WOAH Collaborative Centre Reports Activities 2023

Activities in 2023

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Centre Information

Title of WOAH Collaborating Centre	WOAH Collaborative Centre for Bee Health in Africa
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Name Director of Institute (Responsible Official):	Dr. Abdou Tenkouano, CEO and Director General
Name (including Title and Position) of Head of the Collaborating Centre (WOAH Contact Point):	Dr Subramanian Sevgan, Principal Scientist and Head, Environment Health Theme, icipe
Name of the writer:	Subramanian Sevgan

TOR1 AND 2: SERVICES PROVIDED

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by WOAH

Category	Title of activity	Scope
Disease control (true)	Occurrence and incidence of small hive beetle on colonies of Plebeina armata in Burkina faso	In Burkina faso Plebeina armata is a stingless bee species wildly distributed in the country. The rural community use honey of this species as traditional medicine. Icipe and ULB have trained farmers in domestication of this bee species. However, their management is facing challenge due to high infestation by small hive beetles. It seems that species and occurrence of this beetle is influenced by the type of agroecological zone. We are conducting surveillance on their distribution, seasonality occurrence and their genotypes.
Epidemiology, surveillance, risk assessment, (true)	1. The effect of annual flower strips on pollinator visitation and fruit set of avocado (Persea americana Mill.) in Kenya (	1. We investigated the effects of flower strips on flower visitors and avocado fruit set in Kenya. A strip mixture of sunflower Helianthus annuus L., coriander Coriandrum sativum L., and alfalfa Medicago sativa L. was established at the border of four avocado plots, while four other plots with an unmanaged border served as control. The abundance of insect flower visitors and fruit set at 10 m, 55 m, and 100 m from the border of each plot were assessed during the early, peak, and late avocado flowering periods. The honeybee Apis mellifera L. and hoverflies

		Syrphidae spp. accounted for 22% and 71% of flower visitors, respectively. (Toukem, N. K., Dubois, T., Mohamed, S. A., Lattorff, H. M. G., Jordaens, K., & Yusuf, A. A. (2023). The effect of annual flower strips on pollinator visitation and fruit set of avocado (Persea americana Mill.) in Kenya. Arthropod-Plant Interactions, 17(1), 19-29.)
Wildlife (true)	1. Influence of landscape on foraging range and homing ability of afrotropical stingless bees	1. In this study, we estimated the maximum foraging distance of six different afrotropical stingless bee species (Meliponula bocandei, Meliponula ferruginea, Meliponula togoensis, Meliponula beccarii, Plebeina armata and Hypotrigona gribodoi.) in two different landscapes (urban and natural). We conducted translocation experiments in which marked bees were released at different distances. Time of return and number of bees that returned to the hive were recorded. Our findings showed that the maximum homing distance of the studied bees in an urban landscape ranged between 400 and 800 m, while in a natural landscape it ranged between 800 and 1800 m. The distance at which 50% of the released bees returned, was found to range between 200 and 400 m in an urban and 400–1200 m in a natural landscape. (Kasiera, W., Kariuki, S., Musonye, M., Krausa, K., & Kiatoko, N. (2023). Influence of landscape on foraging range and homing ability of afrotropical stingless bees. Insectes Sociaux, 70(1), 59-67).
Diagnosis, biotechnology and laboratory (true)	1. Occurrence and distribution of Nosema ceranae in honey bee colonies in the Comoros Islands	1. We determined the Nosema species infecting honey bees and their prevalence in two islands of the Comoros Archipelago (Grande Comore (GCO) and Mohéli (MOH)) in the Southwest Indian Ocean. (Kipkoech, A., Okwaro, L. A., Muli, E., & Lattorff, H. M. G. (2023). Occurrence and distribution of Nosema ceranae in honey bee colonies in the Comoros Islands. Journal of Apicultural Research, 62(5), 1197-1206.)
Food security (true)	1. Interactions between integrated pest management, pollinator supplementation, and normalized difference vegetation index in pumpkin, Cucurbita maxima (Cucurbitales: Cucurbitaceae), production.	1. A farmer-managed field study was carried out in Yatta and Masinga Sub-Counties of Machakos County, Kenya, to determine the effectiveness of a recommended IPM package and its interaction with stingless bee colonies (Hypotrigona sp.) for pollinator supplementation (PS). The IPM package comprised Lynfield traps with cuelure laced with the organophosphate malathion, sprays of Metarhizium anisopliae (Mechnikoff) Sorokin isolate ICIPE 69, the most widely used fungal biopesticide in sub-Saharan Africa, and protein baits incorporating spinosad. Four treatments—IPM, PS, integrated pest and pollinator management (which combined IPM and PS), and control—were replicated 4 times. The experiment was conducted in 600 m2 farms in 2 normalized difference vegetation index (NDVI) classes during 2 growing seasons (October 2019–March 2020 and March–July 2020). Fruits showing signs of infestation were incubated for emergence, fruit fly trap catches were counted weekly, and physiologically mature fruits were harvested. There was no effect of IPM, PS, and NDVI on yield across seasons. This study revealed no synergistic effect between IPM and PS in suppressing Tephritid fruit fly population densities and damage. Hypotrigona sp. is not an efficient pollinator of pumpkin. Therefore, we recommend testing other African stingless bees in pumpkin production systems for better pollination

