

WOAH Collaborative Centre Reports Activities 2022

Activities in 2022

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Centre Information

Title of WOA Collaborating Centre	
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Name Director of Institute (Responsible Official):	Dr. Segenet Kelemu, 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:	Dr 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 WOA

Epidemiology, surveillance, risk assessment, modelling	
Title of activity	Scope
	This study sought to establish the influence of bioclimatic, topographic, and vegetation seasonality variables on the spatial

The use of multisource spatial data for determining the proliferation of stingless bees in Kenya	proliferation of stingless bees in Kenya. It also modelled the future distribution scenarios and patterns of stingless bees using simulated bioclimatic data.
Epidemiology, surveillance, risk assessment, modelling	
Title of activity	Scope
Exploring Machine Learning algorithms for classification with multi-class imbalanced data: case of stingless bees morphometrics	This study aimed to contribute on development of smart and automated application for analysis of stingless bee morphometric measurements for species identification.
Training, capacity building	
Title of activity	Scope
Promoting multipurpose trees in agroforestry for supporting honeybee health and mangrove protection in Zanzibar	The purpose was to train Tots selected among local farmers on tree nursery technology, and promote usage of multipurpose trees (<i>Moringa olifera</i> , <i>Calliandra calothyrsus</i>) for supporting honeybee health through forage and protect mangrove against deforestation. 317 persons.
Training, capacity building	
Title of activity	Scope
Promoting apiculture for income generation and pollination services in Zanzibar	The purpose of this training was to train Tots on modern apiculture. 206 participants
Training, capacity building	
Title of activity	Scope
Promoting meliponiculture for income generation and pollination services in Burkina faso, Senegal, DR Congo	Virtual training. The purpose of this training was to train Tots on modern meliponiculture. 48 Tots participants
Training, capacity building	
Title of activity	Scope
Promoting meliponiculture for income generation and pollination services in Baringo, Kenya.	The purpose of this training was to train Tots on modern meliponiculture. 6 Tots participants
Training, capacity building	
Title of activity	Scope
Promoting apiculture for income generation and pollination	The purpose of this training was to train agropastoralist farmers

services for agropastoralist in semi-arid zones and wet zones of Taita Taveta county, Kenya	on modern apiculture as alternative source of incomes. 10 Tots participants
Training, capacity building	
Title of activity	Scope
Promoting meliponiculture for income generation and pollination services for agropastoralist in semi-arid zones and wet zones of Taita Taveta county, Kenya	The purpose of this training was to train agropastoralist farmers on modern meliponiculture as alternative source of incomes. 15 Tots participants
Wildlife	
Title of activity	Scope
Foraging behavior of African stingless bees; A case study of resource competition between two African stingless bee species in Zanzibar Islands	<p>DNA metabarcoding using ITS2 was employed to identify forage plants visited by <i>M. ferruginea</i> and <i>H. araujoi</i> in Zanzibar. A total of 234 plants were reported to be visited by the two stingless bee species. We uncovered that 51 forage plants were shared, whereas 103 and 80 plant species were unique to <i>M. ferruginea</i> and <i>H. araujoi</i>. That the two stingless bees have specific floral preference showing the need to conserve the foraged plants and the bee species involved in pollination.</p> <p>Further, plants in the <i>Searsia discolor</i> and <i>Encephalartos ngoyanus</i> were most dominant nectar source for two stingless bees' species.</p>
Wildlife	
Title of activity	Scope
Body size as a proxy of probing time and visitation rates on cucumber by two African stingless bees increase fruit quality and seed quantity	This study was conducted to contribute to the knowledge of pollination efficiency of stingless bees and to the improvement of fruit production among commercially greenhouse cucumber.
Wildlife	
Title of activity	Scope
African endemic stingless bees as an efficient alternative pollinator to honeybees in greenhouse cucumber (<i>Cucumis sativus</i> L)	This study aimed at identifying the most efficient native stingless bee pollinator of cucumber in a closed greenhouse.
Wildlife	
Title of activity	Scope
Effective pollination of greenhouse Galia musk melon (<i>Cucumis melo</i> L. var. <i>reticulatus</i> ser.) by afro-tropical stingless bee species	This study aimed at identifying the most efficient native stingless bee pollinator of Musk melon in a closed greenhouse.

