
The 2nd International Electronic Conference on Entomology

19–21 May 2025 | Online



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Natural History Museum, London, UK



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Prof. Dr. Kristopher Giles
Oklahoma State University, Stillwater, USA



Dr. Rui-De Xue
Anastasia Mosquito Control District, St. John's
County, USA
Introduction



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University of Belgrade, Belgrade, Serbia

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19–21 May 2025
Online

The 2nd International Electronic Conference
on Entomology

Conference Secretariat

Email: iece@mdpi.com

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Welcome from the Chair

Dear Colleagues,

Three years after the success of the 1st International Electronic Conference on Entomology (IECE) I have the great pleasure to welcome you to the 2nd IECE, organized and funded by *Insects*, a Q1 journal (ISSN 2075-4450, IF: 2.7) in category "Entomology". *Insects* continuously generate huge global issues, e.g., outbreaks, considerable losses in agricultural production, transmission of various diseases, seriously injuring humans and animals, increased resistance to insecticides, difficulties of effective management, enigmatic biology and ecology, gaps in the composition and mutations of genes, disorder of diversity due to natural destructions. Therefore, research is the obligatory path to handle all these current challenges and, simultaneously, improve our perception to foresee the upcoming ones. The 2nd IECE aims to unite entomologists all over the world to communicate their top research outcomes from basic and applied point of view that will be rapidly published in variable ways after peer reviewing process. The meeting includes these latest research topics:

- S1. Morphology and Systematics;
- S2. Biochemistry, Biotechnology, Genetics, and Genomics;
- S3. Behaviour, Biology, and Physiology;
- S4. Biodiversity, Climate Change, Conservation, Ecology, and Evolution;
- S5. Pest Management, Pesticide Resistance, and Toxicology;
- S6. Forest Entomology and Urban Entomology;
- S7. Social Insects;
- S8. Medical and Veterinary Entomology

The 2nd IECE is organized and sponsored by MDPI, a scholarly open access publisher. I look forward to your participations, contributions, and discussions.

Kind regards,

Prof. Dr. Nickolas G. Kavallieratos,

Agricultural University of Athens, Greece

Chair of the 2nd International Electronic Conference on Entomology



**Prof. Dr. Nickolas G.
Kavallieratos,**

Agricultural University of Athens,
Athens, Greece



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- **Journal Rank**: JCR - Q1 (Entomology) / CiteScore - Q1 (Insect Science)
- **Rapid Publication**: manuscripts are peer-reviewed and a first decision is provided to authors approximately 16.7 days after submission; acceptance to publication is undertaken in 2.4 days (median values for papers published in this journal in the second half of 2024).
- **Recognition of Reviewers**: reviewers who provide timely, thorough peer-review reports receive vouchers entitling them to a discount on the APC of their next publication in any MDPI journal, in appreciation of the work done.

Impact Factor: 2.7 (2023); 5-Year Impact Factor: 2.9 (2023)

Invited Speakers



Dr. Christopher S. Bibbs
Salt Lake City Mosquito
Abatement District, Salt Lake
City, USA



Dr. Whitney A. Qualls
Anastasia Mosquito Control
District of St. Johns County, St.
Johns County, USA



Professor Donato Romano
The BioRobotics Institute, The
Sant'Anna School of Advanced
Studies, Pontedera, Italy



Professor Paulo AV Borges
University of Azores, Ponta
Delgada, Portugal



Dr. Yahya Al Naggar
Tanta University, Tanta, Egypt,
King Khalid University, Abha,
Saudi Arabia



Dr. Deanna Scheff
USDA – ARS Center for Grain
and Animal Health Research,
Manhattan, USA



Dr. Changlu Wang
Rutgers University, New
Jersey, USA



Dr. Aaron Llyod
Lee County Mosquito and
Hyacinth Control Districts,
Lehigh Acres, USA



Dr. Ming Bai
Chinese Academy of
Sciences, Beijing, China

Program at a Glance

	Day 1	Day 2	Day 3
Morning	Session 1. Morphology and Systematics Session 7. Social Insects Flash Poster Session	Session 4. Biodiversity, Climate Change, Conservation, Ecology, and Evolution Flash Poster Session	Session 3. Behaviour, Biology, and Physiology Flash Poster Session
Afternoon	Session 2. Biochemistry, Biotechnology, Genetics, and Genomics Flash Poster Session	Session 5. Pest Management, Pesticide Resistance, and Toxicology Flash Poster Session	Session 6. Forest Entomology and Urban Entomology Session 8. Medical and Veterinary Entomology Flash Poster Session

IECE 2025 Program

19 May 2025 (Monday)

Session 1. Morphology and Systematics
Session 7. Social Insects

Start Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST (Central European Summer Time)	EDT (Eastern Daylight Time)	CST (China Standard Time)	Speaker	Title
09:00 – 09:10	03:00 – 03:10	15:00 – 15:10	Prof. Dr. Nickolas G. Kavallieratos Conference Event Chair	Opening Speech
09:10 – 09:15	03:10 – 03:15	15:10 – 15:15	Prof. Dr. Andjelko Petrovic Session 1 Co-Chair	Welcome Speech by Session 1 Co-Chair 1
09:15 – 09:20	03:15 – 03:20	15:15 – 15:20	Dr. Andrew Polaszek Session 1 Co-Chair	Welcome Speech by Session 1 Co-Chair 2
09:20 – 09:40	03:20 – 03:40	15:15 – 15:40	Dr. Ming Bai Session 1 Invited Speaker	Morphological basis and driving force of beetle flourishing
09:40 – 09:55	03:40 – 03:55	15:40 – 15:55	Darija Milenković Session 1 Selected Oral Speaker	Morphological Insights into Cotesia (hymenoptera: braconidae: microgastrinae) Species in melitaeini Hosts
09:55 – 10:05	03:55 – 04:05	15:55 – 16:05	Prof. Dr. Ljubisa Stanisavljevic Session 7 Chair	Welcome Speech by Session 7 Chair 1
10:05 – 10:25	04:05 – 04:25	16:05 – 16:25	Dr. Yahya Al Naggar Session 7 Invited Speaker	Honey Bee Resilience under Interactive Environmental and Pathogen Stressors
10:25 – 10:40	04:25 – 04:40	16:25 – 16:40	Kristen Basson Session 7 Selected Oral Speaker	Genetic data gives new insights on the species diversity of Macrotermes termites in Africa and Asia
10:40 – 10:55	04:40 – 04:55	16:40 – 16:55	Michela Bertola Session 7 Selected Oral Speaker	The Plasticity of the national surveillance plan for Aethina tumida in Italy
10:55 – 11:25	04:55 – 05:25	16:55 – 17:25	Flash Poster Presentation for Session 1 and 7	

Session 2. Biochemistry, Biotechnology, Genetics, and Genomics

Start Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST (Central European Summer Time)	EDT (Eastern Daylight Time)	CST (China Standard Time)	Speaker	Title
14:00 – 14:10	08:00 – 08:10	20:00 – 20:10	Prof. David Haymer Session 2 Chair	Welcome Speech by Session 2 Chair
14:10 – 14:30	08:10 – 08:30	20:10 – 20:30	Prof. Dr. Patrizia Falabella Session 2 Invited Speaker	Biomimicry: The Imitation Game
14:30 – 14:45	08:30 – 08:45	20:30 – 20:45	Zarina Dairbekova Session 2 Selected Oral Speaker	Molecular identification of the spongy moth parasitoid Phryxe heraclei (Tachinidae) in Kazakhstan.
14:45 – 15:00	08:45 – 09:00	20:45 – 21:00	Mayerli Tatiana Borbon Cortes Session 2 Selected Oral Speaker	Candidatus Liberibacter sp. is detected in Russelliana solanicola Tuthill (Hemiptera: Psyllidae) in Brazil: phylogenetic and functional insights

IECE 2025 Program

15:00 – 15:15	09:00 – 09:15	21:00 – 21:15	Meriem Taleb Session 2 Selected Oral Speaker	Genetic Differentiation of Lucilia cuprina and Lucilia sericata Using cox1 and 28S rRNA Genes: Phylogenetic Insights and First Report of L. cuprina in Northwest Africa
15:15 – 15:30	09:15 – 09:30	21:15 – 21:30	Sumit Jangra Session 2 Selected Oral Speaker	First evidence of orally delivered dsRNA-induced RNA interference in the pepper weevil, Anthonomus eugenii Cano (Coleoptera: Curculionidae)
15:30 - 15:45	09:30 - 09:45	21:30 - 21:45	Flash Poster Presentation for Session 2	

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20 May 2025 (Tuesday)

Session 4. Biodiversity, Climate Change, Conservation, Ecology, and Evolution

Start Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST (Central European Summer Time)	EDT (Eastern Daylight Time)	CST (China Standard Time)	Speaker	Title
09:00 – 09:10	03:00 – 03:10	15:00 – 15:10	Dr. António Onofre Costa Miranda Soares Session 4 Chair	Welcome Speech by Session 4 Chair 1
09:10 – 09:30	03:10 – 03:30	15:10 – 15:30	Prof. Paulo AV Borges Session 4 Invited Speaker	Best practices for the implantation of long-term monitoring of forest arthropods: the SLAM project
09:30 – 09:45	03:30 – 03:45	15:30 – 15:45	Roshay Smith Session 4 Selected Oral Speaker	Arthropod diversity and abundance under irrigated and rainfed conditions in South Africa sugarcane
09:45 – 10:00	03:45 – 04:00	15:45 – 16:00	Michelle Anne Taylor Session 4 Selected Oral Speaker	Pollen-deprived bumblebees induce leaf damage, which activates phytohormone signaling pathway(s) and response(s) within tomato plants, but this does not accelerate or induce flowering
10:00 – 10:15	04:00 – 04:15	16:00 – 16:15	Robyn Tamryn Dzirba Session 4 Selected Oral Speaker	Mating success, fecundity and fertility of marula fruit fly, <i>Ceratitis cosyra</i> Walker (Diptera: Tephritidae) exposed to simulated heat waves
10:15 – 10:30	04:15 – 04:30	16:15 – 16:30	Waqar Jaleel Session 4 Selected Oral Speaker	Invasion of red palm weevil among three different imported varieties of Date Palm
10:30 – 10:45	04:30 – 04:45	16:30 – 16:45	Manish Gautam Session 4 Selected Oral Speaker	Soybean leaf trichomes under drought and herbivory have differential effects on soybean looper (<i>Chrysodeixis includens</i> Walker)
10:45 – 11:00	04:45 – 05:00	16:45 – 17:00	Ilaria Latella Session 4 Selected Oral Speaker	A trophic network analysis of <i>Parnassius apollo</i> (Lepidoptera: Papilionidae, Parnassiinae) adults in the Aspromonte National Park, South Italy
11:00 – 11:15	05:00 – 05:15	17:00 – 17:15	Konstantina Nasiou Session 4 Selected Oral Speaker	Orthoptera diversity and community ecology in the mountainous pastures of two protected areas (Natura 2000) in Greece
11:15 – 11:30	05:15 – 05:30	17:15 – 17:30	Riaz Hussain Session 4 Selected Oral Speaker	From Urban to Mountainous Regions: Impact of Various Factors on Butterfly Species Richness, their Prediction, and Habitat Shifts Induced by Climate Change in Jinan, China
11:30 – 11:45	05:30 – 05:45	17:30 – 17:45	Barbara Manachini Session 4 Selected Oral Speaker	Flames and Fragility: The Impact of Wildfires on Butterfly Biodiversity in Southern Italy
11:45 – 12:00	05:45 – 06:00	17:45 – 18:00	Flash Poster Presentation for Session 4	

Session 5. Pest Management, Pesticide Resistance, and Toxicology

Start Time: 14:00 (CEST, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST (Central European Summer Time)	EDT (Eastern Daylight Time)	CST (China Standard Time)	Speaker	Title
14:00 – 14:10	08:00 – 08:10	20:00 – 20:10	Dr. Louis Hesler Session 5 Chair	Welcome Speech by Session 5 Chair
14:10 – 14:30	08:10 – 08:30	20:10 – 20:30	Prof. Oscar Emanuel Liburd Session 5 Invited Speaker	<i>TBC</i>
14:30 – 14:45	08:30 – 08:45	20:30 – 20:45	Adil Tonga Session 5 Selected Oral Speaker	Pre-parasitism host treatment with broflanilide: lethal and sublethal effects on <i>Trichogramma</i> <i>evanescens</i>
14:45 – 15:00	08:45 – 09:00	20:45 – 21:00	Antonino Modafferi Session 5 Selected Oral Speaker	Garlic EO-based nano- emulsion in pest management: formulation and biological activity on target and non-target organisms
15:00 – 15:15	09:00 – 09:15	21:00 – 21:15	Carmine Lupia Session 5 Selected Oral Speaker	In vitro evaluation of the acaricidal activity of four essential oils against the parasitic mite <i>Varroa</i> destructor
15:15 – 15:30	09:15 – 09:30	21:15 – 21:30	Deanna Scheff Session 5 Selected Oral Speaker	Insecticidal effect of contact insecticides applied to metal and concrete surfaces on six species of stored-product insects
15:30 – 15:45	09:30 – 09:45	21:30 – 21:45	Nikita Kamatkar Session 5 Selected Oral Speaker	Mining of Bt insecticidal protein receptors from the soybean looper genome with special reference to ABC transporters
15:45 – 16:00	09:45 – 10:00	21:45 – 22:00	Maria Michalopoulou Session 5 Selected Oral Speaker	Toxicological effects of nicotinic acetylcholine receptor modulators on transgenic <i>Drosophila</i> expressing honey bee cytochrome P450s
16:00 – 16:15	10:00 – 10:15	22:00 – 22:15	Sofia Dervisoglou Session 5 Selected Oral Speaker	Evaluation of encapsulation systems in the efficacy of essential oils of aromatic plants against <i>Tetranychus</i> <i>urticae</i>
16:15 - 16:30	10:15 - 10:30	22:15 - 22:30	Flash Poster Presentation for Session 5	

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21 May 2025 (Wednesday)

Session 3. Behaviour, Biology, and Physiology*Start Time: 9:00 (CEST, Basel) | 03:00 (EDT, New York) | 15:00 (CST Asia, Beijing)*

CEST (Central European Summer Time)	EDT (Eastern Daylight Time)	CST (China Standard Time)	Speaker	Title
09:00 – 09:05	03:00 – 03:05	15:00 – 15:05	Prof. Kristofer Giles Session 3 Co-Chair 1	Welcome Speech by Session 4 Co-Chair 1
09:05 – 09:10	03:05 – 03:10	15:05 – 15:10	Dr. Maria Boukouvala Session 3 Co-Chair 2	Welcome Speech by Session 4 Co-Chair 2
09:10 – 09:30	03:10 – 03:30	15:10 – 15:30	Prof. Donato Romano Session 3 Invited Speaker 1	Robotics and AI in Insect Science
09:30 – 09:50	03:30 – 03:50	15:30 – 15:50	Dr. Deanna Scheff Session 3 Invited Speaker 1	Influence of insect biology on the utilization of methoprene incorporated packaging
09:50 – 10:05	03:50 – 04:05	15:50 – 16:05	Jairo Alexander López Pardo Session 3 Selected Oral Speaker	From Water to Air: Thermal Strategies of <i>Erythrodiplosis abjecta</i> Throughout Its Life
10:05 – 10:20	04:05 – 04:20	16:05 – 16:20	Fatima Djouber-Toudert Session 3 Selected Oral Speaker	Contribution to the Study of Hygienic Behavior and honey production of the Honeybee <i>Apis mellifera</i> <i>intermissa</i> in a mountainous region of Algeria
10:20 – 10:35	04:20 – 04:35	16:20 – 16:35	Jeyarani S Session 3 Selected Oral Speaker	Host Preference of <i>Hyperaspis maindroni</i> Sicard (Coccinellidae; Coleoptera): Unveiling Attraction Patterns in Cassava Varieties
10:35 – 10:50	04:35 – 04:50	16:35 – 16:50	Armando Alfaro-Tapia Session 3 Selected Oral Speaker	Selective flowers to enhance the performance of the adventive <i>Gryon</i> <i>aetherium</i> parasitoid: a good biocontrol agent in the context of conservation biological control of the painted bug <i>Bagrada hilaris</i>
10:50 – 11:05	04:50 – 05:05	16:50 – 17:05	Saifullah Omar Nasif Session 3 Selected Oral Speaker	Seasonal Abundance of Insect Pests Infesting Transgenic and Non- transgenic Brinjal in Bangladesh
11:05 – 11:20	05:05 – 05:20	17:05 – 17:20	Pedro Alexandre Correia de Jesus Silva Session 3 Selected Oral Speaker	Oviposition Preference and larval performance of <i>Ceratitis capitata</i> (Diptera: Tephritidae) on apple and pear fruits: influence of female age and oviposition periodicity
11:20 - 11:35	05:20 - 05:35	17:20 - 17:35		

Session 6. Forest Entomology and Urban Entomology**Session 8. Medical and Veterinary Entomology***Start Time: 14:00 (CET, Basel) | 08:00 (EDT, New York) | 20:00 (CST Asia, Beijing)*

CEST (Central European Summer Time)	EDT (Eastern Daylight Time)	CST (China Standard Time)	Speaker	Title
14:00 – 14:10	08:00 – 08:10	20:00 – 20:10	Prof. Dr. Antonella Di Palma Session 6 Chair	Welcome Speech by Session 6 Chair

14:10 – 14:30	08:10 – 08:30	20:10 – 20:30	Dr. Changlu Wang Session 6 Invited Speaker	Laboratory Evaluation of a Novel Insecticide, Isocycloseram, against the Common Bed Bug
14:30 – 14:45	08:30 – 08:45	20:30 – 20:45	Deepthy T Session 6 Selected Oral Speaker	Comparative Analysis of Short-horned Grasshopper Diversity in Agroecosystems and Forests: Implications for Conservation
14:45 – 15:00	08:45 – 09:00	20:45 – 21:00	Ankur Patwardhan Session 6 Selected Oral Speaker	Urban terraces and backyard gardens for pollinators: Nero's Fiddle or Noah's Ark?
15:00 – 15:10	09:00 – 09:10	21:00 – 21:10	Dr. Rui-De Xue Session 8 Chair	Welcome Speech by Session 8 Chair
15:10 – 15:40	09:10 – 09:40	21:10 – 21:40	Dr Christopher Bibbs Session 8 Keynote Speaker	The Intersection of Managed Honey Bees, <i>Apis mellifera</i> (Hymenoptera: Apidae), and Mosquito Control: Risk Determinations on Aerial Naled Applications
15:40 – 16:00	09:40 – 10:00	21:40 – 22:00	Dr. Whitney Qualls Session 8 Invited Speaker 1	New Frontiers in Mosquito Management: Sterile Insect and Wolbachia-Based Approaches for Public Health
16:00 – 16:20	10:00 – 10:20	22:00 – 22:20	Dr. Aaron Lloyd Session 8 Invited Speaker 2	<i>Lee County Mosquito Control District's Response to Imported Oropouche Virus in Lee County, Florida</i>
16:20 – 16:35	10:20 – 10:35	22:20 – 22:35	Robert Wolff Session 8 Selected Oral Speaker	Vector and Pest Dispersal via Sun Heated Vehicle Microenvironments
16:35 – 16:50	10:35 – 10:50	10:35 – 22:50	Atiqah Nor Ain Session 8 Selected Oral Speaker	<i>Anopheles donaldi</i> (Barbirostris Group) As A Potential Vector For <i>Plasmodium knowlesi</i> In Sarawak, Malaysia
16:50 - 17:20	10:50 - 11:20	22:50 - 23:20	Flash Poster Presentation for Session 6 and 8	

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Session 1. Morphology and Systematics

sciforum-118323: Family-Specific Cox1 Primers For Identifying Aphids From Degraded Samples

Vaylen Hlaka ^{1,*}, **Lieschen De Vos** ¹, **Bernard Slippers** ¹, **David Read** ¹ and **Kerstin Kruger** ²

¹ Department of Biochemistry, Genetics and Microbiology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria 0002, South Africa

² Department of Zoology and Entomology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria 0002, South Africa

Aphids (Hemiptera: Aphididae) are significant agricultural pests and vectors of plant viruses, making accurate species identification an essential component of pest management and ecological studies. However, DNA degradation in preserved aphid samples presents a challenge for reliable molecular identification. This study aimed to develop family-specific primers for amplifying and sequencing the COX1 barcode region for species identification of old aphid samples. Aphid samples were collected from bucket traps in Christiana, South Africa, between 2006 and 2008, representing 31 species across 21 genera. Morphological identification was conducted initially, and the samples were then stored for long-term preservation in ethanol, prior to primer testing. Universal arthropod primers (LCO1490/HCO2198 and LepF/LepR) failed to amplify the samples because they are old and likely have degraded DNA, highlighting the need to amplify smaller regions of the COX1 gene due to DNA degradation. Family-specific primers were designed based on publicly available mitochondrial COX1 sequences from Aphididae, targeting short overlapping fragments (162–178 bp) of the COX1 gene to reconstruct the complete barcode region. A 294 bp mini-barcode was identified, providing reliable species-level resolution for five aphid species: *Acyrtosiphon kondoi*, *Acyrtosiphon pisum*, *Macrosiphum euphorbiae*, *Metopolophium dirhodum*, and *Tetraneura fusiformis*. Species identifications were validated against a curated reference database, achieving high taxonomic resolution. The primers successfully amplified DNA from moderately degraded specimens but were ineffective for severely degraded samples due to DNA fragmentation. This study demonstrates the utility of family-specific primers and the mini-barcode approach for species identification of old aphid samples, offering a robust framework for molecular taxonomy and advancing aphid species identification for ecological research and pest management.



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sciforum-113457: New data on *Eurylomata picturata* Blanchard (Hemiptera: Heteroptera)

Sofía Araya-Lobos ^{1,2,*} and Eduardo Faúndez ¹

¹ Cape Horn International Center, Punta Arenas, CHILE

² Universidad Católica de Temuco, Temuco CHILE

Eurylomata picturata (Miridae: Mirinae: Resthenini) is a plant bug that is native to Argentina and Chile. *E. picturata* is associated with some crops, especially potatoes; however, our knowledge of the bug is sparse. In this work, we report the first record of the species in a native shrub, *Fuchsia magellanica* (Onagraceae), in Temuco, South Chile. Additionally, four of the known morphs (*pluto*, *picturata*, *delta*, *torquata*) were observed together, as were their intermediates. These morphs currently have a range of subspecies, and we propose to synonymize all of them. In our collections, we observed nymphs and exuviae that were collected with the adults, confirming the association with the host plant. As the immature specimens of this species were previously unknown, the V nymph was described, whose main diagnostic characteristics are the following: General coloration blackish with orange ornaments, mainly on the eyes, and a longitudinal midline from the head to protoscutellum, as well as the anterior third of the abdomen. Head is subtriangular, and first antennomere is longer than the head and rostrum, reaching the mesothorax. Thorax with trapezoidal pronotum and pterothecae reaching half of the abdomen, surpassing protoscutellum. Dorsal abdominal gland opening between abdominal segments III and IV, located on a shiny black tubercle.

The information here contradicts previous information, which only locates this species in low herbs, expanding their habitat to high plants (3-4-meter shrubs). In addition, we observed copulation behavior on different morphs, as well as carrion feeding in adult females on dead specimens, which was recorded for the first time on this species. The new information is discussed and analyzed, and finally, the distribution is corrected, locating this species between Coquimbo and Los Lagos Region in Chile and Río Negro in Argentina.



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sciforum-114028: Deciphering Morphological Variability: Addressing Taxonomic Ambiguities in Contemporary Species Delimitation (Hymenoptera, Figitidae)

Mar Ferrer-Suay ^{1,*}, George E. Heimpel ², Ehsan Rakhshani ³ and Jesús Selfa ¹

¹ Universitat de València, Facultat de Ciències Biològiques, Departament de Zoologia. Campus de Burjassot-Paterna, Dr. Moliner 50, E-46100 Burjassot (València), Spain.

² Department of Entomology, University of Minnesota, St. Paul, MN, USA.

³ Department of Plant Protection, College of Agriculture, University of Zabol, P. O. Box: 98615-538, I. R. Iran.

Delimiting species remains a major challenge in taxonomy, particularly in groups with a minute size and high morphological similarity, such as the hyperparasitoid wasps of the subfamily Charipinae (Hymenoptera: Cynipoidea: Figitidae). Accurately selecting morphological characteristics is very important for distinguishing species, yet many traditional diagnostic traits may be unreliable due to high intraspecific variability. In this study, we applied an integrative taxonomy approach to assess species boundaries in ten species of the *Alloxysta* (*A. brevis*, *A. castanea*, *A. obscurata*, *A. pilipennis*, *A. ramulifera* and *A. victrix*) and *Phaenoglyphis* (*P. heterocera*, *P. longicornis*, *P. villosa* and *P. xanthochroa*) genera. We critically evaluated morphological characteristics traditionally used in Charipinae taxonomy and tested their reliability by comparing them with molecular data from three genetic markers: mitochondrial COI, nuclear ITS2, and ribosomal 16S. Phylogenetic analyses confirmed that charipine species delineation based on morphological features is usually correct. Our results underscore the importance of integrating molecular and morphological evidence to refine species boundaries and improve the classification of hyperparasitoid wasps. By establishing a more robust framework for species identification, this study not only enhances our understanding of biodiversity within the Charipinae taxonomy but also provides essential insights for future ecological and evolutionary research involving these intricate parasitic relationships.



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sciforum-113421: Forensic Identification of Sarcophagidae Species in Central Kerala, India: Application of Wing Morphometrics and Male Genitalia Analysis

Rahana P A ^{1,*} and C F Binoy ²

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Insects that are drawn to carrion serve a significant role in the examination of entomological evidence, facilitating legal and criminal investigations and estimation of the minimum postmortem interval (PMI). Flesh flies (Diptera: Sarcophagidae), which are the predominant necrophagous insects, utilize vertebrate tissue as a breeding site, exhibit larviparous reproduction, and complete their entire life cycle on the carrion itself, which is forensically important. Flesh flies are similar in appearance, making identification reliant on male genitalia; however, carrion-attracted flies are predominantly female and challenging to identify using taxonomic keys; wing morphometric analysis was thus implemented. The flies were collected utilizing 50 grams of decomposed beef liver as a baiting agent. Females were permitted to larviposit, and their larvae were subsequently transferred to individual rearing cages. The emerging F1 progeny of both sexes were euthanized with acetone. The male terminalia were dissected after immersion in 10% KOH, while the female wings were separated, mounted on clean slides, and photographed with a Leica microscope. Morphometric analysis was performed using MorphoJ 1.08 software. The study identified four predominant species of Sarcophagidae in Central Kerala: *Sarcophaga albiceps*, *S. dux*, *S. karnyi*, and *S. peregrina*, which are present year-round and are not specific to any particular geographic region. The male terminalia exhibited distinguishable features; however, *S. karnyi* and *S. peregrina* demonstrated variations in the inner forceps and fifth sternite. Principal Component Analysis (PCA) of wing morphology revealed four distinct clusters, encapsulated within ellipses and distinctly separated. Although *S. karnyi* and *S. peregrina* exhibited minor overlap, they remained distinguishable. Wing morphometric analysis provides a dependable methodology for the identification of female flies in forensic contexts, particularly in Central Kerala, and is also instrumental for the estimation of PMI, which is contingent upon species specificity.



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sciforum-112956: Integrative Taxonomy of a New Species of the Genus *Coriophagus* Kinzelbach from West Bengal, India, with a tentative phylogenetic relationship within the genus (Strepsiptera: Halictophagidae)

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Introduction: Kinzelbach (1971) established the genus *Coriophagus* based on the type-species *Halictophagus zanzibarae* Bohart, 1962, in the family Halictophagidae, of the order Strepsiptera. To date, 16 species of *Coriophagus* are known. Most of them are restricted to the Gondwanan countries (Kathirithamby 2023). In this study, an integrative taxonomy of a new species in the genus is made. A cladistic analysis of the genus *Coriophagus* using the discrete morphological characters to hypothesise a possible phylogeny is also conducted. A revised world key to the adult males of *Coriophagus* is also designed to accommodate the new taxon.

Methods: One adult male was captured in Dudhia, Darjeeling, West Bengal, with the aid of an open light trap and preserved in absolute alcohol for DNA analysis. A small sample of tissue was cut from the underside of the thorax of the specimen for sequencing (outsourced). The rest of the specimen was mounted on a glass slide following the phenol–balsam technique of Wirth and Marston, 1968, for traditional taxonomy. The cladistic analysis of 16 species including the new one (as ingroup) was performed, considering two species, *Halictophagus prominens* Roy & Hazra and *Tridactylophagus sufflatus* Hui, Mukherjee & Hazra, as an outgroup. Analysis was carried out using TNT 1.5 (Goloboff & Catalano 2016).

Result: The new species is named *C. bulbous* owing to its bulbous proctiger. The only species of the genus *Coriophagus* in the world is separated by an R_2 detached vein that is half as long and the same thickness as the R_3 detached vein, a unique irregular quadrilateral-shaped tarsomere I of the forelegs, and a unique spherical bulge on the edge of the proctiger from where the aedeagus arises. The genus *Coriophagus* has been recovered as a monophyletic group in this cladistic analysis.

Conclusion: India is a megadiverse country with three biodiversity hotspots. However, this country has not thoroughly been explored to determine the actual diversity of these enigmatic, often overlooked, obligatorily endoparasitic, endopterygote insects. The discovery of the new species has certainly enriched the species inventory of India vis-à-vis the world. The tentative phylogeny is likely to change upon finding out the other life stages of these species, incorporating their characteristics, as well as the discovery of more new species.



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sciforum-112861: Macroscale morphological features of Jurassic European coleorrhynchans (Hemiptera)

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During the Jurassic period, the Hemiptera were a diverse, abundant, and adaptable group of insects. This period saw the diversification of numerous lineages, which continue to exist as crown groups in the present day.

The Jurassic European entomofauna represents one of the most significant Mesozoic faunas. The fossil sites in Germany, Switzerland, Luxembourg, Belgium, and England contain fossils of insects (and other organisms) that originated from the surrounding mainland areas or offshore islands. The degree of preservation varies considerably. In the majority of cases, only isolated wings are present, although in a few localities, complete specimens have been recovered.

The Coleorrhyncha (Hemiptera) are characterised by their minute size, yet they yield a wealth of data. It is an excellent model group, demonstrating the morphological response to changing environments and the direction of Hemiptera evolution. The collection includes specimens that are exceptionally well preserved, as well as those that are severely damaged or of questionable taxonomic value. The majority of diagnoses are based on straightforward characteristics of the forewings, including their individual states and combinations thereof. It is therefore evident that a more detailed recognition and understanding of the features in question is crucial for their study.

The rapid fossilisation process allows for the observation of well-preserved specimens with fine details. We took advantage of this fact through examination with SEM and EDS and morphometric analysis. Over 150 fossils were subjected to analysis. Scanning electron microscopy (SEM) and EDS (Energy-Dispersive Spectroscopy) were employed for macro-scale investigations of colour remnants of cuticles, spinulations, and other previously unidentified minutiae within Coleorrhyncha. The findings of this study revealed novel microfeatures of the pronotum, mesonotum, head, and genital plates. Macrosculptural patterns exhibited variation between the taxa, rendering them useful for taxonomic purposes.



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sciforum-113501: Male-specific leg modifications in five species of European millipedes (Diplopoda, Julida)

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Millipedes (Diplopoda) are sexually dimorphic in various morphological, behavioral and post-embryonic development traits. Morphological intersexual variation in members of the diplopod order Julida encompasses the presence of gonopods (male specialized appendages that are involved in sperm transfer), the presence of glands that open on the coxae of the second leg-pair and modifications of gnathochilarium, mandibles and legs. In order to examine fine morphology of the latter sexually dimorphic trait in five julidan species [*Cylindroiulus boleti* (C. L. Koch, 1847), *Megaphyllum bosniense* (Verhoeff, 1897), *M. unilineatum* (C. L. Koch, 1838), *Ommatoiulus sabulosus* (Linnaeus, 1758) and *Pachyiulus cattarensis* (Latzel, 1884)], we dissected anterior (including the first) leg-pairs in males of the mentioned species and examined them using light and scanning electron microscopy. Our results show that the first leg-pair in all analyzed species shares common features: the legs are reduced in size (compared to other walking legs), consist of only three segments, and are hook-like. The other legs are characterized by the presence of adhesive pads on the ventral surface of the tibia and tarsi. The adhesive pads are of a 'smooth' type: they are made of a thin layer of cuticle with only a few striations. Since these modifications of the walking legs are present only in males of the analyzed species, we propose that these structures enable males to achieve a firmer grip of the female head (hook-like legs of the first pair) and to hold onto the female during mating (walking legs with adhesive pads).



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sciforum-113440: Morphological Insights Into *Cotesia* (Hymenoptera: Braconidae: Microgastrinae) Species In Melitaeini Hosts

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The genus *Cotesia* (Hymenoptera: Braconidae: Microgastrinae) comprises koinobiont endoparasitoid wasps specialized in lepidopteran hosts. This research aimed to investigate the potential to identify *Cotesia* species associated with hosts from the tribe Melitaeini based on their fore wing morphology. Additionally, the intraspecific diversification within the *C. melitaeorum* aggregation was explored. Parasitoids were reared from twelve broods of *Melitaea didyma*, *M. ornata*, *M. phoebe* and *Euphydryas aurinia*, collected primarily in Serbia, as well as in Croatia and Spain. Emerged parasitoids were identified as *C. bignellii*, *C. hispanica*, *C. lycophron* and *C. melitaeorum* agg. The females' fore wings were analyzed using geometric morphometrics to evaluate the interspecific and intraspecific morphological variation. The results of this study revealed significant differences in the forewing shape among the *Cotesia* species. The Principal Component Analysis (PCA) identified four distinct species, supporting species-level differentiation based on identification keys. *Cotesia hispanica* was distinguished by the slight widening and elongation of the distal part of its wings. The evidence suggests the existence of a potential biotype within the *C. melitaeorum* aggregation, which may represent a distinct subgroup, requiring further investigation. This study enhances the identification of morphologically similar species within the highly diverse genus *Cotesia* based on forewing morphology, particularly those utilizing Melitaeini caterpillars as hosts.



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sciforum-113452: Morphometric variation in the weevil species complex *Listroderes costirostris* (Coleoptera: Curculionidae)

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Introduction

The South American weevil species complex *Listroderes costirostris* Schoenherr (“vegetable weevils”) is comprised of three species: *L. costirostris*, *Listroderes difficilis*, and *Listroderes obliquus*. Due to the morphological similarities between the females and the scarce males (parthenogenetic species), there is no consensus about whether they correspond to a single species or three valid ones. These species are agricultural pests of several crops in their countries of origin and where they were introduced.

Methods.

For the morphometric analysis, three structures or regions were considered: rostrum in frontal view (HF), rostrum in lateral view (HL), and pronotum in lateral view (PL), for a total of 135 females (45/ species). Landmarks and curve semilandmarks were established with TPSDig. Procrustes analysis, Principal Component Analysis (PCA), Canonical Variates Analysis (CVA), and discriminant analysis (DA) were performed in MorphoJ and Geomorph 4.2 in R. The structures were analyzed independently.

Results.

In the PCA, all species were differentiated only using the PL structure. In the CVA the species have significant differences (P 0.0001) in all structures analyzed. The DA also showed significant differences between species in the three structures studied.

Conclusions.

Concluding, the three species of the *L. costirostris* complex could be differentiated based on morphometrics. The structures of the head and pronotum are useful for this differentiation, mainly the lateral view of the pronotum. As a future step, we need to correlate the morphometric variation observed with the genetic divergence within this group.



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sciforum-113270: New Records of bristle flies (Diptera: Tachinidae) from Morocco: Expanding the Geographic Distribution of the family

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Tachinidae is a diverse family of calyptate Diptera with a high evolutionary rate and a rapid diversification. More than 8500 species worldwide are grouped into 1501 genera, and in the Palaearctic Region, more than 2100 species have been recorded, grouped in 416 genera.

The Mediterranean Region is recognized as a unique biodiversity hotspot for Diptera, offering a wealth of discoveries in various taxonomic groups in this order. In the last decade, several studies have provided valuable insights into the taxonomy, distribution, and ecological roles of some Dipteran families in Morocco, culminating in the publication of a Catalogue of the Diptera of Morocco (Kettani et al. 2022). In this catalogue, 177 species of Tachinidae are recorded, but research on this family in Morocco remains rather limited compared to other families, and many more species are to be expected, especially noting that Spain has 514 recorded species.

Tachinidae are parasitoids of other insects. Their distribution is related to host preferences as well as to the habitats where the hosts occur on a regular basis and, presumably, in good numbers. A species of Tachinidae that has a wide host preference is more likely to be found in a variety of ecosystems.

A significant effort involving field trips at 163 surveyed sites (46 are home to Tachinidae) resulted in the collection of 309 adult specimens, whose identification revealed 67 species. Of these, 51 have already been recorded in Morocco, 16 species are newly discovered in the country and 11 species are new to North Africa. Seven genera (*Microsoma* Macquart, 1855; *Triarthria* Stephens, 1829; *Macquartia* R.-D., 1830; *Nemora* Robineau-Desvoidy, 1830; *Trigonospila* Pokorny, 1886; *Prosopea* Rondani, 1861; *Elodia* Robineau-Desvoidy, 1863) are cited for the first time in Morocco. These newly recorded species in Morocco belong to four subfamilies, 13 tribes, and 14 genera.



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sciforum-113154: Sexual dimorphism in size and shape of morphological traits in *Drosophila simulans* (Diptera: Drosophilidae): geometric morphometric approach

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Sexual dimorphism (SD) in different morphological traits (both non-sexual and secondary sexual traits), colour pattern, ornamentation, and behavioral repertoire has been analyzed in different animal species. It can be defined more precisely when its two different components, sexual size dimorphism (SSD) and sexual shape dimorphism (SShD), are analyzed separately. In spite of the fact that SSD and SShD are equally relevant components of sexual dimorphism, SShD has not been the subject of a large number of zoological studies. Both SSD and SShD in some morphological traits have been poorly analyzed in *Drosophila simulans*. Therefore, the aim of the present study was to investigate the presence of SSD and SShD in three morphological structures (the head, the wing, and the leg) in *D. simulans*. To analyze SSD and SShD in the abovementioned morphological traits, the geometric morphometric approach was applied. *D. simulans* flies were reared on a standard cornmeal–agar–yeast medium under constant laboratory conditions (25°C, humidity of 60%, and 12h L: 12h D cycle). Fifty individuals per sex were analyzed. TpsDig software was used to digitize different landmark points placed on the morphological structure: 12 landmarks were placed on the head, 15 landmarks were placed on each wing, and 28 landmarks were placed on each leg. The SShD of the aforementioned morphological structures was analyzed using Canonical Variate Analysis in MorphoJ program, whereas their SSD was evaluated using the CoordGen6 program. All statistical analyses of CS variation were conducted using the R program. Sexual shape dimorphism was significant in all morphological structures: the head ($p = 0.0001$), the wing ($p = 0.0001$), and the leg ($p = 0.0027$). Also, sexual size dimorphism was expressed and significant for all investigated structures ($p = 0.0001$). The significant sexual size and shape differences in all the analyzed morphological structures indicate that different evolutionary pressures are present in *D. simulans* males and females.



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sciforum-113158: Temperature-related changes in wing size and shape in two sibling species, *Drosophila melanogaster* and *D. simulans* (Diptera: Drosophilidae)

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Introduction: Morphological and life-history traits represent characteristics influenced by various environmental factors that can contribute to adaptive variability in many organisms. Temperature is an important environmental factor that drives phenotypic change in different traits in *Drosophila* (developmental time, fertility, viability, body size, pigmentation, etc.). Therefore, the aim of this study was to investigate the effect of temperature on wing size and shape in two sibling species, *Drosophila melanogaster* and *D. simulans*. **Methods:** Differences in wing size and shape between *D. melanogaster* and *D. simulans* flies reared on different thermal regimes were analyzed using a geometric morphometric approach. Both *Drosophila* species were separately reared on cornmeal–sugar–agar–yeast substrates, at two temperatures (25°C and 19°C), a humidity of 60%, and 12h L–12h D cycle. Wing size and shape were analyzed in 400 individuals (200 individuals per species, i.e., 100 per sex). TpsDig software was used to mark fifteen landmarks per wing picture. The effect of different temperatures on wing shape in both *Drosophila* species was investigated by Canonical Variate Analysis using the MorphoJ program, while the influence of distinct temperatures on wing centroid size was analyzed in the program CoordGen6. **Results:** The obtained results indicated that temperature significantly influenced wing shape in males and females in both *Drosophila* species ($p = 0.0001$). However, temperature significantly influenced wing centroid size in males and females of *D. simulans*, which was not the case in its sibling (*D. simulans*: $p = 0.0422$; *D. melanogaster*: $p = 0.9994$). **Conclusion:** Based on the results, we can conclude that wing shape is a more variable trait than wing size across temperatures, which could be further related with flying efficiency under different thermal regimes.



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sciforum-113264: The outcome of 2024: New species and new records of fungus gnats (Diptera, Keroplatidae, Mycetophilidae) in Morocco and North Africa

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Fungus gnats are a group of nematocerans flies of Diptera comprising six families, placed in the superfamily of Sciaroidea. They are considered one of the largest groups of Diptera, with more than 5400 species being known globally. Adult fungus gnats are associated with humid areas, especially moist woodlands. They are usually found in shady and moist habitats such as cavities and root systems of fallen trees, overhanging stream banks, and among the undergrowth of woods. Larvae mostly develop in fungal fruiting bodies or in fungal mycelia in dead wood and soil litter. A few species may develop in myxomycetes, rotten wood, bryophytes, bird's nests, or caves.

Although the Moroccan fungus gnat's fauna is the best studied in the North African region, our knowledge on this fauna is still moderate. It is represented by 77 species belonging to three families: Bolitophilidae (1 species), Keroplatidae (12 species), and Mycetophilidae (64 species). Drawing from extensive fieldwork conducted across nearly all regions of Morocco between 2013 and 2023, the year 2024 was notable for fungus gnat research, unveiling six new Mycetophilidae species that were previously unknown to science. Additionally, significant contributions were made to the Moroccan and North African fungus gnat fauna, including the new records of one Keroplatidae species and twenty-four Mycetophilidae species.

The discovery of new Mycetophilidae species, coupled with extensive records of species in Morocco and North Africa, highlights the impressive biodiversity and endemism of fungus gnats from this globally known hotspot.



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Session 2. Biochemistry, Biotechnology, Genetics, and Genomics

sciforum-113514: Repurposing *Spodoptera littoralis*: from pest to sustainable resource cycling model

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Insect farming offers a promising avenue for sustainable food systems, especially when integrated with waste management strategies. *Spodoptera littoralis*, a destructive agricultural pest known for its generalist nature, holds potential beyond its pest status. This study investigates its role within a circular bioeconomy model that utilizes underused local resources as substrates to transform agricultural waste into valuable nutritional outputs. Colonies of *S. littoralis* were maintained under laboratory conditions on two alternative diets, dandelion leaves and a beetroot–potato mix, alongside a standard artificial diet as a benchmark. Dandelion leaves were selected for their abundance, high nutritional value, and minimal environmental footprint. The beetroot–potato mix consisted of cosmetically imperfect, unspoiled vegetables discarded by local markets. This approach aimed to identify a waste stream that does not qualify as true waste but remains outside larger supply chains, ensuring minimal competition with other bioeconomies. While prior work has established the feasibility of these diets in supporting key life history traits, this study shows their preliminary nutritional adequacy through proximate analysis. Caterpillars fed with dandelion contained 46.69 g protein and 14.83 g fat per 100 g, while the beetroot–potato mix offered 31.87 g protein and 15.61 g fat per 100 g, which aligns with nutritional profiles typical for noctuid polyphagous species. Beyond protein production, the go-to focus in the edible insect sector, lepidopteran insects are valued for their bioactive compounds with potential applications in health and industry. Future research into the chemical composition of larvae reared on such substrates could reposition *S. littoralis* as a versatile bioconverter within circular bioeconomy frameworks.



