



World Organisation
for Animal Health

Integrating Antimicrobial Resistance Mitigation into Beekeeping Practices in Eastern Africa

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Beekeeping in Africa: A general overview

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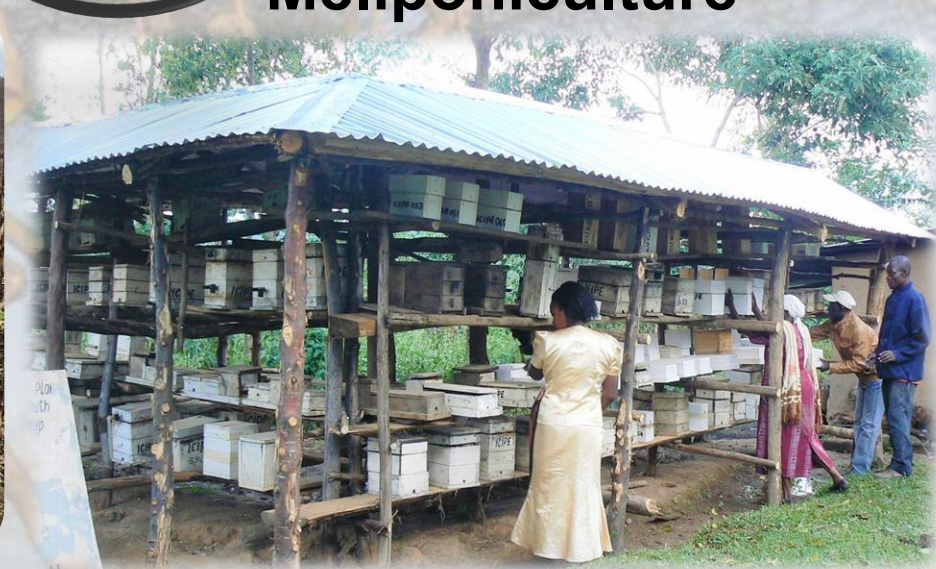
Beekeeping in Africa



Apiculture



Meliponiculture





Bee diversity in Africa

Honey bee subspecies

No	Subspecies name	Common Name	Lineage	Distribution
Africa (11 subspecies)				
	<i>Apis mellifera lamarckii</i> Cockerell 1906	The Egyptian honey bee	O	Egypt, Sudan
	<i>Apis mellifera litorea</i> Smith 1961	The East African coastal honey bee	A	Kenya
	<i>Apis mellifera adansonii</i> Latreille 1804	The West African honey bee	A	Nigeria, Burkina Faso, Uganda, Tanzania, Zambia, Senegal, Sudan
	<i>Apis mellifera scutellata</i> Lepeletier de Saint Fargeau, 1836	The African honey bee	A	Kenya, Tanzania, Uganda, Republic of South Africa, Somalia
	<i>Apis mellifera monticola</i> Smith 1961	The East African Mountain honey bee	A	Mountains of Kenya, Tanzania
	<i>Apis mellifera capensis</i> Escholtz 1822	The Cape honey bee	A	Cape region in the Republic of South Africa
	<i>Apis mellifera unicolor</i> Latreille 1804	The Madagascar honey bee	A	Madagascar
	<i>Apis mellifera simensis</i> Meixner et al., 2011	The Ethiopian honey bee	A	Ethiopia
	<i>Apis mellifera sahariensis</i> Baldensperger 1932	The Saharan honey bee	A	Morocco, Algeria, Tunisia, Libya, Mauritania, Western Sahara
	<i>Apis mellifera intermissa</i> Maa 1953 (synonym: <i>A. m. major</i> Ruttner et al., 1978) (Kerr, 1992; Hepburn and Radloff, 1998)	The Tellian honey bee	A	Morocco, Libya, Tunisia
	<i>Apis mellifera jemenitica</i> Ruttner 1976 (synonyms: <i>Apis mellifera yemenitica</i> Ruttner, 1988, <i>Apis mellifera nubica</i> Ruttner, 1976, <i>Apis mellifera sudanensis</i> Ruttner, 1988, <i>Apis mellifera bandasii</i> Radloff and Hepburn, 1997, and <i>Apis mellifera woyi-gambell</i> Amssalu et al., 2004) (Hepburn and Radloff, 1998; Amssalu et al., 2004; Meixner et al., 2011)	The Arabian honey bee	Y	Arabian Peninsula, Chad, Saudi Arabia, Somalia, Sudan, Uganda, Yemen

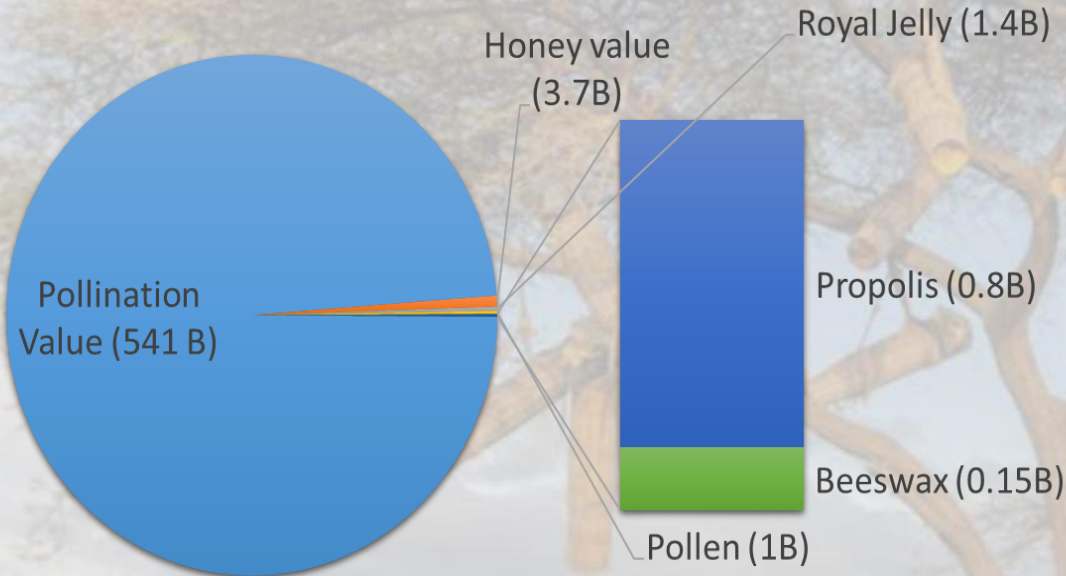
Stingless bee species

Over 38 stingless bee species distributed among these six genera:

- **Hypotrigona**
- **Cleptotrigona**
- **Liotrigona**
- **Plebeina**
- **Dactylurina**
- **Meliponula**

Beekeeping and its impact on livelihood

Economic Value of Pollinators (billions USD)



Annual value of pollination service in Kenya alone is 186 m USD, in Ethiopia it is estimated at 815 m USD



Beeswax candles



Beeswax body cream



Honey soap



Beekeeping and its impact on livelihood

Africa-wide network for bee health monitoring and management



Burkina Faso



Ethiopia



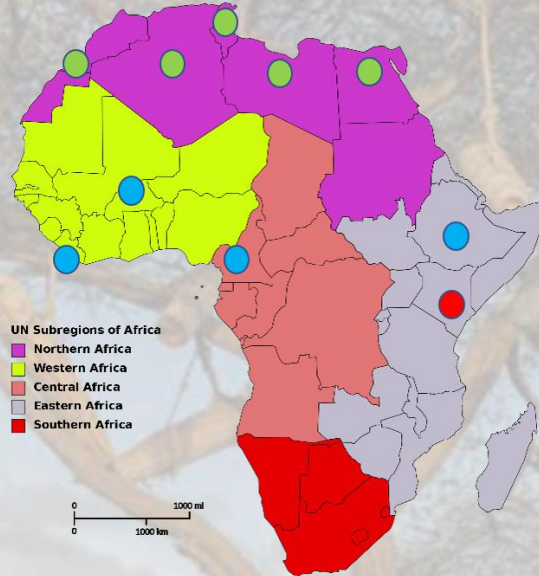
Kenya



Cameroon



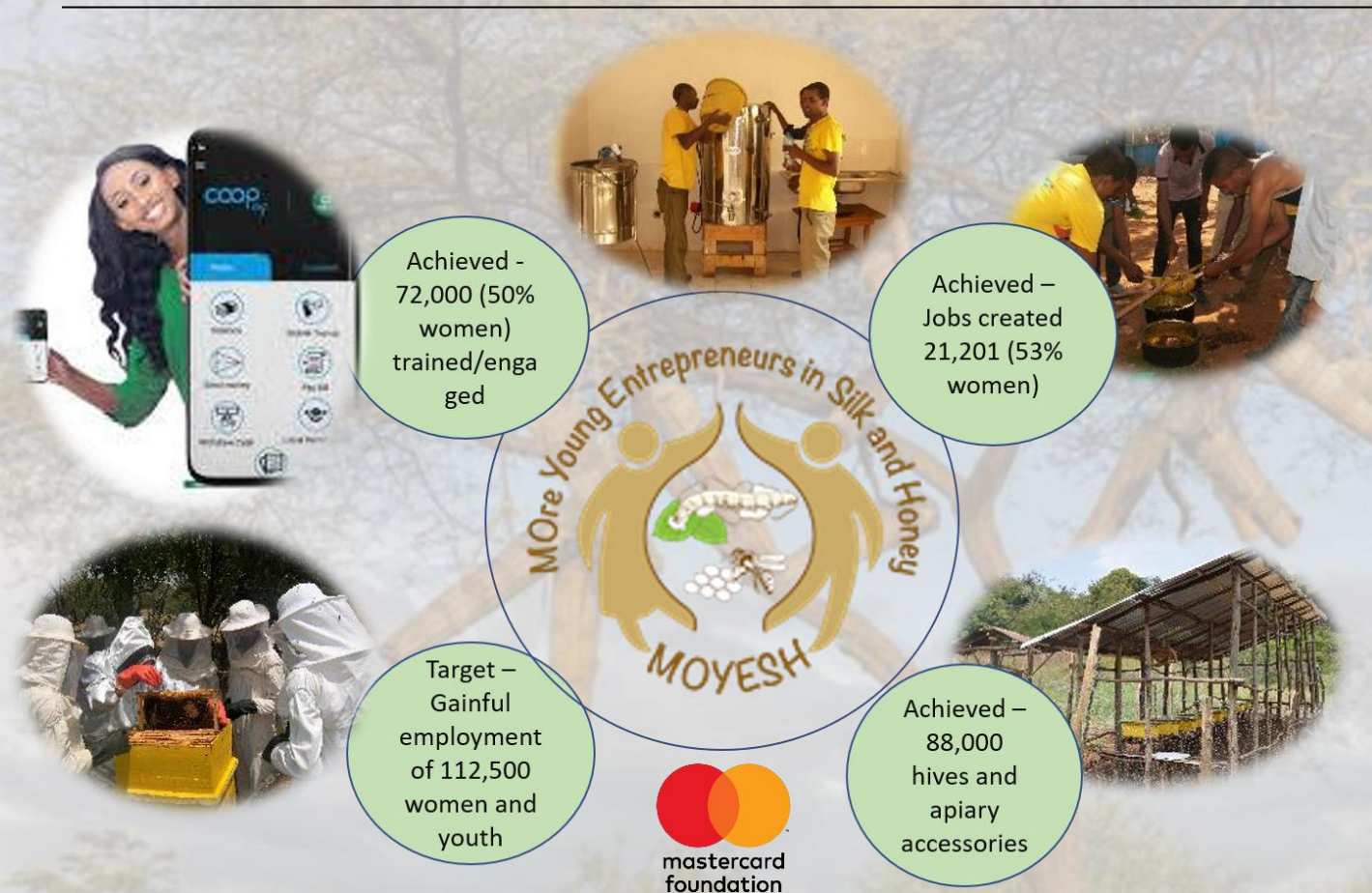
Liberia



- ❑ Develop tools and strategies for management of bee health
- ❑ Support communities with tools for improved honey bee and stingless bee farming
- ❑ 16 Honey Marketplaces in 8 African countries
- ❑ NARES from 21 Anglophone and 28 Francophone countries trained
- ❑ > 1,000,000 national and private sector beneficiaries (50% female) trained in improved beekeeping, agricultural businesses and production of valued-added products



Beekeeping and its impact on livelihood



AfriCent
Internal Cert No: AC-EAOPS-22-001

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Has been inspected and complies with the requirements of East Africa Organic
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For the following scope:
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Farmer group.