Wildlife	
Title of activity	Scope
Foraging behaviour and pollination efficiency among four endemic Afrotropical stingless bees on blueberry (<i>Vaccinium corymbosum</i> var. Stella Blue)	This study aimed to determine the relative importance of wild pollinators and four managed species of stingless bees for pollination of <i>Vaccinium corymbosum</i> L. var. Stella Blue, a cross-pollinated highbush blueberry cultivated in semi open field in East Africa.
Wildlife	
Title of activity	Scope
Comparison of the Efficiency of stingless bee species (as Pollinators of Watermelon in Greenhouse	This study was conducted to determine the possibility of using stingless bee species as a managed pollinator of watermelon in enclosures.
Diagnosis, biotechnology and laboratory	
Title of activity	Scope
Black Queen Cell Virus Detected in Endemic African Stingless bees (<i>Apidae: Meliponinae</i>)	The purpose of the current study was to investigate the potential spillage of honeybee pathogens to stingless bees. It investigated by screening for the presence of seven honeybee pathogens (DWV, BQCV, KBV, IAPV, CBPV, ABPV, SBV, and <i>Nosema</i> microsporidia) in nine species of stingless bees mostly reared by farmers in Kenya. The study further evaluated the phylogenetic differences in the different strains of the pathogens in circulation.
Food safety	
Title of activity	Scope
Characterization of <i>Meliponula ferruginea</i> honey properties from insular ecosystem	The study aimed to investigate the impact of geographical origin on physico-chemical composition and therapeutic potential of afrotropical stingless bee honey by comparing samples from insular (Zanzibar) and continental (Kenya) ecosystems
Food Safety	
Title of activity	Scope
Interspecies variation in phytochemical composition and radical scavenging activity of resin-based materials of stingless bee species from Kenya	The study was aimed at determining chemical and bioactive properties of stingless bees propolis based on the different parts of the nest.
Food Safety	
Title of activity	Scope
	Using LC-MS/MS, 23 Honey samples collected from different landscapes in Kenya, Cameroon and Zanzibar were analyzed for

Pesticide Residues in Honey

pesticides. Out of 107 pesticides tested for, three residues (oxamyl, cymoxanil and carbosulfan) were detected (Fig. 1). Oxamyl was detected in 21.74 % of the honey samples under investigations with highest value of 1.03 µg/ kg in KT2 sample. EU-MRL for oxamyl is 50 µg/kg and the detected load level may not cause health concern to human being. Cymoxanil was detected in 1 out of 23 honey samples was 0.40µg/kg, fig 1. EU-MRL for cymoxanil is 50 µg/kg and the detected load level may not pose human health concern. Carbosulfan was detected in 47.83% of the honey samples and residue load ranged from 6.8-83.98µg/kg. The EU-MRL for carbosulfan is 50 µg/kg and from this investigation it was evident that 13.04% of the studied samples exceeded this tolerable level.

TOR3: HARMONISATION OF STANDARDS

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

Proposal title	Scope/Content
Standards for incorporation of insects in Animal feeds in Rwanda INSECTS FOR FEED IN RWANDA	Against a grand vision of mainstreaming edible insects as a way of achieving food security and economic growth, Rwanda has marked two major milestones: the launch of national standards to guide the emergence of the edible insects sector; and the establishment of the country's first commercial insect-based animal feed plant. http://www.icipe.org/news/rwanda-achieves-landmarks-insect-based-food-and-feed-sector-support-icipe-and-partners#:~:text=icipe%20research%20has%20confirmed%20the,nutrient%2Drich%20bio%2Dfertilisers .
Harmonization of standards for use of insects as ingredient in Animal feeds across Africa.	To achieve edible insects as a way to enhance feed availability and cost for food security and economic growth. icipe in partnership with Rockefeller foundation and African Standards Organisation is working towards harmonized standards for insect protein inclusion in the Animal feed sector.
Regional and continental quality standard and regulations for stingless bee hive products	Stingless bee quality standardization and regulations: Discussion have been initiated with the African Standards Organisation, Nairobi to develop continental standards for Stingless bee honey available in Africa. This can contribute to effective commercialization of stingless bee honey in Africa.

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

Yes

		Region of	
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Name of OIE CC/RL/other organisation(s)	Location	networking Centre	Purpose
OIE Collaborating Centre on Good Beekeeping Management Practices and Biosecurity Measures in the Apiculture Sector	Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana Address: Via Appia Nuova, 1411 – 00178 Roma	Europe	Participated and presented a paper on "Health of bees in Africa" in the Virtual Webinar - Webinar Symposium on biosecurity measures in beekeeping - 10th June 2022

TOR4 AND 5: NETWORKING AND COLLABORATION

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

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
Collaborating Centre on Good Beekeeping Management Practices and Biosecurity Measures in the Apiculture Sector	Roma, Italy	Europe	Participated in a webinar symposium on biosecurity measures in beekeeping Virtual Meeting on 10 June 2022 and presented a paper on "Health of Bees in Africa"

TOR6: EXPERT CONSULTANTS

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

Yes

NAME OF EXPERT	KIND OF CONSULTANCY	SUBJECT
Dr. Kiatoko Nkoba	Capacity building for National Delegates and National Focal Points on wildlife in Africa (6th Cycle Regional Training Workshop for WOAHA National Focal Points for Wildlife in Africa)	Root causes / drivers of disease and how to manage them • Deformed wing virus in wild African honeybee colonies

TOR7: SCIENTIFIC AND TECHNICAL TRAINING

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

Yes

1. Apiculture

1.1. Continental

Type of activity: Training workshop on deformed wing virus in honeybees

Who benefit: 56 National Focal Points for Wildlife in Africa

1.2. Tanzania

Type of activity: Training on modern apiculture

Who benefit: 206 rural farmers along coastal mangrove of Zanzibar, beekeeping staffs of the Ministry of Agriculture of Zanzibar

2. Meliponiculture

2.1. Kenya

Type of activity: Training of Tots on modern meliponiculture of staffs from Kenya Agricultural and Livestock Research Organization (KARLO)

Who benefit: 6 Researcher and technical staffs from Baringo, Kenya (6 Men)

2.2. Burkina faso

Type of activity: Virtual training of Tots on modern meliponiculture for staffs from ULB cooperation, Ministry of Agriculture, Ministry of Environment, Forestry Department, rural farmers

Who benefit: 46 participants (40 Men, 5 Women)

2.3. Senegal

Type of activity: Virtual training of Tots on modern meliponiculture for staffs from ULB cooperation,

Who benefit: 1 participant (1 Man)

2.4. DRCongo

Type of activity: Virtual training of Tots on modern meliponiculture for staffs from ULB cooperation,

Who benefit: 1 participant (1 Man)

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

Yes

a) Technical visit :

b) Seminars : 712

c) Hands-on training courses: 76557

d) Internships (>1 month) :

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
Hands-on training courses	Training on planting and growing beneficial multipurpose agroforestry trees for mangrove protection	Zanzibar	317 persons (106 Men, 211 Women)
Hands-on training courses	Training on apiculture	Zanzibar	206 persons (100 Men, 106 Women)
Hands-on training courses	Training on meliponiculture	Burkina Faso	46 persons (40 Men, 6 Women)

Hands-on training courses	Training on meliponiculture	Senegal	1 person (1 Man)
Hands-on training courses	Training on meliponiculture	DR Congo	1 person (1 Man)
Hands-on training courses	Training on meliponiculture	Kenya	16 persons (7 Men, 9 women)
Hands on Training	Training on apiculture	Kenya	10 persons (9 Men, 1 women)
Seminar	Training on bee health: Deformed wing virus	Africa	56 persons (48 Men, 8 women)
Hands-on training courses	Field and laboratory training on the identification and management of common pests and diseases associated with African honey bee colonies Honeybees in the Amhara region, Ethiopia (20-25 October 2022)	Ethiopia	15 (14 males and 1 female)
Hands-on training courses	Field and laboratory training on the importance of honey bees and stingless bees for the sustainable environmental protection and livelihood improvement, Taita Taveta, Kenya (5th -13th March 2022 and 24th -30th November 2022)	Kenya	46 (16 female + 30 males)
Hands on Training	Hulet Eju Enessie Beekeeping scale up project Entrepreneurship skills development and Beekeeping Technical skills development training: 2 to 7 April 2022	Ethiopia	60 (51 female and 9 male)
Hands on Training	Wag Himra beekeeping scale up project for queen raring, transitional hive making and crud wax refining training from: 3 to 13 September 2022	Ethiopia	216 (204 female and 12 male)