		services and improved yields. (Waithaka, N. A., Kasina, M., Samita, N. E., Guantai, M. M., Omuse, E. R., Toukem, N. K., ... & Dubois, T. (2023). Interactions between integrated pest management, pollinator supplementation, and normalized difference vegetation index in pumpkin, Cucurbita maxima (Cucurbitales: Cucurbitaceae), production. Environmental Entomology, 52(3), 416-425.)
Feed safety (true)	1. Pesticide contamination and their botanical sources in pollen loads collected by honeybees in Kenya: A spatio-temporal context	Insecticides were the most widely used as compared to fungicides. Asteraceae, Poaceae and Rubiaceae were the most contaminated plant families, with more than 70% of the detected pesticides. Pollen loads from different apiaries could appear similar in color, but do not necessarily originate from the same family. Type of pesticide present and their levels, and plant families identified varied across sampling time, but not landscapes. All detected pesticides are not restricted products as per the Pest Control Products Board (PCPB) of Kenya. (Koech, S. J., Karanja, R. H., Kurgat, J. K., Mokaya, H. O., Dubois, T., & Lattorff, H. M. G. (2023). Pesticide contamination and their botanical sources in pollen loads collected by honeybees in Kenya: a spatio-temporal context. Agriculture, Ecosystems & Environment, 343, 108264).
Epidemiology, Surveillance, Risk Assessment (true)	2. Influence of the Type of Pollen Diet on the Survival, Body Weight, and Expression of Immune-Response Genes of the Honeybee Subspecies (Apis mellifera scutellata)	2. Honeybees forage on polyfloral pollen rather than monofloral pollen to satisfy their dietary needs. Increased land use and land cover changes, in sub-Saharan Africa, is reducing polyfloral pollen habitats towards monocultures or few floral habitats. The effect of these two pollen types on Apis mellifera scutellata, the predominant honeybee subspecies, in Kenya is poorly understood. Yet this knowledge is critical because poor diet for bees implies a decreased quantity of hive products and reduced income for beekeepers. To fill this knowledge gap, caged bees were fed with two pollen diets (i) lowly diverse (LD), monofloral pollen (ii) highly diverse (HD), polyfloral diet and their effects on four parameters, namely survival, pollen consumption, body weight, and immune response was tested. HD-fed bees had significantly higher survival (p=0.001) and greater pollen consumption (14 mg) than LDfed bees (11.5 mg). However, LD-fed bees (101.7 mg) were heavier than HD-fed bees (109.5 mg). The correlation between pollen consumption and body weight gain was expressed strongly (r=0.9) in HD-fed bees than in LD-fed bees (r=0.7). Overall, this study reveals the benefits that the highly diverse diets provide to honeybee workers and how pollen diversity influences honeybee life-history traits. This informs the need for conserving the biodiversity of environments for safeguarding the health of the honeybees and other pollinators. (MICHAEL NJIHIA MUTURI, MSc Thesis)
		2. We compared the effect of probing time length and visit frequency of two distinct body size African stingless bee species (Meliponula bocandei, Dactylurina schmidti) as alternative pollinators to Apis mellifera scutellata on greenhouse cultivated cucumber. We found differences in morphometric characteristics, between a set of 9 body parameters. Bee body size was the morphological feature that varied the most among bee species. On average, body size was largest in honeybees, followed by M.

Wildlife (true)	2. Body size as a proxy of probing time and visitation rates on cucumber by two African stingless bees increase fruit quality and seed quantity	bocandei, and finally D. schmidti, which was the smallest. The bee species and the number of visits significantly impacted fruit weight, fruit volume and number of seeds. Subsequent visit performed by M. bocandei positively impacted fruit quality. Three visits on a flower were enough to ensure the production of high-quality fruits. Fruit sweetness depended on the number of visits received by the flower, but not on the bee species that performed the visit. (Kiatoko, N., Pozo, M. I., Kasiera, W., Kariuki, S. K., van Langevelde, F., Hundt, B., & Jaramillo, J. (2023). Body size as a proxy of probing time and visitation rates on cucumber by two African stingless bees increase fruit quality and seed quantity. Scientia Horticulturae, 309, 111671.
Wildlife (true)	3. Can the shape of the wing help in the identification of African stingless bee species? (Hymenoptera: Apidae: Meliponini)	3. We explored the potential of wing shape in delineation and classification of Afrotropical Meliponini using geometric morphometrics. We sampled 749 specimens from nine countries of sub-Saharan Africa, belonging to the genera Meliponula (n = 8), Dactylurina (n = 2) and Plebeina (n = 1). Specimens collected from Kenya were used as standards to assess similar species collected from other eight African countries. Eleven landmarks were plotted on the right forewing of each specimen to conduct multivariate analyses and group/specimen classification. Our results show that seven out of eleven African stingless bee species were reliably discriminated using wing shape, however, there was overlap in the remaining four species, namely Meliponula cameroonensis, Meliponula ferruginea, Meliponula togoensis and Meliponula erythra. (Ndungu, N., Vereecken, N. J., Gerard, M., Kariuki, S., Kati, L. K., Youbissi, A., ... & Nkoba, K. (2023). Can the shape of the wing help in the identification of African stingless bee species?(Hymenoptera: Apidae: Meliponini) Wing geometric morphometrics: a tool for african stingless bee taxonomy. International Journal of Tropical Insect Science, 43(2), 749-759)
Wildlife (true)	4. Seasonal and elevational changes of plant-pollinator interaction networks in East African mountains	4. We recorded plant-bee interactions at 50 study sites between 515 and 2600 m asl for a full year, following all four major seasons in this region. We analysed elevational and seasonal network patterns using generalised additive models (GAMs) and quantified the influence of climate, floral resource availability, and bee diversity on network structures using a multimodel inference framework. We recorded 16,741 interactions among 186 bee and 314 plant species of which a majority involved interactions with honeybees. We found that nestedness and bee species specialisation of plant-bee interaction networks increased with elevation and that the relationships were consistent in the cold-dry and warm-wet seasons respectively. Link rewiring increased in the warm-wet season with elevation but remained indifferent in the cold-dry seasons. Conversely, network modularity and plant species were more specialised at lower elevations during both the cold-dry and warm-wet seasons, with higher values observed during the warm-wet seasons. We found flower and bee species diversity and abundance rather than direct effects of climate variables to best predict modularity, specialisation, and link rewiring in plant-bee-interaction networks. This study highlights changes in network

		architectures with elevation suggesting a potential sensitivity of plant-bee interactions with climate warming and changes in rainfall patterns along the elevation gradients of the Eastern Afromontane Biodiversity Hotspot.
Epidemiology, Surveillance, Risk Assessment. (true)	3. Understanding climate change effects on the potential distribution of an important pollinator species, Ceratina moerenhouti (Apidae: Ceratinini), in the Eastern Afromontane	Monitoring key pollinator taxa facilitates better surveillance and the development of empirical interventions. The potential habitat suitability of Ceratina moerenhouti was established in the Eastern Afromontane biodiversity hotspot. Three robust machine learning algorithms and their ensemble had a very high prediction accuracy. Integrating multi-source data improves the prediction accuracy. (Mukundamago, M., Dube, T., Mudereri, B. T., Babin, R., Lattorff, H. M. G., & Tonnang, H. E. (2023). Understanding climate change effects on the potential distribution of an important pollinator species, Ceratina moerenhouti (Apidae: Ceratinini), in the Eastern Afromontane biodiversity hotspot, Kenya. Physics and Chemistry of the Earth, Parts A/B/C, 130, 103387.
Epidemiology, Surveillance, Risk Assessment (true)	4. Impact of acute oral exposure to paraquat and glyphosate on food consumption and survival rates of the African honeybee Apis mellifera scutellata Lepeletier (Hymenoptera: Apidae)	4. In this study, we exposed A. m. scutellata to field concentrations of both paraquat and glyphosate and determined their effects on bee food consumption and survival rates. We found that the mortality rates of bees upon herbicide ingestion were concentration dependent. Lethal doses of paraquat and glyphosate were 10.8 and 229.5 µg/bee, respectively. Our findings suggest that the African honeybee is susceptible to paraquat and tolerant to glyphosate than its European counterpart. This study provides a baseline to help in regulating herbicide use and/or establishing their safe concentrations to protect biodiversity, particularly the beneficial pollinator insects such as bees. (Wesonga, Z. M., Bargul, J. L., Paredes, J. C., Dubois, T., & Lattorff, H. M. G. (2023). Impact of acute oral exposure to paraquat and glyphosate on food consumption and survival rates of the African honeybee Apis mellifera scutellata Lepeletier (Hymenoptera: Apidae). International Journal of Tropical Insect Science, 43(5), 1513-1521.
Food Security (true)	2. Pollinator-dependent crops significantly contribute to diets and reduce household nutrient deficiencies in sub-Saharan Africa	2. In this study, we investigate the nutrient composition, productivity, and contribution of PD and pollinator-independent (PI) crops to household nutrition in four sub-Saharan African (SSA) countries. We also evaluate the impact of reallocating resources from PI crops to PD crops on nutrient deficiencies, utilizing nationally representative panel data from three waves and over 30,000 household-year observations. Our findings reveal that PD crops exhibit higher micronutrient content per unit, albeit with lower macronutrient content compared to PI crops. PI crops have higher yield of calories per hectare while PD crops have higher vitamin A yield per hectare. (Mulungu, K., Tekelewold, H., Abro, Z., Sevgan, S., Muriithi, B., Ecuru, J., ... & Kassie, M. (2023). Pollinator-dependent crops significantly contribute to diets and reduce household nutrient deficiencies in sub-Saharan Africa. Scientific Reports, 13(1), 15452)
Wildlife (true)	5. Training of rural farmers in meliponiculture in Burkina faso	5. To sustain livelihood of rural farmers through improved beekeeping practices, restauration of degraded forest and processing of value-added beehive products for ecological protection of

		Mangrove in Unguja.
Others (true)	1. Differences in the biochemical content and radical scavenging activity of propolis from different parts of a Meliponula ferruginea hive	1. In this study, we investigated the phytochemicals and radical scavenging activity (RSA) of Meliponula ferruginea propolis from 10 wooden hives (n = 49). The samples were collected from five different locations comprising the entrance, involucrum, pillars, pots and sealant. Principal component analysis showed that there is an intra-hive variation in phytochemical content and RSA. Phenolic content constituted the highest phytochemical content in all the locations. The sealant and entrance had the highest amounts of phytochemicals compared to the involucrum, pillars and pots. Further analysis of propolis extracts by gas chromatography-mass spectrometry revealed occurrence of different compounds such as monoterpenoids, hydrocarbons, triterpenoids and alkaloids. Hydrocarbons were common in all parts while monoterpenes and triterpenes were present in the entrance. The findings of our study indicates that there is an intra-hive variation in propolis of M. ferruginea and hence this information will provide further insight into better understanding of stingless bee propolis.

TOR3: HARMONISATION OF STANDARDS

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the main fucus area for which you were designated

Proposal title	Scope/Content	Applicable area
Continental standards and guidelines for Edible insects-based products	icipe has signed a memorandum of understanding with the African Organisation for Standardisation (ARSO), to provide general overview of cooperation in the development of continental standards and guidelines for edible insects-based products.	Animal production Veterinary products
Stingless bee honey standards	Discussions have been established with Kenya Bureau of stanadards (KEBS) for development of standards for Stingless bee honey standards	Veterinary products

3. In exercising your activities, have you identified any regulatory research needs* relevant for WOAH?

Yes

Research need : 1

Please type the Research need: There is need to fill gaps in knowledge regarding physicochemical, antimicrobial and bioactivity properties of stingless bee's honey that could help in setting standard(s) of their hive products for market assess at local, regional and international level.

Relevance for WOAH Disease Control, Capacity Building, Other, Standard Setting, Animal Welfare, Facilitation of international collaboration,

Relevance for the Codes or Manual Code, Manual,

Field Epidemiology and Surveillance, Diagnostics, Vaccines, Therapeutics,

Animal Category Terrestrial, Aquatic,

Disease:

Kind of disease (Zoonosis, Transboundary diseases) Zoonosis, Transboundary diseases,

If any, please specify relevance for Codes or Manual, chapter and title

(e.g. Terrestrial Manual Chapter 2.3.5 - Minimum requirements for aseptic production in vaccine manufacture)

Answer:

Notes:
Answer:

4. Did your Collaborating Centre maintain a network with other WOAH Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of WOAH CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
World Organization for Animal Health	Online	Europe	Contributed to an Invited Article: Panorama Web Publication on Wildlife and Biodiversity: Bee diversity, bee health, and sustainable agriculture
WOAH Collaborating Centre "Good Beekeeping Management Practices and Biosecurity Measures in the Apiculture Sector"	Webinar	Europe	Delivered an invited talk on "Identification and sustainable management of some honey bee diseases and pests in Africa"

TOR4 AND 5: NETWORKING AND COLLABORATION

5. Did your Collaborating Centre maintain a network with other WOAH Collaborating Centres, Reference laboratories, or organisations in other disciplines, to coordinate scientific and technical studies?

Yes

Name of WOAH CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
Sub-Regional Representation for Eastern Africa	Webinar	Africa	Invited Presentation on "User friendly biomarker-based animal trypanosomiasis diagnosis"

TOR6: EXPERT CONSULTANTS

6. Did your Collaborating Centre place expert consultants at the disposal of WOAH?

Yes

NAME OF EXPERT	KIND OF CONSULTANCY	SUBJECT
Dr. Beatrice Nganso Dr Nkoba Kiatoko.	Two-day non-residential stakeholder consultative workshop on 14th and 15th December 2023 in Accra	

TOR7: SCIENTIFIC AND TECHNICAL TRAINING

7. Did your Collaborating Centre provide advice/services to requests from Members in your main focus area?

Yes

1) Dr Nelly Ndungu participated in two workshops to improve Apicultural policies in KENYA in the following meetings in Kenya.
Title: Workshop to Update, Edit and Finalize Available TIMPs for Apiculture Value Chain at Dairy Research Institute (DRI) Naivasha. 19th – 25th November, 2023, Venue: Kenya Agricultural Livestock Research Organisation (KALRO), Naivasha, Kenya

Title: Workshop – Updating, Revising and Finalizing of Apiculture Value Chain ToT Training Manual 10th – 16th December,2023
Venue: Kenya Agricultural Livestock Research Organisation (KALRO), Njoro, Kenya

2) Dr Beatrice Nganso and Dr Kiatoko Nkoba were invited by the Programme Manager of the UK Animal and Plant Health Agency in Accra, Ghana, Dr. Flavie Vial, to attend three days (13-15th December 2023) residential stakeholder consultative workshop on improving knowledge about honeybee health and best practices in apiculture in Ghana. The workshop was supported by the United Kingdom's Animal Health System Strengthening Project. The workshop brought together representatives from the apiculture industry, private sector, government and non-governmental organizations and academia (the Schools of Veterinary Medicine at the University of Ghana and the Kwame Nkrumah University of Science and Technology). During this workshop, icipe provided technical advice on ways to improve honeybee health and productivity through the adoption of best practices for colony management. Icipe also provided appropriate guidelines on strengthening human and infrastructural capacity for diagnosis, surveillance and risk assessment of honey bee pests and diseases and their control measures.

3) As part of the activities of the National Institute of Agricultural Research of Benin (INRAB), the Crop Defense Support Laboratory (LADC) obtained funding for capacity building of beekeepers in Benin on the recognition and management of honeybee pests and diseases. A workshop was dedicated to this activity and took place from December 6-8th, 2023 in the meeting room of the Departmental Directorate of Agriculture, Livestock and Fishing (DDAEP) of Borgou. It brought together sixty (65) participants made up of beekeepers, a representative of the Departmental Director of Agriculture, Livestock and Fisheries (DDAEP), ICIPE, researchers and staff from the Agricultural Research Centers (CRA) of Agonkanmey and Animal and Fishery Production (PAH). Upon request, icipe trained all participants on the identification and management of common honeybee pests and diseases occurring in Africa. Icipe also recommended to government authorities and researchers to carry out national studies aimed at assessing the impact of pests and diseases on the health and productivity of honeybees and to promote the adoption of best practices for colony management.

4) We provided our contribution to Biovision Africa to develop a mobile app for training African communities in Beekeeping.
-We provided service to ULB cooperation to train Tots in meliponiculture for Burkina faso, Senegal and DR Congo, -We provided service to Biovision Foundation to train over 400 rural farmers in modern beekeeping.

5) We provided service to Helsinki University under the EU funded project to train agropastoral in semi-arid zone of Taita taveta county, Kenta and in Yabello, Ethiopia.

8. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by WOAH, to personnel from WOAH Members?

Yes

a) Technical visit : 1

b) Seminars : 0

c) Hands-on training courses: 13

d) Internships (>1 month) : 2

TYPE OF TECHNICAL TRAINING PROVIDED (A, B, C OR D)	CONTENT	COUNTRY OF ORIGIN OF THE EXPERT(S) PROVIDED WITH TRAINING	NO. PARTICIPANTS FROM THE CORRESPONDING COUNTRY
A	a) Technical visits: to the African Reference Laboratory for Bee Health, Burkina faso satellite station	Burkina Faso	3
C	Apicultural Workshop for Honey bee keeping famers from Baringo and Kitui counties. Held in KAMAKI, Kitui county on 15th to 19th Feb 2023	Kenya	16
C	Apicultural workshop for 16 selected farmers from Baringo and Kitui. Held in Baringo. 2nd to 5th May 2023	Kenya	15
A	Bee Apiary Management and Sample collection KALRO Staff. 2nd -8th Aug 2023	Kenya	5
C	Apiculture training on bee breeding and post-harvest processing, Kitui. 4th to 9th Sep 2023.	Kenya	116
B	A protocol for collecting botanical collections (herbaria)- gaining insight into good practices in Botany Sample collection, preparation, and storage. Held in ICIPE. 46 participants. From KALRO Baringo, ICIPE, and KAMAKI. 7th November 2023	Kenya	5

C	Held training workshop in Baringo for farmers and KALRO ABIRI staff members. Title: Apiculture training on bee breeding and post-harvest processing in Baringo. Participants: 100 participants. 80 farmers and 20 KALRO -ABIRI staff members 14th – 17th Nov 2023	Kenya	100
A	During the consultative workshop in Accra (13-15th December 2023), we trained participants on the identification and management of common honeybee pests and diseases occurring in Africa	Ghana	30
A	During the workshop in Borgou (6-8th December 2023), we trained participants on the identification and management of common honey bee pests and diseases occurring in Africa	Benin	65
C	Modern Beekeeping, Apiary management Honey harvesting and processing	Zanzibar	386
C	Value-addition of Honey through product diversification, Propolis tincture, Shoe polish, infused honey, lip balm, lip sticks, candles honey, body lotion, body cream, Species diversity, Harvesting colonies, Hiving colonies Harvesting honey	Zanzibar	18
A	Training on Honeybee biology, Beekeeping equipment, Apiary selection & Setting, Hive stocking, Colony management, Hive inspection, Pests and Diseases, Honey harvesting	Kakamega, Kenya	18
C	Improved Bee Keeping practices for youth and women beekeepers in Ethiopia	Ethiopia	16000

TOR8: SCIENTIFIC MEETINGS

9. Did your Collaborating Centre organise or participate in the organisation of scientific meetings related to your main focus area on behalf of WOAH?

No

TOR9: DATA AND INFORMATION DISSEMINATION

10. Publication and dissemination of any information within the remit of the mandate given by WOAH that may be useful to Members of WOAH

a) Articles published in peer-reviewed journals:

13

1. Nelly Ndungu, Nicolas J. Vereecken, Maxence Gerard, Sophia Kariuki, Lape Kati Kati, Annie Youbissi, Sabine Nassong, Baerbel Hundt, Juliana Jaramillo & Kiatoko Nkoba (2023). Can the shape of the wing help in the identification of African stingless bee species? (Hymenoptera: Apidae: Meliponini). Int J Trop Insect Sci 43, 749–759. https://doi.org/10.1007/s42690-023-00980-1.

2. Dzekashu FF, Pirk CWW, Yusuf AA, Classen A, Kiatoko N, Steffan-Dewenter I, Peters MK, Lattorff HMG. (2023): Seasonal and elevational changes of plant-pollinator interaction networks in East African mountains. Ecol Evol. 13(5):e10060. doi: 10.1002/ece3.10060. PMID: 37187966; PMCID: PMC10175727.

3. Kegode TM, Mokaya HO, Chogo SI, Noiset P, Vereecken NJ, Tamiru A, Subramanian S, Kiatoko N. (2023) Differences in the biochemical content and radical scavenging activity of propolis from different parts of a Meliponula ferruginea hive. R. Soc. Open Sci. 10: 230241. https://doi.org/10.1098/rsos.230241.

4. Kegode TM, Ndungu N, Kiatoko N. (2023). Determination of total flavonoids, phenolics, and antioxidant activity of propolis from six stingless bee species in Kenya. JSFA Reports. ; 3(9): 441–446. https://doi.org/10.1002/jsf2.147

5. Héger, M., Noiset, P., Nkoba, K., Nicolas J. Vereecken (2023). Traditional ecological knowledge and non-food uses of stingless bee honey in Kenya's last pocket of tropical rainforest. J Ethnobiology Ethnomedicine 19, 42 https://doi.org/10.1186/s13002-023-00614-3.