This certificate is issued based on the signed certification contract between the operator and
AfriCent Limited.
For validity check on the website: www.africentlimited.co.ke.

Product Names	Group members	Status (Organic/in-conversion)	Quantity of the product(kg/l)
Organic honey	482	Organic	90,714kg
Organic bee wax	682	Organic	N/A

The Certification Body **AfriCent Ltd** declares that the production of the products mentioned on
this certificate has been found to be compliant in accordance with the KS EAS 456:2019

Date of issuing: 6th May 2022
Valid from : 6th May 2022
Valid to : 5th May 2023

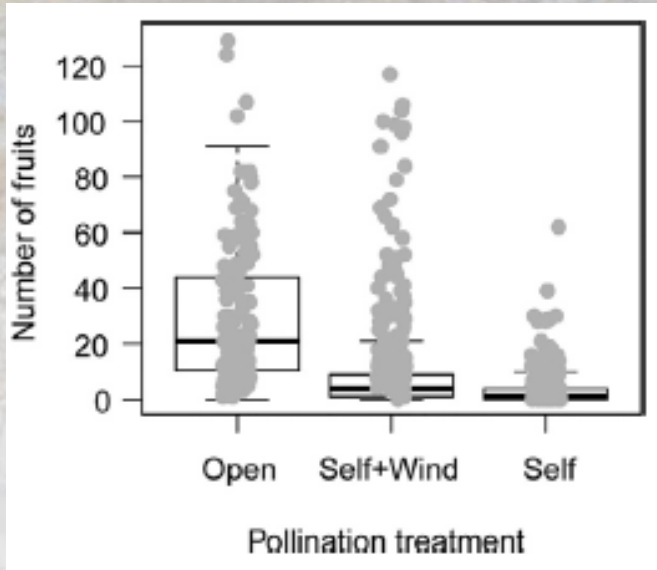
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Bee pollination services and bee forage plant species for climate-smart agriculture

- ❑ *Icipe* has shown that supplementing pollination with bee colonies can enhance yields of avocado crop by up to 20% and quality of pollination-dependent fruits and vegetables (Yellow bell pepper, cucumber and muskmelon).



Sagwe et al 2021



Kiatoko et al., 2014, 2021a&b



The potential of the beekeeping sector remains largely untapped

Table 1: Honey and wax production in sub-Saharan Africa is way below their maximum potential

Countries	Estimated annual honey production potential (tons)	Honey production realized annually (tons)
Ethiopia	500,000	50,000 (10%)
Tanzania	138,000	30,400 (22%)
Kenya	100,000	25,000 (10%)
Uganda, Ghana	500,000	5,000 (1%)
Honey and wax productions are less than 10 and 25% of the world's production, respectively (Wilson et al. 2006)		

Table 1: Export value of African honey in non-African markets

Country	2020 export price outside Africa (US\$/kg)	2024 export price outside Africa (US\$/kg)	Local honey price (US\$/Kg)
Kenya	1.49	3.55	8
Uganda	4.31	3.08	8
Tanzania	1.88	2.66	5
Zambia	3.97	2.96	
South Africa	5.90	2.86	



Bee propolis



Bee pollen



Bee venom



Royal jelly





Factors affecting the sector underperformance

- (a) Hive types
- (b) Environmental factors (mainly forage availability, climate variability)
- (c) Agrochemicals
- (d) Low availability of wild bee swarms
- (e) Poor characterization of beehive products
- (f) Pests
- (g) Poor colony management practices (harvesting and processing techniques)
- (h) Genetic factors (e.g. bee strains)



Hive types and their impact on colony health and productivity

Bamboo & Basket Hives	Grass Hives	Log Hives
 Cone Bamboo Hive  Cylindrical Bamboo Hive  Basket Hive	 Cone Grass Hive  Cylindrical Grass Hive  Cylindrical Grass Hive	 Log Hive  Log Hive with queen excluder  Log Hive  Log Hive  Borassus log Hive
Mud-Plastered/Clay-Pot Hives	Langstroth Hives	Top-Bar Hives
 Mud plastered Grass Hive  Mud-Plastered Raphia fiber Hive  Clay-pot Hive	 Langstroth Hive  Langstroth Hive  Langstroth Hive covered with grass  Langstroth Hive  Langstroth Hive	 Top-Bar Hive  Top-Bar Hive  Top-Bar Hive  Tanzania Top-bar hive  Modern Kenya Top-Bar Hive  Concrete Kenya Top-Bar Hive  Mud-Plastered Top-Bar Hive  Traditional Kenya Top-Bar Hive  Tree Top-bar Hive



