (Gray, GR, 1859), Scarlet Macaw *Ara macao* (Linnaeus, 1758), English Sun Parakeet *Aratinga solstitialis* (Linnaeus, 1758), African Grey Parrot *Psittacus erithacus* (Linnaeus, 1758) and Pineapple Conure *Pyrrhura molinae* (Massena and Souance, 1854). The study area Hyderabad was divided into five urban areas for the collection of samples. The areas included were Heerabad, Hyderabad Zoological Garden, Latifabad, Mir Fazal Town and Paqqa Qila. A total of 80 specimens were collected. All were new records from urban areas of Hyderabad Sindh, Pakistan. The present study found that captive parrots were not as widely distributed compared to other captive birds in the region.

FEWFM-40

Freshwater Biology

ECOLOGICAL ASSESSMENT OF PANJNAD IRRIGATED CANALS USING AQUATIC ENTOMOFAUNA AS BIOINDICATORS

Sana Iqbal^{1*}, Santosh Kumar^{1} and Riffat Sultana²**

¹Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur

²Department of Zoology, University of Sindh, Jamshoro

Corresponding Author: 23-cuvas-0009@student.cuvas.edu.pk, santoshkumar@cuvas.edu.pk**

Irrigated canals are important freshwater ecosystems that support aquatic biodiversity while sustaining agricultural production; however, their ecological condition is often insufficiently assessed. This study aims to evaluate the ecological status of three major irrigated canals associated with Panjnad Headworks, Punjab, Pakistan, using aquatic entomofauna as biological indicators. Aquatic insects will be sampled seasonally from selected sites along each canal and identified to the lowest practical taxonomic level. Physicochemical parameters, including water temperature, pH, dissolved oxygen, electrical conductivity, turbidity, and selected nutrients, will also be recorded to characterize water quality. Community composition, abundance, species richness, diversity, and distribution of aquatic insect taxa will be analyzed using ecological and biotic indices to assess spatial and seasonal variations among canals and sampling sites. Pollution-sensitive taxa, particularly Ephemeroptera, Plecoptera, and Trichoptera (EPT), will be evaluated alongside more pollution-tolerant groups to determine the degree of ecological disturbance. The study is expected to demonstrate the potential of aquatic entomofauna as an effective and cost-efficient tool for monitoring canal ecosystem health. The findings will provide baseline information on aquatic insect diversity and water quality and contribute to the evidence-based management and conservation of irrigated canal ecosystems in Southern Punjab, Pakistan.

FEWFM-41

Fisheries

VITAMIN C AS A NUTRITIONAL INTERVENTION FOR IMPROVING FISH GROWTH RATE, ANTIOXIDANT ENZYMES, PROTEASE LEVEL, AND GASTRO- & HEPATO-SOMATIC INDEX**Muhammad Hamid Irshad^{1*}, Huma Naz¹, Zulfiqar Khursheed¹ and Muhammad Younus^{2*}**¹*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*²*Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia**Corresponding Author: hamidirshad69@gmail.com

Vitamin C enhances growth, boosts antioxidant activity, and improves disease resistance in fish. It also supports better health by promoting strong immune responses and reducing oxidative stress. This study investigates the effects of different doses of vitamin C (VC) on growth parameters, biochemical responses, digestive protease activity, and health indices in juvenile Nile tilapia (*Oreochromis niloticus*). Fish diets were divided into four groups: T0 (control group) with no VC supplementation, T1 (250 mg/100 g VC), T2 (500 mg/100 g VC), and T3 (750 mg/100 g VC). Growth performance was assessed by measuring feed conversion ratio (FCR), condition factor (CF), weight gain (WG), daily length gain (DLG), and specific growth rate (SGR). The key antioxidant enzymes — catalase (CAT), superoxide dismutase (SOD), and peroxidase (POx) — were measured across six organs. Protease activity served as an indicator of digestive efficiency. Organ health was evaluated using the gastro-somatic index (GSI) and hepato-somatic index (HSI). Results indicated that the T3 group exhibited the most significant improvement in growth, with the lowest (most favorable) FCR and highest SGR compared to T1, T2, and the control. Antioxidant enzyme activities (CAT, SOD, and POx) were highest in T3, suggesting superior oxidative stress management. Protease activity increased progressively with increasing VC dose. GSI and HSI values increased with supplementation, reflecting better overall organ development and metabolic function. The highest dose (T3) produced GSI values of 6.93 ± 0.1 compared to control (6.3 ± 0.04), and HSI of 1.34 ± 0.11 compared to control (1.12 ± 0.08). These findings suggest that T3 (750 mg/100 g VC) is the optimal dosage for enhancing growth, digestion, and health in juvenile Nile tilapia.

FEWFM-42

Livestock Production

DIETARY NANO-SELENIUM SUPPLEMENTATION AND ITS EFFECTS ON GROWTH PERFORMANCE AND SERUM BIOCHEMISTRY OF JAPANESE QUAILS**Tayyaba Khan^{1*}, Zahid Farooq and Muhammad Younus^{2*}**¹*Department of Zoology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*²*Institute of Chemical Technology, Ural Federal University, Ekaterinburg, Russia**Corresponding Author: tayyaba.khan2k19@gmail.com

Selenium is an essential trace mineral involved in antioxidant defense, immune function, metabolism, and growth in poultry. However, conventional selenium supplementation may have

limitations related to bioavailability and utilization. Nano-selenium has emerged as a promising alternative because of its distinctive physicochemical properties and potential for improved biological activity at appropriate dietary levels. This study investigates the effects of dietary nano-selenium supplementation on growth performance and serum biochemical parameters of Japanese quails. Experimental birds are provided with diets supplemented with different levels of nano-selenium and compared with an unsupplemented control group. Growth performance is evaluated through body weight, weight gain, feed intake, and feed conversion efficiency during the experimental period. At the end of the feeding trial, blood samples are collected to assess selected serum biochemical indicators associated with metabolic and physiological status. Parameters may include serum total protein, albumin, glucose, cholesterol, triglycerides, and liver-associated enzymes. The study aims to determine whether dietary nano-selenium can improve productive performance and maintain favorable biochemical profiles in Japanese quails. The findings are expected to provide useful information regarding the potential application of nano-mineral supplementation as a nutritional strategy in poultry production. This research may contribute to the development of more efficient trace-mineral supplementation approaches while supporting poultry health, productivity, and sustainable animal production. The study also provides a basis for further investigation of appropriate nano-selenium inclusion levels and their long-term effects in poultry nutrition.

FEWFM-43

Fisheries

Toxicology

TOXOCOLOGICAL INTERACTIONS OF POLYVINYL CHLORIDE MICROPLASTIC AND HEAVY METALS (CHROMIUM, BARIUM) IN FRESHWATER FISH *Tor putitora*

Zainab Bibi and Shehzad Ghayyur

Department of Zoology, Hazara University, Manshera

*Corresponding Author: zbibi4696@gmail.com

Contamination of freshwater ecosystems by microplastics and heavy metals has emerged as a significant environmental issue due to their harmful effects on aquatic life. Polyvinyl chloride (PVC) interacts with toxic metals like chromium (Cr) and barium (Ba), potentially altering their environmental behavior and toxicity. However, limited information is available regarding the combined toxic impacts of these contaminants on *Tor putitora* (golden mahseer). This study thus analyzed the individual and combined toxic effects of PVC microplastics, chromium, and barium by examining biochemical, antioxidant, neurotoxic, and molecular responses. *Tor putitora* were exposed to PVC-MPS, Cr, Ba, and their mixture for 60 days in a controlled laboratory environment. Serum biochemical indicators, activities of antioxidant enzymes, acetylcholinesterase activity, lipid peroxidation, and expression of stress, antioxidant, inflammatory, and apoptosis-associated genes were assessed through established biochemical and molecular methods. All treatments produced significant adverse effects, with the most pronounced effect by combined exposure. Serum ALT, AST, LDH, and ALP levels, GST activity, and lipid peroxidation markers (MDA and LPO) in gills and liver significantly increased, while antioxidant enzyme (CAT and SOD) and acetylcholinesterase activity experienced significant decreases. Gene expression analysis revealed significant upregulation of GST, BCL₂, HSP70, p53, and TNF- α and downregulation of CAT expression, suggesting enhanced oxidative stress, cellular stress, inflammatory

responses, and modulation of apoptosis-associated pathways, together with weakened antioxidant defense. Overall, the findings demonstrate that combined exposure to PVC microplastics, Cr, and Ba induces pronounced biochemical, oxidative, neurotoxic, and molecular alterations in *T. putitora*, with the combined treatment producing greater effects than the individual exposures.

FEWFM-44

Livestock Production

A CROSS-SECTIONAL STUDY OF FEED IMPACT ON GROWTH AND MILK PRODUCTION OF BUFFALO IN DISTRICT SIALKOT, PAKISTAN

Asma Waheed Qureshi and Sheeza Shahzadi

Chairperson, Department of Zoology, GC Women University Sialkot

*Corresponding Author: asma.qureshi@gcwus.edu.pk

A cross-sectional study carried out in the district of Sialkot, Pakistan to evaluate the impact of various feed types on buffalo growth and milk production. In local management systems, the study sought to ascertain how feed composition impacted buffaloes' overall body condition, milk yield, and milk quality. Data from dairy farms was collected using questionnaires, and the farmers were interviewed in person. Laboratory analysis of milk samples was used to assess quality parameters like fat, solids-not-fat (SNF), protein, lactose, density, freezing point, added water, and temperature. Tukey's HSD test and one-way ANOVA were used in statistical analyses to identify significant differences between feed types. The findings showed that buffalo development and milk production were significantly impacted by the diet mix ($p < 0.05$). Buffaloes fed a combination of green grass, silage, concentrates, and supplements had the highest mean milk production (12.9 L/day) and body weight (528.75 kg). There was also significant heterogeneity in milk content across feed groups. Buffaloes fed nutritionally adequate meals showed higher levels of fat ($7.53 \pm 1.69\%$), protein ($3.77 \pm 0.54\%$), and SNF ($9.06 \pm 1.30\%$). Freezing point and added water studies verified the milk samples' cleanliness, and lactose and density levels were within physiological ranges. The inclusion of silage and concentration feed improved rumen efficiency, enhanced energy availability, and led to better milk quality and yield.

FEWFM-45

Freshwater Biology

ECOTOXICOLOGICAL ASSESSMENT OF EMERGING POLLUTANTS IN FRESHWATER ECOSYSTEMS: A REVIEW

Muhammad Muneeb-ur-Rehman^{1*}, Unsar Naeem-Ullah¹, Madiha Mobeen Khan¹, Asif Farooq¹, Muhammad Imran Ali Khan² AND Aiman Mohsin¹

¹*Department of Entomology, MNS University of Agriculture, Multan, Pakistan*

²*Department of Pharmacy, MNS University of Agriculture, Multan, Pakistan*

*Corresponding Author: mmuneeburrehman97@gmail.com

Freshwater resources are among the highly valuable natural assets that sustain biodiversity in freshwater environments and contribute to the provision of vital ecosystem services for human well-being.

However, these ecosystems are now threatened by new pollutants such as pharmaceuticals, personal care products, per- and polyfluoroalkyl substances (PFAS), micro- and nanoplastics, engineered nanomaterials, chemicals from agricultural runoff, and substances suspected of hormonal activity. These pollutants pose significant threats to the environment due to their persistence, bioaccumulation, and the nature of their complex toxic effects. This review summarizes the scientific state of knowledge regarding the environmental and toxicological effects, mechanisms of action, and risk assessment strategies for emerging contaminants (ECs) in freshwater ecosystems. Microplastics (MPs) pose a multifaceted threat causing oxidative stress, metabolic disorders, immune-inflammatory responses, gut microbiota dysbiosis, DNA damage, and apoptosis across trophic levels from plankton to fish. MPs possess the ability to adsorb and transport other co-existing pollutants, potentially giving rise to synergistic effects that further exacerbate their toxicity. Risk Quotient (RQ) models have been used to assess the environmental risks of MPs; however, structure-specific methods are required to accurately evaluate the risks associated with chemical leaching from microplastics. Concerns are growing regarding PFAS contamination, particularly concerning the new types (congeners) that are replacing older compounds like PFOA and PFOS. Acute toxicity experiments conducted on *Daphnia magna* revealed that certain perfluoroalkyl ether sulfonates are more toxic (EC50: 24.56 mg/L) than the banned PFOS (EC50: 50 mg/L). A new class of pollutants, liquid crystal monomers (LCMs), exhibited high bioaccumulation and tissue-specific distribution in fish, with concentrations reaching up to 109,015 ng/g in intestinal tissues. Chronic exposure of *D. magna* to LCMs results in reproductive impairment, molting disruption and oxidative stress. Molecular evidence indicates that the mechanisms of action are related to endocrine disruption. The review highlights significant discrepancies between pollution levels and current regulatory measures and suggests that wastewater treatment plant infrastructure is generally not designed to remove these compounds. The results highlight the urgent need to develop risk assessment tools based on integrated mixtures, expand the list of pollutants subject to regulatory monitoring, and improve treatment technologies to mitigate the impacts of emerging pollutants on freshwater ecosystems and biodiversity. A better understanding of the environmental impacts of emerging pollutants will facilitate evidence-based environmental management, improved freshwater conservation plans, and the development of effective regulatory policies to protect aquatic life and biodiversity.

FEWFM-46

Wildlife

NESTING ECOLOGY AND STRUCTURAL ANALYSIS OF THE BANK MYNA (*ACRIDOTHERES GINGINIANUS*) IN CLIFF HABITATS

Muhammad Usman Mughal* and Muhammad Asif Gondal**

Department of Biosciences. COMSATS University Islamabad**

Corresponding Author: um2873470@gmail.com, asif.gondal@comsats.edu.pk

One example of a colonial nesting bird species is *Acridotheres ginginianus* referred to as the Bank Myna, which inhabits wooded plains of South Asia nesting in holes and crevices. The current work examines the nesting ecology of the Bank Myna on one of the natural cliffs, nest site distribution, structural patterns, internal morphology of nest holes and breeding behavior. The area of the research was a cliff that had 142 nest holes and was 25 feet (7.62 meters) high and 266 feet (81.08 meters) wide. The highest number of nests were in the range of 20 to 25 feet (6.09 to 7.62 meters) above ground, and this

result showed a preference of the lofty location in nests distribution. This vertical choice is probably to reduce predation risk and anthropogenic disturbance. The nest holes measured 30.48cm to 106.68 cm deep and 10.16 to 20.32 cm in diameter of entry and nesting materials were twigs, leaves, stems, and shrubs, and objects that had been altered by humans such as pieces of plastic. Average population in one nest was three to four chicks, and the behavior observations were confirmed to have monogamous pairs. To have a clearer understanding of the internal configuration of the nest cavities, plasters of Paris (POP) casts were made from two representative nest holes. The irregular shapes of these casts were examined using slicing techniques to estimate their internal surface areas. Each cast was sectioned into slices of known thickness, and the surface area of each slice was calculated using the formula mentioned in results. The total internal surface area of cast 1 was 1921 cm² (0.1921 m²) when it was divided into five slices. The total surface area of cast 2 was 4904 cm² (0.4904 m²) when it was divided into eight slices.

FEWFM-47

Fisheries

Toxicology

MITIGATION OF METFORMIN INDUCED HEMATOLOGICAL AND HISTOPATHOLOGICAL ALTERATIONS BY SILYMARIN IN *CATLA CATLA*

Moazama Batool*, Kanwal Shehzadi, Qurat Ul Ain, Saiqa Rauf, Sadia Maalik, Sajida Mushtaq and Sumayya Jalil

Department of Zoology, Government College Women University, Sialkot

**Corresponding Author: moazama.batool@gcwus.edu.pk

Current study was designed to investigate the protective role of silymarin against metformin-induced toxicity in *Catla catla*. For this, fish were exposed to metformin (80 µg/L), low dose silymarin (400mg/kg), high dose silymarin (800mg/kg). Experiment was conducted in two phases. During phase I, metformin toxicity was determined by exposing fish to metformin (80 µg/L) for 30 days and during phase II, low dose silymarin (400mg/kg) and high dose silymarin (800mg/kg) were administered for next 30 days. Results of hematological analysis revealed reduction in red blood cells, hemoglobin, mean corpuscular volume and hematocrit while elevated white blood cells, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration in metformin exposed groups. However, silymarin supplementation effectively restored the level of hematological parameters and ameliorate the metformin-induced toxicity with more prominent effect in high dose silymarin treatment. Similarly, metformin caused histopathological alterations in gills, liver, kidney and muscles of *Catla catla*. Gills showed fusion in primary and secondary lamellae, necrosis and aneurysm. In liver, pyknotic nuclei, activated kupffer cells, vacuolization, and focal necrosis were noticed. Degenerative necrosis, RBCs infiltration glomerulus shrinkage and Bowman's capsule dilation were observed in kidney tissues. In muscles, degenerative necrosis, and myocyte vacuolization were observed. Conversely, silymarin supplementation significantly normalized the histopathological alterations in tissues of respective organs. Hence, it was concluded that silymarin, a flavonoid derived from seeds of *Silybum marianum*, has anti-inflammatory and hepatoprotective activity against metformin-induced hematological and histopathological alterations in *Catla catla* emphasizing its potential use in aquatic toxicology and environmental protection.

FEWFM-48

Toxicology

Fisheries

SILYMARIN MEDIATED PROTECTION AGAINST METFORMIN-INDUCED TOXICITY BY MODULATING ANTIOXIDANT ENZYMES AND DNA INTEGRITY IN *CATLA CATLA*

**Sumayya Jalil¹, Moazama Batool^{*1}, Qurat Ul Ain¹, Saiqa Rauf¹, Sajida Mushtaq¹,
Sadiah Maalik¹ and Kanwal Shehzadi¹**

¹Government College Women University, Sialkot

^{**}Corresponding Author: moazama.batool@gcwus.edu.pk

Current study was designed to investigate the protective role of silymarin against metformin-induced toxicity in *Catla catla*. For this, fish were exposed to metformin (80 µg/L), low dose silymarin (400mg/kg), high dose silymarin (800mg/kg). Experiment was conducted in two phases. During phase I, metformin toxicity was determined by exposing fish to metformin (80 µg/L) for 30 days and during phase II, low dose silymarin (400mg/kg) and high dose silymarin (800mg/kg) were administered for next 30 days. Results of biochemical analysis of liver, kidney, muscles and gills manifested reduction in antioxidant enzymes activity of superoxide dismutase, peroxidase and catalase while increase in TBARs and reactive oxygen species in metformin exposed groups. However, silymarin supplementation effectively restore the antioxidant enzyme level and ameliorate the metformin-induced toxicity with more prominent effect in high dose silymarin treatment. Similarly, metformin caused DNA damage in kidney and liver in term of reduced head length and %DNA in head while increased in tail length, %DNA in tail and tail moment in exposed organs. Conversely, silymarin supplementation significantly normalized the DNA integrity in kidney and liver by increasing head length and %DNA in head while decreased tail length, %DNA in tail and tail moment with more noticeable change in high dose silymarin treated group. Hence, it was concluded that silymarin, extracted from seeds of *Silybum marianum*, has anti-inflammatory and antioxidative activity against metformin-induced oxidative stress and DNA damage in *Catla catla* emphasizing its potential use in aquatic toxicology and environmental protection.

FEWFM-49

Paleontology

ARTIODACTYL FAUNA FROM LATE MIOCENE DEPOSITS OF JHELM, PUNJAB, PAKISTAN

Amina Yasin¹, Khalid Mahmood², Muhammad Asim³ and Muhammad Akbar Khan¹

¹Dr. Abu Bakr Fossil Display & Research Centre, Institute of Zoology, University of the Punjab, Lahore

²Department of Zoology, Quaid-i-Azam University, Islamabad

³Department of Zoology, University of Narowal, Narowal

^{*}Corresponding Author: aminayasin6212@gmail.com

The Siwalik Group (18-0.6 Ma) has abundant fossil deposits of the Cenozoic Era. The Potwar Plateau, located in Northern Pakistan, is a tableland where the Siwalik Hills are more exposed. This

plateau provides an ideal natural laboratory for studying paleoclimatic changes along with tectonics and sedimentation over geological time. It preserves a diverse assemblage of vertebrate fauna that documents important evolutionary and paleoenvironmental changes during the Miocene. The new specimens recovered from Mohal Pati belong to the Middle Siwalik Dhok Pathan Formation belongs to *Tragoportax punjabicus*, *Hippopotamodon sivalense*, *Bramatherium grande*, *Propotamochoerus hysudricus*, and *Gazella* sp. These specimens provide important evidence for faunal diversity, ecological adaptations, and habitat structure of the Siwaliks from the Middle to Late Miocene. This study provides information about Siwalik paleoecology and helps to refine the biostratigraphic framework of the Middle Siwalik.

FEWFM-50

Wildlife

EVALUATION OF STRESS IN NEWLY IMPORTED WILD ANIMALS IN SAFARI ZOO LAHORE THROUGH THE FOCAL METHOD OF BEHAVIOR MONITORING**Tehreem Fatima and Bushra Nisar Khan^{1*}**¹*Institute of Zoology, University of Punjab, Lahore, 54590**Corresponding Author: bushra.zool@pu.edu.pk and bushrank2007@gmail.com

The stress levels of newly imported wild animals at Safari Zoo, Lahore, were assessed by the focal method of behavioral observation and fecal cortisol analysis. Behavioral data was collected during and after-quarantine utilizing an ethogram to document aggressive, submissive, active, and passive behaviors. Confinement in isolated enclosures during quarantine significantly increased signs of stress. Aggressive behaviors, including shoving and head shaking, were most prevalent during quarantine, especially in blue bulls (2.97 ± 0.22), whereas submissive behaviors, including as head lowering, were notable in Arabian oryx (1.87 ± 0.16). Active behavior, such as self-play and movement, were limited across all species, indicating stress associated to confinement. After-quarantine, there was a significant reduction in the incidence of aggressive behavior (1.96 to 0.53) and its duration (1.93 ± 0.81) suggesting improved adaptation to enclosures. Passive behaviors, including resting, emerged in animals like ostriches and addax, whereas active behaviors, such as movement and feeding, intensified. Cortisol levels, a physiological indicator of stress, significantly decreased post-quarantine: from 133.06 ± 0.11 to 115.31 ± 0.19 in ostriches, from 376.08 ± 0.16 to 343.52 ± 0.01 in addax, from 283.16 ± 0.12 to 127.92 ± 0.01 in Arabian oryx, and from 576.16 ± 0.23 to 400.01 ± 0.00 in blue bulls. The results indicate that quarantine affects the behavior and stress levels of wild animals, highlighting the necessity of integrating ethological observations with fecal cortisol assessments to improve their wellbeing during acclimation.

FEWFM-51

Livestock Production

**CIRCULAR BIOECONOMY INTEGRATION OF BLACK SOLDIER FLY
BIOCONVERSION, BIOFERTILIZER, AND MUSHROOM PRODUCTION:
A ONE HEALTH, BIOSAFETY-ORIENTED MODEL**

**Abdul Rehman¹, Omer Naseer², Muhammad Moazam Jalees*¹, Firasat Hussain¹, Rais Ahmed¹,
Faisal Siddique¹, Muhammad Arif¹ and Umaima Nadeem¹**

¹*Department of Microbiology, Cholistan University of Veterinary and Animal Sciences, Bahawalpur*

²*Department of Veterinary Medicine, Cholistan University of Veterinary and
Animal Sciences, Bahawalpur*

*Corresponding Author: mmoazamjalees@cuvas.edu.com

Agricultural and livestock activities in Punjab, Pakistan generate large quantities of organic waste, including livestock manure, poultry litter, crop residues, and food waste, much of which is burned, dumped, or left to decompose, causing environmental pollution and loss of recoverable resources. Existing waste-management approaches generally treat these streams separately and rarely integrate resource recovery with microbiological safety assessment. We propose an integrated circular bioeconomy model combining Black Soldier Fly (*Hermetia illucens*) bioconversion, biofertilizer production, and mushroom cultivation through a waste-cascade system built on relationships supported by prior bioconversion research rather than assumed feedstock proximity. The model separates Black Soldier Fly rearing into a feed production pathway (kitchen and food waste, intended for poultry and fish feed) and a fertilizer production pathway (manure and poultry litter, directed to non-feed use), reflecting documented feed-safety risk associated with manure-derived insect substrate. Frass from both pathways will be processed into compost and biofertilizer. Spent mushroom substrate, cultivated on wheat straw, cotton waste, and sugarcane bagasse, will be reused as a secondary Black Soldier Fly feedstock. Microbiological safety will be assessed using culture- and PCR-based detection of major bacterial pathogens to establish microbiological criteria distinguishing manure- from food-waste-derived batches, with only qualifying batches considered suitable for their intended use. Expected outcomes include measurable diversion of agricultural waste from open burning and dumping, a bacteriologically validated feed and fertilizer production framework, and a scalable, biosafety-oriented model for circular agriculture within a One Health framework.

FEWFM-52

Fisheries

**SYNERGISTIC EFFECTS OF FENUGREEK SEED AND PROBIOTIC SUPPLEMENTATION
ON GROWTH PERFORMANCE OF *LABEO ROHITA***

Muhammad Rafiq and Sana Ashraf

Department of Zoology, The University of Lahore, Lahore

Corresponding Author: sanaashrafdr@gmail.com

The present study was planned to evaluate the growth performance with the combined effects of probiotics and fenugreek by adding in the supplementary diet of *Labeo rohita*. Freshwater fish (*Labeo rohita*) was selected for the experiment due to market demand and consumer preference.

Different studies were carried out to obtain maximum yield with low cost and easily locally available ingredients. Three test diets, T1 (fenugreek), T2 (probiotic) and T3 (fenugreek and probiotic) as a feed additive in commercial feed were formulated and fed with a ratio of 5% of fish body weight per day for sixty days. Weight gain, total length increase and other growth parameters were recorded fortnightly. Specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER) and survival rate were determined and compared statistically. The combined effects of probiotics and fenugreek in fish diets significantly boosted the growth performance and parameters ($p < 0.05$). In the end, it was noticed that fingerlings of *Labeo rohita* fed with test diet T3 performed a remarkable increase in final average weight and total length as (38.06±0.25) and (19.50±0.05) respectively followed by other treatments T2, T1 and T0. The results showed that the best growth performance in different treatments was in $T3 > T2 > T1$. Water quality parameters were also monitored and maintained to their optimal range for fish culture, which proves the survival of 100% at the end of the experiment.

FEWFM-53

Wildlife

SPECIES COMPOSITION, DIVERSITY, AND ABUNDANCE OF MIDWINTER WATERFOWL IN WETLANDS OF DISTRICT MIANWALI, PUNJAB, PAKISTAN**Muhammad Irfan and Sana Ashraf***Department of Zoology, The University of Lahore, Sargodha Campus**Corresponding Author: Sanaashrafdr@gmail.com

Waterfowl population was surveyed at three sites (Chashma barrage, Jinnah barrage, Namal Lake) of District Mianwali to know the diversity of waterfowl from July 2021- February 2022. During study period total 43,212 birds of 14 waterfowl species are recorded from three sites of District Mianwali. Dominant species was Eurasian coot (*Fulica atra*) with a total number of 21,012 birds and White-headed gull (*Larus marinus*) observed in minimum number. Other species recorded from the sites were Red wattled Lapwing (*Vanellus indicus*), Indian Pond Heron (*Ardeo lagrayii*), Neotropic Cormorant (*Nannopterun brasillianum*), Pied kingfisher (*Ceryle rudis*), Little Egret (*Egretta garzetta*), Cattle Egret (*Bubulcus ibis*), White Breasted Waterhen (*Amaurornis phoenicurus*), Common Red Shank (*Tringato tanus*), Crow Pheasant (*Centropus sinensis*), Little Grebe (*Tachybaptus ruficollis*), Mallard (*Anas platyrhynchos*), Gray Heron (*Ardea cinerea*). The population of waterfowl was found to be declining. These findings imply that the habitat must be protected to preserve the waterfowl population, which is a crucial biotic component of the ecosystem.

FEWFM-54

Fisheries

Toxicology

HISTOPATHOLOGICAL ASSESSMENT OF TITANIUM DIOXIDE NANOPARTICLE-INDUCED TOXICITY IN THE VITAL ORGANS OF *CTENOPHARYNGODON IDELLA***Sobia Nawaz and Sana Ashraf***Department of Zoology, The University of Lahore, Lahore*

Corresponding Author: sanaashrafdr@gmail.com

The aim of current study was to analyze the histopathological changes in the organs of *Ctenopharyngodon Idella*. Titanium dioxide nanoparticles (TiO₂ NPs) were widely produced and released into the environment, posing a serious threat to fish and human health. Titanium dioxide nanoparticles (TiO₂-NPs) have the greatest industrial application compared to other nanoparticles. Four million TiO₂ nanoparticles are consumed annually as pigments in a wide range of products, including food colorings, cosmetic industry paper products, ink, and plastic products. A 60-day feeding experiment was conducted to evaluate the effect of TiO₂-NPs on grass carp (*Ctenopharyngodon Idella*) histology. Titanium dioxide nanoparticles at different concentrations (0.5 mg/L, 1 mg/L, 1.5 mg/L, 2 mg/L) were incorporated with fish diet during an 8-week period. Histopathology of vital organ gills, heart, liver, and intestine were examined. After treatment of titanium dioxide nanoparticle histopathological analysis organ showed in gill hyperplasia, necrosis, curvature and mucos secretion. In heart dispersion and swelling were reported. In liver cloudy swelling and hydropic degeneration was reported. In intestine there were signs of necrosis, degeneration and dysplasia in intestine.

FEWFM-55

Fisheries

ASSESSMENT OF THE EFFECTS OF DIETARY ALOE VERA (ALOE BARBADENSIS) SUPPLEMENTATION ON INTESTINAL MORPHOLOGY AND GROWTH PERFORMANCE OF *LABEO ROHITA***Sana Ashraf***Department of Zoology, The University of Lahore, Lahore*

Corresponding Author: sanaashrafdr@gmail.com

Labeo rohita (Rohu) and *Catla catla* (Thaila) are commercial species of Pakistan and main food items of aquaculture. From Pakistan, carps examined as a main source of protein. The base of this study is to enhance the growth of *Labeo rohita* under special dietary conditions. The aim of this study is to check the effect of traditional herb *Aloe barbadensis* on intestinal villi morphology. Initial stocks of fingerlings of *Labeo Rohita* having average weight 14.30g were bought from Government Fish Hatchery, Faisalabad. *Aloe barbadensis* leaf's powder was prepared and mixed with different concentrations of feed. This feed was applied for 90 days to test the effect of *Aloe barbadensis* leaf's powder on the growth and histopathology of *Labeo rohita*. The fish feed was

prepared by using person square method. At the end of feeding trial three fishes from each aquarium were selected randomly for analysis of pyloric caeca. According to the results, different levels of *Aloe barbadensis* leaf's powder had effect on survival rates and intestinal villi morphology of the fish in different groups.

FEWFM-56

Marine Biology

TAXONOMIC AND MORPHOMETRIC ANALYSIS OF *OPHIOTHRIX SAVIGNYI* (ECHINODERMATA; OPHIUROIDEA) FROM THE INTERTIDAL COAST OF PAKISTAN

Nadia Ashfaq and Noor Us Saher*

Centre of Excellence in Marine Biology, University of Karachi

*Corresponding Author: noorusaheer@yahoo.com

Brittle stars of genus *Ophiothrix* (Family Ophiotrichidae) are essential components of intertidal benthic marine communities but baseline taxonomic and quantitative morphometric data for populations along the Northern Arabian Sea is limited. This study is based on morphology and morphometric assessment of *Ophiothrix savignyi* collected during 2023-2025 from the intertidal areas of Buleji and Manora along the coast of Pakistan. Diagnostic features were studied using classical taxonomic methodologies such as oral frame architecture, distribution of disk spinelets, radial shield configuration and series of arm plates. Species level discrimination for two populations was confirmed by oral disk ornamentation and distinct arm plate pigmentation patterns. Quantitative morphometrics measured wet weight (WT: 2.1–4.2 g), disk diameter (9.0–22.0 mm), disk radius (r), maximum arm length (R: up to 130.0 mm), mean arm length (AL mean), and the major-to-minor radius ratio (R/r). The calculated R/r ratios ranged from 10.55 to 22.22 for the specimens examined, which may be the effect of natural variations in proportions, as well as structural changes following arm loss or regeneration. These findings establish critical quantitative morphometric baselines and detailed structural characterizations for *Ophiothrix savignyi* along the Pakistani coast, offering reliable diagnostic frameworks for regional echinoderm biodiversity assessments and classical taxonomic identification without sole reliance on molecular workflows.

FEWFM-57

Marine Biology

SPATIAL SIZE DISTRIBUTION AND MORPHOMETRICS AND SEXUAL DIMORPHISM IN *DIOGENES AVARUS* HELLER, 1865 (ANOMURA, DIOGENIDAE)

Noor Us Saher* and Altaf Hussain Narejo

Centre of Excellence in Marine Biology, University of Karachi, Karachi, Pakistan

*Corresponding Author: noorusaheer@yahoo.com

Diogenes avarus Heller (1865) is widely found in the study area, yet ecological and morphometric studies are scarce due to their lack of commercial value. This study aimed to evaluate the distribution,

sexual dimorphism, sexual maturity, and relative growth of this species. Hermit crabs were collected from six coastal locations in Pakistan (Sonmiani, Sonari, Buleji, Manora, Sandspit, and Mubarak Village) between 2017 and 2019. For morphometric analysis, crabs were sorted, weighed, and measured across key variables, including Cephalothoracic Shield Length (CSL), total length (HCTL), chela length (CL), chela width (CW), and weight (HCW). A total of 173 males, 75 females and 7 ovigerous females were collected for the study on *D. avarus*. The maximum abundance of *D. avarus* was reported from Sonari and minimum from Mubarak village. All sites had male-biased populations. Significant differences were found in carapace length (CL), carapace height (HCTL), and shell length (SL) among the six coastal populations for males, while only HCTL and CL were significant for females. In general males were larger and had longer chelae except at Sonari beach where female sizes were comparable. This study adds novel information on sexual dimorphism and growth of *D. avarus* along the coast of Pakistan and fills a gap in regional studies of this genus.

FEWFM-58

Fisheries

LENGTH WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *JOHNIUS DUSSUMIERI* (PERCIFORMES; SCIAENIDAE) ALONG THE COAST OF PAKISTAN

Abdul Hameed and Noor Us Saher

Centre of Excellence in Marine Biology, University of Karachi

*Corresponding Author: Hameedbaluch@gmail.com

The Sciaenidae family, known as croakers, includes 66 genera and 286 species worldwide and is commonly caught in Pakistan using gillnets, seine nets, and trawl nets. This fish is significant in diets due to its affordability and taste. The study aimed to analyze the length-weight relationship and condition factor of *Johnius dussumieri*, with samples collected from Karachi fish harbor. Weight and total length were measured, and the correlation between length and weight was assessed using least squares regression to calculate the condition factor. The correlation between length and weight serves as significant indicators of stock quality when a species is integrated into a higher food web. In the present study, the slope "b" values of the length-weight equations were determined, revealing a value of $b=2.87$ for *Johnius dussumieri*, which suggests a negative allometric growth pattern. The coefficient of determination, denoted as " r^2 ," was reported at 58.2, indicating a weak relationship between length and growth. The health status of the fish was assessed using Fulton's condition factor. The estimated "k" value suggested that the analyzed fish population was generally in a favourable physiological condition. The results indicate the overall resilience and adaptability of fish communities inhabiting the region's variable aquatic environments. Furthermore, the condition factor implies that the fish population is predominantly healthy in their existing habitat, attributed to the sufficient availability of nutrition.

FEWFM-59

Marine Biology

MORPHOMETRY, RELATIVE GROWTH AND CONDITION FACTOR OF FIVE SPECIES OF FAMILY DOROSOMATIDAE FOUND IN COASTAL WATERS OF PAKISTAN**Muhammad Tabish and Noor Us Saher***Centre of Excellence in Marine Biology, University of Karachi, Karachi, Pakistan**Corresponding Author: M.tabish163@gmail.com

This study investigates the morphometric relationships and condition factors among five species of the Dorosomatidae family (order Clupeiformes) using 1,099 specimens collected from three landing sites along the coast of Pakistan. The research examines length-weight and length-length relationships via the equation $Y = a + bx$. The findings demonstrate significant variation among species, with total length closely proportional to standard length, body depth, and fork length. The high r^2 values indicate that these morphometric characters can serve as reliable predictors for analyzing fish length. The investigation analyzed the relationship between total weight (TW) and various lengths (TL and SL) for seven fish species. The "b" values varied across species, with *Anodontostoma chacunda* (TW vs TL: 3.107; TW vs SL: 3.023) and *Nematalosa nasus* (TW vs TL: 3.365; TW vs SL: 3.272) showing notable results. Proportional data demonstrated r^2 values ranging from 70% to 95%, indicating a strong model fit. The condition factor K, observed between 0.8 and 1.10, suggested that the fish were in good condition. The findings highlight the importance of monitoring length-weight relationships (LWR) and condition factors for effective fish stock management in commercial fisheries.

FEWFM-60

Marine Biology

PRESERVATIVE POTENTIAL OF FISHERY WASTE THROUGH CHITIN EVALUATION AND BIOCHEMICAL CHARACTERIZATION**Abraira Mukhtar and Noor Us Saher***Centre of Excellence in Marine Biology, University of Karachi**Corresponding Author: noorusaher@yahoo.com

The increasing focus on sustainable practices has directed research into the biochemical properties of marine by-products like crustacean shells and fish scales. Understanding the primary biochemical constituents of these shells allows for a comparative analysis of their characteristics. Both have chitin as a major component but variation in deacetylation and bioactive compounds can alter the functional use. Chitin is a biopolymer and polysaccharide (after cellulose) that is found in the exoskeletons of arthropods and in the cell walls of fungi. The present work is aimed at analyzing the biochemical composition and methods of extraction of chitin from bio waste of crab and shrimp species with emphasis on potential applications of chitin. Samples were collected from Karachi Fish Harbor and processed by purification and drying. Interspecific proximate composition was determined by several methods mostly by chitosan extraction, extracted according to Abdou's protocol. The biochemical components such as proteins, carbohydrates, lipids and moisture content showed significant difference between the two types of biowastes i.e. Crab shells, and Shrimp shells. Small variations were observed in the mean protein concentrations, whereas the total carbohydrate contents of the crab shell and shrimp shell samples showed significant differences (DF=4; F-

Value=4.03; P-Value=0.031). There were also significant differences in the total concentration of chitin among species of crab and shrimp shell samples (DF=4; F-Value=9.76; P-Value=0.002). The crab species studied probably had the highest levels of carbohydrates and Chitosan because it uses stored carbohydrates as energy when in cooler temperatures.

FEWFM-61

Marine Biology

**THE EFFECT OF TIDES ON THE DIVERSITY AND DISTRIBUTION OF ZOOPLANKTON
IN THE SONMIANI BAY WATERS, PAKISTAN****Zara Imdad and Noor Us Saher***Centre of Excellence and Marine Biology (CEMB), University of Karachi**Corresponding Author: noorusaher@yahoo.com

Zooplankton are aquatic organisms of sizes ranging from micrometers to meters, showcasing significant taxonomic diversity. They play a critical role in the biological pump, transferring organic carbon from ocean surfaces to deeper layers, which is essential for the carbon cycle. Furthermore, zooplanktons are important for ecological functions, and as a food source for planktivorous fish and indicators of water quality. The present study was designed to study the diversity of zooplankton species in waters of Sonmiani and effect of tidal fluctuations on these species. This study was carried out in the Sonmiani Bay, Pakistan (May 2021 to April 2022) where zooplankton samples were collected and examined microscopically. A variety of groups were identified, including Medusae, Copepoda, Mysids, and others, with Copepods and Mysids being especially abundant. The study revealed significant tidal variation in zooplankton diversity and abundance with higher abundance recorded during high tide than low tide.

FEWFM-62

Marine Biology

**COMPARATIVE BIOCHEMICAL COMPOSITION OF THREE SPECIES OF SEA
CUCUMBERS (ECHINODERMATA: HOLOTHUROIDEA): THE DIETARY POTENTIAL
FROM PAKISTAN COAST****Aqsa Shabbir and Noor Us Saher***Centre of Excellence in Marine Biology, University of Karachi**Corresponding Author: noorusaher@yahoo.com

Research on marine invertebrates, especially echinoderms, highlights their nutritional benefits for human health. This study focused on the biochemical composition of three sea cucumber species in relation to size, specifically moisture and carbohydrate contents. Sea cucumbers, significant in marine ecosystems and they are rich in essential amino acids, fatty acids, minerals, and bioactive compounds, making them a valuable food source for humans. The biochemical composition was determined in three sea cucumber (*Holothuria scabra* Jaeger, 1833, *Holothuria impatiens* (Forsskål,

1775), and *Holothuria arenicola* Semper, 1868) species. For this study, the specimens were collected from the Karachi rocky beach of Buleji and Mubarak village, with biochemical components such as proteins, carbohydrates, and lipids estimated through established methods: the Bradford Method for proteins, Dubois et al.'s technique for carbohydrates, and Folch et al.'s protocol for lipids. The proximate composition analysis revealed significant variations in protein and carbohydrate levels based on the species and size of the sea cucumber, with moisture content also varying across size groups. This study highlights the diverse eating practices regarding fresh or dried sea cucumbers internationally and offers foundational insights into the biochemical composition and nutritive value for the future sustainable utilization, export and culture for these species.

FEWFM-63

Marine Biology

BIOCHEMICAL COMPOSITION OF TWO SPECIES OF MANTIS SHRIMP (CRUSTACEA; STOMATOPODA) FOUND IN COASTAL WATERS OF PAKISTAN**Wafra Matanat¹ and Noor Us Saher²**¹Marine Reference Collection and Resource Centre, University of Karachi²Centre of Excellence in Marine Biology, University of Karachi

*Corresponding Author: noorusaher@yahoo.com

Mantis shrimp, shrimp, and crabs could be a balanced human diet and used as an alternative dietary supplement of protein, vitamins, and minerals in the body because fish and shellfish meat is thought to be highly nutritious due to its content of essential amino acids and proteins. Moreover, they include significant amounts of digestible proteins, essential amino acids, bioactive peptides, long-chain polyunsaturated fatty acids, astaxanthin and other carotenoids, vitamin B12 and other vitamins, minerals, copper, zinc, inorganic phosphate, sodium, potassium, selenium, iodine, and other nutrients that provide the consumer with a range of health benefits. Consuming shellfish on a daily basis may improve heart and brain health, strengthen immunity, and help with weight loss. Because omega-3 fatty acids, which make up the majority of the fat in shellfish, provide a number of health advantages, including enhancing heart and brain function. The current study aimed to determine the proximate composition of two species of Mantis shrimp, *Erugosquilla woodmasoni* (Kemp, 1911) and *Erugosquilla hesperia* (Manning, 1968). The two species under study showed intraspecific and interspecific differences in proximal composition. For this investigation, the specimens were obtained from the Karachi Fish Harbor, and biochemical components such as proteins, carbohydrates, and lipids were evaluated using recognized methods: the Bradford Method for proteins, Dubois et al.'s methodology for carbohydrates, and Folch et al.'s protocol for lipids. Total protein content and carbohydrate percentages differed between males and females of both species, as did total lipid percentages, which ranged from 3.00% to 4.00% in males and 2.97% to 4.01% in females.

FEWFM-64

Livestock

**EFFECT OF NUTRITIONAL SUPPLEMENTATION ON MILK YIELD, HEALTH
AND GROWTH OF DOMESTIC GOATS; AN EPIGENETICS PERSPECTIVE
DISTRICT KHAIRPUR, SINDH, PAKISTAN**

Majeeda Ruk and Javed Ahmed Ujjan

Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh, Pakistan

Correspondence: javed.ujjan@salu.edu.pk

Goat farming plays an important role in supporting rural livelihoods, household nutrition, and food security in District Khairpur, Sindh, Pakistan. However, inadequate or unbalanced nutrition may adversely affect the growth, health, and productive performance of domestic goats. The present study aims to evaluate the effects of nutritional supplementation on milk yield, milk quality, health status, and growth performance of domestic goats, with particular emphasis on the potential role of epigenetic regulation. Supplemented goats will be compared with non-supplemented control animals using a range of physiological, hematological, biochemical, and productive parameters, including body weight, body condition score, hematological and biochemical profiles, milk yield, and milk composition. To explore the molecular mechanisms underlying the effects of nutritional intervention, epigenetic analysis, particularly assessment of DNA methylation patterns, will be conducted to identify possible nutrition-associated molecular changes. The study is expected to provide evidence that improved nutritional supplementation can enhance goat productivity, health, and growth through both physiological and epigenetic mechanisms. The findings may contribute to the development of cost-effective, locally appropriate, and sustainable feeding strategies for goat farmers in District Khairpur. Furthermore, the study may support improved livestock productivity, household nutrition, and rural economic development in Sindh, Pakistan.

FEWFM-65

Toxicology

**STUDY OF ARSENIC ACCUMULATION IN WATER AND MUSCLE OF *LABEO ROHITA*
AND *WALLAGO ATTU* COLLECTED FROM RIVER SUTLEJ, PAKISTAN**

Shoaib Ahmad, Sumaira Abbas¹, Asia Iqbal, Hanzala Yasin and Yousaf Masih

¹*Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences, Lahore*

²*Department of Wildlife & Ecology, University of Veterinary and Animal Sciences, Lahore*

*Corresponding Author: sumaira.abbas@uvas.edu.pk

Arsenic concentrations were investigated in the muscle of two freshwater species including *Labeo rohita* and *Wallago attu* and water sample of two major fishing sites (Sulemanki Headworks and Islam Headworks) of River Sutlej, Pakistan. Ten samples of each fish species collected from each sampling site during experimental trail. Wet acid digestion process was performed to digest the muscle samples after then; the technique of atomic absorption spectrophotometry was used to check the arsenic concentration. Comparison of both Headworks, the fish collected from Sulemanki Headworks showed higher weight (884.36 ± 54.51 g), and *Labeo rohita* collected from Islam Headworks lesser (863.80 ± 29.06 g). The total

average weight (gm) of *Labeo rohita* collected from both Headworks was 874.10 ± 14.57 for six months. The average weight of *Wallago attu* was sampled from Sulemanki Headworks was higher (875.53 ± 64.64 gm) as compared to Islam Headworks (860.20 ± 35.66 gm). The total average weight (gm) of *Wallago attu* collected from both Headworks was 867.86 ± 10.84 gm for the arsenic estimation in its muscle. Additionally, muscle sample of *Labeo rohita* and *Wallago attu* collected from Islam Headworks in September (2.08 ± 0.155^c) and (2.94 ± 0.139^b) showed lesser ($P \leq 0.05$) concentration of arsenic ($\mu\text{g/g}$) as compared to other months of sampling. The *W. attu* showed higher concentration sampled from both sites. While *L. rohita* showed lesser concentration of arsenic. The water of Islam Headworks showed higher arsenic concentration as compared to water sample collected from other sampling site. On monthly basis, the arsenic concentration in water (upstream + downstream) sample of Sulemanki Headworks and Islam Headworks was lesser in September. On the other hand, the water samples collected from Sulemanki Headworks showed higher concentration of arsenic (upstream=16.25 and downstream=11.19) mg/L collected in month of December. While water sample collected from Islam Headworks showed higher concentration of arsenic (upstream=18.35 and downstream=14.34) mg/L in February. Safe and strict measures should be taken to protect our freshwater sources from this deadly contamination. Varying levels of arsenic were found in the water and fish species of River Sutlej (Islam Headworks and Sulemanki Headworks). Although both sampling sites showed varying levels of arsenic in both water and fish samples. Overall, arsenic concentration was found high in carnivorous fish species (*Wallago attu*) as compared to herbivorous fish species (*Labeo rohita*). Arsenic in fish and water was found to be higher than permissible values of arsenic set by EPA (Environmental Protection Agency). Fish from experimental sites is not safe to be consumed.

FEWFM-66

EVALUATING AND DOCUMENTING THE CURRENT STATUS AND CHALLENGES OF PAKISTAN'S BIRDS THROUGH CITIZEN SCIENCE

Nosheen Iqbal¹, Nehafta Sabir² and Munawar Saleem Ahmad¹

¹Department of Zoology, University of Swabi, Swabi, KPK.

²Department of Zoology, Govt Girls Degree College, Mansehra

Corresponding Author: saleemsbs@gmail.com

One of the most critical environmental challenges in the modern era is slowing the decline of biodiversity caused by habitat destruction, climate change, and other human disturbances. Birds act as effective biomonitoring tools for assessing ecosystem's functioning, yet their population is currently declining at an alarming rate. Besides this ecological significance, comprehensive and updated information on country bird's diversity remains limited. Such assessments have traditionally relied on data derived from extensive, long-term and systematic surveys that require significant resources, thereby limiting their feasibility to a few regions of world. Assessment of bird populations now uses both expert surveys and citizen science, which provide more reliable insights into population dynamics and threats. Citizen science enables volunteers to collect observational data, helping to fill the gaps in professional research and improve overall understanding. Despite rich bird diversity and position along key migratory flyways, Pakistan lacks systematic, large-scale data on bird population. So, this study aims to provide a baseline assessment of the status of the Pakistan's birds using citizen-science data from eBird. We also examine the potential impact of climate change on bird population, including population decline across different ecoregions of Pakistan. The data were collected using eBird from 1st June 2010- 31st May 2025. We

processed this data to remove the incomplete data records, duplicated checklists, and inconsistent coordinates. Spatial variation in species diversity was analyzed based on around 240 spatial grid cells. Bird counts in each grid were compiled by seasons. Bird diversity was estimated per grid cell and season, while climatic variables such as temperature and rainfall were extracted from the WorldClim database. Ecoregions were included as categorical variables to determine biodiversity heterogeneity in various regions. Negative binomial regression models were used to establish correlations between bird diversity and climatic variables. Bird species richness from eBird was analyzed seasonally and spatially using descriptive statistics and negative binomial regression to assess climatic, elevational, and eco-regional effects. After analysis of data, we found a total of 498 species during autumn which become a season with the highest richness of bird's species in Pakistan. Species richness was varied substantially across each spatial grid cells. The effect of ecoregions on species richness was highly significant where Mountain Forest ecoregion showed the highest mean richness. A significant negative effect on richness was showed by temperature while rainfall had a positive effect. This study indicates that status of Pakistan's birds is influenced by the seasons, ecoregions and climatic factors. Based on our results, we recommend strengthening of long-term bird monitoring in Pakistan by integrating citizen science platforms with systematic surveys. Conservation efforts should prioritize high diversity eco-regions, especially mountain forest. Policy makers should incorporate climatic variables to reduce the influence of climate change on bird's populations. We also recommend that Pakistan's wildlife societies should actively participate in bird's conservation.

FEWFM-67

Marine Biology

ABUNDANCE, DISTRIBUTION AND DIVERSITY OF PLANKTONIC CILIATES IN GADANI SHIP BREAKING AREA (NORTHERN ARABIAN SEA)

Nafisa Shoaib* and Roomana Yasmeen

Centre of Excellence in Marine Biology, University of Karachi, Karachi-75270

Corresponding Author: nafisashoaib@gmail.com

Planktonic ciliates constitute main, diverse, ubiquitous group of protozoa in the marine pelagic ecosystem. They play an important role in the transfer of energy to the higher trophic level in the marine food web. In marine ecosystems, ciliates have great functional diversity as producers, consumers and decomposers of food webs. The sea water samples were collected from Gadani ship breaking area for the period of one year. The sea water samples were collected using Niskin 1.7L bottle from 1 meter depth the abundance and diversity of planktonic ciliates and physicochemical characteristics were determined. The present results demonstrate 128 ciliates species classified into 56 genera from Gadani coasts. There seems to be comparatively variation in the specie composition of planktonic ciliates. The results showed that the loricate dominated the heterotrophic ciliate community. The microzooplanktons have a significant role in the energy transfer in the marine ecosystem, the change in structure, composition and biodiversity of planktonic ciliates reflects on the fisheries industries. Pollution is a threat and damage that can be caused to fishery industry, environmental and human health. Therefore, there is an essential requirement to monitor the microplankton community with respect to abundance and diversity as it is associated with marine environment and human health.

FEWFM-68**ECOLOGICAL ASSESSMENT OF KEENJHAR LAKE: BIODIVERSITY, CRITICAL HABITATS AND CONSERVATION PRIORITIES****Bargazida Sabahat and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*Corresponding Author: zali.zool@pu.edu.pk

Keenjhar Lake is one of Pakistan's most important freshwater ecosystems, supporting diverse aquatic, terrestrial, and avian communities while providing essential ecosystem services to surrounding human populations. This study assessed the hydrological and ecological characteristics of Keenjhar Lake, with particular emphasis on biodiversity distribution, critical habitats, seasonal ecological patterns, and emerging anthropogenic pressures. The assessment integrated field-based ecological surveys with remote sensing and spatial analysis to characterize aquatic zones, shoreline habitats, and adjacent terrestrial areas within a defined ecological buffer. Biodiversity hotspots and areas of conservation significance were identified through spatial mapping of species occurrence and habitat characteristics. Key environmental parameters, including water quality, sediment characteristics, aquatic and terrestrial vegetation, and habitat condition, were evaluated to assess ecosystem health and ecological integrity. Attention was given to migratory waterbirds and other species of conservation concern that depend on the lake and its associated habitats. The study further evaluated major anthropogenic pressures, including water abstraction, pollution, shoreline modification, and land-use change, and examined their potential implications for habitat quality and biodiversity persistence. Stakeholder consultations were incorporated to identify local perceptions, resource-use practices, management challenges, and opportunities for collaborative conservation. The findings provide an integrated ecological baseline for identifying priority habitats and management interventions. Science-based recommendations are proposed for maintaining hydrological integrity, reducing anthropogenic pressures, conserving critical habitats, and promoting sustainable use of lake resources. The study highlights the importance of integrated, landscape-scale management for safeguarding Keenjhar Lake as a biodiversity refuge and ecologically significant wetland.

FEWFM-69

Wildlife

CRITICAL HABITAT ZONES, WILDLIFE CORRIDORS, AND PRIORITY CONSERVATION AREAS IN PUNJAB'S FRAGMENTED PROTECTED AREA NETWORK**Mudasser Hassan and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*Corresponding Author: zali.zool@pu.edu.pk

Habitat fragmentation and protected area isolation represent the primary threats to biodiversity persistence in densely populated agricultural landscapes. This study presents the first spatial synthesis of connectivity, corridor mapping, and priority conservation zoning across eight national parks in Punjab, Pakistan, using multi-taxa vertebrate assemblages (656 species) and distance-

weighted connectivity modeling. We applied Jaccard similarity matrices, exponential distance-decay functions, and betweenness centrality analysis to quantify ecological connectivity and identify critical corridor gaps. The network exhibits a pronounced distance-decay relationship ($r = -0.72$ between Jaccard similarity and inter-park distance), with connectivity probability declining to <0.05 beyond 200 km. Salt Range emerged as the highest-priority conservation hub (betweenness centrality = 1.000, Priority Conservation Index = 0.568), followed by Chinji (0.979, 0.697) and Tilla Jogian (0.734, 0.680). Critical corridor gaps were identified between Lal Suhanra and all northern parks (gap severity >400), between Kheri Murat and Salt Range (severity = 358), and between Pabbi Rasul and Tilla Jogian (severity = 348), where high ecological similarity coincides with low connectivity probability due to distance and anthropogenic barriers. Class-specific connectivity analysis revealed that mammals exhibit the lowest mean connectivity (0.041) due to dispersal limitation, while birds maintain the highest (0.063) due to flight-mediated movement. A multi-criteria conservation zoning framework identified four functional zones: Core Zones (Salt Range, Chinji, Tilla Jogian) for strict protection; Buffer Zones (Kala Chitta, Kheri Murat, Pabbi Rasul) for restoration; Corridor Zones (Chinji–Salt Range, Pabbi Rasul–Tilla Jogian, Salt Range–Kheri Murat) for connectivity enhancement; and Research Zones (Murree-Kahuta-Kotli, Lal Suhanra) for monitoring. These findings provide a spatially explicit foundation for evidence-based conservation planning in South Asia's fragmented protected area networks, demonstrating that connectivity restoration is as critical as habitat protection for long-term biodiversity persistence.

FEWFM-70

Wildlife

A TRAIT-BASED SPECIES INVENTORY AND FEEDING GUILD CLASSIFICATION OF AVIFAUNA IN PAKISTAN'S MANGROVE ECOSYSTEMS

Farhan Anjum and Zulfiqar Ali

Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan

Corresponding Author: zali.zool@pu.edu.pk

Mangrove ecosystems along Pakistan's Sindh and Balochistan coastlines form a critical, yet increasingly degraded, node along the Indus Flyway for resident and migratory birds. Despite their conservation importance, avifaunal assessments of these habitats have relied largely on taxonomic checklists, with little attention to the functional traits that determine how bird species use mangrove resources. We compiled a trait-based inventory of 336 bird species recorded across five mangrove-associated wetlands of coastal Pakistan (Indus Delta, Sandspit, Sonmiani Khor, Kalamat Khor and Jiwani), spanning 25 orders and 79 families, and classified each species into an AVONET-informed trophic level (Herbivore, Omnivore, Carnivore) and trophic niche (ten guilds, e.g., Invertivore, Aquatic predator, Granivore) using a standardized rule-based scheme applied to raw feeding-ecology descriptions. Carnivorous species dominated the assemblage (60.7%; $n = 204$), primarily Invertivores ($n = 90$) and Aquatic predators ($n = 78$), followed by Omnivores (31.8%; $n = 107$) and Herbivores (7.4%; $n = 25$). Wingspan and beak size, used as proxy AVONET morphological traits, differed significantly among trophic levels (Kruskal-Wallis, wingspan: $H = 10.62$, $p = 0.005$; beak size: $H = 11.05$, $p = 0.004$) and were strongly correlated with one another (Pearson $r = 0.71$, $p < 0.001$), consistent with allometric scaling of foraging apparatus with body size. The Indus Delta held the highest species richness ($n = 325$) and cumulative abundance (38,159 individuals), while Jiwani was the least species-rich ($n = 94$). Seventeen

species (5.1%) were classified as globally threatened (Vulnerable to Critically Endangered) under the IUCN Red List, including Egyptian Vulture (*Neophron percnopterus*), Pallas's Fish Eagle (*Haliaeetus leucoryphus*) and Yellow-breasted Bunting (*Emberiza aureola*). These results provide the first integrated trait-based functional profile of mangrove avifauna in Pakistan and offer a baseline against which future habitat change, and conservation interventions can be assessed.

FEWFM-71

Wildlife

**NON-INVASIVE ASSESSMENT OF STRESS AND WELFARE IN CAPTIVE WILDLIFE:
SEASONAL VARIATION IN FECAL GLUCOCORTICOID METABOLITES
ACROSS TWO ZOOS IN PUNJAB, PAKISTAN**

Kiran Saleem and Zulfiqar Ali

Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan

Corresponding Author: zali.zool@pu.edu.pk

Assessment of physiological stress is an important component of wildlife welfare and captive animal management. Fecal glucocorticoid metabolites (GCMs) provide a non-invasive measure of hypothalamic–pituitary–adrenal (HPA) axis activity and can be used to evaluate stress responses under different environmental and management conditions. This study comparatively assessed GCM concentrations in nine mammalian, avian, and reptilian species maintained at Lahore Zoo (LZ) and Safari Zoo Lahore (SZ), Punjab, Pakistan. Five individuals of each species were repeatedly sampled during winter (December) and summer (July) to examine seasonal and facility-related variation in physiological stress. Fecal samples were collected during early morning hours (06:00–09:00 h) over two-week sampling periods, and GCM concentrations were quantified using validated enzyme immunoassays. Physiological measures were evaluated alongside behavioral observations and selected husbandry variables, including enclosure complexity, environmental enrichment, social conditions, and visitor density. Results demonstrated marked species-specific and seasonal variation in GCM concentrations, with several species exhibiting consistently higher GCM levels at LZ than at SZ. Elevated GCM concentrations were associated with comparatively greater visitor disturbance, lower enrichment complexity, enclosure limitations, and differences in social stability and habitat design. The findings indicate that facility-specific management conditions may substantially influence physiological stress in captive wildlife. This study provides baseline information for non-invasive welfare assessment in Pakistani zoological institutions and demonstrates the potential value of fecal GCM monitoring as a practical conservation and husbandry tool. Evidence-based interventions, including improved enrichment, enclosure modification, visitor management, and species-specific husbandry protocols, are recommended to reduce chronic stress and enhance animal welfare.

FEWFM-72

Wildlife

**FOREST AND ASSOCIATED HABITATS FOR NOTABLE SPECIES INHERITING
MAXIMUM IMPACT ON THEIR DISTRIBUTION AREA TRIGGERED
BY HYDROPOWER PROJECTS****Usman Ahmad and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*

Corresponding Author: zali.zool@pu.edu.pk

Most of the Central Himalayan mountains, which make up more than two-third of the region, are what define the Upper Indus Basin (UIB). Numerous goods and ecosystem services (ES) are available in this UIB. ES provide invaluable services like food/edible products, fuelwood, fodder, fiber, resin, gums, and medicinal plants. The immense forest diversity of the Central Himalayan houses over 675 wild plant species. These plants also act as a huge sink for atmospheric CO₂, which helps to mitigate climate change. Hydropower projects within the UIB of Pakistan can induce ex-tensive implications for forest cover and biodiversity. Unfortunately, forest cover in UIB Pakistan is inadequately low i.e., around 17,275 Km² (21%) in the whole UIB Pakistan. This forest cover is further categorized in major classes, which are Sub-Tropical Broad Leaf (3%), Sub-Tropical Chir Pine (5%), Temperate Forest (65%) and Alpine Grassland (28%), of the forest cover in UIB Pakistan. The construction of dams and reservoirs in UIB Pakistan induces transformations and diminishment of natural habitats, resulting in the displacement or loss of local species associated with the forest cover. Current research was conducted to study the potential impacts on the notable species including birds, mammals, reptiles and amphibians. The field surveys were conducted between 2021 and 2023 for data collection. There are around 37 existing and proposed in UIB Pakistan. During the surveys, 322 species were recorded, that includes 242 birds, 47 mammals, 21 reptiles and 12 amphibians. The results revealed that the five top hydropower projects with maximum species richness were Dasu Dam (270), Tarbela Dam (263), Tangir Hydropower (263) and Kachura Dam (263). The top priority projects with respect to area were Tarbela Dam, Kanch and Basha Dam with 203.07, 159.36 and 115.08 Km² area. There are sixty-six notable species that can be impacted by hydropower projects. The notable species can be impacted due to habitat fragmentation, loss of connectivity, industrialization, flooding and blasting. The species can be affected during construction phase, operation phase or both. To identify complexity and challenges in the quantification and assessment of ES, this paper illustrates the relationships between forest cover, ES, and biodiversity. Based on these relationships, sustainable solutions for environmental conservation and sustainable development in the UIB Pakistan can be pragmatically devised.

FEWFM-73

Wildlife

**CLIMATE CHANGE AND THE VULNERABILITY OF KEYSTONE SPECIES IN PAKISTAN:
ASSESSING THREATS TO THE PUNJAB URIAL AND PANGOLIN****Muhammad Zahid Iqbal and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*

Corresponding Author: zali.zool@pu.edu.pk

Climate change is increasingly recognized as a major threat to wildlife biodiversity, particularly for keystone species whose ecological roles influence ecosystem structure and functioning. In Pakistan, changing temperature regimes, altered precipitation patterns, prolonged droughts, habitat degradation, and increasing climatic extremes are creating new challenges for vulnerable wildlife. This study examines the potential impacts of climate change on two ecologically important species, the Punjab Urial (*Ovis vignei punjabiensis*) and pangolins (*Manis* spp.), representing distinct ecological niches and habitat requirements. The assessment focuses on climate-sensitive factors affecting habitat suitability, food availability, water resources, reproductive success, seasonal movement, and population persistence. Spatial and ecological approaches are used to identify vulnerable climate habitats and evaluate changes in environmental conditions across the species' distribution ranges. Attention is given to the interaction between climate change and existing anthropogenic pressures, including habitat fragmentation, agricultural expansion, overgrazing, illegal hunting, and other forms of human disturbance. The study highlights that climate change may amplify existing threats by reducing suitable habitats, altering resource availability, increasing physiological stress, and potentially disrupting species-habitat relationships. The Punjab Urial may be particularly affected by increasing aridity, vegetation changes, and reduced availability of forage and water, while pangolins may face habitat and prey-resource changes associated with altered temperature and rainfall patterns. The findings emphasize the need to integrate climate projections into species conservation planning, habitat restoration, population monitoring, and protected-area management. Climate-resilient conservation strategies, ecological corridors, community participation, and long-term monitoring are recommended to strengthen the persistence of these keystone species under future environmental change.

FEWFM-74

Wildlife

**BIOTIC HOMOGENISATION OF URBAN AVIFAUNAL COMMUNITIES ALONG THE
CENTRAL ASIAN FLYWAY IN CENTRAL PUNJAB, PAKISTAN****Saleeha Shahid and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*

Corresponding Author: zali.zool@pu.edu.pk

The Central Asian Flyway (CAF) is one of the most vital but least monitored intercontinental migration routes. It serves as a critical path for Palearctic migrants to stop and refuel within the urban landscapes of Punjab, Pakistan; however, the impact of rapid urbanization on the actual functionality of these stopover sites has remained unquantifiable. This study provides the first standardized, multi-site avifaunal baseline for the

corridor, directly quantifying biotic homogenization and its consequences for migratory bird conservation. A total of 101 species, representing $n = 108,037$ individuals, were recorded across 14 study sites in Central Punjab over three seasons from July 2025 to February 2026. Community structure was quantified through alpha diversity indices, beta diversity (including Bray-Curtis and Jaccard dissimilarity alongside hierarchical cluster analysis), functional diversity indices, and a composite Human Footprint Index. The results reveal heavy ecosystem strain: the House Crow and Black Kite alone accounted for 72.5% of all individuals, while the "Big Four" synanthropic birds collectively achieved a staggering rate of 84.0% across all sites. Shannon diversity varied from a stifled 0.803 in Lahore to 2.419 in Wazirabad. Crucially, a negative correlation between species richness and Shannon diversity shows that high species counts at urbanized sites are merely dominance artefacts rather than signs of true diversity. Furthermore, the proportions of invertivores (0.02%) and frugivores (1.3%) were incredibly low, making them functionally extinct throughout the study sites. The most obvious indicator of stopover corridor failure was the alarmingly low proportion of passage migrants, which sat at just 4%. Ultimately, rapid urbanization in Central Punjab has driven intense biotic homogenization, preventing the landscape from serving its purpose as a viable Palearctic migratory corridor. Community-level Pielou's evenness (J') and Berger-Parker dominance (d), combined with House Crow and Black Kite proportional abundance as a waste-governance diagnostic, are proposed as practical inverse sentinel monitoring metrics, offering the first evidence-based, low-cost monitoring tool for this critical portion of the flyway.

FEWFM-75

Wildlife

WILDLIFE DIVERSITY IN SELECTED FOREST PLANTATIONS OF PUNJAB, PAKISTAN: A MULTI-TAXA ASSESSMENT OF TAXONOMIC AND FUNCTIONAL DIVERSITY

Rabia Yaqoob and Zulfiqar Ali-/

Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan

Corresponding Author: zali.zool@pu.edu.pk

Plantation forests are the primary terrestrial wildlife habitat in Punjab, Pakistan, where natural forest now covers less than 2% of the province. No standardised multi-taxa biodiversity baseline exists for these plantations. This study presents the first simultaneous, multi-taxa and multi-season vertebrate diversity assessment across eight irrigated plantation forests of Punjab during summer, monsoon and winter seasons (May 2025–April 2026). Standardised diurnal and nocturnal survey techniques—line transects, point counts, Visual Encounter Surveys (VES) and pitfall arrays—were used to record birds ($n = 105$), mammals ($n = 33$), reptiles ($n = 31$) and amphibians ($n = 4$), totalling 173 species and 71,440 individuals. Alpha diversity (Shannon H') was moderate to high for birds (2.811–2.970), mammals (1.860–2.380) and reptiles (1.156–2.320), and low for amphibians (0.949–1.063). Five functional diversity indices were calculated exclusively for birds using a standardised global avian trait database; functional trait space was widest at Chichawatni Plantation and narrowest at Daphar Plantation. Synanthropic generalists (Common Myna, House Crow, Rock Dove, House Mouse and Wild Boar) accounted for 40–45% of all individuals at every site. Nine threatened or near-threatened species were recorded, including three Endangered species: Indian Pangolin (*Manis crassicaudata*), Steppe Eagle (*Aquila nipalensis*), and Hog Deer (*Axis porcinus*). Punjab's plantation forests harbour substantial vertebrate biodiversity, and target management interventions could significantly enhance this potential. (Abstarct 213).

FEWFM-76

Wildlife

**AVIFAUNAL DISTRIBUTION MODELLING ON KEY BARRAGES OF
CENTRAL PUNJAB, PAKISTAN****Rida Zainab and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*

Corresponding Author: zali.zool@pu.edu.pk

Wetlands are among the world's most productive ecosystems and provide critical habitats for waterbirds while supporting essential ecosystem services. Barrages are man-made wetland systems serving as critical habitats for the avifauna of the Indus Flyway corridor in Pakistan. However, hydrological variations and anthropogenic pressures significantly decline in their biodiversity and ecosystem services. This study assessed avifaunal diversity patterns and its relationship and their dependence on environmental variables across the eight barrages of Central Punjab using Generalized Additive Model (GAM). Monthly point count surveys were conducted from July to December 2025. Dataset was standardized and analyzed using alpha (Shannon and Simpson) and beta (Jaccard and Sørensen) biodiversity indices. A total of 156 species comprising 91,418 individuals of 46 families, and 18 orders were recorded across the study area. Trimmu supported the highest waterbird diversity (132 species; $H' = 3.718$; Simpson = 0.963). In contrast, Marala exhibited the lowest diversity (77 species, $H' = 2.917$; Simpson = 0.898). The richness estimators closely matched observed species richness across all barrages, indicating high sampling completeness. Khanki and Qadirabad had the most similar diversity according to Jaccard (0.943) and Sørensen (0.971) indices. Of the 156 recorded species, 123 met the modelling criteria (≥ 5 unique spatial occurrences). The model performed well as 79.7% of the model achieved $D2 > 0.95$ and at a mean deviance of 95.2%. Moreover, NDVI (24.01%) was the most influential environmental predictor shaping coherent species-environment relationships followed by temperature and other variables. Trimmu, Sulemanki, Rasul, and Marala were identified as priority conservation sites, signifying the importance of NDVI-driven ecosystem management and hydrological regulation.

FEWFM-77

Wildlife

**CONNECTING FRAGMENTED LANDSCAPES: ECOLOGICAL IMPACTS OF
LINEAR INFRASTRUCTURE AND PRIORITIZATION OF WILDLIFE
CORRIDORS IN PUNJAB, PAKISTAN****Zeeshan Haider and Zulfiqar Ali***Environmental Health and Wildlife, Institute of Zoology, University of the Punjab, Lahore, Pakistan*

Corresponding Author: zali.zool@pu.edu.pk

Rapid expansion of roads and highways is increasingly fragmenting wildlife habitats across Punjab, Pakistan, particularly within and around protected areas. This study assessed the ecological impacts of linear infrastructure on wildlife mortality, movement behavior, habitat connectivity, and population isolation, with

particular emphasis on mammals and herpetofauna. A 12-month field survey (March 2025–February 2026) documented roadkill along 5-km transects bordering major highways, while camera trapping (3,200 trap-nights) was used to evaluate wildlife responses and behavioral barrier effects. Kernel density estimation identified roadkill hotspots, whereas Circuitscape and least-cost path analyses were applied to model landscape connectivity and delineate potential wildlife movement corridors. A Connectivity Priority Index was developed to rank candidate corridors according to ecological and spatial criteria. Overall, 847 roadkill incidents were recorded, comprising 72.3% mammals and 27.7% herpetofauna. Golden jackal (*Canis aureus*), Indian crested porcupine (*Hystrix indica*), and Indian spiny-tailed lizard (*Uromastix hardwickii*) were the most frequently affected species. Twenty-three roadkill hotspots were identified across major transportation routes. Camera-trap observations indicated that 45.3% of wildlife approaches resulted in hesitation or retreat, with herpetofauna exhibiting the strongest avoidance response. Landscape modeling identified 47 potential corridors, of which 12 were classified as high priority. Several priority sites incorporated existing drainage culverts, natural ravines, and riverine linkages, providing opportunities for cost-effective mitigation. The findings demonstrate that linear infrastructure is a significant driver of wildlife mortality and habitat fragmentation in Punjab. Integrating wildlife crossings, guide fencing, habitat restoration, and ecological connectivity into road planning and environmental assessments is therefore essential for maintaining viable wildlife populations and promoting infrastructure–biodiversity coexistence.

FEWFM-78

Freshwater Biology

THE EFFECT OF AMMONIA CONCENTRATION ON PLANKTON COMMUNITY IN FRESHWATER AND MARINE ECOSYSTEM OF KARACHI, PAKISTAN

Saoud Mansoor and Hina Jabeen*

Department of Biological Sciences, Virtual University of Pakistan, Karachi Campus

*Corresponding Author: hina.jabeen@vu.edu.pk

The impact of ammonia concentration on marine and freshwater plankton community in four different stations (Hill Park Lake, Aziz Bhatti Park Lake, Sea View and Hawks Bay) was seasonally (pre-monsoon, monsoon and post-monsoon) observed. Plankton samples were preserved with 2 ml of Lugol's solution per 200 ml sample. Samples were filtered onto a 0.2µm polycarbonate (nucleopore) membrane. and enumerated using a stereo microscope. The abundance of common taxa was estimated by random field counts. The concentration of ammonia was analyzed by colorimetric method. Ammonia concentration was observed minimum in marine water 15.03µg/L⁻¹ and 11.93µg/L⁻¹ from Sea View and Hawks Bay stations, respectively, and highest concentration was observed in freshwater 461µg/L⁻¹ and 691µg/L⁻¹ from Hill Park Lake and Aziz Bhatti Park Lake, respectively. Seasonally, highest concentration of ammonia was measured during pre-monsoon (843µg/L⁻¹) in freshwater environment. In both freshwater and marine waters, the phytoplankton community recorded higher than zooplankton in which species of Cyanophyceae and Chlorophyceae were observed. Among zooplanktons, Copepoda, Rotifera, Cirripedia, Ostracoda and Cladocera were reported from both aquatic ecosystems. The purpose of this research is to derive the relationship between the ammonium concentration and abundance of plankton through statistical analyses.

FEWFM-79**Fisheries****LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF THREE FISH SPECIES OF FAMILY (CYPRINIDAE) IN RIVER INDUS SUKKUR BARRAGE SINDH, PAKISTAN****Sajida Memon^{1,2}, Khadim Hussain Memon^{*1} and Waheed Ali Panhwar³**¹Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh²Government College for Women, College Education and Literacy Department, Khairpur^{*}Corresponding Author: khadim.memon@salu.edu.pk

The current study was carried out from River Indus Sukkur Barrage Sindh Pakistan to estimate length-weight relationship and condition factor of three Fish species of Cyprinidae. Fish specimens were collected during September 2023-March 2024 from five different zones of study area with support of fisherman leveraging gill net, cast net and pond net. A total of 500 specimens were caught among all collected specimens Cyprinidae family was dominant with 325 specimens. The identified specimens were of two genus and three species viz; *Labeo rohita*, *Labeo catla* or *Catla catla* and *Cirrihinus mrigala*. Length-weight data of all three collected species was obtained; length was measured in (cm) and weight in (g). Data was analyzed using SPSS software and excel computer program. Mean length of *Labeo catla* (M), *Cirrihinus mrigala* (M), *Cirrihinus mrigala* (F) *Labeo rohita* (M) and *Labeo rohita* (F) was calculated as 25.77±4.31cm, 24.30±3.76cm, 25.25±4.20cm, 21.52±4.61cm and 24.74±5.49cm respectively. While mean weight of *Labeo catla* (M), *Cirrihinus mrigala* (M), *Cirrihinus mrigala* (F) *Labeo rohita* (M) and *Labeo rohita* (F) was calculated as 219.55±138.54g, 243.24±113.02g, 331.34±148.49g, 296.30±150.55g and 348.32±160.98g respectively. Estimated length-weight relationship *b* values for three species ranged from 2.99-3.2 with *p* values <0.05, which showed a positive allometric growth of species and significant correlation. Similarly Fulton's condition factor *Kc* for *Labeo catla* (Male) was calculated as 1.64±0.52 indicating morphological variations, allometric condition factor *Ka* was 8.26±2.42 determining competition and variations in availability of resources, *Kn* relative condition factor was 1.81±0.53 indicating good growth and for *Cirrihinus mrigala* (Male) *Kc* was 1.65±0.54, *Ka* was 8.05±2.40 and *Kn* was estimated as 1.77±0.53, for *Cirrihinus mrigala* (F) *Kc* was 1.99±0.55 *Ka* was 9.90±2.56 *Kn* was estimated as 2.18±0.56, for *Labeo rohita* (Male) *Kc* was 2.83±0.76, *Ka* was 12.89±2.93 and *Kn* was estimated as 2.86±0.65 and for *Labeo rohita* (F) *Kc* was 2.33±0.99, *Ka* was 11.13±3.09 and *Kn* was estimated as 2.46±0.71. Results of Fulton's condition factor *Kc*, allometric condition factor *Ka* and relative condition factor *Kn* determined the morphological variations, differences in resources availability and competition, and indicated good growth respectively. Obtained results provided baseline information which will be helpful for future studies.

SECTION – V I

POSTER SESSION

POSTER-1

IN SILICO SCREENING OF NATURALLY DERIVED DIETARY COMPOUNDS AS POTENTIAL BUTYRYLCHOLINESTERASE INHIBITORS FOR ALZHEIMER'S DISEASE TREATMENT

Itfa Akber

Department of Zoology, University of Okara, Okara

*Corresponding Author: itfakber993@gmail.com

Alzheimer's disease (AD) is a progressive neurodegenerative disorder marked by amyloid- β plaque accumulation, neurofibrillary tangles, and cholinergic dysfunction. Butyrylcholinesterase (BuChE), an acetylcholine-degrading enzyme, becomes increasingly active in AD-affected brain regions and contributes to plaque maturation, making it a valuable therapeutic target. Since current FDA-approved cholinesterase inhibitors lack BuChE selectivity and carry side-effect risks, this study explored naturally occurring dietary compounds as safer alternative inhibitors. A library of 44 dietary phytochemicals, compiled through literature review, was screened against the crystal structure of human BuChE (PDB ID: 1P0I) using a structure-based computer-aided drug design (CADD) pipeline. Molecular docking (Schrödinger Glide) identified three lead compounds with stronger binding affinities than the standard drug donepezil. These were further evaluated using MM-GBSA binding free energy calculations, ADME/toxicity profiling (SwissADME, ProTox-3.0), 250 ns molecular dynamics simulations (RMSD, RMSF, radius of gyration, SASA), principal component analysis, dynamic cross-correlation matrix, free energy landscape mapping, and density functional theory (DFT) calculations. Two compounds — sophocarpine (CID 115269) and a cyclohexenyl chalcone derivative (CID 129886986) — emerged as top candidates, showing higher binding affinity, greater structural stability, favorable drug-likeness, and lower toxicity than donepezil. DFT analysis further indicated strong electronic reactivity and stable binding character for both compounds. These findings suggest that dietary-derived phytochemicals may serve as promising, low-toxicity BuChE inhibitor candidates for AD management. Further in vitro and in vivo validation is required to confirm their therapeutic efficacy.

POSTER-2

AI-DRIVEN COMPUTATIONAL NANOMEDICINE FOR PERSONALIZED CANCER THERAPY

Maryam Riaz

Department of Zoology, University of Okara, Okara

Corresponding Author: mariamriaz440@gmail.com

Cancer remains a significant global health challenge mainly because of tumor heterogeneity, systemic toxicity and the drug resistance caused by conventional treatments. These factors complicate effective therapy and patient outcomes. This review critically analyzes how AI, multi-omics, and nanomedicine have enhanced

the field of precision oncology, particularly in the design of nanocarriers with AI assistance, patient stratification through biomarkers, and predictive modeling of therapeutic responses. The role of bioinformatics resources like TCGA and COSMIC is discussed in the context of genomic and molecular profiling for personalized treatment strategies. Furthermore, computational methods such as molecular docking, receptor–ligand modeling, stochastic simulations, and ADMET prediction are assessed for their role in optimizing nano-carriers and enhancing drug delivery capabilities. The review also underscores the benefits of integrating multi-omics in the recognition of clinically relevant biomarkers, which will facilitate the greater accuracy of AI-based predictive models in cancer nanotherapy. Finally, important barriers for translation are discussed, such as data heterogeneity, the interpretability of models, scalability of nanocarriers' production, and clinical validation, to highlight the future pathway toward the development of clinically feasible AI-driven personalized nanomedicine.

POSTER-3

POLYURETHANE MICROPLASTIC RETENTION IN FECAL MATTER OF ALBINO MICE (*MUS MUSCULUS*): AN EXPERIMENTAL ANALYSIS

**Ayesha Rubab¹, Sidra Safdar^{1*}, Tasmia Asghar, Aiman Razzaq¹,
Nafees Ur Rehman² and Shahid Ullah Khan¹**

*1Department of Wildlife and Ecology, Faculty of Fisheries and Wildlife,
University of Veterinary and Animal Sciences (UVAS), Ravi Campus Pattoki, Punjab, Pakistan*

*2Department of Fisheries and Aquaculture, Faculty of Fisheries and Wildlife,
University of Veterinary and Animal Sciences (UVAS), Ravi Campus Pattoki, Punjab, Pakistan*

Corresponding Author: ayeshrubab65@gmail.com, sidra.safdar@uvas.edu.pk

Polyurethane Microplastics (PUR-MPs) are persistent environmental contaminants that can bio-accumulate in living organisms and may pose health risks to mammals. To learn more about these substances' fate in the body following oral administration, the retention, and excretion of these substances in the fecal matter of albino mice were investigated. To assess fecal excretion and apparent gastrointestinal retention of PUR-MPs in albino mice following oral exposure. The study was conducted at Animal Enclosures, UVAS Ravi Campus, C-block. Forty healthy adult albino mice were randomly allocated into eight groups (n=5) with male and females maintained separately. The mice were administered oral doses of PUR-MPs (Control group: standard feed, T1: 0.5 g/kg, T2: 1.0 g/kg and T3: 1.5 g/kg) for a period of 35 days. Daily fecal samples were collected to determine microplastics (MPs) retention for that, samples were processed using digestion with hydrogen peroxide, density separation with 0.9% NaCl solution, filtration and then stereomicroscopic examination. Across all dosed groups, fecal recovery of PUR-MPs was partial, ranging from 30% to 40%. The highest average recovery was observed in group T2 (1.0g/kg) at 2.75 MPs/sample, which also recorded the smallest mean particle size (83.43µm). Conversely, groups T1 and T3 yielded the largest particle sizes, reaching up to 457µm, but lower overall recovery counts (2.0-2.2 MPs/sample). The control group showed a baseline detection of 1.5 MPs/sample, reflecting background contamination. Overall, an inverse relationship between particle size and fecal count was observed, suggesting size-dependent gastrointestinal retention of larger particles. In the case of albino mice, the feces only partially removed PUR-MPs suggesting that they were retained within the digestive system. These findings suggest that particle size may influence fecal recovery following oral exposure; further studies are needed to determine gastrointestinal retention, systemic distribution, and long-term health effects.

POSTER-4

POLYURETHANE MICROPLASTIC-INDUCED HEPATIC ALTERATIONS IN ALBINO MICE (*Mus musculus*): A HISTOPATHOLOGICAL ANALYSIS**Aiman Razzaq¹, Sidra Safdar^{1*}, Ayesha Rubab¹, Nafees Ur Rehman² and Shahid Ullah Khan¹**¹*Department of Wildlife and Ecology, Faculty of Fisheries and Wildlife, University of Veterinary and Animal Sciences (UVAS), Ravi Campus Pattoki, Punjab, Pakistan*²*Department of Fisheries and Aquaculture, Faculty of Fisheries and Wildlife, University of Veterinary and Animal Sciences (UVAS), Ravi Campus Pattoki, Punjab, Pakistan*Corresponding Author(s): aimanrazzaq806@gmail.com, sidra.safdar@uvas.edu.pk

Microplastics (MPs) are ubiquitous environmental contaminants, yet the toxicological effects of polyurethane microplastics (PUR-MPs) in terrestrial mammals remain poorly understood. After ingestion, PUR-MPs may translocate from the gastrointestinal tract to internal organs, including the liver, a major site of metabolism and detoxification. Therefore, assessing PUR-MPs-induced liver injury is essential to understanding the toxicological effects of polyurethane in mammalian systems. This study aim to investigate the histopathological changes and cellular damage induced in the liver of adult Albino Mice (*Mus musculus*) by oral exposure to PUR-MPs. The study was conducted at Animal Enclosures, UVAS Ravi Campus, C-block. Forty healthy adult Albino Mice, aged 6 weeks and weighing 25-30 g, were randomly allocated into eight groups (n = 5/group), with males and females maintained separately. The control groups received standard feed without PUR-MPs, whereas the treatment groups received feed supplemented with PUR-MPs (particle size: 0.7 mm) for 35 days at low (T1: 0.5 g/kg), medium (T2: 1.0 g/kg), and high (T3: 1.5 g/kg) doses. After the trials, the animals were euthanized, and liver tissues were excised, fixed in 10% formalin, dehydrated through a graded series of ethanol, embedded in paraffin wax, cut into 3-5 µm sections, and stained with Hematoxylin and Eosin (H&E) for microscopic examination. Histopathological examination revealed progressive, dose-dependent, and sex-dependent liver damage across all groups. Descriptive statistics were applied for this analysis. The control group showed minimal physiological change, with mild hepatocellular swelling and necrosis in males and localized inflammation and necrosis in females. In group T1 (0.5 g/kg), the male tissues exhibited greater susceptibility, characterized by cellular damage, tissue necrosis, and pyknotic nuclei, whereas females showed cytoplasmic vacuolization and necrosis. The T2 (1.0 g/kg) group exhibited significant injury: females showed severe hepatocytic cell damage, vascular congestion, and sinusoidal degeneration, while males exhibited cytoplasmic vacuolization, necrosis, and vascular congestion. The T3 (1.5 g/kg) group demonstrated the most severe pathological changes, with prominent cytoplasmic vacuolization, necrosis, and pyknotic nuclei observed in females, and significant sinusoidal congestion and hepatocytic degeneration in males. Oral exposure to PUR-MPs induces severe dose-dependent hepatotoxicity in Albino Mice, characterized by cellular degeneration, vascular disruption, and tissue necrosis. The observed differences in hepatic responses between male and female subjects underline sex-differentiated sensitivity to PUR-MPs toxicity.

POSTER-5**PREVALENCE OF GASTROINTESTINAL NEMATODES IN FOOD-PRODUCING ANIMALS IN DISTRICT LAHORE, PUNJAB, PAKISTAN**

**Atif¹*, Sumaira Shms², Qamar Niaz², Rehan Ul Haq¹, Hira Shamshad¹,
Shahid Ullah Khan¹ and Sania Mehreen¹**

¹*Department of Wildlife and Ecology, Faculty of Fisheries and Wildlife,
University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan*

²*Department of Zoology, Faculty of Chemical and Life Science,
Abdul Wali Khan University Mardan (AWKUM)*

³*Department of Pharmacology and Toxicology, Faculty of Biosciences,
University of Veterinary and Animal Sciences (UVAS), Lahore, Punjab, Pakistan*

Corresponding Author: atifmdn@gmail.com

Gastrointestinal nematodes (GINs) are a major constraint on sustainable livestock production worldwide, causing widespread subclinical economic losses. This cross-sectional study aimed to determine the prevalence, generic distribution, and risk factors associated with GINs in food-producing animals in district Lahore, Punjab, Pakistan. A total of (n = 200) fecal samples were randomly collected from cattle (n = 50), buffaloes (n = 50), sheep (n = 50), and goats (n = 50) at local dairy farms. The parasitological microscopic examination was performed using the direct smear (DS) method, standard flotation technique (FT) test, and quantitative modified McMaster technique (MT) in the postgraduate laboratory of the Department of Wildlife and Ecology, University of Veterinary and Animal Sciences, Ravi Campus Pattoki. The overall prevalence of GINs was 58.5% (117/200). Small ruminants had a significantly higher prevalence of GINs than large ruminants (p < 0.05). Goats had the highest infection rate (70%), followed by sheep (64%), cattle (52%), and buffaloes (48%). Morphological characterization of isolated eggs and third-stage larvae (L3) revealed four major genera: *Haemonchus spp.* (41.9%), *Trichostrongylus spp.* (27.4%), *Ostertagia spp.* (18.8%), and *Cooperia spp.* (12.0%). Statistical analysis showed that intrinsic risk factors, specifically host species, younger age groups, and poor body condition scores (BCS), were strongly correlated with higher infection rates and elevated eggs per gram (EPG) counts ($X^2 = 5.24$, p < 0.001). These findings underscore the endemic nature of GINs in urban livestock supply chains and highlight the urgent need for strategically timed targeted anthelmintic control programs in the region.

POSTER-6**COMPARATIVE AVIAN ASSEMBLAGES ASSOCIATED WITH WHITE FIG (*FICUS VIRENS*) AND CHINABERRY (*MELIA AZEDARACH*) AT UNIVERSITY OF VETERINARY AND ANIMAL SCIENCES, RAVI CAMPUS, PATTOKI, PUNJAB, PAKISTAN**

**Shahid Ullah Khan, Sana Safdar, Hamnah Bint-e-Tariq, Rehan Ul Haq*,
Atif, Nafees Ur Rehman, Aiman Razzaq and Aysha Rubab**

Department of Wildlife and Ecology, Faculty of Fisheries and Wildlife, University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan

*Corresponding Author: Shahidgudik@gmail.com; rehan.haq@uvas.edu.pk

Trees and birds share a fundamental ecological relationship. Canopy architecture, fruit availability, and seasonal phenology directly indicate bird occurrence, species composition, and community structure by providing critical foraging, roosting, and nesting resources. In this study, the birds were observed thrice a day i.e., in the morning (06:00–09:00), midday (11:00–14:00), and in afternoon (15:00–18:00) from 15 Feb 2024, to 15 May 2024 on two tree species; the White Fig (*Ficus virens*) and Chinaberry (*Melia azedarach*) at the University of Veterinary and Animal Sciences, Ravi Campus, C Block, Pattoki. A total observation effort of nine hours per tree per day was conducted using binoculars (10×42 magnification) and birds were identified using field guides, and applications such as Merlin Bird ID, eBird, and BirdNET to assess the species diversity attracted to these tree species. Across the two trees, a total of 24 bird species were recorded with a higher diversity of species visiting Chinaberry (15 species) than White Fig (nine species). However, the most frequent visitor bird species on both tree species were same i.e., House Crow (*Corvus splendens*), House Sparrow (*Passer domesticus*), and Red-vented Bulbul (*Pycnonotus cafer*). The species attracted only to Chinaberry tree were Rufous Treepie (*Dendrocitta vagabunda*), Asian Green Bee-eater (*Merops orientalis*), Purple Sunbird (*Cinnyris asiaticus*), Laughing Dove (*Spilopelia senegalensis*), Black-rumped Flameback (*Dinopium benghalense*), Bank Myna (*Acridotheres ginginianus*), Black Drongo (*Dicrurus macrocercus*), White-throated Kingfisher (*Halcyon smyrnensis*), while the Western Koel (*Eudynamis scolopaceus*) only visits White Fig. Furthermore, the number of bird visitors on both the trees was less during midday compared to morning and afternoon. These results show that both Chinaberry and White Fig provide provide foraging, nesting, or roosting resources but comparatively Chinaberry attract a denser and more diverse avian community, especially during their fruiting period in autumn and a shared resource preference among the dominant local bird species. Multi-sessions and multisite studies are recommended to further assess the ecological importance of these tree species to avian communities.

POSTER-7

PERCEPTION, PERCEIVED IMPACTS AND ADAPTATIONS BY DAIRY FARMERS UNDER CLIMATE CHANGE IN DISTRICT SWABI, PAKISTAN

Nafees Ur Rehman³, Nazish Shah^{*1}, Janbaz Khan¹, Atif², Shahid Ullah Khan²,
Aiman Razzaq⁴, and Ayesha Rubab⁴

¹Department of Zoology, The University of Swabi, Khyber Pakhtunkhwa.

²Department of Wildlife and Ecology, Faculty of Fisheries and Wildlife, University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan

³Department of Fisheries and Aquaculture, Faculty of Fisheries and Wildlife, University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan

⁴Department of Zoology, Faculty of Fisheries and Wildlife, University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan

*Corresponding Author: nafeesurrehman.102@gmail.com

Climate change poses a significant challenge to Pakistan's dairy sector, with increasing temperatures and altered rainfall patterns adversely affecting livestock productivity, animal health, and farm profitability. Understanding dairy farmers' perceptions of climate change, its impacts, and the adaptation strategies they adopt is essential for developing effective climate-resilient livestock policies. This study aimed to assess dairy farmers' perceptions of climate change, evaluate its perceived impacts on dairy production, and identify the adaptation strategies adopted to enhance the climate resilience of dairy farming systems in District Swabi, Pakistan. A cross-sectional questionnaire-based survey was conducted from May to June 2023 in the four tehsils of District Swabi, Pakistan. Data were collected through a structured questionnaire to assess dairy farmers' perceptions of climate

change, its perceived impacts on dairy production, and the adaptation strategies they employed. Most dairy farmers were 31-40 years old (n = 34.8%), had 6-10 years of farming experience (n = 69.6%), and had completed matric-level education (n = 34.8%). The majority of respondents (n = 91.3%) perceived that climate change had significantly affected dairy farming during the past decade. Heat waves (n = 100%), drought (n = 100%), pests and diseases (n = 95.6%), heavy rainfall (n = 78.2%), and humidity (n = 69.6%) were identified as the major climate-related risks. Farmers reported that these hazards negatively affected animal feeding, health, breeding, pregnancy, milk yield and quality, and increased production costs, with heat waves and drought having the greatest impacts. To cope with these challenges, the most commonly adopted adaptation strategies were farm diversification (n = 52.9-73.3%), vaccination against diseases (n = 100% for pest and disease management), and the sale of weak or diseased animals. Climate change poses a significant threat to dairy farming in local dairy farms, highlighting the need for climate-smart adaptation strategies and supportive policies to enhance the resilience and sustainability of dairy products.

POSTER-8

DEVELOPMENT AND CHARACTERIZATION OF BIODEGRADABLE FOOD PACKAGING FILM BASED ON FISH GELATIN

Naveed Ur Rehman^{**1}, Ayesha Ashraf¹, Farzana Abbas^{*1}, Hafeez Ur Rehman¹, Atif², Sidra Mumtaz¹, Ayesha Fatima¹, Saima Aftab¹ and Muhammad Kaleem¹

¹Department of Fisheries and Aquaculture, University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan

²Department of Wildlife and Ecology, University of Veterinary and Animal Sciences (UVAS), Ravi Campus, Punjab, Pakistan

*Corresponding Author: farzana.abbas@uvas.edu.pk, nrehman@gmail.com**

The increasing demand for sustainable alternatives to conventional plastic packaging has accelerated research on biodegradable materials derived from renewable natural resources. Fish gelatin has emerged on promising biodegradable material due to their excellent film-forming ability and bioactive properties. This study aimed to develop biodegradable food packaging films based on Rohu (*Labeo rohita*) fish gelatin incorporated with clove (*Syzygium aromaticum*) extract and to characterize their proximate composition and viscosity properties. Rohu fish waste, including skin and scales, and other organs, were collected from a local fish market, and gelatin was extracted through controlled thermal extraction in the postgraduate laboratory of the Department of Fisheries and Aquaculture, UVAS. Dried clove buds of *Syzygium aromaticum* were cleaned and ground into fine powder using a grinder. About 20 g of clove powder was mixed with 200 mL distilled water in a beaker. The extracted gelatin was blended with clove extract to produce biodegradable films, which were subsequently characterized using standard analytical methods. The developed gelatin composition exhibited a high percentage of Ash (68.25%), protein content (63.83%), moderate moisture content (27.65%), low fat content (5.07%), and a viscosity of 6.23 cp, indicating favorable film-forming properties. Furthermore, gelatin demonstrated satisfactory flexibility, adhered effectively to the surface of packed food item without cracking or tearing, and provided an effective protective barrier during the shelf-life testing period. These findings demonstrated that fish gelatin incorporated with clove extract can be successfully utilized to produce biodegradable food packaging films with desirable physicochemical properties, highlighting their potential as an environmentally friendly alternative to conventional plastic packaging.

POSTER-9

**MAPPING REPORTED WILDLIFE CRIME: SEIZURE PATTERNS
AND DATA BIASES IN PAKISTAN**

Maryam Tariq, Hira Shamshad, Atif, Sania Muqaddas, and Rehan Ul Haq*

Department of Wildlife and Ecology, University of Veterinary and Animal Sciences (UVAS),

Ravi Campus, Punjab, Pakistan

*Corresponding Author: tariqmaryam396@gmail.com; rehan.haq@uvas.edu.pk

Illegal wildlife trade contributes to wildlife population decline, species extinction, and ecosystem degradation. Seizure records are frequently used to examine illegal wildlife trade, but their interpretation may be affected by enforcement effort, public reporting, media attention, and species detectability. In this study, we compiled wildlife seizures and related enforcement incidents reported in publicly accessible Facebook posts and Google news reports in Pakistan from 20 September 2024 to 28 April 2026 and examined their source, taxonomic, temporal, and geographical patterns. Records were organized in a standardized database containing information on species identity, taxonomic classification, conservation status, specimen status, location, date, enforcement action, and reported legal outcome. A total of 501 incidents were documented, of which 407 (81.2%) were on Facebook and 94 (18.8%) on news reports. Of these incidents, 246 incidents reported trade of live animals, and 255 incidents reported animals as dead, killed, or slaughtered. Taxonomic representation was uneven, with birds reported most frequently, followed by mammals and reptiles. Most of the seizures were recorded from Punjab i.e., 255 records (50.9%), followed by 105 (21.0%) from Khyber Pakhtunkhwa, 95 (19.0%) from Sindh, 30 (6.0%) from Balochistan with, 10 (2.0%) from Azad Jammu and Kashmir, and six (1.2%) from Gilgit-Baltistan. Arrests were mentioned in approximately 30% of the incidents, while subsequent legal outcomes were often unavailable. The strong dependence of recorded patterns on information source and reporting coverage indicates that seizure records represent detected and publicly reported incidents rather than the total volume of illegal wildlife trade. An integrated national monitoring system combining standardized institutional records with systematically verified digital data is needed to improve wildlife-crime surveillance and evidence-based conservation planning.

POSTER-10

**DISTRIBUTION, DENSITY, DIET & CONFLICT DYNAMICS OF THE ASIATIC BLACK BEAR
(*URSUS THIBETANUS*) IN THE HINDU RAJ MOUNTAIN RANGE, PAKISTAN**

Muhammad Kabir^{1*}, Faizan Ahmad², Ammar Hassan¹,

Muhammad Rehan¹ and Luciano Bosso³

¹Department of Forestry & Wildlife Management, The University of Haripur, Pakistan

²Pakistan Forest Institute, Peshawar

³Chinese Academy of Sciences, Chengdu, China; 4-CNR, Portici, Italy

*Corresponding Author: kabir@uoh.edu.pk

The Asiatic black bear (*Ursus thibetanus*) is a Vulnerable species in Pakistan, with fewer than 1,000 individuals surviving nationwide due to severe habitat fragmentation, poaching, livestock competition, and

retaliatory killings. This study presents the first comprehensive baseline data on the species' habitat suitability, population density, seasonal diet, and human-bear conflict dynamics in the Hindu Raj mountain range. Using an ensemble Species Distribution Model (SDM) based on 103 occurrence records, we identified that only 19.8% of Swat provides suitable habitat, primarily restricted to mid-to-high elevation forests in the north. Key environmental drivers included dry-month precipitation, forest canopy density, and elevation. Random Encounter Model (REM) analysis across 163 camera-trap stations yielded a population density estimate of 0.24 individuals/km² (95% CI: 0.11–0.37). Temporal activity modeling revealed a strong nocturnal pattern (61% nocturnal activity), indicating behavioral avoidance of human activity. Analysis of 120 scat samples showed a seasonally plastic diet. Soft mast peaked in autumn (85% frequency of occurrence in October), while *Quercus* acorns dominated pre-hibernation energy intake. *Diospyros lotus* was the most frequently consumed species (34% FO). Conflict risk modeling classified 20.5% of the area as conflict-prone, with 9% designated as high-risk hotspots clustered along settlement-forest edges. Proximity to human settlements accounted for over one-third of the conflict probability. Co-occurrence analysis indicated spatial overlap with humans, rhesus monkeys, and feral dogs along forest fringes. To ensure the persistence of this population, urgent conservation strategies must prioritize the protection and restoration of native mast forests (*Quercus*, *Diospyros*), deployment of non-lethal deterrents (e.g., solar electric fencing) at conflict hotspots, zoning of critical seasonal habitats, and strict enforcement against cub poaching and retaliatory killings.

POSTER-11

EFFECTS OF *EUCALYPTUS MICROTHECA* AND *EUCALYPTUS CREBRA* ESSENTIAL OILS ON SURVIVAL AND MOVEMENT OF *CULEX QUINQUEFASCIATUS*

Aleena, Abida Butt and Hadia Anjum

Institute of Zoology, University of the Punjab, Lahore

*Corresponding Author: aleena.zoologist@outlook.com

Culex quinquefasciatus is a major urban mosquito vector in Pakistan responsible for transmitting lymphatic filariasis, West Nile virus, and other diseases. Due to widespread insecticide resistance and environmental concerns, this study investigated the lethal and sublethal effects of essential oils from locally available *Eucalyptus microtheca* and *Eucalyptus crebra* as eco-friendly alternatives. For study, fourth-instar larvae of *C. quinquefasciatus* were collected and reared under controlled laboratory conditions. Essential oils were extracted from fresh leaves of both *Eucalyptus* species by hydrodistillation using a Clevenger apparatus and chemically characterized by GC-MS. Larvicidal activity was evaluated through dose-response bioassays. The sublethal effects of both essential oils (LC₂₀ and LC₅₀) on larval locomotion were assessed using video recordings analysed with idTracker software for parameters like speed, distance travelled, immobility bouts, immobility duration and immobility percentage. GC-MS analysis showed that both *Eucalyptus microtheca* and *Eucalyptus crebra* were rich in monoterpenoids and sesquiterpenoids, with 1,8-cineole as the major compound, followed by globulol and α -pinene. *E. microtheca* exhibited stronger larvicidal activity (LC₅₀ = 154.95 ppm) than *E. crebra* (LC₅₀ = 172.98 ppm) after 24 h exposure. Application of sublethal concentrations caused significant reductions in swimming speed and distance travelled. Essential oil treated larvae also showed increased immobility percentage and duration with fewer immobility bouts, resulting in sparse and localized movement trajectories compared to the controls. This study demonstrates that *E. microtheca* and *E. crebra* essential oils possess promising larvicidal and behaviour-modifying properties against *C. quinquefasciatus*, highlighting their potential as sustainable botanical agents for integrated vector management in Pakistan.

POSTER-12

NAIL HYGIENE AND IT'S IMPACT ON SYSTEMIC HEALTH, A COMPARATIVE TWO GROUP EVALUATION (TRIMMED AND UNTRIMMED NAILS)

Noreen Sadaf, Warda Ahmad, Asmara Nadeem, Aliya Nudrat and Durr e Samin Tahir*

*Department of Zoology, Abdul Salam School of Sciences, Nusrat Jahan College,
Chenab Nagar, District Chiniot*

Corresponding Author: durre.samin@njc.edu.p

Personal hygiene practices play role in preventing infectious diseases, yet nail hygiene plays crucial role in maintaining systemic health. This study evaluate the impact of nail hygiene by comparing trimmed and untrimmed nails, on systemic health profile of college students. Using cross sectional approach a structured questionnaire survey is conducted from 100 college students of Chenab Nagar, to examine their hygiene habit and its impact on their gastrointestinal system and skin. This study also evaluates if only untrimmed nails cause systemic illness or other factors like use of artificial nails or exposure to pets are also involved. The findings reveal a noticeable link between poor nail hygiene maintenance and higher frequencies of systemic illness. Crucially, the findings revealed that the use of artificial nails and exposure to pets, cause transmission of pathogens is another major reason of systemic illness alongside of untrimmed nails habit. These results are crucial to highlight the need of targeted campaign on campuses to educate students about hidden risks of cosmetic enhancement and pets' exposure. Ultimately, this study serves as a milestone for future clinical research to implement microbiological testing, which will help to establish a definitive pathway between nail pathogens and systemic illnesses.

POSTER-13

INSECT DIVERSITY IN CHENAB NAGAR: MALAISE TRAPPING AND DNA BARCODING

Nida Ul Mujeeb, Saira Akram Khokhar, Yasmin Qamar and Durr e Samin Tahir*

*Department of Zoology, Abdul Salam School of Sciences, Nusrat Jahan College,
Chenab Nagar, District Chiniot*

Corresponding Author: durre.samin@njc.edu.p

Despite its ecological importance, the insect diversity of Chenab Nagar, Pakistan, remains poorly documented, particularly at the molecular level. Nusrat Jahan College, Chenab Nagar, Pakistan, in collaboration with Guelph University, Canada, took this initiative to identify insect fauna in the locality. As a one-year programme, the Malaise Trap was set up. The procedure involved collecting samples weekly, in bottles filled with 90 percent ethanol and then refrigerating them. Every six months, the obtained specimens were shipped to Guelph University, Canada, to receive their barcodes. This was achieved through DNA barcoding of the Cytochrome Oxidase I (COI) gene. COI is significant because it is a useful tool for identifying and differentiating between animal species. The findings from the barcoding reported a total of 29 identified species and 1,514 sequences with order Diptera prevailing by 55%. In the near future, this project will provide valuable information for further taxonomic, ecological and biodiversity studies.

POSTER-14**COBALT: NCBI'S DOMAIN-AWARE APPROACH TO MULTIPLE SEQUENCE ALIGNMENT****Maida Khalil, Wajeeha Manzar, Mashal, Tooba Sabahat and Durr-e-Samin Tahir****Department of Zoology, Abdul Salam School of Sciences, Nusrat Jahan College,
Chenab Nagar, District Chiniot*

Corresponding Author: durre.samin@njc.edu.p

COBALT is a tool that simultaneously aligns multiple protein sequences, automatically utilizes information about protein domains, and strikes a good compromise between speed and accuracy. COBALT has a general framework that uses progressive multiple alignment to combine pairwise constraints from different sources into a multiple alignment. The objective of this study is to explore the unique and distinctive features of COBALT (Constraint based alignment tool) and contribute to the limited literature available on this tool. The hemoglobin alpha-subunit protein accession numbers for humans and mice were retrieved using the NCBI database. Comparative protein sequence alignment was performed by entering and submitting the accession numbers into COBALT (Constraint-Based Multiple Alignment Tool). The resulting alignment was examined through the Graphical Overview and Alignment sections. For visualization of amino acid residues, Sharp Amino Acid coloring was applied from the Coloring option. This helps in visualizing amino acid residues and distinguishing conserved and variable positions within the aligned sequences. Expand All was selected from the Tools menu to display the alignment information in greater detail. Detailed sequence examination was performed by selecting the Zoom to Sequence option from the Tools menu. This allowed detailed observation of specific aligned regions in the human and mouse alpha-globin sequences. Future studies can compare hemoglobin alpha subunit sequences from a wider spectrum of vertebrate species using NCBI COBALT. We can further investigate conserved and variable regions to understand functional differences and evolutionary relationships. Modern bioinformatics tools can also be integrated with COBALT to study structural and functional changes in hemoglobin proteins.

POSTER-15**ASSESSMENT OF PMOS AWARENESS AND ITS ASSOCIATION WITH SYMPTOMS AND LIFESTYLE FACTORS AMONG COLLEGE STUDENTS****Amtul Musawar, Imrana Ahmad, Nida Ul Mujeeb, Madiha Ahmad and Durr e Samin Tahir****Department of Zoology, Abdul Salam School of Sciences, Nusrat Jahan College,
Chenab Nagar, District Chiniot*

Cases of menstrual endocrine disorder, Polyendocrine Metabolic Ovarian Syndrome (PMOS) seems to be prevailing. In order to assess the level of awareness regarding this hormonal and metabolic abnormality among college students, an observational survey-based study was conducted. This study aimed to investigate the correlation between PMOS and its symptoms alongside lifestyle patterns. The research was conducted by designing a paper-based structured questionnaire which consisted of three sections. The sections were arranged to assess public knowledge, the clinical features observed in our study population and lifestyle factors that contribute to the symptoms, to view the risks in individuals. The sample size consisted of 120 individuals of age group 18–24. SPSS was used to analyze data, to determine the association between the

factors. The results showed that students with healthier lifestyle, including a balanced diet, regular physical activity and adequate sleep had fewer PMOS-related symptoms. The findings also revealed that students with greater awareness of PMOS are more likely to recognize and report relevant symptoms.

START OF FEE NOT PAID**POSTER-16**

**EVALUATION OF ANTIBACTERIAL ACTIVITY OF HYDROETHANOLIC
SEED EXTRACT OF *DESCURAINIA SOPHIA* AGAINST MULTIDRUG-
RESISTANT *SALMONELLA TYPHI* ISOLATED FROM TYPHOID PATIENTS:
AN INTEGRATED IN SILICO AND IN VITRO STUDY**

**Raim Fatima¹, Momina Touqeer¹, Laiba Nawaz¹, Babar Ali¹, Ali Raza¹, Ahsan Anjum¹,
Bakhtawar Khan¹, Malaika Qureshi¹ and Unsar Naem Ullah²**

¹*Department of Pathobiology and Biomedical Sciences,
Muhammad Nawaz Sharif University of Agriculture, Multan*

²*Department of Entomology, Muhammad Nawaz Sharif University of Agriculture, Multan*

*Corresponding Author: 2023-uam-5135@mnsuam.edu.pk

Typhoid fever, caused by *Salmonella typhi*, is a global public health issue, made exacerbated by increased antibiotic resistance. *Descurainia sophia* (L.) is an anti-infective herb used in Unani and folk medicine. In silico computational methods and in vitro microbiological investigations assessed the antibacterial activity of *D. sophia* hydroethanolic seed extract against a clinical MDR *S. typhi* isolate. Mining manuscripts and screening databases yielded a comprehensive phytochemical library of 14 bioactive chemicals. GC-MS analysis of the hydro-ethanolic seed extract experimentally corroborated twelve of these fourteen compounds (91.4% of the total ion chromatogram area), including all three downstream lead compounds. Three drug-like compounds were selected via ADMET profiling with admetSAR 3.0 for the cogeners helveticoside, evomonoside, and strophanthidin. Helveticoside (−9.7 kcal/mol) and evomonoside (−9.5 kcal/mol) displayed better binding affinity than typical fluoroquinolones (moxifloxacin; −7.9 and gemifloxacin; −8.2 kcal/mol) and strophanthidin (−8.5 kcal/mol) in molecular docking simulation against DNA– gyrase A (PD In vitro disc diffusion assay showed dose-dependent antibacterial activity against five MDR *S. typhi* clinical isolates (MDR-ST1-ST5), with a mean inhibition zone of 17.15 ± 1.3 mm at 100 mg/mL, lower than the pure antibiotic moxifloxacin (19.3 ± 0.9 mm); the two are not directly comparable because the extract is an unfractionated crude mixture and moxifloxacin is a pure compound, so ZOI values are reported descriptively only. A clear concentration–response relationship was observed (ZOI 11.5–17.15 mm across 25–100 mg/mL); formal potency quantification by regression was not attempted because the tested range was insufficient to define both asymptotes of the dose–response curve. Broth microdilution (CLSI M07) showed bactericidal action with geometric mean MICs of 8.4 mg/mL (range: 6.25–12.5) and MBC/MIC ratios of 2 for all isolates. FTIR spectroscopic analysis identified functional groups consistent with phenolic hydroxyl groups, aliphatic chains, glycosidic linkages, and carbonyl moieties, broadly characteristic of the phytochemical classes identified by literature mining, and consistent with the compound-level identifications already established by GC-MS. Erysimoside was the only library compound not detected by GC-MS, consistent with its unsuitability for underivatized GC analysis. The docking findings generate the hypothesis that DNA Gyrase A inhibition by cardiac glycoside constituents may contribute to the extract's antibacterial effect; this mechanistic link remains to be confirmed by bioactivity-guided fractionation and target-engagement assays. Taken together, the in vitro data establish the antibacterial potential of *D. sophia* seed extract against MDR *Salmonella typhi*, and generates a testable mechanistic hypothesis that DNA Gyrase A inhibition by cardiac glycoside constituents may contribute to this activity; direct causal evidence linking the extract's antibacterial effect to gyrase inhibition or to the specific docked compounds requires bioactivity-guided fractionation, isolation of pure constituents, and enzymatic target-engagement assays.

POSTER-17

OCCURRENCE, DIVERSITY AND PATHOGENICITY OF INDIGENOUS ENTOMOPATHOGENIC FUNGI AND NUCLEOPOLYHEDROVIRUS FOR SUSTAINABLE MANAGEMENT OF FALL ARMYWORM (*SPODOPTERA FRUGIPERDA*) IN PAKISTAN

**Usman Khalique^{1*}, Muhammad Zahid¹, Syed Jawad Ahmad Shah¹,
Muhammad Dawood², Hamza Kifayat³ and Shahid Sattar³**

¹*Plant Protection Division, Nuclear Institute for Food and Agriculture, Peshawar, Pakistan*

²*Department of Entomology, University of Agriculture, Peshawar, Pakistan*

³*Department of Plant Protection, University of Agriculture, Peshawar, Pakistan*

*Corresponding Author: usmankhaliq15@gmail.com

The distribution of entomopathogenic fungi in various geographical areas of Khyber Pakhtunkhwa, Pakistan, remain poorly understood. The present study was planned to explore the occurrence and diversity of entomopathogenic fungi from soils collected from maize fields, vegetables, fruit orchards and forests habitats across different districts of Khyber Pakhtunkhwa, Pakistan. A comprehensive field survey was conducted and fungal isolates were recovered using the *Galleria* bait method. A total of 254 fungal isolates were obtained from 243 soil samples, including 69 isolates from maize fields, 67 from vegetable fields, 61 from fruit orchards, and 57 from forest habitats. *Aspergillus* spp. were the predominant fungi, accounting for 58.66% of all isolates, whereas the major entomopathogenic fungi recovered were *Beauveria bassiana*, *Metarhizium rileyi*, *Isaria fumosorosea*, and *Lecanicillium attenuatum*. The pathogenicity of these fungal isolates was evaluated against third instar larvae of fall armyworm, *Spodoptera frugiperda*. Among the tested fungi, *B. bassiana* exhibited the highest virulence, causing 93.3% larval mortality, complete suppression of adult emergence and the lowest LC₅₀ value (5.57×10^5 spores/ mL). The LT₅₀ of *B. bassiana* decreased from 8.26 to 4.12 days with increasing spore concentrations from 1×10^6 to 1×10^8 spores/ mL. In parallel, the efficacy of indigenous nucleopolyhedrovirus (NPV) was also evaluated against third instar larvae of *S. frugiperda*. The highest viral concentration (1×10^8 POBs/ mL) resulted in 100% larval mortality and completely inhibited pupation and adult emergence. Likewise, LT₅₀ values decreased with increasing viral concentrations, reaching 4.46 days at 1×10^8 POBs/ mL compared with 19.18 days at 5×10^4 POBs/ mL. The findings demonstrate the widespread occurrence of indigenous entomopathogenic fungi in diverse habitats of Khyber Pakhtunkhwa and highlight the potential of *B. bassiana* and NPV as promising biological control agents for the sustainable management of fall armyworm.

POSTER-18

CARDIOPROTECTIVE POTENTIAL OF *FAGONIA ARABICA* PHYTOCHEMICALS AGAINST ADRENALINE-INDUCED MYOCARDIAL INFARCTION IN RABBIT: INSIGHTS FROM INTEGRATED NETWORK PHARMACOLOGY, ADMET, AND MOLECULAR DOCKING STUDIES

**Muhammad Imran Ali Khan¹, Imran Ahmad Khan², Abdul Rehman¹, Qasim Ali Ghauri³,
Raim Fatima¹, Malaika Qureshi^{*1} and Unsar Naeem Ullah⁴**

¹*Department of Pathobiology and Biomedical Sciences, MNS University of Agriculture, Multan.*

²*Department of Pharmacy, MNS University of Agriculture, Multan.*

³Department of Biochemistry and Biotechnology, MNS University of Agriculture, Multan.

⁴Department of Entomology, , MNS University of Agriculture, Multan.

*Corresponding Author 2023-uam-5186@mnsuam.edu.pk

Myocardial infarction (MI) remains a leading cause of cardiovascular mortality worldwide, while conventional single-target therapies often provide incomplete protection and may cause adverse effects. To predict the cardioprotective potential of *Fagonia arabica* L. (Zygophyllaceae) against adrenaline-induced stress-related MI. An integrated computational approach involving ADMET profiling, network pharmacology, gene ontology (GO)/KEGG enrichment, and molecular docking was employed. Among 29 phytochemicals, seven lead compounds (Hederagenin, isorhamnetin, kaempferol-3-O-glucoside, kaempferol-7-O-rhamnoside, lupeol, oleanolic acid, and β -Amyrin) were selected using stringent ADMET criteria. Network pharmacology identified 147 overlapping targets from 5,218 MI-associated genes and 291 compound-predicted targets. AKT1 (degree = 85) and TNF (degree = 84) emerged as major hub proteins. GO and KEGG analyses revealed significant enrichment of pathways related to apoptosis regulation, oxidative stress response, and PI3K-AKT, TNF, and NF- κ B signaling. Molecular docking against AKT1 (PDB: 6HHF) and TNF- α (PDB: 5MU8) revealed favorable putative binding affinities for all seven compounds. β -Amyrin exhibited the strongest predicted affinity for AKT1 (-8.84 kcal/mol), whereas Kaempferol-7-O-rhamnoside showed the highest predicted affinity for TNF- α (-8.40 kcal/mol). *F. arabica* phytochemicals may exert cardioprotective effects through multi-target modulation of inflammation, oxidative stress, and cardiomyocyte survival, warranting further experimental validation.

POSTER-19

NETWORK PHARMACOLOGY AND MOLECULAR DOCKING-BASED INVESTIGATION OF *MORINGA OLEIFERA* BIOACTIVE COMPOUNDS AGAINST ALLERGIC DISEASE

Hamza Saleem^{*1}, Muhammad Ahsan Nisar¹, Ayesha Zai¹, Ayesha Latif¹, Alia Azhar¹, Amina Kousar¹, Raim Fatima¹, Malaika Qureshi¹, Ahsan Anjum¹, Bukhtawar Khan and Unsar Naeem Ullah²

¹Department of Pathobiology and Biomedical Sciences,
Muhammad Nawaz Shareef University of Agriculture, Multan

²Department of Entomology, Muhammad Nawaz Shareef University of Agriculture, Multan

*Corresponding Author: 2024-uam-5093@mnsuam.edu.pk

Allergic diseases affect a substantial and growing proportion of the global population, and current first-line therapies, antihistamines, corticosteroids, and anti-IgE biologics, are limited by incomplete symptom control, tolerability issues, and cost, motivating the search for multi-target natural product alternatives. This study applied an integrated network pharmacology and molecular docking framework to characterize the antiallergic potential of *Moringa oleifera* bioactive compounds against the histamine H1 receptor and immunoglobulin E (IgE). Seventeen bioactive compounds identified from *M. oleifera* were screened for druglikeness and ADMET properties, yielding six compounds, apigenin, brassicasterol, ergosterol, catechin, ellagic acid, and quercetin, that met the applied criteria. Target prediction and intersection with allergy-associated genes from GeneCards identified 142 shared targets, which formed a protein-protein interaction network of 142 nodes and 1238 edges (average degree 17.4, clustering coefficient 0.528, PPI enrichment $p < 1.0 \times 10^{-16}$), substantially denser than expected by chance. Hub-target analysis identified ABCB1, ABCC1, ABCG2, ACHE, ADAMTS4, ADORA3, and AKR1B1 among the highest-degree nodes. Molecular docking against the Histamine H1 receptor (PDB: 3RZE) and IgE (PDB: 8VK2) showed that brassicasterol and

ergosterol produced the strongest binding affinities among the six compounds at both targets (−8.3 and −8.1 kcal/mol at 3RZE; −8.0 and −8.4 kcal/mol at 8VK2, respectively), approaching the affinity of the standard antihistamine fexofenadine (−8.5 kcal/mol), Levocetirizine (−6.9 kcal/mol), Diphenhydramine (−8.3 Kcal/mol), Cetirizine (−6.8 kcal/mol) at the Histamine H1 receptor. and the standard affinity Fexofenadine (−7.2 kcal/mol), levocetirizine (−6.3 kcal/mol), Diphenhydramine (−5.4 kcal/mol), Cetirizine (−6.0 kcal/mol) at the IgE receptor. Redocking validation at 3RZE returned a root-mean-square deviation below the 2.0 Å acceptance threshold, supporting the reliability of the docking protocol. These findings identify a defined, testable multi-target mechanism, centered on ergosterol, brassicasterol, and ellagic acid acting at the histamine H1 receptor, IgE, and a network of transport- and adenosine-signaling-related hub genes, that provides a rationale for prioritizing these compounds for in vitro and in vivo validation as candidate antiallergic agents from *Moringa oleifera*.

POSTER-20

SYNTHETIC INSECTICIDES OUTPERFORM BIORATIONAL OPTIONS FOR FALL ARMYWORM MANAGEMENT BUT REDUCE ARTHROPOD DIVERSITY

Muhammad Aizaz¹, Fawad Zafar Ahmad Khan^{1,2}, Mudssar Ali¹, and Babar Farid³

¹Department of Entomology, Muhammad Nawaz Shareef University of Agriculture, Multan.

²Department of Outreach and Continuing Education,
Muhammad Nawaz Shareef University of Agriculture, Multan

³Institute of Plant Breeding and Biotechnology,
Muhammad Nawaz Shareef University of Agriculture, Multan

Corresponding Author: fawad.zafar@mnsuam.edu.pk

Fall armyworm, *Spodoptera frugiperda* (Smith) (Lepidoptera: Noctuidae), is a major polyphagous pest of maize (*Zea mays* L.) and causes substantial yield losses in Pakistan. Chemical control remains the dominant management approach, but repeated insecticide use develops insecticide resistance and also threatens 5t6` natural enemies. A field trial was conducted at MNS University of Agriculture, Multan, Punjab, Pakistan, using maize hybrid P4040. Different biorational and chemical treatments were applied in a randomized block design with five replications in both early and late sown maize. Arthropod abundance, fall armyworm damage scale, and maize yield were recorded throughout the season. Arthropod abundance and diversity were significantly higher in the untreated control than in treated plots ($F = 8.27$, $df = 1$, $P < 0.01$). Damage scale differed significantly among management options in both early and late sowing ($F = 5.65$, $df = 1$, $P < 0.001$). The untreated control demonstrated the highest damage, the synthetic insecticide treatment the lowest, and the botanical powder mixtures did not differ significantly from one another or from the biopesticide treatment. Yield followed the same pattern and was significantly higher in the synthetic insecticide plots than in all other treatments, while the untreated control produced the lowest yield in both sowing dates. Overall, synthetic insecticide application gave the greatest reduction in fall armyworm damage and the highest maize yield but reduced overall arthropod diversity. Botanical powder treatments gave intermediate protection against fall armyworm while conserving arthropod diversity, supporting their use as a low-cost, biodiversity-friendly component of integrated fall armyworm management in maize.

POSTER-21**RISK FACTORS ASSOCIATED WITH PARASITIC CONTAMINATION OF VEGETABLES SOLD IN DISTRICT MALAKAND, PAKISTAN****Salih Mohammad, Wali Khan* and Mustafa Kamal***Department of Zoology, University of Malakand, Lower Dir, Pakistan**Corresponding Author: walikhan@uom.edu.pk

Raw vegetables are the primary major route of human intestinal pathogenic parasite transmission. In the rural areas of Malakand, people depend on a variety of vegetables for their own consumption and income generation. These vegetables are grown on night soil, therefore present study was carried out to investigate which parasites might be harbored by vegetables. This study was conducted to detect the presence of helminth eggs and protozoan cysts in vegetables purchased from Malakand's main vegetable markets. There were 630 vegetable samples in total soaked in physiological saline, violently agitated for 20 minutes with a mechanical shaker, and then analyzed using the sedimentation concentration technique. At least one type of parasite was found in 24.7 percent (n=156/630) of the 630 samples analysed. *Trichuris trichura* 1.42 percent (n=9/630) was the least often found parasite, with *Ascaris lumbricoides* accounting for 16.5 percent (n=104/630) was the most prevalent parasite. The parasite contamination rate of vegetables sold by vendors was significant associated with their educational level ($P = 0.0201$). The link between the vegetables gathered and the sick was insignificant ($P=0.99114$). In regards of parasite contamination, mint was the most polluted (42.8%), while cucumber had the least parasite contamination (11.4 percent). When it comes to the factor means of vegetable display ($P=0.0109$), wash before displaying ($p=0.0026$) the association was noted. The outcomes of this study show that eating raw vegetables has a substantial risk of parasite contamination in the Malakand district of Pakistan. The relevant organizations should make an effort to educate vendors and the general public in order to lower the rate of parasite contamination of public health importance.

POSTER-22**MICROPLASTIC DETERMINATION IN TWO SPECIES OF FAMILY PLATYCEPHALIDAE FOUND IN COASTAL WATERS OF PAKISTAN****Shaista Aijaz and Noor Us Saher***Centre of Excellence in Marine Biology, University of Karachi**Corresponding Author: noorusaher@yahoo.com

Flathead fish species are members of the Family Platycephalidae and possess unique morphological features including an elongated body and a spiny, depressed head. The present study was designed to determine the presence and types of microplastics in the gills and guts of two species of flat-headed fishes collected from Karachi Fish Harbor, Pakistan. This study highlights the ecological hazards of microplastic pollution, such as detrimental effects on marine life. Significant differences are observed in the morphological characteristics of two species of flathead fish, *Grammoplites suppositus* (Troschel, 1840) and *Grammoplites scaber* (Linnaeus, 1758). The study revealed the variation in level of microplastics (MP) in their gut and gills

and were categorized as heavy, moderate and least loading. The MPs were identified in the three major forms; threads, beads and foams. The most common type observed was beads. Results showed differences in the distribution of MPs among organs and species, and a correlation between the size of fish and microplastic concentration. The study emphasizes variable characters for the differentiation of the two species within the Platycephalidae family and concludes that the microplastic content was different in both species and their organs.

POSTER-23

**COMPARATIVE MORPHOMETRY AND MORPHOLOGY OF TWO SPECIES
OF GENUS GRAMMOPLITES (FAMILY PLATYCEPHALIDAE)
FOUND IN COASTAL WATERS OF PAKISTAN**

Sana Ghulam and Noor Us Saher

Centre of Excellence in Marine Biology, University of Karachi

*Corresponding Author: noorusaher@yahoo.com

Flathead fish species from the Platycephalidae family, with around 17 genera and 70 species, are characterized by their elongated bodies, large mouths, and spiky heads. Notably, the lower jaw is often longer than the upper. Otoliths, unique inner ear structures, provide valuable taxonomic information due to their species-specific morphology. This research aimed to explore morphological and morphometric differences in two species of the genus *Grammolites*, with fish collected from various landing sites along the Pakistan coast, including Sonmiani, Korangi, and Karachi. After identification using FAO keys and FishBase, the specimens were preserved for subsequent otolith and morphometric analysis using measuring scales, a vernier caliper, and computerized balances. The morphological traits of the scales, otoliths, and pored spines of the two fish species, *Grammolites suppositus* (Troschel, 1840) and *Grammolites scaber* (Linnaeus, 1758), have exhibited significant variation. Findings show no significant length difference in left and right otoliths, which vary in shape (fusiform, ovate, triangular). Differences were also noted in dorsal fin spines and rays. A positive correlation exists between otolith size, fish size, and body mass. It reveals structural distinctions in pored scales between adults and juveniles, alongside species variations, and highlights the relationship of otolith size and weight to fish size and weight.

LATE RECEIVED ABSTRACTS

CBGP-82

Genetics

GENETIC CHARACTERIZATION OF NEUROLOGICAL DISORDERS IN KASHMIRI FAMILIES USING WHOLE-EXOME SEQUENCING

Alishba Shahid², Ansar Ahmed Abbasi^{1,2} Nadine Krämer,² Na Li³, Tauqeer Ahmed¹, Rameez Nisar¹, Lena-Luise Becker², Xiang Fang³, Hao Hu³ and Angela M. Kaindal²

¹Department of Zoology Mirpur University of science and technology (MUST) Mirpur, AJ&K Pakistan.

²Institute of Cell Biology and Neurobiology and Center for Chronically Sick Children (SPZ), Charité – Universitätsmedizin Berlin, Augustenburger Platz 1, 13353 Berlin, Germany.

³Laboratory of Medical Systems Biology, Guangzhou Women and Children's Medical Center, Guangzhou Medical University, Guangzhou, 510623, China

*Corresponding Author: ansar.abbasi@uajk.edu.pk

Intellectual disability affects 1–3% of the general population and the environmental or hereditary etiology is identified in less than half of patients. Genetic studies have reported mutations in approximately 1000 different genes that may cause intellectual disability. We assessed patients from multiple consanguineous families from Kashmir region, exhibiting non-syndromal intellectual disability and postnatal microcephaly with whole exome sequencing (WES) followed by Sanger sequencing and cosegregation analysis. WES analysis identified novel candidate genes, novel mutations in known genes linked with neurodevelopmental disorders and previously reported mutations in known ID genes. Thus our study expands the phenotypic spectrum of the genes linked with neurodevelopmental disorders and hence contributes towards better understanding of mechanisms involved in brain development and function.

CBGP-83

Genetics

SCREENING OF THE FAMILIES WITH HEREDITARY SKELETAL DYSPLASIA

Syed Zaheer Ud Din Shah¹, Ansar Ahmed Abbasi^{1*}Imran Ullah² and Zahid Latif³

¹Department of Zoology University of Azad Jammu and Kashmir, Muzaffarabad

²Department of Biochemistry Quaid-e-Azam University Islamabad

³Department of Zoology, Mirpur University of Science and Technology, Mirpur

*Corresponding Author: ansar.abbasi@ajku.edu.pk

Skeletal dysplasia is a clinical and genetic multiplex disorder of bone and cartilage growth that affects the development, growth and maintenance of the human skeleton. Recently, 100 types of skeletal dysplasia have been reported, making diagnosis difficult. The presence of individual conditions rarely increases diagnostic complexity. Establishing a precise diagnosis is important for several reasons, including the

exact recurrence risk, forecast of normal adult height, appropriate clinical cure, and prenatal findings of pregnancies. In current study Two Kashmiri families segregating hereditary skeletal anomalies were recruited from Neelum Azad Jammu and Kashmir. Homozygosity mapping of Family A showed a homozygous region on *WNT10B* gene. Sanger sequencing revealed a variant c.338G>A (p. Gly113Asp) in exon 4 of *WNT10B* gene (previously reported in a Pakistani family of KPK origin). Family B is Post Axial Polydactyly Type A (PAPA) which failed to show any homozygous region on previously reported PAPA genes (*FAM92A1*, *IQCE*, *GLII*, *ZNF141*, *KIAA0825*, *EFCAB7*, *DACHI*). Thus, our study broadens the phenotypic spectrum of Hereditary Skeletal dysplasia in Pakistani Population.