Seminar	ICIPE – ICARDA collaborative project on “Artificial Intelligence-Driven Climate-Smart Beekeeping” - 2022	Ethiopia	30 (30 female)
Seminar	Edible insects for circular economy and inclusive development - 14th October 2022	Global	271 (183 men and 88 women)
Seminar	Nature-based solutions for biodiversity, food security and health - October 13th 2022	Global	355 (209 men and 146 women)
Hands on Training	Training of Trainers in Financial Management and Marketing	Ethiopia	133 (42 female)
Hands on Training	Village level Training of youth partners financial Management and marketing	Ethiopia	15434 (7070 female)
Hands on Training	Training in digital marketing (Ecommerce) for selected youth partners from each cooperative	Ethiopia	103 (22 female)
Hands on Training	Digital Finance village level training	Ethiopia	4030 (44% female)
Hands on Training	Refresher training of ESD, Financial Literacy and Marketing (Year 1 and Year 2 youth)	Ethiopia	5076 (2225 female)
Hands on Training	Digital Finance ToT	Ethiopia	65 (30% female)
Hands on Training	Agency Banking training - Telebirr	Ethiopia	26 participants (60% female)
Hands on Training	Entrepreneurship and Business Management Training for SMEs	Ethiopia	43

Hands on Training	Entrepreneurship and life Skills Training of Trainers	Ethiopia	250 (79 female)
Hands on Training	Entrepreneurship and life Skills Village Level Training	Ethiopia	21162 (63% female)
Hands on Training	ToT in beekeeping skills development (MOYESH)	Ethiopia	244 (25% female)
Hands on Training	Village level training of youth partners in beekeeping skills development (MOYESH)	Ethiopia	23661 (65% female)
Hands on Training	Training of Trainers in silkworm farming skills development (MOYESH)	Ethiopia	57 (26% female)
Hands on Training	Village level training of youth partners in silkworm farming skills development (MOYESH)	Ethiopia	2,928 (72% females)
Hands on Training	ToT on honeybee colony multiplication to representatives of youth enterprises	Ethiopia	1,388 representatives of youth enterprises (21% females)
Hands on Training	Tot on post-harvest handling of hive products to representatives of youth enterprises	Ethiopia	878 representatives of youth enterprises (28% females)
Hands on Training	ToT on honeybee colony multiplication to local extension staffs	Ethiopia	123 local extension staffs (13% females)
Hands on Training	Training on castor seed production, collection, and supply system to support Eri silkworm cultures.	Ethiopia (one regions-SNNP region)	22 representatives of YESH youth enterprises, Cooperative Unions, and private companies (18% females)

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 WOA?H?

Yes

NATIONAL/INTERNATIONAL	TITLE OF EVENT	CO-ORGANISER	DATE (MM/YY)	LOCATION	NO. PARTICIPANTS
International	Impact of landscapes on stingless bee honey trehalose content	Queensland Alliance for Agriculture and Food Innovation (QAAFI) The University of Queensland (Australia)	2022-12-02	Virtual	5
International	Scientific meeting on training on survey of honeybee colony losses and causes in Africa	Queen's University	2022-08-05	Virtual	9
International	Nature-based solutions for biodiversity, food security and health	FAO	2022-10-13	Virtual	355
International	4. Edible insects for circular economy and inclusive development	FAO	2022-10-14	Virtual	271

TOR9: DATA AND INFORMATION DISSEMINATION

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

a) Articles published in peer-reviewed journals:

18

1. Makori, D. M., Abdel-Rahman, E. M., Ndungu, N., Odindi, J., Mutanga, O., Landmann, T., ... & Kiatoko, N. (2022). The use of multisource spatial data for determining the proliferation of stingless bees in Kenya. *GIScience & Remote Sensing*, 59(1), 648-669.
2. Wakhungu, D. A., Namikoye, E. S., & Lattorff, H. M. G. (2022). Foraging range of an African stingless bee, *Hypotrigena gribodoi* (Apidae: Meliponini). *African Journal of Ecology*, 60(4), 1094-1098.
3. Kiatoko, N., Pozo, M. I., Van Oystaeyen, A., Musonye, M., Kika, J., Wäckers, F., ... & Jaramillo, J. (2021). African endemic stingless bees as an efficient alternative pollinator to honey bees in greenhouse cucumber (*Cucumis sativus* L). *Journal of Apicultural Research*, 1-13.
4. Kegode, T. M., & Lattorff, H. M. G. (2022). The effects of hive materials on phytochemical and biological properties of honeybee propolis. *JSFA Reports*, 2(10), 466-471.
5. Sagwe, R. N., Peters, M. K., Dubois, T., Steffan-Dewenter, I., & Lattorff, H. M. G. (2022). Pollinator efficiency of avocado (*Persea americana*) flower insect visitors. *Ecological Solutions and Evidence*, 3(4), e12178.
6. Kegode, T. M., Bargul, J. L., Mokaya, H. O., & Lattorff, H. M. G. (2022). Phytochemical composition and bio-functional properties of *Apis mellifera* propolis from Kenya. *Royal Society Open Science*, 9(7), 211214.
7. Wangithi, C., Muriithi, B. W., Diro, G., Dubois, T., Mohamed, S., Lattorff, H. M. G., ... & Kassie, M. (2022). Synergies of integrated pest and pollinator management in avocado farming in East Africa: An ex-ante economic analysis. *Plos one*, 17(7), e0271241.
8. Muturi, M. N., Bargul, J. L., & Lattorff, H. M. G. (2022). Influence of the Type of Pollen Diet on the Survival, Body Weight, and Immune Response in the African Honeybee. *Journal of Apicultural Science*, 66(1), 29-43.
9. Omuse, E. R., Niassy, S., Kiatoko, N., Lattorff, H. M. G., Wagacha, J. M., & Dubois, T. (2022). A fungal-based pesticide does not harm pollination service provided by the African stingless bee *Meliponula ferruginea* on cucumber (*Cucumis sativus*). *Apidologie*, 53(3), 28.
10. Muturi, M. N., Papach, A., Lattorff, H. M. G., & Neumann, P. (2022). A scientific note on in-hive positioning determines small hive beetle trap efficacy. *Journal of apicultural research*, 61(3), 315-316.
11. Bossert, Silas, Thomas J. Wood, Sébastien Patiny, Denis Michez, Eduardo AB Almeida, Robert L. Minckley, Laurence Packer et al.

- "Phylogeny, biogeography and diversification of the mining bee family Andrenidae." *Systematic Entomology* 47, no. 2 (2022): 283-302.
12. Dzekashu, F. F., Yusuf, A. A., Pirk, C. W., Steffan-Dewenter, I., Lattorff, H. M. G., & Peters, M. K. (2022). Floral turnover and climate drive seasonal bee diversity along a tropical elevation gradient. *Ecosphere*, 13(3), e3964.
 13. Toukem, N. K., Mohamed, S. A., Yusuf, A. A., Lattorff, H. M. G., Copeland, R. S., & Dubois, T. (2022). Interactions between integrated pest management, pollinator introduction, and landscape context on avocado *Persea americana* productivity.
 14. Omuse, E. R., Niassy, S., Wagacha, J. M., Ong'amo, G. O., Lattorff, H. M. G., Kiatoko, N., ... & Dubois, T. (2022). Susceptibility of the western honey bee *Apis mellifera* and the African stingless bee *Meliponula ferruginea* (Hymenoptera: Apidae) to the entomopathogenic fungi *Metarhizium anisopliae* and *Beauveria bassiana*. *Journal of Economic Entomology*, 115(1), 46-55.
 15. Mokaya, H. O., Nkoba, K., Ndunda, R. M., & Vereecken, N. J. (2022). Characterization of honeys produced by sympatric species of Afrotropical stingless bees (Hymenoptera, Meliponini). *Food chemistry*, 366, 130597.
 16. Ochungo, P., Veldtman, R., Abdel-Rahman, E. M., Muli, E., Ng'ang'a, J., Tonnang, H. E., & Landmann, T. (2022). Fragmented landscapes affect honey bee colony strength at diverse spatial scales in agroecological landscapes in Kenya. *Ecological Applications*, 32(1), e02483.
 17. 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*, <https://doi.org/10.1007/s00040-023-00899-3>
 18. Pierre Noiset, Nathalie Cabirol, Marcelo Rojas-Oropeza, Natapot Warrit, Kiatoko Nkoba & Nicolas J. Vereecken (2022). Honey compositional convergence and the parallel domestication of social bees. *Scientific Reports* 12:18280. <https://doi.org/10.1038/s41598-022-23310-w>.

b) International conferences:

13

- 1) XIX IUSSI International Congress in San Diego, California, USA, July 3-7 to give an oral presentation titled: "Role of a Niemann-Pick type C2 transcript (Vd40090) in *Varroa*-honey bee interaction".
- 2) Tropentag 2022, Czech University of Life Sciences Prague Czech Republic September 14- 16, Tobias Landmann, "Estimating timing of hatching of desert locusts in eastern Africa"
- 3) 17 Rooms 2022 Global Flagship September Events, online event September 12-13
Subramanian Sevgan participated in the event as a Co-lead for Room 2 discussions along with Dr Betty Kibaara, Rockefeller foundation.
- 4) European Space Agency (ESA) Living Planet Symposium (May 2022), Tobias Landmann (DMMG) presented two poster; One on crop monitoring using denser satellite time series data and another one on coastal morphology, and mangrove restoration on Zanzibar, using nature based solutions such as bee keeping
- 5) HMG Lattorff presented at The first North African meeting for Honey bee diseases (8.3.2022) funded by FAO, OIE and REMESA (Mediterranean Animal Health Network) on "Varroa and small hive beetles in Africa"
- 6) Rose Sagwe presented at 24th Conference of AAIS in Addis on "Pollinator supplementation mitigates pollination deficits in smallholder avocado (*Persea americana* mill.) production systems in Kenya"
- 7) Sheila Koech presented at 24th Conference of AAIS in Addis Ababa (Ethiopia) on "Effects of landscape and flowering seasons on abundance, diversity, and quality of honeybee-collected pollen and their pesticide contamination in Kenya"
- 8) Evanson Omuse presented at 24th Conference of AAIS in Addis Ababa (Ethiopia) on "Susceptibility of the stingless bee *Meliponula ferruginea* (Hymenoptera: Apidae) to entomopathogenic fungi under laboratory and field conditions"
- 9) Solomon Chogo presented at 24th Conference of AAIS in Addis Ababa (Ethiopia) on "Determination of the prophylactic and therapeutic antibacterial effects of different honeys on bee health"
- 10) Tobias Landmann, 24-28th October: African Association of Remote Sensing of the Environment (AARSE), conference in Kigali, Rwanda, presentation: "Insect -based conservation status monitoring in Africa using multi sensor Earth Observation"
- 11) Subramanian Sevgan, 06th – 10th November 2022: Participated in the Basel, Rotterdam and Stockholm convention COP, Geneva and presented icipe's activities and achievements for the year 2021 – 2022.
- 12) Dr Chrysantus Tanga participated in the 13th AFRICA DAY FOR FOOD AND NUTRITION SECURITY on 31st October to 1st November in Ethiopia and presented icipe activities and achievements in *Insects for food and feed*.
- 13) Dr Kiatoko presented a paper on "Root causes / drivers of disease and how to manage them • Deformed wing virus in wild African honeybee colonies". in the 6th Cycle Regional Workshop for WOAHA National Focal Points for Wildlife in Africa

c) National conferences:

2

1. *Presentation at the National Beekeeping workshop organized by the Ministry of Agriculture, Natural Resources, Livestock and Fisheries – Zanzibar on 6th December 2021 by Kiatoko Nkoba “Meliponiculture a prominent diversification activity for income generation for farmers in Zanzibar”*

2. *Participation of JN Kimani and HMG Lattorff with exhibition booth and presentation on “Bee Research 4 Development” at the National Symposium on Apiculture” at Chuka University from 2.-4. February 2022*

d) Other (Provide website address or link to appropriate information):

<http://www.icipe.org/sites/default/files/Women-Led-Beekeeping-Enterprise.pdf>

<http://www.icipe.org/sites/default/files/Three-years-of-the-MOYESH-project.pdf>

<http://www.icipe.org/news/new-evidence-superiority-insect-based-animal-feeds>

<http://www.icipe.org/trypanosome-biomarkers>

11. What have you done in the past year to advance your area of focus, e.g. updated technology?

Some of the key areas of focus in the past year are

1) use of remote sensing to map floral patterns and suitability for bees

2) unravel the role of pollination services by various Eusocial bees and its impacts on crop productivity

3) focus on characterizing the quality and chemical properties of diverse honey available in Kenya.

12. Additional comments regarding your report: