IBRA

INTERNATIONAL BEE RESEARCH ASSOCIATION

UNIVERSIDAD DE LOS ANDES VENEZUELA

INSTITUTE OF ORGANIC CHEMISTRY WITH CENTRE OF PHYTOCHEMISTRY
Bulgarian Academy of Sciences

WESTERN SYDNEY UNIVERSITY

Proceedings of the 2026 International Symposium on Stingless Bees– IBRA Webinar 17th to 18th June

Patricia Vit • Gina Meccia

editors

APIBA
Apiterapia & Bioactividad

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Mérida, Venezuela

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C O N T E N T S

FOREWORD

The 2026 International Symposium on Stingless Bees, organized as a webinar by the International Bee Research Association, brings together researchers and stakeholders united by a shared interest in one of the most diverse and functionally important group of pollinators. These proceedings reflect the breadth of contemporary stingless bee research, spanning chemistry, bioactivity, ecology, microbiology, meliponiculture, and emerging industry applications, among others, while also supporting the next generation of scientists through the Young Researcher Awards.

Recent years have seen growing recognition of the unique chemical composition, biological activity, and functional properties of stingless bee products. At the same time, the ecological importance of stingless bees in supporting tropical and subtropical agricultural systems and biodiversity has become increasingly evident, in the face of accelerating environmental change. The contributions presented here highlight both the complexity of these systems and the interdisciplinary approaches required to understand, protect and promote stingless bees and their products.

I commend the organizers, contributors, and participants for their dedication in bringing this symposium devoted to stingless bees to fruition, and I trust these proceedings will serve as a valuable resource for the continued advancement of stingless bee science.

Looking ahead, it is fitting to announce that the next International Symposium on Stingless Bees: Weaving Knowledge, Conservation, Research and Sustainable Livelihoods (2027 ISSB) will be held at The University of Queensland, in Brisbane, Australia. This symposium will build upon the momentum created by the current meeting and further showcase the diversity of stingless bee research. Brisbane is home to leaders such as Dr Tim Heard, whose multidisciplinary approach, spanning science and stingless bee keeping practice, continues to inspire and connect the stingless bee community worldwide. Fittingly, the defining discovery of trehalulose as the major disaccharide in stingless bee honey, research led by Emerita Professor Mary Fletcher, was also made in Brisbane.

I wish the 2026 symposium great success and lasting impact.

Natasha Hungerford
Brisbane, Australia
June 2026

PREFACE

I am delighted to write the Preface to this Book of Proceedings of the 3rd International Symposium of Stingless Bees (2026 ISBB). I was honored to participate in and be invited to write the Preface for the Proceedings of the 1st Symposium 2024 ISBB in Merida, Venezuela, but was unfortunately, I was unable to participate in the 2nd 2025 ISBB in Bicol, Philippines. These symposia are the initiative of Dr. Patricia Vit, well supported by her colleagues at Universidad de Los Andes, particularly MSc. Gina Meccia. It is most pleasing to see that this Symposium being strongly supported by IBRA, particularly through its Chair, Dr. Fani Hatjina.

Stingless bees have been only relatively recently been recognized by the scientific community and increasingly by the general population as highly useful species for the many unique qualities and attributes of colony products such as pot-honey, pot-pollen, cerumen, propolis, and geopropolis, as well as through their ecosystem services such as pollination. However, their values have been long recognized by local indigenous communities in many countries. It was therefore wonderful to see the increased worldwide status of stingless bees following the Government of Peru enacting Law No. 32235, declaring the Native Stingless Bee (genus *Melipona*) a matter of national interest and the flora it depends on a national treasure in January 2025, with two local municipalities passing Ordinances later in 2025, granting them special rights to exist and be supported. However, stingless bees around the world continue to be challenged by a multitude of (often overlapping) environmental stressors, including loss of floral and nesting resources, injudicious use of pesticides, colony management practices inconsistently optimizing colony health, pests and diseases, as well as impacts of climate change.

The 62 abstracts published in these proceedings address all of these above issues, advancing knowledge on chemistry, sensory, and bioactivity/medicinal/medical uses of colony products; biology, biodiversity and ecology of stingless bees; bee health and pests and diseases; and crop pollination and sustainable meliponiculture practices as well as other topics- with authors from 26 countries and all continents except Antarctica! My special congratulations to the recipients of Young Researcher Awards. You are the future for ongoing research and community engagement for advancement of stingless bees and meliponiculture.

Finally, my sincere thanks to the Organizers. I believe that due to your efforts this Symposium, like the two previous ones, will be a great success and I look forward to the continuation of what has been a wonderful initiative.

Robert Spooner-Hart
Sydney, Australia
June 2026

INTRODUCTION

The **2026 International Symposium on Stingless Bees** is organized as a **Webinar by the International Bee Research Association (IBRA)**.

In my capacity as the Chair of IBRA, I welcome all researchers working hard for this Symposium, either presenting their work or presenting and organizing the event. Research on stingless bees is increasingly important because these bees play major ecological, agricultural, economic, and scientific roles, especially in tropical and subtropical regions. They are contributors to biodiversity, providers of valuable bee products, and models for studying social evolution. Unlike some managed pollinators, stingless bees are native to many tropical regions and can be reared locally. This is particularly valuable for smallholder farmers in tropical countries. As environmental pressures increase worldwide, understanding and conserving stingless bees can help protect ecosystems, strengthen sustainable agriculture, and support food security for future generations. Furthermore, stingless bee honey is highly prized for its unique flavor and medicinal properties as often contains unique bioactive substances that differ from those found in honey produced by Western honey bee.

The 62 abstracts of 189 authors we received are from 26 countries. This is a remarkable number of researchers and participants showing great interest in stingless bees' research and stingless bees' products. An outstanding part of this symposium are the Young Researcher Awards, which are named after leading scientists in diverse disciplines of stingless bees' research: P Vit-Olivier in Pot-Honey Science, C Cervancia in Pollination by Stingless Bees, MZ Mustafa in Meliponitherapy, Father JS Moure in Taxonomy of Stingless Bees, and OM Barth in Palynology of Stingless Bees; as well as in Stingless Bee Biology.

This Symposium was inspired by the scientific conferences of the Founder and first Director of the International Bee Research Association IBRA –Dr. Eva Crane (1912–2007), the Bee Lady– A woman in science, renowned beekeeper, author, and scholar. One of the most prominent bee writers of the 20th century. She discovered that bees are responsible for pollinating at least 40% of our food crops. Her discoveries and contributions on beekeeping and bee science were influential

for the successful IBRA Conferences in Tropical Climates. A delicate and wise focusing on the climate and tropical ecology for bees. The IBRA International Conferences were initially on Apiculture in Tropical Climates, and then on Tropical Bees: 1976 London, UK; 1980 New Delhi, India; 1984 Nairobi, Kenya; 1988 Cairo, Egypt; 1992 Trinidad, Trinidad & Tobago; 1996 Heredia, Costa Rica; 2000 Chiang Mai, Thailand; and 2004 Ribeirão Preto, Brazil.

We continued, much later endorsing the 2024 International Symposium on Stingless Bees organized by Professor Patricia Vit, –the Honey Lady and Founder of ISSB– at Universidad de Los Andes in Merida, Venezuela, as a memorial to honor the legacy of Professor JMF Camargo (1941–2009) from Universidade de São Paulo, Ribeirão Preto, Brazil, and the 2025 International Symposium on Stingless Bees organized in Bicol, Philippines by Professor Amelia Nicolas at Central Bicol State University of Agriculture.

In a brief acknowledgment, I wish to thank all the authors of the abstracts published in this work, without whom this symposium would not have been possible, who keep their scientific interest in stingless bees alive. Many thanks also to the members of the scientific committees for their valuable comments to ensure the quality of the contributions received, as well as for those participating in the evaluation committees for the Young Researcher Awards.

Fani Hatjina
International Bee Research Association (IBRA), UK
Department of Apiculture, Institute of Animal Sceince ELGO DIMITRA, Nea Moudania, Greece
Apimondia Scientific Commission on Bee Health
June 2026

ORGANIZING COMMITTEE

2026 International Symposium on Stingless Bees – IBRA Webinar 17th to 18th June

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Hellenic Agricultural Organization DIMITRA, Nea Moudania, Greece
President

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Chair 2025 ISSB, Bicol, Philippines

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Guidelines of Young Researchers Awards (YRA)

The Award for Best Young Researcher in Pot-honey Science

2026 International Symposium on Stingless Bees, IBRA Webinar, 17-18 June

P Vit-Olivier Young Researcher Award in Pot-Honey Science

The *P Vit-Olivier Young Researcher Award in Pot-Honey Science* is a once-per-lifetime recognition of excellence in new generations of pot-honey scientists up to 40 years old. Professor Patricia Vit is known for the first proposal of *Stingless bee honey standards* (Bee World, 2004), editor of the Springer books *Pot-Honey. A Legacy of Stingless Bees* (2013) APIMONDIA Silver Medal, *Pot-Pollen in Stingless Bee Melittology* (2018), *Stingless Bee Nest Cerumen and Propolis* (2024) APIMONDIA Gold Medal, and Stingless Bee Therapeutic Biomaterials: Novel Anti-Antimicrobial-Resistant (AMR) Agents (in press). *Premio Mujeres en Ciencias de la Salud, Health Science* (ACFIMAN, 2023), and her research group of *Apitherapy and Bioactivity* (APIBA) in the Food Science Department, Faculty of Pharmacy and Bioanalysis, Universidad de Los Andes (ULA), Mérida, Venezuela. She was recipient of the UNU-BIOLAC Research Fellowship on microbiome of stingless bee nest materials at the University of California Riverside (2025). Her e-book *Gastronomia Meliponomia Atures* was the best Gourmand Awards honey book (2025, Saudi Arabia). As an IBRA Executive Council Member (2023–2026) she organized the IBRA Stingless Bees Scientific Team on looking at the standardization of pot-honey by the Codex Alimentarius Commission. New species of two stingless bees and one yeast were named after her: *Partamona vitae* Pedro and Camargo, 2003; *Starmerella vitae* A.R.O. Santos, P.B. Morais, Lachance & C.A. Rosa, 2018; and *Scaptotrigona vitorum* Engel, 2022. P Vit-Olivier started to analyze honey as a collaboration with Father Santiago López-Palacios who collected 26 samples while writing his book *Catálogo para una Flora Apícola Venezolana*. She believes that serving other colleagues is a good habit rewarding unexpected discoveries while mastering new techniques just for the pleasure to help. She organized the 2024 JMF Camargo International Symposium on Stingless Bees, Mérida, Venezuela, 26–29 June, and is the Founder Director of the online *Route of Living Museums of Stingless Bees in the World* –RUTA-MELI in short– where Professor Amelia Nicolas from the Central Bicol State University of Agriculture (CBSUA) is the General Director. This award aims boosting young scientists to accomplish their goals and best achievements, needed for discovery and innovation in pot-honey science.

Significance of the award

- Recognition of individual scientific excellence in pot-honey science, as an influential tool for future advancement and teamwork.
- The winner of the *P Vit-Olivier Young Researcher Award in Pot-Honey Science* will be awarded at the 2026 ISSB IBRA Webinar Closing Ceremony, and will receive:
  1. The Springer book Vit et al., Eds. 2013 *Pot-Honey. A Legacy of Stingless Bees*.
  2. One-year free e-subscription of the *Journal of Apicultural Research*, published by Taylor & Francis (t&f) on behalf of the International Bee Research Association (IBRA).

Application for the award

- The award is open to young scientists –40 years old or less by May 18 – presenting abstracts on pot-honey or stingless bee honey (SBH) for the 2026 ISSB IBRA Webinar, 17-18 June.
- The submitted abstract may be on any topic of pot-honey or SBH research: adulteration, bibliometrics, bioactivity, biodiversity, botanical origin, chemical markers, chemistry, entomological origin, ethnobiology, fermentation, medicine, meliponitherapy, melissopalynology, metabolomics, microbiology, microbiome, pharmacology, physicochemical analysis, post-harvest, rheology, sensory science, and standards.

Instructions to apply

Please, send one Email with the following information to Prof. Azmi W wahizatul@umt.edu.my

1. An English pdf of your favorite authored paper or book chapter on pot-honey.
2. Your submitted abstract on your pot-honey's pdf for consideration by the Scientific Board of the ISSB.
3. Explain the scientific relevance (maximum 100 words) of the pdf, including a link with your Google Scholar *h*-index.
4. Your brief *Curriculum vitae* with a *photo*, *date of birth* and *age* (maximum two A4 pages).

KINDLY NAME YOUR FOUR FILES AS FOLLOWS, USING APPLICANT (INITIALS AND SURNAME)

1 Award_submitted abstract_applicant
2 Award_ pdf_applicant
3 Award_scientific relevance h-index_applicant
4 Award_brief CV_applicant

Deadline for the 2026 Young Researcher Award Applications

To apply for the award, please send your application by 12.00 noon UK time on May 18, 2026. The results will be announced by June 18, 2026.

Evaluation of applications

The Award Committee is composed by a PhD member of each continent and the organizer of the symposium. All collected applications will be read, evaluated, and discussed to make the final decision. The number of publications and h-index are important, but also the relevance of the investigated problem, the results obtained, and the scientific soundness of the work.

2026 Young Researcher Award Committee

Professors	**Role in the Award Committee**	**Affiliation**
Wahizatul Azmi	Organizing Committee 2026 ISSB	University of Malaysia Terengganu
Patricia Vit	Secretariat, Venezuela AMERICA	Universidad de Los Andes
Rofela Combey	Member Ghana AFRICA	University of Cape Coast
Bajaree Chuttong	Member Thailand ASIA	Chiang Mai University
Francisco Tomás-Barberán	Member Spain EUROPE	CEBAS-CSIC
Mary Fletcher	Member Australia OCEANIA	University of Queensland

The Award for Best Young Researcher in Biology of Stingless Bees

2026 International Symposium on Stingless Bees, IBRA Webinar, 17-18 June

Young Researcher Award in Biology of Stingless Bees

Significance of the award

- Recognition of individual scientific excellence in biology of stingless bees, as an influential tool for future advancement and teamwork.
- The winner of the *2026 Young Researcher Award in Biology of Stingless Bees* will be awarded at the 2026 ISSB IBRA Webinar Closing Ceremony, and will receive:
  1, The 2020 Springer Nature book by C Grüter *Stingless Bees: Their Behaviour, Ecology and Evolution*.
  2. One-year free e-subscription of the *Journal of Apicultural Research*, published by Taylor & Francis (t&f) on behalf of the International Bee Research Association (IBRA).

Application for the award

- The award is open to young scientists –40 years old or less by May 18– presenting abstracts on biology of stingless bees for the 2026 ISSB IBRA Webinar, 17-18 June.
- The submitted abstract may be on any topic about biology of stingless bees research: behavior, bibliometrics, biodiversity, breeding and artificial insemination, botanical origin of dietary sources, chemical markers, chemistry, climate change, competition, defense strategies, enemies, entomological origin, evolutionary traits, genetics, melissopalynology, memory and cognitive activity, metabolomics, microbial associations, microbiome, nesting architecture and resources, nutritional value of bee food, physiology, pollination, symbiosis, and VOCs.

Instructions to apply

Please, send one Email with the following information to Prof. Azmi W wahizatul@umt.edu.my

1. An English pdf of your favorite authored paper or book chapter on biology of stingless bees.
2. Your submitted abstract on your biology of stingless bees' pdf for consideration by the Scientific Board of the ISSB.
3. Explain the scientific relevance (maximum 100 words) of the pdf, including a link with your Google Scholar *h*-index.
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To apply for the award, please send your application by 12.00 noon UK time on May 18, 2026. The results will be announced by June 18, 2026.

Evaluation of applications

The Award Committee is composed by a PhD member of each continent except Europe –replaced by Asia– and the organizer of the symposium. All collected applications will be read, evaluated, and discussed to make the final decision. The number of publications and *h*-index are important, but also the relevance of the investigated problem, the results obtained, and the scientific soundness of the work.

2026 Young Researcher Award Committee

Professors	Role in the Award Committee	Affiliation
Wahizatul Azmi	Organizing Committee 2026 ISSB	University of Malaysia Terengganu
Julieta Grajales-Conesa	Member, Mexico AMERICA	Universidad de Chiapas
Christopher A Mduda	Member, Tanzania AFRICA	University of Dar es Salaam
Mohd Z Mustafa	Member, Malaysia ASIA	Universiti Sains Malaysia
Fani Hatjina	Member, Greece EUROPE	Department of Apiculture, Institute of Animal Sceince- ELGO DIMITRA, Nea Moudania
Mary Fletcher	Chair, Australia OCEANIA	University of Queensland

The Award for Best Young Researcher in Palynology of Stingless Bees

2026 International Symposium on Stingless Bees, IBRA Webinar, 17-18 June

OM Barth Young Researcher Award in Palynology of Stingless Bees

The *OM Barth Young Researcher Award in Palynology of Stingless Bees* is a once-per-lifetime recognition of excellence in new generations of scientists specialized in palynology of stingless bees up to 40 years old. Ortrud Monika Barth Schatzmayr was born in Germany 08.11.1939, lives in Brazil since 1950, and naturalized Brazilian in 1962. PhD in Natural History of the National Faculty of Philosophy, Universidade do Brasil (1964). Pos-doctor in Celular Ultrastructure, Universities of Heidelberg and Freiburg, Germany (1966). Senior Researcher and Chief of Laboratory, Instituto Oswaldo Cruz, Fundação Oswaldo Cruz (since 1959). Ex-Associated Professor and actual Collaborating Professor of the Departments of Botany and Geology and Chief of the Laboratory of Palinology, Universidade Federal do Rio de Janeiro (since 1974). Senior Researcher of the Conselho Nacional de Desenvolvimento Científico e Tecnológico (since 1962). Acting in research and teaching in Palynology, Structural Virology and Cytology. Professional position: Senior Researcher (Full Researcher) at the Fundação Oswaldo Cruz, Instituto Oswaldo Cruz (IOC), and fellow of the CNPq (National Research Council). Present address: Instituto Oswaldo Cruz (IOC), Avenida Brasil 4365, 21040-900 Rio de Janeiro, Brasil. Briefly, 1959: Admission to the IOC. 1962–2023: Fellowships by the CNPq for research activities. 1965–1966: Research extension at the Forstbotanisches Institut der Universität Freiburg, Germany, by a grant of CNPq. 1966: Electron Microscopy training at Siemens A.G., Karlsruhe, Germany. 1967–1975: Responsible of the Ecology Section at IOC. 1975–1977: Responsible of the Center of Electron Microscopy at IOC. 1974–1976: Associated Professor of the Department of Botany, Instituto de Biologia, Universidade Federal do Rio de Janeiro. 1978: Electron Microscopy training at Carl Zeiss, Oberkochen, Germany. 1979–current: Chief and Senior Researcher of the Laboratory of Morphology and Viral Morphogenesis, IOC.1985 – current: Responsible of the Laboratory of Palynology, Department of Geography, Instituto de Geociências, Universidade Federal do Rio de Janeiro. Memberships: Sociedade Brasileira de Microscopia e Microanálise, Sociedade Brasileira de Virologia, Associação Latino-americana de Paleobotânica e Palinologia, Sociedade Botânica do Brasil, Sociedade Brasileira de Estudos do Quaternário. Referee of several scientific journals. Post-graduation development of human resources in Palynology (Botany) and Virus Ultrastructure and Cell Biology (Virology). Participation at National and International Congresses and Scientific Meetings. Financial supports obtained by Brazilian (CNPq, CAPES, FAPERJ, IOC) and International (DAAD, EEC, ORSTOM) agencies. Acting in research and teaching in Palynology, Structural Virology, and Cytology. Scientific production: more than 400 full papers published, ten books, and book chapters. Her h-index is 49 and has more than 10,000 citations. Her last book is on *Morfologia do Pólen de Plantas Essencialmente Arbóreas do Brasil Meridional* by Barth OM and Misumi SY (2023) DOI: 10.22533/at.ed.749231906 *My life among pollen grains, honey and bees* is her video for the 2025 ISSB Bicol, on a life devoted to research and scientific dissemination of natural melissopalynology. This award aims to support young scientists in reaching their goals and achievements on palynology of stingless bees in order to promote more research and discoveries.

Significance of the Award

- Recognition of individual scientific excellence in palynology of stingless bees, as an influential tool for future advancement and teamwork.
- The winner of the *OM Barth Young Researcher Award in Palynology of Stingless Bees* will be awarded at the 2025 ISSB Bicol Closing Ceremony, and will receive:

  1. The Springer Nature book Vit et al., Eds. 2018. *Pot-Pollen in Stingless Bee Melittology*.

  2. One-year free e-subscription of the *Journal of Apicultural Research*, published by Taylor & Francis (t&f) on behalf of the International Bee Research Association (IBRA).

  3. The e-book Barth OM, Misumi SY. 2023. *Morfologia do Pólen de Plantas Essencialmente Arbóreas do Brasil Meridional*. E-book. Atena Editora, Ponta Grossa, Paraná, Brazil. 440 pp.

Application for the Award

- The award is open to young scientists –40 years old or less by May 18– presenting abstracts on palynology of stingless bees for the 2026 ISSB IBRA Webinar, 17-18 June.
- The submitted abstract may be on any topic related to the palynology of stingless bees' research: Acetolysis, biodiversity, biogeography, botanical origin, classification, comparative biology, comparative morphology, geographical origin, habit, microscopic analysis, multifloral, natural pollen, nectariferous taxa, nectarless taxa, pollen frequency classes, polleniferous taxa, resiniferous taxa, and unifloral.

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Professors	Role in the Award Committee	Affiliation
Wahizatul Azmi	Organizing Committee 2026 ISSB	University of Malaysia, Terengganu
Ortrud M Barth	Chair, Brazil AMERICA	FIOCRUZ, Rio de Janeiro
Christopher A Mduda	Member, Tanzania AFRICA	University of Dar es Salaam
Analinda Fajardo	Member, Philippines ASIA	University of the Philippines Los Baños
Maria Dimou	Member, Greece EUROPE	Aristotle University of Thessaloniki
Elia Ramirez-Arriaga	Member, Mexico AMERICA	Universidad Nacional de Mexico

The Award for Best Young Researcher in Taxonomy of Stingless Bees

2026 International Symposium on Stingless Bees, IBRA Webinar, 17-18 June

Father JS Moure Young Researcher Award in Taxonomy of Stingless Bees

The *Father JS Moure Young Researcher Award in Taxonomy of Stingless Bees* is a once-per-lifetime recognition of excellence in new generations of scientists specialized in biology of stingless bees up to 40 years old. Father Jesus Santiago Moure (1912-2020) was a Priest from the Claretians and a Professor at Universidade Federal do Paraná (Curitiba, Brazil) for almost six decades. He was born in Ribeirao Preto, São Paulo state, Brazil, and passed away in Batatais, São Paulo state, Brazil. His famous Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region thanks to Prof. GAR Melo. Father Moure was the recipient of the Brazilian awards *National Order of Scientific Merit (1995)* and *Great Cross of the National Order of Scientific Merit (1998)*. As a prolific taxonomist, he left an important imprint on the taxonomic research of stingless bees, describing 16 new genera from the Neotropics, as follows in chronological order: *Scaptotrigona* Moure, 1942; *Geotrigona* Moure, 1943; *Schwarziana* Moure, 1943; *Duckeola* Moure, 1944; *Friesella* Moure, 1946; *Schwarzula* Moure, 1946; *Tetragonisca* Moure, 1946; *Celetrigona* Moure, 1950; *Dolichotrigona* Moure, 1950; *Leurotrigona* Moure, 1950; *Trigonisca* Moure, 1950; *Aparatrigona* Moure, 1951; *Ptilotrigona* Moure, 1951; *Nogueirapis* Moure, 1953; *Trichotrigona* Camargo and Moure, 1983; and *Camargoia* Moure, 1989. In addition to seven genera endemic to Africa: *Apotrigona* Moure, 1961; *Axestotrigona* Moure, 1961; *Cleptotrigona* Moure, 1961; *Liotrigona* Moure, 1961; *Meliplebeia* Moure, 1961; *Plebeiella* Moure, 1961; and *Plebeina* Moure, 1961. And additional 11 genera found in Asia and Australia: *Austroplebeia* Moure, 1961; *Geniotrigona* Moure, 1961; *Homotrigona* Moure, 1961; *Lisotrigona* Moure, 1961 *Lophotrigona* Moure, 1961; *Odontotrigona* Moure, 1961; *Pariotrigona* Moure, 1961; *Platytrigona* Moure, 1961; *Tetragonilla* Moure, 1961; *Tetragonula* Moure, 1961; and *Tetrigona* Moure, 1961. This award aims to support young scientists in reaching their goals and making the biggest contributions to the taxonomy of stingless bees in order to promote innovation and research.

Significance of the award

4. Recognition of individual scientific excellence in taxonomy of stingless bees, as an influential tool for future advancement and teamwork.
5. The winner of the *Father JS Moure Young Researcher Award in Taxonomy of Stingless Bees* will be awarded at the 2026 ISSB IBRA Webinar Closing Ceremony, and will receive:
   1. The Springer book Vit et al., Eds. 2013 *Pot-Honey. A Legacy of Stingless Bees* book chapters authored by late CD Michener *The Meliponini*, and by late JMF Camargo *Historical Biogeography of the Meliponini (Hymenoptera, Apidae, Apinae) of the Neotropical Region*.
   2. The Springer Nature book Vit et al., Eds. 2024 *Stingless Bee Nest Cerumen and Propolis* Vol. 1.
   3. One-year free e-subscription of the *Journal of Apicultural Research*, published by Taylor & Francis (t&f) on behalf of the International Bee Research Association (IBRA).

Application for the award

- The award is open to young scientists –40 years old or less by May 18– presenting abstracts on taxonomy of stingless bees for the 2026 ISSB IBRA Webinar, 17-18 June..
- The submitted abstract may be on any topic related to the taxonomy of stingless bees' research: Biodiversity,` biogeography, cladistics, classification, comparative biology, comparative morphology, nomenclature, phylogeny. species delimitation, systematics, taxonomic revision, trait evolution, etc.

Instructions to apply

Please, send one Email with the following information Prof. Azmi W wahizatul@umt.edu.my
1. An English pdf of your favorite authored paper or book chapter on taxonomy of stingless bees.
2. Your submitted abstract on your taxonomy of stingless bees' pdf for consideration by the Scientific Board of the ISSB.
3. Explain the scientific relevance (maximum 100 words) of the pdf, including a link with your Google Scholar *h*-index.
4. Your brief *Curriculum vitae* with a *photo*, *date of birth* and *age* (maximum two A4 pages).

KINDLY NAME YOUR FOUR FILES AS FOLLOWS, USING APPLICANT {INITIALS AND SURNAME)]

1 Award_submitted abstract_applicant
2 Award_ pdf_applicant
3 Award_scientific relevance h-index_applicant
4 Award_brief CV_applicant

Deadline for the 2026 Young Researcher Award Applications

To apply for the award, please send your application by 12.00 noon UK time on May 18, 2026. The results will be announced by June 18, 2026.

Evaluation of applications

The Award Committee is composed by a PhD member of each continent and the organizer of the symposium. All collected applications will be read, evaluated, and discussed to make the final decision. The number of publications and *h*-index are important, but also the relevance of the investigated problem, the results obtained, and the scientific soundness of the work.

2026 Young Researcher Award Committee

Professors	**Role in the Award Committee**	**Affiliation**
Wahizatul Azmi	Organizing Committee 2026 ISSB	University of Malaysia Terengganu
Eduardo AB Almeida	Chair, Brazil AMERICA	Universidade de São Paulo, Ribeirão Preto
Jane M Macharia Kanyi	Member, Kenya AFRICA	National Museums of Kenya, Nairobi
Wahizatul A Azmi	Member, Malaysia ASIA	Universiti Malaysia Terengganu, Kuala Nerus
Claus Rasmussen	Member, Denmark EUROPE	Aahrus Universitet
Tim A Heard	Member, Australia OCEANIA	Sugarbag Bees, Brisbane

The Award for Best Young Researcher in Meliponitherapy

2026 International Symposium on Stingless Bees, IBRA Webinar, 17-18 June

MZ Mustafa Young Researcher Award in Meliponitherapy

The *MZ Mustafa Young Researcher Award in Meliponitherapy* is a once-per-lifetime recognition of excellence in new generations of meliponitherapy scientists up to 40 years old. Professor Mohd Zulkifli Mustafa is a DVM renowned neuroscientist whose research on the benefits of honey in enhancing memory and combating brain diseases, and has driven his mission to boost Malaysia's production of high-quality honey. He serves as the *Project Leader for the Advanced National Honey Landmark (AnNaHL) Translational Centre at Universiti Sains Malaysia (USM)* and is also the *Vice President of APIMONDIA Regiona Commissionl Asia*. Currently Dr. Mustafa is actively managing five preclinical and ten clinical research studies on the medicinal applications of stingless bee honey, focusing on its potential in treating various health conditions. At the national level, he pioneered the *KELULUNOMIC initiative*, a comprehensive program dedicated to stingless bee conservation while fostering socio-economic development within communities. This initiative began with the *Reinventing Honey Quality (RHQ)* project, leading to several significant patented innovations that improved honey quality, including: the *MUSTAFA Hive, the HILDA System (honey dehydration system) and the KEIFh System (honey quality control device).* Furthermore, he played a pivotal role in establishing *Malaysia's first GMP, HACCP, and ISO 22000-Certified Stingless Bee Honey Production Facility*. His dedication to education and industry development has led to the training of over 4,000 stingless bee keepers nationwide. In addition to his contributions to stingless bee keeping and industry development, He is also the *Founder & CEO of Brainey Sdn Bhd*, a USM spin-off company committed to re-engineering the stingless bee industry and unlocking its full potential as an innovation-driven national commodity. Dr. Mustafa has received numerous prestigious accolades for his groundbreaking contributions to stingless bee research and innovation. Notable among these are the *ArtScience Award 2022*, recognizing the fusion of scientific excellence and creative innovation; the *National Agriculture Innovation Award*, celebrating transformative advancements in sustainable agricultural practices; and the *Entrepreneur Icon Award*, honoring his exceptional efforts in translating research into impactful commercial ventures. The purpose of this award is to encourage young scientists to reach their objectives and best results, which are essential for innovation and discovery in meliponitherapy.

Significance of the award

6. Recognition of individual scientific excellence in pot-honey science, as an influential tool for future advancement and teamwork.
7. The winner of the *MZ Mustafa Young Researcher Award in Meliponitherapy* will be awarded at the 2026 ISSB IBRA Webinar Closing Ceremony, and will receive:
   1. The Springer Nature book Vit et al., Eds. 2026 *Stingless bee therapeutic biomaterials: Novel anti-antimicrobial-resistant (AMR) agents* (submitted)
   2. One-year free e-subscription of the *Journal of Apicultural Research*, published by Taylor & Francis (t&f) on behalf of the International Bee Research Association (IBRA).

Application for the award

- The award is open to young scientists –40 years old or less by May 18– presenting abstracts on meliponitherapy for the 2026 ISSB IBRA Webinar, 17-18 June.
- The submitted abstract may be on any topic of meliponitherapy research: Anti-inflammatory effects, antimicrobial properties, antioxidant activity, bioactive compounds, cerumen, chronic disease management, clinical applications, complementary and alternative medicine (CAM), functional foods, holistic healing, immunomodulation, memory, phytochemical analysis, pot-honey, pot-pollen. propolis, stingless bee biomaterials' pharmacology, therapeutic potential, traditional medicine, and wound healing.

Instructions to apply

Please, send one Email with the following information to Prof. Azmi W wahizatul@umt.edu.my

1. An English pdf of your favorite authored paper or book chapter on meliponitherapy.
2. Your submitted abstract on your meliponitherapy's pdf for consideration by the Scientific Board of the ISSB.
3. Explain the scientific relevance (maximum 100 words) of the pdf, including a link with your Google Scholar *h*-index.
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Evaluation of applications

The Award Committee is composed by a PhD member of each continent except America, and the organizer of the symposium. All collected applications will be read, evaluated, and discussed to make the final decision. The number of publications and h-index are important, but also the relevance of the investigated problem, the results obtained, and the scientific soundness of the work.

2026 Young Researcher Award Committee

Professors	Role in the Award Committee	Affiliation
Wahizatul Azmi	Organizing Committee 2026 ISSB	University of Malaysia Terengganu
Patricia Vit	Chair, Venezuela AMERICA	Universidad de Los Andes, Merida
Vassya Bankova	Member Bulgaria EUROPE	Bulgarian Academy of Sciences
Cristina Mateescu	Member Rumania EUROPE	Laboratoarele Medica, Otopeni
Mary Fletcher	Member Australia OCEANIA	University of Queensland

The Award for Best Young Researcher in Pollination by Stingless Bees

2026 International Symposium on Stingless Bees, IBRA Webinar, 17-18 June

C Cervancia Young Researcher Award in Pollination by Stingless Bees

The *C Cervancia Young Researcher Award in Pollination by Stingless Bees* is a once-per-lifetime recognition of excellence in new generations of scientists specialized in pollination by stingless bees up to 40 years old. Professor Cleofas Cervancia is a renowned figure in Philippine bee research and extension, particularly in the use of stingless bees (*Tetragonula biroi*) for pollination across Asia. The UPLB Bee Program training course created quite a buzz, making farmers, researchers, students, teachers, hobbyists, and practicing beekeepers swarm the University in order to learn more about it. She has pioneered beekeeping technologies, including stingless bee propagation, wild honey harvesting, and bee product processing, contributing to agricultural productivity, food security, and environmental sustainability. Dr. Cervancia's work has reduced pesticide use, conserves bee populations, and created livelihood opportunities for farmers. Her interdisciplinary approach has led to collaborations across fields, resulting in innovations like mathematical models, pollen identification tools, and key policies in beekeeping. She holds a patent for technology tracing bee product origins and has made significant strides in bee health, ensuring strong colonies for effective pollination. Dr. Cervancia has also advanced meliponitherapy, demonstrating the therapeutic benefits of propolis and stingless bee honey for tumor treatment, wound healing, and more. Dr. Cervancia's recent project, *Supporting Countries with Data Collection for Monitoring Bee Diversity*, significantly advanced the understanding of Asian bee diversity. Her research has also contributed to the international pot-honey and propolis market and the establishment of small-scale stingless bee keeping enterprises in rural communities. Notably, she developed a technology for stingless bee pollination that has boosted crop yields, including mango, avocado, and coffee. As a leader in the field, Dr. Cervancia has served as *President of Apimondia Regional Commission of Asia* for 11 years, and is now an active member of the *Scientific Commission on Pollination and Bee Health*. She has received numerous awards, including the *Presidential Lingkod Bayan Award, the NRCP Achievement Award in Biological Sciences*, the *Scientific Productivity Award, and the UPLB Outstanding Alumni Award*. Recently, Dr. Cervancia received the *2016 Mt. Everest Pollination Award* and, *2023 APIBA Academic Excellence Award* and was named the *2024 Eminent Stingless Bee Scientist from the Philippines*, an honor conferred by Universidad de los Andes, Venezuela. She was conferred the title of *Academician by the National Academy of Science and Technology, Philippines*, in recognition of her significant contributions to the growth of Science & Technology in the country. She was an ambassador of coco-tech hives in international meetings, showing the Philippine innovation of Rodolfo Palconitin. This award aims to support young scientists in reaching their goals and making their best contributions to stingless bee pollination in order to promote innovation and research.

Significance of the award

8. Recognition of individual scientific excellence in pollination by stingless bees, as an influential tool for future advancement and teamwork.

9. The winner of the *Young Researcher Award in Pollination by Stingless Bees* will be awarded at the 2026 ISSB IBRA Webinar Closing Ceremony, and will receive:
   1. The Springer Nature Vit et al., Eds. 2018 book *Pot-Pollen in Stingless Bee Melittology*.
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Application for the award

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2026 Young Researcher Award Committee

Professors	Role in the Award Committee	Affiliation
Wahizatul Azmi	Organizing Committee 2026 ISSB	University of Malaysia Terengganu
Breno Freitas	Member, Brazil AMERICA	Universidade Federal do Ceara, Fortaleza
Peter Kwapong	Member, Ghana AFRICA	University of Cape Coast, Ghana
Cleofas Cervancia	Chair, Philippines ASIA	University of the Philippines Los Baños
Fani Hajitna	Member, Greece EUROPE	Department of Apiculture, Institute of Animal Sceince- ELGO DIMITRA, Nea Moudania
Stephen Trueman	Member, Australia OCEANIA	Griffith University, Brisbane

PROGRAM

Videoconference IBRA Council Room
Compulsory Registration

<table>
<tr><th rowspan="2">UK Time</th><th>Wednesday</th><th>Thursday</th></tr>
<tr><th>17th June</th><th>18th June</th></tr>
<tr><td>11</td><td>Opening Ceremony</td><td rowspan="5">Oral presentations
No. 32-62</td></tr>
<tr><td>12</td><td rowspan="4">Oral presentations
No. 1-31</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>Closing Ceremony</td></tr>
<tr><td>17</td><td>Good bye</td><td>Good bye</td></tr>
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LIST OF PRESENTATIONS

We received 62 abstracts of 189 authors from 26 countries (Argentina, Australia, Belgium, Brazil, Burkina Faso, Denmark, Ecuador, El Salvador, Greece, India, Italy, Kenya, Korea, Malaysia, Mexico, Nepal, Panama, Philippines, Switzerland, Taiwan, Tanzania, Thailand, Uganda, United Kingdom, United States of America, and Venezuela), which we classified (C) in the last column to the right as 7 Africans (A), 21 Asians (S), 2 Australians (U), none European (E), 14 Multinationals (M), and 18 Neotropicals (N). Having 44 connected in person and 23 videos online presentations.

No.	Abstract Titles	Authors	C
	17th June		
1	Stingless Bee Therapeutic Biomaterials: Novel Anti-Antimicrobial-Resistant (AMR) Agents	Vit P	N
2	Microbiomes of Stingless Bee Nest Materials: Impact on Composition and Bioactivity of Fermented Pot-Honey, Pot-Pollen, and Propolis	Mora FD, Vit P	N
3	Taxonomic Identification of Stingless Bees (Hymenoptera: Apidae: Meliponini) from Selected Locations of Tanzania Using DNA Barcoding	Mduda CA, Makwinja FS, Hussein JM	A
4	Volatilome, botanical origin, and isolation of the mold *Gibellulopsis fusca* in Kelulut *Heterotrigona itama* honey fom Malaysia	Betta E, Vit P, Moreno E, Barbosa RN, Meccia G, Mora FD, Mustafa MZ, Biasioli F	M
5	Stingless Bee Nest Materials Using Bibliometrics: Healing Biomolecules, Nutritional and Bioactive Characterizations	Vit P, Chuttong B	M
6	Kelulunomic in Action: Transforming Stingless Bee Keeping into a Profitable and Evidence-Based Industry Workshop	Mustafa MZ, Nordin NI	S
7	Pot Honey from Yucatan; between Quality and Innocuity	Grajales-Conesa J, Zacarias-Calzada D, Balam-Ballote Y, López-García JA, Cimé-Pool A, Álvarez-Ruíz D, Torres de los Santos R, Albores Flores VJ	N
8	Stingless Bee *Heterotrigona itama* Foraging Ecology and Economic Value of Gelam Honey in Fragmented Gelam Forests	Azmi WA, Mamat MII, Mohamed NZ, Omar CM, Abdullah DM	S
9	Three Distinct Groups within *Tetragonula* Species in the Philippines	Baroga-Barbecho J, Wu CY, Tendero BJ, Locsin A, Cervancia C, Su YC	S
10	Geographic Distribution and Diversity of Pests Associated with Stingless Bees (*Tetragonula* spp.) in the Philippines	Baroga-Barbecho J, Sabino N, Anderson C, Luna D, Locsin A, Cervancia C	S
11	Colony Growth Dynamics of *Tetragonula biroi* in Coconut-Based and Diversified Farming Systems	Baroga-Barbecho J, Nuñeza O, Locsin A, Micor JR, Cervancia C	S
12	Volatilome of 13 Commercial Pot-Honeys from Bahia, Brazil	Betta E, Vit P, Meccia G, Lima R, Biasioli F	M
13	Foraging Activeness and Honey Production of Stingless Bee *Heterotrigona itama* in Marang, Terengganu, Malaysia	Fuaad MFL, Mamat II, Azmi WA, Rahman EA	S

No.	Abstract Titles	Authors	C
14	Integrative Morphological and Molecular Characterization of Pot-Pollen Resources used by Stingless Bees in Two Types of Tropical Forest in Ecuador: Implications for Conservation and Meliponiculture	Ocaña-Cabrera JS, Ron-Román J, Martin-Solano S, Saegerman C	M
15	Palynological analysis of honey to determine foraging preferences in six Brazilian stingless bee species (Meliponini)	Correia-Oliveira ME, Peixoto CM, Carvalho CAL	N
	B R E A K		
16	Managing Translocated Stingless Bee Species from Luzon to Visayas and Mindanao: Practical Farmer-Level Tools for Adaptive Meliponiculture	Gaitana LS	S
17	Morphological and Taxonomic Analysis of Meliponini Metatibial Keirotrichia	Jalil AH	S
18	Sustainable Meliponiculture with Vernacular Architecture in South East Asia	Jalil AH	S
19	Integrative Taxonomy of Stingless Bees Using Morphological and DNA Barcoding Techniques	Kumar V	S
20	Thermal Tolerance and Vulnerability to Heat Stress in the Stingless Bee *Tetragonisca angustula* Under Controlled Experimental Conditions	Puscan JR, Hrncir M	N
21	Integrated Multi-Analytical and Chemometric Profiling Reveals the Chemical Signatures of Matured Stingless Bee Honeys	Santos LFP, Boness HVM, Alves RMO, Lima MS, Souza CO, Boffo EF, Ribeiro CDF	N
22	Sensory Properties of Stingless Bee Honey from Argentina	Romero CA, Sosa N, Vallejos OA, Navarro AS, Yamul DK, Baldi Coronel BM	N
23	Legislation, Regulations, and Challenges in Wild Collection and Rearing of Stingless Bees (Meliponini) in Malaysia: Insights from Peninsular Malaysia, Sabah, and Sarawak	Chong JL	S
24	Pot-pollen Supplementation Reduces Fasting Glucose and Modulates the Gut Microbiota in High-Fat/High-Sucrose Fed C57BL/6 Mice	Rebelo KS, Nunez CEC, Cazarin CBB, Maróstica Júnior MR, Kristiansen K, Danneskiold-Samsøe NB	M
25	Efficiency of Stingless Bee *Tetragonula biroi* (Friese, 1898) as Pollinator of Red Hot F1 Hybrid Hot Pepper (*Capsicum frutescens* x C. *annuum*) in the Philippines	Deyto RC, Cervancia C	S
26	Preliminary Microbiome of Erica *Melipona favosa* (Fabricius, 1798) from Paraguana Peninsula, Venezuela	Stajich EJ, Wu-Woods J, Reschini A, Vit L, Vit D, Vit P	M
27	Antibacterial Activity and Synergistic Effect of Mexican *Melipona beecheii* Pot-Pollen Extracts Against Drug-Susceptible and Multidrug-Resistant *E. coli* Strains	Ortiz-Vázquez E, Díaz-Medina C, Chan-Paz A, Sierra JR, Pool-Yam F, Yam-Puc A, Uc-Cachón AH, Molina-Salinas GM	N
28	Stingless Bee Keeping in Uganda: A Developing Industry	Kasangaki P, Otim SA, Mugume R, Abila PP, Angiro C, Chemurot M	A
29	Floral Resources Used by *Melipona favosa* for Honey Production in the Lara Semiarid Region, Venezuela	Castro-Laportte M, Petit D, Ruíz-Zapata T, Lastres M, Guevara, P, Torrecilla P, Sánchez J	N
30	A Comprehensive HS-SPME-GC-MS Approach for the Volatile Characterization of Diverse *Tetragonisca angustula* Products from Venezuela	Betta E, Vit P, Meccia G, Biasioli F	M
31	Identification and Verification of Polyphenols and Aliphatic Acids Against Depression-Related Targets Through Antioxidant, UHPLC/Q-TOF-MS Analyses and In Silico Evaluation	Suhaimi NAA, Ghani FAA, Lukman Y, Shamsudin SH, Ismail MN, Muhammad SA, Mustafa MZ	S

No.	Abstract Titles	Authors	C
	18th June		
32	Comparative Detection of Mannitol Across Various Timepoints in Malaysian Kelulut Honey from *Heterotrigona itama* via UHPLC/Q-TOF-MS analysis	Suhaimi NAA, Ismail MN, Shamsudin SH, Muhammad SA, Nordin NI, Mustafa MZ	S
33	Optimized Production of *Frieseomelitta longipes* Propolis: a Sustainable Alternative for the Gran Sabana, Venezuela	Marcel N	N
34	Volatilome by HS-SPME-GC-MS of Venezuelan Angelita *Frieseomelitta longipes* Pot-Pollen and Propolis from El Paují, Venezuela	Meccia G, Betta E, Vit P, Marcel N, Oliveira FF, Mora F, Biasioli F	M
35	In Vitro Antifungal Evaluation of Ethanolic Stingless Bee Propolis Extracts Against *Ascosphaera apis* and *Aspergillus niger*	Amada A, Atienza A, Lopez P, Macale A, Sabino N	S
36	Evaluation of the Wound Healing Efficacy of *Tetragonula biroi* Friese Propolis Alginate Dressing in a Murine Full Thickness Excisional Wound Model	Bariuan JV, Rada SMU, Ang MJC, Calibo MBT, Arbis CCH, Collantes TMA, de Guzman ZM, Cervancia CR, Estacio MAC	S
37	Meliponiculture as a Territorial Platform for Conservation, Education, and Value Creation in El Salvador: The CREVAS Experience.	Takahashi S	N
38	Stingless Bee Tourism at Guáquira Ecological Reserve, Yaracuy, Venezuela.	Pietri O, Ortíz S	N
39	Viral Screening of Brazilian Meliponiculture: A Multi-Species Survey in the State of Bahia, Brazil	Peixoto CM, Neves VSL, Mello IKS, Silva JRQ, Correia-Oliveira ME, Carvalho CAL	N
40	Variation in Sugar Composition of Brazilian Stingless Bee Honeys: Insights from Ion Chromatography	Hungerford NL, Zhang J, Yates HSA, de Avelar Gomes CR, Nicodemo D, Fletcher, MT, Marelli J-P	U
41	Pests and Diseases of Australian Stingless Bees- an Update.	Spooner-Hart RN, Pickard G, Cook JM, McDougall RN	U
42	Physicochemical Variation of *Tetragonula biroi* Pot-Honey Across Selected Locations in the Philippines	Cinches JR, Mondejar E, Vit P, Chuttong B	M
43	Meliponitourism, an Approach to the Conservation of Bees in Tanzania	Krausa K, Steyn W	A
44	Native Stingless Bees Provide the Majority of the Pollination Services in Australian Mango Orchards	Singh G, Makinson J, Spooner-Hart R, Cook J	M
45	Pathogens and Parasites in Brazilian Stingless Bees	Correia-Oliveira ME, Neves VSL, Mello IKS, Silva JRQ, Peixoto CM, Carvalho CAL	N
	B R E A K		
46	Nesting Preferences and Habitat Associations of Stingless Bees in Mangrove, Forest and Farmland in Coastal Region, Tanzania	Lameck AM, Ahungu A, Mduda CA	A
47	Community Composition and Diversity of Stingless Bees (Hymenoptera: Apidae, Meliponini) Across Island and Mainland Habitats in Coast Region, Tanzania	Lameck AM, Ahungu A, Mduda CA	A
48	Nutritional Supplementation Enhances Physiological Resilience and Colony Productivity of *Tetragonula pagdeni* Under Nutritional and Pesticide-Related Stress	Maitip J, Charachit A, Straub L, Promsart W, Ungwiwatkul S, Chanasit W, Chuttong B, Wu M	S
49	Laboratory Studies Show Australian Stingless Bees are More Vulnerable to Pesticides than Honey Bees	Sapkota H, McDougall R, Makinson JC, Singh G, Cook JM, Spooner-Hart RN	M

No.	Abstract Titles	Authors	C
50	Physicochemical and Nutritional Properties of Stingless Bee Honey from Uganda	Chemurot M, Oromokoma C, Akite P, Mugume R, Kajobe R, Mangusho G, Matovu M, Kasangaki P	A
51	Meliponiculture as a Strategy for Participatory Conservation and Biocultural Innovation in El Salvador	Flores Soto BA, Martinez Beltrán OA, Sánchez Ávalos S, Takahashi S	N
52	Palynological Insights into Floral Resource Diversity of the Indo-Malayan Stingless Bee *Heterotrigona itama* in Fragmented Tropical Melaleuca Forests	Mamat MII, Khamis S, Fuaad MFL, Mohamed NZ, Omar CM, Abdullah DM, Azmi WA	S
53	Ecological Plasticity and Nesting Patterns of Stingless Bees in Urban Environments in Northwestern Argentina	Castro FM, Fabio Flores FF, Lupo LC	N
54	A Comprehensive Review on Stingless Bees (Putka Mauri): Species Diversity, Bio-ecology, Ethno-medicinal Significance, Conservation and Utilization Perspectives	Bohara CB, Bhandari D, Pandit B, Pariyar N, Mainali RP	S
55	Second Anniversary of the RUTA-MELI Route of Living Museum of Stingless Bees in the World	Vit P, Nicolas A	M
56	Bioculturality and Stingless Bee Keeping for the Symbiocene	Aldasoro Maya EM	N
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ABSTRACTS OF PRESENTATIONS

1

Stingless Bee Therapeutic Biomaterials: Novel Anti-Antimicrobial-Resistant (AMR) Agents

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Abstract

Antibiotic resistance (AMR) is a critical challenge of public health involving humans, animals, and the environment. Bacterial pathogens of clinical and public health importance are termed multidrug-resistant (MDR), extensively drug-resistant (XDR), and pan drug resistant (PDR). Twelve antibiotic-resistant bacteria were identified by the World Health Organization last year to guide research developing strategies to prevent and control AMR. The One Health viewpoint on AMR has different perspectives not limited to antibiotic therapies alone. Thus, including strategies to curb AMR, fighting bacterial infections with nanotechnology, silver emulsions, bacteriophages, marine products, algae, plant extracts, and insect-derived products for entomotherapy, and particularly focusing on stingless bees (SBs) meliponitherapy. Stingless bees (Hymenoptera, Apidae, Meliponini) are a biodiverse resource with 605 pantropical species. We propose a screening of stingless bee materials after demonstrating synergism of *Tetragonisca angustula* pot-pollen ethanolic extract with amikacin (a semi-synthetic antibiotic of the aminoglycoside class) and meropenem (a synthetic antibiotic of the carbapenem class) against six XDR gram-negative bacteria. This discovery might lead to a paradigm change regarding anti-antimicrobial-resistant (anti-AMR) agents. Compounds reversing AMR are known as antibiotic adjuvants, resistance breakers, antibiotic potentiators or chemosensitizers. The antimicrobial activity of those compounds is variable, but when co-administered with an antibiotic, they may potentiate the activity of the antibiotic and the synergism can be quantified. Stingless bee biomaterials from Brazil, Malaysia, Mexico, Tanzania, Thailand, and Venezuela were tested searching future prospects related to global AMR. Microbial associations with stingless bees gain relevant importance to elucidate the microbial origin of potential active biomolecules. Our scientific contribution from the biodiverse stingless bee world to the medicinal and clinical anti-AMR scenario is a novel scientific target. This book maps how much we have learned about this topic on SB anti-AMR potential non pharmacological alternative towards synthetic sources of most powerful biomolecules treasured in stingless bee nests.

Keywords: antibiotics, antimicrobial resistance (AMR), synergism, stingless bee nest materials

2

Microbiomes of Stingless Bee Nest Materials: Impact on Composition and Bioactivity of Fermented Pot-Honey, Pot-Pollen, and Propolis

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Abstract

Stingless bees (Meliponini) harbor a complex microbiome within their cerumen pots, honey, pollen, and propolis which actively contributes to product preservation, maturation, and bioactivity. Unlike *Apis mellifera*, Meliponini store food in sealed cerumen pots, creating unique microenvironments that select distinctive microbial communities, including *Starmerella* yeasts, lactic acid bacteria, and actinomycetes such as *Streptomyces*. Recent research reveals that these microorganisms act as biological cell factories, producing bacteriocins, volatile organic compounds, and other metabolites that synergize with conventional antibiotics. Notably, extracts from *Tetragonisca angustula* pot-pollen and propolis demonstrate synergistic effects with amikacin, meropenem, and polymyxin B against extensively drug-resistant Gram-negative bacteria (GNB), including *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*. A promising approach to addressing antimicrobial resistance (AMR) is provided by these cooperative antimicrobial networks. To effectively utilize the therapeutic potential of Meliponini nest microbiomes, advanced omics techniques are necessary. With a focus on recent developments in antimicrobial synergism against Gram-negative bacteria (GNB) creating antimicrobial resistance (AMR), We reviewed how the microbiome of meliponine nests influences the preservation and therapeutic qualities of stingless bee nest materials.

Keywords: antimicrobial resistance (AMR), microbiome, pot-honey, pot-pollen, propolis, stingless bees,

3

Taxonomic Identification of Stingless Bees (Hymenoptera: Apidae: Meliponini) from Selected Locations of Tanzania Using DNA Barcoding

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Abstract

Accurate taxonomic identification of stingless bees is critical for their conservation and sustainable management, yet morphological methods are often limited by species complexity and lack of expertise. This study employed DNA barcoding targeting a 650 bp fragment of the mitochondrial cytochrome oxidase I (COI) gene to identify stingless bee specimens collected from 19 locations across mainland Tanzania. A total of 28 specimens from wild colonies were analyzed, yielding reliable species-level identification (>97% similarity to reference sequences in the BOLD database) for 53.6% of the samples. Identified species included *Plebeina armata*, *Hypotrigona gribodoi*, *Axestotrigona ferruginea*, and *Dactylurina schmidti*. Specimens with barcode similarity between 95 - 97% were assigned to the genus *Axestotrigona*, with their taxonomic status remaining unresolved. Despite reliable identification, we observed significant morphological diversity among *P. armata* and *H. gribodoi* specimens, with average within-group genetic distances of 3.5 and 4.1%, respectively. Phylogenetic analysis corroborated these identifications and revealed potential cryptic speciation and genetic structuring consistent with geographical locations. The findings underscore the utility of DNA barcoding to complement traditional taxonomic approaches, and highlight the underexplored diversity of Afrotropical stingless bees. Further molecular and morphological studies are recommended to clarify species boundaries within the genus *Axestotrigona*, resolve taxonomic discrepancies in Afrotropical stingless bees, and improve regional biodiversity assessments.

Keywords: cytochrome oxidase I (COI), cryptic species, DNA barcoding, genetic diversity, Meliponini, stingless bees

4

Volatilome, Botanical Origin, and Isolation of the Mold *Gibellulopsis fusca* in Kelulut *Heterotrigona itama* Honey from Malaysia

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Abstract

Kelulut *Heterotrigona itama* (Cockerell, 1918) is an Asian stingless bee (Hymenoptera, Apidae, Meliponini) distributed in Brunei, Indonesia, Malaysia, Singapore, and Thailand. *Heterotrigona itama* pot-honey was collected from Kampung Pulau Berangan, Jerteh, Terengganu, Malaysia, was dehydrated up to 20% moisture. The botanical origin was assessed with acetolyzed palynology. Accessory pollen of the Fabaceae family was the most frequent, *Cassia* sp. 28% and aff. *Machaerium* sp. 40% of the total counts. Fifty-seven volatile organic compounds (VOCs) from different chemical classes were identified and quantified by relative abundance using Head Space-Solid Phase Micro Extracion/Gas Chromatography-Mass Spectrometry (HS-SPME/GC-MS): 9 aliphatic organic acids, 14 alcohols, 4 aldehydes, 1 aromatic, 12 esters, 4 ketones, 2 monoterpenes, 4 oxides, 2 sulfides, and 5 unknowns. phenylethyl alcohol exhibits antimicrobial and inhibitory activity of quorum sensing (Çevikbaş et al., 2024). Several of them have been reported as bioactive: 1. Dimethyl disulfide and dimethyl trisulfide lead to the change of β-galactosidases and the leakage of cellular nucleic acids from the bacterial cells. 2. Linalool oxides (cis/trans) are potent against *Staphylococcus aureus*. 3. Octanoic and nonanoic acids have broad spectrum microbicidal activity and inhibit *S. aureus* biofilm. 4. Alcohols such as ethanol, benzyl alcohol, and phenylethyl alcohol are commonly produced by yeast and bacterial fermentation. The mold *Gibellulopsis fusca* (Thirum. & Sukapure) Giraldo López & Crous 2018 was isolated for the first time from *H. itama* honey. Considering its phylogeny within Plectosphaerellaceae, its ecology as a soil inhabitant, and based on evidence of VOC production in related fungi, it is hypothesized that *Gibellulopsis fusca* produces bioactive VOCs with functions in microbial competition. A profile including compounds with antifungal and microbial competition, is similar to the reported for *Fusarium oxysporum* and other soil fungi, includimg acetic acid, ethyl acetate, ethanol, and linalool oxides, while linalool oxides are more likely of botanical origin.

Keywords: botanical origin, HS-SPME/GC-MS, *Heterotrigona itama*, *Gibellulopsis fusca*, pot-honey, Malaysia, volatile organic compounds (VOCs)

5

Stingless Bee Nest Materials Using Bibliometrics: Healing Biomolecules, Nutritional and Bioactive Characterizations

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Abstract

Combining traditional antibiotics with natural products, including the bioactive components of stingless bee nests, is a practical strategy to increase antibacterial potency against AMR. In the nests of stingless bees (Hymenoptera, Apidae, Meliponini), four components are processed: pot-honey, pot-pollen, cerumen, and propolis. In both traditional and contemporary medicine, secondary metabolites derived from plants and microbial processes combine to generate active biomolecules with a variety of health advantages. Using the Scopus database for a bibliometric overview with traditional rankings of authors, institutions, countries, sources of the publications, sponsors of the research, and subject areas, including the total number of publications and time-span. The following materials are converted by stingless bees: floral or extrafloral nectar and honeydew into pot honey; floral pollen into pot pollen; admixtures of plant resins and stingless bee wax into cerumen; and plant resins-latex-gums into propolis. The Scopus database's metadata on pot-honey, pot-pollen, stingless bee cerumen, and propolis research were covered in this bibliometric review (1955–2024). Top-three authors, institutions, countries, sources, sponsors, and subject areas in publications of stingless bee materials were tabulated. The search strategy for each material was different, corresponding to diverse query strings. Research on the more than 600 species of stingless bees is producing an increasing number of documentations. The Scopus database's taxonomy was helpful in comparing the output of stingless bee publications. They were suggested as an insect-derived substitute to reduce the threat to public health posed by antimicrobial resistance (AMR), investigating both their potential to combat AMR on their own and in combination with antibiotics.

Keywords: bibliometrics, bioactivity, biomolecules, stingless bee nest materials

6

Kelulunomic in Action: Transforming Stingless Bee Keeping into a Profitable and Evidence-Based Industry Workshop

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Abstract

The global demand for functional foods and natural therapeutics has positioned stingless bee honey as a high-value bioresource with significant untapped economic potential. Despite increasing interest, the stingless beekeeping sector remains largely fragmented, characterized by inconsistent product quality, limited standardization, weak supply chain integration, and insufficient clinical validation to support premium market positioning. This workshop addresses these critical gaps by presenting a holistic framework for transforming stingless beekeeping into a profitable, scalable, and evidence-driven industry. The session begins by elucidating the unique properties of stingless bee honey which differentiate it from conventional honey and underpin its emerging role as a functional food and ethnomedicinal resource. A key focus of the workshop is the development of a hygienic and value-preserving honey supply chain, emphasizing best practices from hive management to post-harvest processing. Participants will be introduced to critical control points, including moisture regulation, fermentation prevention, contamination risks, and innovations such as dehydration technologies and standardized harvesting systems. Strengthening these components is essential for ensuring product consistency, regulatory compliance, and market trust. The workshop further explores the translation of traditional knowledge into scientific evidence, highlighting ongoing clinical trials that investigate the therapeutic potential of stingless bee honey. In addition, participants will gain insights into product development and diversification strategies, moving beyond raw honey into high-value applications. Emphasis will be placed on innovation pipelines, intellectual property considerations, branding, and market positioning to enhance profitability and competitiveness. Ultimately, this workshop introduces the concept of "Kelulunomic"—an integrated approach that aligns science, entrepreneurship, and community-based production systems to drive sustainable income generation and industry expansion. By equipping participants with practical knowledge, strategic frameworks, and scientific insights, the session aims to empower stakeholders to elevate stingless beekeeping from a supplementary activity into a resilient and impactful bioeconomic sector.

Keywords: kelulunomic, meliponiculture, meliponitherapy

7

Pot-honey from Yucatan: Between Quality and Innocuity

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Abstract

Stingless bees are cultivated on a large scale in Yucatán for the consumption of honey, artisan nutraceutical products, and naturopathic medicinal treatments. Meliponiculture is part of the Mayan culture and contributes to preserving local knowledge through ritual practices, with pot-honey, propolis, pollen, and wax being economically important. In Yucatan, the species mainly cultivated is *Melipona beecheii*, and produces a natural sweet substance known as pot-honey, which composition varies according to the geographic region, botany, and storage conditions. However, the quality and safety standards for pot-honey are not the same as those proposed for *Apis mellifera* at Codex Alimentarius, thus, there is a need to establish these standards for this region. In this study, the physicochemical characteristics of pot-honey (humidity, free acidity, electrical conductivity, pH, HMF, diastase activity, total phenol content, flavonoids, and reducing sugars) and the microorganisms present in samples from six different municipalities (sites) of Yucatán State in Mexico were determined. We found that conductivity ranged from 0.013 to 0.023 mS/cm, HMF values from 2.38 to 5.93, free acidity from 4.5 to 1.5 meq/kg, polyphenols from 0.681 to 3.302 mgQE/mL, and flavonoids from 0.94 to 1.466mgQE/mL. Diastase and HMF content were low. The honey parameters of physical and chemical quality confirm that these kinds of products are in concordance with those from other tropical meliponii areas. Microbiological analysis reported the presence of coliforms and yeast in three of the six municipalities, which indicates poor practices in honey manufacturing processes. It was concluded that the microbiological results of pot-honey showed the need to standardize harvest techniques in order to comply with safety and quality standards.

Keywords: meliponiculture, physico-chemical, microorganism, food safety

8

Stingless Bee (*Heterotrigona itama*) Foraging Ecology and Economic Value of Gelam Honey in Fragmented Gelam Forests

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Abstract

Gelam forests in Terengganu, Malaysia, are ecologically important ecosystems known for their biodiversity and for producing unique monofloral Gelam (*Melaleuca cajuputi)* honey, which is widely used in traditional medicine. Despite its significance, there is limited information on the botanical origin of Gelam honey and its economic contribution, particularly amid increasing threats from land conversion and forest fragmentation. This study investigates the melissopalynological composition of Gelam honey and evaluates its economic value to local communities. Palynological analysis was conducted on pollen loads from 251 foraging workers of the stingless bee *Heterotrigona itama* collected from two meliponaries in fragmented Gelam forests. A total of 37 pollen types from 13 plant families were identified. *Melastoma malabathricum* and *Cyperus aromaticus* were the dominant pollen sources, showing high visitation frequency and floral constancy. These species, together with *Syzygium incarnatum*, are abundant within a 100-meter radius of the hives, reflecting the opportunistic foraging behaviour of *H. itama*. Although *Melaleuca cajuputi* (Gelam) pollen was present, its relatively low abundance suggests that habitat fragmentation affects floral resource availability. Continuous flowering of key species such as *Cyperus aromaticus* and *Melastoma malabathricum* provides a stable food source for bee colonies. The study also identifies other important plant species, including *Areca catechu*, *Cocos nucifera*, and *Mangifera indica*, highlighting complex plant–pollinator interactions within the ecosystem. Economic evaluation shows that stingless bee keepers harvest 20–150 kg of Gelam honey monthly, generating an average income of RM3000–RM4000 per month, or approximately RM15,000 during the five-month flowering season (July–October). These findings highlight the ecological and economic importance of Gelam forests and support the need for their conservation and sustainable management to sustain stingless bee populations and honey production.

Keywords stingless bee, *Heterotrigona itama*, melittopalynology, plant–pollinator interactions, Gelam forest ecosystem

9

Three Distinct Groups within *Tetragonula* Species in the Philippines

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Abstract

Twelve species across three genera were reported by Baltazar in 1966 and for over fifty years, no subsequent taxonomic reassessment of Philippine stingless bees has been conducted, despite their increasing ecological and economic importance. These native, resilient pollinators are widespread across the country and are increasingly managed for crop pollination and hive products, particularly species currently known as *Tetragonula biroi, T. laeviceps*, or *T. fuscobalteata*, whose taxonomic identities remain unclear. To fill this gap, molecular and morphometric analyses were performed to determine their taxonomic status. Adult bees were sampled from 170 managed colonies across the country between 2022 and 2023. A total of 205 individuals were examined using Restriction-site Associated DNA sequencing (RAD-seq) to produce genome-wide SNP data, while 81 specimens underwent detailed morphometric analysis based on 13 diagnostic features. RAD-seq analyses reveal three distinct genetic cluster within the genus *Tetragonula*, supported by morphometric clustering and brood structure. The three genetic–morphological clusters identified in this study are called the *biroi*, *sapiens,* and *laeviceps-fuscobalteata*, which together form an informal species group. Further studies are needed in order to formally resolve species boundaries using additional genetic, morphological, and ecological evidence. The three groups differed in body size, wing and tarsal dimensions, pronotum features, brood arrangement, behavior, and geographic location. Our results indicate that Philippine stingless bee diversity is underestimated and that multiple cryptic species exist within what is currently considered a single taxon in beekeeping. This study is the first genome-wide and morphometric reevaluation of Philippine stingless bees in over fifty years, providing a vital foundation for biodiversity documentation, conservation efforts, and the formulation of science-based policies for sustainable stingless bee-keeping in the Philippines.

Keywords: Meliponini, Philippine stingless bee, RAD-seq, *Tetragonula*

10

Geographic Distribution and Diversity of Pests Associated with Stingless Bees (*Tetragonula* spp.) in the Philippines

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Abstract

The Philippines is rich in stingless bee diversity, with *Tetragonula* spp. as the commonly propagated species for pollination and production of honey, pollen, and propolis. However, these bees are increasingly threatened by pests, diseases, and abiotic stressors. This study aimed to (1) identify pests associated with stingless bee colonies and (2) assess their geographic distribution in selected regions of the Philippines. Field surveys and colony inspections were conducted from 2024 to the present and collected pest specimens were identified using morphological methods. The major pests were hive beetles (*Aethina tumida*, *Procoryphaeus* sp., *Epuraea* sp.) and the lesser wax moth (*Achroia grisella*). *A. tumida* was detected in the Davao Region; *Procoryphaeus* sp. in the Bicol Region, Bukidnon, and Davao; *A. grisella* in Davao; and *Epuraea* sp. in Davao, Cavite, and Quezon Province. Minor pests, including black formicid ants and black soldier fly (*Hermetia illucens*) larvae, were also noted, typically found in weakened or dead colonies. In contrast, major pests were commonly found within nests, where they fed on pollen, weakening the colony due to food depletion. Our results warrant strengthening biosecurity measures. and the development of an IPM for stingless bees. This includes the burning of infested colonies and restricting bee movement. At the policy level, strengthened quarantine protocols, surveillance programs, and beekeeper training are critical for mitigating pest risks and supporting the sustainability of stingless beekeeping in the Philippines.

Keywords: Meliponini, pest distribution, stingless bees, Philippines, *Tetragonula* spp.

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Colony Growth Dynamics of *Tetragonula biroi* in Coconut-Based and Diversified Farming Systems

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Abstract

This study evaluates the colony performance of *Tetragonula biroi* across two contrasting agricultural systems in Lanao del Norte (Mindanao, Philippines) to determine the role of forage diversity in sustaining productivity and pollination services. Focusing on *T. biroi*, we compared colony growth dynamics in Ditucalan, a diversified agroecosystem, and Linamon, a coconut-based farming system. Results showed that colonies in Ditucalan increased steadily in weight, indicating robust growth and consistent productivity. Both sites showed initial colony expansion from July to October; however, Ditucalan maintained significantly higher performance throughout the study period. This trend is attributed to its diverse vegetation, including fruit trees, shrubs, vines, and herbs, which provide continuous nectar and pollen resources. In contrast, colony performance in Linamon declined after the removal of understory vegetation, which significantly reduced forage resources. Although coconut provided some floral resources, reliance on a monocrop proved insufficient to sustain long-term colony health and productivity. These findings emphasize the importance of diverse forage for supporting stingless bee colonies, enhancing pollination services, and ecological resilience within agricultural landscapes. Importantly, the results serve as the basis for developing a practical primer on coconut pollination using *Tetragonula biroi*, intended for local farming communities. Through this initiative, we translated scientific insights into accessible knowledge, emphasizing the need to maintain understory plants and establish diverse bee pastures. This approach not only improves the colony performance and pollination efficiency, but also strengthens livelihood sustainability, demonstrating the value of integrating ecological principles into community-based agricultural practices.

Keywords: agroecosystems, bee pasture management, forage diversity, stingless bee keeping *Tetragonula biroi*, understory vegetation

12

Volatilome of 13 Commercial Pot-Honeys from Bahia, Brazil

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Abstract

The Meliponary Polen Dourado of Bahia is endorsed by UNESCO for maintaining biodiversity, managing scientific and traditional knowledge, and for sustainable development. Pot-honey is sold in 140 g jars with both the scientific name and the ethnic name of the bee species on the label. A subsample of 13 pot-honeys was submitted for volatile organic compounds (VOCs) by head space-solid phase microextraction/gas chromatography-mass spectrometry (HS-SPME/GC-MS) to Italy. The entomological origin of the bees was provided by the Instituto Nacional de Pesquisas Amazonicas (INPA) Manaus: 1. Mombucão *Cephalotrigona femorata* (Smith, 1854), 2. Tiuba *Melipona fasciculata* Smith, 1854, 3. Uruçú amarela *Melipona flavolineata* Friese, 1900, 4. Uruçú grande *Melipona grandis* Guérin, 1844, 5. Jupará *Melipona interrupta* Latreille, 1811, 6. Smith *Melipona mandacaia* Smith, 1863, 7. Bugia *Melipona mondury* Smith, 1863, 8. Uruçú nordestina *Melipona scutellaris* Latreille, 1811, 9. Uruçú boca de renda *Melipona seminigra* Friese, 1903, 10. Jandaíra *Melipona subnitida* Ducke, 1910, 11. Canudo amarela *Scaptotrigona nigrohirta* Nogueira & Santos-Silva, 2022, 12.Tubí *Scaptotrigona* sp. Moure, 1942, and 13. Borá *Tetragona clavipes* (Fabricius, 1804). The average abundance (ngVOCs/g honey) varied from 921.47 ng/g *Melipona subnitida*, to 32536.13 ng/g *Tetragona clavipes*, almost 30X. The volatile core of pot-honey produced by 13 stingless bee species in Bahia, Brazil was 55/114 total VOCs: Aliphatic acids (10), alcohols (14), aldehydes (4), aromatic compounds (3), esters (13), ketones (3), monoterpenes (2), oxides (2), and unknowns (3). Four chemical classes were not represented in the core volatiles: Polyols, sesquiterpenes, sulfides, and unsaturated hydrocarbons. Unique VOCs were detected in three pot-honey types produced by *Melipona mondury* (6, 1 alcohol, 1 polyol, and 4 unknowns), *Scaptotrigona* sp. (1 ketone), and *Tetragona clavipes* (5, 1 aliphatic acid, 1 ester, 1 sesquiterpene, and 2 sulfides). Most of the VOC origins in nature, functions in the nest, and human health remain to be elucidated.

Keywords: Brazil, commercial pot-honey, volatiles

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Foraging Activeness and Honey Production of Stingless Bee *Heterotrigona itama* in Marang, Terengganu, Malaysia

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Abstract

Stingless bees are critical pollinators in tropical ecosystems, yet the dynamics between their foraging activity, environmental variables, and honey yields remain understudied in East Coast Peninsular Malaysia. A study investigating the relationship between *Heterotrigona itama* foraging activity, abiotic factors, and honey production was conducted in Marang, Terengganu, from February 2022 to April 2023. Five healthy *H. itama* colonies were selected to monitor foraging activity patterns. Observations were recorded for 10 minutes during each one-hour interval from 0700 to 1700 hours on a bi-monthly basis. Abiotic factors (temperature, light intensity, and humidity) were recorded hourly, alongside bi-monthly honey yields provided by the meliponiary owner. Foraging activity exhibited significant temporal variations, with activity levels significantly influenced by both the time of day and the specific month of observation. The foraging activities were observed significantly increased from 0700 until the peak time at 1100 and then reduced from 1100 until 1500. The highest bee activeness was recorded in April 2022, followed by February 2023. While February, June and August in 2022 and April 2023 showed lower bee activeness. Statistical analysis indicated that foraging activity was not significantly influenced by abiotic factors, yet it served as a significant driver of honey production. Seasonal variations in honey yield were statistically significant, with peak production recorded in July 2022. Stingless bee activity peaked in the morning to coincide with nectar availability, while the July production spike reflects critical food storage behavior ahead of the rainy season. This study offers practical insights for beekeepers to improve colony management and yield forecasting in tropical climates.

Keywords: abiotic factors, activeness, foraging, *Heterotrigona itama*, honey

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Integrative Morphological and Molecular Characterization of Pot-Pollen Resources used by Stingless Bees in Two Types of Tropical Forest in Ecuador: Implications for Conservation and Meliponiculture

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Abstract

Stingless bees are essential pollinators in tropical ecosystems, contributing to plant reproduction, gene flow, and ecosystem resilience. In Ecuador, despite the lack of specific regulations, meliponiculture retains great traditional significance and is gaining significant commercial relevance in terms of pot-honey. However, our understanding of pollen resource preferences is limited, which constrains the effective management of colonies. This study uses a combination of palynological morphology, geometric morphometrics, and DNA barcoding to identify pollen sources and evaluate the foraging patterns of stingless bees in different ecological regions. A total of 52 pot-pollen samples collected from dry tropical forests and the Amazon rainforest were analysed using the Number–Position–Character system, scanning electron microscopy, landmark-based morphometry, and two molecular markers (ITS2 and rbcL). Morphometric analysis enabled the differentiation of 46 pollen types, 27 families, and 18 genera. DNA barcoding, particularly of the ITS2 region, provided higher taxonomic resolution, achieving 41% of identifications at the species level. The most frequent pollen sources were *Prockia crucis*, *Coffea canephora*, *Cecropia ficifolia*, species of *Miconia*, and *Theobroma.* Melastomataceae and Asteraceae were the dominant families in both types of tropical forest. The mean pollen abundance was 1,148 ± 799 grains per sample, indicating high richness but low dominance. No significant differences in plant richness were detected between regions ($p = 0.21$). Foraging networks revealed predominantly generalist behaviour in *Melipona*, *Scaptotrigona*, and *Tetragonisca*, with 27% of the pollen originating from introduced plants. These results demonstrate that combining morphological and molecular approaches enhances pollen identification and reveals complex plant–pollinator interactions. The findings provide practical tools for meliponiculture, including the development of floral calendars and improved management strategies that support biodiversity conservation and sustainable agroecosystems.

Keywords: DNA barcoding, meliponines, pollen, SEM, stingless bee keeping

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Palynological analysis of honey to determine foraging preferences in six Brazilian stingless bee species (Meliponini)

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Abstract

Understanding the floral resource requirements of stingless bees is critical for their conservation, the management of native pollinator populations, and the commercial valorization of their products. This study investigates the plant foraging preferences of six stingless bee species (*Melipona fasciculata*, *M. mandacaia*, *M. quadrifasciata anthidioides*, *M. scutellaris*, *M. subnitida*, and *Tetragonisca angustula*) to identify primary botanical food sources and species-specific dietary specializations based on the floral composition of their honey. A palynological analysis was conducted on 51 honey samples from four Brazilian states (Bahia, Paraíba, Piauí, and São Paulo). The foraging dominance within the pollen grain in honey was evaluated using standard frequency classes: Very Frequent (>50%), Frequent (20–50%), Uncommon (10–20%), and Rare (<10%). The plant families Mimosaceae and Myrtaceae emerged as the most critical floral resources, representing the "Very Frequent" dominant pollen type in 39% (n=20) and 19.6% (n=10) of all honey samples, respectively. Fabaceae acted as a ubiquitous supplemental source, present in 30 samples but rarely dominant. Species-specific specializations were observed in *M. fasciculata* (Piauí) exhibiting an exclusive reliance on Rubiaceae (dominant in 100% of its samples), while *M. subnitida* (Paraíba) demonstrated an absolute preference for Mimosaceae. Conversely, *T. angustula* displayed a highly polylectic profile, utilizing Rutaceae, Fabaceae, and Mimosaceae as primary sources. Furthermore, species such as *M. scutellaris* and *M. quadrifasciata anthidioides* showed high intraspecific variance in pollen harvest volumes, adapting their primary intake between Myrtaceae and Mimosaceae. The findings highlight a complex dynamic of both extreme floral specialization and broad polylecty among closely related stingless bee species. The overwhelming reliance on Mimosaceae, Myrtaceae, and Rubiaceae in honey production underscores the necessity of prioritizing these botanical families in regional flora restoration and meliponiculture efforts to sustain native bee biodiversity and ensure product quality.

Keywords foraging behavior, *Melipona*, melissopalynology, stingless bee honey *Tetragonisca angustula*

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Managing Translocated Stingless Bee Species from Luzon to Visayas and Mindanao: Practical Farmer-Level Tools for Adaptive Meliponiculture

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Abstract

The expansion of stingless beekeeping in the Philippines has been encouraged by agricultural livelihood, training, and enterprise development programs, including initiatives supported by the Department of Agriculture and its attached agencies. This has increased demand for productive managed colonies, including Luzon-origin stingless bee species now transported to beekeepers in Visayas and Mindanao. While translocation creates opportunities for livelihood, pollination, and honey-based enterprises, it also presents management risks because colonies are exposed to unfamiliar forage availability, climate patterns, competing species, and local ecological pressures. This paper presents practical farmer-level tools developed by Pia's Bee Farm through field-based training, extension work, and observations from beekeeper-managed colonies outside their original locality. The tools are designed to help beekeepers observe, record, and interpret colony performance using simple methods that do not require laboratory equipment or highly technical procedures. These include floral calendar preparation, forage mapping, colony profiling, entrance activity counts, pollen carrier monitoring, and adaptive management records. By using these tools, beekeepers can assess whether translocated colonies are adjusting to local conditions and whether interventions such as supplemental feeding, hive relocation, shade management, colony strengthening, or reduced colony multiplication are needed. The paper argues that translocation should not be treated simply as distribution of productive colonies, but as a continuing management responsibility. It also emphasizes that introduced species should not overshadow locally adapted stingless bees, which remain important for biodiversity, pollination, and long-term meliponiculture resilience. By translating ecological and colony-monitoring concepts into practical field tools, adaptive meliponiculture can help farmer-level beekeepers make evidence-informed decisions, improve colony survival, and support more sustainable stingless bee production across different Philippine island environments.

Keywords: adaptive meliponiculture, colony profiling, farmer-level tools, forage assessment, Philippines stingless bees, translocation

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Morphological and Taxonomic Analysis of Meliponini Metatibial Keirotrichia

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Abstract

This research report provides a comprehensive morphological and taxonomic analysis of the keirotrichiate zone, a specialized setose structure on the metatibia (hind leg) of stingless bees(tribe Meliponini). Focusing primarily on the Indo-Australasian genus *Heterotrigona*, the study examines the structure's diagnostic utility, functional morphology, and evolutionary significance. The keirotrichiate zone is defined as a densely hairy, often elevated region on the inner and retrolateral surfaces of the metatibia, bordered by distinct glabrate (smooth) zones. Taxonomically, the report highlights how variations in the dimensions and proportions of this zone—specifically the ratio between the Keirotrichia Median (Km) and the Posterior Glabrate (Pg) areas—serve as a cornerstone for distinguishing genera and subgenera. Morphometric data for various species, including *Heterotrigona itama* and *Sahulotrigona paradisea*, demonstrate how these traits support phylogenetic hypotheses and reflect evolutionary divergence across biogeographic boundaries, such as Weber's Line. Beyond classification, the document explores the multifunctional roles of the keirotrichia. In worker bees, it functions within a material-handling system for processing pollen and resin. In males, the zone is hypothesized to compensate for simplified internal reproductive anatomy by facilitating mechanical stabilization, sensory feedback, and pheromone transfer during copulation. The report also details other key anatomical markers, such as the superior marginal subglabrate zone and torulocellar distance, while providing a taxonomic key based on wing venation patterns. The study concludes that the keirotrichiate zone is a dynamic, functionally adaptive innovation central to the reproductive success and ecological adaptation of stingless bees. By bridging classical morphology with modern systematics, the research offers deep insights into the diversity of one of the world's most vital pollinator groups and suggests future directions for integrated molecular and ethological research.

Keywords: *Heterotrigona*, functional morphology, Meliponini, keirotrichiate zone, metatibia, stingless bees

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Sustainable Meliponiculture with Vernacular Architecture in South East Asia

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Abstract

This paper explores the strategic intersection of Meliponiculture (stingless bee farming) and vernacular architecture as a resilient framework for environmental conservation in Southeast Asia (SEA). The *Tropical Meliponiculture Eco-System Bubble* currently faces unprecedented threats from climate change and geological instabilities, including high-magnitude earthquakes, volcanic eruptions, and extreme regional heat waves. This study posits that traditional building techniques, refined over generations, offer sophisticated mitigation strategies that modern industrial methods often lack. By analyzing indigenous architectural styles—such as the Malay stilted house, the Nias Island structures, and the high-pitched roof designs of East Nusa Tenggara (NTT) and the Javanese Joglo—the research identifies key passive cooling mechanics and structural innovations. Specifically, the "Stack Effect" and cross-ventilation features of traditional Malay houses are shown to maintain internal temperatures within the critical 25–28°C range required for live brood chambers, even during ambient heat waves exceeding 40°C. Furthermore, the implementation of "rock castor" foundations (pillars positioned over large boulders) provides essential base isolation during seismic events, a principle directly applicable to establishing hive stands. The study culminates in the development of "Model Hive Housing," which integrates these vernacular principles with modern "technification" through green roofs and mini-landscaping. These structures create a stable microclimate that protects colonies from transboundary haze and intense solar radiation. Ultimately, this holistic approach safeguards the biological heritage of the stingless bee while supporting the cultural heritage of the Malay world. The findings suggest that integrating traditional wisdom into modern meliponary management is a functional necessity for ensuring regional biodiversity and the economic sustainability of rural communities.

Keywords: climate mitigation, meliponiculture, passive cooling, Southeast Asia, sustainability, vernacular architecture

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Integrative Taxonomy of Stingless Bees Using Morphological and DNA Barcoding Techniques

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Abstract

They are mostly found in tropical and subtropical regions, where they are crucial for preservingecological stability and raising agricultural output. Because of physical similarities, hidden variety, and geographical variations across species, it can be challenging to accurately identifyand classify stingless bee species. In order to improve species delimitation and evolutionary understanding, this work investigates the integrated taxonomy of stingless bees using both morphological characterization and DNA barcoding techniques. Using established taxonomic keys based on distinguishing physical characteristics such body size, wing structure, mandible shape, and antennal segments, specimens were collected from a variety of ecological settings. different coloring schemes. The mitochondrial cytochrome c oxidase subunit I (COI) gene, a commonly used DNA barcode marker for insect taxonomy, was amplified and sequenced to perform molecular identification. Significant genetic difference across physically similar species was found by sequence analysis and phylogenetic reconstruction, suggesting the existence of cryptic taxa and evolutionary lineages within the populations under study. When morphological and molecular methods were integrated, species identification was more accurate than when traditional taxonomy was used alone. Additionally, integrative taxonomy improved knowledge of stingless bee evolutionary links, biogeographic distribution, and biodiversity conservation. The work emphasizes how crucial DNA barcoding is as a supplementary method for resolving taxonomic uncertainties and bolstering long-term conservation plans for pollinator diversity. The results support the creation of precise taxonomic databases and offer a scientific foundation for upcoming research on stingless bees that is connected to ecology, evolution, and pollination.

Keywords: biodiversity conservation, COI gene, DNA barcoding, integrative taxonomy, morphological characterization, phylogenetics, stingless bees

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Thermal Tolerance and Vulnerability to Heat Stress in the Stingless Bee *Tetragonisca angustula* Under Controlled Experimental Conditions

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Abstract

Stingless bees play a fundamental role in tropical ecosystems as important pollinators and are considered sensitive bioindicators of environmental changes. However, increasing global temperatures associated with climate change may negatively affect their physiology, behavior, and survival. This study evaluated the acute thermal tolerance of the stingless bee *Tetragonisca angustula* under controlled laboratory conditions as part of a research internship conducted at the Laboratory of Bee Physiology, University of São Paulo, Brazil. Forager workers were collected using artificial feeding with sugar syrup and exposed to different temperature treatments (47, 49, 50, 53, and 55°C). Individuals were maintained in controlled experimental chambers, and their responses to thermal stress were recorded through continuous video monitoring and temperature data logging. Time to knockdown and time to death were determined as physiological indicators of thermal stress tolerance. In addition, the effect of feeding condition (with and without food) on thermal resistance was evaluated. The results showed that increasing temperature significantly reduced both the knockdown time and survival time of the bees. Furthermore, individuals without food exhibited lower thermal tolerance and shorter survival times compared to fed bees, suggesting that energetic reserves play an important role in resistance to extreme heat stress. These findings demonstrate the negative effects of elevated temperatures on the physiological performance of *Tetragonisca angustula* and highlight the importance of understanding thermal vulnerability in stingless bees under climate change scenarios, consistent with previous studies on stingless bee heat tolerance. This study also contributes to the standardization of eco-physiological methodologies for future research on thermal stress in Meliponini bees.

Keywords: climate change, eco-physiology, heat stress, stingless bees, *Tetragonisca*, thermal tolerance,

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Integrated Multi-Analytical and Chemometric Profiling Reveals the Chemical Signatures of Matured Stingless Bee Honeys

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Abstract

This study characterized 76 matured stingless bee honeys (SBH) from 40 species belonging to the genus *Melipona* and other stingless bee genera by integrating physicochemical parameters, bioactive compounds, antioxidant activity, metabolic profiles obtained using proton nuclear magnetic resonance (^{1}H-NMR), volatile compounds, and mineral composition, all analyzed by chemometrics. SBH samples showed high moisture content (20–40%), acidic pH (2–4), and higher electrical conductivity and ash content in genera other than *Melipona*. According to the Pfund scale, the SBH from other genera exhibited predominantly dark amber to very dark colors, whereas the SBH from *Melipona* showed lighter shades. ^{1}H-NMR revealed fructose and glucose as the major sugars, in addition to fermentative metabolites (lactate, acetate, and ethanol); trehalulose emerged as the predominant disaccharide in three species, highlighting its nutritional and authenticity relevance. The mineral composition (mg/100 g) was dominated by potassium (1–700), magnesium (1–750), and sodium (25–550), which were positively correlated with electrical conductivity. Volatile analysis revealed fermentation-related compounds, including ethanol, acetic acid, ethyl lactate, and D-limonene, whereas trans-linalool oxide was identified as a floral marker more characteristic of *Melipona* honeys. The phenolic profile of SBH from seven commercially relevant species identified and quantified 33 compounds, highlighting glycosylated flavonols such as kaempferol-3-glycoside (8.7 mg/kg) and quercetin-3-glycoside (5.6 mg/kg), flavanones such as naringin (3.1 mg/kg) and hesperidin (2.1 mg/kg), as well as flavanols and proanthocyanidins. PCA and dendrograms indicated that other genera were associated with lower pH, higher mineral content, darker color, and fermentation-related metabolites, whereas *Melipona* honeys showed stronger contributions from α/β-glucose and ethanol. This integrated approach clarified the influence of maturation on physicochemical, metabolic, volatile, and phenolic profiles of SBH.

Keywords analytical methods, chemometrics, food analysis, ^{1}H-NMR, maturation, meliponiculture, stingless bee honey

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Sensory Properties of Stingless Bee Honey from Argentina

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Abstract

This work studied the sensory properties of 15 honey samples collected from different geographic areas of Chaco province, produced by the native stingless bees *Tetragonisca fiebrigi* and *Scaptotrigona jujuyensis*. A trained panel of 19 assessors with prior experience in honey sensory analysis evaluated the samples using quantitative descriptive analysis. Regarding aroma, the three most frequently selected descriptors were wood, mellow, and fermented. The dominance of the "wood" descriptor is likely attributable to the fact that most honeys were harvested from bee nests located in tree holes, imparting a characteristic woody scent. The "fermented" descriptor, while considered a defect in *Apis mellifera* honey, is regarded as a natural and distinctive attribute in stingless bee honey, as fermentation is carried out by microorganisms associated with the storage vessels and may continue even after harvesting. Sweet was the dominant taste descriptor, followed by acid and bitter. A strong linear correlation (r^2 = 0.932) was found between sensory acidity scores and measured free acidity values. Although *S. jujuyensis* honey scored higher in wood, fermented, vegetable, and primitive descriptors, and *T. fiebrigi* showed a more prominent mellow and bitter character, overlapping error bars indicated no statistically conclusive differentiation between species. Cluster analysis dendrograms based on both aroma and taste descriptors showed a random, non-clustered sample arrangement regardless of the distance considered, with clusters containing samples from both bee species indistinctly. Importantly, bee species did not significantly influence the sensory profile of the honeys, aligning with Costa et al. (2018), who reported that the sensory profile of stingless bee honeys correlates more strongly with the flowering season than with species identity. Overall, these results reinforce the conclusion that honeys share similar sensory characteristics regardless of the producing species.

Keywords: stingless bee honey, sensory properties, *Tetragonisca fiebrigi, Scaptotrigona jujuyensis*

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Legislation, Regulations, and Challenges in Wild Collection and Rearing of Stingless Bees (Meliponini) in Malaysia: Insights from Peninsular Malaysia, Sabah, and Sarawak

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Abstract

Stingless bees (kelulut) are the smallest honey-producing bees, with approximately 600 species worldwide and 35 recorded in Malaysia. However, with the increasing popularity of stingless bee rearing in Malaysia, sustainability issues especially collection of the stingless bees from the wild and harvesting of their honey from the wild is essential to be considered. Wild collection of the stingless bees is indirectly regulated by some regulations and laws already in place, such as The Plant Quarantine Act 1976 and Regulations 1981. These laws regulate how stingless bees and any associated plant products or hosts can be brought into or moved within the country to protect agricultural industries. Under this act, the movement of plant parts (logs, branches, stumps) which are often used as hives for stingless bees is controlled while bringing hive materials or new colonies from outside Malaysia requires a permit from the Malaysian Department of Agriculture. Peninsular Malaysia is found to have the most developed commercial rearing infrastructure and enforcement while Sabah and Sarawak maintain stronger traditional wild harvesting practices, with additional monitoring under state-specific wildlife and forestry regulations. Key challenges identified include low adoption of modern hives, habitat loss from logging, over-reliance on destructive wild harvesting, enforcement gaps, and standardization across species which threaten long-term conservation of native stingless bees. As such, the integration of sustainable practices with enhanced training by relevant authorities, and potential establishment of a dedicated body to oversee, monitor and conserve stingless bees are recommended to balance commercialization with biodiversity protection.

Keywords: laws, meliponiculture, stingless bees, sustainability

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Pot-pollen Supplementation Reduces Fasting Glucose and Modulates the Gut Microbiota in High-Fat/High-Sucrose Fed C57BL/6 Mice

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Abstract

Pot-pollen is a mixture of pollen and nectar from flowers combined with salivary substances of stingless bees, which together are fermented inside cerumen pots. As pot-pollen is rich in polyphenols, we hypothesized that dietary ingestion could modulate obesity, glucose metabolism, and the gut microbiota in an animal model of diet-induced obesity. Male C57BL/6J mice were fed a low-fat/low-sucrose diet (LF/LS), a HF/HS diet, or a HF/HS diet containing 0.1% pot-pollen (HF/HS-PP) for 12 weeks. In HF/HS-fed mice, pot-pollen supplementation decreased fasting blood glucose and increased glucose-stimulated insulin secretion without modifying weight gain, body composition, glucose tolerance, and insulin sensitivity. Intake of pot-pollen resulted in changes in the gut microbiota, including a decrease in the abundance of the Rikenellaceae RC9 gut group and Lactobacillus, and an increase in the abundance of *Romboutsia*. Correlations between genus abundances and metabolic changes in response to supplementation indicated that the gut microbiota contributed to the positive effects of pot-pollen ingestion on fasting glucose. Pot-pollen supplementation-associated changes in the gut microbiota composition correlated with the lowering of fasting glucose levels without modulating weight gain.

Keywords: Amazon, glucose metabolism, obesity, polyphenols, *Romboutsia*, stingless bee

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Efficiency of Stingless Bee *Tetragonula biroi* (Friese, 1898) as Pollinator of Red Hot F1 Hybrid Hot Pepper (*Capsicum frutescens* x *C. annuum*) in the Philippines

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Abstract

Stingless bees have been found to contribute to the pollination of many crops and wild plants in tropical and subtropical parts of the world. This study was conducted to evaluate the effect of stingless bee pollination to the quality and quantity of fruits and seeds of red hot F1 hybrid hot pepper *Capsicum frutescens* x *C. annuum.* Four pollination methods were assessed in the study: (1) control (no pollination by external vectors), bagged flowers; (2) hand pollination, bagged flowers; (3) open pollination; and (4) stingless bee pollination. ANOVA results and pairwise t-test comparison results show that there are no significant differences between means percentage fruit set for hand, open and stingless bee pollinated treatments, but they are significantly higher than the control treatment. Stingless bee-pollinated plant has an average of 100 % fruit set, hand pollination has 84 $\pm$ 19.37 % fruit set and 87 $\pm$ 13.12 % fruit set in open pollination. Control treatment has percentage fruit set of 26 $\pm$ 14.30 %. Fruit weights in hand-pollinated and stingless bee-pollinated plants were not significantly different, but were significantly higher than the fruits collected in control. The fruit diameter was significantly higher in hand-pollinated and open-pollinated plants with 10.9 $\pm$ 0.97 mm and 10.7 $\pm$ 0.82 mm diameter respectively, than in stingless bee-pollinated (10.0 $\pm$ 0.72 mm) and control (8.4 $\pm$ 1.54 mm) plants. However, diameter of fruit harvested from open-pollinated and hand-pollinated plants did not vary significantly, while fruit diameter from plants with stingless bees was significantly higher than the control. The 100 % fruit set of high quality in stingless bee-pollinated hot pepper plants suggests that stingless bee, *T. biroi* are effective pollinator of hot pepper and can be utilized as an alternative pollinator to improve fruit yield and quality of hot pepper in greenhouses.

Keywords: fruit set, hot pepper, pollination, stingless bee *Tetragonula biroi*

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Preliminary Microbiome of Erica *Melipona favosa* (Fabricius, 1798) from Paraguana Peninsula, Venezuela

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Abstract

Erica *Melipona favosa* (Fabricius, 1798) is a Neotropical stingless bee known for its delicate fermented medicinal honey of fruity-floral smell and aroma, a distinctive volatilome, and recently tested as a therapeutic synergistic agent complementary to antibiotics used to fight antimicrobial resistance (AMR). Gut microbiome of eusocial corbiculate bees is more studied than nest materials. Host-specific microbes associated to stingless bees have roles in food processing, pathogen defense, host health, life cycle, and social immunity. Conserved ancient associations of obligate symbionts like the bacteria *Snodgrassella* and *Gilliamella* are consistent in more than 95% of *Apis mellifera* gut, but not in *Melipona*. This shift in microbiota composition deserves scientific research. The 605 global species of stingless bees envisage microbial biodiversity, functions in the nest, and applications in biotechnology and human health. Dried specimens of the bee were identified by JMF Camargo† at Universiade de São Paulo, Ribeirão Preto, SP, Brazil. The *M. favosa* pot-honey was extracted by suction with at sterile 10 mL syringe from sealed honey pots and kept frozen. Soluble solids were removed dissolving 10 g honey and 20 g PCR water in a 50 mL Falcon centrifuge tube, and two centrifugations at 3500 rpm x 15 min, 25°C. DNA was extracted from the pellet using a NucleoSpin Macherey Nagel Qiagen food kit. The Earth Microbiome Project (EMP) primers for fungi, the ribosomal internal transcribed spacer 1 (ITS1) region was amplified. For bacterial EMP 515F designed and modified primers, the 16S ribosomal RNA (rRNA) gene was amplified. Libraries were prepared using forward and reverse primers, including Illumina adapter sequences, quality checked, and submitted to be sequenced at the University of California, Riverside Genomics Core Facility. Amplicon sequences were processed and clustered with DADA2. Taxa were assigned to bacteria with the RDP database and fungi with the UNITE TS database implemented in the amptk taxonomy tool. The microbiome composition for the ITS1 region and 16S rRNA amplicon sequencing variants (ASV) was: The dominant fungi was 27% of the yeast *Debaryomyces*, 20% of the mold *Aspergillus*, 18% *Cephalosporium*, 12% *Penicillium*, 5% Meyerozyma, 4% *Wallemia*, 2% *Cladosporium*, *Geotrichum*, *Rhodotorula*, *Yarrowia*, and *Zygosaccharomyces*. The dominant bacteria was 80% family Lactobacillaceae, 11.8% *Lactobacillus*, 1.4% *Dysgonomonas*, 1.0% *Haemophilus*, and 0.6% *Comamonas*.

Keywords: amplicon sequence variable (ASV), bacteria, *Melipona favosa*, microbiome, mold, pot-honey, stingless bee nest, yeasts

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Antibacterial Activity and Synergistic Effect of Mexican *Melipona beecheii* Pot-Pollen Extracts Against Drug-Susceptible and Multidrug-Resistant *E. coli* Strains

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Abstract

Pot-pollen from stingless bee *Melipona beecheii* and its quality are crucial for the health and development of bees. In addition, Melipona beecheii pot-pollen, which contains essential amino acids, lipids, and other compounds, is a food known for being a rich source of proteins, lipids, vitamins and minerals for colonies, with biological activities, which contribute to the medicinal properties attributed to them by traditional Mayan medicine. In this sense, M. beecheii pot-pollen is a rich source of compounds with antimicrobial, antioxidant, anti-inflammatory and antineoplastic activity. On the other hand, the increase of multi-resistant microorganisms to commonly used antibiotics such as E. coli, has motivated the search for new alternatives to combat or assist in the growth inhibition of these pathogens. Our goal was to find the synergistic effect of *M. beecheii* pot-pollen extract against Multidrug-resistant E. coli. Pot-pollen from *M. beecheii* was collected from the bee hive in Ticimul, Yucatán, México. Palynological analysis and bacterial community from *M. beecheii* pot-pollen fresh were determined. Then, ethanolic extract from pot-pollen was obtained by solid-liquid extraction, using absolute ethanol as solvent. Antimicrobial activity of the pot-pollen ethanolic extract was determined using disk diffusion method and microdilution method for determining Minimum Inhibitory Concentration. Then, we evaluated the synergistic effect of *M. beecheii* pot-pollen extract with each of three conventional antibiotics (amikacin, amoxicillin, and ciprofloxacin) against drug-susceptible and Multidrug-resistant *Escherichia coli* strains using microdilution method.

Keywords: drug-susceptible *E. coli*, *Melipona beecheii*, multidrug-resistant *E. coli*, pot-pollen extract, synergistic effect.

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Stingless Bee Keeping in Uganda: A Developing Industry

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Abstract

Stingless bees are important resources in the production of medicinal honey and other products and for pollination services. However, throughout developing countries in Africa, meliponiculture has received less attention in beekeeping development programs. Here, the current situation of stingless beekeeping in Uganda was assessed using structured questionnaires and field observations. First, stingless bee species exploited for their products were collected and identified. In addition, the socio-economics of stingless bee keeping in two agro-ecological zones of Uganda with anecdotal reports of meliponiculture were analysed. The findings reveal that there is indigenous knowledge of stingless beekeeping in Uganda, though it is still at early stages of development. The rich knowledge base of beekeepers that can assist in locating wild stingless bee nests for domestication was also noted. Four stingless bee species (*Axestotrigona ferruginea, Meliponula bocandei, Apotrigona nebulata,* and *Plebeina hilderbrandtii)* were identified. However, only two species *A. ferruginea* and *M. bocandei are* exploited for honey and propolis. These species of stingless bees have been selected and appropriate technologies for their domestication developed. In order to transform the stingless beekeeping industry in Uganda, capacity building in hive making, colony management, product harvesting and processing have to be conducted.

Keywords: agro-ecological zones, colony management, meliponiculture, pollination services

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Floral Resources Used by *Melipona favosa* for Honey Production in the Lara Semiarid Region, Venezuela

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Abstract

Melipona favosa (Fabricius, 1798) belongs to Hymenoptera: Apidae: Meliponini, and is one of the most widely distributed stingless bee species in Venezuela. In the Lara semiarid region, this species is used by small-scale rural stingless bee keepers for honey production, which is highly valued for its medicinal properties. Furthermore, it is considered that *M. favosa* (erica) play a significant role as a pollinator of plant species native to this ecosystem. In order to determine the floral resources most widely used by this species for honey production, 12 samples from two meliponiculturists in La Fundación, Iribarren municipality, Lara state, were studied between 2024 and 2025. Standard methods for determining botanical origin were followed, adhering to the Mexican Official Standard with modifications. A total of 51 palynomorphs were observed, 16 of which could not be identified. Among the remaining 37, 16 botanical families were identified, with Fabaceae being the most significant (11 species), followed by Asteraceae (4 species). The predominant species in the honeys were *Plectrocarpa arborea* (vera) and *Melicoccus bijugatu*s (mamón); *Croton* sp. (canapire) and a Myrtaceae morphotype were also frequent. Of the pot-honeys studied, three were monofloral for *Plectrocarpa arborea*, two were monofloral for *Melicoccus bijugatus*, six were bifloral with the presence of these two species, and one was multifloral. The results suggest that *Melipona favosa* exhibits a preference for tree species characteristic of the Lara semiarid region, particularly *Plectrocarpa arborea*, a species that is currently threatened due to extraction pressure for charcoal production and its slow growth rate.

Keywords: botanical origin, Lara semiarid region*, Melipona favosa*

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A Comprehensive HS-SPME-GC-MS Approach for the Volatile Characterization of Diverse *Tetragonisca angustula* Products from Venezuela

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Abstract

Solid-phase microextraction (SPME) is a well-established sample preparation technique widely applied in food analysis for quality control and the monitoring of volatile organic compounds (VOCs). This solvent-free method integrates sampling, extraction, and concentration into a single step, making it ideal for characterizing complex food matrices without the need for large solvent volumes or tedious pretreatment. By exposing a polymer-coated fused-silica fiber to the sample's headspace, analytes are efficiently concentrated via absorption or adsorption processes. The extraction kinetics are governed by the distribution constant of analytes between the matrix and the stationary phase, ensuring high reproducibility. Furthermore, the technique is ideally suited for coupling with Gas Chromatography-Mass Spectrometry (GC-MS), as it enables the direct thermal desorption of analytes into the analytical system, combining simple and efficient sample preparation with versatile and highly sensitive detection. Building upon this framework, the volatilomes of pot-honey, pot-pollen, cerumen, and propolis were characterized by adapting a protocol established for nest materials. Using a DVB/CAR/PDMS fiber and optimized headspace conditions, detailed chemical fingerprints were obtained across different matrices. This methodology was applied to analyze products from *Tetragonisca angustula* in Venezuela. While significant similarities were found (e.g., acetic acid, ethanol, benzaldehyde), clear differences emerged: propolis was uniquely characterized by monoterpenes like α -thujene and camphene, whereas pot-honey and pot-pollen showed specific markers such as nonanoic acid and benzyl nitrile, respectively. Overall, this study confirms that HS-SPME-GC-MS is a powerful and versatile tool for mapping the chemical diversity of stingless bee products, providing a comprehensive understanding of the volatile profiles across highly different biological matrices.

Keywords: cerumen, HS-SPME-GC-MS, pot-honey, pot-pollen, propolis. stingless bees, volatile organic compounds (VOCs)

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Identification and Verification of Polyphenols and Aliphatic Acids Against Depression-Related Targets Through Antioxidant, UHPLC/Q-TOF-MS Analyses and *In Silico* Evaluation

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Abstract

Major depressive disorder (MDD) is an intricate interaction between monoaminergic neurotransmission, chronic neuroinflammation, hypothalamic-pituitary-adrenal axis dysregulation, and oxidative stress, leading to persistent depressive symptoms and cognitive-emotional impairment. Kelulut honey, a functional food rich in bioactive metabolites, has shown potential to alleviate these pathological processes via blood-brain barrier-mediated and systemic antioxidative and anti-inflammatory mechanisms. This study compares antioxidant levels across multiple sampling intervals (weeks 1, 3, 5, and 7), whilst targeting gluconic acid and gallic acid metabolites, together with their derivatives with potential antidepressant effects. Interaction of these compounds with gut-brain axis modulation and neuroimmune-related receptors, P2X7R and GPR43, using molecular docking and molecular dynamics (MD) simulation approaches, is evaluated. The antioxidant activities, namely total phenolic content, total flavonoid content, DPPH free radical scavenging, and FRAP assay, increased simultaneously over time, reflecting progressive biochemical maturation that strengthens overall antioxidant profiling. Gluconic acid, classified as an aliphatic acid, and gallicynoic acid, a polyphenolic derivative from gallic acid, are targeted through UHPLC/Q-TOF-MS. Results show gluconic acid exhibited an initial decline followed by an increase at the final week, whereas gallicynoic acid displayed intermittent increases and decreases, suggesting differential metabolic processing and stability within honey maturation. Molecular docking supported, where gallicynoic acid F has the highest binding affinity toward P2X7R (−8.1 kcal/mol) and forms stable hydrogen bond interactions with key active-site residues, with gluconic acid also binds strongly towards the same receptor (-7.1 kcal/mol). These residues are associated with ligand stabilization, receptor conformational regulation, and inflammatory signal transduction, suggesting potential interference with ATP-mediated P2X7R activation and modulating GPR43-mediated gut–brain immune signalling. The stable RMSD, RMSF, and radius of gyration (Rg) profiles in MD simulation indicate sustained binding stability and minimal structural fluctuations. Therefore, aliphatic acid and polyphenols possess neuroprotective, antioxidant, and anti-inflammatory effects through purinergic and gut–brain axis receptor modulation in MDD.

Keywords: antioxidant activity, gallicynoic acid, gluconic acid, gut-brain-axis, *In silico* evaluation, Kelulut honey, major depressive disorder, UHPLC/Q-TOF-MS

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Comparative Detection of Mannitol Across Various Timepoints in Malaysian Kelulut Honey from *Heterotrigona itama* via UHPLC/Q-TOF-MS analysis

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Abstract

Kelulut honey, a low-viscosity honey with naturally elevated water content, is highly valued for its multifaceted nutritive and therapeutic properties. Their pot-honey is enriched with complex metabolite profiles from floral nectar and in-hive biotransformation, including the fermentation of species-specific microbiota, such as lactic acid bacteria and osmophilic yeasts, upon honey maturation. Mannitol, an ample polyol, has recently been identified as a potential chemical marker in kelulut honey, attributed to its low glycaemic functional profile and enhancement of free radical scavenging activity. Its uniqueness further lies in its consistent presence in multiple kelulut honey species, as previously reported, whereas it is typically found in trace amounts of *Apis* honeybee honey. In this framework, we detect D-(-)-Mannitol and its glycosylated derivative, 1-O-alpha-D-Glucopyranosyl-D-mannitol, using an ultra-high-performance liquid chromatography/quadrupole time-of-flight mass spectrometry system (UHPLC/Q-TOF-MS) in Malaysian Kelulut *Heterotrigona itama* honey samples for comparative assessment across four time points (weeks 1, 3, 5, and 7). Results showed that D-(-)-Mannitol was abundantly detected, followed by its derivatives in a lower relative concentration over time. The natural pot exhibited a fluctuating trend for D-(-)-Mannitol, where it increases progressively from week 1 to 3, followed by a decrease at week 5, and rises by week 7, while conversely, its derivatives illustrate a contrasting pattern. The disparity in trends between mannitol and its derivatives may suggest an independent pathway of transformation during honey maturation. It is possibly driven by microbial fermentation processes, where fructose breaks down into mannitol sugar alcohols, while its derivatives arise from secondary metabolic conversions by associated microbial communities. Overall, as the mannitol is consistently detected across all timepoints with distinctive trends further highlights its potential as a complementary metabolite that underpins authentication, quality assessment, and functional characterization of kelulut honey.

Keywords: free radical scavenging activity, *Heterotrigona itama*, honey maturation, Kelulut honey, mannitol and derivatives, UHPLC/Q-TOF-MS

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Optimized Production of *Frieseomelitta longipes* Propolis: a Sustainable Alternative for the Gran Sabana, Venezuela

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Abstract

This project documents the professionalization of the meliponiculture in El Pauji, Gran Sabana (Bolivar State, Venezuela) during the 2025-2026 season. The initiative aims to transform the management of the stingless bee *Frieseomelitta longipes* (Smith 1854) into a high-value scientific and economic activity, positioning it as a strategic tool for 'mining reconversion' (reconversion minera) in this ecologically sensitive border region. Production was monitored across five meliponaries, each consisting of eight colonies (n=40) during the periods of August-November and February-April. Propolis was harvested using adapted apiculture traps. To stimulate production a weekly incremental shifting of the hive cover was implemented, while maintaining the colonies under permanent shade to avoid direct sunlight. To prioritize nest health the harvest was restricted to a bimonthly schedule since February. The roof-shifting technique significantly boosted monthly yields from 30 g to 130 g per hive. A multidisciplinary team conducted volatile organic compounds (VOCs) analysis, revealing an interesting percentage of terpenes which underscore the pharmaceutical potential of the resin. While the terpene profile is confirmed, further research into bioflavonoid concentrations is required to complete the product's standardization for international markets. The high productivity achieved in El Pauji, combined with the sophisticated chemical profile of *Frieseomelitta longipes* propolis, demonstrates that meliponiculture is a viable, sustainable alternative to extractive mining. Standardizing these bio-products through continued biochemical study will provide the local community with a high value export commodity, fostering environmental conservation and ecological resilience in the Venezuelan Amazon.

Keywords El Pauji, Gran Sabana, *Frieseomelitta longipes,* propolis production, meliponiculture, sustainable

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Volatilome by HS-SPME-GC-MS of Venezuelan Angelita *Frieseomelitta longipes* Pot-Pollen and Propolis from El Paují, Venezuela

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Abstract

Angelita *Frieseomelitta longipes* (Smith, 1854) is a stingless bee reared in meliponaries of southern Venezuela, El Paují, Ikabarú parish, Gran Sabana municipality, Bolívar state. This Gran Sabana Angelita is highly productive of pot-pollen and propolis, but not pot-honey. Sampling was done scratching propolis with a spatula, and collecting the inner content of pollen pots. This bee makes layers of cerumen inside the pollen pots, creating compartments before piling foraged pollen in stacked fermenting strata. Solid-phase microextraction (SPME) was coupled with Gas Chromatography-Mass Spectrometry (GC-MS) for analysis of volatile organic compounds (VOCs). A total of 118 VOCs from different chemical classes were identified in *F. longipes* pot-pollen (98) and propolis (99): 8 aliphatic acids, 19 alcohols, 11 aldehydes, 7 aromatic compounds, 15 esters, 8 ketones, 26 monoterpenes, 2 oxides, 4 polyols, 11 sesquiterpenes, 1 unsaturated hydrocarbon, and 6 unknowns. Pot-pollen was richer in aliphatic acids, alcohols, aldehydes, aromatic compounds esters, and polyols; and propolis in monoterpenes, oxides, and distinctive sesquiterpenes. Ketones were similar in both nest materials. A complex interface prevails between botanical chemotaxonomy – the chemical signature of plants visited by bees, and microbial biotechnology – the fermentative processes mediated by symbiotic microbes associated with stingless bees. VOCs of environmental or microbial origins, as well as their roles in the bee nest (colony health, immunity, life cycle), and potential agents for human health need more research to explain their presence in pot-pollen and propolis of Gran Sabana *Frieseomelitta longipes*.

Keywords: *Frieseomelitta longipes*, HS-SPME-GC-MS, pot-pollen, propolis, Venezuela, volatile organic compounds (VOCs)

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In Vitro Antifungal Evaluation of Ethanolic Stingless Bee Propolis Extracts Against *Ascosphaera apis* and *Aspergillus niger*

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Abstract

Propolis, a resinous material collected by bees from diverse botanical sources, is recognized for being a potent antimicrobial mixture of secondary metabolites. The recent rise in fungal infections primarily involving the entomopathogenic fungi *Ascosphaera apis* (the causative agent of chalkbrood) and *Aspergillus niger* has significantly compromised apicultural sustainability and global bee populations. While many antifungal agents have been investigated internationally, the potential of stingless bee propolis as a self-targeted therapeutic intervention remains under-researched. This study evaluated the bioactivity of stingless bee propolis extracts against these two specific pathogens. The methodology involved the maceration of crude propolis using ethanol as a solvent in a controlled mechanical shaker, followed by filtration and concentration via rotary evaporation. Antifungal efficacy was quantified through the agar well diffusion method, with potency measured by zones of inhibition (mm). Experimental results indicated that a 1:9 propolis-to-solvent concentration (macerated at a 1:4 ethanol ratio for 6 hours) exhibited no statistically significant inhibitory activity against *Aspergillus niger* and yielded inconclusive results against *Ascosphaera apis*. It is recommended to optimize the extraction and antifungal testing of stingless bee propolis to further explore its antifungal properties.

Keywords: antifungal efficacy, ethanol extraction, self-targeted intervention, stingless bee propolis,

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Evaluation of the Wound-Healing Efficacy of *Tetragonula biroi* Friese Propolis-Alginate Dressing in a Murine Full-Thickness Excisional Wound Model

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Abstract

Full-thickness excisional wounds heal by secondary intention and are prone to prolonged inflammation and scarring; propolis from Philippine stingless bees (*Tetragonula biroi* Friese) contains flavonoids and phenolics with anti-inflammatory, antimicrobial, antioxidant and wound-healing properties. This study evaluated the healing activity and cost-effectiveness of a propolis-alginate dressing in a murine excisional wound model. Thirty 6-week-old male BALB/c mice were randomized into three groups (n=10 per group) receiving daily applications of either a povidone-iodine patch, deproteinized calf blood extract (Solcoseryl®), or a propolis-alginate dressing for 21 days following creation of a standardized 5 × 5 mm full-thickness dorsal excisional wound. Wounds were scored daily for wound edges, erythema, exudate, pus, necrosis and scab to derive a mean total wound score (MTWS); wound areas were measured on days 0, 3, 6, 9, 12, 15, 18 and 21 to calculate percent contraction; histopathology (H&E) assessed re-epithelialization, dermal matrix restoration, adnexal structures and scarring; and one-way ANOVA with Bonferroni correction ($P<0.05$) was used for statistical comparisons. All wounds closed by day 21. Propolis-alginate treatment yielded significantly shorter durations of erythema and pus (mean erythema 0.30 ± 0.48 days; pus 0.50 ± 0.85 days; $P<0.05$) and consistently lower MTWS compared with other groups. Wound contraction occurred in all groups with similar mean healing times (propolis 16.4 ± 1.26 days). Histologically, propolis-alginate–treated wounds demonstrated complete re-epithelialization, intact dermal matrix with abundant hair follicles and sebaceous glands and minimal fibrosis, whereas povidone-iodine and Solcoseryl® groups showed epidermal thickening, dermal fibrosis, reduced adnexa and scarring. Cost-benefit analysis indicated propolis-alginate was the most cost-effective treatment (Php 260.92 per mouse). These findings indicate that propolis-alginate dressing enhances qualitative and histologic healing of full-thickness excisional wounds in mice, reduces inflammatory signs, and is cost-effective, supporting further development and evaluation in larger animal models and clinical studies.

Keywords: excisional wound, excisional wound, Philippine stingless bee, propolis-alginate dressing, *Tetragonula biroi* Friese, wound healing

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Meliponiculture as a territorial platform for conservation, education, and value creation in El Salvador: The CREVAS experience

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Abstract

Stingless bees are increasingly recognized not only as pollinators and producers of pot-honey, but also as living bridges between biodiversity conservation, rural livelihoods, education, and territorial identity. In El Salvador, rural areas face environmental degradation, urbanization, and limited opportunities for young people. In this context, meliponiculture can help reconnect communities with nature while opening new pathways for local value creation. This contribution presents the experience of the CREVAS Project, implemented with the Faculty of Agronomic Sciences of the University of El Salvador. CREVAS has promoted meliponiculture as a territorial platform, rather than as a simple honey production activity. The approach integrates conservation of native stingless bees, environmental education, demonstration colonies, training for producers and students, value chain development, and exploration of differentiated products and services linked to local biodiversity. The experience shows that sustainable meliponiculture requires more than technical management of colonies. It also requires collaborative spaces where universities, producers, students, communities, public institutions, and private actors can identify problems, share knowledge, and design practical solutions together. Through this platform-based approach, stingless bees become an entry point for strengthening environmental awareness, supporting rural entrepreneurship, promoting youth participation, and generating pride in local natural resources.The case of El Salvador suggests that meliponiculture can contribute to conservation and livelihoods when embedded in a broader process of value co-creation. Rather than focusing only on production volume, the CREVAS approach emphasizes education, biodiversity, cultural meaning, product differentiation, and territorial identity as key elements for building sustainable meliponiculture systems. This experience may offer useful lessons for other countries *seeking to connect science, livelihoods, and conservation through stingless bees*.

Keywords: conservation, El Salvador, environmental education, meliponiculture, rural livelihoods, stingless bees, value co-creation

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Stingless Bee Tourism at Guáquira Ecological Reserve, Yaracuy, Venezuela.

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Abstract

In the tropical forests of Guáquira Ecological Reserve, western Venezuela, native stingless bees quietly sustain the ecological balance of one of the country's most biodiverse landscapes. What began as field observations of meliponines nesting in living trees, wooden structures, gardens, and agricultural areas, has evolved into an integrated project combining conservation, environmental education, sustainable honey production, and regenerative tourism. The initiative has tentatively documented 18 taxa of stingless bees, including Angelita *Tetragonisca angustula,* Mosquita *Plebeia* sp.*,* Ajicita *Oxitrigona* sp.*,* Lame ojos *Trigonisca* sp.*, Trigona fulviventris,* Pegón *Trigona* sp. 1*, Trigona* sp. 2*, Trigona* sp. 3*,* Boca de Sapo *Partamona* sp.*,* Mandelita *Frieseomelitta paupera,* Pegón pico *Scaptotrigona pectoralis,* Erica *Melipona favosa,* Guanota *Melipona compressipes*, *Melipona* sp.*,* Zamurita *Nannotrigona* sp.*, Nannotrigona mellaria, Tetragona perangulata*, and Angelita grande *Tetragona ziegleri*. We will send specimens to a stingless bee collection aiming to receive vouchers of each entomological identification, positioning Guáquira as a living laboratory for tropical meliponiculture research and biodiversity monitoring. Building on this biological richness, the Guáquira Meliponary was created as a center for responsible colony management, reproduction through hive division, genetic conservation, and sustainable production of pot-honey, pot-pollen, cerumen, and propolis. Guáquira Meliponary station will join the RUTA-MELI *Route of Living Museums of Stingless Bees in the World* online. Beyond productive management, the project seeks to reconnect visitors with the invisible ecological processes sustained by pollinators. Educational trails, hive interpretation stations, biodynamic gardens, and immersive ecotourism experiences allow visitors, students, and researchers to understand the ancestral relationship between stingless bees, tropical flora, and forest regeneration. Through direct interaction with pollinators, the reserve promotes awareness of biodiversity conservation and the ecological importance of meliponines in food security and ecosystem resilience. In a global context shaped by biodiversity loss and climate change, Guáquira proposes a replicable model where science, conservation, and tourism converge to protect what the project defines as *the invisible heartbeat of the forest*.

Keywords: biodiversity, conservation, environmental education, meliponiculture, native pollinators, regenerative tourism, stingless bees

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Viral Screening of Brazilian Meliponiculture: A Multi-Species Survey in the State of Bahia, Brazil

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Abstract

Meliponiculture—the management of stingless bee colonies—is rapidly expanding across Brazil due to its ecological economical importance. Consequently, the health of stingless bees has garnered significant attention. To better understand the pathogen landscape affecting these vital pollinators, we investigated the prevalence of common bee viruses in native Brazilian stingless bees. Samples were collected from seven municipalities in the state of Bahia, Brazil. We evaluated a total of 51 colonies representing seven distinct species: Melipona quadrifasciata (n = 13 colonies), *Melipona scutellaris* (n = 27), *Melipona mondury* (n = 4), *Tetragonisca angustula* (n = 2), *Plebeia droryana* (n = 2), *Frieseomelitta doederleini* (n = 2), and *Scaptotrigona postica* (n = 1). Molecular tests were conducted to screen for Deformed Wing Virus (DWV), Acute Bee Paralysis Virus (ABPV), Black Queen Cell Virus (BQCV), Chronic Bee Paralysis Virus (CBPV), and Israeli Acute Paralysis Virus (IAPV). Our findings revealed that 17.6% of the 51 evaluated colonies tested positive for DWV (detected in *M. quadrifasciata, M. scutellaris, M. mondury*, and *T. angustula*), while 11.8% were positive for ABPV (detected exclusively in *M. scutellaris*). Notably, *M. scutellaris* emerged as the most frequently infected species, with 22.2% of its samples testing positive for ABPV and 18.5% for DWV and, this species exhibited the study's only recorded case of co-infection (ABPV and DWV). Among the other infected species, DWV was present in 7.7% of *M. quadrifasciata* samples, and in 50% of both *M. mondury* and *T. angustula* samples. This research represents the first study to investigate the presence of these specific viral pathogens in several of these native species. Our results significantly expand current knowledge regarding viral epidemiology within Brazilian stingless bee populations, underscoring the urgent need for routine health monitoring to ensure the conservation of these indispensable pollinators.

Keywords: ABPV, bee health, DWV, Meliponini, viruses, pathogens

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Variation in Sugar Composition of Brazilian Stingless Bee Honeys: Insights from Ion Chromatography

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Abstract

Stingless bee honey (SBH) differs markedly from conventional honeybee honey in its physicochemical composition, yet standardised quality criteria remain underdeveloped. A distinctive feature of SBH is the presence of trehalulose, a disaccharide increasingly proposed as a biomarker for honey authentication. This study evaluated variation in sugar profiles of Brazilian SBH to assess the influence of bee species and botanical origin using high-performance ion chromatography with pulsed amperometric detection (HPIC-PAD). Nineteen honey samples from 15 stingless bee species across five genera (*Melipona*, *Plebeia*, *Scaptotrigona, Tetragona*, and *Tetragonisca*) were collected from eight Brazilian states. The analytical approach enabled reliable separation and quantification of ten sugars. The dominant sugars in SBH were trehalulose, glucose, and fructose, while other minor sugars were only detected in some samples. Trehalulose content varied markedly, ranging from below the limit of quantitation in certain *Melipona* honeys to 39.03 g/100 g in *Tetragona* samples. *Tetragonisca* honeys showed intermediate to high levels (5.44–23.90 g/100 g), whereas *Scaptotrigona* and *Plebeia* honeys exhibited comparatively lower concentrations. Glucose (12.00–37.92 g/100 g) and fructose (20.73–44.95 g/100 g) were also major sugars across all samples. Substantial variability was also identified within species, indicating a strong influence of botanical origin alongside bee taxonomy. These findings demonstrate that trehalulose is not universally dominant across all stingless bee species and highlight the complexity of SBH composition. This study provides the first quantification of trehalulose across diverse Brazilian SBH species and supports the need for species-specific benchmarks when defining honey quality standards. Incorporating both entomological and botanical factors will be essential for developing robust regional and global standards for SBH authentication and commercialisation.

Keywords: Brazil, ion chromatography, stingless bee honey, sugar profile, trehalulose

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Pests and diseases of Australian stingless bees- an update.

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Abstract

Australia has eleven known stingless bee species, in the genera *Tetragonula* and *Austroplebeia*. The major species kept are *Tetragonula carbonaria* (Smith, 1854), *Tetragonula hockingsi* (Cockerell, 1929), *Austroplebeia australis* (Friese, 1898) and *Tetragonula mellipes* (Friese, 1898). They are maintained in the states of Queensland, New South Wales and Northern Territory for commercial (pollination, colony propagation, honey) as well as hobby use. A range of stingless bee pests and diseases have been reported in scientific and other communications, within managed colonies and attacking foraging bees; this information was presented at the 2024 International Symposium. To obtain an objective assessment of the distribution and severity of pests and diseases, we conducted a survey of Australian stingless beekeepers in early 2026, with 386 respondents. The resultant data are yet to be fully analysed; however, a preliminary assessment indicates that although our results are generally consistent with previous information, there are several key differences, including previously underreported problems. Within colonies, the major pests reported were the native phorid fly *Dohrniphora trigonae*, the native syrphid fly *Ceriana ornata* and the introduced bee parasite small hive beetle *Aethina tumida*. These pests primarily feed on stores and brood and can destroy colonies if infestations are severe. Less frequently occurring pests were black soldier fly *Hermetia illucens*, and native sap beetles *Brachypeplus* spp.. External pests were predatory sand wasps *Bembix* spp., the assassin bug (probably *Pristhesancus plagipennis*) and the parasitoid *Syntretus trigonaphagus*. The most commonly reported diseases were stone brood (associated with *Aspergillus* spp.) and Shanks brood disease caused by the bacterium *Lysinibacillus sphaericus*, with *Nosema ceranae* the other reported disease. Because the majority of respondents were hobbyist beekeepers disease identification and incidence may be underreported. The extent to which colony stress influences susceptibility to pests and diseases is also being investigated as part of our study.

Keywords: Australian Meliponini, disease, pathogens

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Physicochemical Variation of *Tetragonula biroi* Pot-Honey Across Selected Locations in the Philippines

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Abstract

Pot-honey produced by stingless bees is recognized for its unique physicochemical characteristics, which are strongly influenced by floral origin, environmental conditions, and geographic location. This study evaluated the physicochemical properties of seven samples of pot-honey produced by *Tetragonula biroi* from selected locations in the Philippines: the municipalities of Casiguran (3) and Gubat (1) in Sorsogon; Esperanza (1) in Agusan del Sur; Alabel (1) in Sarangani; and Tubajon (1) in Dinagat Islands. Parameters analyzed included moisture content, water activity, ash content, electrical conductivity, pH, free acidity, diastase activity, and pollen composition. Moisture content ranged from 26.74% to 32.04%, while water activity ranged from 0.69 to 0.77. Ash content (0.63-1.21%) and electrical conductivity (0.58-1.29 mS/cm) showed parallel variation, indicating differences in mineral composition linked to floral and geographic origins. All samples were acidic, with pH values ranging from 3.08 to 3.75 and free acidity from 116.67 to 347.67 mEq/kg, reflecting the acidic nature of pot-honey and its susceptibility to natural fermentation. Diastase activity was consistently low (0.02-2.09 Gothe), suggesting that reduced enzymatic activity is an intrinsic property of stingless bee honey rather than an indicator of deterioration. Botanical origins also varied across sampling sites, based on pollen composition, five samples were classified as monofloral and two as multifloral. Arecaceae-type pollen was the predominant pollen source in most samples, whereas other samples exhibited a more diverse pollen spectrum. Significant differences ($p < 0.05$) were observed among sampling locations for most physicochemical parameters, confirming that geographic origin influences the composition, quality, and potential market value of pot-honey. These findings highlight the distinct physicochemical profile of Philippine *T. biroi* pot-honey and provide baseline information for the development of species-specific quality standards, authentication, protocols, and commercialization strategies.

Keywords: botanical origin, geographic origin, physicochemical properties, pot-honey, *Tetragonula biroi*

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Meliponitourism, an Approach to the Conservation of Bees in Tanzania

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Abstract

Tanzania boasts a rich and diverse beekeeping heritage, woven deeply into both rural livelihoods and the nation's natural landscapes. As one of the cornerstones of the country's economy, tourism is intersecting with beekeeping: apitourism. This emerging niche invites travellers to immerse themselves in the world of bees, offering unique experiences that range from witnessing hive-making to participating in honey harvesting and learning about sustainable beekeeping practices. In Tanzania, apitourism is not only focused on the popular honeybee (*Apis mellifera*), it also includes stingless bees (Meliponini). The passive nature of stingless bees makes them a very suitable ambassador of the natural world. Without the dangers of getting stung, melitourism can be more than just an additional tourism product or a novel revenue stream for local communities—it is a powerful tool for education and conservation. By opening beekeeping sites to visitors, apitourism/ melitourism raises awareness about the crucial ecological role of bees, the challenges they face, and the importance of their preservation for both biodiversity and agriculture. Currently, Tanzania features more than 20 apitourism/melitourism destinations welcoming both local and international tourists. Our talk will underscore the significance of establishing a robust network of apitourism/melitourism facilitators. Through collaboration and knowledge-sharing, such a network has the potential to strengthen the sector, support community development, and ensure that apitourism/melitourism remains a sustainable and beneficial approach for both people and pollinators.

Keywords: apitourism, conservation, education, meliponitourism, sustainable enterprise, value chain

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Native Stingless Bees Provide the Majority of the Pollination Services in Australian Mango Orchards

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Abstract

Pollination is a critical ecosystem service underpinning mango production, yet the role of wild native insects in Australian mango orchards remains poorly understood. We investigated the contribution of insect flower visitors to pollination and fruit set in Kensington Pride mango orchards in the Northern Territory, Australia. Pollinator exclusion experiments were conducted using three treatments: open pollination, exclusion of large flower visitors (>5 mm), and total exclusion of insect visitors. In parallel, we assessed visitation patterns, foraging behaviour, pollen loads, and single-visit pollen deposition of major flower visitors to determine their relative pollination importance. Fruit set was substantially higher in both open and large-visitor exclusion treatments compared with total exclusion, confirming the essential role of insect-mediated pollination in mango production. Interestingly, excluding larger flower visitors such as honey bees, hover flies, and blow flies did not significantly reduce fruit set, despite a substantial decline in overall visitation rates, suggesting that smaller visitors, particularly stingless bees, were highly efficient pollinators. The native stingless bee *Tetragonula mellipes* was the dominant flower visitor and exhibited the highest pollen loads and stigma pollen deposition rates among all observed taxa. Based on visitation frequency and pollination effectiveness, *T. mellipes* accounted for the majority of pollination services within orchards, far exceeding the contribution of other visitors such as hover flies. Our findings demonstrate the importance of conserving native pollinator communities in tropical agricultural landscapes and highlight the potential of stingless bees as effective managed pollinators for mango production in northern Australia. Enhancing habitat availability and integrating stingless bee colonies within orchards may improve pollination services and support sustainable mango productivity.

Keywords ecosystem services, mango pollination, *Mesembrius*, native pollinators, *Tetragonula,* tropical horticulture

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Pathogens and Parasites in Brazilian Stingless Bees

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There are currently over 600 known species of stingless bees (tribe Meliponini) worldwide, with Brazil hosting the greatest diversity, accounting for approximately 300 registered species. Further research on the pathogens and parasites affecting native stingless bees is essential to address current knowledge gaps. In this study, we evaluated the presence of *Apis mellifera* (Apini) parasites and pathogens in social stingless bees (Meliponini). We assessed 80 samples from 40 colonies representing eight social bee species: *A. mellifera* (used as a positive control), *Melipona quadrifasciata anthidioides*, *M. scutellaris*, *Nannotrigona testaceicornis*, *Partamona helleri*, *Scaptotrigona xanthotricha*, *Tetragonisca angustula*, and *Trigona spinipes*. We screened for ectoparasitic mites (via mechanical screening) and used molecular analyses to detect *Nosema apis*, *N. ceranae*, *Ascosphaera apis*, the bacteria *Paenibacillus larvae* and *Melissococcus plutonius*, and several viruses like Acute Bee Paralysis Virus (ABPV), Israeli Acute Paralysis Virus (IAPV), Black Queen Cell Virus (BQCV), Chronic Bee Paralysis Virus (CBPV), Sacbrood Virus (SBV), Kashmir Bee Virus (KBV), and Deformed Wing Virus (DWV). The mite *Leptus* spp. was found in *A. mellifera*, *M. quadrifasciata* and *M. scutellaris*; ABPV was detected in *A. mellifera*, *M. quadrifasciata anthidioides*, *M. scutellaris*, *N. testaceicornis*, *P. helleri*, *S. xanthotricha*, *T. angustula*, and *T. spinipes*; and the IAPV virus was identified in *A. mellifera*, *M. quadrifasciata anthidioides* and *T. angustula*. Our results indicate that native stingless bees are susceptible to the same parasites and pathogens that afflict *A. mellifera*. The potential for interspecies transmission through shared floral networks highlights an urgent need for broader health monitoring to protect the biodiversity of native Neotropical pollinators.

Keywords: Brazilian stingless bee, Meliponini, stingless bees health, viruses in stingless bee

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Nesting Preferences and Habitat Associations of Stingless Bees in Mangrove, Forest and Farmland in Coastal Region, Tanzania

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Abstract

We examined the nesting preferences and habitat associations of stingless bees across mangrove, forest, and farmland ecosystems in coastal Tanzania. Field surveys conducted using visual searches to locate natural nests. Environmental variables associated with nests, including nesting substrate, nest height, tree diameter at breast height (DBH), crown cover, and distance to water sources, were recorded and analyzed among stingless bee species and habitat types. Nesting site of five stingless bee taxa were studied, namely *Axestotrigona ferruginea*, *Hypotrigona gribodoi*, *Hypotrigona araujoi*, *Dactylurina schmidti*, and *Liotrigona* sp. 1. Nesting preference analysis revealed a strong reliance on tree substrates, with 85.8% of colonies occurring in trees, while fewer nests found in mud walls, concrete structures, coconut shells and thatch. However, stingless bee species did not preferentially select particular tree species for nesting ($X^2 = 62.8$, df = 48, $p = 0.074$). Nest height ranged from 1.1 to 6.5 m, with most nests occurring between 2–3 m high. Most stingless bee colonies found in medium sized trees (100–150 cm DBH), representing 46.8% of all recorded nests. A substantial proportion (37.6%) also occurred in large trees (>150 cm DBH), while few colonies (15.6%) were associated with small trees (<100 cm DBH). No nest recorded in tree with <50 cm DBH. Environmental variables did not differ significantly among species ($p > 0.05$). DBH emerged as the most important factor determining nest site selection, as it directly influences the availability and size of nesting cavities. Mangrove habitats supported the highest number of colonies, followed by forest and farmland ecosystems. *Axestotrigona ferruginea* occurred across all habitat types and showed the widest habitat distribution. Distance to water ranged from 150 – 500m, with no strong clustering of stingless bee's nests observed near water points. Our results provide baseline information for developing conservation measures for stingless bees in African tropics.

Keywords: Meliponini, nesting preference, nesting site, stingless bees, Tanzania

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Community Composition and Diversity of Stingless Bees (Hymenoptera: Apidae, Meliponini) Across Island and Mainland Habitats in Coast Region, Tanzania

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Abstract

In this study we examine the diversity and composition of stingless bees in Coast Region, Tanzania. Field survey were conducted across mangroves, forest and village habitats. Stingless bees were sampled using visual searching, targeted netting and pan traps along established transects. A total of five stingless bee taxa were recorded, including four species that were identified to species level (*Axestotrigona ferruginea*, *Hypotrigona gribodoi*, *Hypotrigona araujoi* and *Dactylurina schimdti*), and one that was designated as *Liotrigona* sp. 1. Diversity analysis using Hill numbers showed slightly higher values in mainland habitats than in island habitats across all diversity orders: q = 0 (3.00 ± 0.41 vs 2.67 ± 0.21), q = 1 (2.45 ± 0.39 vs 2.29 ± 0.17) and q = 2 (2.23 ± 0.37 vs 2.14 ± 0.17) respectively, although these differences were not statistically significant (all $p > 0.05$). Colony density differed significantly among species ($F = 4.28$, $p = 0.004$), whereas habitat had no significant effect ($F = 0.65$, $p = 0.527$). *Liotrigona* sp. 1 was the most abundant species, accounting for 40.2% of all recorded colonies, while *Dactylurina schmidti* was the least abundant species. NMDS ordination and PERMANOVA revealed substantial overlap in species composition across habitats ($R^2 = 0.188$, $F = 1.85$, $p = 0.169$). The observed patterns in diversity are consistent with other studies conducted at tropical islands, where stingless bee diversity is often lower than in nearby mainland habitats.

Keywords: diversity, islands, mainland, Meliponini, stingless bees, Tanzania

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Nutritional Supplementation Enhances Physiological Resilience and Colony Productivity of *Tetragonula pagdeni* Under Nutritional and Pesticide-Related Stress

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Abstract

Stingless bees (*Tetragonula pagdeni* Schwarz) serve as essential pollinators and producers of high-value honey; however, their colonies face increasing threats from food shortages, climate change, colony splitting, and pesticide exposure. These stressors impair worker physiology, diminish colony strength, and may ultimately result in colony collapse. This study investigated whether nutritional supplementation could enhance worker survival, physiological development, and colony productivity of *T. pagdeni* under conditions of nutritional and pesticide-related stress. Laboratory experiments measured worker survival, hypopharyngeal gland (HPG) development, and body fat content across various dietary treatments, including supplementary feed and pollen nutrition, with or without sublethal thiamethoxam exposure. Field trials evaluated the impact of the most effective diet on colony performance and honey production. The A2 diet formulation, comprising soybean meal and probiotics, yielded the highest laboratory performance, with worker survival at 56.67 ± 0.58%, HPG acini width at 45.23 ± 1.50 µm, and body fat content at 0.10 ± 0.01 mg per bee. Thiamethoxam exposure significantly decreased worker survival and HPG development, while pollen or nutritional supplementation improved these parameters and partially alleviated pesticide-induced physiological impairment. Under field conditions, colonies receiving the A2 supplement produced 1.96–2.73 times more honey than non-supplemented colonies, without compromising honey quality or safety. These results demonstrate that targeted nutritional supplementation increases colony resilience and productivity, offering a practical approach to reducing colony losses and promoting sustainable stingless bee farming under environmental stress.

Keywords: colony resilience, hypopharyngeal gland, probiotics, soybean meal, stingless bee nutrition, *Tetragonula pagdeni*, thiamethoxam

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Laboratory Studies Show Australian Stingless Bees are More Vulnerable to Pesticides than Honey Bees

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Abstract

Stingless bees are important pollinators in subtropical and tropical regions, including Australia, where they provide crucial pollination services for both native flora and high value horticultural crops. It is well known that pesticides can have lethal and sublethal effects on stingless bees, yet current risk assessment relies almost exclusively on data from the European honey bee *(Apis mellifera*), leaving stingless bees vulnerable to pesticide exposure. In the absence of toxicity data for other bee species, regulatory frameworks commonly apply a default 10x safety factor to account for interspecific variations. In this study, we evaluated the acute oral and contact toxicity of two commonly used insecticides, dimethoate and flupyradifurone in four stingless bee species: *Tetragonula carbonaria, Tetragonula hockingsi, Tetragonula mellipes* and *Austroplebeia australis*. Toxicity assays were conducted using OECD-adapted guidelines. A separate study evaluated 16 commercially formulated pesticides for residual toxicity using standard protocols employed in research on bio-control organisms. This methodology was designed to simulate realistic field exposure scenarios, incorporating contaminated nectar and pollen as well as pesticide residues encountered in agricultural landscapes. Mortality and behaviour were recorded up to 120 hours after treatment (HAT). All four stingless bee species showed clear dose- and time-dependent toxicity. LD_{50} values for both insecticides were lower than published values for honey bees, indicating greater sensitivity of stingless bees at lower doses. Abnormal behaviour, such as hyperactivity, paralysis, slow movement, and disorientation, was also observed below the LD_{50} values. The residual toxicity study found consistent results with dimethoate and flupyradifurone but lower than expected impacts in terms of mortality associated with four chemicals moderately or highly toxic to honey bees – these unusual findings will be investigated in future studies. Our findings demonstrate that applying a uniform default safety factor of 10x from honey bee studies may not adequately protect Australian stingless bee species. We recommend establishing a species-specific regulatory framework for pesticide risk assessment in stingless bees.

Keywords: insecticides, risk assessment, sensitivity, stingless bees, toxicity

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Physicochemical and nutritional properties of stingless bee honey from Uganda

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Abstract

The stingless bee, *Meliponula bocandei* (Spinola, 1853) was recently domesticated in Uganda for sustainable harvesting of its products. Here, the physicochemical and nutritional properties of *M. bocandei* honey collected from the Western Highlands and Lake Victoria Crescent agroecological zones are assessed. Physicochemical properties that include moisture content, water activity, pH, viscosity, hydroxymethylfurfural (HMF) and electrical conductivity were determined following standard protocols in Association of Official Analytical Chemists, 1990. Nutritional and antioxidant profiles were analysed following the protocols in International Honey Commission (2009). The findings reveal the following means of the physicochemical properties: moisture content (26.45±3.9%), viscosity (38.32±2.25Pa.s), HMF (5.42±4.78mg/kg), pH (4.15±0.68), electrical conductivity (228.80±86.91µS/cm) and water activity (0.71±0.04%). These values are within the standard means stated in the East African Community standards for stingless bee honey. The values recorded for nutritional and antioxidant properties were: sugar (50-76 mg/g), total phenolic compounds (7.21-95.38 gGAE/100g), total flavonoids (1.88-57.37 gCEQ/100g) and DPPH (2.07-18.04%). Mineral elements detected in the honey included Phosphorus, Zinc, Calcium, Iron, Copper, Potassium, Manganese, Magnesium and Sodium. Phosphorus was the most abundant mineral element in the *M. bocandei* honey from the two agro-ecological zones of Uganda. Total phenolic compounds and DPPH were significantly higher in honey collected during the dry season compared to the wet season. However, *M. bocandei* honey collected during the wet season had a significantly higher total amount of flavonoids than that of the dry season. Lead and Cadmium were detected in some honey samples. Therefore, the location of meliponaries should be carefully selected to minimize potential sources of heavy metal pollution.

Keywords: acidity, antioxidants, electrical conductivity, HMF, minerals, moisture content, stingless bee products

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Meliponiculture as a strategy for participatory conservation and biocultural innovation in El Salvador

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Abstract

Stingless bees are native pollinators of great biological, ecological and cultural importance in tropical regions. In El Salvador, habitat loss, landscape fragmentation and the decline of traditional ecological knowledge threaten both the conservation of these species and the community practices associated with their management. In this context, meliponiculture offers an opportunity to connect stingless bee biology with participatory conservation, environmental education and biocultural innovation. This work systematizes the experience developed by students linked to the CREVAS Project, under technical and academic guidance, in coordination with the Faculty of Agronomic Sciences of the University of El Salvador. The experience was based on observation, technical support, training activities and collaboration with producers and local communities. It focused on recognizing stingless bees as key organisms for ecosystem resilience, considering aspects related to their habitat, colony management, availability of floral resources, conservation of native species and relationship with productive and community landscapes. The lessons learned show that the sustainability of meliponiculture depends not only on the technical management of colonies, but also on social participation, knowledge exchange and local appreciation of native pollinators. The involvement of students and producers helped strengthen capacities for colony care, environmental awareness and understanding of the role of stingless bees in biodiversity conservation. This experience demonstrates that meliponiculture can be understood as a strategy of applied biology, conservation and rural innovation, capable of linking science, education and community action in favor of native pollinators in El Salvador.

Keywords: stingless bees, meliponiculture, applied biology, participatory conservation, native pollinators, environmental education, El Salvador.

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Palynological Insights into Floral Resource Diversity of the Indo-Malayan Stingless Bee *Heterotrigona itama* in Fragmented Tropical *Melaleuca* Forests

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Abstract

Stingless bee palynology in Malaysia's tropical coastal ecosystems remains poorly documented despite its importance for pollination, biodiversity, and habitat conservation. *Melaleuca* forests dominated by *Melaleuca cajuputi* constitute important tropical coastal wetland ecosystems in Peninsular Malaysia, serving as major foraging habitats for stingless bees and contributing to the production of the iconic Malaysian Gelam honey. However, increasing anthropogenic disturbance and habitat fragmentation have progressively reduced the availability of floral resources essential for stingless bee survival and colony sustainability. Therefore, this study aimed to investigate the dominant pollen sources and pollen diversity preferred by the Indo-Malayan stingless bee, *Heterotrigona itama*, reared in fragmented *Melaleuca* forests of Terengganu, Malaysia. Palynological analysis was conducted on corbicular pollen loads collected from foraging workers. A total of 61 pollen types belonging to 20 plant families were identified, revealing substantial floral diversity within the fragmented coastal ecosystem. Pollen assemblages were predominantly represented by *Cyperus aromaticus*, *Acacia* type, *Melastoma malabathricum*, and *Cocos nucifera*, suggesting selective floral preference and adaptive foraging behaviour by *H. itama* under fragmented habitat conditions. Interestingly, pollen of *M. cajuputi* was also detected, confirming that this species remains an important floral resource for stingless bees despite increasing habitat disturbance. The reduced representation of *M. cajuputi* pollen may indicate the ecological effects of habitat degradation and fragmentation within *Melaleuca* Forest ecosystems, highlighting the need for conservation, habitat restoration, and sustainable ecosystem management.

Keywords: floral resource utilization, fragmented *Melaleuca* forest, *Heterotrigona itama*, melissopalynology, pollen assemblage, pollination ecology, tropical biodiversity

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Ecological Plasticity and Nesting Patterns of Stingless Bees in Urban Environments in Northwestern Argentina

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Abstract

Urban areas and their unplanned expansion impact natural habitats and contribute to their fragmentation and loss. Numerous species persist, adapt, and find refuge by using alternative nesting sites and resources that meet their nutritional requirements. In this context, the aim of this study was to report the species of stingless bees and characterize the nesting substrates used in different urban spaces of San Salvador de Jujuy, Argentina (24°11'S, 65°17'W; 1259 m a.s.l.). During 2025, systematic surveys were conducted in two urban parks and two cemeteries within the city. For each nest, the bee species, the type of substrate used, and, in the case of tree cavities, the plant species, height, and DBH were recorded. A total of 171 nests belonging to four species were reported: *Tetragonisca fiebrigi* (53.80%), *Plebeia catamarcensis* (40.94%), *Scaptotrigona jujuyensis* (2.92%), and *Plebeia droryana* (2.34%). Most nests were found in artificial substrates (63.07%), mainly in walls, cemetery tombs, and utility poles. The remaining 36.93% were located in tree cavities, with a marked predominance of exotic tree species (90.62%, including *Casuarina cunninghamiana, Grevillea robusta, Ligustrum lucidum*, and *Cupressus sempervirens*) over native species (9.38%). *Tetragonisca fiebrigi* and *P. droryana* showed greater ecological plasticity by using both natural and artificial cavities across all surveyed sites. In contrast, *S. jujuyensis* was exclusively associated with tree cavities of *C. cunninghamiana* with an average DBH of 60.21 cm. Meanwhile, *P. catamarcensis* was recorded exclusively in stone walls, exhibiting gregarious nesting behavior with a high nest density in reduced spaces (15 nests in 4 m²). These results highlight the importance of cities and the key resources they provide for the conservation of stingless bees, particularly for species with specific nesting requirements such as *S. jujuyensis.*

Keywords: ecological plasticity, nesting, urban ecology

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A Comprehensive Review on Stingless Bees (Putka Mauri): Species Diversity, Bio-ecology, Ethno-medicinal Significance, Conservation and Utilization Perspectives

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Abstract

Stingless bees (tribe Meliponini) are among the most ecologically and economically important eusocial insects inhabiting tropical and subtropical regions worldwide. This comprehensive review synthesizes current knowledge regarding the taxonomy, phylogeny, morphology, colony organization, hive management, honey properties, medicinal importance, nest construction behavior, resin utilization, and major threats affecting stingless bees. A systematic evaluation of published scientific literature, review articles, books, and online databases was conducted to assess global species diversity and the biological significance of stingless bees. From our comprehensive review, we found that a total of 605 stingless bee species belonging to 60 genera have been reported worldwide, indicating greater diversity than previously documented. Morphologically, stingless bees are generally smaller than honeybees (2–15 mm body length) and are characterized by the absence of a functional sting, reduced wing venation, and specialized structures such as the penicillum. Their perennial colonies exhibit highly organized social systems with mass-provisioned brood cells and distinct honey and pollen storage areas. Physicochemical analyses demonstrate that stingless bee honey possesses unique characteristics, including higher moisture content, lower pH, and elevated free acidity compared with honey produced by *Apis mellifera*. Furthermore, stingless bee honey, propolis, and geopropolis contain abundant polyphenols, flavonoids, and other bioactive compounds responsible for antioxidant, antibacterial, anticancer, anti-inflammatory, and neuroprotective activities. Stingless bees also provide indispensable pollination services for numerous tropical food, horticultural, and medicinal plants, thereby supporting biodiversity and food security. In Nepal, *Tetragonula iridipennis* remains the primary documented species, although meliponiculture is still underdeveloped. Despite their ecological significance, stingless bees face increasing threats from habitat destruction, pesticide exposure, climate change, pathogens, and erosion of indigenous knowledge. Integrating traditional ecological knowledge with modern conservation and sustainable meliponiculture practices is essential for safeguarding stingless bee diversity and their ecosystem services globally.

Keywords: meliponiculture, Meliponini, pollination and conservation, stingless bees, stingless bee honey

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Second Anniversary of the RUTA-MELI Route of Living Museum of Stingless Bees in the World

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Abstract

One colony of Angelita *Tetragonisca angustula* (Latreille, 1811) originated the concept of our living museum on stingless bees at MUNAPIH *Museo Nacional de Apicultura Ignacio Herrera* at Parque La Isla, Mérida, Venezuela before the 2000 vandalism. RUTA-MELI is the online *Route of Living Museum of Stingless Bees in the World*. A joint endeavor of the Central Bicol State University of Agriculture (CBSUA, Philippines) where Prof. Nicolas is General Director, and Universidad de Los Andes (ULA, Merida, Venezuela) with Prof. Vit serving as Founder Director. The digital platform https://ruta-meli.cbsua.edu.ph/ was launched in May 2024, implemented and hosted by Information and Communications Technology (ICT) at CBSUA. Our coveted treasure are stingless bees and stingless bee keepers of the world. We praise scientists checking quality, investigating new biomolecules, bioactivities, and taxonomical IDs. Educational initiatives wisely promote conservation and sustainable use of nest materials, as needed in meliponitourism. The first anniversary of the RUTA-MELI has been very productive as informed last year in the 2025 ISSB Bicol, Philippines: 1. MELI-Routes, destinations of meliponitourism in 11 countries (Brazil, China, Costa Rica, Ecuador, Ghana, Guatemala, Malaysia, the Philippines, Tanzania, Thailand, and Venezuela), 2. SCI-Routes, on scientific collaborations with 13 countries (Italy, Mexico, Indonesia, Venezuela, Spain, Malaysia, Colombia, Japan, Brazil, Panama, Costa Rica, Thailand, and India), 3. SB-Stars showcasing RUTA-MELI winners of female (2024) and male (2025) global stingless bee scientists, directors, and keepers, and 5. SB-Lines holds a global information hub, of curated resources such as official websites, and social media platforms visualizing stingless bee sanctuaries, meliponiculture shops, and inclusive initiatives. Institutions, specialized researchers, and practitioners passionate on biodiversity conservation of stingless bees, unite here as spotlighted by UNESCO worldwide. New stations from Australia, El Salvador, Nepal, Paraguay, Peru, and Venezuela should join for the third anniversary, because after the glamorous 2025 International Symposium on Stingless Bees, Bicol, Philippines June 10-11, RUTA-MELI was neglected.

Keywords: biodiversity, conservation, digital platform, global stingless bees, living museum, meliponiculture, meliponitourism

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Bioculturality and Stingless Bee keeping for the Symbiocene

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Abstract

Archaeological evidence suggests that rural and indigenous cultures in Mesoamerica have been keeping stingless bees for at least two thousand years. This represents a biocultural legacy of great significance, which also makes an undeniable contribution to the conservation of pollinators and the fabric of life in general. This proposal offers a theoretical and methodological framework for the study and analysis of the crucial importance of biculturalism and contemporary 'knowledge' for the continuity of this legacy and the sustainability of meliponiculture. It is approached as part of the world's onto-epistemological diversity. To this end, the use of methodologies based on participatory action research and authentic dialogue of knowledge is proposed, through which stingless bee-keepers are recognized as full-fledged subjects. Furthermore, it identifies some of its main threats and challenges, as well as the relationship between meliponiculture and Mexican public policies and the consequences of that relationship. By denying this knowledge, public policy-makers deny cognitive justice to peoples who have been rearing native stingless bees for generations. We therefore propose that, in addition to the dialogue of knowledge between stingless bee keepers, and between stingless bee keepers and the academic world, it is also necessary for this dialogue to take place with the government. The aim is to provide insights that contribute to the recognition and appreciation of the complex, profound and beautiful relationship between humans and bees, as well as the contribution of meliponiculture to the continuity and care of life, and thus to the possibility of moving towards the Symbiocene—a concept which, as its name suggests, proposes a symbiotic relationship between humanity and other forms of life.

Keywords: biological diversity, cultural diversity, meliponiculture, Mesoamerica, traditional ecological knowledge, traditional wisdom

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Ecological and architectural characteristics of the nests of the stingless bee *Plebeina armata* (Magretti, 1895) (Apidae: Meliponini) in Burkina Faso

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Abstract

Plebeina armata is one of the stingless bee species whose honey is highly prized by the people of Burkina Faso.. The harvesting of *P. armata* honey comes at the cost of the unregulated excavation of these bees' nests which may lead to a gradual decline of colonies. The conservation of this bee could be achieved through the practice of meliponiculture. However, to practise meliponiculture with *P. armata*, it is essential to understand the environment of its nests and, in particular, certain architectural features of these nests. This study aims, on the one hand, to determine the edaphic and hygrothermal characteristics of the nest environment and, on the other hand, to characterise their architecture. A total of 21 *P. armata* nests were identified in three ecosystems (fallow land, forests and fields). The soil composition of clay, silt and sand in the nest environment was determined. A thermohygrometer was used to measure the temperature and relative humidity outside and inside the nests. The dimensions of the various compartments within the nests were measured. The results show that the soil composition of clay, silt and sand did not vary significantly from one ecosystem to another. Similarly, the internal and external temperatures, as well as the internal and external relative humidity, were statistically similar across the three ecosystems. Average external temperatures ranged from 32.35 ± 1.6 to 34.13 ± 1.76 °C, and average internal temperatures ranged from 27.88 ± 0.88 °C to 30.3 ± 1.35 °C. The diameter of the nest cavities was significantly greater in fields (31.82 cm) than in fallow land (17.53 cm) and forests (15.82 cm). The results obtained could facilitate the practice of meliponiculture with *P. armata* through better site selection, the choice of hive construction materials and the adaptation of hive dimensions to the rearing of this bee.

Keywords: Burkina Faso, Ecosystems, Meliponiculture, Nests, *Plebeina armata*

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Plega hagenella (Neuroptera) as a Parasitoid of Stingless Bees (Meliponini): Biology, Infestation Dynamics, and Community-Based Management Strategies

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Abstract

Stingless bees (Meliponini) are among the most important pollinators of tropical ecosystems, providing essential ecological functions and supporting sustainable livelihoods through meliponiculture. Despite their ecological and economic significance, brood parasitoids remain an underestimated threat to colony health and productivity. Here, we report new records of the mantispid *Plega hagenella* (Neuroptera: Mantispidae) associated with stingless bee colonies and describe its infestation dynamics, biological traits, and an effective management strategy developed through a collaborative process involving researchers and traditional Quilombola meliponiculturists. Field surveys were conducted in meliponaries managed by traditional communities in the Brazilian Amazon and complemented by observations from other regions of Brazil. *Plega hagenella* was recorded for the first time parasitizing colonies of *Melipona compressipes* in Amapá State, extending both its known host range and geographic distribution. Additional records from Goiás, São Paulo, Pará, and Tocantins indicate that the parasitoid is widely distributed across Brazil and capable of exploiting multiple Meliponini hosts. Observations revealed that females oviposit on the external surfaces of hive boxes during the evening. After hatching, larvae enter colonies and actively search for brood cells containing prepupae or pupae, which serve as hosts throughout their development. Exuviae attached to external hive walls proved to be reliable indicators of infestation, while variation in adult body size suggests successful development on different host species. A key outcome of this study was the identification of a simple and highly effective control method resulting from the integration of scientific investigation and traditional ecological knowledge. Quilombola stingless bee keepers had long observed that routine brushing of hive exteriors reduced infestation levels. Systematic monitoring confirmed that weekly brushing removes eggs and newly hatched larvae before colony invasion, interrupting the parasitoid life cycle without chemical intervention. Our findings highlight the importance of knowledge co-production between scientists and traditional communities and demonstrate how locally developed practices can provide sustainable solutions for protecting stingless bee colonies and strengthening meliponiculture conservation efforts.

Keywords: brood parasitoid, colony health, *Plega hagenella*, Quilombola communities, stingless bees, sustainable meliponiculture, traditional ecological knowledge

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Microbiological Safety, Contaminants, and Risk Assessment of Stingless Bee Honey from Different Regions of Thailand

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Abstract

Stingless bee honey is a high-value product in Thailand, but information on its safety, contamination risks, and species-specific production practices remains limited. This study evaluated microbiological safety, contaminants, chemical residues, risk factors, and prevention measures for Thai stingless bee honey to support product standard development and good practice guidelines. A total of 150 honey samples were collected from stingless bee farms in Northern, Eastern, Central, and Southern Thailand. Samples were obtained from three commonly cultivated taxa: *Lepidotrigona flavibasis*, *Tetragonula laeviceps–pagdeni* species complex, and *Heterotrigona itama*. Harvesting practices differed according to honey pot size. Medium-large honey pots of *L. flavibasis* and *H. itama* were harvested using vacuum suction or droppers, whereas small honey pots of the *T. laeviceps–pagdeni* species complex were harvested by cutting the pots and pressing the honey in a processing area. Most samples showed no detectable heavy metal or pesticide contamination. However, microbiological contamination was associated with livestock activities and poor farm hygiene, while heavy metals and pesticide residues were occasionally detected near petrol stations, vehicle repair areas, or pesticide-intensive agricultural areas. Risk analysis showed species-specific concerns. *L. flavibasis* honey had moderate risks for yeast and *Bacillus cereus*. *H. itama* honey showed high risks for excessive yeast, total microbial counts, and B. cereus. Honey from the *T. laeviceps–pagdeni* species complex showed very high risks for excessive yeast and total microbial counts, high risk for *B. cereus*, and moderate risks for lead and carbaryl contamination. Recommended preventive measures include improved equipment sanitation, hive cleaning, clean processing areas, separation from livestock or composting activities, and avoidance of contaminated surroundings. These findings provide scientific evidence for drafting Thai stingless bee honey standards and improving product quality and safety.

Keywords: food safety, heavy metals, microbiological contamination, pesticide residues, pot-honey, risk assessment, stingless bee honey

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From Easel to Hive: An Art Educator's Journey into Stingless Bee Keeping, Community Livelihood, and Environmental Stewardship

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Abstract

A transformative narrative on repurposing education for ecological and economic resilience. Formerly teaching visual arts in a traditional classroom, her learning space now resonates with the hum of native stingless bees, *Tetragonula biroi*, turning pedagogy into practice through meliponiculture and sustainable enterprise. This paper documents how the integration of stingless bee keeping into STEM (Science, Technology, Engineering, and Mathematics) education and community outreach created a living laboratory for youth, women, researchers, and entrepreneurs in Labo, Camarines Norte. Through Beesfriend Honeybee Farm and Meliponitourism Bicol, over 30 STEM students and 15 women artisans were trained in stingless bee management, honey processing, and the production of natural organic cosmetics and bee- based products. The initiative demonstrates measurable outcomes: increased student engagement in science, the establishment of micro-enterprises, and a community-driven model for pollinator conservation and livelihood. As a member of the Beekeepers Association of Camarines Norte, the author bridges art, science, and entrepreneurship to serve women's groups, youth, researchers, business entrepreneurs, environmentalists, and faith-based communities. Using reflective practice and action research, the study highlights three transitions: from creative expression to ecological caretaking, from classroom instruction to community empowerment, and from individual skill to collective prosperity. The findings affirm that when an art educator becomes a stingless bee keeper, the classroom extends beyond walls, becoming a hive of innovation, environmental advocacy, and sustainable rural development rooted in natural organic practices.

Keywords: art educator, collective prosperity, ecological caretaking, meliponitourism, STEM, student engagement in science, women's groups

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Sensitivity of Stingless Bees in Environmental Stressors- Need for More Research

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It is well documented that environmental stressors are increasing worldwide, with major ones the pesticide exposure, other environmental pollution, the climatic changes, the habitat loss and land uses fragmentation, the limitation of resources, and of course the pathogens and parasites. However, most research has focused on honey bees, leaving a significant gap in studies concerning other bee species, such as the stingless bees. At the same time, the pollinators' populations are declining globally and meliponiculture, is an expanding field that offers significant economic and conservation benefits, which deserves immediate attention. Recent research has shown that stingless bees are particularly susceptible to pesticide toxicity, even at very low concentrations. In several cases, they show higher sensitivity than honey bees, the model species for toxicological studies. The high biodiversity of stingless bees in tropical and sub-tropical areas suggests possible differentiated patterns in sensitivity among the species, highlighting the need to insert more than one surrogate species in risk assessment protocol development. Climatic changes, with heat waves increasing in intensity and frequency, have been shown that has a detrimental effect on stingless bee colony survival, due to increased brood mortality and adult bee tolerance to temperatures. Yet, research is limited and there is a large gap in assessing the nonlethal effects of temperature increases on those tropical species. Rain limitations are enhancing the resource scarcity caused by the warmer conditions, and nutritional needs of these social insects are similar, yet different, to those of honey bees. Furthermore, similarly to honey bees and solitary bees, urgent research is needed to assess the synergetic effects of several different environmental stressors to stingless bees, and to support the implementation of sustainable regulation strategies in meliponiculture.

Keywords: climate change, environmental stressors, nutrition, pesticides, stingless bees, synergism,

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Second Call of Young Researcher Awards in Stingless Bee Science During the 2026 ISSB

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Abstract

We continued this initiative to underscore scientific production on stingless bee science by researhers up to 40 years old in the 2026 ISSB, rescued by IBRA as a Webinar after Australia, Ghana, and Tanzania venues failed. It is an honor to be virtually hosted by the International Bee Research Association (IBRA). The Young Researcher Award (YRA), was introduced at the 2025 International Symposium on Stingless Bees (2025 ISSB) held at CBSUA in Bicol, Philippines. Disciplined and seminal achievements in propolis and evaluation strategy by Prof. Dr. Vassya Bankova inspired YRA at ISSB. Here we honor young researchers in multidisciplinary fields investigating stingless bees. Our YRA were named after leading scientists in diverse disciplines P Vit-Olivier in Pot-Honey Science, C Grüter in Biology of Stingless Bees, C Cervancia in Pollination by Stingless Bees, MZ Mustafa in Meliponitherapy, Father JS Moure in Taxonomy of Stingless Bees, and OM Barth in Palynology of Stingless Bees. We kept the simple and modem guidelines prepared last year for each of the six YRA. A selected scientific publication and corresponding abstract, relevance of that research, was carefully valued with professional criteria including h-index, CV, novelty, and scientific impact. In the 2026 call, 11 applications were received; one of them was disqualified due to topic mismatch, and one for inconsistent abstract. Future applicants are encouraged to closely align their established field of research to ensure fair evaluation within the respective YRA category. The nine valid applications were evaluated in five categories. The Award Committees were composed of experts from different continents, representing each YRA category, and proposed the winners. The relevance of evidence-based investigation results, as well as the number, type, and theme of publications, and h-index were considered important. Book prizes were donated by Springer and a one-year online subscription of the *Journal of Apicultural Research* by IBRA. Three awards were granted to the following researchers: 1. Kemilla S Rebelo from Brazil in Meliponitherapy, 2. Joseline Sofia Ocaña Cabrera from Ecuador in Palynology of stingless bees, and Garauv Singh from India in Pollination by stingless bees. We celebrated winner applicants sending their best papers in the 2025 call: Barbosa et al. (2017), Desamero et al. (2023), Honorio et al. (2024), Lepeco et al. (2024), Pimentel et al. (2023); and the 2026 call: Rebelo et al. (2022) abstract **24**, Ocaña Cabrera et al. (2022) abstract **14**, and Singh et al. (2024) abstract **44**. Paradoxically, awardees of the 2025 YRA did not submit abstracts to the 2026 ISSB. One goal of YRA is expanding public awareness of the significance of stingless bees, improving international and interdisciplinary cooperation, and visibility to fund young researcher projects.

Keywords: biodiversity, biology of stingless bees, meliponitherapy, palynology, pollination; pot-honey, stingless bee science, taxonomy, Young Researcher Award

OUR INSPIRATION AND GRATITUDE

The motto *Yes, We Can* by Paulo Nogueira-Neto in the 2013 Foreword of the book *Pot-Honey. A Legacy of Stingless Bees.* We can save the stingless bees.

Stingless bees and stingless bee keepers of the world.

Classic stingless bee taxonomy by JMF Camargo and his Master Father Jesus S Moure Catalogue of Bees (Hymenoptera, Apoidea) in the Neotropical Region, version online, in the priceless chapter Meliponini Lepeletier, 1836 https://moure.cria.org.br/catalogue/catalogue/catalogue?id=117368 All his entomological IDs for the Venezuelan stingless bees at Universidade de São Paulo in Ribeirão Preto, SP, Brazil. His sensibility and rigor as the artist chosen by stingless bees to depict the architecture of their nests with materials and functions, he mastered and praised in nature, expanding to biogeography.

For non-Neotropical valid species names using the ITIS database, as recommended by John S Ascher at National University of Singapore. No matter recent claims ignoring ITIS and usage of solely DNA barcoding to identify stingless bees, not aligned with its integrative role. Traditional taxonomy applies morphometrics to stingless bee specimens deposited in a collection, as the gold standard needed for the entomological ID in any field of research within the Tribe Meliponini

From the Neotropics to a Cancer Research Laboratory in Australia at the University of Sydney, where IC_{50} of *Melipona favosa* pot-honey quadrupled its efficacy in the ovarian cancer model. The season, botanical origin, or associated microbes within the nest may account for this paramount variability in meliponitherapy. Endless learning with Professor Fazlul Huq. From his chemical synthesis of novel metal-based antineoplastic agents and combinations with phytochemicals to overcome CA, to his poetry by Jujube pen name, where *Honey Lady* was born along his charismatic scientific team in 2011 during an Endeavour Awards Research Fellowship.

A lab where I learned DNA extraction from stingless bee nest materials in the land where experimental *Plebeia* of Nogueira-Neto in the 60s survived in Palo Alto, California. What a magnificent opportunity this UNU-BIOLAC Research Fellowship and an anonymous benefactor shaped for the first microbiome of a Venezuelan pot-honey at the University of California Riverside 2025, ongoing at Stajich Laboratory after I left.

In a beautiful and shiny place, perusing on the microbes preserving sour-sweet pot-honey and their network of antimicrobials for survival in that fermenting matrix of transient bacterial, fungal, and yeast communities. What active biomolecules they originate as therapeutic agents?

Vassya Bankova and Francisco Tomás Barberán beyond science, as well as Cleofas Cervancia, MZ Mustafa, Breno Freitas, Monika Barth, Fani Hatjina, and the Huottuja.

Wish all scholars and meliponiculturists find pearls of wisdom in these divine proceedings of specialized abstracts gathering at the IBRA Webinar for the 2026 ISSB.

Our beloved families, friends, and colleagues always sharing our buzz, and the memory of those who left, thankful for the precious time shared in this dimension.

Patricia Vit
Mérida, Venezuela
June 2026

ALPHABETICAL INDEX OF PARTICIPANTS ABSTRACT Number

A different kind of beekeeping takes flight
Douglas M Main, New York Times
https://archive.nytimes.com/green.blogs.nytimes.com/2012/02/17/a-different-kind-of-beekeeping-takes-flight/

Stingless bees from the Peruvian Amazon have become the first insects to be granted legal rights anywhere in the world, in 2024

Photo: © S Ortiz