

Honey bee diseases : current status of surveillance, diagnostic capacity and overall animal health constraints faced by bee keepers (in eastern Africa).

Eva Musyimi

Introduction

Bees not only play an important role in conservation of the ecosystem, but are of commercial value today as pollinators of forests, horticultural and agricultural crops and for their marketable products such as honey and wax.

The most important species for bee keeping in East Africa and the wider sub Saharan Africa is *the Apis mellifera scutellata* (the African Honey Bee)[1].

Over the past 5-10 years, honey bees have been faced with many threats including pests and diseases, [2] which has led to the listing of honey bee diseases in OIE Terrestrial Animal Health Code. Listed diseases include, Acarapiosis, American Foulbrood, European Foulbrood Small Hive Beetle Infestation, Tropilaelaps infestation and Varroosis. [3]. In East Africa, these diseases remain unreported to date as indicated in the *World Animal Health Database* (WAHID) [4].

Recent analysis on the status of Honey Bee Diseases and pests in East Africa

Nevertheless, though not reported in WAHID, *Varroa destructor* is confirmed to be present but its prevalence is unknown. Interestingly the African bee seems to be resistant to the mite, coexisting with the mite without being affected by its parasitic activities as accounted by Bee specialists in the respective countries. The small hive beetle which is most active in the dry season is also present in East Africa, and just like the Varroa mite, there seems to be some tolerance between the bees and the beetle with minimal adverse effects on bee colonies. [Kangave.A., Kagya.M., Kassina.M., otieno.I.,personal communications, July 2013]

However the wax moth pest is rampant in Kenya and Uganda, devastating bee productivity as the moth larvae feed on wax and hive debris leaving behind an extremely sticky white web. Ultimately the larvae destroy the brood comb causing death of the brood within a very short time if unchecked. The status of the other OIE listed diseases notably; American foulbrood, Acarapiosis and Tropilaelaps in East Africa is unknown. [Kangave.A.,*et al*, personal communications]

Table 4: Summary of current honey bee disease and pest status in the respective countries

	Disease and pest Status					
	American Foulbrood	Acarapiosis	Small Hive Beetle	Tropilaelaps	Varroa Mite	Wax Moth
Kenya	unknown	Suspected in 2004,currently unknown	present	unknown	present	Present
Tanzania	unknown	unknown	present	unknown	present	Present
Uganda	unknown	unknown	present	unknown	present	Present

Ongoing National Research on Honey Bee Diseases

Kenya

The Zoological Department at the *Department of Veterinary services* in collaboration with the *National Bee Keeping Institute*(NBI) has been carrying out active surveillance since 2011 in various districts in the country such as Homa Bay, Mwingi, Mbeere among others, where the Varroa mite in bee hives has been positively identified using a Simple "Field Sugar Shake Method". In the course of surveillance, the department has been collecting samples of the mite from bee colonies for differentiation of the various mite species and also for isolation of viruses associated with it, which will then undergo molecular analysis.[5]The field samples are stored at the *International Livestock Research Institute* (ILRI), since they have the storage capacity as well as diagnostic capacity for molecular analysis of associated viruses. Molecular analysis was due to begin in June 2013 [Otieno.I. and Oketch.J., personal communication, June, August 2013]

In addition the *Kenya Agricultural Research Institute* (KARI), has been doing research on the importance of bees in pollination of both crop and non-crop plants and the negative effects of crop pesticides on honey bee health, diversity and population.(kassina.M., personal communication, June 2013)

Uganda

The *National Livestock Resources Research Institute* (NaLIRRI), a public agricultural research institute, is currently doing research on identification and classification of honey bee diseases and races, selective breeding of bees for increased productivity and formulating control plans for the bee predators and pests. The Makerere University is also doing some research on bee diseases but mainly for Educational purposes. [6]

Tanzania

The *Njiro Wildlife Research Centre* is the sole centre under *Tanzania Wildlife Research Institute* (a parastatal organization under the Ministry of Natural Resources and Tourism) and in the whole of Tanzania responsible for research on bees and beekeeping, with current research programmes on modern tools for beekeeping, bee biology, bee behavior and management, diseases, pests and predators, extension and training services, and environmental conservation. [7]

Presently there are no special national laboratories for diagnosis of honey bee diseases in all three countries. Though a basic field method of visually identifying and determining levels of Varroa mite, using a simple "sugar shake method" is widely used with satisfactory results.

ICIPE-AU-IBAR Bee health Project

According to Fries and Raina, there is limited information on Honey bee diseases in Eastern, central and western Africa .However reports of low level of American foulbrood (a bacterial disease that causes death of larvae in the brood cell) in large parts of Africa and recent confirmed presence of *Varroa* mite has raised concerns of the future of honey bee health and productivity in the region.

Moreover other non-OIE listed honey bee diseases such as Kashmir bee virus, Nosema disease and Chalkbrood fungal disease are believed to be widespread in Africa.[8]

The sketchy status of honey bee diseases in Africa has led to a new initiative by *International Center for Insect Physiology and Ecology (ICIPE)* and *African Union-Interafrican Bureau for Animal Resources (AU-IBAR)* to establish an "*African reference laboratory (with satellite stations) for the management of pollinator bee diseases and pests for food security*" to carry out research and generate new information on bee diseases as recommended by the OIE, and devise suitable disease control measures and general training on modern methods of Beekeeping.[9a]

The project which is due to begin in early August 2013 will use 22 locations in selected 5 countries to collect data which will be reviewed and approved by bee experts and National Research Institutes in East Africa. The findings in each of the participating countries will be recorded and will be used to give a tentative projection of the bee health status in Central, Eastern and Western Africa. Ultimately, a Central Reference Laboratory (CRL) at ICIPE-Kenya and four satellite stations; one each in Cameroon, Ethiopia, Burkina Faso and Liberia will be established. The target potential beneficiaries of the project will be beekeepers, government institutions, non-governmental organizations, private sector and universities. [9b]

Early Warning systems for Honey Bee Diseases and Pests

Early warning systems for exotic honey bee diseases such as American Foulbrood in the three countries is based on proactive regulations requiring export permits and sanitary certificates at sea ports, borders, airports before importation of live bees or bee products. In Tanzania regulations further inhibit imports of used bee hives and bee equipments.[Kangave.A., Kagya.M., Otieno.I,- personal communications, July 2013]

In Kenya the department of veterinary services plans on setting up sentinel hives to aid in continuous monitoring of Varroa mites and other bee diseases. The control hives (Langstroth hives) will be distributed to pre-selected farmers in the field. [5]

Honey Quality control

The East African countries are able to meet sanitary requirements and obtain international certification for export of quality honey free of chemical residues (pesticides, chemicals and antibiotics) approved by the respective National Bureau of Standard bodies to countries such as Saudi Arabia, Australia, Japan and EU countries (Germany, the UK, Spain, Italy, Belgium, Switzerland and France). In support of production of wholesome bee products, bee experts sensitize beekeepers on the adverse effects of pesticides on bee health and on quality of bee products, encouraging the keepers to locate their apiaries far from agricultural farms especially commercial farms where pesticide usage is heavy. The National Bee Keeping Institute advises crop farmers near apiaries to use less toxic pesticides and to apply the pesticides early morning or late evening when bees aren't foraging for nectar. Consequently in Kenya most of the honey in the market is certified organic.[Kangave *et al.*, personal communication]

In Kenya, the Honey Quality Control Laboratory at ICIPE and the Hive Products Quality Assurance Unit at the National Beekeeping Institute verifies honey samples brought in by farmer groups and Honey processors/packers, meets trade standards by analyzing honey enzymes, amino acids, moisture content. Illegal sugar additives are also checked. The Laboratories through extension services also disseminate information on proper harvesting, processing, and transportation to ensure that high

quality honey reaches the consumer. [Nyamoita.I. and Oketch.J., Personal communications ,August 2013]

Constraints faced by Bee keepers in East Africa

In spite of the steady growth in commercial apiculture, bee keepers in East Africa face various challenges;

- Modern bee hives such as the Langstroth bee hives are considered too expensive for the bee keepers and therefore they improvise with locally available and affordable materials such as sticks, mud, logs, dung to construct traditional bee hives. These hives unfortunately are not durable as bees are exposed to predators especially the Wax moth which invade weak hives.[Kangave *et al*, personal communication] Interestingly traditional bee hives have a higher rate of colonization by bees than the recommended modern hives according to reports in Kenya and Uganda, tentatively attributed to the fact that the hives are set up high on trees where it is cooler with minimal human and predator interference.[Kangave.A. and Oketch.J., personal communication, July 2013]
- Bee pests such as the wax moth, sugar ants and the bee louse if uncontrolled can lead to low bee productivity. [10]
- Few honey processing plants and unaffordable processing equipment (settling tanks, honey mixers, honey pumps, honey extractors, bottling machines etc) force farmers to sell their honey raw or semi-refined in markets with little value addition. Furthermore Lack of specialized transport vehicles with refrigeration for honey, leads to losses and reduction in honey quality from heat. [Nyamoita.I., Personal communication,2nd August 2013]
- Detrimental environmental factors such as drought, erratic rainfall which affects flowering of plants and deforestation activities leads to reduced plant diversity and forage for bees to feed on.Bees to starve to death and some abscond their bee hives leading to reduction of their populations during this period.

Conclusion

It has been noted that the general bee population in East Africa is on the decline .It is difficult to pinpoint the reason for this outcome, however the prominent suspects are deforestation activities for charcoal burning and agriculture, drought and use of agro-chemicals. The pesticides cause toxicity and death of bees whereas deforestation and drought destroy the natural bee habitats, reducing forage and plant diversity and leading to insufficient nutrition and ultimate starvation of the bees.

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