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***sciforum-113532: Candidatus Liberibacter* sp. is detected in *Russelliana solanicola* Tuthill (Hemiptera: Psyllidae) in Brazil: phylogenetic and functional insights**

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Emerging diseases associated with *Candidatus Liberibacter* have become increasingly significant in recent decades. Devastating diseases such as Zebra Chip and Huanglongbing, caused by *Ca. L. solanacearum* (CLsol) and *Ca. L. asiaticus* (CLas), respectively, are leading to substantial economic losses in agriculture worldwide. *Ca. Liberibacter* is a phloem-restricted bacterial genus that, as far as currently known, is naturally transmitted exclusively by psyllids (Hemiptera: Psylloidea). The South American potato psyllid *Russelliana solanicola* Tuthill (Psyllidae), recognized as a potential vector of *Ca. Liberibacter*, feeds on a diverse range of plants from families such as Solanaceae, Apiaceae, and Asteraceae, including both cultivated and non-cultivated species. The hybrid approach, integrating metagenomic and metataxonomic methods, enabled the discovery of a novel association between *Ca. Liberibacter* sp. and *R. solanicola*. This was achieved through shotgun sequencing utilizing Illumina technology and amplicon sequencing with Oxford Nanopore Technology. Subsequent phylogenetic, genomic, and functional analyses enabled a comprehensive initial characterization of the bacterium. Phylogenetic analysis of 16S rRNA gene sequences revealed that *Ca. Liberibacter* sp. associated with *R. solanicola* forms a distinct clade closely related to *Ca. L. americanus* and *Ca. L. europaeus*, sharing 98% sequence identity. This clade diverges from other species, including CLsol, CLas, and *C. L. africanus*. Metagenomic analysis recovered 81 contigs with high assembly consistency (90.1% coarse, 89.6% fine) and an N50 value of 168,363 bp. Functional annotation identified 205 protein-encoding genes with assigned functions and 176 protein-encoding genes without functional assignments, highlighting both known and unexplored aspects of its genomic repertoire. The phylogenetic relationships, combined with the identified genomic and functional characteristics, open the door to understanding the potential ecological role of this association and future implications, especially considering the polyphagy of *R. solanicola*. This research is ongoing and remains crucial for understanding its role in uncovering novel bacterial species and ecological associations.



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sciforum-118326: Wolbachia-mediated mitochondrial introgressions in butterflies: a case study of the Palearctic Sulphurs (Lepidoptera, Pieridae)

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Wolbachia is considered one of the most common and widespread endosymbiotic bacteria. *Wolbachia* has varied impacts on the biology and evolution of its hosts. It can obscure true phylogenetic relationships and lead to erroneous mitochondrial-based phylogenetic reconstructions, species misidentification and incorrect taxonomical conclusions.

Our study aimed to shed light on the role of *Wolbachia* endosymbionts in the evolutionary history, biogeographic patterns and phylogenetic relationships of taxa of the genus *Colias*, a taxonomically challenging group of butterflies. We analyzed five nuclear (CAD, EF-1a, GADPH, RPS5, wingless) and mitochondrial (COI) genes for a large set of samples per species and conducted PCR screening for three *Wolbachia* genes (16S, wsp, ftsZ) in order to reveal patterns of *Wolbachia* infection in *Colias* taxa.

We discovered several cases of deeply diverged mitochondrial lineages (haplotypes) within the species that were characteristic of the species level. We found that these distinct haplotypes are usually shared by morphologically well-differentiated *Colias* species. Further investigation revealed the strong association of these diverged lineages with *Wolbachia* infection. We demonstrated that *Wolbachia* infection is strongly female-biased and haplotype selective: females bearing deviant haplotypes turn out to be totally infected, while males of these haplotypes, as well as males and females bearing common haplotypes, were either uninfected or had a very low rate of infection (less than 5%). We revealed that females carrying haplotypes shared by morphologically well-differentiated *Colias* species are always totally infected by the same *Wolbachia* strain. This fact suggests the transfer of *Wolbachia* across species through occasional hybridization resulting in mitochondrial introgression.

We conclude that *Wolbachia* endosymbionts play an essential role in the biology, diversification and evolution of *Colias* butterflies.

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sciforum-118386: Evaluation of Talin expression on testes from adults of *Ceraeochrysa claveri* Navás, 1911 (Neuroptera: Chrysopidae) exposed to pyriproxyfen during larval phase

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Under proper conditions, green lacewings (Neuroptera: Chrysopidae) larvae show great voracious predatory habits, being an effective biological control species against several pest insects. They are constantly exposed to insecticides as much as their prey on the field, which could impair their lifespan and reproduction, and so far, there are no molecular data available showing the impact of the insecticide pyriproxyfen on testes of *Ceraeochrysa claveri*. Even when presenting some cellular damage and ultrastructural alterations in the testes cells, this species had already demonstrated tolerance against the insecticide pyriproxyfen, being able to reproduce and maintain their lifespan under lab conditions. Being of great ultrastructural importance, Talin is a protein that connects to the cytoskeleton by the actin and vinculin binding sites and enhances the integrin connection to the extracellular matrix, maintaining the cell structure. This work aimed to evaluate the expression of Talin on testes of *C. claveri* adults treated with pyriproxyfen during the larval phase by RNA-seq. Newly hatched larvae (0-12h) of *C. claveri* were individualized, fed on *Diatraea saccharalis* eggs treated at two concentrations of pyriproxifen (50 mg and 100 mg a.i. L⁻¹), and compared to a control group (no insecticide intake) for 10 days. After that, all insects fed on eggs with no insecticide until pupation. When adults emerged, 10-day-old males were dissected, with the testes removed and taken for RNA extraction, library construction, and sequencing. The reads were *de novo* assembled and the genes were annotated by scanning the ORFs for homology. Differentially expressed genes (DEGs) were observed among the groups (50mg vs control; 100mg vs control; and 50mg vs 100mg). RNA-seq results showed that Talin was upregulated in the 50mg vs control and 100mg vs control groups, with both results confirmed by RT-qPCR. These molecular results could help improve Integrated Pest Management (IPM) strategies to better preserve green lacewings on field.



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sciforum-118301: Evaluation of the freezing and drying process on the physicochemical properties of the agave white worm (*Aegiale hesperiaris*).

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The agave white worm (*Aegiale hesperiaris*) is a seasonal larva that is stored frozen (-18 °C) for marketing. However, the effects of freezing the larva on its nutritive and bioactive components have not been studied. Therefore, this study investigated the effects of freezing the white agave larva on its nutritive and bioactive components and evaluated two drying methods subsequently used for its preservation. Larvae collected in 2023 and 2024 were frozen and after thawing at room temperature (~25 °C) and then drying by convection (40 °C) or freeze-drying (-55 °C), their chemical and bioactive constituents were determined. In terms of nutrient composition, GBL24 was the best preservation method. The freezing process had an influence on the chemical composition of the larvae, especially on the soluble compounds that are formed during thawing. For this reason, the insoluble compounds in the larvae collected in 2023 were more than twice as high as in the larvae collected in 2024. Two main fatty acids were detected in the larvae according to their concentration, namely, linolelaidic acid methyl ester (27-42.40%) and methyl palmitate (23.19-33.02%), which decreased after the drying process, while an increase in methyl butyrate and methyl palmitoleate was observed in the freeze-dried samples (0.8-4.67-fold, respectively). Among the entomochemicals present in the larvae that are considered bioactive compounds, alkaloids, triterpenoids, tannins and saponins were identified. Saponins and tannins were the most abundant compounds when methanol was used as an extractant. Freeze-drying preserves the highest concentration of bioactive compounds, while convection drying preserves the highest concentration of fatty acids. In view of the above, the drying process is crucial for the preservation of bioactive compounds and fatty acids.



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sciforum-113517: Genetic Differentiation of *Lucilia cuprina* and *Lucilia sericata* Using *cox1* and 28S rRNA Genes: Phylogenetic Insights and First Report of *L. cuprina* in Northwest Africa

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Lucilia cuprina Wiedemann and *Lucilia sericata* Meigen (Diptera: Calliphoridae) are blowflies that may cause cutaneous myiasis in sheep, among other wild and domestic animals, leading to major economic losses in the sheep industry. The mitochondrial cytochrome c oxidase subunit 1 (*cox1*) gene has been considered ineffective for species identification when used alone. Some *Lucilia* (*Phaenicia*) *cuprina* exhibit mitochondrial DNA haplotypes that closely resemble those of *Lucilia sericata*, suggesting a paraphyletic relationship between *L. cuprina* and *L. sericata*. To address this, we examined both the nuclear 28S rRNA gene and the mitochondrial *cox1* gene to differentiate between *L. cuprina* and *L. sericata* using new DNA data from Northwest Africa. This study provides the first evidence of *L. cuprina* in Northwest Africa.

Adult flies were captured from Tipaza Province, North Algeria (36°33'11.254"N, 1°48'5.749" E). We sequenced both the *cox1* and 28S genes and constructed phylogenetic trees using the maximum likelihood method with 1000 bootstrap replicates. The sequencing generated approximately 675 base pairs (bp) for *cox1* and 633 bp for 28S. All sequences were identified using BLASTn and deposited in GenBank (accession numbers PP918012- PP918014, PP922527- PP922529, PP922531- PP922533, and PP916230- PP916232). No intraspecific differences were observed among the sequences. The 28S analysis confirmed the monophyly of the two species, while the *cox1* analysis revealed that *L. cuprina* is divided into two distinct clades, paraphyletic with respect to *L. sericata*. The 28S sequences clustered together without showing any consistent geographic patterns.

Despite the paraphyletic relationship between *L. sericata* and the two forms of *L. cuprina*, mitochondrial DNA appears useful in distinguishing these species. However, the subspecies *L. cuprina cuprina* (Wiedemann) and *L. cuprina dorsalis* Robineau-Desvoidy cannot be differentiated using the 28S and *cox1* genes, nor can their differences be inferred based on geographic location, particularly in areas where both subspecies coexist.



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sciforum-118153: Molecular identification of *Cydia pomonella* (Lepidoptera: Tortricidae) from apple orchards in Kazakhstan

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The codling moth (*Cydia pomonella* L.) is a widely distributed harmful pest in Kazakhstan that affects agricultural crops, primarily fruits such as apples. Despite its economic significance, its molecular identification had not been conducted in the country before this study.

A total of 91 fruit samples infested with *C. pomonella* larvae were collected in orchards across Almaty and Zhetysu (Kazakhstan), as well as the Jalal-Abad regions (Kyrgyzstan). In orchards, fruit pests were misidentified as *G. molesta* due to the lack of molecular identification, distorting quarantine pest statistics.

Genomic DNA was isolated using the CTAB method. Partial sequences of the 16S rRNA and cytochrome c oxidase subunit I (COI) genes were amplified and sequenced using Oxford Nanopore Technology (MinION Mk1B). Mapping to reference 16S rRNA sequences NC_020003.2 (*C. pomonella*) and KT004682.1 (*G. molesta*), as well as to reference COI sequences PP991409.1 (*C. pomonella*) and PQ876920.1 (*G. molesta*), was performed using Minimap2, and post-alignment metrics were calculated with SAMtools. The distribution of these metrics was visualized using ggplot2 in R.

Sequencing data from 91 samples exhibited a mean sequence identity of 93.31% to the reference sequences of *C. pomonella* and 90.5% to *G. molesta*. Mapping quality scores ranged from 40 to 60, with an average sequencing depth of ~1,300× and a mean coverage of 99.83%. The high sequence identity to *C. pomonella* reference sequences across both mitochondrial markers provides strong molecular confirmation that all collected specimens belonged to *C. pomonella* rather than *G. molesta*. These findings underscore the need to revise pest identification methods, as the widespread misclassification of pests can impact quarantine measures and pest management strategies. These results highlight the importance of implementing accurate molecular diagnostic techniques to ensure reliable pest monitoring and control.

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sciforum-118165: Molecular identification of the spongy moth parasitoid *Phryxe heraclei* (*Tachinidae*) in Kazakhstan.

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The spongy moth (*Lymantria dispar*) is a harmful phytophagous insect, causing significant damage to forest ecosystems. During the collection of *Lymantria dispar* samples, a parasitoid developing in the pupae of this pest was discovered. A parasitic fly emerged after two days of incubation. Judging from morphological characteristics, the fly was identified as a dipterian from the family *Tachinidae*. To determine the species, a molecular genetic analysis was conducted.

gDNA was extracted using the CTAB method. Barcoding was performed using universal primers targeting 16S rRNA (5'-TARTYCAACATCGRGGTC-3' and 5'-CYGTRCDAAGGTAGCATA-3') gene. Then, species identification was performed using ONT sequencing. Reads were mapped against a database of 88274 dipteran rRNA sequences using minimap2 (V.2.28), further processed with SAMtools (V.1.21). Quality metrics visualized in R (V.4.4.2) using Rsamtools and ggplot2 packages.

The sequencing analysis generated 5,066 total reads, of which 4,751 (93.78%) were successfully mapped to reference sequences. A total of 704 reads were mapped to the *Phryxe heraclei* mitochondrial 16S rRNA gene (GenBank accession no. AB465921.1), with mapping quality scores (MAPQ) ranging from 40 to 60. While other species such as *Pexopsis pilosa* and *Bothria japonica* showed mapped reads, these alignments were predominantly of low quality (MAPQ 20) with scattered coverage patterns.

A literature analysis showed that this parasitoid is one of the main natural enemies of the spongy moth in the Far East. However, there are no data on its detection or research in Kazakhstan. Nevertheless, the molecular analysis provided strong evidence supporting the identification of the parasitoid as *Phryxe heraclei*.

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sciforum-118271: Bugs Tell No Lies: Enhancing The Role Of Insects In Forensic Science

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Forensic entomology is a well-established tool in post-mortem interval (PMI) estimation, relying on the succession and development of necrophagous insects. However, despite its forensic significance, the field faces methodological challenges that impact the accuracy and reliability of its conclusions. The most critical limitations include environmental variability, species misidentification, and the influence of toxicological substances on insect development, which can lead to over- or underestimations of PMIs due to altered insect growth rates and succession patterns. To address these concerns, this review evaluates existing forensic entomology methodologies and explores emerging approaches that could enhance its forensic applicability.

A systematic review of the recent literature on forensic entomology was conducted, focusing on its practical applications, challenges, and the influence of external factors on PMI estimation. Case studies, experimental research, and forensic toxicology analyses were examined to assess how species variability and environmental conditions affect forensic accuracy. Additionally, AI-based insect classification and biochemical approaches for detecting toxicological residues were explored as potential advancements in forensic entomology.

This review indicates that species misidentification remains a significant concern, particularly due to morphological similarities among necrophagous insects. Furthermore, toxicological substances found in decomposing remains can alter insect development rates, leading to inaccurate PMI assessments. AI-driven classification methods are a promising improvement in species identification accuracy, while biochemical analyses of necrophagous insects present new opportunities for forensic entomotoxicology by enhancing toxicological screening in forensic investigations.

Despite its established forensic significance, forensic entomology requires methodological refinements to enhance its reliability in criminal investigations. The integration of AI-driven insect classification and biochemical analysis into forensic protocols can significantly improve PMI estimation accuracy and forensic toxicology assessments. Future research should focus on validating these technologies through controlled forensic studies and real-case applications to ensure their accuracy, reproducibility, and forensic admissibility.



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sciforum-112366: First evidence of orally delivered dsRNA-induced RNA interference in the pepper weevil, *Anthonomus eugenii* Cano (Coleoptera: Curculionidae)

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The pepper weevil (*Anthonomus eugenii* Cano), a significant pest of pepper crops in the United States, Mexico, and the Caribbean, can be controlled using RNA interference (RNAi), a common technique for analyzing gene activities and creating innovative management plans for a variety of insect pests. This pest's larval stages develop inside the fruit, making it difficult to handle effectively with both conventional and biorational insecticides. The current study examined the possibility of oral double-stranded RNA targeting arginine kinase (ArgK) and pepper weevil heat shock protein 70 (Hsp70) in managing this destructive pest. According to our findings, adult pepper weevil (both male and female selected randomly) death rates within 10 days were 61.67 and 48.33%, respectively, when Hsp70 and ArgK were silenced. The relative mRNA expression of *ArgK* and *Hsp70* was drastically reduced by 5.06 and 4.15 times, respectively, after 72 hours of DsRNA exposure. According to our findings, pepper weevils respond well to dietary RNA interference, and Hsp70 and ArgK may be useful RNAi target genes for managing this damaging pest. RNAi-based control of the pepper weevil opens avenues for the development of RNA-based commercial biopesticides. The results suggest that *ArgK* and *Hsp70* play a key role in pepper biology. However, extensive research to determine off-and-non-target effects, environmental consequences, and the possibility of any resistance development is also critical.



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sciforum-118440: Folic acid-enriched diet genotype and sex-dependent effects on *Drosophila melanogaster* imago life expectancy: chronic experiment

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Introduction

The negative effects of excessive folic acid consumption by insects are widely known, like gut microbiota disruptions, reactive oxygen species accumulation, and aberrant DNA methylation. These can either directly lead to an individual's death due to metabolic changes, or affect further generations through the aberrant gamete production of exposed individuals. At the same time, there is a high demand for folates during the larval stage, including for proper DNA synthesis and DNA and histone methylation. This study represents the analysis of folic acid supplementation effects at 1 mg/ml concentration on the imago life expectancy of two *Drosophila melanogaster* stocks (*radius incompletus* and *Canton-Special*).

Methods

To determine if adaptation to folic acid excess in a larval culture medium takes place or not, we performed a chronic experiment in a sixth generation of flies. Additionally, to determine the sex-specific parental influence on the offspring's survival, two groups were added to the analysis, in which either the mother or father came from a group that consumed additional folic acid at the larval stage. The survival curve analysis was conducted using Aalen's additive model from the survival package in R.

Results

When chronically consuming excess folic acid (1 mg/ml), *drosophila* imago life expectancy varies depending on the genotype (belonging to a particular stock) and sex of the individual. The directionality of the detected effects does not depend on which parent (mother, father, or both) was exposed, but depends on the sex of the offspring under analysis. We note the negative impact of excess folic acid intake by parents at the larval stage on their offspring's life expectancy at the adult stage, especially that of male offspring.

Conclusions

Folic acid, when consumed in excess by *Drosophila melanogaster* individuals at the larval stage for several generations, has genotype- and sex-dependent effects, including negative ones, on the life expectancy of the imago--offspring of exposed parents.



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sciforum-113136: Heat-Driven Adaptations: Temperature-Modulated Enzymatic Strategies in Mustard Aphid Morphs

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Temperature plays a pivotal role in shaping the physiological responses of mustard aphid (*Lipaphis erysimi* Kalténbach) morphs, influencing their enzymatic activity and oxidative stress management. This study examined their enzymatic activities using spectrophotometric assays, with SOD and CAT evaluated as markers of antioxidant responses and LPO as an indicator of oxidative damage in alate (winged) and apterous (wingless) morphs under field conditions during the Rabi season at the Agricultural Research Farm, Banaras Hindu University. Aphid populations peaked at 13.6°C in mid-January, correlating with significantly higher enzymatic activity in alate morphs, which exhibited elevated SOD (0.405 ± 0.042 U/mg protein) and CAT (0.046 ± 0.011 U/mg protein) levels, reflecting their enhanced oxidative stress defences during dispersal. Apterous morphs, adapted for reproduction, demonstrated lower SOD (0.314 ± 0.067 U/mg protein) and CAT (0.023 ± 0.006 U/mg protein) activities, consistent with their sedentary lifestyle and reduced exposure to temperature-induced stress. Lipid peroxidation was notably higher in alates (0.210 ± 0.035 nmol-TBARS/mg protein) compared to apterous morphs (0.068 ± 0.004 nmol-TBARS/mg protein), underscoring the oxidative cost of flight. The overall study results corroborate the hypothesis that temperature variability strongly influences the enzymatic responses of *L. erysimi* morphs, providing insights into their physiological plasticity and potential vulnerabilities. Understanding these mechanisms can inform pest management approaches by targeting the biochemical pathways involved in stress adaptation.



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sciforum-118112: Hybridization of Tephritid fruit flies: a cytogenetic study of *Bactrocera zonata* and *Bactrocera dorsalis* at lab conditions

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Hybridization modifies the genetic structure of the individuals or populations and affects the phenotypic stability depending on the genetic diversity of closely related species. In some cases, it exposes strong heterotic characters or disrupts their developmental stabilities due to new interrogated and/or broken gene(s). To check these inferences, we crossed *Bactrocera zonata* ♂ and *B. dorsalis* ♀ at a 1:3 ratio and studied their mitotic metaphase chromosomes following air drying and C-banding techniques at the CBR lab, IFRB, AERE, Dhaka. We examined five pairs of autosomes and one pair of sex chromosomes (parents and the hybrid). Karyotype morphology and heterochromatin distribution in mitotic metaphase chromosomes of *B. zonata* were studied and have already been reported. The total chromosome length of *B. dorsalis* and the hybrid was 47.16 µm and 33.18 µm, respectively. Chromosome 2 was the longest and the sex chromosome (X) was smallest except in the hybrid where 6 was the smallest one. Chromosomes 4 and X were metacentric, and 5 and 6 were submetacentric in all cases. Chromosome 2 was metacentric and Chromosome 3 was submetacentric in *B. dorsalis* and the hybrid. The Y chromosome was dot-shaped and fully heterochromatic. The *B. dorsalis* female contained more heterochromatin block than its male while the opposite scenario was found in the hybrid. Chromosomes 2, 3 and 4 had pericentric and 5, 6 and X had centromeric heterochromatin block. The hybrid was composed of the largest telomeric band in the X chromosome long arm. Due to genetic introgression, the hybrid's resulting autosome's length of was similar to that of its parental father (*B. zonata*) and its morphology was similar to that of its parental mother (*B. dorsalis*). Genetic material transmission from *B. zonata* to *B. dorsalis* or vice versa was a positive sign that *B. zonata* would become a new member of the *B. dorsalis* species complex that mediates in active pest management program.



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sciforum-112316: Innovative Genetic Manipulation of Insect Brains: Redefining Neural Control

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Insects play dual roles in agriculture—they can be indispensable allies or formidable adversaries. Advances in genetic engineering, particularly with tools like CRISPR-Cas9, now offer the potential to reshape this dynamic by influencing insect behavior through neural pathway manipulation. This presentation delves into cutting-edge methods for modifying specific genes in insects to alter behaviors such as foraging, mating, and social interactions. By doing so, pests can be transformed into valuable contributors to ecological restoration or optimized for enhanced pollination, providing novel solutions to critical agricultural challenges.

Insects' relatively simple yet informative neural systems make them ideal models for such modifications. This research presents a transformative approach to pest control, reducing the dependency on chemical pesticides and promoting sustainable agricultural practices. Additionally, genetically modified insects could significantly enhance pollination efficiency, improving crop yields and contributing to global food security. However, with great potential comes great responsibility. Ethical and ecological safeguards are paramount to ensure that these innovations are applied thoughtfully and without unintended consequences. This presentation also addresses the safety protocols and ethical considerations necessary to responsibly advance this research. By leveraging genetic insights into insect neural pathways, this work seeks to revolutionize pest management and pollination, paving the way for a sustainable future while deepening our understanding of the indispensable role insects play in ecosystems.



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sciforum-117655: Plasmodium-mosquito midgut interactions: Role of peritrophins and digestive proteases

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The life cycle of *Plasmodium* has three phases: the asexual pre-erythrocytic and erythrocytic stages in humans, and the sexual stage in mosquitoes. Although the stages within the human host are well-documented, the early bottleneck ookinete stage occurring within the first 24 hours after the parasite enters the mosquito remains less understood. Upon taking in a blood meal from a parasite-infected host, male and female gametes merge to create a zygote, which eventually develops into a motile and invasive ookinete that penetrates the peritrophic matrix and midgut while also evading the mosquito's immune responses. The advancement of the parasite aligns with the digestion of the mosquito's blood meal essential for egg development, facilitated by enzymes. This study investigates the role of *carboxypeptidase B* (CPB) and *peritrophin 48* (Per48) during *Plasmodium* transmission in *Anopheles stephensi* and explores their potential molecular interactions. To evaluate mRNA and miRNA expression profiles in the mosquito midgut tissues, high-throughput sequencing was employed under four experimental conditions: infected (IBF) and uninfected (BF) samples at 18 and 24 h post blood feeding. mRNA analysis revealed significant changes in gene expression, with 1,366 upregulated and 800 downregulated genes at 18 h post-infection, which shifted to 1,780 upregulated and 204 downregulated genes at 24 h. Within this expression profile, both *Per48* & *CPB* were downregulated in infected samples at 18 h which was confirmed by qRT-PCR analysis. Additionally, miRNA sequencing identified 22 known miRNAs and 12 novel miRNAs, with a rise in the expression of *ast-miR-2944* & *ast-miR-29a*. In silico analysis of miRNA-mRNA interactions suggested that the increased miRNA expression could lead to the downregulation of *CPB* and *Per48*. Further, molecular docking showed high binding affinity between Per48 and CPB. This study establishes that Per48 and CPB in a coordinated manner influence both digestion and parasite transmission during the early infection phase offering new insights into vector-parasite interactions and potential targets aimed at blocking transmission.



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sciforum-118102: Preliminary genetic characterization of fall armyworm *Spodoptera frugiperda* from maize fields in Cabo Verde

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The fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae), an invasive pest in West Africa, threatens agricultural production in the region. Accurate identification and genetic diversity assessment are crucial for developing effective management strategies. This study aimed to characterize the *S. frugiperda* population, identify its strain diversity in maize fields across Cabo Verde, and investigate potential introduction routes within the archipelago.

Specimens were collected from maize fields in two agroecological zones on Santiago Island, as well as from other islands in Cabo Verde and multiple West and Central African countries. DNA barcoding of the cytochrome oxidase I (*COI*) gene was performed by means of PCR amplification using universal primers. Sequences were obtained using sanger sequencing, edited, and supplemented with reference sequence data from the NCBI and BOLD databases. Then, a phylogenetic analysis using the Maximum Likelihood method was carried out in MEGA with 1000 bootstrap analyses.

The preliminary genetic analysis revealed the strain variability in *S. frugiperda* populations across Cabo Verde, with evidence of Rice- and Corn-strain overlap on maize fields. The phylogenetic analysis suggested a complex species diversity and possible hybridization, warranting further investigation.

These findings emphasize the need for extending sample collection to assess the progeny of each strain and its implications for *S. frugiperda*'s population dynamics. Understanding the genetic composition of predominant strains will contribute to the development of targeted pest management strategies.



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sciforum-111237: Telomeres in the polytene genome of *Bactrocera zonata* and *Zeugodacus tau* (Diptera: Tephritidae) detected by the C-banding technique

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Telomeres are repetitive sequences of non-coding DNA found at the ends of eukaryotic chromosomes. Here, telomere banding patterns were detected in the salivary gland polytene chromosomes of *Bactrocera zonata* and *Zeugodacus tau* by C-banding technique. Both species infest a wide number of fruits and vegetables in tropical, sub-tropical and temperate regions of the world. Studies of polytene genomes of these and other tephritid fruit flies have been of great value in elucidating aspects of chromosome structure, gene activity and serving as tools for identification that can be critical for adoption novel control strategies to control these pests. Polytene genome of these species consists of five (2-6) banded chromosomes with ten polytene arms. Long arms are abbreviated as Left (L) and short arms as Right (R). In *B. zonata*, 2L telomere is slightly swollen with a combination of heterochromatic and euchromatic parts, 2R is totally heterochromatic. 3L tip has dotted heterochromatic cover, while 3R tip is rounded heterochromatic. 4L and 4R telomeres are rectangular with dense heterochromatic accumulation in ending caps. 5L telomere is expanded with dotted heterochromatic, 5R is rounded with heavily heterochromatic cap. 6L telomere is rhomboid and heterochromatic, while 6R is rounded and euchromatic. In *Z. tau*, 2L telomere is convex and euchromatic, 2R is straight and heterochromatic. 3L telomere is densely heterochromatic, 3R is comparatively flattened with dotted heterochromatic material. 4L and 4R tips are straight and highly heterochromatic. 5L and 5R have extensive euchromatic telomeres, but 5L end is heterochromatic, 5R is euchromatic. 6L is expanded and largely heterochromatic, whereas 6R telomere largely euchromatic. In fruit flies, telomeres of polytene chromosomes may serve as a cover for chromosome tips to protect them from nucleolytic degradation, recombination, repair and interchromosomal fusion. Thus, they play a vital role in maintaining chromosomal stability and preserving information in the genome.



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sciforum-114893: The Evolutionary Dynamics of Lysozyme-like Genes Across the Insecta Class

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Lysozymes are essential enzymes in innate immunity, hydrolyzing bacterial cell walls. In Insecta, C-type and I-type lysozymes are conserved and play dual roles in immunity and digestion. Lysozyme gene dosage effects that are linked to copy number variation may influence their functional efficacy. This study investigates the distribution and evolution of lysozyme-like genes across Insecta. Genomes and protein files from 302 insect species were retrieved from the NCBI RefSeq database, maintaining the species with BUSCO above 90%. Alternative splicing isoforms were filtered using AGAT, retaining only the longest isoforms. Orthologous groups were identified using OrthoFinder and classified into C-type or I-type lysozymes through BLASTP and InterProScan analyses based on the predicted domains for the sequences. Phylogenetic reconstruction was performed with IQ-TREE using a constriction tree based on the literature, while gene family expansion/contraction events were analyzed using GeneRax. The conservation of active sites was evaluated via sequence alignment against the *Gallus gallus* C-type lysozyme (53-E; 70-D) and *Crassostrea virginica* I-type lysozyme (83-E; 94-D). Our analysis revealed 1,834 C-type and 886 I-type lysozyme-like sequences. Only 1,203 C-type sequences retained conserved active sites, with none being observed in Hymenoptera genomes, except for the groups Tenthredinoidea, Ichneumonoidea and Vespoidea. Conversely, no Insecta I-type sequences exhibited conserved active sites. Phylogenetic reconciliation identified major duplication events during the Paleoptera–Neoptera split, with subsequent lineage-specific duplications and losses. Our results showed that Lysozyme-like genes exhibit significant variations in their copy number and sequence conservation across Insecta. The absence of conserved active sites in I-type sequences implies functional diversification beyond canonical muramidase activity; the absence of these sites in the majority of the Hymenoptera C-type lysozymes is otherwise potentially linked to taxon-specific adaptations, since several species of this group exhibit social immunity behavior. Our findings underscore the dynamic evolutionary history of lysozymes, highlighting their roles in immunity, digestion, and lineage-specific biological processes.



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sciforum-113336: The potential use of silkworm-derived antimicrobial peptides as a natural antimicrobial source in aquaculture

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The global antibiotic resistance crisis has prompted the search for new therapeutic alternatives. In this context, the aquaculture industry has been focused on screening natural alternative sources for developing innovative therapeutics with antibacterial activity that can act as alternatives to conventional antibiotics without promoting resistance. Recently, researchers aimed to design novel strategies for infection management that reduce negative consequences for fish, humans, and aquatic ecosystems. Antimicrobial peptides (AMPs) have gained attention as potential alternatives to conventional antimicrobial agents, primarily due to their effectiveness in suppressing bacterial pathogens and, secondly, for the advantage that microorganisms are unable to develop resistance against these substances. Silkworms *B. mori*, as representative lepidopteran economic insects, are a promising natural source of AMPs defined as amphipathic small protein molecules, generally containing fewer than fifty amino acid residues. Most of these peptides are recognised for their immunostimulatory effects and broad-spectrum activities against various infectious and non-infectious microorganisms including bacteria, fungi, viruses, and parasites. Therefore, the synthesis and release of AMPs occur as a fundamental aspect of the innate immune defence mechanism against pathogens. In summary, this review synthesizes current knowledge on the various families of AMPs identified in silkworms, their mechanisms of action, antimicrobial properties, and the potential health benefits of AMPs as natural antimicrobial sources in aquaculture.



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sciforum-118435: The Power of Insect-Based Nutrition through the Example of Bread

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Edible insects are becoming a valuable source of protein, unsaturated fatty acids, vitamins, and minerals. Their addition to food, including bread, enriches its nutritional value and contributes to sustainable development. This study aimed at investigating the effect of the partial replacement of wheat flour with powder from *Tenebrio molitor* larvae and powder from *Acheta domesticus* insects on the techno-functional properties of flours and consumer acceptance of adding powdered insects to wheat bread. The nutritional value of traditional bread and bread with added insects was also compared.

This study was conducted on flour mixtures in which wheat flour was partially replaced with powder from *Tenebrio molitor* and *Acheta domesticus* larvae in proportions of 5%, 10%, 15%, 20%, 25%, and 30%. Techno-functional flour properties such as color, granulometry, fermentation capacity, and baking value were assessed. In addition, a sensory evaluation of bread with powdered insects was carried out, and the nutritional value of bread was calculated based on the licensed computer program Dieta 6D.

Adding powdered *Tenebrio molitor* and *Acheta domesticus* insects resulted in a darker flour color. Bread enriched with powdered insects retained good baking quality. Adding insect powder in a proportion of 30% to wheat flour remained acceptable for consumers. The nutritional value of bread with the addition of edible insects varied depending on the insect type and was higher than that of bread without the addition of insects.

The study results suggest that adding powdered insects in a proportion of up to 30% is sufficient for consumers. In the future, using edible insects as functional ingredients in a bakery product may be an alternative to enriching the diet with plant protein and contribute to the sustainable development of the food industry, reducing the negative impact of animal production on the environment.



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sciforum-113112: The use of *Galleria melonella* larvae as an alternative animal model to evaluate the toxicity of the ethanolic extract of *Schinus lentiscifolius*

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In recent decades, the use of animals in research has been reduced due to the requirements of ethics committees and good laboratory practices. However, total replacement is not yet feasible, as animals are essential for studies that seek to understand human physiology. Insects such as *Galleria mellonella* have been used as infection models, presenting advantages such as easy reproduction, incubation between 25 and 37 °C, and phagocytic cells called hemocytes, similar to mammalian phagocytes. *G. mellonella* larvae have six types of hemocytes, essential in the immune system, with variable density in the hemolymph, which can be measured to evaluate responses to infections. The viability of the larvae is verified by the absence of movement and intense melanization, indicators of response to pathogens. Thus, *G. mellonella* has been used to evaluate the virulence of pathogens and the toxicity of substances. In the test performed, groups of 10 larvae (200–250 mg) were subjected to toxicity analyses. After 24 hours without feeding at 37 °C in the dark, the larvae had their prolegs sanitized with 70% ethanol and were injected with 10 µL of extracts (2500 µg/mL), fractions (2500 µg/mL), or solvent (DMSO 2.5%) using a glass syringe previously cleaned with hypochlorite, ethanol, and saline solution. The larvae were kept at 37 °C and monitored at intervals of 2 to 24 hours, and then daily for seven days. The results indicated a natural mortality of up to 10% in the control group, while all extracts showed a mortality below 20%.



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Session 3. Behaviour, Biology, and Physiology

sciforum-118433: Contribution to the Study of Hygienic Behavior and honey production of the Honeybee *Apis mellifera intermissa* in a mountainous region of Algeria

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In the honeybee, *Apis mellifera*, hygienic behavior is defined as the ability of bees to detect and remove diseased larvae and pupae from the brood nest before the pathogen spreads throughout the colony. This is one of the key mechanisms of resistance to foulbrood and fungal diseases. The aim of our study is to investigate the hygienic behavior and honey production of *Apis mellifera intermissa* in a mountainous region of Tizi-Ouzou, Algeria, using the freezing test. To achieve this, 20 populous colonies with naturally mated queens of the same age (2 years) were used. Rectangles in sealed brood frames were cut out and then frozen for 24 hours. We quantified the removal of brood killed by freezing in sealed cells after 24 hours and then after 48 hours, as well as the honey production. The studied colonies ranged from less hygienic (4 colonies), with 68.33% of brood removed at 24 hours and 93.45% at 48 hours, to fully hygienic (14 colonies), with 100% of larvae removed within 48 hours, including 4 colonies that cleaned all cells within 24 hours. Furthermore, colonies of bees exhibiting hygienic behavior, known as "hygienic bees," produced more honey than non-hygienic colonies, yielding an additional 3 kg of honey per hive. Thus, it appears that the *Apis mellifera intermissa* bee subspecies is hygienic and may develop strong resistance to diseases.



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sciforum-112725: EDAX-Based Elemental Analysis of Okra Genotypes and Their Impact on Leafhopper Infestation

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Okra is the most commonly cultivated vegetable crop in India throughout the year. The inhabitation of insect pests is considered to be a major impediment in okra cultivation. The leafhopper *Amrasca biguttula biguttula* Ishida is considered to be the foremost important insect pest causing severe yield loss. In the present agrarian scenario, the use of resistant varieties serves as an alternate mode of pest management with no further cost and environmental hazards. Considering the significance of host plant resistance, the present research was carried out to profile elemental composition in selected okra-susceptible and -resistant genotype leaf samples using EDAX. Major nutrients viz., nitrogen, phosphorous, and potassium, were also analyzed by adopting standard procedures; it was found that the nitrogen and phosphorous contents were high in highly susceptible genotypes, while they were low in moderately resistant genotypes. From correlation studies, it was found that a significant and positive correlation with the leafhopper population was recorded in nitrogen content ($r = 0.872$), while a non-significant positive correlation was registered in phosphorous content ($r = 0.737$). A strong negative and significant correlation was recorded with potassium content ($r = -0.971$) and leafhopper numbers. Among other elements, Si content was at its maximum in the moderately resistant genotype AE 65, which showed a negative correlation with the leafhopper population. Thus, the elemental composition of leaves may have an impact on leafhopper population. Therefore, this study aids in the development of the resistant crop development programme.



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sciforum-108483: First Record of Apefly (*Spalgis epius*) (Lepidoptera: Lycaenidae) Predation on Gooseberry Mealybug *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) in India

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Abstract: Fruits of the Indian gooseberry (*Phyllanthus emblica*), rich in nutrients and biologically important phytochemicals, are susceptible to infestations by various insect pests, leading to significant crop damage. Among these pests, the gooseberry mealybug *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) is prevalent in tropical and subtropical regions, affecting multiple economically important crops. The aphid fly, *Spalgis epius* (Lepidoptera: Lycaenidae), is recognized as a natural predator of mealybugs across different agricultural settings. This study presents the first recorded instance of *S. epius* preying on *N. viridis* in gooseberry plantations. Field observations were conducted in Vidyannagar, Kasaragod, Kerala, India (12°31'02.8"N, 75°00'44.9"E), where *S. epius* was identified to be predating on various life stages of *N. viridis*. The life cycle of *S. epius* was subsequently studied under laboratory conditions to assess its development while feeding exclusively on *N. viridis*. *Spalgis epius* completed its life cycle in an average of 30.47 ± 1.55 days. The mean developmental durations for the egg, first to fifth instar larvae, and prepupal stages were 4.31 ± 0.28 , 2.5 ± 0.37 , 3.52 ± 0.39 , 3.46 ± 0.36 , 3.4 ± 0.35 , and 3.01 ± 0.35 days, respectively. The pupal stage lasted an average of 10 ± 1.67 days. Adults reared under laboratory conditions had an average body length of 1.1 ± 0.07 cm and a wingspan of 2.18 ± 0.06 cm. This study provides novel insights into the predatory behavior and life cycle of *S. epius* on the gooseberry mealybug *N. viridis*, highlighting its potential as a biological control agent. Further research into the ecological interactions between *S. epius* and mealybugs is crucial to evaluate its effectiveness in integrated pest management strategies for *P. emblica* cultivation.



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sciforum-116698: Occurrence of *Botrytis cinerea* across honey bees, hives, and blueberry flowers and fruit on farms in Western Cape, South Africa

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Honey bee (*Apis mellifera*) pollination is an essential ecological service, particularly in South Africa's growing blueberry industry. Honey bees may, however, also act as vectors of *Botrytis cinerea*, a destructive fungal pathogen causing blossom blight and grey mould in blueberries. This study investigated *B. cinerea* occurrence on blueberry flowers, fruits, honey bees, and hive entrances across six blueberry farms in Western Cape province, South Africa. The blueberry farms were categorized by historical *Botrytis* pressure (farm status), namely, high, medium, or low. Samples were collected from two farms per status, and two variety blocks per farm. The samples were plated onto *Botrytis*-selective media, and isolates were identified morphologically and molecularly. The effect of farm status, variety, and tissue type on the presence of *B. cinerea* was tested using generalized linear fixed effects models, whereas a simple linear regression was used to test the relationship between the presence of the pathogen on blueberry plants and honey bees and hives. The results showed that *B. cinerea* presence was the highest in the two high-pressure farms and on swabs collected from hives, specifically on the farm where hives were placed near the soil surface. *Botrytis cinerea* presence on swabs was significantly affected by farm status, while the other variables did not have a significant effect. Additionally, there was no significant relationship between *B. cinerea* on blueberry plants and honey bees or hive swabs. These findings suggest that honey bees can carry *B. cinerea* spores to blueberry plants, but the risk of infection depends on multiple factors, particularly environmental ones. The role of honey bees in *B. cinerea* transmission in blueberries, and biological control agents for the pathogen, warrants further investigation. Cultural control methods such as field sanitation may reduce the build-up of inoculum sources, particularly overwintering structures, while strategic hive placement can further minimise exposure.



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sciforum-118402: Oviposition Preference and larval performance of *Ceratitis capitata* (Diptera: Tephritidae) on apple and pear fruits: influence of female age and oviposition periodicity

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The Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), is a major pest affecting fruit-producing regions in Portugal, with particularly severe impacts in the Oeste region, Algarve, and island territories. The Oeste region is one of the largest apple and pear production areas in the country. These two economically important fruits are often cultivated in adjacent orchards and suffer significant economic losses due to this pest. This study investigated the effects of female age on oviposition preference, larval development, and oviposition periodicity of *C. capitata*. The first experiment consisted of a laboratory free-choice test to evaluate oviposition preference throughout the adult lifespan between Royal Gala apple (*Malus domestica*) and Rocha pear (*Pyrus communis*). The number of oviposition attempts and the number of larvae per fruit were recorded and correlated with key fruit parameters, including colour (ripeness), penetration resistance, and soluble solids content. Fresh fruits were provided daily. The second experiment focused on determining the daily oviposition periodicity under controlled photoperiod conditions (14h light : 10h dark). During the day, mated females (7–9 days old) were exposed to fruits at different intervals: every 3.5 hours during the light phase and one fruit during the dark phase. The number of emerging larvae was recorded at each interval to identify peak oviposition activity. Although data analysis is still in progress, we anticipate that our findings will provide novel insights into *C. capitata*'s reproductive behaviour, with direct implications for pest management strategies in fruit orchards. By the time of the congress, complete results will be available for discussion, offering valuable information for improving monitoring and control techniques in affected regions.



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sciforum-113531: Preferência alimentar de *Cladomorphus phyllinus* Gray, 1835 (Phasmatodea, Phasmidae) em criação em laboratório

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The insects of the order Phasmatodea, commonly known as stick insects, stand out for their camouflage ability. Despite their ecological relevance, studies on their biology and feeding behavior are scarce, especially for South American species. Thus, this study aimed to evaluate, under laboratory conditions, the dietary preferences of *Cladomorphus phyllinus* with and without a choice of different plant species. The experiment was conducted at the Forest Entomology Laboratory of the Federal University of Recôncavo da Bahia. The following treatments were used: T0: Guava tree (*Psidium guajava*) (control); T1: Guava tree + Araçá (*Psidium cattleianum*); T2: Guava tree + *Eucalyptus grandis*; T3: Guava tree + *Eucalyptus urophylla*; T4: Guava tree + Mulberry (*Morus alba*); T5: *Eucalyptus grandis* + *Eucalyptus urophylla*; T6: *Eucalyptus grandis*; T7: *Eucalyptus urophylla*; T8: Mulberry; and T9: Araçá. The individual *C. phyllinus* were kept in arenas of 3,000 cm³ with fresh leaves from the aforementioned treatments, and their consumption habits were evaluated from September to December 2024. Consumption was measured by direct observation of the consumed leaf area. The results indicated a clear dietary preference for *Eucalyptus grandis*, especially in treatments T6 and T2, for which consumption was significantly higher. The second most consumed food was the guava tree, followed by *Eucalyptus urophylla*. Treatments containing araçá showed low consumption, indicating that this species is not preferred by the insects. No mulberry leaves were consumed, suggesting that the feeding behavior for eucalyptus and guava species may be associated with a preference for Myrtaceae family species. The study indicated that the behavior of *C. phyllinus* is selective, as they showed a greater preference for *Eucalyptus grandis*, followed by *P. guajava* and *E. urophylla*, while species such as *P. cattleianum* and *M. alba* were not attractive.



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sciforum-113509: Understanding the ecological consequences of invasive species on host plant selection by native insect herbivores

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The ecological consequences of invasive plant species extend beyond the displacement of native flora, influencing interspecies interactions and reshaping community dynamics. Among these interactions, the associations between herbivorous insects and their host plants are understudied. This study focuses on *Oecanthus indicus*, a native tree cricket species, to examine how host plant associations are affected by the introduction of invasive plants. Using a combination of olfactory tube assays and performance trials, we investigated the behavioral preferences and physiological outcomes of *Oecanthus* when exposed to native and invasive plant species. Olfactory assays revealed a notable preference for the volatile emissions of invasive plants, suggesting that these plants may emit stronger or chemically distinct cues that attract the crickets. However, performance trials, which evaluated fitness outcomes such as survival, growth rates, and reproductive success, showed that this attraction does not consistently translate into enhanced fitness. This disconnect suggests that invasive plants could function as ecological traps, luring native herbivores without supporting their long-term viability. Our findings emphasize the complex interplay between behavioral attraction and physiological adaptation, highlighting how generalist herbivores like *Oecanthus indicus* navigate the altered host plant landscape introduced by biological invasions. While generalists are often presumed to have greater adaptive flexibility, our results reveal significant ecological trade-offs, underscoring the challenges these species face in balancing immediate preferences with long-term fitness. By exploring the mechanisms underpinning host plant shifts, this study contributes to a broader understanding of how invasive plants reshape insect–plant interactions. These insights are crucial for biodiversity conservation and ecosystem management, as they underscore the potential for invasive species to disrupt ecological networks and drive unintended consequences for native insect populations. Our work highlights integrative approaches that incorporate chemical ecology, behavioral biology, and conservation strategies to mitigate the cascading impacts of plant invasions on native insect herbivores.



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sciforum-118365: Can an artificial or natural diet influence the rearing success of *Spodoptera frugiperda* and its parasitism efficiency by the egg parasitoids?

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Spodoptera frugiperda is an invasive pest species in Pakistan mainly damaging the maize crop. The rearing of this pest in the laboratory is crucial as it provides insights into the biology and nutritional requirements of pests that can help develop effective pest management strategies. This study aims to provide a comprehensive understanding of the most suitable diet that can be used in the laboratory to rear *Spodoptera frugiperda* and its parasitism by *Trichogramma chilonis* and *Telenomus remus*. For this purpose, three artificial diets (corn, bean, chickpea) and one natural diet (maize) were evaluated along with the parasitism efficiency of *Trichogramma chilonis* and *Telenomus remus* under optimum laboratory conditions. Through the results, it is evident that immature stages of *Spodoptera frugiperda* had less duration in the chickpea diet (16.94 days) as compared to bean, corn, and maize, while there was no significant difference in the pre-pupal, pupal, and adult durations among all diets. On the other hand, the overall survival rate was highest in the corn diet while the corn-based diet showed the best results regarding fecundity (1283 eggs) as compared to the bean-based diet (863 eggs). In the case of parasitism efficiency, all the diets with 48 hrs of exposure of the eggs to *T. remus* and *T. chilonis* had more parasitism than after 24 hrs of exposure. Upon comparing the results, *T. remus* exhibited the highest parasitism efficiency of 91.5 and 92.3%, respectively, against eggs obtained from the bean and natural diet, while *T. chilonis* recorded the highest parasitism against the eggs of *S. frugiperda* reared on chickpea and natural diets (70.2 and 65.9%). From the results, it can be concluded that chickpea was the most suitable diet for the rearing of *S. frugiperda*, while the least compatible diet was a bean-based diet.



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sciforum-116598: Diapause in mango nut weevil, *Sternochaetus mangiferae* (Fabricius), a serious pest of mango in India

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The survival of any species depends on how efficiently it can thrive during unfavourable seasons. Diapause in *Sternochaetus mangiferae*, a monophagous pest of mango in India and other mango-growing countries of the world, was achieved by it remaining in a dormant phase during its adult stage. The diapause in the weevil was studied based on an extensive survey carried out in pest-infested areas of Kannur and Kozhikode districts of Kerala from the year 2023 to 2024. The mangoes that were collected from the field were cut open to identify the presence of the different immature stages of the pest and studied using a stereo zoom microscope. The pulps of the ripened mangoes were removed to expose the nuts, and 500 nuts were placed in plastic containers with small holes at the bottom and top. The nuts were observed regularly for the emergence of the weevil. Sudden falls in temperature and relative humidity, rainfall, and the onset of flowering in mango trees were recorded regularly to study their effects on the onset of diapause and its termination. The details of the life cycle, including the immature stages, were studied and discussed. This work showed that in Kerala (India), the emergence of the adult from the nut depended on the humidity, fall in temperature, and rainfall. Under the cage conditions, all the adults entered the diapause stage by the second week of July, which was influenced by heavy rainfall, humidity, and a fall in temperature. Meanwhile, the break in diapause was observed to occur along with the flowering of mango. In the study area of Kerala during the years of 2023 and 2024, the exit from diapause was achieved in the months of January and February of the year 2024. Various factors involved in diapause and its termination are discussed.



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sciforum-117404: Effect of tube diameter and tube colour on flight ability of laboratory-reared Melon fly, *Zeugodacus cucurbitae* (Diptera: Tephritidae)

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Tephritid fruit flies are serious agricultural polyphagous pests in tropical and subtropical regions of the world such as Bangladesh, causing economic losses. *Zeugodacus cucurbitae* causes damage to crops from primordial stages to harvest stage. Flight ability test is a quality control parameter and serves as a key component in sterile insect technique (SIT). In this experiment, we studied the effect of tube diameter and tube colour on the flight ability of laboratory-reared melon fly adults. The pure-line mass rearing of *Z. cucurbitae* is continuously conducted at the Cytology and Biocontrol Research (CBR) fruit fly laboratory to maintain its quality in different biological parameters for fundamental and advanced research. To test the effect of tube diameter on flight ability, we used two tube diameter treatments, the first being 4.5 cm diameter and the second being 5.5 cm diameter. Tube height was constant (10 cm). Six tubes were set up for each of the two treatments (with 100 pupae in each tube), resulting in a total of 12 tubes with 1200 pupae in total. There was no significant difference between the two tube diameter treatments in percentage fliers ($p > 0.05$, $df = 1, 10$; $F = 0.02$). To assess whether tube color has an impact on flight ability, we conducted another experiment. A total of 12 tubes (6 black tubes and 6 white tubes) with 100 pupae in each tube were observed, resulting total 1200 pupae. The tube height was same for all tubes (10 cm). There was significant difference in percentage fliers ($p < 0.05$, $df = 1, 10$; $F = 9.49$) between the two tube color treatments. This study will help to standardize flight ability assessment of *Z. cucurbitae* and provides baseline data for future research.



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sciforum-117171: From Maize to Soybean: How Fall Armyworm Thrives Across Crops

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The fall armyworm, *Spodoptera frugiperda* (J.E. Smith), is a destructive invasive pest that has emerged as a major threat to agricultural production and food security in India. Understanding its biological parameters and feeding behavior on different host plants is essential for developing sustainable pest management strategies. This study assessed the development, survival, and food consumption of *S. frugiperda* on five crops: maize (*Zea mays* L.), popcorn (*Zea mays everta* Sturt), sweet corn (*Zea mays saccharata* Sturt), sorghum (*Sorghum bicolor* L.), and soybean (*Glycine max* L. Merr.).

Life table analysis and consumption rates were modeled using computer simulations. The results indicated that larvae completed development most rapidly on popcorn (28.02 days), maize (28.04 days), and sweet corn (28.31 days), whereas soybean led to the slowest growth (34.83 days). The highest reproductive and population growth rates were recorded on maize, which also supported the greatest food consumption. The sixth-instar larvae consumed a maximum of 19,470.47 mm² of maize leaf area, whereas the lowest consumption was observed on soybean (9,033.67 mm²). Over a simulated 90-day period, population growth was fastest on maize, popcorn, and sweet corn, while soybean restricted development.

Significant larval and pupal survival on non-maize hosts such as sorghum and soybean suggest that *S. frugiperda* could pose a risk to their cultivation and may impact maize–soybean intercropping systems. Thus, this study highlights the adaptability of *S. frugiperda* to the tested crops and lays the groundwork for evaluating its potential threat to other intercropping systems.



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sciforum-118434: From Water to Air: Thermal Strategies of *Erythrodiplax abjecta* Throughout Its Life

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Thermoregulation in dragonflies is a key physiological process that influences their ecological performance and behavior. While adults can employ active thermal regulation strategies, larvae rely more on water temperature. In this study, we analyzed the thermal relationship of adult and larval individuals of *Erythrodiplax abjecta* to assess how their body temperature varies in response to environmental variables. To measure temperature in adults, individuals were captured using an entomological net and held ventrally with forceps. Body temperature (T_b) was recorded in the thorax (T_{th}), abdomen (T_{ab}), and head (T_h). A MAX6675 sensor with a type K thermocouple ($\pm 1.0^{\circ}\text{C}$) was used, operated via software based on an ARDUINO NANO, registering thermal values in real time every second. In the case of larvae, both water temperature and body temperature were measured. Adults exhibited a variable thermal pattern throughout the day, with temperature peaks around midday, showing a stronger correlation with solar radiation temperature. Thoracic temperature was consistently higher than that of the abdomen and head, suggesting a possible differential thermal control. In contrast, larvae displayed a close thermal coupling with water temperature, with minimal differences compared to the ambient temperature. Preliminary results indicate that *Erythrodiplax abjecta* employs distinct thermal strategies depending on its developmental stage. Adults actively regulate their temperature, whereas larvae rely mainly on the aquatic environment. These findings contribute to the understanding of thermal physiology in odonates and their responses to changing environmental conditions.



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sciforum-118123: Host Preference of *Hyperaspis maindroni* Sicard (Coccinellidae; Coleoptera): Unveiling Attraction Patterns in Cassava Varieties

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The behavioral response of *Hyperaspis maindroni* to different cassava (*Manihot esculenta*) varieties was assessed using multi-choice pot culture and olfactometer bioassays. Four cassava varieties, viz. Sree Athulya (resistant), CO3 (moderately resistant), Kunguma Rose (susceptible), and Mulluvadi (highly susceptible), were tested under both healthy and cassava mealybug (CMB)-infested conditions. In the multi-choice pot culture bioassay, *H. maindroni* exhibited significant variations in its attraction among the cassava varieties. The highest attraction was observed in CMB-infested MVD-1 (11.80 nos.), followed by Kunguma Rose (8.40 nos.), CO3 (5.80 nos.), and Sree Athulya (3.60 nos.). The dual-choice bioassays confirmed that MVD-1 was the most preferred variety, showing the highest attraction percentages when paired with the other varieties (86.60% vs. Sree Athulya, 76.60% vs. CO3, and 65.90% vs. Kunguma Rose). In the olfactometer bioassay, *H. maindroni* was most attracted to the arm containing the CMB alone (9.10 nos.), followed by healthy MVD-1 (3.40 nos.), Kunguma Rose (2.80 nos.), CO3 (2.40 nos.), and Sree Athulya (1.20 nos.). When testing the CMB-infested leaves, MVD-1 attracted the highest number of *H. maindroni* (6.90 nos.), followed by Kunguma Rose (5.10 nos.), CO3 (4.30 nos.), and Sree Athulya (3.20 nos.), while the arm with CMB alone had the lowest attraction (0.30 nos.). These findings highlight the strong preference of *H. maindroni* for CMB-infested MVD-1, emphasizing the role of plant resistance levels in host selection. Understanding these interactions can aid in developing effective pest management strategies for cassava crops.



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sciforum-117475: Impact of Acute Lead Exposure on Cognitive Abilities in *Drosophila melanogaster* Larvae

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Introduction

Metals are universal constituents of ecosystems and play a significant biologically essential function. Lead (Pb) is a toxic metal that is not required for any physiological function in the body, and it is a severe threat to the nervous system. Nevertheless, the processes through which Lead influences neurotoxicity and neuronal sensitivity, especially for senses, are not fully understood.

Aims and Objectives

Our aim was to establish *Drosophila* as a potential model organism to study the toxic effects of heavy metals on humans. The larvae of *Drosophila melanogaster* allowed us to examine how acute Lead exposure induced disruption in the olfactory response.

Methods

The early third instar larvae of *Drosophila melanogaster* were exposed to varying concentrations of Lead, with a control set of larvae not being treated with Lead. After the exposure, their olfactory response towards ethyl acetate was measured using larval plate assay.

Results and Conclusion

This study showed that Lead treatment led to a dose-dependent reduction in olfactory sensitivity to ethyl acetate odor. More importantly, the response index of the larvae that were exposed to higher concentrations of Lead before was significantly lower than those of the control specimens that had not been exposed to Lead. These findings underscore the detrimental effects of Lead on the olfactory circuitry, indicating potential disruptions in sensory processing pathways. By unraveling the details of the Lead-mediated deficits in olfaction in *Drosophila*, our study contributes to a better understanding of the neurotoxic effects of heavy metal exposure on sensory function and behaviour across species. Lastly, this study underlines the significance of inquiring into how contaminants in the environment affect sensory processing to ensure that no adverse effects associated with heavy metal pollution extend to humans and wildlife.



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sciforum-093670: Influence of refuge availability on the oviposition strategy of anachroetic and non-anachroetic aphidophagous ladybirds

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Scymnus nubilus Mulsant and *Coccinella undecimpunctata* L. are two generalist aphidophagous predators abundant in herbaceous habitats. *Coccinella undecimpunctata*, a larger species, lays its eggs in uncovered clusters, whereas *S. nubilus*, a tiny species, lays its eggs singly and, possibly, in concealed sites. Reproductive strategies in ladybirds seem to be adaptive, allowing for the co-occurrence of both predators, apparently without interfering with each other. The aim of this study was to characterize the following oviposition strategies in *S. nubilus* and *C. undecimpunctata*: daily fecundity, effect of available sites on females' fecundity and daily pace of oviposition. We hypothesize that the single-egg-laying strategist (i) is more dependent on the availability of concealed sites to oviposit and (ii) lays eggs closer to aphid colonies. We found that different levels of concealability sites allow *S. nubilus* to increase fecundity. Contrarily to *C. undecimpunctata*, in the absence of a suitable substrate to conceal their eggs, *S. nubilus* females refrain from oviposition. *Scymnus nubilus* prefers to hide its eggs beneath prey carcasses, while *C. undecimpunctata* is less selective concerning oviposition sites. *Scymnus nubilus* dilutes its fecundity effort through more oviposition sites and events, while *C. undecimpunctata* requires one event to lay its clusters. Our results showed that the smaller ladybird is more dependent than the larger one on habitat structural complexity to maximize its fitness and that laying single hidden eggs, mainly during the scotophase, confers a potential adaptive advantage to increase fitness.



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sciforum-108492: Seasonal Abundance of Insect Pests Infesting Transgenic and Non-transgenic Brinjal in Bangladesh

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Brinjal is a highly cultivated vegetable in Bangladesh facing significant yield challenges due to pest infestations. This has led to innovative solutions in pest management such as the introduction of transgenic brinjal. We explored the seasonal patterns of insect pest incidences on genetically modified (Bt) and non-genetically modified (non-Bt) brinjal varieties. This study compared the incidence and infestation of the major insect pests in two different genotypes of brinjal: BARI Bt brinjal 2 and BARI brinjal 4. The experiment was conducted on a central farm of Sher-e-Bangla Agricultural University, Dhaka, in rabi season. The primary pests documented included the brinjal shoot and fruit borer (*Leucinodes orbonalis*), jassid (*Amrasca biguttula biguttula*), aphid (*Aphis gossypii*), whitefly (*Bemisia tabaci*), and epilachna beetle (*Epilachna dodecastigma*). Results indicated that shoot and fruit borer incidence was notably lower in Bt brinjal compared to non-Bt counterparts, demonstrating the effectiveness of the Bt gene in reducing damage. Conversely, non-target pests such as aphids, jassids, and whiteflies showed no significant differences in population levels between the two brinjal types, emphasizing that Bt modification did not extend protection against these sucking pests. The seasonal peak for the shoot and fruit borer was observed from mid-February to March, coinciding with the reproductive stage of the crop, where infestations surged, resulting in substantial damage to non-Bt brinjal. Epilachna beetle populations peaked in late February, correlating with favorable temperature and humidity. These findings reveal that while Bt brinjal effectively mitigates damage from specific borers, an integrated pest management approach is essential for comprehensive control, particularly for non-target sucking pests. This dual strategy could pave the way for more resilient and sustainable brinjal cultivation in Bangladesh.



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sciforum-115667: Selective flowers to enhance the performance of the adventive *Gryon aetherium* parasitoid: a good biocontrol agent in the context of conservation biological control of the painted bug *Bagrada hilaris*

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For parasitoid wasps, nutrition is crucial to ensuring their survival and reproductive success. Nevertheless, the accessibility of nutritional sources, particularly plant nectar, may fluctuate significantly within agricultural environments. This variability may impact the fitness of parasitoids and consequently their effectiveness in pest control. The egg parasitoid *Gryon aetherium* Talamas (Hymenoptera, Scelionidae) is a promising candidate as a biological control agent against the painted bug *Bagrada hilaris* (Burmeister) (Hemiptera, Pentatomidae), a pest that was not recorded in Chile (South America) until 2016. Consequently, its recent invasion has renewed the interest in its biological control, especially in conservation biological control (CBC), as an effective and sustainable approach to managing this pest. Since the effectiveness of *G. aetherium* depends on its survival and conservation within agroecosystems, the provision of flowers as food resources (nectar) constitutes a sugar-rich food source to increase its fitness. In Chile, *Coriandrum sativum* L., *Petroselinum crispum* (Mill.), *Foeniculum vulgare* Mill. (Apiaceae), *Lobularia maritima* (L.) (Brassicaceae) and *Pelargonium hortorum* Bailey (Geraniaceae) were effectively tested in the field to attract and support the natural enemies of different cabbage pests. In this study, we evaluated the potential of these selected flowers to enhance the performance of the parasitoid *G. aetherium* under laboratory conditions using water as the control. Our results demonstrate that *G. aetherium* exhibited increased survival when provided with *C. sativum* and *P. crispum* flowers compared to *F. vulgare*, *L. maritima*, *P. hortorum* and water, respectively. Moreover, the fecundity and emergence rates were similar across all of the flower treatments but were significantly reduced when exposed to water. Furthermore, a female-biased sex ratio was observed in the flower treatments. This information may be applied to enhancing the floral diversity in agroecosystems through “ecological engineering”, ultimately improving the effectiveness of conservation biological control.



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sciforum-112283: Social facilitation among adult Papilionoidea across the Himalayan foothills of West Bengal, India

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Social facilitation highlights a phenomenon among individuals forming groups associated with behavioral changes that are induced due to the presence of other conspecific organisms. Such an event happens through group interactions between these individuals further increasing in frequency or intensity with time. Bibliographic research has revealed the presence of such activity among insect orders (Blattodea, Isoptera, and Hymenoptera). The present investigation attempted to explore such aggregation-stimulating behavior among Lepidoptera (Superfamily: Papilionoidea) across the Himalayan foothills of West Bengal, India. Specially designed transects (500-800 m) were laid across the study site for observation of the cluster formation among adult butterflies. The mean number of butterfly species was noted at each cluster to determine the Resource Preference Index (RPI). Wing wear was used to ascertain the age of the butterflies, as wings are not repaired with age. Hierarchical clustering was used to illustrate the similarity in the duration of the association of a species with its resource. The association of butterflies at mud puddles and pond edges, in damp soil, and on carrion, animal dung, and bird droppings was significant. The formation of such aggregations exclusively by Papilioninae (Family: Papilionidae), Coliadinae, and Pierinae (Family: Pieridae) is worth mentioning. Danainae (Family: Nymphalidae) practiced pharmacophagy (gathering pyrrolizidine alkaloids) by aggregating on dead, damaged, or withered plant species (Apocynaceae, Asteraceae, Boraginaceae, and Fabaceae). During puddling on non-floral resources, butterflies, i.e., *Graphium*, *Chilasa*, *Papilio*, *Eurema*, *Catopsilia*, *Colotis*, *Ixias*, and *Appias*, gather supplementary nutrients. Such activity is generally performed predominantly by younger males and rarely by older females. *Euploea*, *Tirumala*, and *Danaus* are known to engage in the repeated scratching of dried plant parts to gather pyrrolizidine alkaloids. Such alkaloids serve as male pheromones stimulating courtship. Thus, social facilitation among Papilionoidea occurs to enhance its resource acquisition and decrease predation risk through increased vigilance and dilution effects.



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sciforum-113277: Starving or not: What stink bug hunger level do I need for my bioassay?

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The Southern green stink bug (*Nezara viridula*) is a cosmopolitan pest that affects crops like soybean (*Glycine max*), reducing grain yield and quality. Its feeding behavior involves phases such as locating, accepting, and consuming food, which are influenced by nutritional stimuli. This study aimed to optimize bioassays to evaluate soybean damage and the behavior of *N. viridula* by developing a starvation protocol to standardize experimental conditions. This study also examines how the insect's nutritional status impacts soybean crops, providing tools for applied ecology and entomology in agroecosystems.

Experiments were conducted in the Biochemistry Laboratory of the Faculty of Agronomy at the University of Buenos Aires (UBA) using adult *N. viridula* differentiated by sex that were fed with fresh soybean pods (*Glycine max*, cv Williams 82, R6 stage). Different stink bug starvation periods (0, 24, 48, 72 h) were evaluated, and the insects were allowed to feed on pods with different treatments (control, damaged by stink bug and MeJA). In “no-choice” experiments, feeding behaviors were recorded using BORIS software. The digestive protease activity of insect guts was analyzed in pools comprising one male and one female (N=72) with 4–6 replicates per treatment.

Our results suggested that *N. viridula* at 24 h of starvation increased selectivity among pod treatments. To evaluate plant damage, 48–72 h starvation periods are more suitable, as the response time of the stink bugs remains consistent regardless of their initial state. In general, the insects become less selective after prolonged periods without food, aligning with findings by Matthews and Matthews (2009). These insights help to optimize experimental protocols for behavior and damage studies in crops.



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sciforum-114918: The behavioral and physiological effects of temperature and TRPA1 overexpression in *D. melanogaster* and *L. sericata* larvae: mechanotransduction, locomotion, thermotaxis, and membrane potential

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As climate change rapidly occurs, it is essential to understand how temperature impacts the behavior and physiology of small ectotherms such as insects. Insects are influenced by the temperature in terms of survival, development, and physiology. To exogenously regulate their body temperature, insects often exhibit escape behavior to navigate to preferred temperatures. In insects such as *D. melanogaster* larvae, the TRPA1 channel is activated by warm temperatures (>26°C), and the larva senses temperature changes. However, there is limited research on how the temperature influences sensory stimuli, which holds implications for ectothermic survival under climate change. Thus, this study investigated the comparative effects of temperature and TRPA1 overexpression in various sensory neurons and muscle tissues on the (1) mechanotransduction, (2) locomotion, (3) thermotaxis, and (4) membrane potential of *D. melanogaster* and *Lucilia sericata* larvae. First, the head–abdomen–tail assay was performed by means of a tap to each area with a monofilament. Second, body wall movements and mouth hook movements assays were performed. All behavioral assays were conducted at 20°C and 33°C with second- and third-instar larvae. Next, larvae of the same genetic strains or species were placed in Petri dishes to assess their thermal preference zones using IR imaging. Finally, intracellular electrophysiological recordings were conducted in muscles to determine the effects on the resting membrane potential. The results revealed behavioral differences due to localized stimuli, temperatures, larval stages, and TRPA1 channel overexpression.



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sciforum-118074: The Effect of Temperature on the Development and Life Cycle of the Melon Fruit Fly (*Zeugodacus cucurbitae*)

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The melon fruit fly, *Zeugodacus cucurbitae* (Coquillett), is a major pest of cucurbit crops, causing economic losses of up to 30-100% depending on the severity of infestation. Temperature is a critical factor influencing its development, reproductive potential, and survival. This laboratory study was conducted at the Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, to evaluate the effect of different temperatures on its life cycle. Experiments were performed at three temperatures, 15°C, 25°C, and 35°C, under a controlled relative humidity of 75% ($\pm 5\%$), using infested cucumber fruits as the culture source. The incubation period was observed to be significantly prolonged at 15°C (8.4 ± 0.63 days) compared to 25°C (0.72 ± 0.13 days) and 35°C (0.65 ± 0.13 days). The total maggot duration was the longest at 15°C (23.9 ± 1.71 days) compared to 25°C (5.08 ± 1.50 days) and 35°C (3.65 ± 1.27 days). Similarly, the pupal period was the longest at 15°C (34.3 ± 0.81 days), decreasing at 25°C (8.7 ± 0.68 days) and 35°C (8.0 ± 0.94 days). Adult longevity was significantly higher at 15°C (males: 46.3 ± 0.82 days; females: 48.1 ± 1.58 days) compared to 25°C (males: 23.3 ± 1.42 days; females: 25.3 ± 2.06 days) and 35°C (males: 16 ± 0.67 days; females: 20.2 ± 0.63 days). Female fecundity was the highest at 25°C (77.1 ± 3.21 eggs) compared to 15°C (70.3 ± 0.49 eggs) and 35°C (72.5 ± 2.84 eggs). A male-biased sex ratio was observed at all temperatures, with values of 1:0.64, 1:0.74, and 1:0.76 at 15°C, 25°C, and 35°C, respectively. These findings highlight the influence of temperature on the developmental biology of the melon fruit fly, which has important implications for its population dynamics and management.



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sciforum-113181: The impact of different long-term dietary regimes on microbiota communities in *Drosophila melanogaster*

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Introduction: Microbiota communities have been found as entities whose diversity significantly contributed to various dimensions of animal health, including that of humans. Since the fruit fly, *Drosophila melanogaster*, shares significant proportions of its genes that cause human diseases, it is currently widely used as an important model organism when testing the microbiota composition and its relation to development, physiology, and behavior. **Methods:** In this work, we focused on adult fly microbiota communities in *D. melanogaster* strains which had been maintained for over twenty years in different nutritional regimes. Flies were reared under optimal laboratory conditions, on five different diets: standard cornmeal–sugar–agar–yeast medium, as well as substrates prepared with their natural food sources, i.e., apple, banana, tomato, and carrot. Adult fly microbiota communities were characterized by employing 16S rRNA sequencing and additionally corroborated through machine learning-based analysis. **Results:** The results confirmed the dominance of the phyla *Proteobacteria* and *Firmicutes* irrespective of the diet type, while the most abundant families, such as *Acetobacteraceae*, *Lactobacillaceae*, *Moraxellaceae*, *Bradyrhizobiaceae*, and *Leucostonocaceae*, varied in community proportions among strains. A high level of distinctiveness among strains was also recorded regarding some other bacterial families of lower abundance. Further, adult fly microbiota communities differed between males and females, which may be related to specific sex-linked host metabolic needs. **Conclusion:** The aforementioned results indicate connectedness between the diet types, adult fly microbiota, and host phenotype in *D. melanogaster*, which further opens new opportunities for linking microbiota composition with various aspects of fruit fly biology.



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Session 4. Biodiversity, Climate Change, Conservation, Ecology, and Evolution

sciforum-118126: Pollen-deprived bumblebees induce leaf damage, which activates phytohormone signaling pathway(s) and response(s) within tomato plants, but this does not accelerate or induce flowering

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Pollinators and plants share complex and mutually beneficial relationships critical to ecological sustainability. The timing of some interactions is crucial; if pollinator populations are not synchronized with the blooming periods of flowers, plants may fail to reproduce, or pollinators may face starvation. Environmental challenges such as pollen scarcity can disrupt this delicate balance, prompting adaptive behaviors in pollinators. A recent study shows that pollen-deprived bumblebees (*Bombus terrestris*) bite tomato plants, and this accelerates flowering. We have replicated this bee behaviour, but are unable to replicate the plant response at a macro-level. As insect saliva facilitates digestion, maintains mouthparts, provides antimicrobial protection, and is able to bypass plant defences we are interested to determine whether pollinator saliva may play a role in mediating plant interactions and whether this can be used to identify molecular mechanisms that drive adaptive behaviors associated with plant–pollinator co-evolution. To unravel the association, we detail the salivary gland proteome of *B. terrestris*, analyze plant miRNAs and protein markers in the bee gut, use Florigen to determine whether the plants were already committed to flowering, analyze phytohormones in bee-bitten leaves, and establish a Raman microscopy system. Our data suggest that the plants are responding to these bee bites at a micro-level. To aid further research, we highlight the utility of Attenuated Total Reflectance–Fourier Transform Infrared (ATR-FTIR) spectroscopy integrated with multivariate analyses to understand insect secretions through the differences in chemical composition of tissues (salivary gland, proboscis, and pretarsus) from two species of bumble bee (*B. terrestris* and *B. hortorum*). This analytical method required minimal sample volume and provided detailed spectral fingerprints for analysis. Unsupervised Principal Component Analysis revealed natural clustering in the dataset, while supervised Partial Least Squares Discriminant Analysis further classified the data based on known classes. Notably, chemical profiles remained conserved under nutritional stress.



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sciforum-113528: The third record of the hangingfly *Bittacus hageni* in the Balkans with notes on Bulgarian scorpionflies (Mecoptera: Bittacidae, Panorpidae)

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Scorpionflies (Mecoptera) represent a small insect order, comprising three families in Europe: Bittacidae, Boreidae, and Panorpidae. Bittacidae contain only two rare species in Europe. The first one, *Bittacus italicus* (Müller, 1766), is considered extinct in Bulgaria, because it has not been recorded since 1980 according to the Bulgarian Red List, and only has three Balkan records after 1950 according to Devetak et al. (2022). *Bittacus hageni* Brauer, 1860, is quite rare in the territory of the Balkan peninsula, with only two recent records, both in the Northwest (Croatia and Bosnja and Herzegovina, respectively). Our record from Burgas district, Rezovo village (SE Bulgaria), is the first one from Bulgaria, the third one for the Balkans, and the southeasternmost one. This considerably expands its known range and highlights the need for surveying this rare genus in the periphery of its range.

From the family Panorpidae, there are eight species so far reported from Bulgaria (one of which has two subspecies), all in the genus *Panorpa*. Three of these species can be defined as common: *P. germanica* Linnaeus, 1758, *P. hybrida* MacLachlan, 1882, and *P. vulgaris* Imhoff & Labram, 1845. *Panorpa alpina* Rambur, 1842 is one of the rarest species, with only one report from Bulgaria with no exact location. The present report confirms the first exact locations for *P. alpina* in several closely situated localities in the Vitosha Mts (subalpine zone and beech). It is a notoriously variable species which caused previous authors to describe multiple species, most of which have been synonymized since. The structure of the Balkan populations has been poorly studied, with Lauterbach (1972) describing one "species" under the name of *P. plitvicensis*. The Bulgarian individuals do not conform to this morphotype. This study is part of a project under grant contract number KP-06-N61/6 – 14.12.2022.



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sciforum-117522: Arthropod Communities in the Mountain–Arctic Ecosystems of the Kola Peninsula

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The increase in air temperature and precipitation in recent decades has led to a rise in forest boundary in polar mountains, a reduction in low-temperature habitats, a decrease in the diversity of cold-adapted biota, and its displacement by thermophilic species. We investigated the current arthropod diversity and environmental conditions on peaks of the Khibiny mountain massif, which is the largest and most complex orography in the Kola Subarctic. The research was conducted at altitudes 1050–1090 meters above sea level, in the cold goltzy desert belt (GD), which is considered an analogue to polar deserts in the northern hemisphere. We used the standard 500 ml soil traps with formalin but applied a long-term trapping method for the first time in zoological studies on Khibiny peaks. The period of capture of arthropods was 60 days from July to September in 2023 (25 traps in five repetitions under the main types of vegetation and in bare rocky ground) and 90 days in 2024. As a result, 100 forest, polyzonal and boreal–montane arthropod species widespread in Holarctic and Palearctic were identified. Arctic, arctic–alpine and arctic–boreomontane species were rare, as is the case in the zonal and mountain tundras of Fennoscandia as a whole. Such boreal physiognomy of arthropod fauna on the peaks of the Khibiny Mts contrasts with local fauna on arctic coasts and sea islands, in which the proportion of arctic species reaches 40%. It is also contrasted with the flora of vascular plants, 65% of which is represented on the peaks of the Khibiny Mts by arctic species. These data help to understand the historical ways in which the Khibiny Mts were colonized after glacier retreat. The studies also revealed that such specific factors attracted forest arthropod species on Khibiny bare peaks, given the high atmospheric humidity, low soil acidity due to the physical weathering of alkaline rocks, and the good warming of substrates during the round-the-clock polar day.



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sciforum-115858: Arthropods and Acariens in the Nests of the Ferruginous Duck (*Aythya nyroca*)

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Our study explores the diversity and ecological roles of arthropods and acariens in the nests of the Ferruginous Duck (*Aythya nyroca*) at Lac Tonga, El Kala National Park, northeastern Algeria. The aim is to identify the insect and mite species associated with these nests, assess their abundance, and investigate their ecological interactions with the host species.

Methodology

This research was carried out over two years (2015-2016), involving the examination of 21 nests located within the Lac Tonga region. Nests were chosen based on their accessibility and proximity to water. Arthropod specimens were collected using hand collection, and Berlese funnels were used to extract mites. The specimens were sorted and identified to the species level using taxonomic keys, with the insects categorized into five orders, Coleoptera, Hymenoptera, Psocoptera, Hemiptera, and Diptera, and the mites classified into three orders, Mesostigmata, Sarcoptiformes, and Trombidiformes. The species abundance was recorded, and ecological interactions were analyzed based on trophic roles, including detritivores, predators, and ectoparasites. This study also considered factors such as nest location, the surrounding vegetation, and the presence of other bird species. A statistical analysis was applied to evaluate the relationship between these variables and arthropod diversity.

Results and Discussion

This study identified 11 insect species from five orders and 12 mite species from three orders across the 21 nests. Key species included *Homalota serrata* (Staphylinidae), the *Myzus sp.* (Aphididae), and *Ceratophysella pratorum* (Collembola), with the *Galumna sp.* being the most abundant mite species. The arthropod community was influenced by the nest location, the vegetation type, and the presence of other bird species. The arthropods performed various ecological roles, from detritivores and predators to ectoparasites, which could affect the nesting environment and the health of ducklings.

This research offers important insights into the ecological dynamics within bird nests and emphasizes the significance of arthropod communities in conservation efforts for bird species and their habitats.



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sciforum-113519: Evaluation of insect attraction to garden plants in a semi-arid region of Spain

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Urban environments can provide essential resources for food, nesting and hibernation for insects. Green spaces in cities often exhibit higher flower diversity and lower pesticide levels compared to rural areas. Although gardens are typically designed for aesthetic purposes, growing interest in their benefits for wildlife has driven research on pollinator attraction to plants, with the aim of enhancing urban biodiversity.

To our knowledge, no published studies have evaluated insect attraction to garden plants in the Iberian Peninsula. This study aimed to identify the garden plants and shrubs most suitable for supporting insects in southeastern Spain. Weekly observations were conducted on flowering plants in four urban gardens in Murcia between mid-April and mid-May 2024. For each plant and shrub species, two patches of similar size were monitored for two minutes each. Insect visitors were recorded and classified as “honey bees,” “wild bees,” “syrphids,” “non-syrphid flies,” or “others.”

A total of 31 plant and shrub species were sampled, of which only eight were native to the Iberian Peninsula. No significant difference was found in the number of insects attracted to native versus non-native plants. *Lavandula dentata*, *Salvia officinalis*, *Zygophyllum fabago*, *Phlomis purpurea* and *Pyracantha coccinea* attracted the highest number of insects. These findings provide practical recommendations for promoting insect-friendly gardening in a semi-arid Mediterranean region, highlighting the potential of urban gardens to support insect biodiversity.



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sciforum-118201: Mating success, fecundity and fertility of marula fruit fly, *Ceratitis cosyra* Walker (Diptera: Tephritidae) exposed to simulated heat waves

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Anthropogenic activities contribute to more volatile weather conditions, including more frequent heat waves of higher intensity and longer duration. Heat waves may have the potential to change the distribution patterns of pest species, which may relate to the effects of high temperatures on fertility. This study determined the reproductive consequences associated with exposure to heat waves for the marula fruit fly, *Ceratitis cosyra* (Walker) (Diptera: Tephritidae). Heat waves were represented by five consecutive days of temperatures 5 – 7°C higher than the optimal temperature for development. Female and male *C. cosyra*, were exposed to four separate temperature treatments (25°C as the control; and 31°C, 34°C and 37°C as heat waves) to evaluate the effects of each temperature on survival over five days (n = 50 for each sex and temperature). Thereafter, females and males exposed to the same temperatures were paired with untreated individuals of the opposite sex to mate (n = 50 for each sex and temperature). This was repeated five times and mating propensity, mating latency, fecundity and fertility were recorded. Heat wave temperatures did not reduce survival when compared with the control. Sex and temperature had no effect on mating propensity. A decrease in mating latency occurred as temperatures increased, with both treated sexes mating slightly earlier at 34°C. Heat-treated females had significantly lower fecundity and fertility than untreated females paired with heat-treated males. Females mated with heat-treated males did not suffer decreased fecundity relative to the control, but fertility tended to decline with temperature. In conclusion, *C. cosyra* females were more susceptible to increasing heat wave temperatures than males. Results also indicated that fecundity and fertility were the reproductive traits mostly affected in *C. cosyra* when exposed to heat waves. This research could help to derive more accurate distribution predictions for *C. cosyra* in a changing climate.



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sciforum-113431: Pollination ecology of butterflies in tropical plants of Western Ghats of India

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Pollinators' visits to flowers are guided by various factors, with nectar availability being one of them. Butterflies remain underexplored with respect to their contribution to pollination. Extensive field observations were conducted to gain insights into the floral morphology of 23 plant species from the northern Western Ghats (a globally recognized and threatened biodiversity hotspot), which are frequently visited by butterflies. Plants were observed during their peak flowering season. Parameters such as the pollen shape, apertural characters, and exine ornamentation were studied. In total, 91 butterfly species foraging on the 23 plant species were encountered. The Nymphalidae family, with 28 species, was the most abundant, followed by members of Lycaenidae (22), Hesperidae (20), Papilionidae (11), and Pieridae (10). Plain tiger butterfly (*Danus chrysippus*) was recorded visiting eight different plant species, the highest amongst all the butterfly species. The highest average nectar quantity was recorded in *Psydrax dicoccos* (1.27 μ l/flower). The maximum number of butterfly visitors (56 different species) were observed to be foraging on *Ligustrum robustum subsp. perrottetii*, which is an endemic tree species, followed by *Mappia nimmoniana*, which attracted 44 butterfly species. Butterflies were captured using swipe nets, and their bodies were screened for any pollen load. Pollens of an isopolar nature were predominant, while 12 species exhibited a monad dispersal unit. Triaperturate pollens was the most common type with a tricolpate aperture condition. The present study highlights the possible role of butterflies as contributors to pollination.



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sciforum-113438: Symphony across latitudes: exploring the acoustic diversity of katydids across the latitudinal gradient in India

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Katydid (order: Orthoptera) are nocturnal insects that use species-specific calls for acoustic communication. Katydid communities are affected by variations in environment and habitat. However, very little is known about the biogeographic patterns of katydid communities from the biodiverse regions of the Indian subcontinent. It is important to understand biogeographical patterns in the rapidly changing environment due to climate change and invasive species. The objective of my study was therefore to understand the latitudinal patterns in acoustic assemblages of katydids from the Indian subcontinent. Field studies were conducted from 2015 to 2024 in three geographical locations from Western Ghats to Central India and the Western Himalayas in an increasing latitudinal gradient. A total of 26 call types were recorded from the study sites located across the three latitudes. This study also provides the first description of acoustic communities from Central India and the Western Himalayas. I also included eight call types from previously described acoustic assemblage data, making a total of 34 call types, to understand the latitudinal patterns. Preliminary analysis shows distinct community composition in the biogeographic areas. Only few species inhabited all three areas, and most call types were observed in a specific geographical area. The study indicated that the acoustic diversity of katydids follows the general pattern of a latitudinal biodiversity gradient. Given that katydids are important ecological indicators of ecosystem health, my study can help in understanding ecological processes that drive diversity and predicting how recent anthropogenic changes will affect species interactions and diversity.



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sciforum-117394: A Comparative Analysis of Insect Succession on Chicken Carrion in Indoor and Outdoor Environments

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This study presents a comparative analysis of the insect succession on chicken carrion in both indoor and outdoor habitats, highlighting the influence of environmental conditions on decomposition processes. Insect colonization patterns play a crucial role in the breakdown of organic matter, and understanding these patterns is essential for applications in forensic entomology, particularly in estimating post mortem intervals. This experiment was conducted by placing chicken carcasses in controlled indoor and outdoor environments, ensuring consistent initial conditions across both settings. The insect activity was monitored systematically over a defined period, with observations recorded at regular intervals to track the changes in species composition and abundance.

Key insect species, primarily from Diptera (flies) and Coleoptera (beetles), were identified and documented. Their succession rates and colonization patterns were compared between the two habitats to assess the differences in the decomposition dynamics. The results revealed significant variations in the insect community structure and decomposition rates. The outdoor environments exhibited more rapid and diverse insect colonization, driven by environmental factors such as fluctuating temperatures, higher humidity, and exposure to natural elements like wind and sunlight. In contrast, indoor environments, while they were more sheltered from external influences, showed delayed insect succession and a reduced diversity of species, likely due to limited access and more stable microclimatic conditions.

These findings provide valuable insights into how habitat conditions influence insect-mediated decomposition. These results have important implications for forensic investigations, aiding in more accurate estimations of time since death, and contribute to broader ecological studies on nutrient cycling and decomposition in different environments.



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sciforum-109019: A temperature-dependent phenology model for *Plutella xylostella*

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The diamondback moth, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae), is an important pest of crucifers distributed along different climatic regions of the world. Experiments were carried out at different temperature regimes, viz., 31, 32, 33, 34, 35 and 36°C, in Open-Top Chambers. Observations made on the life cycle parameters of *P. xylostella* at different temperatures were used for developing forecasting models. The prediction models developed using Insect Life Cycle Modeling (ILCYM) showed that the developmental rate and developmental duration of different life stages of *P. xylostella* decreased when there was an increase in temperature, whereas the mortality, senescence and fecundity of *P. xylostella* increased with elevated temperatures. We also observed the non-viability of *P. xylostella* eggs when the temperature reached 36°C. The prediction models showed that the upper threshold temperature for the complete development of *P. xylostella* larvae into adults was between 34 and 35°C. The lifetime fecundity and cumulative oviposition rate were also temperature-dependent. The phenology models predicted 32°C as the most favourable temperature for the survival of eggs, larvae and pupae. Geospatial modeling of *P. xylostella* risk, based on the outputs of a temperature-driven phenology model linked to GIS, will allow for a detailed analysis of the impact of climate change on the future invasiveness and spread of this pest in various parts in the context of global climate change.



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sciforum-113251: A trophic network analysis of *Parnassius apollo* (Lepidoptera: Papilionidae, Parnassiinae) adults in the Aspromonte National Park, South Italy

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Parnassius apollo L. is a widespread species that inhabits various regions of Europe, and in Italy, it can be found in the Alps, in the Apennines, and in the isolated mountain ranges of Sicily. Its Alpine populations are abundant and not currently threatened, whilst Apennine populations are strongly fragmented and in decline. The reasons for the decline of this butterfly may be different, such as anthropic disturbances and climate change, but reforestation, which has considerably reduced the open environments suitable for its survival in several areas within its European range, could also play a major role. Its larvae feed on few genera from the Crassulaceae family (e.g., *Sedum*, *Jovibarba*, *Rhodiola*, and *Sempervivum*), but *Sedum* is recognised as its main larval foodplant. The adults feed on nectar obtained from a variety of plants depending on their geographic range. With the aim of understanding the trophic network of one of the most isolated Italian populations of *Parnassius apollo*, field surveys were performed in the Aspromonte National Park, South Italy. Observations were carried out weekly in two areas where the presence of adults was abundant. In detail, the botanical species visited by the adults, the duration of their trophic activity, the number of other pollinators present on flowers, and the abundance classes of flowering species were recorded. The results highlighted that *P. apollo* adults foraged on a limited number of species, the most abundant of which belonged to the families Asteraceae and Campanulaceae. In addition, the observations showed that *P. apollo* adults preferred flowers from the same plants as those visited by several other pollinators (i.e., bees and other butterflies). This study highlighted the feeding preferences and floral resource use of *P. apollo* in an isolated southern Italian population and provided insights into its trophic interactions and potential conservation needs.



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sciforum-108337: Arthropod diversity and abundance under irrigated and rainfed conditions in South Africa sugarcane

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Insect diversity and abundance are often the base for formulating strategies that involve the appropriate application of pest control methods, considering the ecosystem services provided by insects. Arthropods represent more than half of the global described biodiversity, and form part of several food webs providing ecosystem services and serving as ecosystem engineers. For over 40 years, there have been no updated data on the diversity and abundance of insects in commercial sugarcane under field conditions in South Africa. Thus, a knowledge gap exists on the current diversity and abundance of insects associated with conventional sugarcane in South Africa. Therefore, the aim of this study was to provide recent baseline data on the diversity and abundance of insects in conventional sugarcane, based on two sugarcane fields in KwaZulu-Natal. Three sampling methods, namely pitfall, sticky and water pan traps, were used to sample insects in rainfed and irrigated sugarcane in Gingindlovu and Pongola from March to October 2022. This study collected 12,493 insects belonging to 14 insect orders and 88 families in rainfed sugarcane and 22,309 insects belonging to 14 orders and 94 families in irrigated sugarcane. Significant differences in the diversity indices were found between the sampling methods and between the sampling periods. This study provides recent baseline data on the diversity and abundance of insects in sugarcane.



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sciforum-112587: Communities of the endangered and protected *Carabus hungaricus* Fabricius, 1792 (Coleoptera: Carabidae) in Bulgaria

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This study examines the communities of the protected *Carabus hungaricus* Fabricius, 1792 (Coleoptera: Carabidae), in Bulgaria. With the help of 252 pitfall traps, in the period of 24 May 2021 – 10 December 2023, we surveyed 42 sample plots in central-western Bulgaria. *Carabus hungaricus* was established in seven of the sampling sites (frequency of occurrence, $F = 17\%$), with a total of 198 specimens (1.3% of the total numbers of the carabids). In these seven sites, we found 57 species belonging to 23 genera and 12 tribes, mostly open habitat dwellers. Tribe Harpalini had 19 of the species (33%). The most species-rich genera were *Harpalus* (13 sp., 23% of all), *Amara* (8 sp., 14%), and *Carabus* (6 sp., 10%). The most represented species were the superdominant *Calathus distinguendus* (with more than 71% of all carabid specimens), the dominants *Carabus coriaceus* and *Laemostenus terricola*, and the subdominants *Calathus cinctus*, *Carabus cavernosus*, *C. hungaricus*, and *C. convexus*. Euconstant species, collected in all seven sampling sites ($F = 100\%$), were *C. coriaceus* and *Calathus distinguendus*. Among the common and abundant members of the *C. hungaricus* communities in Bulgaria were the constant species, found in six or five of the sites ($F = 86\%$, $F = 71\%$): *Calathus cinctus*, *Laemostenus terricola*, *C. cavernosus*, *C. convexus*, *Cymindis axillaris*, and *Licinus cassideus*. In terms of the ecological relationships of *C. hungaricus*, possible competition might be expected from the closely related species *C. morio*, insofar as they have very similar ecological requirements, and to some extent from *C. torosus*, which is more xerophilous. However, they do not occur in the area where *C. hungaricus* lives in Bulgaria. *Carabus scabriusculus* seems to occupy a different ecological niche, and has a wider tolerance in its requirements; in addition, in recent decades, in Bulgaria this species has seemed to decline more and more.



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sciforum-117298: Comparative study of Insect Presence Among Differently Colored Roses in Savar, Bangladesh

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In roses, the presence of insects varies with flower color, potentially affecting the species diversity, pest dynamics, and plant health. This study examined the variation in insect abundance across five differently colored roses—red, white, pink, pink-white, and yellow—grown in Savar, Dhaka, Bangladesh, from July 2019 to April 2020. The sampling process involved periodic field surveys and systematic collection of insects from the flower petals, leaves, and stems, conducted weekly using manual collection techniques and insect nets, followed by species identification in the laboratory. A total of 2,530 insect individuals belonging to 29 species from 7 insect orders were recorded. The presence of insects varied significantly across flower colors, with white roses exhibiting the highest number of insects (32.5%), while red roses had the lowest (12.8%). Among the identified insect orders, Thysanoptera (thrips) were the most abundant, comprising 38.2% of all insect individuals, followed by Hemiptera and Lepidoptera. Additionally, the species diversity was highest in yellow roses, which hosted 15 of the 29 identified species, whereas pink-white roses had the lowest diversity, with only 9 species. Furthermore, sap-sucking insects such as aphids and thrips were significantly more prevalent on white and pink roses (54.3% combined), whereas Lepidoptera larvae were most frequently found on red roses, comprising 24.7% of all insect occurrences in roses of this color. This study is valuable, as it highlights how insect species vary across rose colors, helping farmers select varieties that attract fewer pests, potentially improving plant health. While the mechanisms remain unclear, these findings suggest that insect occurrence may be influenced by visual attraction, chemical cues, or plant traits. Further research could clarify how color impacts insect activity, leading to more effective, targeted pest management strategies and reducing the reliance on chemical pesticides in rose cultivation.



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sciforum-113462: Comparing the effectiveness of different monitoring methods on butterfly richness and abundance (Lepidoptera: Rhopalocera) in Serbia

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Butterflies are essential for ecosystem stability, offering various ecosystem services, with pollination standing out as particularly important. The ongoing global decline in their richness and abundance highlights the critical need for focused conservation actions, and the first step towards their protection is understanding their richness. On a European scale, the European Pollinator Monitoring Scheme (EUPoMS), created as part of the STING project, is tackling this issue. Based on the EUPoMS, the SPAS project (Serbian Pollinator Advice Strategy – for the next normal) was initiated in Serbia, focusing on the monitoring of wild bees, butterflies, hoverflies, and the plants they visit. Within SPAS, several sampling methods were implemented, with line transects and pan traps (in blue, yellow, and white) as the primary techniques. Butterfly monitoring was conducted across 30 locations in Serbia, three times per year (spring, summer, autumn) from 2022 to 2024. This study evaluated the efficiency of these methods in assessing butterfly richness and abundance. Our findings revealed that line transects recorded a higher species richness and abundance compared to pan traps. However, pan traps detected certain species not observed during transect sampling, suggesting their complementary role in monitoring. Among the trap colors, blue pan traps captured the highest richness and abundance of butterflies, reflecting a possible preference for blue-colored flowers. These results emphasize the importance of employing diverse sampling techniques to achieve a comprehensive understanding of butterfly diversity. They also emphasize the importance of understanding pollinator preferences to enable better decision making and improve strategies for their conservation.



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sciforum-113219: Conserving Insect Biodiversity to Sustain Ecosystem Services and Functionality

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Insects are the most diverse group of animals on Earth because they are essential to the functioning of ecosystems and the global economy. These insects are found in almost every habitat across the globe and have a significant influence on agriculture, human health, and natural resources. Insect biodiversity is facing ever-increasing threats. Climate change, the impact of pesticides, deforestation, and urbanization are the main threats to insect biodiversity. Insect decline and biodiversity loss have attracted a lot of attention in recent years, but a lack of comprehensive data, conflicting interests among stakeholders, and insufficient policy guidance hinder progress in preserving their biodiversity. As a result, the conservation of insect diversity is a global concern. According to the Secretariat report of the Convention of Biological Diversity (2020), scientists have officially described and named almost 1 million bug species. This represents only 20% of the estimated total insect population. Insects serve as pollinators, decomposers, and food sources for other animals, among other essential functions in the ecosystem. Insect biodiversity is truly exceptional because of the many different factors that contribute to their incredible diversity. Despite their importance, the majority of insect species are still poorly known and understudied despite their significance. To fully grasp the complexities and importance of insect biodiversity, it is crucial to explore the fascinating ecology of these small creatures and utilize technological advancements like remote sensing and DNA barcoding for efficient insect monitoring.



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sciforum-114854: Dipteran abundance and family richness in different olive landscape contexts

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Biodiversity is a key aspect conditioning the resilience of agroecosystems. Landscape complexity favours the abundance and diversity of several groups of beneficial insects in olive groves and disfavours the abundance of the damaging olive fly, *Bactrocera oleae*, and the olive moth, *Prays oleae*. In addition to beneficial and harmful Dipterans, canopy-dwelling flies in olive groves have a role in the sustainability of the agroecosystem by providing alternative prey to important predators. The abundance and family richness of Dipterans was studied in the olive-growing area of southeastern Madrid, Spain, in 15 olive groves representing a landscape complexity gradient. Flies were sampled in the spring of two growing seasons by means of yellow sticky traps, and the landscape structure was characterised using composition and configuration indices calculated using Fragstats in ArcGIS.

Dipterans belonging to 32 families were recorded, with Chloropidae and Sciaridae being the most abundant. Some families with predatory or parasitoid behaviour were observed, such as Syrphidae, Dolichopodidae, and Tachinidae. No strong landscape effects were detected. The area of the olive groves (CAO) around the groves sampled had a slight negative effect on both the abundance and family richness of Diptera, a pattern that followed the effect of landscape structure on beneficial insects. However, a negative effect of the Shannon's evenness index (SHEI) was detected, which more closely followed the pattern described for harmful insect pests. Thus, Dipteran populations in olive canopies appear to be quite stable in different landscape contexts, without strong dependence on resources outside the olive groves, although different families are likely to have different behaviours. This ensures the presence of alternative prey for predators, contributing to biological control of pests and therefore to the resilience of the olive grove agroecosystem.



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sciforum-114596: Distribution patterns of the Intermediate Cross-backed Grasshopper *Dociostaurus brevicollis* (Eversmann, 1848) (Orthoptera: Acrididae) across the Asian steppes

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Dociostaurus brevicollis is associated with the dry grasslands of Eurasia. In Asia, it is distributed from the Ural Mts. to the eastern parts of Mongolia and from the southern edges of the forests up to the southern boundaries of the semi-deserts. The species is often extremely abundant and may be an important pest. The goal of this presentation is to discuss some possible shifts in *D. brevicollis* distribution relative to global warming and local ecosystem transformations.

Data on species distribution were collected in 1976-2024. Data from some publications and collections were used. Localities with the relevant geographic coordinates (229) were included in the database. The species distribution models were generated on the basis of two different approaches (maximum entropy and ellipsoid ecological niches). Actual and predicted bioclimatic variables were used for the contemporary period and the periods 2021-2040 and 2041-2060 (the CNRM-ESM2-1 global model and the 3-7.0 Shared Socioeconomic Pathway).

In the steppes of West Siberia, the species' abundance is usually high, sometimes extreme. The comparative analysis of species distribution until 1960 and from 1961 onwards shows no evident shifts with the exception of the right (eastern) side of the Ob River, where the species began to spread in the 1970s. The analysis of the models showed that the areas with optimal conditions may remain almost the same until the middle of the 21st century, but the levels of suitability will slightly decrease and some new areas with applicable environments will appear in the southern parts of Central Siberia. The distribution patterns of *D. brevicollis* and their possible changes in the future look similar to those of some other abundant steppe grasshoppers.

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sciforum-113258: Does traffic intensity affect insect communities? Impact on pollinator mortality

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Population decline trends among pollinators have become a major global concern in recent years. Many action plans and strategies have been launched to assess the causes and consequences of the global decline in insect pollinators. Road construction presents an increasing threat to pollinators by directly contributing to habitat fragmentation. Additionally, pollinators face risks from road traffic. This study aimed to contribute to our understanding of the impact of traffic on the abundance of insects (due to direct collision) and examine the differences in their presence between minor and major roads, focusing on two groups of pollinators—bees and butterflies. Insects were examined at 24 localities in northern Serbia during three seasons in 2023, along two types of roads (12 minor and 12 major road types) within areas dominated by either agricultural or semi-natural habitats. To measure the direct insect mortality caused by traffic, sticky traps measuring 10cm x 25cm were attached to a car, which was driven along the 1.25km stretch of road in both directions at a constant speed of 60km/h. A total of 476 insect specimens were documented on sticky traps, including only six bees and two butterflies. Hymenoptera, especially parasitoid wasps, were the insects most affected by traffic, accounting for up to 25% of the total number of insects caught on traps. These findings suggest that traffic may have a greater effect on the mortality of smaller insects. Insect counts were 14% higher on sticky traps on minor roads compared to major roads, with 75% of targeted pollinators recorded on minor roads. Our results show that more insects were recorded on minor roads within semi-natural landscapes than on major roads within agricultural landscapes. However, the low number of pollinators on sticky traps suggests that direct traffic does not significantly affect bee and butterfly mortality.



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sciforum-112585: Ecological and zoogeographical structure of the communities of the endangered and protected *Carabus hungaricus* Fabricius, 1792 (Coleoptera: Carabidae), in Bulgaria

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The endangered ground beetle *Carabus hungaricus* Fabricius, 1792 (Coleoptera: Carabidae), is protected in Bulgaria, but little is known about its ecological and zoogeographical features, and this study aimed at clarifying these aspects of its communities. With 252 pitfall traps, in the period May 2021–December 2023, we surveyed 42 sample plots in central-western Bulgaria. *Carabus hungaricus* was established in only seven of them, with a total of 198 specimens. In these sites, we found 57 species from 23 genera. The beetles belonged to 18 categories from the five main faunal types of Bulgarian carabids. The European–Asiatic complex prevailed (17 species, 30%), followed by the Northern Holarctic European–Siberian (15 species) and Mediterranean complexes (12 species). The European complex consisted of nine species (16%). The Endemic complex was only represented by two Balkan endemics and two Balkan subendemics. Most represented were the European–Neareastern (17.5%), Palaearctic and European–Central Asian (10.5% each) elements. The two classes of life forms had almost equal proportions, namely, 28 (49.1%) Zoophagous and 29 (50.9%) Mixophytophagous species, which is extraordinary for Bulgaria, but typical for the steppe zone of Eurasia. Such predominance of the mixophytophages (even weak) has never been established in Bulgaria. Macropterous were 32 species (56%), brachypterous (hind wings shorter than elytra, or missing) were 14 species (25%), and di(poly)morphic (some individuals with fully developed, others with vestigial wings) were 11 species (19%). The relatively low number of winged species is comparable only with typical montane habitats. In relation to their humidity preferences, mesoxerophilous carabids had the largest share (25 species, 44%). Mesophilous were 15 species and 6 species were eurybiontic. Xerophilous and mesohygrophilous groups included five species each. Hygrophilous was only one species. In relation to its ground beetle fauna, the studied complex of habitats is quite remarkable for Bulgaria and appears to be stable and characteristic for the steppe biome.



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sciforum-113368: Ecological preferences and new data on distribution of perlid stonefly *Dinocras megacephala* (Klapálek, 1907) in Serbia

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Introduction

The present study provides data on the ecological preferences and distribution of perlid stonefly *Dinocras megacephala* in Serbia in the 2012-2023 period. This species is often misidentified as the well-known perlid stonefly species, *Dinocras cephalotes* (Curtis, 1827). Males of *D. cephalotes* differ from *D. megacephala* by having patches of stronger sensilla basiconica on the ventral side of the abdomen (Hlebec et al, 2022).

Methods

Aquatic macroinvertebrate sampling was performed according to the AQEM protocol (AQEM, 2002). The semi-quantitative sampling was carried out using a hand net (25x25 cm, 500 µm mesh size), or the specimens were manually collected using tweezers. Samples were preserved using 70% ethanol solution and further processed in laboratories, where the specimens of *D. megacephala* were sorted from composite macroinvertebrate samples that were collected during Annual Water Quality Monitoring Programmes, conducted by the Serbian Environmental Protection Agency (SEPA), as well as other field research carried out by the Faculty of Biology in Belgrade.

Results

During the 2012-2023 period, the perlid stonefly *Dinocras megacephala* was recorded in a total of 30 sampling sites in Serbia. The majority of sampling sites are situated in southwestern and southeastern Serbia.

Conclusions

Dinocras cephalotes was hitherto the most common *Dinocras* species in Serbia, but we assumed that *D. megacephala* is more frequent than previously thought, and it is most likely that the species was erroneously identified as *D. cephalotes*. The species prefers well-oxygenated medium streams in submountainous and mountainous regions of Serbia, dominated by rock and gravel riverbed substrate types. Furthermore, brachypterous males of *D. megacephala* also occur at higher elevations (Illies, 1966), so brachyptery cannot be used as a characteristic to distinguish this species from *D. cephalotes* (usually at higher elevations). In addition, larvae of *D. megacephala* were used to estimate the effects of trout farms on the mass of the larvae and their antioxidative defense under pollution stress conditions (Mirčić et al, 2016).



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sciforum-113286: Effectiveness of two monitoring methods (transect walk versus pan traps) in recording species richness of wild bees: A case study in Northern Serbia

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Bees are considered the most important group of pollinators, playing a crucial role in maintaining ecosystem stability. A worldwide decline in the diversity of wild bees underlines the urgent need for their conservation. Addressing this challenge in Europe, there begins the development and implementation of effective monitoring strategies (European Pollinator Monitoring Scheme - EUPoMS). Together with transect walks, pan traps were initially used but recently excluded from the EUPoMS core scheme for financial reasons. However, as a survey method, pan traps offer several advantages for monitoring pollinators. In line with global needs, the monitoring of wild bees was conducted in semi-natural grassland and forest fragments in Serbia's northern province, by using these two methods. The data from nine sampling sites, collected during 2022 and 2023, were used to evaluate the effectiveness of these two monitoring methods, as well as the effectiveness of three different colors (yellow, white and blue) of the pan traps in recording species richness. A total of 199 wild bee species were recorded: 109 during transect walks (55%), 25 caught in pan traps (12%) and 65 species detected using both methods (33%). This suggests that, although the transect walk was more efficient in recording species richness of wild bees, colored pan traps should not be overlooked but used as complementary method in order to provide more complete data. Most species were captured in blue pan traps (64), followed by white (52) and yellow traps (36). The correlation between flower cover and the number of wild bee species caught in pan traps was -0.3 ($p = 0.052$). This indicates that when floral cover increases, the number of species caught in traps tends to decrease. However, the connection is weak, suggesting that there are probably more factors that altogether affect the effectiveness of pan traps.



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sciforum-118315: Entomocomposting: an innovative strategy for sustainable organic waste management

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The increasing global population has significantly raised the demand for food production, leading to a substantial rise in waste generation. It is estimated that around 998 million tons of agricultural waste is produced worldwide each year, yet only 16% is recycled, while 46% is discarded. According to a 2019 report, global food waste amounted to 1 billion metric tons, with households generating approximately 570 million metric tons, representing 61% of the total waste. To address these challenges, various waste management strategies have been introduced. One promising method gaining widespread attention is entomocomposting, the use of insects to convert organic waste into valuable resources such as food, animal feed, and other eco-friendly products. In particular, black soldier fly larvae (BSFL) have emerged as an effective solution for recycling organic waste while producing protein-rich biomass. Additionally, insect frass, composed of unconsumed substrate, feces, and exuviae, is a nutrient-rich material containing beneficial microbes, making it a valuable organic fertilizer. This bioconversion process aids in soil remediation, enhances soil fertility, and boosts crop productivity. The organic waste market is projected to grow from USD 39.02 billion in 2023 to USD 53.46 billion by 2030, with a CAGR of 4.6% during the forecast period. This review examines the role of insect-based organic waste management in sustainable agriculture and its potential to drive the transition toward a circular economy.



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sciforum-113522: Expert systems in interactive species identification: a case of 2,000 caterpillars

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The growing application of computer vision in species identification has significantly accelerated biodiversity data collection globally, and the ecologically and morphologically diverse group of exophytophagous caterpillars is no exception. However, many identification tools fail to incorporate critical aspects of a species' biology and ecological role within complex biotic and abiotic systems. This omission often compromises traditional knowledge preservation, contextual understanding, and the transfer of expertise inherent in classical identification keys. To bridge this gap, this study developed an interactive web application designed to enhance species identification and help link taxa to their ecological functions. Central to this work were three standardized data matrices encompassing morphological, ecological, and behavioral polyphenisms, constructed for 2,000 European exophytophagous caterpillar species, addressing 41 descriptive traits and several hundred character states. The matrices were developed through a combination of manual and semi-automated approaches, ensuring robust variability management and data consistency, while both crisp and fuzzy coding schemes were employed to accurately capture and replicate the expert identification process in a systematic format. This application features an intuitive filtering system that enables users to identify species efficiently while preserving the ecological context of each taxon. Beyond its practical utility, this tool supports biodiversity research and educational initiatives by integrating traditional taxonomic methods in contemporary data management, which can facilitate expert-to-user knowledge transfer and improve biodiversity literacy in an era of rapid environmental change.



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sciforum-113254: Exploring the impact of temperature on butterfly abundance and diversity (Lepidoptera: Rhopalocera) across selected localities in Serbia

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Global warming and climate change have been recognized as key factors contributing to the decline in insect pollinator populations. Understanding how animals can quickly respond to temperature changes is essential for predicting the impacts of climate change on biodiversity. An adequate microclimate is crucial for determining habitat quality for butterflies, particularly for the less mobile immature stages. Butterflies, like other insects, rely on behavioral thermoregulation, with some species being more vulnerable to the effects of climate change. In this study, conducted at 33 selected localities in the Republic of Serbia, an assessment was carried out to determine the impact of key environmental variables on the abundance and species composition of butterflies. In total, 105 butterfly species (Lepidoptera: Rhopalocera) were registered and analyzed during three seasons (spring, summer, and autumn) in 2022. To evaluate the effect of selected environmental and landscape variables on the abundance and species composition of butterflies, we used generalized linear models and canonical correspondence analyses (CCAs). To identify the most significant environmental variables influencing species composition and the abundance of butterflies, a "forward selection" analysis was conducted which showed a high dependence of the examined species on green cover and temperature. Furthermore, Van Dobben circles (t value biplots) were used to assess the significance of specific species' preference for temperature. The results showed that butterfly species which demonstrated preferences for lower values of temperature compared to other species were as follows: *Erebia medusa*, *Melitaea arduinna*, *Melitaea trivia*, *Brenthis ino*, *Callophrys rubi*, and *Pseudophilotes vicrama*. Two of these species are listed as strictly protected in the Republic of Serbia, and one is in the IUCN Nearly Threatened category in Europe. Given the results, species with preferences for lower temperatures may experience population decline in the future.



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sciforum-117669: Fireflies of Kanger Valley National Park: Exploring their Floral Associates, faunal relationship, and myths and beliefs

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Fireflies, often regarded as the jewels of nature, play a vital role in ecology, medicine, and culture. However, they are currently threatened globally, and minimal ecological research on them has been conducted. This study focuses on the diverse distribution of fireflies, their floral associations and faunal relationships, and the myths surrounding them in Kanger Valley National Park, Jagdalpur, and Chhattisgarh, India. For data collection, we utilized stratified transect random sampling, with specimens being obtained through net-sweeping and hand-picking. We examined the relationship between fireflies and various plant species for resting, courtship, and mating, while considering secondary parameters such as the humidity, temperature, altitude, and moon phase. Our documentation of faunal relationships indicates that bush cricket frogs exhibit attraction to the bioluminescence that is produced by fireflies; however, they tend to avoid consuming them. A questionnaire was also administered to understand the cultural significance of fireflies among Indigenous tribal communities in the area. The research identified a single firefly species, *Abscondita perplexa*, during the observation period, revealing various morphs that were previously misidentified as *Abscondita terminalis* and *Abscondita chinensis*. Fireflies are seen as indicators of a healthy environment and are known by various names among local Indigenous communities, such as "chirkup minal" in the Dhurwa community. Understanding their bio-ecology can aid in the development of techniques for research and ecotourism, as well as enhance conservation efforts for these important species.



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sciforum-094485: Flames and Fragility: The Impact of Wildfires on Butterfly Biodiversity in Southern Italy

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Introduction

Fire influences species abundance, community composition, structure, and ecosystem functions in Mediterranean ecosystems. In Italy, the incidence of wildfires has markedly increased, yet the ecological responses—particularly regarding biodiversity and invertebrate species—remain largely unknown. In July 2023, severe wildfires devastated natural reserve areas near Palermo, Italy, part of the Natura 2000 network. Between 2010 and 2015, a monitoring initiative focused on butterfly biodiversity in these areas. After the catastrophic fires of 2023, research aimed to evaluate the impact on Lepidoptera biodiversity at the same sites and transects established eight years earlier.

Methods

Three habitats affected by 2023 fires were selected: 1) F5.53: *Ampelodesmos mauritanica*-dominated garrigue areas - SCI ITA020023; 2) F5.5: Thermo-Mediterranean scrub - SCI ITA020023; and 3) F5.5: Coastal Thermo-Mediterranean scrub - SCI ITA020006. Data from bi-weekly butterfly surveys conducted from June 2010 to December 2015 were compared with data collected from September 2023 to December 2024. For each habitat, monitoring transects were established, and all data were included in a database to analyze species occurrence patterns and flight periods. Butterfly responses to fire were assessed by comparing specific biodiversity indices, including abundance and species richness. A statistical analysis of monthly species abundance was conducted to evaluate fire effects on community structure.

Results

The overall effect of fire on butterfly abundance and richness was negative across all habitats, particularly pronounced in early post-fire communities for some species. Taxonomic resolution influenced the observed impacts; analyses at species/genus and family levels revealed significant effects. Lepidoptera abundance showed a notable negative response in coastal Thermo-Mediterranean scrub.

Conclusions

Although some literature suggests butterflies tend to recover after wildfires, the findings highlight the negative impact of fire on lepidopteran populations, particularly in specific habitats. Monitoring post-fire butterfly dynamics is essential as changing global fire regimes significantly influence lepidopteran community dynamics.



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sciforum-118399: From Urban to Mountainous Regions: Impact of Various Factors on Butterfly Species Richness, their Prediction, and Habitat Shifts Induced by Climate Change in Jinan, China

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Urbanization is a major global phenomenon, highlighting the essential need for biodiversity conservation in urban settings. This study aimed to find the factors affecting butterfly species richness in Jinan City, their habitat suitability, and elevation changes. A total of 2,583 individual butterflies were collected from 23 different sites, representing 50 species across five families. Butterfly species richness showed significant positive correlations with distance from the city center and vegetation density. Conversely, elevation and topographic diversity demonstrated weak positive correlations. A strong negative correlation was observed with human population, while moderate negative correlations were noted with land surface temperature and urban island. The MaxEnt model and the Welch two-sample t-test were employed to assess the influence of bioclimatic variables on the suitable habitats and elevation shifts of butterflies in the city, utilizing Current (1970-2000) and projected climate scenarios. The SSP4.5 2070s and RCP6.0 2070s showed a significant decrease in highly suitable habitats, accompanied by a relocation to the southern mountains of the city. The RCP4.5 2070s showed a significant upward shift in butterfly elevation, whereas the SSP4.5 2090s showed no significant change. Improving habitat diversity, vegetation health, and reducing urban stressors contribute to butterfly conservation in urban environments. This study establishes a foundation for subsequent research and conservation initiatives concerning butterflies in Jinan.



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sciforum-117531: Hymenoptera In Riparian Vegetation

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Hymenoptera are among the dominant insects in terrestrial ecosystems, in number of species, number of individuals and even biomass. They perform vital ecological functions for ecosystems, such as pollination and natural biological control. The present study aimed to discuss the use of Hymenoptera fauna as a bioindicator of environmental quality in areas with different percentages of riparian vegetation. To this end, insect gatherings were carried out between November and December 2016, by installing Malaise traps in riparian zones of 12 streams, located in the Alto Uruguai region, in Rio Grande do Sul, with different percentages of vegetation. These were classified into natural, intermediate and impacted riparian zones. A total of 1,363 Hymenoptera were collected, belonging to 22 families. Ichneumonidae, Braconidae and Vespidae were the most representative families. The natural riparian zones had greater abundance and greater richness (709 specimens and 20 families, respectively). Meanwhile, in the impacted riparian zones, only 206 specimens belonging to 10 families were collected. ANOVA showed that abundance and richness differed significantly between riparian zones. Pearson's Linear Correlation showed that the percentage of vegetation in the drainage area is correlated with the abundance and richness of families. Redundancy Analysis indicated that Braconidae and Vespidae were influenced by the percentage of vegetation in the drainage area. The results of this study indicate that the percentage of vegetation in the drainage area affects the abundance and richness of the Hymenoptera fauna, showing that this group is an important bioindicator of environmental integrity.



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sciforum-113520: Insect Behavior in Fossil Wood: Linking Wood-Boring Activity to Resin Formation in Baltic Amber Deposits

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Insects have played an important role in an understanding of the fossil records of plants, revealing insights into their past ecological interactions (Labandeira et al., 2001; Hulcr et al., 2015). This case study presents the results of the examination of a unique conifer xylite specimen from the Baltic amber-bearing deposits, showing evidence of insect behaviour and its connection to resin production. The specimen contains a system of cylindrical borings, likely created by xylophagous beetles, characterised by longitudinal tunnels connected by cross tunnels and chambers. These structures, filled with a fossilised resin that preserves fungal hyphae and singular coprolites, indicate a complex interaction between plants, insects, and fungi (Franceschi et al., 2005; Nagy et al., 2022).

Specimen analysis included imaging using stereoscopic microscopy, UV light photography, and Fourier Transform Infrared (FT-IR) spectroscopy to confirm the resin as succinite, the most abundant fossil resin of Baltic amber deposits (Kosmowska-Ceranowicz, 2015). The results suggest that the borings represent insect habitation and feeding traces, which triggered a plant defense mechanism involving extensive resin production. This finding suggests that wood-boring insects could have had a significant impact on resin secretion and amber formation (Cognato & Grimaldi, 2009).

This study provides new insights into the ichnotaxonomy of trace fossils in xylic substrates and the paleoecology of amber-producing forests. The research further highlights lignite deposits as valuable data sources on fossil resin preservation and taphonomy.



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sciforum-114381: Invasion of red palm weevil among three different imported varieties of Date Palm

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Background

The date palm, or *Phoenix dactylifera* L., is a significant fruit crop and a source of income for many nations. The invasive bug *Rhynchophorus ferrugineus* (Olivier, 1790), often known as the red palm weevil (RPW) causes harm to palm via eating the internal stems of palm trees all over the world.

Aims

The purpose of this study is to identify susceptible and resistant kinds and to investigate the population dynamics of *R. ferrugineus* in three different imported date palm varieties: Dhakki, Bari, and Ajwa.

Methodology

In a date palm orchard in Bahawalpur, Pakistan, Red Palm Weevil (RPW) adults, larvae, and pupae were monitored. Using a stethoscope to listen for larval feeding sounds and by examining symptoms like yellowish discharges and disagreeable smells, infestations were found. As previously noted, three imported date palm kinds were chosen, and monthly records of the RPW population dynamics were made. Three orchards containing eighteen trees (three of each kind) were examined. Using a drill machine, immature and mature RPW stages were gathered, counted, and then put back into the trunk, which was sealed with soil paste containing 1 ml of chlorpyrifos water.

Results

Our research findings indicate that the Dhakki variety of date palms experienced the highest levels of infestation across both age groups examined. Specifically, plants aged between ten and fifteen years, as well as those older than sixteen years, were significantly impacted by Red Palm Weevil (RPW) infestations. The Dhakki variety was found to be particularly vulnerable to RPW infestations during the months of January to March, likely due to environmental conditions or the life cycle of the weevil during this period. This timing allows for proactive measures to be taken before the peak infestation period, thereby reducing the potential for significant damage to the Dhakki date palms.



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sciforum-118429: Mantids and associated Chalcidoidea parasitoids in natural areas from Eastern Spain

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Mantids (Mantodea) are generalist predatory insects in their nymph and adult stages. The female lays her eggs into an ootheca, which is made of structural proteins and tanning agents, in order to create a protective egg case. Some families of hymenoptera belonging to Chalcidoidea are known as mantid ootheca parasitoids. The vast majority of Torymidae are entomophagous species attacking Coleoptera, Lepidoptera, and the gall-formers Diptera and Hymenoptera, but the whole tribe Podagrionini is strictly associated with mantid oothecae, and a few species from Microdontomerini also attack mantid egg cases. Eupelmidae are mainly parasitoids of Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, and Neuroptera, but some species from the subfamily Eupelminae have a range of hosts, including spider sac eggs, Orthoptera egg pods, and the oothecae of Blattodea and Mantodea. The aim of this study is to provide information about the Torymidae and Eupelmidae wasps that act as parasitoids of the mantid species found in several natural parks of the province of Valencia in Eastern Spain. Several mantid oothecae were collected on garrigue vegetation, glued to bushes, in several periods between 2016 and 2024. The oothecae were stored in boxes at room temperature until the emergence of mantid nymphs and parasitoid wasps. Nymphs were returned to their territories. The egg cases belonged to the mantid species *Iris oratoria* (L., 1758), *Mantis religiosa* (L., 1758), and *Sphodromantis viridis* (Forsk., 1775). The parasitoids were species of the torymid genera *Podagrion* Spinola and *Podagrionella* Girault and the eupelmid genus *Anastatus* Motschulsky. *Podagrion bouceki* Delvare, 2005 was reared from *S. viridis*, with this being a new parasitoid–host relationship discovered in Spain, while *Anastatus maculosus* Askew, 2004 was recorded for the first time, emerging from the egg case of *I. oratoria*. The mantid–parasitoid relationships were indicated.



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sciforum-113369: Merolimnic vs. hololimnic insects: spatio-temporal inconsistency in linking species populations to sampling locations

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Introduction

The present study aimed to reveal the complexity of the spatio-temporal population dynamics of merolimnic and hololimnic insect species in terms of sampling site precision relevant to aquatic macroinvertebrate community metrics used for ecological status assessment/potential assessment of certain waterbodies.

Methods

Aquatic insect taxa were identified in the laboratory, together with other taxa from composite macroinvertebrate samples collected using the AQEM protocol (AQEM, 2002) covering all microhabitats with at least 5% distribution at the sampling site during Annual Water Quality Monitoring Programmes conducted by the Hydrometeorological Service of Serbia (2009 and 2010) and the Serbian Environmental Protection Agency (2011-2023), resulting in approx. 1700 samples in total.

Results

Data on aquatic insect taxa collected during a 15-year period (2009-2023) revealed the difficulties in determining the sampling locations of both insect groups. These difficulties can be attributed to the species' complex annual spatio-temporal variability in population dynamics, comprising cumulative effects of intrinsic (insect behavior, age, and life history traits) and extrinsic factors (primarily microhabitat conditions and heterogeneity).

Conclusions

Based on the data obtained, it was concluded that the merolimnic insect life cycle is seasonally dependent. The duration of the stage periods varied from year to year, particularly in light of recent climate change. Due to active dispersion, they can reach the most suitable stretches for their emergence.

On the other hand, hololimnic insect species spend their whole life cycle in the water and can only disperse via drift, active swimming, or phoresy (Li et al, 2016), but some aquatic beetle species have flying adults (macropterous forms) and disperse in the ways mentioned above. They can also have mixed populations consisting of both forms (including brachypterous forms).

Both insect group species can be passively carried by heavy rainfall and torrents in downstream stretches, which is also a problem for the determination of their precise sampling location.



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sciforum-118322: Monitoring Aphid Population Dynamics And Species Composition In South African Agriculture Using Bucket And Suction Traps

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Aphids (Hemiptera: Aphididae) are significant agricultural pests, recognized for their role as vectors of plant viruses and their direct damage to crops through sap extraction, impacting growth, vigor, and yield. Monitoring aphid populations is crucial for integrated pest management (IPM), enabling early detection and minimizing reliance on chemical control measures. This study aimed to examine the distribution, species composition, and population dynamics of aphids across six agricultural sites in South Africa—Christiana, Douglas, Cedara, Underberg, Fort Nottingham, and Highlight—using data from bucket and suction traps between 2006 and 2021. As part of a pilot study, bucket traps were initially deployed at a single site in Christiana to collect ground-level aphids at weekly intervals. These traps collected aphids from 31 species within 21 genera. Subsequently, suction traps were deployed continuously at six sites to capture airborne aphids as part of a national-scale monitoring effort. Aphids were morphologically identified, resulting in 168,869 individuals representing 68 species from 47 genera. Aphididae dominated (94.3%), followed by Pemphigidae (4%), with 1.4% unidentified. *Rhopalosiphum padi* was the most abundant species (31.4%), likely due to its polyphagous feeding behavior and year-round reproduction, supported by key host plants like maize, wheat, and potatoes. Seasonal peaks in abundance occurred in spring and autumn, correlating with moderate temperatures and host plant availability. Extreme summer and winter conditions led to population declines. Warmer, low-elevation regions (Christiana, Douglas) supported higher aphid populations compared to cooler, high-elevation sites (Cedara, Underberg, Fort Nottingham, Highlight). These findings provide insights into aphid ecology, offering a baseline for pest management strategies at a national level. Future research should integrate factors like pesticide regimes, host plant diversity, and viral transmission dynamics to improve pest and disease control.



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sciforum-118280: Monitoring insects: Insights from citizen science initiatives

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Citizen science (CS) plays a crucial role in monitoring and conserving biodiversity by actively engaging the public in scientific research and data collection. To explore recent CS initiatives focused on insects globally, we conducted a structured search utilizing *SciStarter* and the *EU-citizen.science* platforms, which provide extensive databases of CS projects across various disciplines. Our analysis identified 88 projects specifically targeting insects, either as focal taxa or within broader biodiversity initiatives. Projects were analyzed based on their target taxon and participant tasks. Insect community monitoring emerged as the focus of 29 projects (33.0%), while pollinator-specific initiatives accounted for 16 projects (18.2%). Within the pollinator-focused projects, 9 were specifically dedicated to monarch butterflies (*Danaus plexippus*) (10.2%), and 8 projects centered on bees, including honey bees (*Apis mellifera*) and bumblebees (*Bombus* spp.) (9.1%). Other insect groups, such as moths and beetles, represented 11.4% of the projects, while dragonflies constituted 6.8%. Less than 5% of initiatives targeted taxa like caterpillars, ants, mosquitoes, and fireflies, indicating a limited emphasis on these groups. Participant tasks across the projects were categorized into three main areas: wildlife monitoring (tracking species populations and documenting seasonal changes), biodiversity documentation (mapping various species), and community engagement (involving citizens in conservation efforts through training and reporting observations). Multi-taxon approaches were widely adopted, with initiatives monitoring insects, arthropods, and freshwater macroinvertebrates, capturing broader biodiversity patterns. Notably, over 15 invasive species, including the tiger mosquito (*Aedes albopictus*) and brown marmorated stink bug (*Halyomorpha halys*), were tracked to support early detection and mitigation efforts. Observations also revealed key ecological interactions, including pollinator–plant networks, caterpillar–foliage arthropod dynamics, and ant–habitat associations. However, a gap identified in many CS initiatives is the absence of an interdisciplinary approach, particularly in incorporating social dimensions, which limits collaboration among stakeholders and undermines the potential impact of conservation efforts.



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sciforum-113389: Moth communities across 'moist temperate ban oak (*Quercus leucotrichophora*)' and 'tropical moist deciduous sal (*Shorea robusta*)' forests in Uttarakhand, Northern India

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Seasonal sampling surveys of macro-moths were conducted in the 'moist temperate ban oak (*Quercus leucotrichophora*)' (Western Himalaya) and 'tropical moist deciduous sal (*Shorea robusta*)' (the Shiwalik range) forests of Uttarakhand in Northern India. This was carried out to understand the differences in the species diversity, seasonality and community structure between these two forest types, located on two different mountain ranges that are geologically distinct. Eight locations (four in each forest) were taken up for study. The surveys covered 125 days and three seasons (pre-monsoon; monsoon; and post-monsoon). Moths were attracted to artificial light nightly after sunset from 1900 to 2200 hours, totaling 375 hours of sampling, and we used a CFL (27 Watts; 220-240 Volts) hung vertically in front of a white canvas cloth (moth screen: 180 x 120 mm).

This study revealed 451 species from 22 families (species richness estimators: Chao 2 = 948; Jackknife 1 = 709) in the ban oak forests as compared to 231 species from 18 families in the sal forests (Chao 2 = 544; Jackknife 1 = 349), respectively. The families Geometridae followed by Erebidae, Crambidae, Noctuidae, and Drepanidae were dominant in the ban oak forests, whereas Erebidae followed by Geometridae, Crambidae, and Noctuidae were dominant in the sal forests, respectively. Shannon's diversity index was higher in the ban oak forests (4.22) in comparison to that in the sal forests (3.923). The species richness and abundance showed two seasonal peaks annually: in the sal forests, the peaks occurred during 'monsoon', followed by 'post-monsoon', while in the ban oak forests, the first peak occurred during 'pre-monsoon', followed by a second peak during the 'early post-monsoon', respectively.

Non-metric Multi-Dimensional Scaling (NMDS) of the moth abundance across the eight sites and three seasons showed distinct moth communities. The sal forest sites exhibited greater moth similarity across sites, while the ban oak sites exhibited greater 'beta diversity', and this variation was more pronounced during the 'post-monsoon' season compared to the 'pre-monsoon' and 'monsoon' seasons. The moth communities in the sal and ban oak forests were thus determined to be distinct from each other in Northern India.



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sciforum-113526: New and interesting records of Diptera (Brachycera: Empididae, Micropezidae, Rhinophoridae, Sarcophagidae) from Bulgaria.

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Diptera is one of the most diverse insect orders in the world, possibly ranking second or third in terms of estimated species diversity, and it requires a significant time investment in order to be studied even within one geographic area, with many new taxa being reported or described throughout the decades. This is the case for Bulgaria, where the systematized and extensive Catalog by Hubenov (2021) highlights the need for further research, creating a good baseline for future studies. We have caught or photographed multiple fly species new to the fauna of Bulgaria from multiple families, four of which are discussed here. The hyper-diverse family Empididae is represented by *Rhamphomyia anfractuosa*, collected from the region of Kyustendil. The family Micropezidae is represented by *Rainieria calceata*, which was observed and photographed near Vidin. From Rhinophoridae, *Melanophora roralis* was observed near Vidin and collected in the region of Sofia, where it is common in urban parks and green areas. From the family Sarcophagidae, the species confirmed to be among the fauna of Bulgaria are *Sarcophaga belanovskyi* and *S. schusteri* Lehrer, 1959. The former species was collected twice in the city of Sofia in 2022. It may have been previously reported under the name of *S. ancilla*, but these are currently considered to be separate species. *Sarcophaga schusteri* has been collected from different parts of Vitosha Mts in 2022 and 2023. Its taxonomic status is not fully clear, as it is similar to other montane taxa from the Alps. This species is likely not synonymous with *Sarcophaga subvicina*, as it was compared to material of *S. subvicina* from Czechia and Slovakia and shows differences. Povolny and Verves (1990) expressed suspicion about the older records of *Sarcophaga subvicina* in Bulgaria. This study is a part of the project under Grant contract number KP-06-N61/6 – 14.12.2022).



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sciforum-113529: New distribution records of some alien and invasive spiders (Araneae: Salticidae, Titanoecidae) and insects (Cicadomorpha: Acanaloniidae; Coleoptera: Cerambycidae, Dermestidae, Latridiidae) in Bulgaria

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Human transportation and agriculture have facilitated both the intentional and accidental introduction of species of organisms outside of their natural area. While a significant portion does not survive at their new destination, historically, a large number of species have successfully established populations way outside of their natural distribution, and this number continues to grow. Some of them have proven to be detrimental to local ecosystems (invasive species), others, especially phytophagous ones, to human agriculture. Other species have not shown such adverse effects to their new environment, but a portion of them may exhibit such traits in the future. These factors highlight the importance that the monitoring of imports holds.

We provide the first record of *Pandava laminata* (Thorell, 1878) (Araneae: Titanoecidae) from the Balkans, as well as the first records of *Hasarius adansoni* (Audouin, 1826) (Araneae: Salticidae) and *Neoclytus acuminatus* (Fabricius, 1775) (Coleoptera: Cerambycidae) from Bulgaria. In addition, new records of *Acanalonia conica* (Say, 1830) (Acanaloniidae) in the city of Sofia, of *Reesa vespulae* (Milliron, 1939) (Coleoptera: Dermestidae) in Sofia and Plovdiv, and *Cartodere nodifer* (Westwood, 1839) (Coleoptera: Latridiidae) from Sofia are provided.

This study is a part of the Project "Monitoring the effects of global climate changes through qualitative and quantitative analysis of model animal groups in selected corridors of thermophilic fauna penetration in Bulgaria" (funded by the National Science Fund of Bulgaria under grant contract number KP-06-N61/6 – 14.12.2022).



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sciforum-113527: Notes on digger wasps and potter wasps (Hymenoptera: Bembicidae, Vespidae) in Bulgaria with first record of genus *Oryttus*

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The hymenopteran fauna of Bulgaria is particularly diverse, with one of the main factors being its key location on the border between the Mediterranean and Central Europe. As a result, this country is an important corridor for the migration of many species, especially along natural highways like river valleys and the Black Sea Coast.

Ongoing large-scale monitoring of these corridors, including various sampling methods combined with reviews of observations on citizen science platforms, has resulted in numerous discoveries of generally rare or previously unknown local animal species.

Here, we provide the first documented records of the digger wasp *Oryttus concinnus* (Rossi, 1790) and the genus *Oryttus* from Bulgaria, based on six specimens collected over the past three years on the territory of the capital city of Sofia (SW Bulgaria) and photographically documented observations from 2018 in Varna on the Black Sea coast and from 2025 in Sofia.

The potter wasp *Rhynchium oculatum* (Fabricius, 1781) has a mostly Mediterranean distribution. It was first reported in Bulgaria in Petrich (SW Bulgaria, Struma River Valley) more than 60 years ago. Here, we present a new observation of the species from Rezovo (SE Bulgaria) on the Black Sea coast, near the border of Turkey.

All Bulgarian records of *Oryttus concinnus* are from towns, supporting the thesis that the open urban areas are particularly suitable for digger wasps and bees because of the warmer microclimate they sustain. The observations of both species show the potential of citizen science groups for the monitoring of changes in the distribution of key species, which could complement traditional research methods tracking the impact of climate change on species distributions.

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sciforum-117260: On the distribution and status of the protected bush-cricket *Bradyporus macrogaster* (Lefebvre, 1831) (Orthoptera: Tettigoniidae: Bradyporinae) in Bulgaria

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Big-bellied glandular bush-cricket *Bradyporus* (*Callimenus*) *macrogaster macrogaster* (Lefebvre, 1831) is a rare species with severely fragmented populations. It has “Endangered” status on the IUCN Red List and is “Critically Endangered” on the Bulgarian Red Data Book and the European Red List of Orthoptera.

In the period 2021–2023, we set 252 pitfall traps in 42 sampling areas in Western Bulgaria. In four areas we recorded *Bradyporus macrogaster*. Three of the locations are within the Tri Ushi mountain (near the villages of Bezden, Ponor and Aldomirovtsi). The fourth area is near Breste village, and represents the first locality of this species for Northwestern Bulgaria. The species was previously found there by N. Kodzhabashev in 1989 and 1995, but was not published. This new locality represents a local karst steppe refugium on the edge of the Iskar River Gorge. The river is the only natural ecological corridor crossing the Stara Planina range and contributes to the presence of typical steppe species (*Carabus hungaricus*, *Carabus bessarabicus*, common spadefoot toad) in the periphery of the Sofia Basin, the southernmost area from the entire Eurasian steppe biome.

For the first time, the long collection period and the abundant material allow for the establishment of phenological features of *Bradyporus macrogaster*, its sizes during different instars and of imagoes, and specific diapauses during the year. We also mapped a significant part of steppe bioindicator biota and accompanying species in studied localities.

The localities of the species fall into two Natura 2000 Areas, but the protection of the stenobiont steppe species requires the imposition of highly restrictive conservation measures. Protecting rare species such as the *Bradyporus macrogaster* is only possible by consolidating the conservation efforts of the entire European community and developing a common strategy for immediate conservation measures that will guarantee the complete integrity of steppe habitats and biota.



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sciforum-118279: Orthoptera diversity and community ecology in the mountainous pastures of two protected areas (Natura 2000) in Greece

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Mountainous ecosystems are biodiversity refugia and centers of endemism. This study explores the Orthoptera communities in the Tymphi and Smolikas mountains within the Northern Pindos National Park in Greece (sites of the Natura 2000 network). We selected 11 montane pastures per mountain, including grasslands and forest clearings (1,250 to 1,940 m). We recorded the presence of Orthoptera and 20 microhabitat parameters in three 5 x 5 m plots per site every 150 m and repeated this three times (pooled seasonal data for June–September 2022: 66 plots in total). Furthermore, we randomly searched for red-listed species and recorded the microhabitat parameters in their presence (35 additional plots). The study area has high ecological value, hosting 70 grasshopper species (54 species recorded in the current study), including 10 globally red-listed species and 3 endemics. The Canonical Correspondence Analysis showed that elevation, mean herb/grass height, flowerhead abundance, stony cover, and shrub cover regulated the Orthoptera community composition (CCA: 14% of the variance explained) and that elevation, flowerhead abundance, shrub cover, and litter cover regulated the red-listed Orthoptera community (CCA: 32% of the variance explained). Orthoptera species richness was predicted by herbaceous plant cover, mean herb/grass height, mean shrub height, and flowerhead abundance (a positive effect), as well as litter cover (a negative effect) (Generalized Linear Model: 43% of the deviance explained). Our findings highlight the importance of food resources (herbaceous plant cover and herb/grass height) and shrub availability, providing shelter and thermoregulation, for grasshopper conservation. Further research is recommended to investigate the impact of cattle overgrazing and the role of mild sheep/goat grazing for mountainous Orthoptera communities. Our fieldwork was supported by the Feraki Fund.



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sciforum-113515: Potential Invasion and Distribution of *Lymantria mathura* in Ukraine: Risk Assessment and Management Strategies

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Lymantria mathura (Moore, 1865), the rosy gypsy moth, is a polyphagous defoliator from the family Erebidae, which inhabits deciduous forests mainly in South and Southeast Asia. The broad trophic spectrum of this species makes it an important pest that threatens forests, urban greenery, ornamental plants, and fruit trees. Due to climate change, this species could become a threat beyond its natural range and the aim of our research was to assess the risk of invasion and establishment of *L. mathura* in Ukraine and to model the potential distribution of natural enemies of this moth.

GIS modeling in MapInfo Pro 15.0 (ESTIMap) and IDRISI Selva (Clark Labs) was used to model the potential distribution of *L. mathura*, and MaxEnt was used to model the potential distribution of entomophagous insects known to be effective in *L. mathura* biocontrol.

We found that the potential range of *L. mathura* covers almost all of Ukraine, except for the Carpathian highlands. The most important bioclimatic factors influencing its establishment are the mean annual temperature, the temperature of the warmest month, and the sum of active temperatures above 10 °C, while the limiting factor is the mean temperature of the coldest month. Modeling suggests that natural enemies such as *Cotesia melanoscela* (Hymenoptera: Braconidae), *Compsilura concinnata*, and *Carcelia gnava* (Diptera: Tachinidae) could play a crucial role in biological control if *L. mathura* invades Ukraine.

Due to its high risk of introduction, broad climatic tolerance, excellent flight ability, and numerous suitable host plants, *L. mathura* poses a serious threat to Ukraine's plant resources. A key risk management strategy could be its inclusion in List A1 (absent) of the Ukrainian Regulated Pests List.



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sciforum-118146: Pterostichus montanus population dynamics: the impact of climate and cyclicity in Northern Baikal

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The diversity of life and the complexity of ecosystems are rooted in cyclicity—an order that ensures the functioning of biological processes. In various industries that utilize natural resources, it is crucial to consider the characteristics of natural cyclicity and make corresponding forecasts. In our study, we approached this task by analyzing the cyclicity of long-term numerical series of insects. As a model species, we selected a widespread species of the ground beetle family, *Pterostichus montanus*. From 1988 to 2020, we conducted quantitative surveys from May to September at 14 stationary sites located along a 30-kilometer transect stretching from the shore of Lake Baikal to a mountain peak of the Barguzinsky ridge. Simultaneously, we recorded average the monthly air temperature and total monthly precipitation. For the visualization and interpretation of the long-term series, we used spectral analysis and elements of fractal geometry, specifically Pareto histograms, which rank factor categories in descending order and allow us to identify the most significant factors influencing the entire process. These methods enabled us to detect cycles and determine the most important factors affecting the abundance of ground beetles. In the long-term series of the model species, we identified eight cycles of varying strength. The most pronounced were the two-year cycles associated with the cyclicity of atmospheric precipitation ($p = 0.001$) and the three-year cycles determined by temperature regimes ($p = 0.001$). Longer cycles with a frequency of 8–11 years were of secondary importance ($p = 0.1$). We also found that the abundance of this species does not decrease with increasing altitude. Favorable conditions for the abundance of ground beetles include a pronounced litter layer, moderate light, and moisture. The studied species primarily coordinates its population dynamics with the cyclicity of meteorological parameters, highlighting the importance of studying cyclicity and its impact on natural ecosystems.



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sciforum-111448: Public Perceptions of Insect Pollinators in Morocco: Bridging Awareness Gaps for Effective Conservation

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The conservation of insect pollinators is essential for preserving biodiversity and sustaining ecosystem services, particularly in Morocco, where pollination supports both agricultural productivity and wild plant ecosystems. Despite the critical role of pollinators, public understanding of their ecological importance remains limited. This study explores public perceptions of insect pollinators, with a focus on the awareness and attitudes of educated urban youth in Morocco. Over a four-month period, we collected 301 survey responses distributed via online media platforms. The findings indicate that while participants are generally aware of the decline in pollinator populations and the threats they face—such as habitat loss, pesticide use, and climate change—there is a significant knowledge gap regarding non-bee pollinators. Honey bees and bumble bees are widely recognized for their pollination roles, but less attention is given to solitary bees, flies, and other pollinating insects that contribute significantly to ecosystem health. These results highlight the urgent need for targeted educational programs to enhance public knowledge of the ecological functions of lesser-known pollinators. Expanding outreach efforts within Morocco's national biodiversity strategy to include diverse demographic groups, including rural and less-educated populations, could further strengthen public engagement in pollinator conservation. This presentation underscores the importance of inclusive, evidence-based strategies to safeguard pollinator diversity and ecosystem resilience.



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sciforum-116368: Soybean leaf trichomes under drought and herbivory have differential effects on soybean looper (*Chrysodeixis includens* Walker)

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Leaf trichomes have been extensively studied as physical defensive structures against abiotic and biotic stress in plants. Climate change-driven stresses such as drought and/or herbivory can aggravate crop morpho-physiology as well as physical and chemical defenses. However, the interactions of such stresses on trichomes, as well as their impact on herbivores, remain poorly understood. To study the effects of drought and herbivory (D×H) on leaf trichomes, we introduced soybean looper (SBL) (*Chrysodeixis includens* Walker), a polyphagous herbivore, to drought stressed soybeans. After assessing trichome density, the trichomes were extracted and incorporated into artificial diets to examine SBL growth traits under various leaf-diet concentrations (10% and 20%) and trichome diets (high and low). Following that, a time-to-feed experiment was performed to evaluate the effects of trichomes on SBL feeding initiation. We found that SBL started feeding faster on shaved leaves with trichomes removed than on unshaved leaves that had intact trichomes. The results also revealed that D×H induced trichomes in new leaves, which led to cascading effects on SBL growth traits. Although SBL showed a positive mass gain under the leaf diet from stressed plants, they had early pupation and eclosion under D×H leaf diet. Post-ingestion effects were evident from frass pellets under trichome diets, since the caterpillars that fed on high trichome diet also had a higher number of trichomes in their frass. In conclusion, trichomes are substantially induced by D×H and have cascading effects on SBL growth and development, exhibiting both pre- and post-ingestive effects. The highly inducible nature of trichomes in response to abiotic and biotic stresses provides the potential for future investigation in defensive priming and integration into resistance-breeding programs.



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sciforum-113418: Study on the polytene chromosomes of *Chironomus* spp. (Diptera: Chironomidae) in the wetlands of the Savar region, Dhaka district, Bangladesh

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Chironomid larvae have distinct salivary gland polytene chromosomes with precise banding patterns. Chromosome arms possess two transcriptionally active sites, i.e., Balbiani rings (BRs) and Nucleolar organizers (NORs). Structural changes in the chironomid chromosomes serve as pollution bioindicators in fresh water ecosystems, which are directly related to the ecology of the aquatic environment. Savar city is centrally located in Bangladesh and about 380,000 people live there, which makes it the second most populous city in the district. Anthropogenic sources, such as untreated industrial effluents, household waste, and run-off from agriculture, are the main reasons for surface and underground water pollution. Therefore, the aim of this study was to observe the polytene chromosome structural patterns of chironomid larvae collected from Savar wetland regions. Salivary gland polytene chromosomes of the 4th instar larvae were examined in order to describe their chromosomal diversity in these habitats. We followed the lacto aceto orcein squash method for polytene chromosome preparation. Two karyotypes (Type 1 from Jahangirnagar Campus under Pseudothummi Cytocomplex and Type 2 from Savar DOHS under Thummi Cytocomplex) have been observed. Pseudothummi Cytocomplex has an AE, CD, BF, and G- chromosome arm combination, whereas Thummi cytocomplex shows an AB, CD, EF, and G- chromosome arm combination. Here, Thummi is considered to be basic, while Pseudothummi is considered to be structurally changed due to environmental factors. Chromosome arms BF and AB are the longest and G is the smallest in the karyotypes. In both types, BRs and NORs were detected in the G arms. Centromeric bands were also detected in each arm and these bands were deeply stained, i.e., were highly heterochromatic in nature. Karyotypic analysis in these two cytocomplexes has indicated the presence of a much larger chironomid fauna in this region, as well as structural changes in their chromosome arm combinations. Further research on the various structural rearrangements in the polytene chromosomes of chironomid larvae collected from polluted wetland water bodies is in progress.



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sciforum-113222: Temporal dynamics of carrion fly communities at carrion bait in the South African Highveld

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Calliphoridae, Sarcophagidae and Muscidae are important components of invertebrates involved in decomposition and nutrient cycling and dispersal. These carrion flies are vectors of gastroenteric pathogens, pollinators, and are valuable as evidence in medicolegal investigations. Despite their importance, carrion fly surveying methods applied in the published literature are inconsistent, varying in bait type, mass, and exposure period, making it difficult to compare results and be certain that representative samples of target communities were captured. This study aimed to determine how species of Calliphoridae, Sarcophagidae and Muscidae are attracted to chicken liver-baited traps decaying over time and, therefore, the time required to catch representative samples of carrion flies in the Highveld ecoregion of South Africa. Modified Redtop® bag traps were used and baited with 120g of food-grade chicken liver. Grassland, shrubland and woodland habitats were surveyed with the traps exposed for three, six, nine and twelve days in the spring and winter of 2024. In total, 28 species were trapped. The flies arrived at the traps at different rates between habitat types and seasons. In spring, *Chrysomya chloropyga* was the most abundant species at traps while in winter, *Sarcophaga* spp. were most abundant at traps. Species accumulation curves indicated that more than 12 days of bait exposure are required for a representative sample to be obtained across all habitats and seasons sampled thus far. The patterns of arrival of members of Calliphoridae, Muscidae and Sarcophagidae at traps align with studies using other baiting methods. However, this method caught fewer species than studies in the same region using large animal carcasses and fewer Sarcophagidae species compared to using fish carrion.



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sciforum-112588: The conservation status and prospects of the endangered and protected *Carabus hungaricus* Fabricius, 1792 (Coleoptera: Carabidae) in Bulgaria

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Carabus hungaricus Fabricius, 1792 (Coleoptera: Carabidae) is a Natura 2000 species, protected by Directive 92/43/EEC (Annexes II and IV) and included in the Berne Convention (II) and CORINE. It is declining everywhere across its highly fragmented distribution range (from Central Europe to Eastern Siberia), sharing the fate of the temperate grasslands that it lives in, which are among the most threatened biomes on Earth. In Bulgaria, it is protected by the Biological Diversity Act (Annexes II and III), added in the Bulgarian Red Data Book as “Vulnerable”, and included in the standard form of only one protected area (BG0000322 “Dragoman”) with an unfavourable status. This study presents a part of the results from the work on the development of an Action Plan for its conservation in Bulgaria. During the three-year study (May 2021–December 2023), using 252 pitfall traps, we explored 42 plots in central–western Bulgaria. We proved the strong attachment of the species to the karst steppes, and its requirement for a lack of anthropogenic pressure or changes in the landscape structure, vegetation, edaphotope, and microclimatic characteristics. In the developed Action Plan, for the period of 2023–2032, restrictive measures related to the conservation of the old and newly established localities and the use of traditional extensive practices maintaining the karst steppe biome in an unchanged state, ensuring the existence of the entire steppe biota, were established. All localities of *Carabus hungaricus* in Bulgaria are situated in the karst steppes of the small mountains around the Sofia Basin. Since they represent the southernmost areas of the entire Eurasian steppe biome, the existence of the entire steppe complex in this border refugium is highly vulnerable and dependent on full conservation, which can only be achieved by designating strictly protected areas.



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sciforum-112579: The current distribution of the endangered and protected *Carabus hungaricus* Fabricius, 1792 (Coleoptera: Carabidae) in Bulgaria

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Carabus hungaricus Fabricius, 1792 (Coleoptera: Carabidae) is a zoophagous, mesoxerophilic, stenotopic steppe species and endangered everywhere across its highly fragmented distribution range, from Central Europe to Eastern Siberia. The known range of the species in Bulgaria is limited to the western part of the Sofia Basin and, in particular, the neighbouring parts of the Western Stara Planina Mountains. The presented results were obtained during a three-year study (24 May 2021–10 December 2023) using 252 pitfall traps, set in 42 sample plots situated in xerophytic landscapes near the Sofia Basin and similar regions in central–western Bulgaria. The studied areas represent the southernmost limits of the distribution of the steppe fauna in Eurasia and, in Bulgaria, *C. hungaricus* is only found there (and not in all of them). *Carabus hungaricus* was established in only seven of the sampling sites, with a total of 198 specimens. These sites are located in the Chepan Planina and Tri Ushi Mountains, both in the range of the Western Stara Planina Mts. Our results add four new points to the distributional map of *C. hungaricus* in Bulgaria and can be used to update the information regarding its altitudinal limit (the species was so far known from between 500 and 800 m a.s.l), elevating it to 1180 m, under the top of the Chepan Planina Mt. The species will probably be found at the very top (Petrovski Krast Peak, 1206 m) as well. The species was not found in the Western Forebalkan (the “exit” of the Iskar River Gorge) or in the Kraishte Region (Lyubash and Golo Bardo Mountains). Generally, our results confirm that the distribution of *C. hungaricus* in Bulgaria seems to be limited to within the boundaries of the Natura 2000 Site of Community Importance (SCI) BG0000322 “Dragoman”, but the discovery of new localities indicates that there are still gaps in our knowledge.



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sciforum-118263: The Impact of Traffic Pollution and Anthropogenic Pressures on Firefly Populations in the Western Ghats

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Fireflies, renowned for their bioluminescence, are increasingly threatened by traffic pollution, anthropogenic pressures, and habitat disruption. This study, conducted in 2023 along Charmadi ghat (13°03'25"N and 75°25'40"E), Chikkamangaluru, Karnataka, investigated the effects of traffic-related pollution—such as light, noise, and air pollutants—on firefly behaviour and population dynamics.

We measured traffic volume by directly counting vehicle passes on Charmadi Road, noise using a sound level meter (IEC 61672 class 1), light intensity using a lux meter (LX-101A), and air pollutants (RSPM, SPM). A survey involving 1,500 participants assessed perceived threats.

Noise levels reached a maximum of 68.12 dB near the road, approaching the suggested threshold of 74 dB at 10 meters for impacting fireflies (STIS, 2021). Heavy vehicles, such as trucks (82.64 lx) and buses (92.08 lx), exhibited the highest light intensity. Measured air pollutants included RSPM at 24.479 µg/m³ and SPM at 36.6319 µg/m³. The survey revealed that artificial lighting is perceived as a primary factor in firefly decline, with deforestation, flooding, and agricultural chemical use also cited as significant threats.

The observed noise and elevated air pollutant levels contribute to habitat degradation, potentially forcing fireflies to relocate and impeding their ecological functions. The high light intensity from heavy vehicles may disrupt firefly bioluminescence, mating behaviour, and predator–prey interactions. These particulate matter levels suggest potential long-term impacts on firefly habitats, warranting further investigation. The participant survey supports these findings, highlighting the role of artificial lighting and other anthropogenic pressures in firefly population decline. This research emphasizes the critical significance of managing artificial lighting pollution. Furthermore, the findings indicate that firefly ecotourism can positively contribute to the economy while reinforcing conservation efforts and research initiatives aimed at firefly preservation. The study concludes that addressing traffic-related pollution and promoting sustainable practices are essential for conserving firefly populations in this region.



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sciforum-113680: The Rising Risk of Stem Borers in Gilan's Rice Fields Due to Climate Change: A Case Study of *Chilo suppressalis*

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The northern provinces of Iran along the Caspian Sea coast, with their favorable climate and ample water resources, host extensive rice fields that are vital to both local livelihoods and the national economy. *Chilo suppressalis*, a major pest species, is estimated by the Agricultural Organization of Gilan province to cause a 30–50% reduction in crop yield and a decline in product quality. Despite its significance, the potential impact of climate change on this pest has not been thoroughly studied in Iran, leaving a critical knowledge gap. In this study, we address this gap by projecting the future distribution of *C. suppressalis* under two climate change scenarios (SSP2-4.5 and SSP5-8.5) for the year 2070. The results confirm the pest's current widespread presence in the rice fields of Golestan, Mazandaran, and Gilan provinces, aligning with recorded data from the Agricultural Organization. However, projections indicate a sharp decline in the species' spread in eastern Mazandaran and Golestan, with a shift toward western regions. Conversely, Gilan province is predicted to experience both stability and an expansion of suitable habitat for the pest. As *C. suppressalis* is highly sensitive to extreme temperature fluctuations, preferring a range of 25–32 °C, these distribution shifts are consistent with expected climate impacts. To mitigate potential economic losses, it is imperative to implement proactive management strategies to address this issue promptly.



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sciforum-113109: Weather-Driven Mango Field Forecasting: Integrating the Prophet Model, Normalized Difference Vegetation Index, and Mealybug Dynamics for Precision Agriculture

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This study focuses on developing a reliable forecasting system for mango field delimitation using weather data, the NDVI (Normalized Difference Vegetation Index), and the role of the mango mealybug (*Drosicha mangiferae*) in production dynamics. Hourly weather data and NDVI values were analyzed to understand their collective impact on mango cultivation. Prophet, a forecasting model designed for time series data with seasonal trends, was utilized to predict weather patterns, while NDVI changes captured vegetation health influenced by climatic conditions. Mango mealybugs, a significant pest, negatively affect mango yield through sap extraction, leading to reduced fruit quality and premature fruit drop. Climatic factors like temperature, humidity, and rainfall play a crucial role in managing mealybug infestations. Lower temperatures of 21° C with dry conditions favor their activity, while increased rainfall and humidity limit their spread by disrupting their lifecycle and behavior. Comparisons of Prophet with traditional statistical methods like ARIMA revealed its superior accuracy in forecasting mango production and area. Stepwise regression identified significant climatic variables that influence production. By integrating real-time weather patterns, pest impacts, and NDVI trends, this research highlights an advanced, climate-responsive forecasting model. This system offers mango growers actionable insights to optimize resources, implement timely pest control strategies, and mitigate climate-related risks effectively.



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sciforum-113456: Whiteflies (Hemiptera: Aleyrodidae) of the Eocene succinite

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Whiteflies (Hemiptera: Sternorrhyncha: Aleyrodidae) are minute insects with a body length of 1 mm to 2 mm and a wingspan of less than 3 mm. The nomenclature of this insect is derived from the presence of a powdery secretion that is preened over the bodies and wings of the adults of almost all species. These insects typically feed on the undersides of plant leaves during their larval, pupal, and adult stages. The fossil record of whiteflies extends back to the Late Jurassic, with the majority of known fossils being reported from resins, including the first specimen, which was described by Menge in 1856 under the name of 'Aleyrodes' aculeatus from the Eocene Baltic amber. The Eocene fossil resins of Europe, which contain inclusions of whiteflies, comprise the Lowermost Eocene amber from Oise (Paris Basin, France) and younger resins collectively named 'Baltic amber', of various ages (Lutetian to Priabonian). These resins have yielded five taxa of Aleurodicinae from Ypresian Oise amber. More taxa representing both Aleyrodinae and Aleurodicinae originate from the succinite of various ages and geographic origins. Succinite from the Gulf of Gdańsk area has yielded five identified species to date (three taxa of Aleurodicinae and two of Aleyrodinae), while a single Aleurodicinae species is known from amber found in Rovno. Recently, seven species of Aleurodicinae were described from the succinite of Denmark. A further Aleyrodinae species was identified from the succinite found in the Miocene Lower Lusatia deposits, although the resin appears to be older. These fossils exhibit significant morphological diversity, and their distribution provides valuable insights into the palaeobiogeographic and palaeoenvironmental differentiation of Europe during the Eocene. Whiteflies can serve as valuable indicators of local faunas, while also facilitating our understanding of the taphonomy, transportation, and deposition of amber. This research was funded by the National Science Centre, Poland grant no. 2022/47/B/NZ8/02113.



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Session 5. Pest Management, Pesticide Resistance, and Toxicology

sciforum-113377: Polyphenol-Based Biostimulants Shape Soybean–Pest Interactions

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Glycine max (Fabales: Fabaceae) is a key global crop, with over 17 million hectares dedicated to soybean production in Argentina, making it a cornerstone of agricultural systems. To promote sustainable agriculture practices, farmers increasingly use plant-based biostimulants, yet their effects on pest interactions remain unclear. This study evaluates the impact of a polyphenol-based biostimulant applied to soybean seeds on two pests: *Spodoptera frugiperda* (Lepidoptera: Noctuidae) and *Nezara viridula* (Hemiptera: Pentatomidae). Yield traits were assessed, while insect bioassays measured the survival and weight gain of larval *S. frugiperda* and nymphal *N. viridula*. Additionally, protease inhibitor (PI) levels in leaves and seeds were measured after 24 and 72 hours of herbivory. Biostimulant-treated plants exhibited improved yield parameters, including seed count and plant height. Serine PIs (defensive against lepidopterans) increased in the treated plants' leaves, but cysteine PIs (defensive against stink bugs) showed no significant differences, even after feeding. The survival and weight gain of *S. frugiperda* were significantly affected by the treatment, whereas no effect was observed for *N. viridula*. The results suggest that biostimulant-treated soybeans enhance lepidopteran resistance while having limited effects on stink bugs. These findings highlight the potential of polyphenol-based biostimulants to improve integrated pest management and boost crop productivity in sustainable soybean farming systems.



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sciforum-118248: Efficacy of low-copper-content and silicate-based particle film products against olive fruit fly (*Bactrocera oleae* Rossi) infestations in olive groves

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The olive fruit fly (*Bactrocera oleae*) is the most important olive pest worldwide, which can cause total yield losses in olive groves where its population is not controlled. The current knowledge suggests that some commonly used copper-based fungicides and silicate-based particle films can contribute to reductions in *B. oleae* infestations. The aim of this study was to determine the efficacy of commonly used copper fungicides, two different low-copper products (alternative fungicides), and a silicate-based particle film for *B. oleae* infestations. This study lasted from July to October 2023 in an olive grove on the Croatian coast. It was set up on the most widespread Croatian cultivar, Oblica, and the following treatments were applied: the commonly used copper oxychloride (37.5 % Cu), copper gluconate (12 % Cu), a low-copper product (1 % Cu), a silicate-based particle film product, a mixture of a low-copper (1 % Cu) and a silicate-based particle film product, and water (the control). The fruits were sampled every 15 days and examined for the presence of *B. oleae*. Total (% of fruit showing signs of infestation) and harmful infestations (% of larvae, pupae, or exit holes) were determined. All of the treatments, with the exception of copper oxychloride, significantly reduced the total infestation of *B. oleae* compared to that with the control. While all of the treatments were found to be more effective in reducing harmful infestations than the control, only the silicate-based particle film product and the combination of the low-copper product and the silicate-based particle film product significantly reduced infestations. These results indicate that the silicate-based particle film product and the mixture of the low-copper product and the silicate-based particle film product were the most effective in reducing *B. oleae* infestations. These products might have an important role in future olive fruit fly management programs.



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sciforum-113315: Evaluation of entomopathogenic action of *Beauveria bassiana* using two application methods: Trunk inoculation on kiwi trees and seed coating on cotton

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The insecticidal action of the entomopathogenic fungus *Beauveria bassiana* (Hypocreales: Cordycipitaceae) has been documented for a wide range of pests, and in recent years, its formulated application has been tested in several crops. In this work, two different application methods of *B. Bassiana* PPRI 5339 Velifer® were studied over two years. In one case, *B. bassiana* was applied as a coating to the cotton seed (treatment A) *Gossypium hirsutum* (Malvales: Malvaceae), and in the other case, it was applied via syringe inoculation to the kiwi trunk (treatment B) *Actinidia deliciosa* “Hayward” (Ericales: Actinidiaceae). For each case, plants without the application of *B. bassiana* were used as a control (treatment C). The sucking insects *Aphis gossypii* (Hemiptera: Aphididae) on cotton plants and *Halyomorpha halys* (Hemiptera: Pentatomidae) on kiwi trees were counted. In addition, the total chlorophyll contents and the leaf area were measured during the experiment. The presence of *H. halys* was significantly reduced in kiwi trees, and the total chlorophyll content in the leaves was increased. In the cotton plants, the population of *A. gossypii* was reduced, and the leaf area appeared larger. The presence of *B. bassiana* on treatments A and B, on the one hand, reduced the sucking pests, while on the other hand, it enhanced the total chlorophyll content and the leaf area. The results of both application methods are encouraging reasons to investigate *B. bassiana* and similar endophytes in other crops, given the biotic stresses and yield losses that can be caused by aphids or new exotic pests in Greece, such as *H. halys*.



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sciforum-112922: Modulations in the Activities of Digestive Enzymes and Phosphatases in *Trogoderma granarium* Larvae Following Exposure to Bifenthrin, Chlorpyrifos, and Their Combinations.

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Introduction: *Trogoderma granarium* larvae severely damage stored commodities, but their resistance to common insecticides like deltamethrin and phosphine is a growing concern. Our previous research showed bifenthrin, chlorpyrifos, and their combinations to be effective alternatives at low concentrations which may pose no threat to health and the environment. This study investigates the impact of these neurotoxic insecticides on the digestive enzymes and phosphatases of *T. granarium* larvae to uncover their secondary mechanisms of toxicity on nutritional physiology and xenobiotic detoxification.

Methods: In the present study, 48 hours of exposure to LC₂₀ (ppm) of bifenthrin, chlorpyrifos, and their combinations (3:1 and 1:3 bifenthrin:chlorpyrifos) were used to investigate the enzymatic responses of fourth and sixth instar *T. granarium* larvae. The study utilized both insecticide-susceptible (Lab-S) and deltamethrin-resistant (GUW) populations. Biochemical analyses were conducted to assess the activities of digestive enzymes (lipase, invertase, trehalase, amylase, and protease) and phosphatases (acid and alkaline phosphatase) in the exposed larvae.

Results: Exposure to bifenthrin, chlorpyrifos, and their combinations significantly ($p \leq 0.05$) elevated the specific activities of lipase, invertase, trehalase, amylase, and acid phosphatase in comparison to control (untreated) in both susceptible and resistant populations of *T. granarium* larvae. The treatments decreased protease activity significantly. Alkaline phosphatase activity was decreased significantly in GUW larvae, but increased significantly in Lab-S larvae, except for some treatments that decreased activity in sixth instar Lab-S larvae.

Conclusions: The findings of this study suggest that bifenthrin, chlorpyrifos, and their combinations at low LC₂₀ levels can affect the digestive physiology of *T. granarium* larvae, potentially leading to impaired growth and increased mortality. These results have implications for the development of novel pest management strategies targeting digestive enzymes and phosphatases, and provide further evidence for safe and effective use of chlorpyrifos at low concentrations, minimizing environmental and health risks while maintaining its pest control efficacy.



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sciforum-114981: Protecting honey bee health: The role of polyphenolic supplements in oral administration of deltamethrin

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Introduction: Deltamethrin (DTM) is widely used in forestry, professional agriculture, and amateur farming. However, its application presents specific risks to pollinating insects. DTM disrupts the physiology of honey bees (*Apis mellifera*), causing abnormalities in behaviors such as dancing and foraging, as well as issues like memory impairment, hypofertility, and hypothermia [1]. Antioxidant compounds incorporated into bee diets can defend bees against the adverse effects of various pesticide classes [2-3]. This study aimed to evaluate the potential of the polyphenolic fraction of bergamot (BPF) to mitigate the harmful effects of DTM exposure.

Materials and Methods: Twelve experimental groups consisting of 20 honey bees each were established. Under controlled laboratory conditions, honey bees were exposed to oral DTM administration for three days at a concentration of 21.6 mg/L. Additional experimental groups received BPF (1 mg/kg) in combination with the specified toxic DTM doses. Abnormal behaviors—including a curved-down abdomen, hyperactivity, apathy, motion coordination issues, and moribundness—were observed and recorded at 1, 2, and 3 days post-treatment. Survival rates were also assessed for each group.

Results: By day 3 of the experiment, all honey bees in the groups exposed solely to the highest DTM dose (21.6 mg/L) had perished. Conversely, in the groups treated with both BPF and DTM (21.6 mg/L), a survival rate of 46% was observed after 3 days. Overall, groups receiving only toxic DTM doses exhibited lower survival rates (day 1 = 38%, day 2 = 25%) compared to those treated with the BPF and DTM combination (BPF + DTM: day 1 = 86%, day 2 = 72%). Additionally, honey bees exposed to the BPF/DTM combination displayed fewer abnormal behaviors compared to those treated with DTM alone.

Conclusions: Oral administration of BPF can reduce the harmful effects of DTM. However, further research is necessary before recommending the inclusion of BPF in honey bee diets, despite the promising positive effects observed.



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sciforum-111329: Sublethal effects of an Argentine *Bacillus thuringiensis* strain on the development and fitness of *Alphitobius diaperinus* (Coleoptera: Tenebrionidae)

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Alphitobius diaperinus, the lesser mealworm, is a key pest of poultry in broiler and layer facilities. The highly virulent INTA Mo4-4 strain of *Bacillus thuringiensis* is the most effective choice for controlling larval *A. diaperinus*. This study evaluated its sublethal effects on development, survival and fitness. Initially, six concentrations of INTA Mo4-4 spores and crystals were incorporated into the diet of *A. diaperinus* starting with 4-day-old larvae to assess virulence. Mortality was recorded after 14 d at 28 °C, and LC₃₀ and LC₅₀ were determined from four independent bioassays, yielding values of 69 and 136 µg/ml, respectively. Subsequently, sublethal bioassays using the LC₃₀ and LC₅₀, alongside a control group, determined the effects on surviving larvae. After 14 d at 28 °C, 791 larvae from five independent bioassays were analyzed. Their weights and larval areas were measured and later monitored to determine the durations of their larval and pupal stages, as well as their pupal and adult weights and body areas. Sublethal effects were clear in the LC₃₀ and LC₅₀ treatments, showing significantly reduced weights/areas per larva (0.25 mg/0.97 mm² and 0.20 mg/0.82 mm², respectively) compared to controls (0.37 mg/1.32 mm²). Although these trends persisted, differences were no longer statistically significant for developmental periods, pupae or adult fitness traits. Average larval (76.7, 83.1 and 104.6 days) and pupal periods (5.7, 6.4 and 7.0 days) and pupal (10.08 mg/9.32 mm², 8.75 mg/8.44 mm² and 8.12 mg/7.80 mm²) and adult weights/areas (8.97 mg/9.63 mm²; 7.65 mg/8.54 mm²; and 6.96 mg/7.95 mm²) per specimen followed similar trends across the control, LC₃₀, and LC₅₀ treatments, respectively. This study showed that INTA Mo4-4 induces both mortality and sublethal effects that could affect the development and fitness of *A. diaperinus*, offering valuable insights for bioinsecticide development targeting this pest.



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sciforum-113231: Biocides and pest repellents containing materials from *Lamiaceae* plants: A Patent Analysis Using Cooperative Patent Classification

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Analyzing patents related to *Lamiaceae*-derived materials offers a robust framework for assessing the state of the art in their agricultural use, particularly for biocides and pest repellents targeting entomological pests. These patents highlight key trends and innovations, including the development of natural compounds that are effective against pests such as aphids, whiteflies, and beetles, as well as technologies like microencapsulation and synergistic applications with other natural compounds. This study provides a comprehensive analysis of patent families associated with biocides and pest repellents derived from plant materials, focusing on the *Lamiaceae* family. By leveraging Cooperative Patent Classification (CPC) codes, the research identifies key trends in patent activity, botanical diversity, and technological applications. The analysis spans over 150 years, revealing distinct phases of innovation. Key CPC codes, representing more than 8% presence among the analyzed patent families, highlight the dominance of materials from the *Magnoliopsida* (dicotyledonous plants) and *Liliopsida* (monocotyledonous plants) classes, particularly the *Lamiaceae* family, with thyme, rosemary, and peppermint as primary examples. Other significant plant families include *Asteraceae*, *Myrtaceae*, *Rutaceae*, *Poaceae*, and *Aloeaceae*, among others. The findings emphasize the increasing focus on natural, sustainable solutions for pest management, aligning with global trends in eco-friendly agricultural practices and climate change adaptation. Specifically, the results underscore the strategic role of plant-based compounds in addressing vector-borne diseases transmitted by insects such as mosquitoes (e.g., malaria and dengue) and enhancing agricultural productivity through improved crop protection and yield. This study also highlights the technological and geographical distribution of innovation, with significant patent activity observed in regions such as Europe, North America, and Asia. These insights offer valuable guidance for stakeholders in academia, industry, and policy-making to foster further development in sustainable pest management and agricultural innovation.



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sciforum-113430: Bioefficacy and biochemical responses to *Acorus calamus* essential oil-loaded nanoemulsions in *Sitophilus oryzae*

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Post-harvest stored grain losses caused by insect pests are a growing concern, emphasizing the need for eco-friendly alternatives like plant-derived essential oils (EOs). However, due to their low solubility and persistence, EOs are formulated into nanoemulsions (NEs), which enhance their stability and effectiveness. Therefore, NEs based on 6% (v/v) *Acorus calamus* rhizome essential oil (ACEO) were evaluated for their contact insecticidal, fumigant, and repellent activity, alongside their impact on antioxidant systems and acetylcholinesterase activity against *S. oryzae*. GC/MS analysis revealed that the chemical profile of ACEO was predominantly composed of α -asarone (80.46%). ACEO was encapsulated into four NEs at varying EO:Tween80 ratios: ACNE1 (1:1), ACNE2 (1:3), ACNE3 (1:4), and ACNE4 (1:6). The particle sizes decreased with increasing Tween80 concentration, ranging from 329.62 nm (ACNE1) to 270.20 nm (ACNE2), 162.5 nm (ACNE3), and 30.49 nm (ACNE4). The Polydispersity Index (PDI) values were observed as 0.231, 0.124, 0.515, and 0.339 for ACNE1, ACNE2, ACNE3, and ACNE4. The zeta potential, which is the electrical potential difference between a particle's surface and the surrounding liquid that reflects the stability of colloidal dispersions, resulted in -12.60 mV, -11.58 mV, -7.07 mV, and -1.18 mV for ACNE1, ACNE2, ACNE3, and ACNE4, respectively. The ACNE4 demonstrated significantly enhanced insecticidal properties, including a six-fold increase in contact and fumigant toxicity as well as a five-fold repellency compared to ACEO after 24 hours. ACNEs also altered enzyme activities in *S. oryzae*, increasing oxidized glutathione levels while reducing glutathione, catalase, peroxidase, and acetylcholinesterase activities. The current study provides a first-time account of introducing ACNEs leading to the efficient, cost-effective use of ACEO in stored-grain insect pest management.



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sciforum-117825: Characterization and evaluation of formulations based on shrimp co-products for the protection of stored semolina.

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This work focused on the evaluation of insecticidal activity by the fumigation of essential oils of *Laurus nobilis* and *Thymus vulgaris* and the formulations encapsulated in a powder matrix obtained from shrimp and chitosan against adult *Rhyzopertha dominica*. Chromatographic analyses identified 21 and 16 compounds, respectively, for *T. vulgaris* and *L. nobilis* essential oils, including 1,8-cineole (43.23 %), α -Terpinene (17.47 %) and β -Linalool (14.86 %) for *L. nobilis*, and Carvacrol (75.01 %) and o-cymene (7.93 %) for *T. vulgaris*. The fumigant toxicity of crude essential oils depended on the concentration and storage period. Indeed, after 10 days of storage, LC₅₀ values were 73.19 and 81.92 μ L/ L air, respectively, for *L. nobilis* and *T. vulgaris* compared to 59.85 and 64.66 μ L/ L, respectively, after 20 days storage. The characterization of shrimp co-products revealed that the powder contains essential protein (21.24 %) and fats (17.05 %). In addition, these co-products exhibited 10.03 % of moisture content and 26.67 % of ash content. The insecticidal activity of *L. nobilis* and *T. vulgaris* essential oil formulations encapsulated in shrimp powder increased during the storage period. The toxicity of the formulations increased significantly with increasing concentration and storage period. Indeed, after 10 days of storage, LC₅₀ values varied from 12.03 to 29.88 g/ L air, respectively, for *L. nobilis* and *T. vulgaris* compared to 3.65 and 7.78 g/ L air after 30 days of storage. In addition, the formulations decreased the number of emerged larvae. The results of the present study highlighted the promising potential of the formulations prepared from the powder of shrimp co-products for the control of insect pests of stored food.



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sciforum-113435: Chemical characterization and biopotency of black pepper (*Piper nigrum*) corn essential oil-loaded nanoemulsions: Effects on enzymatic activities in *Tribolium castaneum*

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Declines in post-harvest loss during storage due to insect pests require the development of eco-friendly bio-insecticide formulations such as plant-derived essential oils (EOs). Despite their advantages, the transient nature and high volatility of EOs are addressed through nanoemulsion (NE) formulations, enabling sustained release, enhanced stability, and prolonged bioefficacy. Considering the above, the contact insecticidal and repellent activity of 6% (v/v) of *Piper nigrum* corn EO (PNEO)-based NEs (PNNEs) were evaluated on *Tribolium castaneum*. The NEs were prepared using the high-shear emulsification method, with a single surfactant of Tween80 at three EO:Tween80 combinations, PNNE1 (1:5), PNNE2 (1:8), and PNNE3 (1:10). The chemical profile of PNEO was analyzed via GC-MS. The effect of cutaneous exposure of the treatments on antioxidant systems and acetylcholinesterase (AChE) in *T. castaneum* was further assessed. The chemical constitution of PNEO was dominated by (+/-)-alpha-thujene. With increasing Tween80 levels, PNNE particle sizes decreased from 11.66 nm through 10.5 nm to 9.581 nm. Correspondingly, the PDI values were 0.210, 0.153, and 0.130, resulting in zeta potential values of -10.65mV, -17.87 mV, and -11.27 mV for PNNE1, PNNE2, and PNNE3, respectively. In comparison to PNEO treatments, the insecticidal activity of PNNE increased by ~2-fold, ~3-fold, and ~7-fold for PNNE1, PNNE2, and PNNE3, respectively, after 12 h of post-treatment, while all PNNEs showed ~2 times more repellency than PNEO. The results revealed that PNNEs significantly depleted the levels of glutathione (GSH), catalase (CAT), and peroxidase (POD), along with an augmenting effect on oxidized glutathione (GSSG) levels and Acetylcholinesterase (AChE) inhibition rates after cutaneous application compared to that of PNEO. Consequently, the encapsulation of PNEO in NEs improved the stability and bio-effectiveness of PNEO, thereby making it a potentially applicable bio-insecticide against *T. castaneum*.



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sciforum-113309: Comparative damage assessment and performance of larvae of *Spodoptera frugiperda* J.E. Smith (Lepidoptera: Noctuidae) on different maize varieties

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Fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), is a highly damaging pest of agricultural crops, particularly of maize. As screening of the available crop germplasm is an integral part of integrated pest management programs, the main objective of this research was the screening of available maize varieties, including both hybrid and non-hybrid varieties, against *S. frugiperda* larval infestation. The seeds of available maize varieties were sown in the field under RCBD, and one-month old plants were artificially infested with laboratory-reared 3rd instar larvae of *S. frugiperda*. Data regarding larval infestation and plant damage were assessed using a literature-based damage scale. Moreover, the comparative feeding preference and performance of *S. frugiperda* larvae were determined in the laboratory under controlled conditions. The overall highest and lowest larval weight gain was observed for Dekalb-6321 (27.12 mg) and YH-5427 (15.55 mg), respectively. Maximum and minimum leaf consumption was recorded for Dekalb-6321 (378 mg) and Gohar-19 (297 mg), respectively. The maximum and minimum relative consumption rate was recorded for the varieties YH-5427 (66.79 mg/mg/day) and Mercury (16.27 mg/mg/day), respectively. Regarding relative growth rate (RGR), the larvae of *S. frugiperda* showed maximum growth when offered leaves of maize varieties Super Green (0.71 mg/mg/day) and Dekalb-6321 (0.48 mg/mg/day). Similarly, maximum ingested food conversion efficiency (ECI) was observed in Super Green (7.47%), followed by Pioneer-1429 (7.43%) and G-7 (7.33%). According to William's leaf damage scale, the highest levels of in situ leaf damage by lab-reared larvae were recorded on the Mercury (7.33) and Afgoi (6.48) varieties, while the minimum levels of damage were observed on Pioneer (5.20) and YH-5427 (5.41). The findings of this laboratory and field experiment showed the differential feeding preferences of *S. frugiperda* for the evaluated maize varieties.



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sciforum-118373: Deep-learning-based identification of *Halyomorpha halys* using phenotypic image analysis

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The identification of plant pests is crucial for effective phytosanitary monitoring and agricultural decision-making. The traditional identification methods often require expert knowledge and manual examinations, making them time-consuming and prone to inconsistencies. This study proposes a deep-learning-based approach to automating the identification of *Halyomorpha halys*.

Methods: The dataset comprised 10,000 labeled images of adult *H. halys* specimens. A Convolutional Neural Network (CNN) was implemented using TensorFlow and Keras. The data preprocessing included image augmentation, resizing, and normalization to improve the model generalization. The CNN architecture incorporated Global Average Pooling, dropout layers, and dense layers for robust identification. The model was trained on a stratified dataset using categorical cross-entropy loss and the Adam optimizer. The training progress was monitored through loss convergence and accuracy metrics.

Results: The trained model achieved a identification accuracy of 85-95% on the test set, with precision, recall, and F1-score values of 0.85-0.95, 0.80-0.93, and 0.82-0.94, respectively. The confusion matrix analysis revealed that the pest was correctly identified 85-95% of the time. The area under the receiver operating characteristic (ROC-AUC) curve was 0.90-0.98, indicating a high level of discriminatory capability. The validation loss and accuracy trends indicated minimal overfitting, suggesting a well-generalized model. Additionally, an error analysis was performed to point out misidentified instances, revealing potential areas for improvement through additional data augmentation or hyperparameter tuning.

Conclusion: This study validates the feasibility of CNN-based identification for adult plant pests using a phenotypic image analysis. The proposed method enhances the automated monitoring capabilities, reducing the need for manual inspections. Future work will focus on expanding the dataset and refining the model to improve the identification accuracy in real-world applications.



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sciforum-113228: Differential responses of three stink bugs species to soybean defenses: Insights into the impact on digestive enzymes

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The stink bugs *Diceraeus furcatus*, *Piezodorus guildinii*, and *Nezara viridula* (Hemiptera: Pentatomidae) are major pests of soybean (*Glycine max*; Fabales: Fabaceae) that feed on developing seeds. In response to herbivory, soybean plants synthesize protease inhibitors (PI) as a key defense mechanism. These inhibitors interact with digestive cysteine proteases in stink bug guts —such as cathepsins— thereby reducing nutrient assimilation. Because herbivory induces cysteine PI in soybean seeds, studying this regulation is important to decrease stink bug damage. Although some information is available on the effects of cysteine PI on *N. viridula*, little is known about how different stink bug species induce these defenses in field-grown soybean. In this study, we measured cysteine PI activity in soybean seeds following herbivory by *D. furcatus*, *P. guildinii*, and *N. viridula*. We compared cysteine PI activity between damaged and undamaged seeds at 24 and 72 hours post-feeding. We also analyzed cathepsin B and L activities in stink bug guts after feeding on growing seeds, with boiled seeds as controls, and recorded pod piercings to determine feeding behavior. Our results showed that cysteine PI activity increased significantly after herbivory but remained low in undamaged controls. Despite this increased defense, all stink bugs exhibited similar pod-piercing frequencies, approximately 25 piercings per pod. We observed that cathepsin B activity was inhibited in *P. guildinii* and *N. viridula* but not in *D. furcatus*, whereas cathepsin L activity was inhibited in *D. furcatus* and *P. guildinii* but not in *N. viridula*. Our findings reveal species-specific interactions between soybean defenses and stink bug digestive enzymes. Field-grown soybean plants recognize herbivory and induce cysteine PI as a defense strategy, but the efficacy of these inhibitors depends on the pest species. This insight could guide the development of targeted pest management strategies adjusted to specific stink bug species.



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sciforum-109516: Early Detection and Monitoring of Pesticide Resistance in Cole Crop Pests

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The emergence of pesticide resistance in major cole crop pests poses a significant threat to global Brassica production, with annual losses exceeding USD 4.5 billion worldwide. This study investigated resistance patterns in three primary pest species—*Plutella xylostella* (diamondback moth), *Brevicoryne brassicae* (cabbage aphid), and *Trichoplusia ni* (cabbage looper)—across 87 commercial farms in major cole crop-producing regions during 2020-2023. Bioassays were conducted using five commonly applied pesticide classes: pyrethroids, organophosphates, carbamates, diamides, and *Bacillus thuringiensis* (Bt) formulations. The results revealed significant resistance development, with *P. xylostella* showing 15-fold to 87-fold resistance to pyrethroids and 8-fold to 23-fold resistance to diamides. *B. brassicae* populations exhibited moderate resistance levels (5-fold to 12-fold) to organophosphates, while *T. ni* demonstrated emerging resistance to Bt products (3-fold to 7-fold). Molecular analysis identified key resistance mechanisms, including target-site mutations in the sodium channel gene (*kdr*) and enhanced metabolic detoxification through elevated P450 and esterase activity. The implementation of a novel resistance monitoring protocol, integrating biochemical markers and field-based bioassays, enabled the early detection of resistance development with 89% accuracy. Economic analysis indicated that early resistance detection reduced pest management costs by 32% through timely intervention strategies. This research establishes a comprehensive framework for proactive resistance management in cole crops, emphasizing the importance of regular monitoring and resistance mechanism characterization for sustainable pest control.



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sciforum-113521: Effects of *Tropaeolum majus* compounds on the control of leaf-cutting ants and their symbiotic fungus

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Leaf-cutting ants represent a significant threat to forests and agriculture. In this context, the use of plant-derived substances has garnered growing interest as an alternative to synthetic insecticides. This study aimed to evaluate the effects of different concentrations of diphenyl disulfide and lyral, compounds present in the essential oil of *Tropaeolum majus* (Brassicales: Tropaeolaceae), on the leaf-cutting ant *Atta sexdens* and its symbiotic fungus *Leucoagaricus gongylophorus*. First, we assessed the effects of these compounds on fungal growth. Subsequently, we evaluated the impact of topical application and exposure to the compounds through an artificial diet on the survival of gardener and forager worker ants. We also analyzed worker ant interactions using a software tool for behavioral assessments, to evaluate the spread of the compounds via topical application. No significant changes were observed in the mass or growth area of fungi exposed to diphenyl disulfide or lyral. Through topical application, diphenyl disulfide demonstrated a toxic effect that increased with higher concentrations of the compound, while lyral showed no toxic effect on any ant caste. No significant effects on ant mortality were observed when the compounds were administered via artificial diet, nor was there inhibition of ant feeding, indicating that the compounds did not directly influence food consumption. Diphenyl disulfide increased interactions between treated and untreated ants compared to lyral and the control. However, this increase in interactions did not compromise colony activities. Thus, the results suggest that diphenyl disulfide is a compound with characteristics worth exploring to assess its potential for managing *Atta sexdens*.



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sciforum-117498: Effects of diet on the fecundity of continuously mated females of the Melon Fruit Fly *Zeugodacus cucurbitae* (Diptera: Tephritidae).

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The melon fruit fly, *Zeugodacus cucurbitae*, is a major fruit pest in Bangladesh. The Sterile Insect Technique (SIT) has proved effective in controlling the melon fly. One of the main challenges of SIT is that it is expensive to rear a large number of flies in the laboratory. Minimizing rearing cost without compromising reproduction capabilities is important. If the fly colony is maintained with a good dietary supplement, competitive adults could bring about an effective suppression in the field population. In the present study, we tried to identify the optimal diet by altering yeast sugar ratios in an artificial diet to maximize egg production in *Z. cucurbitae*. The melon fly stock was housed in steel-frame cages covered with a nylon net, maintained at a temperature of $25\pm5^{\circ}\text{C}$, a humidity of 65-70%, and 12:12 L: D at the fruit fly laboratory of the Institute of Food and Radiation Biology (IFRB), Atomic Energy Research Establishment (AERE), Savar, Dhaka. The flies were provided with ad libitum food and water. We recorded the fecundity (no of eggs) of continuously mated females. Four feeds with varying yeast-to-sugar ratios were provided: F1 (0: 100, Y: S) (refers to sugar only), F2 (1.96: 98.04, Y: S), F3 (4.76: 95.24, Y: S), and F4 (25: 75, Y: S). The results revealed that diet significantly affected female fecundity. The mean fecundity of continuously mated females maintained on the four diet types, i.e., F1, F2, F3, and F4, was 125, 311, 380, and 492, respectively. Our study showed an increase in mean fecundity, as well as the highest fecundity, with an increase in the yeast-to-sugar ratio; fecundity was highest for the ratio of 25% and lowest for 0%. These results could be valuable for the population dynamics studies and mass rearing of *Z. cucurbitae*.



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sciforum-118459: Efficacy of Contact Insecticides on Stored-Product Insects on Wood, Metal, and Concrete Surfaces at Different Temperatures

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Stored-product insects such as *Tribolium castaneum* (red flour beetle), *Sitophilus oryzae* (rice weevil), and *Rhyzopertha dominica* (lesser grain borer) threaten food security by infesting stored grains and processed commodities. This study evaluates the initial and residual efficacy of two contact insecticides, Tempo® SC Ultra (β -cyfluthrin) and Gravista™ (deltamethrin, methoprene, and piperonyl butoxide), applied to wood, metal, and concrete surfaces under controlled temperatures (16, 22, 27, 32, and 37°C) at 65% RH. A total of 675 bioassay arenas (225 per surface type) were prepared using 6 mm plywood, 20-gauge steel, and concrete sections secured in 100 × 20 mm plastic Petri dishes. Each arena was treated with an insecticide using an artist spray brush at label rates. Ten adults of each species were introduced per arena along with a 500 mg diet. Mortality was assessed at 1, 3, and 7 days post-exposure, with residual bioassays conducted every 4 weeks up to 24 weeks post-application. The bioassay conditions were monitored and recorded by using HOBO data loggers. The preliminary results suggest that insecticide efficacy varied significantly across surface types and temperature conditions, generally showing greater lethality as the temperature increased. These findings emphasize the importance of considering various environmental conditions to maximize the efficacy of insecticides in protecting stored grains from insect pest damage and ensuring long-term food security worldwide.



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sciforum-117175: Evaluating the effects of fungicides on the biocontrol potential of *Neoseiulus longispinosus* (Acari: Phytoseiidae) against *Tetranychus urticae* (Acari: Tetranychidae)

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Tomato (*Solanum lycopersicum* L.) is a vital horticultural crop with economic and nutritional benefits. However, it is vulnerable to pests like the two-spotted spider mite (*Tetranychus urticae* Koch), which causes significant yield loss and resists many acaricides. Biological control using the phytoseiid mite *Neoseiulus longispinosus* (Evans) is an eco-friendly alternative. However, the fungicides and pesticides used in tomato cultivation may impact its effectiveness.

The present study was conducted to assess the toxicity of four fungicides viz., copper oxychloride 50% WP (3000 ppm), thiophanate methyl 70% WP (1000 ppm), mancozeb 75% WP (2500 ppm), and metalaxyl 4% + mancozeb 64% WP (2500 ppm) to *N. longispinosus* and its progeny's fitness against *T. urticae*. Ten gravid females of *N. longispinosus* were released onto tomato leaf discs (3cm × 3cm) treated with fungicides in eight replicates by the leaf dip method under laboratory conditions. After 48 hours, cumulative mortality data of *N. longispinosus* females showed that the fungicide combination metalaxyl + mancozeb caused the highest mortality (60%), followed by mancozeb (52.50%), copper oxychloride (35%), and thiophanate methyl (17.50%). From each treatment and control, 10 surviving predator females were selected and a cohort of 100 predator eggs was collected to further investigate the life table parameters of *N. longispinosus* on *T. urticae*. Metalaxyl + mancozeb and mancozeb treatments significantly impacted the life table parameters of *N. longispinosus* compared to the control, while the effects of copper oxychloride and thiophanate methyl were moderate to negligible.

Thus, *N. longispinosus* exhibited the ability to withstand the effects of copper oxychloride and thiophanate methyl, while metalaxyl + mancozeb and mancozeb affected its fitness. However, controlled laboratory experiments may not fully account for the influence of biotic and abiotic factors that affect invertebrate fitness under field conditions. Therefore, further field investigations will ascertain the response of the predatory mite to fungicide exposure.



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sciforum-115327: Evaluating the Haemolymph and Haemocyte Response of the American Cockroach (*Periplaneta americana*) to the Azadirachtin-Based Compound Neemazal: Dose-Dependent Effects and Temporal Variations

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Neemazal, a biopesticide containing 47.25% azadirachtin, was assessed for its impact on the haemolymph and haemocyte profile of *Periplaneta americana*. This study examined variations in the Total Haemocyte Count (THC), Differential Haemocyte Count (DHC), and blood volume in both male and female cockroaches after exposure to different doses of Neemazal (3, 5, 7, and 12 μ L) at specific post-treatment-periods (PTPs) of 10, 30, 60, and 120 minutes.

The THCs recorded for female cockroaches at the 10-minute PTP were 6172.8 ± 0.75 , 6163.0 ± 1.54 , 6162.2 ± 1.66 , 6160.8 ± 1.66 , and $6158.8 \pm 1.31/\text{mm}^3$ for doses of 3, 5, 7, 10, and 12 μ L, respectively. In males, the corresponding THC values were 6192.4 ± 2.05 , 6189.2 ± 1.66 , 6184.2 ± 1.24 , 6181.5 ± 1.28 , and $6176.8 \pm 1.24/\text{mm}^3$. Similar trends were observed across the other PTPs. Neemazal exposure led to a dose-dependent decrease in the THC in both sexes compared to that in the control group.

For the treatment with 3 μ L and the 10-minute PTP, the DHCs found in female cockroaches were 19, 59.2, 40.2, 27.6, and 30.8%; in male cockroaches, these were 18, 52, 40.4, 28, and 20.8%. Prohaemocytes, plasmatocytes, granulocytes, oenocytes, and coagulocytes were observed, which indicated a decrease in haemocytes as compared to the controls. The DHC analysis revealed an initial decline within 10 minutes post-treatment, followed by a partial recovery, though these values remained consistently lower than those for the controls in all PTPs.

The blood volume changes observed for the 3 μ L dose were 35.36 ± 0.0014 , 29.48 ± 0.0013 , 25.34 ± 0.0023 , and 30.71 ± 0.0014 at 10, 30, 60, and 120 minutes, respectively. Similar trends were noted across the different doses and PTPs. Overall, blood volume exhibited a progressive, dose-dependent decrease across all of the PTPs.

The statistical analysis revealed significant changes in all of the parameters measured in the treated groups compared to those in the controls, with p-values of $p < 0.005$, $p < 0.01$, and $p < 0.02$. These findings suggest that Neemazal disrupts the haemocyte dynamics and haemolymph homeostasis in *P. americana*, indicating that its potential mode of action involves impairing its immune and circulatory functions.



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sciforum-118846: Evaluation of encapsulation systems in the efficacy of essential oils of aromatic plants against *Tetranychus urticae*

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The essential oils (EOs) of aromatic plants have shown promise in the control of crop pests whereas their encapsulation in biodegradable and biocompatible nanosystem carriers may increase their bioactivity. In this work, the EOs of three aromatic plants, *Mentha pulegium* L., *Ocimum basilicum* L. and *Origanum majorana* L. encapsulated in yeast cells and β -cyclodextrin (β -CD) were evaluated for their potential in the control of *Tetranychus urticae* Koch (Acari: Tetranychidae). The chemical profile of each EO was determined using the GC-MS technique. Contact toxicity and repellency bioassays were conducted. In the former case, nymphal mortality was recorded daily for 7 days post treatment and in the latter case, the number of adults on each side of a bean leaf disc which had been previously half-dipped in each emulsion or encapsulated oil recorded 1h, 2h, 4h and 24h after treatment. Finally, their side effects were explored in the case of the predatory mite *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae). The main components of *M. pulegium*, *O. majorana* and *O. basilicum* EO was pulegone (66.5%), terpinen-4-ol (40.6%) and linalool (49.8%), respectively. The results showed that *M. pulegium* EO caused a 58% mortality rate on nymphs while the encapsulated oil in β -CD and yeast cells showed remarkably increased mortality rates (88% and 90%, respectively). *O. basilicum* EO caused 37% mortality. However, its encapsulation in β -CD or yeast cells almost doubled its efficacy (76% and 70%, respectively). An increase was also recorded for *O. majorana* EO (84% vs. 90% and 88%, respectively). Encapsulated EOs in most cases showed an extended period of bioactivity. *M. pulegium* and *O. basilicum* caused high repellency activity. Finally, no mortality was recorded in the case of *P. persimilis*. In conclusion, the EO of *O. majorana* was highly effective against *T. urticae* nymphs whereas the encapsulation of *M. pulegium* or *O. basilicum* EOs highly increased their repellency.



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sciforum-113363: Evaluation of nano- and hydrogel formulations of some selected synthetic insecticides against fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae)

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The fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) has been a challenging pest of maize crops around the world. Novel, effective, eco-friendly and target-oriented approaches are needed to mitigate the damage of *S. frugiperda*. Farmers rely predominantly on extensive and repetitive use of synthetic insecticides, but they have unsatisfactory control because of the cryptic feeding style of the pest's larvae and rapid decomposition of the applied insecticides. This study aimed to screen out available synthetic insecticides being used against different lepidopterous pests including *S. frugiperda* under field conditions, and then the two most effective insecticides were further formulated with silver nanoparticles and with sodium alginate hydrogel beads and bioassayed against the third larval instar of *S. frugiperda* under laboratory conditions using the standard leaf-dip method. Treatments included the following: T₁ = emamectin benzoate and chlorantraniliprole formulation at the recommended dose (90 mL/acre); T₂ = nanoformulated emamectin benzoate and chlorantraniliprole formulation; T₃ = nanoformulated emamectin benzoate and chlorantraniliprole at the recommended dose (90 mL/acre); T₄ = emamectin benzoate and lufenuron formulation at the recommended dose (400 mL/acre); T₅ = nanoformulated emamectin benzoate and lufenuron formulation; T₆ = nanoformulated emamectin benzoate and lufenuron formulation at the recommended dose (400 mL/acre); T₇ = nanoparticles alone (control); and T₈ = water (control). According to the results, the nanoformulated recommended dose of the emamectin benzoate and lufenuron formulation manifested the highest mortality (100%) at 24 h, followed by the nanoformulated recommended dose of the emamectin benzoate and chlorantraniliprole formulation (100%) at 48 h post-treatment. In other bioassays, alginate beads loaded with the recommended dose of emamectin benzoate and lufenuron formulations caused up to 50% more larval mortality compared to beads loaded with emamectin benzoate and chlorantraniliprole formulations, which resulted in 40% higher larval mortality than the control treatments. Overall, the findings of this laboratory study suggest further evaluation of such formulated application of synthetic insecticides combating *S. frugiperda* under semi-field and field conditions.



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sciforum-113424: Garlic EO-based nano-emulsion in pest management: formulation and biological activity on target and non-target organisms

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Among botanicals used as insecticides, essential oils (EOs) attract the interest of different stakeholders despite some of their intrinsic properties limiting their use in real field conditions. In this scenario, the use of nanotechnologies seems a promising tool to overcome these drawbacks.

Our research aimed to develop garlic EO-based nano-emulsion with a high EO–surfactant ratio (3: 1) and conduct an insecticidal evaluation against different citrus pests. The biological effects on different non-target organisms (pollinators and predators) were also investigated.

Garlic EO was chemically analysed (GC-MS) and formulated as a nano-emulsion through the use of a high-pressure microfluidizer apparatus (HPM). The resulting formulation (15% EO; 5% Tween® 80; 80% water) was physically characterized (i.e. size, PDI and surface charge) using dynamic light scattering (DLS) analysis. Garlic EO was composed of sulphur compounds (96.3%), and diallyl disulphide was the most abundant one (37.26%). The optimal physical properties of the developed formulation (size 250nm; PDI 0.2, and negative surface charge) were maintained for up to 1 year.

The efficacy against target pests showed high insecticidal activity, with an estimated LD₉₀ always less than 2.5 % of EO against all the tested insects. On the other hand, the garlic nano-emulsion was completely safe against non-target insects and showed no phytotoxic effects on citrus plants. Plants treated with the formulated nano-emulsion overexpressed different genes involved in plant defence, suggesting a dual benefit effect (insecticidal activity and enhancement of plant defence) of this formulation.

Overall, the high insecticidal activity, the absence of adverse effects on non-target organisms, and the beneficial effects on plants suggest the potential use of this formulation in organic and/or integrated pest management programmes.



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sciforum-113503: Horizontal transmission and persistence of *Metarhizium anisopliae* in *Dacus frontalis* (Becker) and the effect of the fungus infection on fly reproduction

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The Greater melon fly, *Dacus frontalis*, is an economically damaging pest of cucurbit fruits in Libya. The ability of *Dacus frontalis* flies emerging from soil inoculated with MET52 Granular biopesticide, based on a pathogenic fungus, *Metarhizium anisopliae*, var *anisopliae*, to induce new infection in untreated flies was investigated. Contaminated adults were able to transmit the fungus conidia to untreated individuals of the opposite sex, resulting in above 30% mortality among females and 15% among males. The impact of MET52 on adult reproductive success in different mating combinations was assessed. The progeny pupation rates were affected by the treatments. The lowest pupal number was produced when inoculated males were paired with untreated females, resulting in a nearly 89% reduction. The persistence of MET52 was assessed in terms of infectivity against larval–pupal stages (measured by calculating adult emergence rate) and adult *D. frontalis* under laboratory conditions. The fungus reduced the emergence rate and caused mortality in newly emerging adults for more than two months after a single application.

Overall, the MET52 fungus was able to persist in soil, reducing the adult emergence rate and subsequent fly population for more than two months after a single application. In addition, it induced new infections among the fly population and reduced adult reproduction.



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sciforum-118360: Implementation of multifunctional areas as tool to improve natural enemy populations in stone fruit fields in Spain

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The mid-20th century saw significant shifts in land use, transforming diverse agricultural landscapes into uniform expanses. This consolidation drastically reduced or eliminated crucial ecological niches like field borders, disrupting habitats for various species. The consequences were far-reaching, altering the composition of local natural communities of birds, insects, and mammals.

Beneficial insects, such as pollinators and natural enemies, have been severely affected and have suffered the greatest decline, reaching up to 50%. Reviews demonstrate that six key factors explain the reduction in insect abundance and diversity: habitat loss, fragmentation, and degradation; invasive species; parasites and diseases; unsustainable use of pesticides; extinction cascades; and climate change.

Following the LIVINGRO® protocol, which promotes regenerative agriculture practices with the aim of protecting biodiversity and improving soil health while ensuring crop yields, insect biodiversity studies were conducted in productive (non-experimental) stone fruit orchards in Spain over the years 2020–2024.

In each field, we investigated which groups of insects are attracted and what the impact of multifunctional areas is on insect biodiversity. Additionally, populations of pests and beneficial insects, especially predators and parasitoids, have been compared. Malaise traps and sweep nets were used as sampling methods.

The studies revealed higher concentrations of insects, especially beneficial species, in areas featuring diverse vegetation corridors. This early evidence suggests that modern agricultural practices can coexist with biodiversity conservation efforts, paving the way for food systems that are equitable, health-promoting, and environmentally sustainable.



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sciforum-118422: Improving Beneficial Insect Behavior by Reducing Cannibalism in Green Lacewing Larvae using Operant Conditioning at Multiple Life Stages in Various Social Settings

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Every year, 40% of all crops are lost due to plant pests and diseases, with pest insects costing the global economy approximately USD 70B. Pesticides have undesirable environmental effects and are becoming less effective against target pests. The use of green lacewings (from the family Chrysopidae) as biological pest control has risen recently, but the cannibalism displayed in lacewing larvae contributes to their low survivability rates and variability in performance. This can be addressed through behavioral conditioning. Citronella oil disrupts hunting behavior by interfering with lacewings' olfactory receptors and can be utilized to condition lacewings without harming them. Y-Maze bioassays indicated that when all four experimental groups (first instar solitary, first instar grouped, second instar solitary, and second instar grouped) were combined, behavioral conditioning was successful at reducing their cannibalistic tendencies towards lacewing eggs by 82% ($p < 0.001$). On average, the lacewings trained in solitary environments reduced their cannibalistic behavior by 87% ($p < 0.01$), while those trained in environments with other lacewings reduced their cannibalistic behavior by 77%, with the p -value indicating near-significance ($p = 0.0513$). The lacewings conditioned at the second instar effectively reduced their cannibalistic behavior by 99% ($p < 0.01$), but those conditioned at the first instar did not, with an average reduction of 65% and a p -value indicating near-significance ($p = 0.0542$). These results indicate that lacewing larvae are capable of learning through citronella-based behavioral conditioning and their cannibalistic behavior can be more effectively reduced when they are trained at the second instar in solitary settings. This study's implications align with efforts to utilize green lacewings as biological pest control in agricultural settings and their role in the global effort to reduce our pesticide dependency and combat pest-induced crop loss.



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sciforum-116999: In vitro evaluation of the acaricidal activity of four essential oils against the parasitic mite *Varroa destructor*

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Introduction

Varroa destructor is currently the most serious parasitic threat to honey bee health. The intensive use of synthetic acaricides has led to the emergence of resistant mite populations, creating an urgent need for alternative control strategies. This study evaluates the acaricidal activity of essential oils (EOs) from *Origanum vulgare* subsp. *viridulum*, *Thymus capitatus*, *Thymus longicaulis*, and *Salvia rosmarinus* against *V. destructor* through in vitro testing.

Methods

Each EO was dissolved in HPLC-grade acetone (2 mg/ml) and applied at a volume of 50 µl inside Eppendorf tubes. The open tubes were placed in an incubator at 35 °C and rotated multiple times to facilitate the EO impregnation of the tube walls while allowing for acetone evaporation. Subsequently, five *Varroa* mites were introduced into each tube, which was then resealed and returned to the incubator. Control groups included a negative control (acetone only) and a positive control (Amitraz diluted in acetone). Mortality was assessed manually after 1 hr in the incubator by probing individual mites with an entomological pin. Mites showing no movement were classified as dead, while those unable to walk but still capable of moving at least one leg were classified as inactive.

Results and conclusions

The control groups confirmed assay reliability, with 100% survival in the negative control and 100% mortality in the Amitraz-treated group. Among the tested EOs, *O. vulgare* subsp. *viridulum* and *T. longicaulis* exhibited the highest acaricidal activity, each killing 94% of mites. *T. capitatus* showed slightly lower but still significant efficacy (92%). In contrast, *S. rosmarinus* demonstrated a more moderate effect, killing 32% of mites. These findings suggest that oregano and thyme essential oils have strong acaricidal properties and could be promising candidates for *Varroa* control in beekeeping.



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sciforum-117569: Insecticidal effect of contact insecticides applied to metal and concrete surfaces on six species of stored-product insects

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Surface treatments are specific insecticides that can be applied as pre-bin treatments and across a wide range of areas such as cracks and crevices, as well as the floors and walls of processing and storage facilities. The efficacy of surface treatments is affected by the type of surface, temperature, sanitation, and chemical formulation. The objective of this study was to evaluate three insecticides on metal and concrete surfaces to control six species of stored-product insects. Metal and concrete surfaces were constructed in the bottom of a 62 cm² plastic Petri dish. EverGreen® (active ingredient (a.i.), pyrethrin), Centynal EC™ (a.i. deltamethrin), and Sensat™ (a.i. spinosad), were applied at their label rates, and water was used as a control. Ten adults of one species, *Tribolium castaneum* (Herbst), *Rhyzopertha dominica* (F.), *Cryptolestes ferrugineus* (Stephens), *Tribolium confusum* Jacquelin du Val, *Sitophilus oryzae* (L.), or *Oryzaephilus surinamensis* (L.), were added to individual treated areas (n=5), along with ~500 mg of feed, and held for seven days. Adult beetles were observed after one, three, and seven days for the number of live, affected (those exhibiting uncoordinated movement or twitching or unable to walk) and dead beetles. Among all species, longer exposure to the treated surfaces resulted in increased mortality. Among all treatments, the percent survival (live + affected adults) was highest on concrete compared to metal for all species. *Tribolium castaneum* and *T. confusum* were the most tolerant species. Contact insecticides are an important component of a comprehensive integrated pest management program for controlling and preventing infestations. Understanding the impacts of surfaces on efficacy will provide pest management professionals with information to help them apply targeted applications within highly diverse post-harvest supply-chain storage and processing environments.



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sciforum-116916: Isolation and evaluation of indigenous entomopathogenic fungi against larvae of fall armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae)

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The fall armyworm (FAW) (J.E. Smith) is a destructive and polyphagous agricultural pest worldwide. Non-target effects of synthetic insecticides being used extensively against FAW necessitate looking for biorational pest control options such as entomopathogenic fungi (EPF). Nevertheless, EPF conidia are sensitive to high temperatures and low humidity. This study evaluated the effectiveness of two indigenous EPF strains (*Beauveria bassiana* Bals. and *Metarhizium anisopliae* Metschn.) against FAW larvae under laboratory, screenhouse, and field conditions. Our laboratory bioassay showed that the highest concentrations (1.0×10^9 conidia mL⁻¹) of both EPF exhibited the highest larval mortality (i.e., 86.66 and 73.33% by *B. bassiana* and *M. anisopliae*, respectively), and these were further formulated with 1.5% (w/v) sodium alginate hydrogel beads (SAHBs) by adsorbing 40 mL of conidial concentration in 1.0 g of SAHBs. The results showed maximum larval mortality by *B. bassiana* SAHBs (93.33%), *B. bassiana* alone (73.33%), and *M. anisopliae* SAHBs (66.66%) at 10 DAT in our laboratory bioassay. Under screenhouse conditions, maximum mortality of FAW larvae was observed by *B. bassiana* SAHBs (86.66%), *B. bassiana* alone (66.66%), and *M. anisopliae* SAHBs (66.66%) at 10 DAT. Furthermore, under field conditions, *B. bassiana* SAHBs exhibited maximum larval mortality (80%) on maize plants artificially infested with 3rd instar lab-reared FAW larvae, followed by *M. anisopliae* SAHBs (60%) at 10 DAT. These findings validate the effectiveness of EPF conidia when formulated with SAHBs as a safe and eco-friendly strategy against FAW and other lepidopterous larvae.



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sciforum-117929: Mining of Bt insecticidal protein receptors from the soybean looper genome with special reference to ABC transporters

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Soybean looper (*Chrysodeixis includens*) is a lepidopteran pest primarily found in North and South America. Soybean looper feeds on soybeans, corn, cotton, cereals, and vegetables. The control of soybean looper largely relies on insecticides and transgenic crops, e.g., Bt (*Bacillus thuringiensis*) transgenic soybean expressing Cry1 insecticidal proteins such as Cry1Ac. Activated Bt Cry1 proteins bind to receptor proteins on the extracellular matrix of lepidopteran midgut epithelial cells, mediating oligomerization and subsequently pore formation by membrane insertion, leading to the death of the targeted pest. There is an emerging body of evidence that, in particular, ABC transporters such as ABCC2 act as Bt Cry protein receptors and mediate pore formation. There have been no reports of field resistance against Cry1Ac in soybean looper yet. This study focuses on the annotation, diversity, and role of ABC transporters and other Bt Cry1 protein receptors (such as cadherins, alkaline, and aminopeptidases) potentially involved in Cry1Ac susceptibility in soybean loopers. Although their roles have not yet been well investigated, soybean looper has two duplicated ABCC2 genes and numerous other ABCC transporters such as ABCC3 that may serve as potential Cry1Ac receptors. Understanding how ABCC transporters influence Cry1Ac susceptibility and resistance is critical for developing strategies to prolong the efficacy of Bt crops and resistance management.



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sciforum-111414: Multi-Disciplinary Approach To Understanding Host Plant Resistance (Hpr) Mechanisms Of Sugarcane Varieties To Yellow Sugarcane Aphid (Ysa) (*Sipha Flava* Forbes) Herbivory: Systematic Review

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The yellow sugarcane aphid (YSA) (*Sipha flava*) has become a threat to sugarcane production worldwide because of its pre-harvest damage, which results in huge economic losses. A systematic literature search was conducted to understand the HPR of sugarcane to YSA using Google Scholar (<https://scholar.google.com>), SCOPUS (<https://www.scopus.com>), Web of Science (<https://www.webofknowledge.com>), and Sciencedirect (<https://sciencedirect.com>), and we selected 992 papers from the year 1884 up to 2023. The hunt for studies commenced with 1884, the year Forbes identified YSA, in order to fully capitalize on the necessity of this investigation. The search parameters included the following terms ("yellow sugarcane aphid" OR "*Sipha flava*") AND ("Host plant resistance mechanism") AND ("sugarcane" OR "*Saccharum officinarum*"). Book chapters, reviews, and meta-analyses were not included in the analyses. Other prerequisites for suitability for inclusion in the review were studies including sugarcane aphid (SCA) and YSA studies involving cereal grasses or sugarcane. Seventy-eight articles were included in this study. This study aimed to assemble research on *S. flava* to address the following four objectives: (i) leaf pubescence (trichomes) that mediates resistance to YSA in sugarcane varieties; (ii) biochemical properties affected by *S. flava* in sugarcane; (iii) physiological responses of sugarcane to *S. flava* herbivory; and (iv) phytochemical profiling of metabolites that confer resistance to *S. flava* in sugarcane. Most of the work was biased towards other aphid species, insect arthropods, and crops other than *S. flava* in sugarcane. Using YSA-resistant sugarcane varieties in combination with other management practices is a promising management strategy for *S. flava* control. The lack of adequate research on sugarcane HPR in response to YSA is a result of complex screening for resistance, and farmers focus on other control methods. Therefore, there is need for policies that support the incorporation of HPR into existing Integrated YSA management strategies.



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sciforum-112843: Over-time changes in the plant transcriptomic profile during the incompatible interaction of *Mi-1*-gene-carrying tomato with the whitefly *Bemisia tabaci*

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Plant resistance is one of the essential tools for the development of Integrated Pest Management (IPM) programmes. In tomato cultivation, the whitefly *Bemisia tabaci* is one of the major pests, causing both direct and indirect damage. So far, the *Mi-1* gene is the only one with the capacity to confer resistance not only to *B. tabaci* but also to other insects and nematodes; thus, it deserves a detailed investigation of its function. In this work, gene expression was studied during the incompatible interaction of *B. tabaci* with plants carrying the *Mi-1* gene, using the oligonucleotide microarray technique (GeneChip® Tomato Genome Array from Affymetrix®). For this purpose, leaflets of resistant plants (cv. Motelle) were sampled and analysed at 2 and 12 days post infestation (dpi) with adult insects, and the transcriptomic profile was compared to that of other uninfested plants of the same age.

At the early phase (2 dpi), 159 transcripts were significantly more expressed in the infested plants than in the uninfested ones; meanwhile, 189 transcripts were repressed. Transcriptional reprogramming was most intense later, at 12 dpi, as 595 transcripts were overexpressed and 437 were repressed. Only 44 upregulated and 68 downregulated transcripts were common at both time points (2 and 12 dpi). The Mapman categories with most differential transcripts were those that include genes with unknown function or that are in the miscellaneous group. However, relevant differential gene expression was also observed in the categories RNA, protein, signalling, cell wall, hormone metabolism and biotic and abiotic stress. These results provide important information about genes related to the resistance conferred by the *Mi-1* gene against the attack of adults and nymphs of *B. tabaci* and whose role deserves further investigation.



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sciforum-113512: Potential for automation of citrus psyllid pest identification using computer vision-based artificial intelligence recognition

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Huanglongbing (HLB), commonly known as Asian citrus greening, is a devastating citrus disease associated with ‘*Candidatus Liberibacter asiaticus*’ (CLAs), a pathogen transmitted by *Diaphorina citri*. This psyllid species is of Asian origin, and since the mid-2010s has been recorded in Kenya, Ethiopia, Nigeria, Tanzania, Benin, and Ghana, while CLAs is present in Ethiopia and Kenya. HLB is also vectored by *Trioza erytreae*, a psyllid species indigenous to sub-Saharan Africa. Monitoring, early detection, and timely identification are needed to manage the vectors, and consequently HLB. Currently, psyllid identification is expensive due to the use of yellow sticky traps and the need for specialists for time-consuming screening of traps and species identification. Therefore, we aimed to develop a laboratory-based, artificial intelligence (A.I.)-driven diagnostic tool for citrus psyllid pests, while accounting for native non-pest *Diaphorina* species, on yellow sticky traps. We deployed 544 traps across multiple citrus growing areas within South Africa, Reunion Island, and Mauritius, between December 2021 and September 2023. The traps were collected and inspected for *D. citri*, native South African *Diaphorina* species, and *T. erytreae*. Traps with any of the target psyllid species were photographed using a digital RGB camera, which were annotated highlighting those species. The annotated images were processed and augmented to develop and train five YOLOv8 models using a 7:2:1 training, validation, and testing ratio. Models YOLOv8s and YOLOv8m show promise for rapidly identifying psyllids to permit faster implementation of control methods. Both models achieved a mean average precision of 0.85, taking 6.7 seconds and 12.7 seconds, respectively, to process a two-sided trap. These models showed potential for the initial screening of yellow sticky traps to identify those needing verification of psyllid presence.



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sciforum-113449: Potential of *Dittrichia viscosa* as a biopesticide for controlling *Bradysia* sp. in nurseries of aromatic plants

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Bradysia sp. (Diptera) or fungus gnat are among the most important pests affecting nursery root cuttings for plant multiplication, due to the direct feeding damage caused by their larvae. Currently, new solutions based on botanical and biological solutions are being studied and tested to address these pests. *Dittrichia viscosa* (Asteraceae), a shrub native to the Mediterranean region, has been identified as a potentially insecticidal botanical for controlling various pests.

In two separate trays, we installed cuttings from 5 aromatic semi-wood species (*Rosmarinus officinalis* with white flower (RoW), *R. officinalis* with purple flowers (RoP), *Santolina rosmarinifolia*, *Thymus vulgaris*, and *Lavandula angustifolia*). A heavily infected plant with *Bradysia* sp. was placed nearby to infest plants. After infestation, every two weeks, an aqueous extract of *D. viscosa* with a concentration of 2% m/m was applied to one tray (treated modality), while the other tray served as the untreated control. A spraying irrigation system was used to enhance application efficiency. Using a Log-Rank test (Kaplan-Meier Survival), we evaluated: i) the susceptibility of the plant species to the pest, and ii) the effectiveness of the plant extract in reducing plant mortality.

Our findings confirmed our expectations, showing that *T. vulgare* was the least susceptible species to *Bradysia* sp., followed by RoP.

The application of *D. viscosa* extract reduced plant mortality by 20% in RoW and 5% in *L. angustifolia*.

Future trials must standardize the species tested as hosts and the concentration of the *D. viscosa* extract to ensure consistent results. Additionally, it will be crucial to analyse the specific compounds within the extract that may be responsible for its observed effects. Despite these considerations, the current findings suggest promising potential for using *D. viscosa* extract in sustainable pest management strategies.



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sciforum-111492: Pre-parasitism host treatment with broflanilide: lethal and sublethal effects on *Trichogramma evanescens*

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Broflanilide has recently emerged as a highly effective tool for managing a diverse array of pest insects, including both chewing and sucking species. However, its compatibility with natural enemies—a crucial component of Integrated Pest Management strategies—remains underexplored. Therefore, there is an urgent need to evaluate its selectivity towards natural enemies, particularly the generalist egg parasitoid *Trichogramma evanescens* Westwood (Hymenoptera: Trichogrammatidae). This study aims to investigate the lethal and sublethal effects of host eggs being treated with broflanilide on *T. evanescens*. To determine the median lethal concentrations, a series of concentrations, 0.0, 0.1, 0.5, 1, 5, 7, and 10 mg.ai.L⁻¹, were employed to cause mortality. The median lethal concentrations were determined as an LC₂₅ = 0.3 mg.ai.L⁻¹ and an LC₅₀ = 1.1 mg.ai.L⁻¹. The F0 parasitism performance and the F1 emergence ratio were unaffected by these concentrations. Subsequently, further experiments assessed whether the parasitoids could distinguish between untreated host eggs and those treated with sublethal broflanilide concentrations (LC₂₅ and LC₅₀). The parasitism preference index showed that the parasitoids could not distinguish between the insecticide-treated and untreated host eggs in two-choice experiments. These findings offer preliminary insights into the toxicity of broflanilide to *T. evanescens* when the host eggs are treated prior to parasitism. Ongoing research aims to refine these results and offer more conclusive and practical recommendations.



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sciforum-117840: Prec-WINE-Farm: Sustainable Viticulture through Precision Agriculture

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Viticulture in Samos Island, Greece, has unique characteristics due to diverse altitudes, slopes, and landscapes, impacting plant protection, yields, and wine quality. These conditions complicate management, particularly for the island's numerous smallholdings, affecting operational costs and potentially compromising wine quality. With 2000 vineyards covering 1,100 ha and producing 5,500 tn of wine annually, improved management practices are important. The Prec-WINE-Farm project aims to develop and implement precision agriculture applications for Samos' viticulture sector. During the project, we created an integrated, real-time Geographic Information System (GIS), which was accessible via internet and mobile devices, supporting viticultural activities. This GIS integrates three mobile applications: (1) a plant protection module for monitoring the European grapevine moth, *Lobesia botrana* (Lepidoptera: Tortricidae), populations, with potential expansion for bacterial and fungal disease monitoring and targeted spraying; (2) a production traceability system with input–output mapping; and (3) an information platform for producers providing real-time data on plant protection, harvesting, and other key activities. Comprehensive user training accompanied the application's deployment, focusing on both the software and good farming practices, with emphasis on pest management. This initiative aims to (1) enhance the safety and health of wine products; (2) optimize farm input costs; (3) provide detailed cultivation documentation through the WebGIS, visualizing farm spatial characteristics and producer practices; and (4) strengthen the unique identity of certified Samos wines. In this study, we present the methodology developed in the context of the Prec-WINE-Farm project, as well as the results of the first year of its implementation, focusing on the sustainable management of the European grapevine moth.



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sciforum-118305: Pyrethroid Resistance in *Anopheles gambiae* s.l. from Oyo State, Nigeria: Mechanisms and Implications for Malaria Control

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Background: Insecticide resistance among malaria vectors threatens control strategies that are reliant on insecticidal interventions. This study assessed pyrethroid resistance in *Anopheles gambiae* s.l. populations across Ibadan North (IBN) and Ido LGAs, Oyo State, Nigeria, to elucidate resistance mechanisms and their implications for vector control.

Methods: Larvae and pupae from both LGAs were collected using the dipping method and reared to adulthood in the University of Ibadan Insectary. Molecular identification of *An. gambiae* complex members was conducted. Three- to five-day-old adult females (n=25/insecticide) were exposed to permethrin, deltamethrin, bendiocarb, and pirimiphos-methyl using WHO susceptibility tests. Synergist assays with Piperonyl Butoxide (PBO) were used to assess the metabolic resistance. *kdr* (L1014F/S) mutations were detected via allele-specific PCR (TaqMan) at the Nigerian Institute of Medical Research (NIMR), Lagos. Data were analyzed using descriptive statistics and ANOVA ($\alpha=0.05$).

Results: *An. coluzzii* predominated in IBN (96.0%) compared with Ido (78.7%), while *An. gambiae* s.s. was higher in Ido (21.3%) than in IBN (3.3%). *An. arabiensis* was only recorded in IBN (0.7%). While bendiocarb and pirimiphos-methyl susceptibility was high (98.0 - 100.0%), pyrethroid resistance was widespread (25.0 - 95.0%). PBO restored deltamethrin susceptibility in IBN and one Ido community, suggesting cytochrome P450-mediated metabolic resistance. However, permethrin resistance persisted post-synergist exposure, indicating voltage-gated sodium channel mutations. Only *kdr-w* (L1014F) was detected, with the allelic frequencies nearing fixation (0.61 in Ido; 01 in IBN).

Conclusion: This study confirms significant pyrethroid resistance in *An. gambiae* s.l., driven by *kdr-w* (L1014F) mutations and metabolic resistance. Our findings highlight the urgent need for molecular surveillance and alternative vector control strategies to sustain malaria prevention efforts.



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sciforum-113833: Resistance Evolution of the Asian Pear Moth (*Grapholita molesta*) to Organophosphate and Pyrethroid Insecticide in Orchards

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The Asian pear moth (*Grapholita molesta*) is one of the most significant pests affecting pear orchards in China, causing extensive damage to fruit production. Over the past few decades, the widespread use of organophosphate and pyrethroid insecticides to control this pest has led to concerns about the evolution of pesticide resistance. This study investigates *G. molesta* populations' development of resistance to these two major classes of insecticides commonly used in Chinese pear orchards. We conducted a series of laboratory bioassays to evaluate the susceptibility of *G. molesta* larvae and adults from multiple orchards in key pear-growing regions of China to a selected organophosphate (chlorpyrifos) and pyrethroid (deltamethrin). The study also examines the underlying mechanisms of resistance, including metabolic detoxification through cytochrome P450 enzymes, esterase activity, and mutations in the target site of the insecticides. Our results show a significant increase in resistance ratios among *G. molesta* populations to both organophosphates and pyrethroids, with some populations exhibiting resistance levels up to 20-fold higher than susceptible strains. Resistance was most pronounced in regions where chemical control has been heavily relied upon for multiple seasons. Enzyme assays revealed elevated levels of P450-mediated detoxification in resistant populations, and molecular analysis identified key mutations in the voltage-gated sodium channels of pyrethroid-resistant individuals. These findings highlight the adaptive potential of *G. molesta* to pesticide pressure and underscore the risks of prolonged chemical use without rotation or integrated pest management (IPM) strategies. This study provides a comprehensive understanding of the mechanisms driving resistance in *G. molesta* and emphasizes the need for sustainable pest management practices in pear orchards. To mitigate further resistance development, we recommend the adoption of IPM approaches that integrate biological control, alternative insecticides with novel modes of action, and resistance monitoring to ensure the long-term viability of chemical control in pear production.



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sciforum-108577: Resistance of Cabbage varieties for management of Diamondback Moth (*Plutella xylostella*) under field conditions

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A field study was conducted to assess the resistance of four cabbage varieties to the Diamondback Moth (DBM, *Plutella xylostella*) under field conditions. The trial took place during the growing season of 2020–2021 at the Agricultural Research Station, University of Basrah, Iraq. The results revealed statistically significant differences in the DBM population density between the cabbage varieties. The red cabbage varieties Hanar and Kirmizi exhibited significantly lower densities of larvae and pupae compared with the white variety Dalal, which showed the highest infestation levels. This study explored the role of morphological traits and phytochemicals—including plant pigments (chlorophyll a, b, total, carotene, and anthocyanin), proteins, carbohydrates, phenols, and glucosinolates—in cabbage's defense against DBM. The red varieties Hanar and Kirmizi were found to have a thick cuticle, epidermal layers, and parenchymal cells compared with the susceptible variety Dalal. The glucosinolate profiles of the studied cabbage varieties revealed several compounds, including progoitrin, gluoraphanin, sinigrin, gluconapin, glucoiberberin, glucoberferoin, glucoalyssin, goitrin, and sulforaphaneolate. The lower infestation levels on Kirmizi correlated with its higher concentrations of anthocyanin, carotene, phenols, and the glucosinolates progoitrin and goitrin. This study highlights the importance of selecting cabbage varieties with specific anatomical traits as a key element in integrated pest management (IPM) strategies to prevent DBM infestation.



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sciforum-118320: Synergistic integration of *Citrus aurantium* essential oil and gamma radiation: A strategy for optimizing radiation in the effective control of *Sitophilus oryzae* and *Tribolium castaneum*

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The management of stored-grain insect pests, *Sitophilus oryzae* and *Tribolium castaneum*, can be enhanced through combined gamma radiation and plant-derived essential oils. This study assesses the potential of Cobalt-60 γ -radiation together with *Citrus aurantium* essential oil (CAEO) as an alternative to synthetic fumigants. Lethality was assessed for single γ -radiation treatments, applied at 20 doses (100–2000 Gy at 3.98 kGy/h), and CAEO fumigation at five concentrations (16.66–100 μ L/L air). Combined effects were evaluated using sublethal CAEO concentrations (*S. oryzae*: LC₅: 8.87 μ L/L air; LC₁₀: 15.40 μ L/L air; *T. castaneum*: LC₅: 6.45 μ L/L air; LC₁₀: 15.68 μ L/L air) with sublethal γ -radiation doses (*S. oryzae*: LD₅: 260 Gy; LD₁₀: 305 Gy; *T. castaneum*: LD₅: 598 Gy; LD₁₀: 710 Gy). After 72 h, mortality rates for *S. oryzae* following single γ -radiation treatments were 14% (100–500 Gy), 82% (600–1000 Gy), and 100% (1100–2000 Gy), while for *T. castaneum*, they were 2% (100–500 Gy), 16.4% (600–1000 Gy), 34.8% (1100–1500 Gy), and 84% (1500–2000 Gy). CAEO alone induced 12–50% mortality. Combined treatments significantly increased mortality (66–86% for *S. oryzae* and 44–58% for *T. castaneum*), demonstrating synergistic effects and notably reducing the required radiation dose by ~4-fold for *S. oryzae* and ~3-fold for *T. castaneum*. For *S. oryzae*, LD_{5(y)} combined with LC_{5(CAEO)} and LC_{10(CAEO)} yielded synergism indices of 0.489 and 0.469, while LD_{10(y)} combinations produced indices of 0.492 and 0.474. For *T. castaneum*, LD_{5(y)} with LC_{5(CAEO)} and LC_{10(CAEO)} resulted in synergism indices of 0.482 and 0.530, and LD_{10(y)} yielded 0.560 and 0.567 in combination. The radiation doses in this study remained well below the IAEA's recommended 1000 Gy threshold for stored-grain pest disinfestation. Combining sublethal radiation doses with CAEO enhanced insect mortality, suggesting that lower radiation doses could be used effectively, potentially reducing concerns about high-dose irradiation and offering a sustainable alternative to synthetic fumigants for managing stored-grain pests.



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sciforum-116523: Testing the efficacy of λ -cyhalothrin plus chlorantraniliprole against four insect pests of stored grains

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Introduction: *Rhyzopertha dominica*, *Sitophilus oryzae*, *Trogoderma granarium*, and *Tribolium castaneum* are serious stored-product pests. The pyrethroids inhibit neurotransmission by affecting the function of sodium channels in the nervous system. The anthranilic diamides disturb calcium homeostasis and cause arthropod mortality by specifically activating arthropod ryanodine receptors. The use of combinations of insecticides with different modes of action is more effective compared to single applications.

Methods: A formulation containing the active ingredients λ -cyhalothrin (pyrethroid) plus chlorantraniliprole (anthranilic diamide) was tested in various doses (0.01–5 ppm) against *S. oryzae*, *T. granarium*, *T. castaneum*, and *R. dominica* on wheat, rice, and maize in laboratory mortality and persistence mortality/progeny production bioassays.

Results: In all bioassays (laboratory and persistence), *S. oryzae* and *R. dominica* proved to be the most susceptible species, followed by *T. castaneum* and *T. granarium*. The same pattern was noted for progeny production in laboratory and persistence bioassays. Among the tested commodities, wheat led to higher mortality rates compared to rice and maize.

Conclusions: The efficiency of λ -cyhalothrin plus chlorantraniliprole was affected by various biotic and abiotic parameters, such as insect species, commodities, exposure intervals, and doses. The need for innovative and efficient techniques to improve protection in storage facilities is growing because of the limited number of approved grain protectants used in stored products. This research has shed light on the possible application of λ -cyhalothrin plus chlorantraniliprole in storage conditions by combining various parameters.



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sciforum-113507: The insecticidal potential of plant extracts on the wild cochineal *Dactylopius opuntiae* (Hemiptera: Dactylopiidae)

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The wild cochineal *Dactylopius opuntiae* (Hemiptera: Dactylopiidae) is a major insect pest of the prickly pear *Opuntia ficus-indica* in Morocco, causing significant damage to the crop and economic losses. Chemical control is the most common method used to manage this pest. However, due to the negative impacts associated with pesticide use, plant-based pesticides represent an alternative control strategy. The present study aims to evaluate the insecticidal potential of aqueous extracts of *Ricinus communis* and *Nicotiana glauca* on *D. opuntiae* under field conditions. Plant extracts at 10% (w/v) concentrations were applied solely or in combination with black soap at 2% (w/v) on the nymphs and adults of *D. opuntiae*. Moreover, the total soluble phenol and flavonoid content in the plant extracts was determined using the spectrophotometric method with Folin–Ciocalteu and aluminum chloride (AlCl₃), respectively. The combination of each plant extract and black soap exhibited high insecticidal activity against *D. opuntiae* nymphs and females with 100% mortality. Regarding the individual applications, plant extracts resulted in mortality rates of $72.27 \pm 12.13\%$ and $95.94 \pm 1.73\%$ for *N. glauca* and *R. communis* extracts, respectively, while black soap showed a mortality rate of $86.42 \pm 6.52\%$. The total phenols show a higher content in *N. glauca* (62.43 ± 0.59 µg GAE/mg DE) compared to *R. communis* (21.49 ± 0.87 µg GAE/mg DE). Meanwhile, no significant difference was recorded for flavonoid content between the two plant extracts, with 7.17 ± 0.03 µg QE/mg DE for *N. glauca* and 7.02 ± 0.42 µg QE/mg DE for *R. communis*. The findings highlight the potential of applying aqueous plant extracts combined with black soap as an eco-friendly approach for managing *D. opuntiae*.

Keywords: *Dactylopius opuntiae*; *Opuntia ficus-indica* L.; plant extracts; black soap; insecticidal activity



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sciforum-113268: The systemic defenses of soybean seeds within pods: the role of protease inhibitors against *Nezara viridula* (Hemiptera: Pentatomidae)

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Soybean is the main oilseed crop in Argentina, accounting for nearly half of the country's production. The stink bug complex, particularly the southern green stink bug (*Nezara viridula*), significantly affects soybean yields. Leveraging the natural resistance of plants can be important to reduce insecticide applications. Among soybean's defenses are protease inhibitors (PIs), which deactivate digestive cysteine proteases in the gut of *N. viridula* and are induced in pods and seeds by herbivory. While many studies have explored local defense responses to insect damage, less is known about systemic mechanisms that enhance resistance in undamaged seeds. This study evaluated the systemic PI activity of seeds from the same pod of field-grown soybean cv. Williams 82 and stink bug responses to PI levels. Aluminum foil covered two of the three seeds in selected pods to identify the targeted seed. A starved adult stink bug was confined to each pod (excluding controls) within a mesh bag to feed on the uncovered seed. After 24 h, this stink bug and the foil were removed, and a second starved stink bug was introduced. The first seed pierced by this stink bug was recorded. Additionally, the gut protease activity in dissected stink bugs and the PI activity of attacked and unattacked seeds (24 and 72 h) were determined. Herbivory increased PI activity in both attacked and unattacked seeds within the same pod. Stink bugs feeding on these seeds exhibited elevated gut protease activity. Furthermore, choice experiments revealed that *N. viridula* preferred to feed on unattacked seeds. These findings suggest that soybean plants respond systemically to herbivory by synthesizing PIs, even in undamaged seeds. This systemic response alters feeding preferences of *N. viridula* by affecting the activity of their gut proteases, highlighting the potential of PIs in pest management strategies.



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sciforum-113510: Toxic Effects of Diatomaceous Earth Treated with Citrus Peels on the Granary Weevil (*Sitophilus granarius* L.) [Coleoptera: Curculionidae]

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The lethal effects of Detech®, lemon peel, and their mixture were tested against the granary weevil (*Sitophilus granarius* L.) on wheat grains. For the single-dose test, 2000 ppm of Detech®, lemon peel, and a 50% (w/w) mixture of lemon peel and Detech® were applied to 10 g of wheat grains. Ten granary weevils were added to each sample under controlled conditions of 27±2°C and 60% relative humidity. The samples were then placed in complete darkness for a period of seven days, allowing the granary weevils to feed and breed without any external influences. At the end of the incubation period, the lemon peel + Detech® mixture demonstrated almost 100% mortality rate, which was comparable to that of the Detech® alone treatment. Additionally, a dose–response study was conducted using the lemon peel + Detech® mixture to determine lethal concentration values (LC₁₀, LC₃₀, LC₅₀, and LC₉₀). The calculated LC₁₀, LC₃₀, LC₅₀, and LC₉₀ were 200 ppm, 600 ppm, 1400 ppm, and 9100 ppm, respectively. These results revealed a very high mortality rate in both single-dose and dose–response tests, highlighting the notable toxicity of the lemon peel + Detech® mixture against *Sitophilus granarius* adults. Consequently, this study supports the development of environmentally sustainable pest control strategies in grain storage systems, providing alternative solutions for sustainable agriculture.



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sciforum-118048: Toxicological and biochemical effects of Malathion on *Ceratitis capitata* adults (Tephritidae) from Tunisian oasis

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In Tunisia, the Mediterranean fruit fly (or medfly), *Ceratitis capitata* (Wiedemann), is one of the most damaging insect pests in horticulture. It is primarily managed with the application of organophosphate insecticides, notably malathion. In this work, we investigate the toxicological and biochemical effects of malathion application on *C. capitata* adults from the Gafsa oasis in south Tunisia. The toxicological study was carried out by a contact test, and the biochemical activities were analyzed via acetylcholinesterase (AChE) activity, as well as by using catalase (CAT), glutathione S-transferase (GST) and malondialdehyde (MDA) levels as oxidative stress biomarkers in whole bodies of adult Mediterranean fruit flies. For toxicological effects, the highest concentrations (50 ppm) generated 66.66% of mortality after 24 h of exposure, whereas the lowest concentration (3.125 ppm) achieved 30% of mortality for the same duration. For biochemical activities, malathion application increased MDA content. In addition, results indicated that malathion caused decreased AChE activity, decreased CAT activity, and increased GST activity compared to controls (non-treated flies). We infer that while malathion resistance in *C. capitata* populations from Gafsa oasis has not yet been described, a marked increase in Glutathione S-transferase levels after exposure of Medfly adults compared to the controls strongly suggests that the oasis' Medfly populations tend to acquire resistance to malathion. Therefore, safer control alternatives should be implemented.



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sciforum-113378: Toxicological and biochemical effects of Malathion on *Ceratitis capitata* adults (Tephritidae) from Tunisian oasis

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In Tunisia, the Mediterranean fruit fly (or medfly), *Ceratitis capitata* (Wiedemann), is one of the most damaging insect pests in horticulture. It is primarily managed with the application of organophosphate insecticides, notably malathion. In this work, we investigate the toxicological and biochemical effects of malathion application on *C. capitata* adults from the Gafsa oasis, south Tunisia. This toxicological study was carried out by contact testing, and the biochemical activities were analyzed via acetylcholinesterase (AChE) activity, as well as catalase (CAT), glutathione S-transferase (GST), and malondialdehyde (MDA) levels as oxidative stress biomarkers in the whole bodies of adult Mediterranean fruit flies. For toxicological effects, the highest concentrations (50 ppm) generated 66.66% mortality after 24 h of exposure, whereas the lowest concentration (3.125 ppm) achieved 30% mortality for the same duration. For biochemical activities, malathion application increased the MDA content. In addition, the results indicated that malathion caused decreased AChE activity, decreased CAT activity, and increased GST activity compared to the control (non-treated flies). We infer that while malathion resistance in *C. capitata* populations from Gafsa oasis has not been described, marked increases in Glutathione S-transferase levels after exposure of Medfly adults, compared to the control, strongly suggest that oasis' Medfly populations tend to acquire resistance to malathion. Therefore, safer control alternatives should be implemented.



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sciforum-118383: Toxicological effects of nicotinic acetylcholine receptor modulators on transgenic *Drosophila* expressing honey bee cytochrome P450s

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The effects of competitive modulators of insect nicotinic acetylcholine receptors (nAChRs), such as those of neonicotinoids on bee pollinators, have been—and still are—a subject of extensive research and debate. Recent studies on honey bee cytochrome P450 monooxygenases (P450s) identified CYP9Q3 as the key determinant driving insecticide selectivity for various chemical classes, including neonicotinoids. In this study, artificial diet overlay bioassays were conducted with transgenic *Drosophila melanogaster* (Diptera: Drosophilidae) strains expressing honey bee P450s, particularly CYP9Q2 and CYP9Q3. Flies were exposed to varying concentrations of eight different commercial nAChR competitive modulators, and mortality was assessed after 48 hours. Our results demonstrate a varying level of mortality depending on the transgene when compared to wildtype flies and underpins the importance of CYP9Q enzymes as molecular determinants of insecticide selectivity. We identified nicotine as the least effective compound when tested against wildtype flies. Nitenpyram was most effective against wildtype flies, while showing significantly lower toxicity to flies ectopically expressing honey bee CYP9Q3. In general, our findings underscore the utility of transgenic *D. melanogaster* as a model to study various aspects of insect toxicology and resistance. Future studies will expand on these results by exploring biochemical and molecular tools to further understand and evaluate the mechanisms of insecticide selectivity and the potential risks to bee pollinator health.



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Session 6. Forest Entomology and Urban Entomology

sciforum-113460: Blastobasis Glandulella: A Poorly Studied Alien Pest Of Quercus, Juglans And Aesculus Fruits

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The acorn moth, *Blastobasis glandulella* (Riley, 1871) (Lepidoptera: Blastobasidae) is native to the USA. It was recorded in Europe at the beginning of the 1980s and in western Ukraine in 2009 as *Blastobasis huemeri*. This insect was often found in acorns already infested by weevils or damaged by rodents and was not considered a serious pest. In 2021, a large population of the acorn moth was recorded in oak plantations in Poland. Considering this information, we asked the foresters and amateurs to send samples of acorns, chestnuts, walnuts, and other hard-shelled fruits from various regions to the Ukrainian Research Institute of Forestry & Forest Melioration to study the host range, prevalence, rate of infestation, phenology of acorn moth, and its associations with other fruit pests. The fruits collected on different dates and places were dissected. Part of the samples were reared in the laboratory to obtain pupae and adults. The presence of *B. glandulella* was confirmed in 14 regions of Ukraine. It infests the fruits of *Quercus* sp., *Aesculus* sp., and *Juglans* sp. The infestation rate depends on the region, fruit crop, weather, and forest structure and exceeds 60 % of fruits in some samples. The development of all stages is very extended: the moths swarm from April to mid-September. The early swarming moths can be the first invaders in developing fruits. After consuming the cotyledons, the larva crawls to another fruit in the crown or on the forest litter, sometimes doing it several times before pupation. In August, the larva of *B. glandulella* may be found in prematurely fallen fruits with other carpophagous insects, their excrements, or molting skins. The larva of the last instar overwinters. In spring depending on the instar, it crawls to another fruit or pupates inside or outside the fruit, or on the forest litter.



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sciforum-112658: First record of the gall-inducing insect *Ophelimus mediterraneus* (Hymenoptera: Eulophidae) in *eucalyptus* plantations in the Americas, and the first record of males of the species.

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Eucalyptus (Myrtaceae) is a genus native to Australia and has become widely distributed due to its rapid growth and commercial applications. However, these trees are highly susceptible to pests, including gall wasps of the genus *Ophelimus* (Hymenoptera: Eulophidae), which can cause significant damage to plantations. In Argentina, two species of this genus have been detected: *Ophelimus maskelli* was first reported in 2013, and an unidentified species, *Ophelimus sp.*, was observed in 2017. This study aimed to identify the species *Ophelimus sp.* present in Argentina using morphological and molecular data. *Eucalyptus* branches with leaves containing mature galls were collected from two locations in the Province of Buenos Aires. The leaves were stored under controlled conditions until the adults emerged. Specimens were preserved in 96% ethanol for molecular analysis or in 70% ethanol for morphological characterization. Molecular analyses included sequencing of two molecular markers: Cytochrome Oxidase subunit I (COI) and the 28S rDNA region (28S). Morphological analysis was performed by critical point drying specimens preserved in ethanol and mounting them in cards and Canadian balsam. The results confirmed the first record of *Ophelimus mediterraneus* in Argentina and the Americas, affecting *Eucalyptus* species such as *E. dunnii*, *E. viminalis*, *E. benthamii*, and *E. cinerea*, and the first record of males of the species. The galls are circular and brown and develop on only one side of the leaf. The sequence of COI and 28S revealed a 99-100% identity with those of European populations of the species. In addition, this study provides the first description of *O. mediterraneus* males, contributing new insights into their morphology and biology.



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sciforum-117976: Comparative Analysis Of Short-Horned Grasshopper Diversity In Agroecosystems And Forests: Implications For Conservation

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Grasshoppers are an integral part of terrestrial ecosystems, playing a crucial role in nutrient cycling and serving as a food source for various predators. This study aimed to compare the diversity of grasshoppers in the Aralam Wildlife Sanctuary and its surrounding agroecosystem. A total of 35 species of short-horned grasshoppers belonging to 14 genera and five subfamilies were recorded from six locations. The species richness and diversity of grasshoppers were highest in the sanctuary and lowest in the agricultural fields. The Shannon–Wiener diversity index (H') and the Simpson index (D) were used to quantify the diversity of grasshoppers in different habitats. The results showed that the grasslands and forests within the sanctuary support a higher diversity of grasshopper species than the agricultural fields. The evenness index (J) suggested that the grasslands have a more uneven distribution. Agroecosystems and forests exhibit distinct management practices, with agroecosystems witnessing intensive anthropogenic activities and forests experiencing minimal human disturbance. This disparity in management regimes has significant implications for the distribution of the grasshopper population. *Chituara indica*, a dominant species, shows wide distribution across agroecosystems and forests, and has been observed to tolerate pesticide usage. The findings of this study highlight the importance of conserving the natural habitats of the Aralam Wildlife Sanctuary and its surrounding agroecosystem to maintain the diversity of short-horned grasshoppers.



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sciforum-113359: Effect of anthropogenic factors and climatic variables on butterfly diversity

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Anthropogenic causes like habitat destruction, pollution, species invasion, and excessive urbanization are major reasons for biodiversity loss. Butterflies are good bioindicators for biodiversity assessments, as habitat destruction can affect butterfly communities. This study was conducted across four types of habitats, rural areas near agricultural fields, suburban areas near grassland, urban parks, and reserve forests, seasonally for a year. A maximum of five, 500 m permanent transect lines were considered in each study area. Butterflies were surveyed following the 'Pollard Walk' method. Photographs of the observed species were taken for further identification. Temperature and humidity were recorded for each study site on each sampling day. Butterfly diversity was estimated using the Shannon and Simpson's indexes. Species richness was calculated using Margalef's index. A comparative analysis of the species richness, habitat preferences, and frequency of individual species at different sites across all seasons was conducted based on the diversity indices. According to the analysis, there was a statistically significant difference in species numbers and individuals between rural areas (species number: 60; individuals: 3656) and reserve forests (species number: 38; individuals: 985), as well as between rural areas and suburban grassland (species number: 50; individuals: 1832). This study indicated that rural areas exhibited high butterfly diversity and richness, likely due to the presence of various nectaring host plants and lower anthropogenic pressure. This study also signified a statistically significant difference in the species number between the post-monsoon (species number: 58; individuals: 3145) and winter (species number: 45; individuals: 1150) seasons. Correlation and regression analyses showed a positive correlation between individual butterfly numbers and humidity, while species evenness and humidity were correlated negatively. No significant relationship was found between temperature and species diversity. These insights can assist in protecting the butterfly population by considering areas with high butterfly diversity as butterfly conservation zones in the future.



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sciforum-118254: Evolution of adaptation and avoidance of natural selection in species of Aphidoidea

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The genome is a complex system of interaction of plesiomorphic and apomorphic genes. Plesiomorphic genes and the traits controlled by them (genus, familia, classis, phylum, regnum) are characterized by high stability over millions of years, do not mutate and avoid the action of natural selection

Genes that control and regulate apomorphic features function according to statistical laws and carry out the processes of adaptation and evolution of species. Only these genes form (dominant or recessive) mutations and adjust the parameters of apomorphic features within the limits of the "reaction norm" to environmental changes.

Adaptation or "continuous rearmament" from the point of view of the concept of "economy of nature" is unprofitable. In the process of evolution, a more economical way emerged, which is based on avoiding the influence of natural selection similar to plesiomorphic genes.

Avoidance can be briefly traced in certain species of Aphidoidea. The vast majority of species live openly on the leaves and shoots of fodder plants, adapting to a wide range of factors, and species that have avoided the influence of certain factors of natural selection.

Yes, *Pemphigus fuscicornis* (Koch), *Daktylosphaera vitifoliae* (Fitch) pressed on the root system grew, the species *Adelges laricis* Vallot, *A.laricis* Vall., *Dysaphis devector* (Walk.), *Sacchiphantes abietis* (L.), *S.viridis* (Ratz.) form galls, or false galls of *Hamamelistes betulinus* (Horvath) changing the environment to suit their needs. A common biological phenomenon of Aphidoidea species avoidance is dispersal, dioecy and parthenogenesis of some species. Sexual reproduction is considered unprofitable.

So, the genome is a complex biological system of the interaction of plesiomorphic (determined) and apomorphic (mutating and acting within the framework of statistical regularity) genes.



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sciforum-108364: How do diving beetle (Coleoptera: Dytiscidae) assemblages respond to water colour in urban ponds?

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Urban land use changes can drive brownification by washing compounds such as dissolved organic matter and iron from terrestrial ecosystems into urban blue spaces. Such changes in the physicochemical properties of water can consequentially impact aquatic communities. Here, I present the results of how diving beetles, a family of aquatic insects, respond to water colour in 26 urban ponds in the Helsinki Metropolitan Area, Finland. My results showed that urbanisation did not have significant effects on water colour in urban ponds. Yet diving beetle assemblages in urban ponds were shaped by the colour of the pond water. Diving beetle assemblages responded to water colour differently in ponds with and without fish: in the presence of fish, diving beetle species richness and abundance exhibited significant positive correlations with increasing water colour, but in ponds without fish, the correlation was not significant. Although more species could be found in highly coloured water, some species, such as *Hyphydrus ovatus* and *Hygrotus* spp., tended to occur in clear water, indicating that some species are intolerant to brown water, despite the fact that brown water may provide dytiscids with prey refuges. This study emphasises the availability of heterogeneous habitats to meet the habitat requirements of aquatic invertebrates to support urban aquatic biodiversity.



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sciforum-108478: How the Commercialization of Underutilized Edible Insects Shapes Livelihood Status: Insights from Rural Households in North Central, Nigeria

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In Nigeria, there are a ton of untapped edible insect species that present countless business opportunities. Additionally, they are a necessary part of a human diet for sustainability given their substitutionary characteristics over other expensive protein source. It is therefore important to have a thorough understanding of the current degree of its commercialization in order to formulate appropriate policies that will maximize their potential. The objective of this study is therefore to determine the contribution of commercialization of under-utilized edible insects to the livelihood status of rural households. The study was carried out in Benue State due to its high involvement in edible insect commercialization in the North-central zone of Nigeria. A random selection of 5% out of the 368 rural communities was then sampled. A total of 10 respondents were then randomly selected from the sampled 19 communities making a total of 190 respondents that were involved in the commercialization of under-utilized edible insects in Benue State. Of this lot, only 156 were valid for the study. Descriptive statistics, Household commercialization index, livelihood security index and the Ordinary Least Square regression analytical tools were adopted for this study. The study revealed that commercialization is on the high side and cricket, termite, caterpillar, grasshopper and palm weevil were the edible insect species that are popularly commercialized in the study area. About 55.13% of the respondents fell in the low livelihood security class while 44.87% were in the high livelihood security class. Commercialization of under-utilized edible insects significantly enhanced the livelihood status of the rural households. Estimates showed that for every unit increase in commercialization, there is a 6.8% increase in livelihood status of the respondents. The study recommended that farmers be encouraged to commercialize more of these under-utilized edible insects.



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sciforum-114470: Laboratory Evaluation of a Novel Insecticide, Isocycloseram, against the Common Bed Bug (*Cimex lectularius* L.)

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During the last two decades, the common bed bug (*Cimex lectularius* L.) (Hemiptera: Cimicidae) has resurged to become a common urban pest. Insecticide sprays are commonly used to manage this pest. However, most of the available insecticide sprays registered for bed bugs are not very effective due to insecticide resistance. Bed bugs are considered one of the most difficult urban pests to control. There is strong interest in developing novel, effective insecticide materials to combat widespread bed bug infestations. Isocycloseram is a novel insecticide in the class isoxazoline that shows excellent efficacy and selectivity against invertebrate pests. We evaluated the direct spray and residual efficacy of two 0.1% isocycloseram formulations in a laboratory against four insecticide-resistant field strains of common bed bugs (*Cimex lectularius* L.) (Hemiptera: Cimicidae) on three surfaces (fabric, vinyl tiles, and unpainted pinewood). Their efficacy was compared with five commercial insecticides including Demand CS (0.03% γ -cyhalothrin), Temprid FX (0.05% imidacloprid and 0.025% β -cyfluthrin), Crossfire (0.4% clothianidin, 0.01% metofluthrin, and 1.0% piperonyl butoxide), Bedlam Plus (0.4% Cyclopropanecarboxylate, 1.0% N-Octyl bicycloheptene dicarboximide, and 0.05% imidacloprid), and PT Phantom II (0.5% chlorfenapyr). Both isocycloseram 45 SC and 400 SC formulations were the most effective among the tested insecticides. The isocycloseram 45 SC formulation caused faster mortality than the 400 SC formulation. Four hours of exposure to 0.025, 0.05, and 0.1% isocycloseram 45 SC residue on porous and non-porous surfaces caused 100% bed bug mortality after 3–4 days. Exposure to 30 d aged 0.1% isocycloseram 45 SC residue for 4 hours still caused 100% mortality, compared to 0–73% mortality by the five commercial insecticides. Isocycloseram is a highly effective compound for controlling resistant *C. lectularius* populations



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sciforum-113427: Landscape Alterations and Butterfly Diversity in the Moist Shiwalik Sal Forest of the Lower Garhwal Himalayas: A Comparative Study between Natural Forests and Urban Areas

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Forest ecosystems in the lower Garhwal Himalayas are severely threatened by urbanization, commercial activities, and resource overuse, leading to fragmented and degraded habitats. Given these threats, modern biodiversity assessments are crucial for conserving the remaining forest patches in the Himalayan ecosystem. The urbanization of natural and semi-natural habitats is a primary driver of habitat loss and fragmentation, reducing both the quantity and quality of habitats, which negatively impacts biodiversity. The lower western Himalayas, strongholds of biodiversity, face rapid deforestation and habitat degradation due to anthropogenic activities. Butterflies, due to their sensitivity to environmental changes, serve as effective indicators of the ecological impacts of urbanization and landscape development. In this study, butterfly diversity was monitored across different land use types in the lower Garhwal Himalayan region, focusing on natural forests and urban landscapes. The data collection spanned two years (2022–2024), using seasonal sampling surveys across 288 transects. A total of 34,849 individuals, representing 129 species, were recorded. Of these, 113 species were identified in natural forest habitats, while 83 species were observed in urban areas. The data analysis was conducted using Past software (version 5.0.2), revealing significantly higher species richness and butterfly abundance in the natural forest sites compared to urban areas. These results highlight significant differences in butterfly species' richness and abundance, reflecting the impact of land use changes in the valley. These findings underscore the value of butterflies as bioindicators of land use alterations and can inform land use planning and conservation strategies in the region, promoting areas for future biodiversity preservation.



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sciforum-113296: New records of leaf-miner flies (Diptera, Agromyzidae) from Morocco

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Abstract: The family Agromyzidae or leaf-miner flies (Diptera, Acalyptratae) is widely distributed in the Palaearctic Region, in which it comprises more than 1,303 species. They are considered as the third largest of Acalyptratae families which possess entirely phytophagous larvae that develop in a wide range of hosts in the plant kingdom. Our knowledge of Moroccan agromyzid fauna is still poor and many gaps remain for this diverse family of Diptera where many regions in the country are still unexplored such as the Rif region in northern Morocco. This study aims to present new faunistic records as an attempt to fill gaps in our knowledge of Moroccan leafminers. The specimens used in the present study were captured by sweep net and by Malaise trap at different localities throughout Morocco from 2012 to 2023. Of the 140 sites surveyed, 38 were home to the agromyzid species mentioned in this study. Specimens were kept in 70% ethanol until identification. Each specimen was examined in detail before and after its genitalia were mounted in glycerin on glass-slides. All species have been identified based on the male genitalia. We provide new records of the family Agromyzidae (leaf-miner flies) from Morocco. Thirty agromyzid species are newly recorded, seven of these in Agromyzinae (*Agromyza anthracina*, *A. conjuncta*, *A. mobilis*, *A. myosotidis*, *A. nigrescens*, *Hexomyza simplex* and *Ophiomyia pinguis*). The other 23 new records are in Phytomyzinae (*Amauromyza* (*Cephalomyza*) *karli*, *Calycomyza flavomaculata*, *C. solidaginis*, *Cerodontha* (*Butomomyza*) *eucaricis*, *C. (Dizygomyza) luctuosa*, *C. (Icteromyza) geniculata*, *Chromatomyia centaurii*, *Liriomyza amoena*, *L. brassicae*, *L. strigata*, *Phytoliriomyza arctica*, *P. perpusilla*, *P. pteridii*, *Phytomyza anemones*, *Ph. clematidis*, *Ph. crassisetia*, *Ph. notata*, *Ph. plantaginis*, *Ph. rufipes*, *Ph. vitalbae*, *Pseudonapomyza confusa*, *Ps. palavae* and *Ps. vota*). *Calycomyza* Hendel is newly reported from the country. The present study has increased the total number of agromyzid species in Morocco to 92.



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sciforum-114489: Prevalence and diversity of mite found on house mice (*Mus musculus* L.) in urban apartments and a farm building.

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House mice (*Mus musculus* L.) are known to carry ectoparasites that can cause dermatitis and serve as vectors for human diseases. However, little is known about the prevalence and diversity of ectoparasites on house mice in urban environments. In this study, we collected and identified ectoparasites from house mice trapped in apartment buildings and a chicken breeding facility across three cities in New Jersey, USA. A total of 189 house mice were captured from apartment buildings, while 113 were trapped in a chicken breeding building. Mites were the only ectoparasites detected, with infestation rates ranging from 25% to 89% across sites. Mite species richness varied from 1.0 ± 0.0 to 2.2 ± 0.1 species per mouse. Four mite species were identified: *Myocoptes musculus* (Koch), *Myobia murismusculi* (Schrank), *Echinonyssus butantanensis* (Fonseca), and *Liponyssoides sanguineus* (Hirst), also known as the house mouse mite. In addition, two blood-sucking mite species were genetically barcoded to support future species identification. The house mouse mite was the only medically significant species, found exclusively in apartment buildings with a prevalence of 30% to 79% and a mean density of 2.6 ± 0.6 to 8.5 ± 1.2 mites per mouse. This study marks the first reports of *E. butantanensis* and the house mouse mite on house mice in New Jersey. The findings are significant, as the house mouse mite poses a potential health risk to humans in buildings where infestations are common.



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sciforum-118441: Scale insects (Hemiptera, Coccoomorpha) in selected urban areas in Poland

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Introduction

Scale insects constitute a group of plant-feeding hemipterans that comprises over 8500 species. In Poland 143 species of Coccoomorpha have been registered excluding greenhouse species. Investigations on scale insect fauna in urban environments in Poland have been conducted for over 80 years.

Methods

Our studies were carried out between 2005 and 2024 in selected cities and towns in Upper Silesia, which is the most industrialized region in Poland. Adult females were collected by carefully combing through the host plants and the surface layers of the soil by hand. Specimens were preserved in 70% ethanol and identified on the basis of permanent microscope slides. The specimens were found in urban parks, forests, xerothermic and psammophilous grasslands and post-industrial wastelands.

Results

We found 64 species that belonged to 10 families. The Pseudococcidae was the largest family comprising 23 species. Among the collected species 30 were found on woody plants, 33 on herbaceous plants and only 1 in the surface layer of the soil. Some species formed large colonies on their host plants e.g. *Pulvinaria kuwacola* Kuwana, 1907, which is invasive species collected in urban parks in different sites. Each year new localities of this species were found in the area of Upper Silesia. *Parthenolecanium corni* (Bouché, 1844) and *Lepidosaphes ulmi* (Linnaeus, 1758) were among the most common species. There were species considered to be rare in Poland that were collected in urban areas e.g. *Porphyrophora polonica* (Linnaeus, 1758) and *Puto superbus* (Leonardi, 1907).

Conclusions

The assemblages of scale insects in urban environments showed lower species diversity and a larger percentage of polyphagous species than in non-urban areas. The increase in the range of invasive species in the cities and towns is caused by many factors, of which global warming seems to be one of the most important.



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sciforum-112968: Seasonal changes in the abundance and distribution of thrips (Thysanoptera) in a diverse agricultural landscape in the Levubu region, Limpopo province, South Africa

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Thrips (Thysanoptera) are major pests of fruit crops globally. In South Africa, *Scirtothrips aurantii* Faure (Thripidae) damages avocados and macadamias, reducing their yield and profitability. Understanding the spatial distribution of *S. aurantii* over time will enable the targeted application of control measures. Therefore, we aimed to document the seasonal changes in the abundance, diversity, and distribution of thrips to identify areas as hot spots (high-abundance) and cold spots (low-abundance). We sampled thrips in the Levubu region of Limpopo province, South Africa, using 150 yellow sticky traps deployed at monthly intervals between September and January in the avocado and macadamia production seasons of 2021/22 and 2022/23. Eight species of thrips were encountered, namely the *Caliothrips* sp., *Frankliniella occidentalis*, the *Franklinothrips* sp., *Haplothrips gowdeyi*, *Heliiothrips haemorrhoidalis*, the *Megalunothrips* sp., *S. aurantii*, and *Thrips tenellus*. Across the entire area, *S. aurantii* was the most abundant in September, coinciding with avocado and macadamia flowering. A geographic information system (GIS) was used to map and symbolise the mean *S. aurantii* sticky trap catch. An optimised hot spot analysis was used to classify and summarise trap catches aggregated into a raster layer of 1×1 km (1 km²) through the use of zonal statistics and the minimum bounding geometry. Significant *S. aurantii* hot spots (with 90-99% confidence) were concentrated in the hot and dry regions of the eastern and northeastern parts of Levubu, whereas significant cold spots were concentrated in the colder and wetter areas in the northwest of the region. Non-significant areas of random variation in *S. aurantii*'s abundance were mostly found in the central region. However, the hot spot and cold spot locations changed over the months and production seasons, suggesting the potential for local microclimates, topography, vegetation type, and plant phenology as drivers of *S. aurantii*'s distribution and abundance.



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sciforum-108481: The Impact of the Invasive Teak Defoliator *Hyblaea puera* on Coastal Mangrove Ecosystems in Kannur District, Kerala, India

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Mangroves play a vital role in coastal protection, biodiversity, and supporting local livelihoods. Kerala, known for its rich mangrove habitats, is facing a significant threat, as this study reports the first recorded infestation of these critical ecosystems by the invasive moth *Hyblaea puera* in Dharmadam and other regions of Kannur District, Kerala, India. The aggressive feeding behaviour of the larvae has led to severe defoliation in *Avicennia officinalis* (Acanthaceae), the dominant mangrove species, across vast areas, leaving the landscape with a scorched, ashy appearance. This ecological crisis poses serious risks to local biodiversity, livelihoods, and the crucial role of mangroves in Kerala's coastal ecosystems. *H. puera*, commonly known as the teak defoliator, has caused similar outbreaks in Maharashtra's Airoli and Vashi Creek, predominantly affecting *Avicennia marina*. In Kannur, epidemic-level infestations were recorded in 2024, with sporadic occurrences during the monsoon months. The larvae of *H. puera* not only feed on mangroves but also pupate on other plant species, including *Volkameria inermis* (Lamiaceae), *Derris trifoliata* (Fabaceae), *Rhizophora mucronata* (Rhizophoraceae), *Acanthus ilicifolius* (Acanthaceae), *Avicennia officinalis* (Acanthaceae), and *Bruguiera cylindrica* (Rhizophoraceae), further expanding their impact on the local flora. This species was previously documented in Brazil, with the first report in Paraná in 2016. During the infestation in Kerala, various natural predators, including birds, snails, spiders, and many parasitoids, were observed interacting with the pest, indicating their potential as biological control agents. This study evaluates the impact of *H. puera* on Kerala's mangroves and explores management strategies to protect these ecosystems. Potential control methods include leveraging natural predators as biological control agents, chemical treatments, or physical removal techniques. By assessing the scale of the infestation and developing effective control measures, this research aims to mitigate the detrimental effects of *H. puera* on Kerala's rich coastal mangrove environment.



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sciforum-118308: Toxicity of insecticidal gel baits against several developmental stages of American cockroach *Periplaneta americana* (Blattodea: Blattidae)

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The American cockroach (*Periplaneta americana* (L.); Blattodea: Blattidae) is an important peridomestic pest with high significance in public health. This study evaluated the toxicity of eleven gel-based insecticidal gel bait formulations with different modes of action and active ingredients such as abamectin B1, boric acid, clothianidin, dinotefuran, emamectin benzoate, fipronil, imidacloprid, and indoxacarb, against several developmental stages of *P. americana* (adults of both sexes and nymphs of varying sizes). A completely randomized block design was used to estimate final mortality and median survival times (MSTs) over a 14-day period. Gel baits, preferred for their efficacy in sensitive environments and reduced environmental contamination, demonstrated variable effectiveness. Hotshot (Dinotefuran 0.05%) and Alpine (Dinotefuran 0.5%) did not cause significant mortality ($P > 0.05$) compared to the control across small and medium nymphal stages. Except for the female adults, these two insecticides were comparatively less effective than others. Combat gel bait (Fipronil 0.01%) and MaxForce FC Magnum (Fipronil 0.05%) exhibited the highest efficacy, achieving the lowest MST of 24-48 hr across all tested stages. All other gel baits were moderately effective for all the developmental stages. Boric acid (33.3%), except for small and large nymphs, was efficient in controlling other stages of *P. americana*. These findings highlight the potential of fipronil-based gel baits as a reliable tool for managing all the stages of *P. americana* populations, emphasizing the importance of active ingredient selection for optimal pest control.



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sciforum-113062: Tracing potential pinewood nematode semiochemicals emitted by its insect vector *Monochamus galloprovincialis*

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Monochamus spp., commonly known as sawyer beetles (Coleoptera: Cerambycidae), are conifer wood borers capable of causing decreases in wood value of up to 40 % due to the tunnels built by their larvae in freshly cut logs. However, the greatest impact on pine forests comes from their phoretic association with the pinewood nematode (PWN), *Bursaphelenchus xylophilus*, an aggressive phytoparasite that causes rapid pine decline in Asian and European forests (Portugal and Spain). Beetles become vectors for the PWN during the callow adult stage while still inside the pupal chambers, deep in infected pine wood. The presence of teneral adults in dead infected wood stimulates PWN's transition from the propagative to the dispersive stage (Dauer juveniles), involving extensive morphological changes. The colonized beetles transport PWNs in their respiratory system (trachea) and transmit them to uninfected pines during maturation feeding. The interaction between these two different organisms is still not completely understood, but volatile compounds are believed to mediate their communication. The present work aimed at profiling the volatiles emitted by different life stages of the European pine sawyer beetle *Monochamus galloprovincialis* through solid-phase microextraction (SPME) using sorbent packed tubes to capture emitted volatiles and thermal desorption coupled to gas chromatography–mass spectrometry (TD-GC-MS) for compound identification. Several volatiles were found to be constitutively emitted by the different insect life stages (larvae, pupae, and callow adult males and females); however, seven compounds were found in callow adults only, e.g., C12 and C13 aliphatic alkanes, C7 and C8 aliphatic aldehydes, or the ketone 6-methyl-5-hepten-2-one. Further studies will focus on their attractiveness to the PWN. This knowledge will contribute to developing innovative strategies to break the intricate cycle of pine wilt disease caused by the PWN.

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sciforum-113443: Urban terraces and backyard gardens for pollinators: Nero's Fiddle or Noah's Ark?

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Pollination is one of the most important ecosystem services. Of about 200,000 species of animals that provide pollination as a service, >90 % are insects. They pollinate 75% of the world's food crops. However, there has been a steady decrease in the health of the pollinator community worldwide (15-40%). Major drivers responsible for this are urbanization, habitat loss, pollution and climate change. With nearly half of the world's population now living in cities, the overall landscape is fast-changing. Habitats in natural areas have decreased, but terraces and backyard gardens have increased. The present case study from Pune City, India, which is situated along one of the most urbanized belts in Asia, highlights how urban terraces and backyards can become potential habitats for pollinators. Systematic planning of key plant species (> 50), including wild and cultivated plants (herbs, creepers, climbers, vegetables) centered around a carefully designed yearly floral calendar, resulted in visits from and colonization by more than 30 species of butterflies and 20 species of bees, flies, wasps, ants and birds. Broad-leaved species were used as nesting habitats by birds like tailorbird (*Orthotomus sutorius*) and ashy prinia (*Prinia socialis*). Bamboo sticks used for supporting climbers acted as nesting sites for solitary bees. To date, urban terraces have been overlooked as potential habitats to protect and promote biodiversity. However, with an increasing interest in terrace gardening among common citizens, we feel that this can become a replicable and scalable model for maintaining a healthy pollinator community in urban areas.



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Session 7. Social Insects

sciforum-118114: *Apis cerana* Honey Production and Colony Behavior: A Study on Hive Material Variations

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The native honeybee, *Apis cerana*, plays a critical role in maintaining ecological balance and supporting livelihoods in Azad Jammu and Kashmir Pakistan. *A. cerana* is regarded as an excellent crop pollinator for a large variety of fruit and vegetable crops. In Azad Jammu and Kashmir, local beekeepers maintain *A. cerana* colonies as a source of honey production and livelihood of the rural area communities directly or indirectly related to the beekeeping of this native honeybee species. Local beekeepers are using different types of hive materials for the traditional beekeeping of this species in the Azad Kashmir region of Pakistan. The selection of suitable hive material for enhancing honey quality and production is urgently needed for this region. This study was designed to explore the impact of different types of hive materials on *A. cerana* honey production and colony behaviour. Different hive materials such as wooden rectangular hives, concrete brick hives, mud hives, and wood log hives were studied for honey production (kg) and colony behaviour including the number of forager bees, number of combs, size of combs (inches), number of swarms, and number of queens produced in each hive. The results of this study show that the wooden rectangular hive was found to be significantly effective for *A. cerana* colonies with maximum honey production (11.98 ± 0.115), number of queens (4.60 ± 0.509), number of swarms (4.20 ± 0.374), and number of combs (10.40 ± 0.0509). While the wood log hive was found least effective with minimum honey production (5.28 ± 0.0159), in the case of bee trafficking, the wooden rectangular hive was also recorded with maximum outgoing and incoming bees. The wooden rectangular hive was also recorded with the maximum number of combs with large comb sizes. This study will contribute to developing sustainable beekeeping practices by optimizing hive designs for enhanced honey production and colony health. The findings may also inform global apiculture strategies, benefiting both local and commercial beekeepers.



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sciforum-113432: Myrmecofauna of Mesta river valley (Bulgaria): A report of fifteen new species in the region

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The myrmecofauna of Bulgaria is diverse, including Central and Northern European species as well as thermophilic and xerophilic Mediterranean species. Potential corridors for thermophilic fauna penetration include the valleys of the Struma, Mesta, and Maritsa rivers. Here, we consider the species diversity and the availability of thermophilic species in the Mesta river valley. Three sampling plots were situated in the Mesta river biocorridor, from the southernmost point in the Bulgarian territory up north to where Mediterranean influence is still significant. A total of 30 pitfall traps and 2 mesovoid shallow substratum (MSS) traps were set. The myrmecofauna was additionally sampled by hand collection, leaf litter sifting, and sweep netting. Only five species were reported in the literature for the region of Mesta Valley prior to our study. Twenty species were recorded in total during the survey in Mesta Valley. Fifteen species are new to the area, and fourteen are thermophilic species. The collected specimens were preserved in 70-80% ethanol and deposited in the Institute of Biodiversity and Ecosystem Research collection at the Bulgarian Academy of Sciences (IBER). Additional studies will clarify the rates of penetration of thermophilic species after qualitative and quantitative comparison of the composition of the myrmecofauna, along the south–north gradients. This study is a part of the Project “Monitoring the effects of global climate changes through qualitative and quantitative analysis of model animal groups in selected corridors of thermophilic fauna penetration in Bulgaria” (funded by the National Science Fund of Bulgaria under grant contract number KP-06-N61/6 – 14.12.2022).



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sciforum-118404: Bee pathogens in *Apis florea* samples accidentally introduced into Malta and Italy

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Introduction

Apis florea, the red dwarf honey bee, is a wild bee species native to Asia. Its adaptability and nesting behaviour make it a potential alien invasive species, raising concerns about its competition with *Apis mellifera* and the introduction of novel pathogens. This study investigates the presence of known and emerging honey bee pathogens in *A. florea* to increase the available knowledge on this species.

Methods

In 2024, after the first detection in Europe of a fully established colony of *A. florea* in Malta, a small nest was found in the same area, near the Malta Freeport Terminals, a very busy cargo and transshipment port in the southern part of the island. In May of the same year, in Italy (port of Gioia Tauro, Calabria region), a small nest of *A. florea* was discovered on the wall of a container coming from India. Specimens of *A. florea*, collected from both locations before the destruction of the nests, were analysed for species identification by the sequencing of a *cytochrome c oxidase subunit I* (COI) region of mitochondrial DNA, and for the presence of possible honey bee pathogens (fungi, viruses and trypanosomatids).

Results

The sequencing of the COI region confirmed the *species A. florea in both samples* and only bee viruses were detected. Whereas viral co-infections (DWV, ABPV, SBV, BQCV and AmFV) were present in samples from Malta, only SBV was found in *A. florea* from Italy.

Conclusion

The spread of *A. florea* in the Mediterranean region due to global trade poses an ecological risk to local biodiversity. Furthermore, the presence of pathogens in the *A. florea* populations raises concerns about their potential spread to local honey bee populations, highlighting the need to monitor the potential presence of *A. florea* nests through an early warning system and to take prompt action for their eradication.



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sciforum-113530: First record of *Camponotus (Tanaemyrmex) compressus* (Hymenoptera: Formicidae: Formicinae) from Bulgaria with notes on invasive and alien ants in the country

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Camponotus (Tanaemyrmex) compressus is a common species in South Asia. Its natural range includes Bangladesh, India, the Maldives, Nepal, Pakistan, and Sri Lanka, and due to human activity, it has managed to settle in parts of East Asia and Africa. Here, we provide the first record of *C. compressus* from Sofia, where we found and collected a group of specimens. We determine the probability that they will successfully "integrate" into the country and adapt to our climatic areas, even in the presence of a queen (as was not established), which is very unlikely. However, we do not rule out such a possibility because of global climate change. The subgenus *Tanaemyrmex*, in which *C. compressus* is also classified, has four representatives that can be found in Bulgaria. These are *C. aethiops*, *C. ionius*, *C. samius*, and *C. universitatus*. The most common is *C. aethiops*, which is found in almost all xerothermic meadows and pastures, where it can often be seen collecting honeydew from aphids on plants. The other three species also prefer warmer habitats but have a limited range in the country.

Currently, there are two established alien ant species in Bulgaria. The Argentine ant *Linepithema humile* (Dolichoderinae) has a South American origin but can be found on every continent (except Antarctica). In Bulgaria, *L. humile* has been reported in Sofia, Varna, and Burgas. The pharaoh ant *Monomorium pharaonis* (Myrmicinae) can be defined as a synanthropic species. It has spread all over the world and mainly inhabits factories, hospitals, and homes. In the tropics, it can also nest outside buildings. In Bulgaria, *M. pharaonis* has been reported in Ruse, Shumen, Sofia, Svilengrad, Plovdiv, Malko Tarnovo, Varna, Obzor, Tsarevo, Burgas, Sozopol, and Ahtopol. This study is a part of the project under grant contract number KP-06-N61/6 – 14.12.2022.



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sciforum-118255: Genetic data gives new insights on the species diversity of *Macrotermes* termites in Africa and Asia

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Termites in the genus *Macrotermes* are important ecosystem engineers, forming the basis of many food webs. Recent research has shown that taxonomic classifications do not fully capture the genetic diversity within this genus, and large areas across Africa and Asia remain unsurveyed.

To bridge this gap, we generated new mitogenomic and DNA barcoding sequence data for *Macrotermes* specimens collected in seven African countries (Angola, Botswana, Kenya, Ivory Coast, Namibia, South Africa, and Zimbabwe). The new sequences were pooled with the mitogenome and COI sequences available on GenBank and BOLD Systems. Phylogenetic reconstruction was performed for both the mitogenomic and COI sequences separately. The COI dataset was used for species delimitation through the bPTP, p-distance, and ASAP methods.

The neighbour-joining tree showed the most concordance with all of the species delimitation methods, excluding African genetic groups G02 and G17 and Asian genetic groups G28 and G32. Notably, G28 contained 12 taxonomic species, indicating a high level of oversplitting in the Asian clade. In contrast, the African clade shows a high level of cryptic diversity, e.g., as the specimens identified as *Macrotermes subhyalinus* in previous studies fall into four different genetic groups.

The mitogenome tree showed the African *Macrotermes bellicosus* in the basal position, and the remaining sequences were divided into African and Asian as sister clades. Although the mitogenome tree does not contain all of the genetic groups identified by the COI analysis, the cryptic diversity in *M. subhyalinus* is well supported. The Asian genetic group G28 was only represented by two mitogenomes, one of them not identified to the species level; therefore, oversplitting could not be confirmed.

In conclusion, taxonomic problems occur in both the Asian and African clades. This study supports the notion that the genetic and species diversity in *Macrotermes* has been incorrectly estimated and emphasises the need for taxonomic revision and more comprehensive sampling across under-represented regions of Afro-Eurasia.



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sciforum-117902: Microbial Profiling of *Apis mellifera*: Biochemical and Molecular Insights on bacteria from Dead Brood, pupa, and comb

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The present study investigated bacterial pathogens in honey bee colonies, focusing on American Foulbrood diseases and European Foulbrood diseases caused by *Paenibacillus larvae* and *Melissococcus plutonius*, respectively. Samples from infected brood, pupa, and combs of *Apis mellifera* were collected from modern apiaries in Nainital district, Uttarakhand. Three different culture media, i.e., nutrient media, MYPGP media, and KSBHI media, were used to isolate the bacteria under aerobic and anaerobic conditions. Morphological, biochemical, and molecular characterizations (16S rRNA sequencing) of 12 selected bacterial isolates were performed, and the obtained sequences were submitted to NCBI GenBank. The isolates were identified as *Enterococcus faecalis*, *Bacillus tropicus*, *Bacillus safensis*, *Bacillus licheniformis*, *Pseudomonas hibiscicola*, *Bacillus haynesii*, *Delftia tsuruhatensis*, *Bacillus subtilis*, *Williamsia serinedens*, *Carnimonas nigrificans*, *Pseudomonas parafulva*, and *Bacillus paralicheniformis*. The dominant phyla were Firmicutes (58%), Proteobacteria (34%), and Actinobacteria (8%), with *Bacillus spp.* being the most prevalent. This study highlights the diverse bacterial community associated with honey bee colonies and their potential role in bee health and disease. The study also revealed that the apiaries in the study area were not affected by the pathogens *Paenibacillus larvae* and *Melissococcus plutonius*. These findings contribute to understanding the microbial ecology of honey bees and the impact of bacterial infections on colony health.



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sciforum-118233: Molecular identification of termite assemblages at the source of the Okavango Delta in the Angola highlands

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The National Geographic Okavango Wilderness Project aims to secure sustainable protection for the Okavango Delta and its waterways. With 95 % of water flowing into the Okavango Delta originating from the Angolan highlands, this water tower is of great importance, and biodiversity documentation is still in its infancy. As ecosystem engineers, termites play a pivotal role in the breakdown and recycling of organic matter. Termite assemblages in Angola are generally undocumented, and the highlands are no exception.

We sampled over 500 specimens in the open miombo, forest and wetland habitats in Angola's Cuando Cubango and Moxico provinces, performing DNA barcoding of 242 specimens. Morphological identification was not attempted due to a lack of available taxonomic expertise. Therefore, we relied exclusively on DNA-based methods to infer the most likely taxon. BOLD Systems was utilised for sequence searches, and phylogenetic context was created using new and publicly available DNA barcodes obtained from other Southern African regions. Genetic clusters identified were assessed for intragroup genetic divergence.

The analyses placed the specimens in a total of three families (Kalotermitidae, Hodotermitidae and Termitidae) and four subfamilies of Termitidae (Apicotermitinae, Nasutitermitinae, Macrotermitinae and Termitinae), spanning 18 genera. Only 24.79 % of the sequences were identified to the species level, encompassing 13 species.

Our results represent the first attempt to document termite diversity at the source of the Okavango Delta and sets the baseline data for documenting termite diversity in Angola. We also highlight that the paucity of DNA sequence data for termites in Southern Africa severely hinders the construction of comprehensive biodiversity assessments.



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sciforum-118314: Strategies for the Sustainable Protection and Enhancement of Indigenous Bumblebee (*Bombus haemorrhoidalis*) Populations to Support Mountain Food Systems in Azad Jammu and Kashmir

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This research aimed to develop and implement strategies for the sustainable protection and enhancement of *Bombus haemorrhoidalis* populations to support mountain food systems in Azad Jammu and Kashmir (AJK). We conducted a comprehensive assessment of *B. haemorrhoidalis* habitats, identifying critical areas that required protection. Field surveys and habitat mapping were performed to monitor population trends and determine factors affecting bumblebee health and distribution. The study examined the impact of agricultural practices, pesticide usage, and climate change on *B. haemorrhoidalis* populations. Community engagement and education were integral to the research, involving local farmers and stakeholders through participatory workshops and training sessions to promote pollinator-friendly farming practices. Emphasis was placed on organic farming techniques, reduction of pesticide application, and creation of flower-rich habitats to provide foraging and nesting resources for bumblebees. To ensure long-term sustainability, we developed policy recommendations for the conservation of *B. haemorrhoidalis* and other pollinators in AJK, collaborating with local government bodies, NGOs, and international conservation organizations to implement these policies effectively. The findings contributed to enhancing the resilience of mountain food systems by securing pollination services, thereby supporting agricultural productivity and biodiversity. The strategies developed served as a model for the conservation of other indigenous pollinators in similar mountainous regions, ensuring food security and ecological balance.



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sciforum-112257: The distribution of cryptic species of *Bombus lucorum*-complex in Eastern Fennoscandia

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The cryptic bumblebee species of *Bombus lucorum*-complex pose challenges for conservation management. They are morphologically indistinguishable in much of their range, leading to misidentification in most cases. However, total DNA barcoding for such a widespread species is impossible due to financial and labor costs. Among the regions of Northern Europe, reliable data on their distribution exist for Britain, Ireland and Finland. Regarding Finland, only one paper (Pamilo et al. 1997) has been published which provides some data on the distribution of the cryptic species *B. lucorum*-complex. Concerning the Russian part of Fennoscandia (Murmansk Region and Karelia), no information is available.

In this research, we studied the distribution of the cryptic species *B. lucorum*-complex in Eastern Fennoscandia (within the administrative boundaries of two regions of the Russian Federation, i.e., Murmansk Region and Karelia). Morphological characters were used for initial species identification. After that, we used the PRC-RFLP method. This approach allows for accurate, quick and relatively cheap identification of the species of *Bombus lucorum*-complex.

We found that two species, *B. cryptarum* and *B. lucorum*, are present in Eastern Fennoscandia. Two other species of *B. lucorum*-complex, i.e., *B. terrestris* and *B. magnus*, have not yet been found in this region. *B. cryptarum* is recorded in the whole territory of the studied region. Only this species is recorded in the northernmost localities near Norway and the northern part of Finland. In Karelia, the higher proportion of *B. lucorum* in the samples is in the southern part of this region. *B. cryptarum* and *B. lucorum* are associated with a wide range of habitats. The typical sites of concentration of foraging bumblebees are different types of meadows. However, the range of habitats of *B. cryptarum* is broader. Only this species is found in tundra in the north of Eastern Fennoscandia.



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sciforum-118197: The Plasticity of the national surveillance plan for *Aethina tumida* in Italy

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The small hive beetle, *Aethina tumida*, which is an exotic parasite in Europe, has been present in Calabria since September 2014 and recently (re)emerged in northeastern Sicily, necessitating updates to Italy's national surveillance plan. The surveillance plan, led by the Ministry of Health in collaboration with IZSve and regional authorities, aims to protect apiculture and prevent the beetle's spread. Key components of the annually updated plan include the following:

- i) Randomized surveillance: Structured clinical inspections of stationary apiaries in low-risk areas are carried out, stratified by region and considering the beekeeping heritage. This approach targets a 2% expected infestation prevalence (EP) with a 95% confidence level (CL), encompassing a significant sample of apiaries per macroarea (North, Central, and South Italy).
- ii) Targeted surveillance: Focused inspections of high-risk apiaries, identified based on criteria such as inter-regional nomadism, biological material introduction, or processing facilities receiving extra-regional supers (5% EP, 95% CL), are conducted.
- iii) Adapted surveillance and implementation of sentinel hives to monitor the evolution of the epidemiological situation in Calabria and Sicily and beetle circulation near known infestation zones and high-risk borders are carried out.

Standardized clinical protocols ensure consistent diagnostic accuracy, with regional and national data being centralized for epidemiological analysis. Sentinel hives, inspected biweekly, provide independent, reliable data. The outcomes of this surveillance inform containment measures, including protection zones, movement restrictions, and enhanced epidemiological investigations. In case *A. tumida* is detected, protocols mandate sample collection and notification to authorities, with diagnostic confirmation by the National Reference Center for Beekeeping. These measures align with EU regulations, emphasizing control rather than apiary destruction. This comprehensive surveillance plan integrates clinical inspections, risk-based targeting, and sentinel monitoring to safeguard Italian apiculture, highlighting inter-agency collaboration and strategic adaptability in response to evolving epidemiological challenges.



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sciforum-113237: The tissue- and life-stage-specific gene expression dynamics in the drywood termite, *Incisitermes schwarzi* (Isoptera: Kalotermitidae)

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Termites are eusocial keystone insect species that feed on wood matter and plants to obtain cellular energy. Certain invasive wood-feeding isopteran termite pests such as *Coptotermes* (Rhinotermitidae), *Macrotermes*, *Odontotermes* and *Microtermes* species (Termitidae) have caused immense damage to eucalyptus forests in Malaysia, Australia, India, China and Africa due to their increased sensitivity to wood decomposition under warming temperatures, leading to global economic losses. The traditional forest pest management strategies have failed to curb these termite infestations, thereby urgently calling for the deployment of novel methods. A detailed understanding of termites' adaptation and physiology at the molecular level would aid in the development of future management measures utilizing molecular tools such as RNA interference (RNAi). In this study, we have selected the drywood termite, *Incisitermes schwarzi* (Isoptera: Kalotermitidae), to investigate how these specific termites survive during their voracious feeding on spruce and birch deadwood in a drywood habitat. To understand their wood digestion response and the detoxification behavior of the natural toxins present in deadwood, we conducted a gene expression analysis in different life stages and different tissues. The differential gene expression (DGE) analysis across developmental stages and tissue types revealed multiple gene families related to wood detoxification, wood digestion, the growth and development of the termites and their eusocial behavior and adaptation to biotic- and abiotic-stress-causing agents. Further, to understand the RNAi susceptibility/resistance of the termites, we identified RNAi machinery genes and explored their expression dynamics across the different life stages and tissues in the drywood termites. The differentially expressed genes identified through this study could help in improving our understanding of termites' adaptation to their lignocellulosic habitats and could serve as excellent putative targets for RNAi-based termite management.



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Session 8. Medical and Veterinary Entomology

sciforum-118045: Entomological Transmission Risk of Arboviral Diseases: Aedes Mosquito Infestation in Urban and Semi-Urban Areas of Ibadan, Nigeria

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Background: Arboviral diseases, such as dengue, Zika, chikungunya, and yellow fever, are significant public health threats, primarily transmitted by Aedes mosquitoes. Understanding vector infestation levels and breeding site preferences is essential to develop effective control strategies. This study assesses the entomological transmission risk of arboviral diseases by evaluating Aedes mosquito distribution, abundance, and breeding habitats in urban and semi-urban areas of Ibadan, Nigeria.

Methods: A cross-sectional entomological survey was conducted in 5,223 households, with 36,779 water-holding containers examined for Aedes mosquito breeding. Standard infestation indices—the House Index (HI), Container Index (CI), and Breteau Index (BI)—were calculated. The Breeding Preference Ratio (BPR) was used to determine habitat suitability. Data analysis included statistical comparisons of larval and pupal densities between study locations.

Results: This study revealed high infestation levels, with HI values of 71.2% (semi-urban) and 75.2% (urban), CI values of 79.0% (semi-urban) and 67.3% (urban), and BI values of 579.9% and 443.8%, respectively. These indices exceed World Health Organization thresholds, indicating high transmission risk. Artificial containers, particularly tyres, plastics, and vehicle parts, were dominant breeding sites, with BPR values exceeding 1.0 for key habitats. A total of 104,989 larvae and 43,002 pupae were recorded in semi-urban areas, while 78,016 larvae and 34,652 pupae were found in urban locations. Semi-urban areas had higher larval densities, whereas urban sites exhibited greater pupal densities, suggesting differential transmission dynamics.

Conclusion: Targeted vector control interventions, including environmental sanitation and larval source reduction, are essential to mitigate arboviral disease transmission risks in Ibadan and similar endemic regions.

Keywords:



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sciforum-109504: *Anopheles donaldi* (Barbirostris Group) As A Potential Vector For *Plasmodium knowlesi* In Sarawak, Malaysia

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Plasmodium knowlesi is a significant cause of simian (zoonotic) malaria in Sarawak, Malaysia. Until 2018, only one study had been carried out in Sarawak to identify of *P. knowlesi*, where *Anopheles latens* was incriminated as the vector in Kapit Sarawak. A comprehensive entomological investigation was conducted in Limbang, Sarawak, following an imported *Plasmodium falciparum* malaria case in March 2018. The objective was to identify the vector species and determine the presence of malaria parasites in mosquitoes. Human Landing Catch (HLC) and Human Bait Trap (HBT) sampling were conducted from April 18 to 21, 2018, between 1800 and 2400 hours. Female *Anopheles* mosquitoes were captured, identified by means of microscopy, and dissected to examine oocysts and sporozoites. Positive slides and the remaining undissected *Anopheles* were sent to the Malaysian Institute of Medical Research (IMR) for species confirmation by means of polymerase chain reaction (PCR) and molecular testing for malaria parasites. A total of 117 female *Anopheles* mosquitoes were examined. Of these, 29 were identified as *Anopheles donaldi* based on their morphology, while the rest comprised *An. leucosphyrus*, *An. barbirostris* and *An. kochi*. One *An. donaldi* that was dissected was found to have oocysts on its midgut and confirmed as *P. knowlesi* through molecular analysis. Molecular testing of 36 specimens also revealed 4 abdominal and 2 thoracic samples that were positive for *P. knowlesi*, including the sample slide, and 6 abdominal and 1 thoracic sample that were positive for *P. vivax*. This study marks the first report of *P. knowlesi* in *An. donaldi* (Barbirostris group) in Sarawak, Malaysia, a species that was not previously associated with *Plasmodium knowlesi*. These findings suggest that *Anopheles* species outside of the *An. leucosphyrus* group may also serve as vectors for *P. knowlesi*. The detection of both *P. knowlesi* and *P. vivax* in mosquitoes indicates the vulnerability of this locality to malaria transmission, emphasizing the need for sustained malaria control efforts.



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sciforum-118113: Assessing the ability of *Aedes albopictus* and *Aedes cretinus* (Diptera: Culicidae) adults to survive winter under sheltered microclimatic conditions in northern Attica, Greece

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After the introduction of the invasive mosquito *Aedes albopictus* in the Attica Region and other areas of Greece, the native mosquito species *Aedes cretinus* has become scarce, while *Ae. albopictus* is widely distributed. The overwintering of mosquitoes determines their population dynamics in the next season. This study explored the survival ability of *Ae. albopictus* and *Ae. cretinus* adults in a sheltered environment in the northern area of the Attica Region, Greece, during the winter of 2023-2024. Male and female *Aedes albopictus* and *Aedes cretinus* were placed in cages within a sheltered environment in mid-December, and their survival was monitored continuously until mid-April. The results demonstrated that 11% of *Ae. albopictus* females and 21.1% of *Ae. cretinus* females were able to survive beyond the winter season (overwintering), indicating their potential to build up high populations early in the spring season. However, adult males of both species failed to overwinter. The capacity of adults to survive winter was significantly higher in *Ae. cretinus* than in *Ae. albopictus*, according to log-rank tests. This finding may justify the presence of *Ae. cretinus* in the cooler environments of vegetated and wooded locations in northern areas of Attica Region. However, the fact that *Ae. albopictus* females survived the winter under the same sheltered microclimatic environment underscores the potential of interspecific competition in these areas. This study emphasizes the need for extended monitoring of *Ae. albopictus* and *Ae. cretinus* populations during winter in sheltered places in Attica Region and other areas where these species co-exist to allow us to better understand their distribution patterns. Additionally, our results advocate targeted control measures for both mosquito species in sheltered places during winter to prevent early spring population growth.



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sciforum-113488: Bacterial communities in defecated contents and the gut of post-defecated females of the vector of bluetongue virus, *Culicoides oxystoma* Kieffer (Diptera: Ceratopogonidae)

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Defecation by haematophagous insects allows for the rapid elimination of the water content ingested along with the blood meal from their hosts. Efficient vectors defecate during or shortly after the blood feeding, and the chances of pathogenic transmission via defecation during blood feeding to their hosts increase. The duration of blood feeding and defecation varies depending on species and sexes of haematophagous insects. *Culicoides* females take blood meal from their hosts. *C. oxystoma* Kieffer (Diptera: Ceratopogonidae) are the proven vector of many arboviruses, most importantly bluetongue viruses, and protozoa—the nematode of livestock. This study investigates the bacterial communities in defecated contents and the gut of post-defecated females of *C. oxystoma*. To observe any pathogenic bacteria in their defecated contents, field-collected engorged females were allowed to excrete under laboratory settings. The engorged females defecated within 48 hours of transferring onto moistened cotton beds. The defecated contents discharged by *C. oxystoma* consisted of the following bacteria: *Bacillus cereus*, *Enterococcus faecium*, and *Alcaligenes faecalis*. The following bacteria, *Bacillus cereus*, *Lysinibacillus* sp., and *Paenibacillus* sp., were identified from the gut of post-defecated females. Within the defecated content, the following pathogenic bacteria, *B. cereus* and *A. faecalis*, were detected, which raises serious concern and the chances of zoonotic posterior station transmission towards their hosts.



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sciforum-118035: Breeding Habitat Preferences and Environmental Dynamics of *Aedes* Mosquitoes in Urban and Semi-Urban Areas of Ibadan, Nigeria

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Aedes aegypti and *Aedes albopictus* are primary vectors of dengue, yellow fever, and chikungunya, with their breeding ecology and environmental adaptability influencing distribution and transmission dynamics. Effective control strategies require targeted larval habitat management, necessitating a comprehensive understanding of breeding patterns.

A longitudinal study (July 2017–April 2020) was conducted in the Ibadan North (urban) and Akinyele (semi-urban) Local Government Areas (LGAs) of Ibadan, Nigeria. *Aedes* eggs were collected using ovitraps, while larvae and pupae were sampled from natural and artificial habitats via the dipping method. Water quality parameters (temperature and dissolved oxygen) were recorded. Immature insects were reared to adulthood and identified using morphological keys.

A total of 4,429 ovitraps were positive, with ovitrap and egg density indices at 82.2% and 51.3%, respectively. Immature *Aedes* were found in 73.0% of breeding sites, with higher positivity in semi-urban (56.8%) than urban areas (43.2%). Artificial habitats dominated breeding sites (>88%), with disused tyres (13.1%) and plastic containers (12.1%) being the most common. Water temperature was significantly higher in urban areas ($28.17^{\circ}\text{C} \pm 2.11$) than semi-urban areas ($27.85^{\circ}\text{C} \pm 2.01$), while dissolved oxygen was higher in semi-urban sites ($4.42 \text{ mg/L} \pm 0.94$ vs. $4.08 \text{ mg/L} \pm 1.07$). Adult *A. aegypti* emergence from ovitrap-collected eggs was higher in urban areas, whereas *A. aegypti* and *A. albopictus* from dipping-collected larvae were more abundant in semi-urban areas. House, Container, and Breteau indices exceeded WHO transmission thresholds, indicating a high risk of arboviral outbreaks.

The prevalence of artificial breeding sites, especially in semi-urban areas, highlights the need for targeted larval source reduction. Community-based interventions, including proper disposal of water-holding containers, are essential for effective vector control.



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sciforum-107901: Evaluating the Effect of African Basil, Garlic Vine, Lemongrass, and Moringa Extracts on *Aedes aegypti* Larval Stage: A Sustainable and Natural Method

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Millions of people suffer from mosquito-borne infections yearly, including dengue fever, chikungunya, and the Zika virus. All these infections pose great threats to global health. The main vector population requires careful management to prevent its spread. This study delves into the larvicidal activity of hexanolic extracts prepared from different plants as a measure of controlling and reducing the larval population of *Aedes aegypti* (Linnaeus) in New Delhi, India. Some of the plants explored in this study include African basil, garlic vine, lemongrass, and moringa leaves. The WHO standard protocol was used for the evaluation of the larvicidal activity of various plant extracts. All the plants were potent and excellent against *Aedes aegypti* larvae, with the larvicidal activity ranging from 10.503 ppm to 6.376 ppm. The LC₅₀ of *Cymbopogon citratus* was 10.503 ppm after exposure for 24h and decreased to 1.924 ppm after 48h. Among the four plants tested in this experiment, *Cymbopogon citratus* was 3.92 fold more effective than *Moringa oleifera*, 5.73 fold more effective than *Ocimum gratissimum*, and 5.94 fold effective than *Mansoa alliacea* within the 24h exposure period. With emphasis on the development of natural measures to control mosquitoes, the present study intends to design novel and efficient methods to manage mosquitoes and also reduce disease transmission. The findings of this research might provide the reader with insight into the development of new insights and applications of plant-based larvicides, creating eco-friendly means of controlling mosquito populations and conserving these populations from spreading hazardous diseases.



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sciforum-118227: Evaluating the impact of the ovitrap size and substrate on the collection of *Aedes albopictus* (Diptera: Culicidae) eggs in a field study in Athens, Greece

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Aedes albopictus, known as the Asian tiger mosquito, is an invasive mosquito species and a key vector of several mosquito-borne diseases. Since its first record in Greece in 2003-2004, it has been established in almost all areas of the country, including Athens. Effective mosquito surveillance is vital for controlling mosquito populations. Ovitrap have been extensively used as a surveillance tool for *Ae. albopictus*, while their efficiency may vary depending on various factors such as the size and the substrate type. This study investigates the influence of trap size and substrate material on *Ae. albopictus* egg catches under field conditions. Over a 12-week period, a network of ovitraps of three different sizes —350 mL (small), 600 mL (medium), and 1100 mL (large)— were set up at the campus of the Agricultural University of Athens, Greece. Each trap was filled to three-quarters of its capacity with water and equipped with one of two types of substrates: a wooden strip or styrofoam. The traps were monitored weekly, using a 6 × 6 Latin square design for trap rotation. A zero-inflated negative binomial model was utilized to analyze the egg count data. The results showed a significant effect of both substrate and trap size on the collection of *Ae. albopictus* eggs. Wooden substrates were more effective, collecting almost double the number of eggs than styrofoam. Regarding the trap size, large and medium traps significantly outperformed small traps, catching a mean of 38.5 (± 5.06), 44.4 (± 5.98), and 24.7 (± 5.03) eggs per week, respectively, while no profound difference was identified between large and medium sizes. Our findings demonstrate that wooden substrates and larger trap sizes are the most effective combination for *Aedes albopictus* egg collection. This study provides insights from the field for optimizing ovitrap design to improve mosquito population surveillance and control strategies.



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sciforum-118049: Insecticide Susceptibility and kdr Mutation in *Aedes* Mosquitoes: Implications for Arboviral Disease Control in Ibadan, Nigeria

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Introduction

Aedes albopictus and *Aedes aegypti* are the primary vectors of arboviral diseases such as dengue, chikungunya, and yellow fever. In the absence of effective vaccines for most of these infections, vector control through insecticide use remains the primary preventive strategy. However, increasing resistance to multiple insecticide classes among *Aedes* mosquitoes poses a significant challenge, potentially compromising control efforts. Assessing insecticide susceptibility and resistance mechanisms is crucial for developing effective and sustainable vector management strategies. This study evaluated the insecticide susceptibility and kdr mutation frequency in *Aedes* populations from urban and semi-urban areas of Ibadan, Nigeria, to support targeted control interventions.

Methods

Immature *Aedes* mosquitoes were collected from natural and artificial breeding sites in Ibadan North (urban) and Akinyele (semi-urban) LGAs and reared to adulthood (F1 progeny). Insecticide susceptibility tests were conducted on adult mosquitoes using the CDC bottle bioassay with WHO diagnostic doses of deltamethrin, permethrin, bendiocarb, and pirimiphos-methyl. PCR assays were performed on pyrethroid-exposed mosquitoes to detect the kdr (F1534C) mutation through direct sequencing of PCR products.

Results

Insecticide susceptibility tests revealed that *Aedes aegypti* exhibited resistance to permethrin in both urban (89.4% ± 1.9% mortality) and semi-urban (88.9% ± 9.3% mortality) areas, whereas *Aedes albopictus* remained fully susceptible. Both species demonstrated complete susceptibility to pirimiphos-methyl (>99%) and bendiocarb (>99%). The kdr (F1534C) mutation frequency was low (0.06–0.22), suggesting minimal target-site resistance to pyrethroids.

Conclusion

The observed resistance of *Aedes aegypti* to permethrin underscores the need for continuous insecticide resistance monitoring and the adoption of rotational insecticide use in vector control programs. The low kdr mutation frequency suggests that other resistance mechanisms, such as metabolic resistance, may be involved. Implementing integrated vector management strategies is essential for the effective and sustainable control of *Aedes*-borne diseases.



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sciforum-117042: Integrated Morphological and Molecular Differentiation of *Culicoides oxystoma* and *Culicoides kingi* (Diptera: Ceratopogonidae) in India

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Culicoides kingi and *Culicoides oxystoma* belong to the Schultzei group of biting midges, which are significant vectors of livestock diseases in India. The morphological identification of these species remains challenging due to overlapping characteristics, making species-specific identification crucial for resolving taxonomic ambiguities and understanding their roles in disease transmission. This study aims to develop accurate tools for differentiating *C. oxystoma* from *C. kingi* using traditional morphometry and DNA-based identification assays which can be effectively utilized. Specimens were collected from various regions of India. A total of 143 *C. oxystoma/C. kingi* individuals were identified using a combination of traditional morphometric analyses and PCR targeting the cytochrome c oxidase subunit I gene. Thirteen morphometric measurements were taken from the head, wings, and abdomen of slide-mounted specimens for species discrimination. Five morphometric characteristics such as the antennae, wings, spermathecae, maxillary palp with size and shape of the sensory pit, and the hind tibial comb proved to be effective for species differentiation. Molecular phylogenetic analysis further validated the accuracy of the DNA-based identification approach, demonstrating its efficiency as a simple and rapid molecular identification tool. This study provides the first comprehensive differentiation of both species in India using a combination of morphological and molecular techniques. The application of identification from female genitalia and the DNA-based identification method offers a reliable approach for species identification, which can be instrumental in future epidemiological studies at national and international levels.



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sciforum-118200: Italy as a Hotspot for Honey Bee Threats

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Italy is increasingly a hotspot for honey bee pests and predators, facing threats from *Varroa destructor* (1981), *Aethina tumida* (Small Hive Beetle, SHB) (2014), invasive *Vespa velutina* (2012), and the expanding native *Vespa orientalis* (2018). Adding to these concerns, *Tropilaelaps* spp. are emerging as a potential new threat to European beekeeping.

Tropilaelaps mercedesae mites, established since 2021 in Russia's Krasnodar region and more recently in Georgia's Samegrelo-Zemo Svaneti region (2024), pose significant challenges due to their rapid reproductive cycle and lack of effective control options. Unlike in Asia, where *Tropilaelaps* is well known, European beekeeping differs in hive management and honey bee species, requiring tailored surveillance and mitigation strategies.

Infestations spread quickly through direct contact between bees and the movement of infested bees or brood. Left undetected, mite populations grow rapidly, causing high hive mortality and acting as vectors for honey bee viruses.

The presence of exotic pests in Italy highlights the need for proactive measures. With *Varroa*, SHB, and *Tropilaelaps* all regulated under the Animal Health Law (EU 2016/429), Italy already faces three of the four listed honey bee diseases (EU 2018/1629). Key challenges include identifying effective surveillance methods, developing veterinary medicinal products (currently unavailable in Italy), and refining hive management techniques for containment and control.

The responsibility for maintaining colony health and biosecurity lies with beekeepers, but a science-based strategy is urgently needed. Managing *Varroa*, SHB, and invasive wasps demands integrated pest management and coordinated monitoring. Addressing the absence of approved *Tropilaelaps* treatments in Italy is critical to safeguarding European apiculture.



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sciforum-118285: Malaria Vector Composition, Abundance, and Plasmodium Infection Rates in Rural Southwestern Nigeria: Implications for Targeted Control Strategies.

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Background: Malaria remains a major public health concern in Nigeria, particularly in rural communities where environmental and socio-demographic factors drive sustained transmission. Understanding mosquito species composition, abundance, and infection rates is essential for effective vector control interventions.

Methods: This study investigated malaria vector diversity and transmission dynamics in two rural communities, Igbo-Ora and Idere, in southwestern Nigeria. Indoor-resting mosquitoes were collected monthly during the 2022 rainy season using pyrethroid spray collection methods. Collected specimens were morphologically and molecularly identified, and circumsporozoite protein (CSP) ELISA was performed to detect *Plasmodium* infection.

Results: A total of 739 mosquitoes belonging to three genera (*Anopheles*, *Culex*, and *Aedes*) were collected, with *Anopheles* species being the most abundant (57.2%). Molecular identification of the *Anopheles gambiae* complex revealed three sibling species, *An. gambiae* s.s. (56%), *An. coluzzii* (31.2%), and *An. arabiensis* (10.1%), with hybrid forms also detected. *An. gambiae* s.l. was the primary malaria vector, comprising 70.4% of the *Anopheles* mosquitoes. Vector density varied between locations, with higher indoor resting density (IRD: 0.45) and man-biting rate (MBR: 0.11) in Idere compared to Igbo-Ora (IRD: 0.04; MBR: 0.01). Sporozoite infection rates were low, with only two *An. coluzzii* testing positive for *Plasmodium falciparum* CSP antigen in Igbo-Ora (2.53% infection rate).

Conclusion: The findings highlight the ecological factors influencing malaria vector distribution and transmission dynamics in rural Nigeria. The dominance of *An. gambiae* s.l. and localized differences in vector abundance emphasize the need for site-specific, adaptive vector control strategies. Continuous surveillance is essential, particularly in the context of insecticide resistance and evolving vector behavior, to enhance malaria intervention programs in endemic regions.



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sciforum-113065: Molecular Insights into Ixodid Tick (*Hyalomma scupense*): Potential Vector of Theileriosis in Algeria

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Ticks are major vectors of several pathogens of veterinary and medical importance. *Hyalomma scupense* is a potential vector of *Theileria annulata*, the parasite responsible for tropical theileriosis in cattle. This disease negatively impacts livestock production and causes substantial economic losses. Our study investigates the molecular and phylogenetic profiles of *Theileria* spp. in Algeria. A total of 40 *H. scupense* ticks were collected from Medea, Algeria, and five samples tested positive for *Theileria* spp. based on their COXIII mitochondrial partial sequences. These positive ticks were further analyzed using partial mitochondrial COXI and SSU 12S genes. The results revealed two novel haplotypes for the *H. scupense* 12S gene and one new haplotype for the *H. scupense* COXI gene. For *T. annulata*, one haplotype was identified, previously reported in Algeria from cattle blood. Phylogenetic analysis confirmed the genetic diversity of the detected haplotypes, providing insights into the evolutionary relationships of these parasites and their vectors. To our knowledge, this study represents the first molecular characterization of *T. annulata* from its vector, *H. scupense*, in Algeria. These findings highlight the need for continued research into the transmission dynamics and pathogenic mechanisms of this parasite to better understand its epidemiology and develop effective control strategies to mitigate its impact on livestock health.



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sciforum-113458: Public health concerns: Assessment of synanthropic status and sanitary risks of muscid flies (Insecta: Diptera) from wet market areas of Kolkata Metropolitan Area, West Bengal, India

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Introduction: Determination of the synanthropic index is essential for assessing the degree of association between species, in this case, necrophagous dipterans, and humans; thus, knowledge of synanthropic relationships is crucial not only from the perspective of animal ecology and behavior but also from the standpoint of human health and hygiene.

Methods: This study aimed to detect muscid flies with the highest synanthropy and relative abundance in and around the open wet markets of the Kolkata Metropolitan Area (KMA), along with their potential risk to human health and hygiene as potential carriers of pathogenic bacteria. Furthermore, pathogenic bacteria on both the external body surface and within the gut of the most abundant eusynanthropic muscid species were assessed, highlighting potential sanitary and hygiene concerns. To detect communities of bacteria, amplicon sequencing of the V3-V4 hypervariable region (16S rDNA) was performed using the Illumina (NOVASEQ 6000) platform.

Results: The experiment was conducted from 2022 to 2023 in twelve study sites involving four municipalities. A total of 4669 muscid flies representing seven genera and thirteen species were collected using baited traps. Differences in flies' abundance were evident across different environments. *Musca domestica* and *Musca sorbens* were the prevailing muscid species in urban and rural wet markets, with relative abundance values of 57.57 and 18.05, respectively. *Musca domestica* was also the most dominant fly in all of the three environments. Principal Component Analysis (PCA) indicated a robust connection between *Musca domestica* and urban wet markets, as evidenced by the highest synanthropic index (+91.14). Pathogenic bacterial genera like *Vibrio*, *Aeromonas*, *Enterobacter*, *Vagococcus*, *Proteus*, *Escherichia-Shigella*, *Pseudomonas*, *Acinetobacter*, *Klebsiella*, *Morganella*, etc., were identified from both the external body surface and gut of *Musca domestica*.

Conclusion: These results regarding muscid flies describe their role as potential vectors and can aid in assessing proper sanitation and promoting better control strategies instead of eradicating the whole fly community.



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sciforum-118205: The *Varroa destructor* Infestation: A Persistent Challenge for Beekeeping

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The infestation of *Varroa destructor* is one of the most critical challenges that global beekeeping faces, causing varroosis (or varroosis). First identified in the late 1960s in the Soviet Republics and Eastern Europe, *Varroa* reached Italy in 1981, spreading nationwide by 1985, and was detected in the Aosta Valley (the extreme northwestern part of the country) in 1988.

During the initial spread of the mite, varroosis was classified as a notifiable disease, requiring beekeepers to report infestations, monitor colonies, and adopt preventive measures, among which colony destruction was not unusual. In some regions, financial compensation was provided for apiary losses. As *Varroa* became endemic in Italian apiaries, attention shifted toward implementing authorized veterinary treatments, integrated pest-management strategies, and ongoing beekeeper education.

Over the years, the Ministry of Health has issued increasingly structured ordinances emphasizing prevention, monitoring, and treatment. Current guidelines recommend at least two annual interventions aligned with the parasite's biology and seasonal bee-colony cycles: i) after the main honey harvest and ii) before the wintering period. However, these interventions must be adapted to local climatic conditions and colony development stages. In certain regions, additional treatments may be required, considering factors such as infestation levels and nectar flow dynamics.

Beekeepers, supported by industry associations, play a central role in monitoring infestation levels and timing interventions. Effective *Varroa* control requires strategic planning and distributing treatments throughout the year. This approach ensures optimal colony health while minimizing the risk of significant losses.

Structured national surveillance is essential to monitor resistance to active ingredients used in treatments, safeguarding their continued efficacy. Timely, well-planned interventions, adapted to local conditions and the biological cycles of both the mite and the bees, are fundamental for managing *Varroa* infestations and maintaining the productivity and health of bee colonies.



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sciforum-113524: The Development of an Odor-Free Method for Rearing *Lucilia sericata* Larvae for Maggot Debridement Therapy

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Maggot debridement therapy (MDT) is the use of live maggots, mainly the larvae of *Lucilia sericata* Meigen (Diptera: Calliphoridae), to debride and stimulate the healing of chronic wounds, like diabetic ulcers. Despite its long history, dating back several centuries, the modern application of MDT remains scanty because of the limited commercial availability of medicinal maggots. One of the important challenges in rearing medicinal maggots is the unpleasant odor often arising from their rearing facilities, which has stood in the way of their wider use. Moreover, using raw meat may introduce pathogens that are difficult to eliminate, even with disinfection. This study aimed to devise an odor-free and safe method for the rearing of medicinal maggots in order to solve the major problem of odors in the rearing environment.

We established a colony of *L. sericata* and tested two substrates for egg-laying: a sterile protein substrate—Sondalis® Standard Fibre—and chicken liver (the traditional substrate). The female maggots showed a strong preference for ovipositing on the protein substrate, which lacked the foul odor characteristic of the chicken liver. The eggs were surface-sterilized with a 0.5% NaOCl solution that successfully killed the bacteria and yeasts on the eggs' surfaces while maintaining a high hatchability rate. In vitro antimicrobial testing showed no significant effect on larval viability or their antimicrobial activity.

This study provides a dependable and odor-free approach to the mass rearing of medicinal maggots, thereby pointing to its potential in the eradication of unpleasant odors in rearing facilities. In addition, it emphasizes the need for health professionals to be trained in MDT to increase the treatment options for wound care.



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sciforum-118411: Ticks and Tick-Borne Microorganisms in the United Arab Emirates: Diversity, Abundance, and Research Gaps

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The United Arab Emirates, like the rest of the world, is experiencing the effects of climate change, which significantly influences the abundance and distribution pattern of ticks and tick-borne microorganisms. Other factors, such as land use changes and habitat fragmentation, also contribute to the complexity of tick population dynamics. This review aims to assess the diversity of ticks infesting livestock and wildlife, analyze the variety and abundance of tick-borne microbes in the context of climate change, and identify research gaps in the field of tick studies within the country. A total of seventeen tick species belonging to four genera have been reported: *Amblyomma gemma*, *A. lepidum*, *Hyalomma anatolicum*, *H. excavatum*, *H. impeltatum*, *H. dromedarii*, *H. marginatum*, *H. truncatum*, *H. hussaini*-like, *H. scupense*, *H. rufipes*, *Rhipicephalus appendiculatus*, *R. evertsi*, *R. pulchellus*, *R. sanguineus*, *R. sulcatus*, and *Ornithodoros muesebecki*. The most commonly reported genera, *Hyalomma* and *Rhipicephalus*, are typically found on animals. Additionally, eight tick-borne microbes have been detected in ticks and animals, including Crimean–Congo hemorrhagic fever (CCHFV), *Anaplasma phagocytophilum*, *Coxiella*-like endosymbiont, *Coxiella burnetii*, *Francisella*-like endosymbiont, *Rickettsia* sp., *Theileria annulata*, and *T. ovis*. Microbiome studies in the UAE revealed that the microbial communities associated with *H. dromedarii* ticks vary throughout the year, with different bacterial genera dominating at different times. Dominant genera, such as *Staphylococcus*, *Bacillus*, *Francisella*, and *Corynebacterium*, have been consistently reported. Tick populations depend on a combination of large-scale climate influences, microclimates, host densities, and tick predators. Extreme temperatures, both hot and cold, and low humidity can reduce tick activity and survival, while excessive rainfall also inhibits their activity. The risk of human infection increases with the density of infected ticks, which varies locally. The study of ticks and pathogen lifecycles, microbial interactions, and host and habitat ranges is essential for targeted interventions.



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sciforum-118544: Vector and Pest Dispersal via Sun Heated Vehicle Microenvironments

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Some vector species have limited dispersal abilities. This includes important disease vectors such as *Aedes aegypti* which averages just over 100 meters flight range based on multiple studies. This limited dispersal provides hope to control the spread of diseases, but just as larvae are able to move in scrap tires, infected adult mosquitoes may also find means to disperse to geographic localities without the disease. While the ability to be transported in vehicles is often assumed, there is no published data showing that solar heating of vehicles can still allow vector organisms to find microenvironments that allow survival and transport. Insect pests species, including agricultural, are also able to use vehicles for transport to new areas. This study is the first to demonstrate temperatures and their high variability inside passenger cars. The sunlight heating from 45 to 460 minutes resulted in temperature ranges inside of trunks from 32.5°C to 43.5°C, the surface of shaded seats surfaces ranged from 42.2°C to a high of 62°C, while objects under the seat ranged from 32.5°C to 39.4°C. These areas protected from the highest temperatures, as well as glove boxes, console areas, and floor mats, should allow for the transport of the vectors, and their diseases, to new geographic areas. Controlling the spread of newly emerging diseases needs to include consideration of, and limiting, means of vector transport by vehicles. This may be critical for limiting the spread of vectors and their pathogens with the coming disease situations associated with climate change.



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