CBGP-84

Physiology

THE CASCADING EFFECTS OF ENVIRONMENTAL CHANGES AND HEAT STRESS ON PATHOGEN SUSCEPTIBILITY, MORTALITY AND PRODUCTION IN BACKYARD POULTRY IN KASHMORE, SINDH, PAKISTAN

Shahid Ali Jakhrani¹*, Shaista Ghumro¹, Mushtaque Ali Jakhrani²

¹Department of Zoology, Shah Abdul Latif University, Khairpur Mirs

²Institute of Chemistry, Shah Abdul Latif University, Khairpur Mirs

*Corresponding Author: shahid.jakhrani@salu.edu.pk

Backyard poultry production in arid subtropical regions faces escalating threats from extreme climatic events, hyper-thermal stress, and compound pathogen loads. This study evaluated the cascading physiological, immunological, histological, and socio-economic impacts of heat stress and environmental degradation on backyard poultry in Kashmore District, Sindh, Pakistan. Microclimatic logging revealed an extreme thermal profile, with peak summer temperatures reaching 46.5–50.0°C, relative humidity between 68–82%, and Temperature-Humidity Index (THI) values peaking at 38.5–41.2 across 110–135 critical heat stress days annually. Physiological profiling demonstrated severe systemic stress, characterized by a 145% spike in plasma corticosterone (7.8–11.2 ng/mL), an elevated Heterophil-to-Lymphocyte (H/L) ratio of 0.88–0.92, and marked electrolyte imbalances (hypokalemia at 3.1 mEq/L). Pathologically, hyperthermia induced a 38.2% reduction in intestinal villus height and a 42.0% atrophy rate in primary lymphoid organs (spleen and bursa of Fabricius), compromising gut mucosal integrity and suppressing humoral immunity. Consequently, birds exhibited severe vaccine failure (Newcastle Disease Virus antibody titers dropping to 2.8 log²), high Avian Influenza H9N2 seropositivity (61.5%), elevated *Salmonella enterica* shedding (58.2%), and heavy ectoparasite infestations (>500 mites/bird). These physiological disruptions translated into a cumulative flock mortality rate of 34.2% peaking at 41.6% in adult laying hens alongside a 32.5 g/bird/day drop in feed intake and severe shell degradation (breaking strength reduced to 1.8kg/cm²). Socio-economically, smallholder households sustained an average annual financial loss of \$236.00 USD per flock and (62.0%) decline in domestic protein supply. Reversing this crisis requires integrated interventions combining local genetic selection, nutritional supplementation, portable emergency field treatments, and improved housing microclimates.

FEWFM-80

Wildlife

**ALTITUDINAL GRADIENTS AS DRIVERS OF VERTEBRATE DIVERSITY
AND CONSERVATION PRIORITIES IN THE WESTERN HIMALAYAN
FOOTHILLS OF PAKISTAN****Muhammad Siraj¹ Bibi Nazia Murtaza^{1*}, and Muhammad Ayaz Khan²**¹*Department of Zoology, University of Science and Technology, Abbottabad, Khyber Pakhtunkhwa*²*Conservator Wildlife, Hazara Wildlife Circle Abbottabad, Khyber Pakhtunkhwa*

Montane ecosystems of the Western Himalayas are global biodiversity hotspots, yet vertebrate diversity patterns in Pakistan's foothills remain fragmented across literature. This review synthesizes published data and recent field observations from January 2024 to June 2026 to evaluate altitudinal drivers of vertebrate diversity and conservation priorities in Abbottabad District, Khyber Pakhtunkhwa. A comprehensive review of peer-reviewed articles, literature, and wildlife department reports was conducted alongside ground-truthing surveys. Consistent with previous studies, species richness in the Western Himalayan foothills peaks at mid-elevations of 1000-1800m, attributed to intermediate climatic stability and habitat heterogeneity. Published records and recent observations confirm the presence of key mammalian, avian, reptilian and amphibian taxa, including several IUCN-listed species. Community composition showed significant turnover with elevation, strongly correlated with vegetation structure, temperature gradients, and anthropogenic disturbance. Major threats reported across studies and confirmed during 2025-2026 include habitat fragmentation, unsustainable wood fuel collection, and climate-induced shifts in phenology. These patterns align with global mountain biodiversity research and highlight Pakistan as a critical gap in regional conservation planning. This study provides the first integrated assessment of vertebrate diversity along an altitudinal gradient in the Western Himalayan foothills of Pakistan. We recommend elevation-based conservation strategies, wildlife corridors, and community-led monitoring to achieve CBD and SDG 15 targets. The findings contribute to broader European and Asian efforts to understand biodiversity responses to global change.

FEWFM-81

Wildlife

**HUMAN-WILDLIFE CONFLICT ASSESSMENT IN RURAL AREAS OF ABBOTTABAD
DISTRICT, KHYBER PAKHTUNKHWA, PAKISTAN****Bibi Nazia Murtaza^{1*}, Muhammad Siraj¹ and Muhammad Iftikhar²**¹*Department of Zoology, University of Science and Technology, Abbottabad, Khyber Pakhtunkhwa*²*Chief Conservator Officer Wildlife, Hazara Circle, Khyber Pakhtunkhwa*

*Corresponding Author: nazia.murtaza@gmail.com

Human-wildlife conflict is an emerging conservation challenge in mountainous regions of Pakistan. This study was conducted to assess the extent, pattern, and causes of wildlife conflict in rural areas of Abbottabad District, Khyber Pakhtunkhwa. Data were collected from 150 households

across 10 selected rural villages using structured questionnaires, focus group discussions, and field surveys from October 2025 to March 2026. The conflict incidents were recorded with respect to crop damage, livestock depredation, and human injuries caused by key wildlife species. The results indicated that leopards, wild boar, and monkeys were the primary species involved in conflict. Crop damage was the most frequently reported conflict type at 62.4%, followed by livestock predation at 28.7%, and human-wildlife encounters at 8.9%. Maize and wheat were the most affected crops with an average annual loss of PKR 45,600 per household. Livestock losses were mainly attributed to common leopard with an average of 3.2 animals per affected household per year. Statistical analysis revealed a significant positive correlation between proximity to forest areas and conflict intensity ($r = 0.73$, $p < 0.01$). Lack of proper fencing, inadequate guarding, and habitat fragmentation were identified as major factors aggravating conflict. 78% of respondents showed negative attitudes toward wildlife conservation due to economic losses. The study concludes that human-wildlife conflict in Abbottabad is increasing and needs urgent mitigation measures. Recommendations include community-based conflict mitigation strategies, compensation schemes, habitat management, and awareness programs in collaboration with the Wildlife Department, Hazara Circle. This research will provide baseline data for effective wildlife management under the 10BTTP/UGPP Phase-I, upscaling of green Pakistan programme: Revival of forestry and wildlife Resources in Pakistan.

ENT-39

DIVERSITY AND ECOLOGY OF FAMILY TETRIGIDAE (ORTHOPTERA) OF DISTRICT KHAIRPUR SINDH PAKISTAN

Hafeeza Gul Lund¹, Waheed Ali Panhwar², Abdul Manan Shaikh²,
Saeeda Anjum Buriro² and Shabana Mangi¹

¹Department of Zoology, Shah Abdul Latif University, Khairpur

²Department of Zoology, University of Sindh, Jamshoro

Corresponding Author: gulhafeeza@gmail.com

Tetrigidae is one of them belonging to sub order califera. Tetrigidae hoppers are usually known as pygmy grasshoppers or ground hoppers these are ancient group of grasshoppers with the morphological character. Long pronotum covering abdomen and wings, lack of tympana, collar like sternum (modified first thoracic sternites) Lack of arolium between tarsal claws Tarsal formula 2-2-3. During the present study, 426 specimens were captured from district Khairpur Sindh Pakistan and sorted into family Tetrigidae, three genera and 07 species i-e *Hedotettix gracilis* (Haan, 1843), *H. lineifera* (Walker, 1871), *H. attenuates*, Hancock, 1904, *Hedotettix punctatus* Hancock, 1909, *Ergatettix dorsiferus* (Walker, 1871), *Euparatettix tricarinatus*, *Euparatettix indicus* Hancock, 1907 were identified which were captured from streams, ponds and swampy places where algal growth is abundant.

PC-31

UNMANNED AERIAL VEHICLES IN PLANT PROTECTION: ADVANCING PRECISION PEST MANAGEMENT FOR SUSTAINABLE AGRICULTURE

**Shahzad Ali Nahiyoon^{1,2*}, Mazhar Din Keerio², Imran Khatri³,
Yan Xiaojing¹, and Yuan Huizhou¹**

¹*Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing, China*

²*Department of Entomology, Horticulture Research Institute,
Agriculture Research Tando-Jam, Sindh, Pakistan*

³*Department of Entomology, Sindh Agriculture University Tando-Jam, Sindh, Pakistan*

*Correspondence Author: shezi_129@yahoo.com

The escalating pressure of insect pests and disease vectors on global crop production demands innovative, precise, and scalable pest management solutions. Unmanned Aerial Vehicles (UAVs) so call Agriculture Drones have emerged as a transformative technology in plant protection, offering entomologists a powerful tool for targeted pesticide and biocontrol agent delivery across diverse cropping systems, including field crops, vegetables, fruits, and orchards. This paper reviews recent advancements in UAV-based pest control, emphasizing their role in improving the timing, uniformity, and efficiency of insecticide applications while reducing operator exposure to harmful chemicals, a critical consideration in integrated pest management (IPM) programs. Key operational parameters influencing spray efficacy and drift control, including spray heights of 1–3 meters, flight speeds of 2–5 meters per second, and flow rates of 1–3 litres per minute, are examined in relation to their impact on pesticide deposition, canopy penetration, and ultimately pest suppression efficacy. The study pays particular attention to UAV performance in structurally complex and topographically challenging environments, such as terraced orchards and dense canopy systems, where conventional ground-based application methods often fail to achieve adequate pest coverage. Drawing on China's rapid UAV adoption from fewer than 4,000 units in 2016 to over 190,000 by 2024, covering an operational area exceeding 93 million hectares, this work illustrates the scalability of UAV technology for area-wide pest management and its potential to support precision entomology initiatives globally. The integration of UAVs with smart sensing technologies, including multispectral imaging for early pest and disease detection, further positions this platform at the convergence of remote sensing, precision agriculture, and applied entomology. We conclude by identifying priority research areas, including droplet dynamics optimization, target-pest specificity, resistance management implications, and non-target arthropod safety, to guide the responsible development of UAV-based pest control as a cornerstone of sustainable crop protection strategies.

PAR-7

DIVERSITY AND CONTROL OF PLANT PARASITIC NEMATODES OF APRICOT IN DISTRICT HUNZA

Mian Sayed Khan* and Kubra Bibi**

Department of Zoology, University of Swabi, KPK, Pakistan

*Corresponding Author: mshkhan@uoswabi.edu.pk

Plant parasitic nematodes that parasitize plants are common and can affect not only commercial fruits but also a variety of other crops. The purpose of the study was to determine the percentage of plant

parasitic nematodes (PPN) connected to apricot trees in different areas of the Hunza district. To evaluate and determine the percentage of PPN, samples were collected from Nasir Abad, Aliabad, Karim Abad, Atta Abad, and Sost. These were then analyzed using the Baermann funnel technique. The results showed that Karim Abad had the highest PPN recorded (52%) of any locality, while Sost had the lowest PPN. Recorded (24%) of all the areas. The following species, which belong to various genera, were identified in a variety of apricot orchards: *Tylenchorhynchus annulatus*, *Helicotylenchus pseudorabustus*, *Longidorus* larvae, *Aphelenchus avenae*, and *Merlinius* larvae. Three organic manures were used for PPN management: pigeon manure (8 kg), chicken manure (6 kg), and cow dung (4 kg). The most used organic manure among these amendments was cow dung, which demonstrated the greatest PPN population decline. In addition, pigeon manure was less common than cow and chicken manure. It was concluded that the presence of PPN in apricot trees in Hunza district causing damage to apricot trees and reduced the yield and its growth. For their management, three types of organic manure were used, but the study revealed that cow manure is the best nematicide it should be used. And it is recommended that a program be started that raises the use of organic amendments and its benefits for those farmers who are unaware and lack knowledge about nematode damage.

AUTHOR INDEX

This index enlists only the names of the oral presenter, who is also the first author in the Abstract

A			Bano, N.	140
Abbas, S.	154	Bano, S.	139	
Abbas, S.	157	Bashir, F.	34	
Abbasi, A.A.	30	Batool, J.	23	
Abbasi, F.	77	Batool, M.	164	
Adja, B.I.	43	Bhanger, N.	107	
Aftab, K.	130	Bibi, M.	119	
Aftab, S.	114	Bibi, Z.	161	
Afzal, Z.	26	Bughio, B.A.	105	
Ahmad, F.	142	Bughio, H.	107	
Ahmad, S.	175	Bughio, Z.	106	
Ahmad, U.	181			
Ahmadani, S.	135	C		
Ahmed, N.	16	Chaudhry, M.T.	23	
Aijaz, S.	202			
Aizaz, M.	201	D		
Akber, I.	187	Das, J.	18	
Akhtar, S.	94	Devi, N.	90	
Akhter, A.A.	20	Dhiloo, K.H.	81	
Alam, S.	35	Durrani, A.Z.	27	
Alam, Z.	116			
Aleena	194	F		
Al-Hussain, F.	19	Faheem, U.	86	
Ali, M.	8	Farooq, J.	76	
Ali, Z.	47	Farooq, S.	88	
Amir, A.	114	Fatima, M.	53	
Amur, A.	92	Fatima, M.N.	52	
Andleeb, S.	68	Fatima, R.	198	
Anjum, F.	179	Fatima, T.	166	
Anjum, H.	80			
Anjum, K.	64	G		
Anum, F.	104	Gabol, K.	130	
Arain, M.A.	63	Gamallat, Y.	7	
Asghar, F	51	Ghaffar, A.	121	
Ashfaq, N.	170	Ghaffar, S.	137	
Ashraf, S.	169	Ghafoor, N.	58	
Ashraf, T.	17	Ghani, G.M.A.	25	
Asif, R.M.	99	Ghulam, S.	203	
Asif, S.	138	Gul, N.	51	
Atif	190			
Attaullah, M.	77	H		
Azhar, M.	150	Haider, Z.	184	
Aziz, A.	67	Hameed, A.	171	
Aziz, I.	50	Hashim, S.	140	
		Hassan, A.	144	
		Hassan, M.	178	
B		Hassan, Z.	44	
Baig, F.	84			

Huda, N.	154	Khan, Q.	37
Hussain, F.	56	Khan, S.	67
Hussain, I.	48	Khan, S.A.	81
Hussain, M.	42	Khan, S.U.	190
Hussain, M.A.	48	Khan, T.	160
Hussain, S.	94	Khan, W.	123
Hyder, S.	102	Khatrri, I.	13
		Khattak, N.G.	101
I		Khizar, R.Z.	117
Ibrahim, A.	34	Kovaleva, E.G	3
Ijaz, J.U.	59	Kumar, S.	76
Imdad, Z.	173	Kumari, V.	101
Iqbal, M.	32		
Iqbal, M.	39	L	
Iqbal, M.Z.	182	Laraib, S.	104
Iqbal, N.	176	Laskar, R.	46
Iqbal, S.	159	Latif, M.	27
Irfan, M.	168	Li, Y.	2
Irfan, M.	46	Lund, H.G.	208
Irshad, M.H.	160		
Irum, S.	127	M	
Ishtiaq, M.	85	Mahar, B.	103
		Mahmood, K.	133
J		Mahmood, T.	132
Jabbar, M.	38	Mal, B.	111
Jakhrani, M.A.	36	Malik, M.	57
Jakhrani, S.A.	206	Malik, M.N.	54
Jalees, M.M.	55	Mangi, A.	61
Jalil, S.	165	Mangrio, W.M.	82
Jamil, M.	156	Mansoor, S.	185
		Mastoi, S.M.	25
K		Matanat, W.	174
Kabir, M.	193	Mehmood, K.	66
Kanwal, S.	116	Memon, S.	186
Kausa, R.	37	Memoona	45
Khadim, S.	145	Mirza, S.	123
Khadima	39	Mohammad, S.	202
Khalid, F.	141	Mohsin, A.	89
Khalid, K.	120	Moubeen, A.	136
Khalil, M.	196	Mpofu, T.J.	6
Khalil, M.	60	Muanprasat, C.	5
Khalique, U.	199	Mughal, M.U.	163
Khan, B.N.	9	Mughal, T.A.	70
Khan, I.A.	121	Mughal, W.G.	158
Khan, M.	24	Mujeeb, N.	195
Khan, M.I.A.	199	Mujeeb-Ullah, M.	40
Khan, M.M.	89	Mukhtar, A.	153
Khan, M.S.	209	Mukhtar, A.	172

Mukhtar, A.	54	Sabahat, B.	178
Mukhtar, I.	155	Sabir, A.M.	28
Mumtaz, S.	133	Sadaf, N.	195
Muqadas, S.	149	Saeed, K.	110
Murtaza, A.	73	Saher, N.	170
Murtaza, B.N.	207	Sahito, K.N.	62
Murtaza, S.	18	Salal, M.S.	72
Musawar, A.	196	Salar, M.Z.	59
Mushtaq, S.	86	Saleem, H.	200
		Saleem, K.	180
N		Salika	72
Nahiyoona, S.A.	209	Sawaira	20
Nawaz, S.	169	Sehar, U.	84
Naz, A.	100	Shabbir, A.	173
Naz, S.	33	Shadab, M.	69
		Shah F.	151
P		Shah, M.A.	91
Pahooja, S.K.	126	Shah, R.	105
Panhwar, W.A.	97	Shah, S.A.	134
Pervaiz, U.	31	Shah, S.Z.U.	205
Perveen, S.	16	Shahid, A.	205
		Shahid, S.	182
Q		Shahzad, M.M.	131
Qadeer, K.	75	Shaikh, A.	91
Qasim, B.	136	Shaikh, F.	125
Qasim, S.	144	Shaikh, M.	92
Qayyum, M.	151	Shaikh, S.	118
Qayyum, M.A.	111	Shamshad, A.	148
Qazi, I.	112	Shamshad, H.	148
		Shanza	147
R		Sharif, U.	87
Rafiq, M.	167	Sher, A.	108
Rafique, D.	49	Shoaib, N.	177
Rasheed, M.	138	Sidhu, A.S.	61
Rasheed, R.R.	82	Siraj, M.	207
Raza, N.	120	Siyal, S.	158
Razaq, S.	152	Solangi, B.K.	79
Razzaq, A.	189	Soomro, A.P.	109
Rehman, A.	167	Su, W.	1
Rehman, A.	57	Subhani, A.R.	143
Rehman, M.M.	162	Sultana, R.	10
Rehman, N.	191		
Rehman, N.	192	T	
Rehman, S.	41	Tabish, M.	172
Riaz, M.	187	Tahir, R.	79
Rubab, A.	188	Talpur, S.A.	102
Ruk, M.	175	Tanveer, M.	99
S		Tanzeela	70

Tariq, M.	193	Y	
Thaheem, M.A.R.	125	Yaqoob, R.	183
		Yaseen, F.	22
U		Yasin, A.	165
Ujan, J.A.	64	Yasin, H.	65
Ujjan, S.A.	30	Younus, M.	43
Ujjan, Z.	118		
Ullah, R.	31	Z	
Unar, K.	71	Zahid, M.	115
Usmani, B.	93	Zahid, M.T.	21
		Zahler, S.	4
W		Zahra, I.	29
Wahab, M.	146	Zain ul Abedin, M.	98
Waheed, A.	113	Zainab	78
Waheed, A.	162	Zainab, R.	184
Waseem, M.	97	Zaman, M.	11