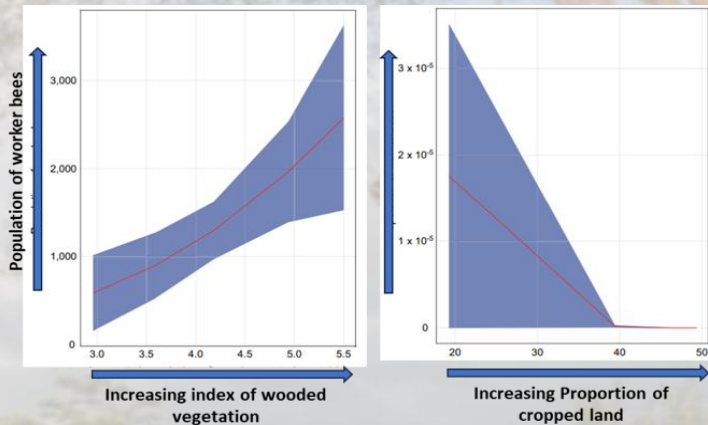
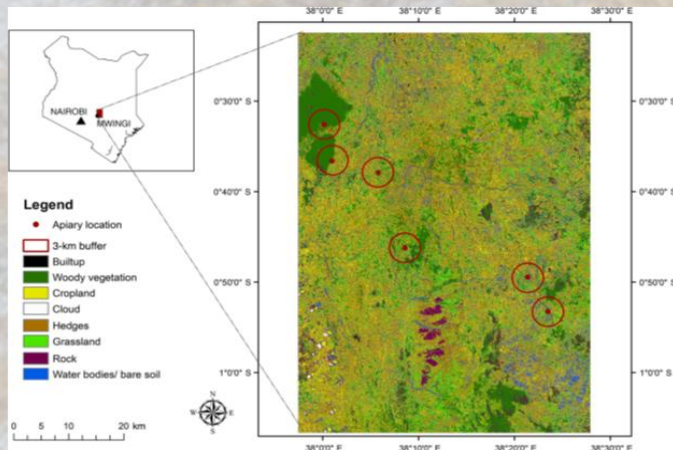
Stingless bee hive types and their impact on colony health and productivity

Hives of mostly domesticated stingless bees for honey production and for polination.

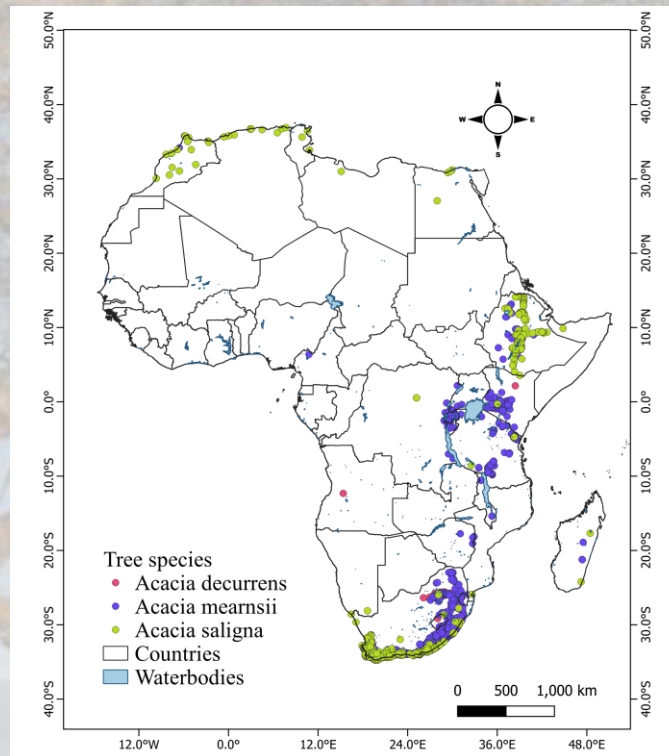
ASB	Bee	Hive	Nest sites	Nest architecture	Reference
<i>Meliponula bocandei</i>			Tree cavities in natural forests	Clustered brood cells, honey pots and pollen pots	©Nicolas Vereecken
<i>Meliponula ferruginea</i>			Tree cavities in Natural forests, Mud house walls	Horizontally arranged, brood cells, honey and pollen pots	©Nicolas Vereecken & kiatoko Nkoba
<i>Meliponula lendiliana</i>			Tree cavities in trunks and branches, underground cavities	Use resin, wax, propolis in nest construction	©Nicolas Vereecken & Kiatoko N
<i>Liotrigona spp</i>			Crevices in the walls of mud houses, Crevices in rocks, door frames, old tubes	Clustered brood cells, honey pots and pollen pots	©Ndungu N-Bee photo ©Kiatoko N-Hive



Landscape fragmentation affects bee forage availability



Ochungu et al., (2022) *Ecological Applications*



Mapping bee forage plants to enhance landscape suitability for insect pollinators, Nganso et al., 2025 *Scientific Reports*

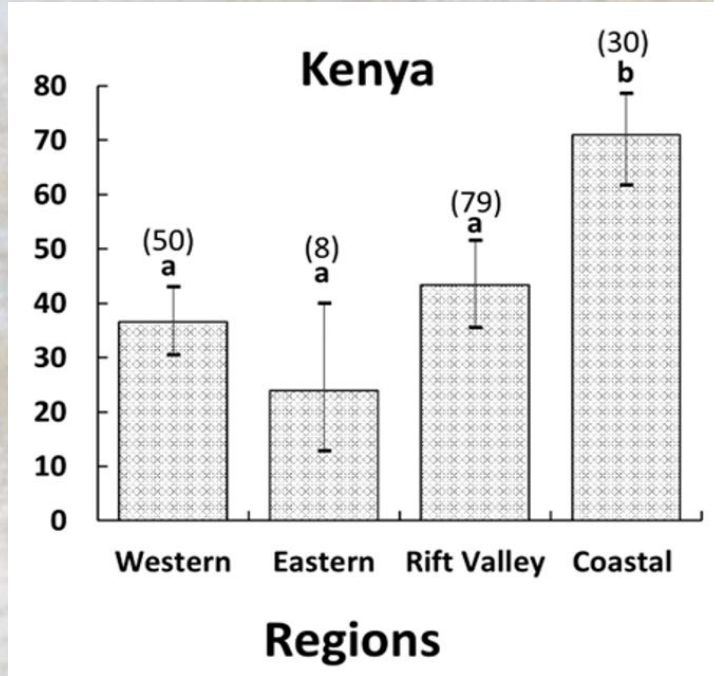


FORESTED



Climate variability (drought) enhances absconding

Total Colony loss rate (%)



Nganso et al., 2025 *PLOS ONE*

Sibaja Leyton et al. 2025

36.6%: dry (32%) and wet (20%)

Absconding due to water scarcity

Pesticide use: a growing threat to bee health in Africa



Insecticides (35%)

Fungicides (27 %)

Herbicides (20 %)

Acaricides (7 %)

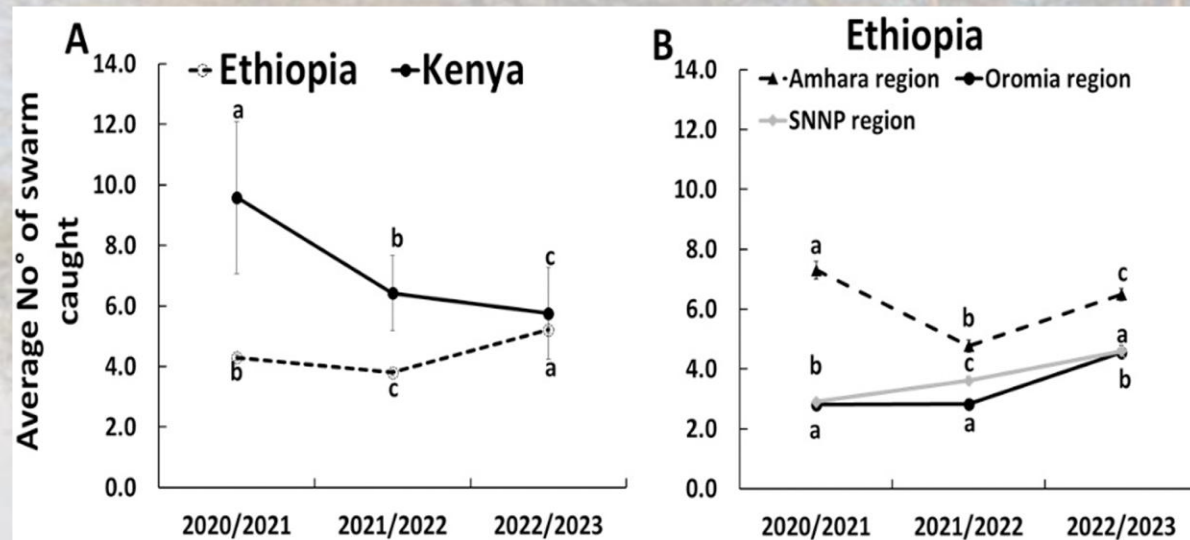


- ❑ Analysis of honey samples from Kenya, Ghana, Uganda and Ethiopia revealed four classes of pesticides
- ❑ Residue levels in most cases were less than the minimum residue levels prescribed by EU
- ❑ In some of the samples, Neonicotinoids, acetamiprid, imidacloprid and thiamethoxam were observed nearly 3-folds the minimum residue levels prescribed.



Pesticide use: a growing threat to bee health in Africa

Three-year trend in mean bee swarm catches (Mean $\pm$ SE) in Ethiopia and Kenya (A), and across Ethiopian regions (B)



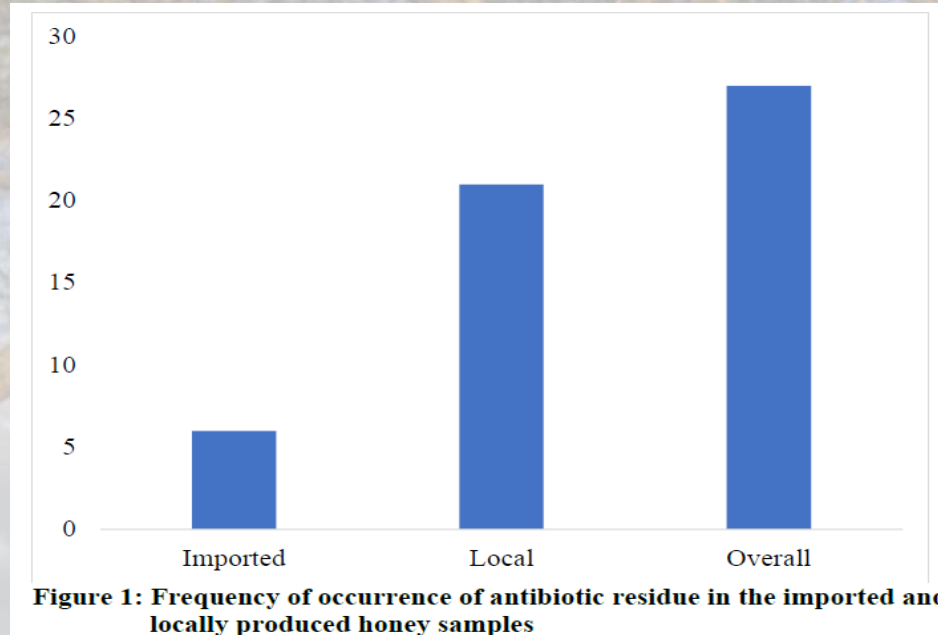
Nganso et al., (2025) *PLOS ONE*





Antimicrobial residues associated with African bee colonies

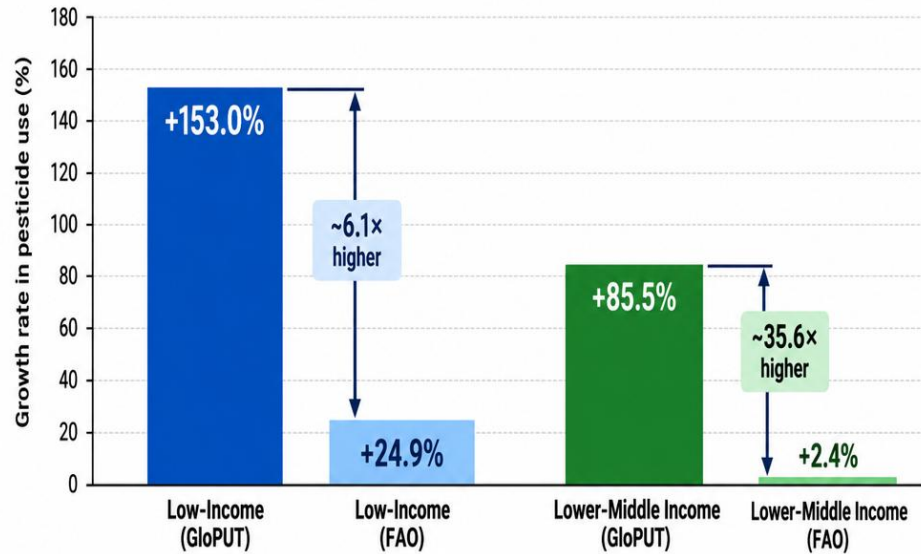
- ❖ Not much is known about the antimicrobial residues found in African bee colonies
- ❖ Nzeh et al 2020 reported antibiotic residues in imported and locally produced honey from Tamale region in Ghana, detected in 27 (90 %) out of the 30 honey samples.





Pesticide use is changing - but are we seeing the full picture?

GloPUT vs. FAOSTAT growth in Pesticide use (2008-2018) Low- and lower-middle income countries



Shattuck et al., (2023) *Global Environmental Change*

Pesticide exposure is a major concern for bee health, highlighting the urgent need for systematic monitoring across Africa.

Drivers of pesticide growth

- ❑ Pesticides became cheaper and more widely available
 - Patent expiry and the rapid expansion of low-cost generic pesticides increased production and access to the Global South.
 - Generic pesticides rose from 51% of global sales in 2011 to 75% in 2019.
- ❑ Farming systems were changing rapidly
 - Crop-price booms in 2007–08 and 2011 encouraged agricultural expansion and greater reliance on pesticides.
 - Rising labour costs and reduced public extension services also encouraged greater reliance on purchased agrochemical inputs.
- ❑ More pesticide use → more resistance → more pesticide use
 - Intensive use of herbicides such as glyphosate contributed to resistant weeds, encouraging additional and diversified herbicide use.
 - Similar resistance trends occurred with insecticides, including neonicotinoids.

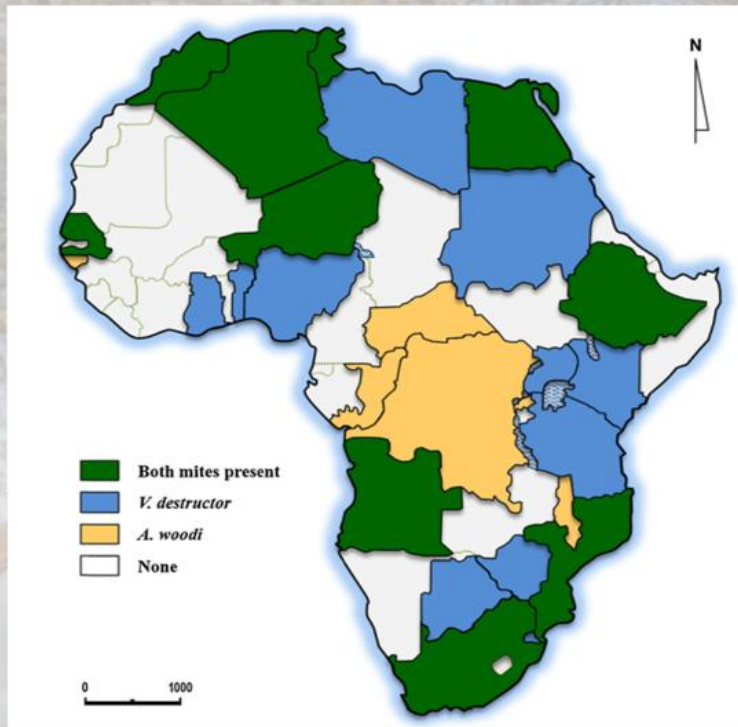


Pests associated with African honey bee colonies



Varroa mites
(*Varroa destructor*)

Tracheal mites
(*Acarapis woodi*)



Pirk et al 2016: *Apidologie*



Small hive beetle
(*Aethina tumida*)



Large hive beetle
(*Oplostomus* sp)



Greater wax moth
(*Galleria mellonella*)



Bee louse
(*Braula coeca*)



Pathogens associated with African honey bee colonies

Bacteria

- ❖ **American foulbrood (AFB) disease** caused by *Paenibacillus larvae*
- ❖ **European foulbrood (EFB) disease** caused by *Melissococcus plutonius*

Fungi

- ❖ Nosema disease caused by *N. ceranae*, *N. apis*, *N. neumannii*
- ❖ Chalkbrood disease caused by *Ascosphaera apis*

Viruses

- ❖ Deformed wing virus (DWV)
- ❖ Acute bee paralysis virus (ABPV)
- ❖ Kashmir bee virus (KBV)
- ❖ Israeli acute paralysis virus (IAPV)
- ❖ Sacbrood virus (SBV)
- ❖ Slow bee paralysis virus (SBPV)
- ❖ Black queen cell virus (BQCV)
- ❖ Chronic bee paralysis virus (CBPV)

Negative-sense single-stranded RNA (-ssRNA) viruses

- ❖ Lake Sinai Virus (LSV1-7)
- ❖ Apis rhabdovirus-1 (ARV-1&2)

Double-stranded DNA (dsDNA) viruses

- ❖ *Apis mellifera* filamentous virus (AmFV)



Pests associated with African stingless bee colonies

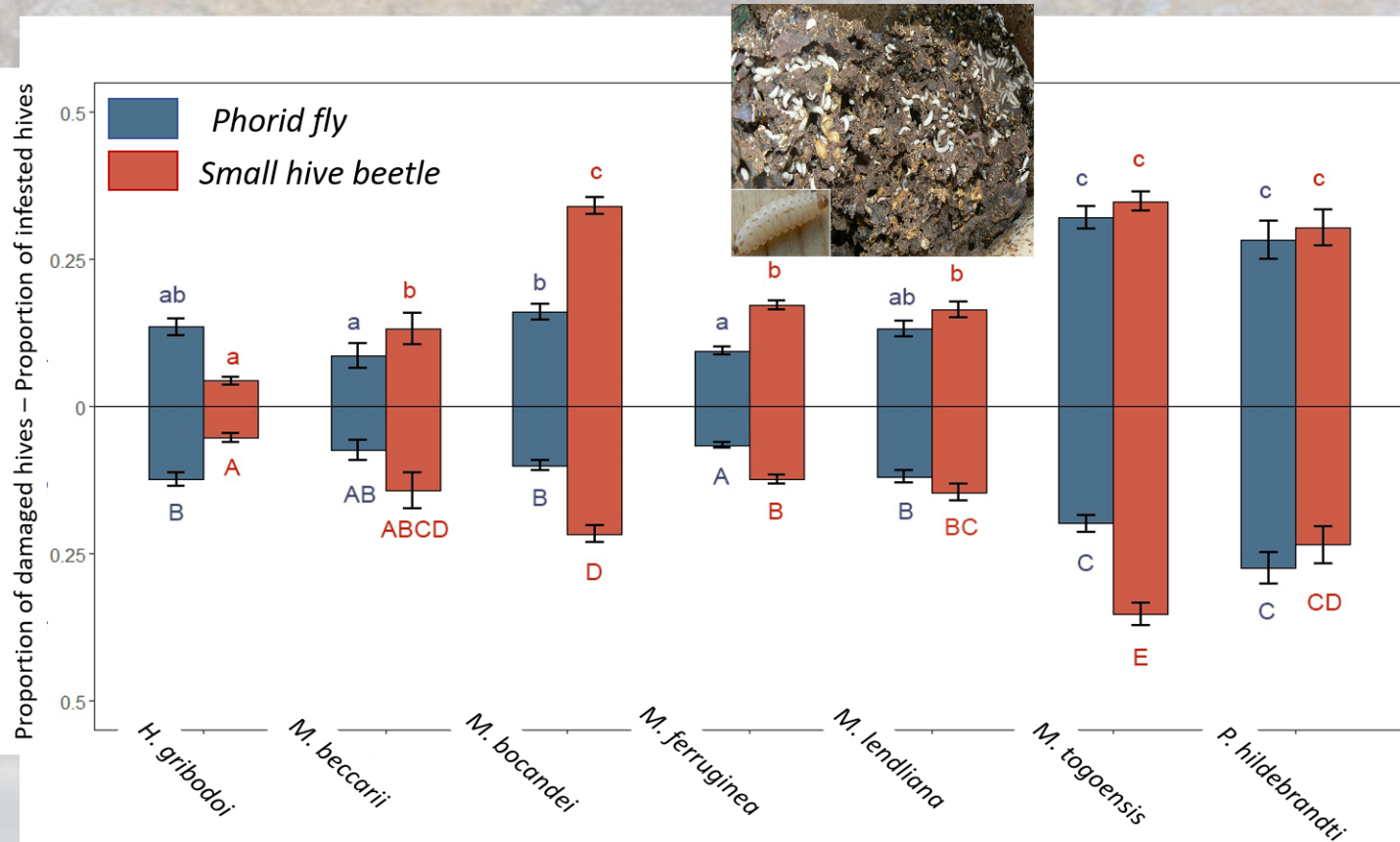


Small hive beetle
(Aethina tumida)



Scaled Hump-backed Fly
Megaselia scalaris

© Luis Silva iNaturalist.com





Pathogen associated with African stingless bee colonies

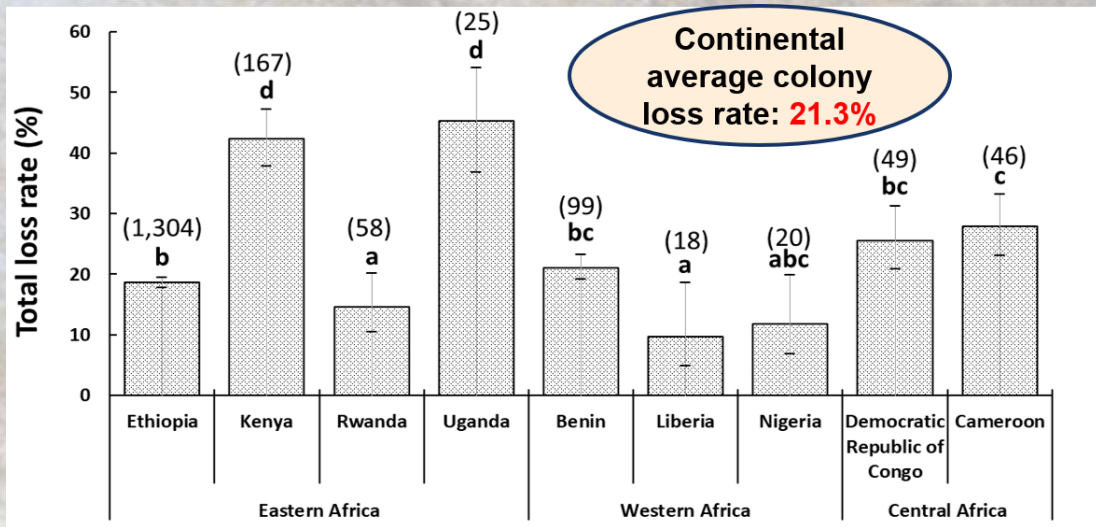
Virus pathogen: Black queen cell virus



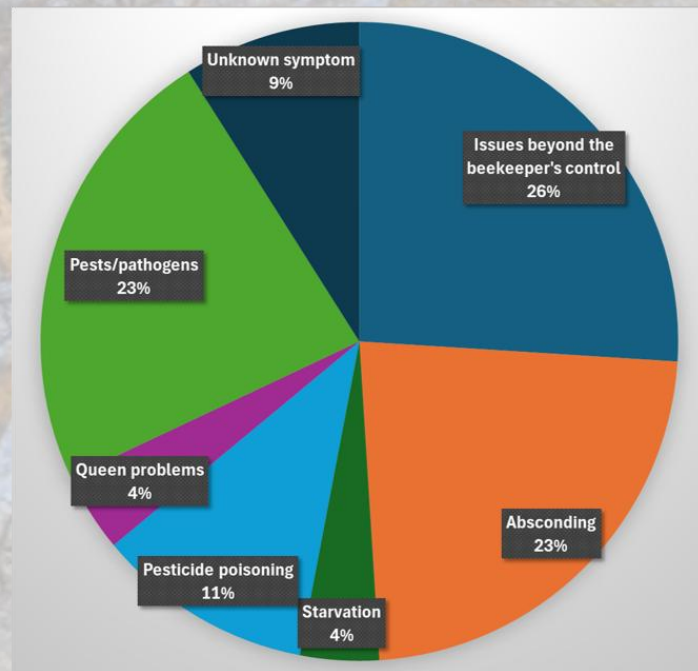
This virus was detected in worker bee samples of *H. gribodoi*, *M. lendliana* and *M. bocandei* collected inside the colony.



Best practices for colony management in Africa



Farmers' perceived causes of losses



Impact of hive types and colony management practices on loss rate

- ❖ Using movable-frame hives, practicing professional beekeepers, migratory beekeeping, and receiving training on best colony management practices mitigate these losses.



Best practices for colony management in Africa

Agro-Ecological factors

- Honey bee genetic diversity
- Habitat loss
- Pesticide usage
- Climate variability and change
- Farming practices (monoculture)

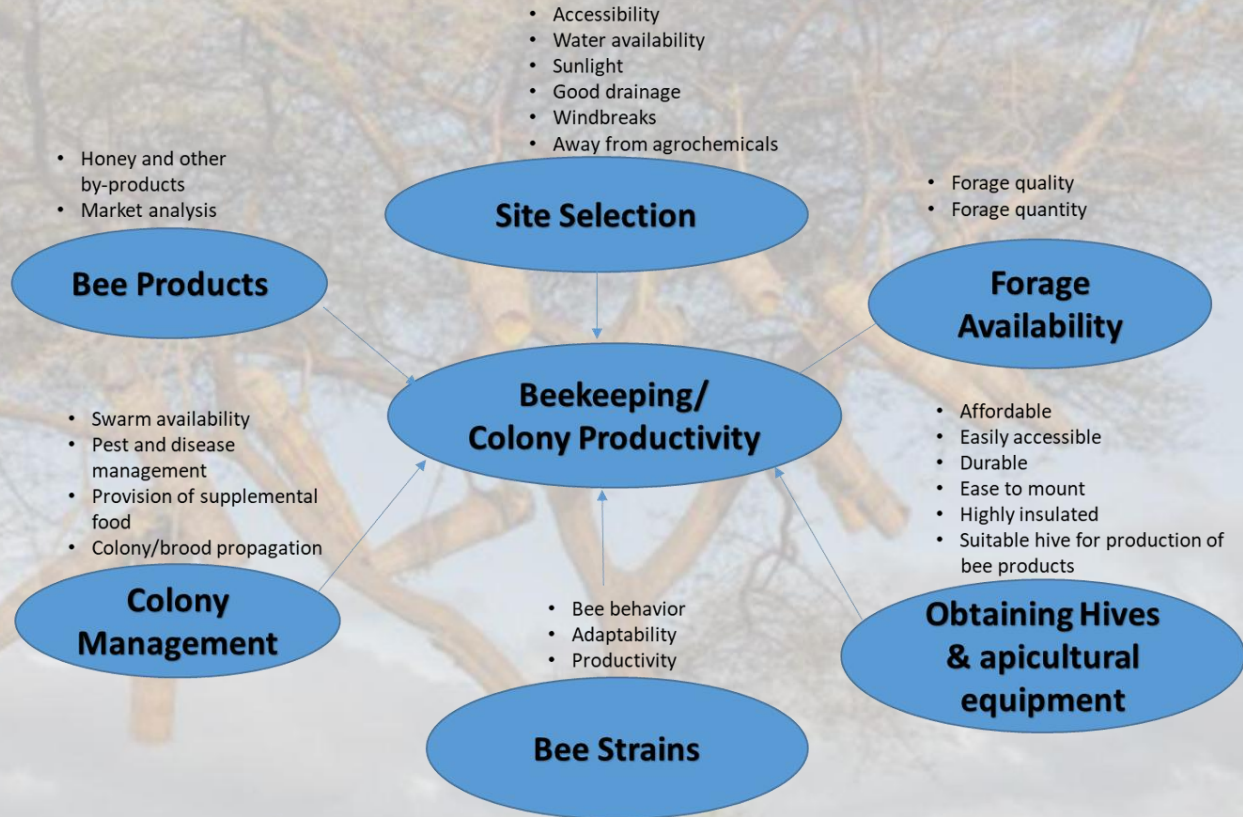
Biotic Factors

- Pest
- Parasites
- Diseases
- Human activities

Socio-political factors

- Land tenure
- Economic factors
- Education and knowledge
- Policies and regulations
- Collaboration and social network

Factors that impede or bridge colony productivity





Conclusions

- ❖ There is need for continued investment, capacity building, infrastructural and institutional development, and innovation in the beekeeping sector in Africa.
- ❖ There is need for continued surveillance of wild bee colonies, antimicrobial residues, pesticides, pests and diseases.
- ❖ Develop and harmonise standards and guidelines for beehives and bee products
- ❖ Establishment of quality standards and geographic indications for beehive products.

Thank You



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