6. Kasiera, W., Kariuki, S., Musonye, M., Krausa, K., & Kiatoko, N. (2023). Influence of landscape on foraging range and homing ability of afrotropical stingless bees. Insectes Sociaux, 70(1), 59-67
7. Toukem, N. K., Dubois, T., Mohamed, S. A., Lattorff, H. M. G., Jordaens, K., & Yusuf, A. A. (2023). The effect of annual flower strips on pollinator visitation and fruit set of avocado (Persea americana Mill.) in Kenya. Arthropod-Plant Interactions, 17(1), 19-29.
8. Kiatoko, N., Pozo, M. I., Kasiera, W., Kariuki, S. K., van Langevelde, F., Hundt, B., & Jaramillo, J. (2023). Body size as a proxy of probing time and visitation rates on cucumber by two African stingless bees increase fruit quality and seed quantity. Scientia Horticulturae, 309, 111671.
9. Koech, S. J., Karanja, R. H., Kurgat, J. K., Mokaya, H. O., Dubois, T., & Lattorff, H. M. G. (2023). Pesticide contamination and their botanical sources in pollen loads collected by honeybees in Kenya: a spatio-temporal context. Agriculture, Ecosystems & Environment, 343, 108264.
10. Mukundamago, M., Dube, T., Mudereri, B. T., Babin, R., Lattorff, H. M. G., & Tonnang, H. E. (2023). Understanding climate change effects on the potential distribution of an important pollinator species, Ceratina moerenhouti (Apidae: Ceratinini), in the Eastern Afromontane biodiversity hotspot, Kenya. Physics and Chemistry of the Earth, Parts A/B/C, 130, 103387.
11. Kipkoech, A., Okwaro, L. A., Muli, E., & Lattorff, H. M. G. (2023). Occurrence and distribution of Nosema ceranae in honey bee colonies in the Comoros Islands. Journal of Apicultural Research, 62(5), 1197-1206.
12. Mulungu, K., Tekelewold, H., Abro, Z., Sevgan, S., Muriithi, B., Ecuru, J., ... & Kassie, M. (2023). Pollinator-dependent crops significantly contribute to diets and reduce household nutrient deficiencies in sub-Saharan Africa. Scientific Reports, 13(1), 15452.
13. Wesonga, Z. M., Bargul, J. L., Paredes, J. C., Dubois, T., & Lattorff, H. M. G. (2023). Impact of acute oral exposure to paraquat and glyphosate on food consumption and survival rates of the African honeybee Apis mellifera scutellata Lepeletier (Hymenoptera: Apidae). International Journal of Tropical Insect Science, 43(5), 1513-1521.

b) International conferences:
20
1) December 2023 - Beatrice Nganso (Scientist) facilitated a COLOSS event and initiate a survey of managed honeybee colony losses and causes in partnership with the National Agricultural Research Institute of Benin (INRAB)
2) December 2023 - Beatrice Nganso (Scientist) participated in a stakeholder consultative workshop organised by the United Kingdom's Animal Health System Strengthening Project. The workshop will focus on improving knowledge on honeybee health and best practices in apiculture.
3) October -_November 2023 - Elfatih M. Abdel-Rahman (Scientist) participated in the "2023 Asian Conference on Remote Sensing" that was held at the Center for Space and Remote Sensing Research, National Central University.
4) November 2023 - Tobias Landmann (Integrated Expert) participated in the 2023 Global One Health Symposium.
5) November 2023 - Online participation in the Annual conference of the regional centers of the Stockholm, Basel and Rotterdam conventions and presentation of the Annual report.
6) November 2023 - Participation in the FAO - Global symposium on Fall armyworm management in Beijing.
7) October 2023 - Organised a training on African Standards and Certification Schemes for insects for food, feed and derived products with African Organisation for Standardisation (ARSO) in icipe, Nairobi
8) October 2023 - The Director General delivered a lecture on innovations in insect science at the 59th Nobel conference, titled "Insects: Little Body, Big Impact." - Minnesota, USA
9) October 2023 - Dr Beatrice Nganso (Scientist) virtually participated in the 19th COLOSS Conference where she gave a presentation on 'A survey of managed honeybee colony losses and causes in eight sub-Saharan Africa countries"
10) September 2023 - Dr Fathiya Khamis, (Senior Scientist) virtually participated in the Crawford Fund Annual Conference Themed Global Food Security in a Riskier World. She gave a presentation on Food Loss and Waste in Circular Economy
11) September 2023 - Dr Tobias Landmann, (Integrated Expert in Geospatial Science) attended the Africa Climate Summit 2023. The inaugural Africa Climate Summit aimed to address the increasing exposure to climate change and its associated costs, both globally and particularly in Africa.
12) August 2023 - Dr Tobias Landmann, (Integrated Expert in Geospatial Science) attended the Optica Sensing Congress and delivered a keynote on the "Use of spectroscopy for assessing crop productivity and health of agro-ecological systems in Africa" - Munich, Germany
13) August 2023 - The Director General, icipe participated in the Plant Health 2023 meeting themed, "LINKS to a Sustainable Future," with programming that illuminates the interconnectivity of local and indigenous knowledge to the future of global agriculture. The meeting was organized by the International Organisation for Biological Control – West Palaearctic Regional Section (IOBC-WPRS)
14) July 2023 - Dr Saliou Niassy (Head, Technology Transfer Unit) participated in the Annual Geo-Zone workshop of the regional plant protection task force organized by Food and Agriculture Organisation (FAO).
15) July 2023 - Dr Baldwyn Torto, (Head of Behavioural and Chemical Ecology Unit) presented a plenary lecture on 'Nature-based crop protection solutions for below- and above-ground plant pests' at the 38th Annual Meeting of the International Society of Chemical Ecology, Bangalore, India
16) July 2023 - The Director General, icipe, Dr Segenet Kelemu participated in the UN Food Systems Summit, FAO Head Quarters, Rome. This meeting will serve as the first global follow-up to the 2021 Food Systems Summit and provided the opportunity to review commitments and assess the progress on implementing national food systems.
17) June 2023 - Dr Elfatih Abdel-Rahman, (Scientist) gave a talk on 'A landscape-scale assessment of pollinator habitats quality and distribution: harnessing remote sensing and geospatial tools" at the 2nd International Conference on Pollinator Biology, Health, and Policy - Penn State University.
18) June 2023 - Organization of the Global forum on biological control in icipe, Nairobi
19) May 2023 - Dr Frank Chidawanyika, (Scientist) attended the 9th International Conference on Management of the Diamondback Moth and Other Crucifer Insect Pests organized by the World Vegetable Center in association with Royal University of Agriculture in Cambodia and Taiwan Agricultural Chemicals and Toxic Substances Research Institute.
20) May 2023 - Dr Balwyn Torto, (Head, Behavioural and Chemical Ecology Unit) attended the Jim Tumlinson Memorial Lecture Series and gave a lecture on "Inter-organismal chemical communication in obligate agricultural parasitic pests."

c) National conferences:
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1) June 2023 Dr Saliou Niassy (Head, Technology Transfer Unit) participated in the launch of the 'Emergency support to manage outbreaks and infestation by African Armyworm in Eastern Africa' project.
2) May 2023 Dr Amanuel Tamiru, (Scientist) and Emmanuel Peter, (PhD

Scholar) attended the 28th International Working Group on Ostrinia and other maize pests meeting at the Kenya Plant Health Inspectorate Service (KEPHIS) Conference Centre.
3) May 2023 - Inception workshop on Scaling regenerative black soldier fly farming innovations with vegetable push-pull cropping systems for One Health in Rural Kenya, Rwanda and Uganda"_ Mbita, Kenya

d) Other (Provide website address or link to appropriate information):
6
Through the KALRO/EU project we recorded Videos on beekeeping management and made available to the public through the you tube, see the links below;
Episode 1 - Bees and their importance - https://www.youtube.com/watch?v=k5h4Ivwdf3g
Episode 2 - Hive & Hive Management- https://www.youtube.com/watch?v=_GPkotowjQs
Episode 3 - Stingless Bees Part 1- https://www.youtube.com/watch?v=5qZs14mcMQc
Episode 4- Stingless Bees part 2 - https://www.youtube.com/watch?v=zCKmbN9rAkM
Episode 5 - Processing & Quality Control - https://www.youtube.com/watch?v=inio0B3ZMzQ
Episode 6: Pest & Disease Control -https://www.youtube.com/watch?v=SuB5OQT7euM

11. What have you done in the past year to advance your area of focus, e.g. updated technology?
In August 15th 2022, Icipe in partnership with the University of Pretoria, South Africa and the African Union-Inter Bureau of Animal Resources (AU-IBAR) launched the first annual survey of managed honey bee colony losses and causes across Africa. The survey aims to quantify the annual colony loss rate and identify the potential risk factors. So far, national coordinators from nine Sub-Saharan African countries have willingly agreed to be part of this initiative: Cameroon, Democratic Republic of Congo, Rwanda, Kenya, Ethiopia, Nigeria, Liberia, Nigeria, and Uganda. They have collected data which are currently being analysed for publication in a suitable scientific journal. This first report on colony losses and causes in several sub-Saharan countries will provide baseline data for future long-term monitoring of colony health and management to improve the management of stressors that will be identified during this study.

2. We have also acquired diagnostic kits to inspect the presence of some honey bee diseases that have never been reported in some sub-Saharan countries that are involved in the survey of managed honey bee colony losses and causes. If identified, their presence will be further confirmed through conventional PCR for future surveillance and management of disease. r comment

12. Additional comments regarding your report: