

Beekeeping in Kenya

*The International Centre of Insect Physiology and Ecology (icipe)
Nairobi, Kenya*



**An Analysis of Food Supplementations During the Drought Period to
Contribute to Improving the Colony Build-up of *Hypotrigena gribodoi***

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Introduction

A Nebraska Beekeeper

I am from small town Nebraska. Everybody knows you, and most people in the town are farmers. They farm corn, soybeans, and livestock such as cattle, pigs, and sheep. I'm different though. Some farmers may own a couple hundred head of cattle, but I own about 40,000 head of honeybees during the summer. It is a unique hobby that I have come to enjoy. But owning honeybees can be tricky, especially now, in a time when Colony Collapse Disorder, abbreviated CCD, is threatening hives, and bees seem to disappear. People rely on bees in so many ways, but it wasn't until I came to Africa, that the need for bees became very real.

I arrived at the International Centre of Insect Physiology and Ecology (*icipe*) on June 15, 2012. After only a few days, it was easy to see the passion these people have for insects. While working with the Bee Health team, it became evident that beekeeping was so much more than a hobby; it was a lifestyle. Some people depend solely on the income presented by their bees. *Icipe* is working hard to make sure maximum quality and quantity of beekeeping is achieved throughout not only Kenya, but also Africa.

My interest in agriculture is a newfound interest, and began once high school started. On a whim, I decided to join my school's FFA chapter. Later, I decided to do a speech about honeybees, and it was then that I decided it was something I wanted to do too. Since then, I have tried to spread the importance of bees as best as I can. I included them in every speech I presented, and gave presentations to various local organizations. Mrs. Anita Wollenburg, the former agriculture teacher at Wilber-Clatonia High School, approached me one day and told me about the World Food Prize. She explained to me what it is about, and how I could qualify to go.

I attended the 2012 World Food Prize Convention, and with it, my perspective on the world changed. Sometimes, we tell ourselves not to think about the bad things in life, but when you see the way of life in other countries, you can't help but ignore it. Some of the biggest impacts on me was taking part in the hunger meal and packaging meals to be sent to third world countries. We can't control what lifestyle we were born into, but we can control how we affect others.

I am grateful for my previous experiences in beekeeping, as it really helped me not only understand my research, but also fit in at *icipe*. During my internship, I not only gained a new perspective on beekeeping, but I was humbled by the kindest people and I appreciate the work *icipe* is doing. I truly believe in what can be accomplished, and I have been blessed to be able to work with such an amazing team. I am proud to call them not only my friends, but also my family.

Background Information: *International Centre of Insect Physiology and Ecology*

Founded in Kenya in 1970 by Professor Thomas Odhiambo, the International Centre of Insect Physiology and Ecology, abbreviated *icipe*, studies tropical insects with the goal to help ensure food security and better health, protect the environment, and conserve natural resources. (icipe.org) This mission is much the same as it was when founded, and *icipe* works hard to accomplish these objectives.

Icipe's main research areas are known as the 4-H's; human health, animal health, plant health, and environmental health. Each "H" has specific objectives that must be met to ensure success. However, *icipe* also has centre wide goals that enfold all the programs. These are to create knowledge, build capacity, develop agriculture policies, and reduce poverty.

The main headquarters is located on Dudville Campus in Nairobi, Kenya and a majority of research and field work is also done at Mbita Point near Lake Victoria. *Icipe* also has field sites in other areas across Kenya and in other countries, to help ensure all ecosystems and habitats are studied.

Icipe has made a huge difference in many people's lives. The centre is a major contributor in the fight against malaria, they have helped alleviate the threats posed by ticks and the tsetse fly, have aided in the improvement of crop production, and have helped people break the poverty line with the Commercial Insects Programme.

Icipe hopes to introduce the best practices to the farmers and raise awareness and appreciation of stingless bees and the vital roles they play in agriculture. This knowledge is hoped to be incorporated into African country development strategies. This will allow African nations to achieve their development goals in beekeeping.

Stingless Bees – *Hypotrigona gribodoi*

There are over 600 species of stingless bees worldwide, and of this number 22 species live in Africa. Stingless bees are found mainly in tropical and subtropical areas, making Kenya the perfect home for the fascinating creatures. Along with honeybees, these two groups create very highly social bee groups. Both live in colonies with a definite division of labor from fertile queen bee to infertile worker bee. (Kwapong, 2010) One species in particular has been particularly noteworthy: *Hypotrigona gribodoi*.

Hypotrigona gribodoi have shown themselves to be vital pollinators, and visit almost all crop species. They are also known as one of the most frequent crop visitors in East Africa. Kiatoko et al. (2013) reported that green pepper flowers (variety California Wonder) which are pollinated by *H. gribodoi*, yield to fruits of better quality than self-pollinated flowers and those pollinated by feral bees. Thus, bigger fruits are sold at higher prices at the local market, giving more return

to the rural farmer. *H. gribodoi* are found primarily in grasslands, natural forests, wetlands, marshes, woodlands, and forests.

The existence of this important insect is being threatened though. With habitat degradation, insecticide misuse, food shortages during drought, disease, and natural predators, these bee colonies are slowly becoming smaller and smaller.

As the population of the bees dwindles, the farmers in the area are affected more and more. The beekeeper loses profit gained from the bees, the farmers lose the vital pollination provided by these insects, and the community loses a natural remedy used to treat many of the illnesses that arise in a poor village, such as illness and infection.

Research and Analysis

Abstract

Bee health is becoming a growing problem worldwide, especially the health of stingless bees. Found only in tropical regions, stingless bees, particularly *Hypotrigona gribodoi*, offer excellent pollination to various plants and their honey has been proven to have medicinal qualities. However, during the drought season, many colonies will abscond the hive, or weaken to the point of failure. This situation constitutes a constraint in the use of *H. gribodoi* colonies for crop pollination in open field during the draught season and in greenhouses due to neediness of nectarine plants. Similar situations are encountered in the rearing of honey bees but are solved by practicing supplementary feeding. Supplementary feeding with syrup solutions for honey bees involves use of sugar, icing sugar, or honeys diluted in water; and has never been applied in colonies of *H. gribodoi*. It is possible that introducing these practices for *H. gribodoi* might contribute to preventing colony collapse and loss during scarcity of nectarine flowering plants.

In order to learn the advantages of feeding *Hypotrigona gribodoi*, a study was conducted in the Kakamega Forest of Kenya to analyze the effects of supplement feeding, and by which strategy of feeding has the most improvement. The hives were fed a sugar solution, icing solution, honey solution, or no solution. Data on the number of food pots and brood cells that each colony has constructed, filled with food and sealed will be recorded and shows the colony activity due to the specific treatment. The study proved that feeding does increase production, and also showed that honey is the best feeding solution.

Introduction

Bees make a huge impact on people worldwide, provided pollination, food, and medicinal values. Stingless bees in particular are extraordinary insects, providing pollination to even the smallest blooms and producing some of the most medicinal honey known and proven by science. For centuries tribal people have been using stingless bee honey to cure a variety of ailments. Honey kills bacteria, builds the immune system, and is anti-inflammatory. Some of the uses of medicinal honey include regulating weight gain, fighting chronic fatigue and building energy,

prevent and treat bladder infections, relieve depression, and treat malnutrition. (Melipona.org)
These are just to name a few!

Hypotrigona gribodoi, a species of stingless bees, have proven to be a very strong asset to farmers and families. When used for pollination, it has been found that plants pollinated by *Hypotrigona gribodoi* yield larger fruits, therefore increasing the selling price and profit of the farmer. In addition, the honey of *Hypotrigona gribodoi* has proven beneficial as well. The honey of *Hypotrigona gribodoi* is a very smooth, sweet tasting honey that carries its own set of cures. The Luhya Tribe of Kakamega Forest uses the honey to treat cough, chest pains, abdominal pains, ulcers, and kidney pains. For these people, it is a better alternative to treat an ailment with honey than it is to make the long and expensive trip to town to be cured by a doctor, and their methods work.

However, during the drought season and the heavy rains, the hives begin to collapse. The farmers find it difficult to maintain the hives during these periods and often lose more hives than they can afford.

Objectives and Methodology

Objectives

The first main objective of this study was to analyze the effects of feeding *Hypotrigona gribodoi* hives in the Kakamega Forest during the drought season, and to observe how the hives improved, decreased, or maintained. Hives in the Kakamega area see a definite decrease during the rainy season. The bees are no longer able to forage on flowers due to the rain. Without the ability to forage, the hives become very weak and may die during the season. This is a major setback for a farmer who makes his living off beekeeping. It is also a major setback for the people relying on the medicinal uses of the stingless bee honey.

Methodology

Nine hives of *Hypotrigona gribodoi* in the Kakamega Forest, in the same apiary and environment, were selected as test hives. The hives were all of approximate equal strength in the beginning of the study. Of the hives, two hives received 60% sugar solutions, two received 60% icing sugar solutions, two received 60% honey solutions, and three received no solution. External feeders were used to provide the hives with the solutions, and were re-filled with solution when needed. The hives were checked at specific times (8:00, 12:00, and 15:00) every day for 11 days, and data was recorded. Marker pens were used to differentiate the counted cells from day to day. The initial count of the cells (the open cells that were there previously to the experiment) were marked and recorded. This is included for understanding purposes.

Observations

While at the International Centre of Insect Physiology and Ecology headquarters in Nairobi, test hives of *H. gribodoi* were studied. The most effective feeder used was an external feeder with a tube extending into the hive for the bees to suck the drops of solution from. The strength of the solution that would be used while in the field was also tested. A 25/75 solution, 50/50 solution, and 75/25 solution of honey solution, sugar solution, and icing sugar solution were tested to reveal what the bees were most drawn to. It was found that the bees preferred the strongest solution (75/25), and in fact this solution yielded the best results. The results of these tests were brought to the field to be used there in a two week analysis of the hives.

Results

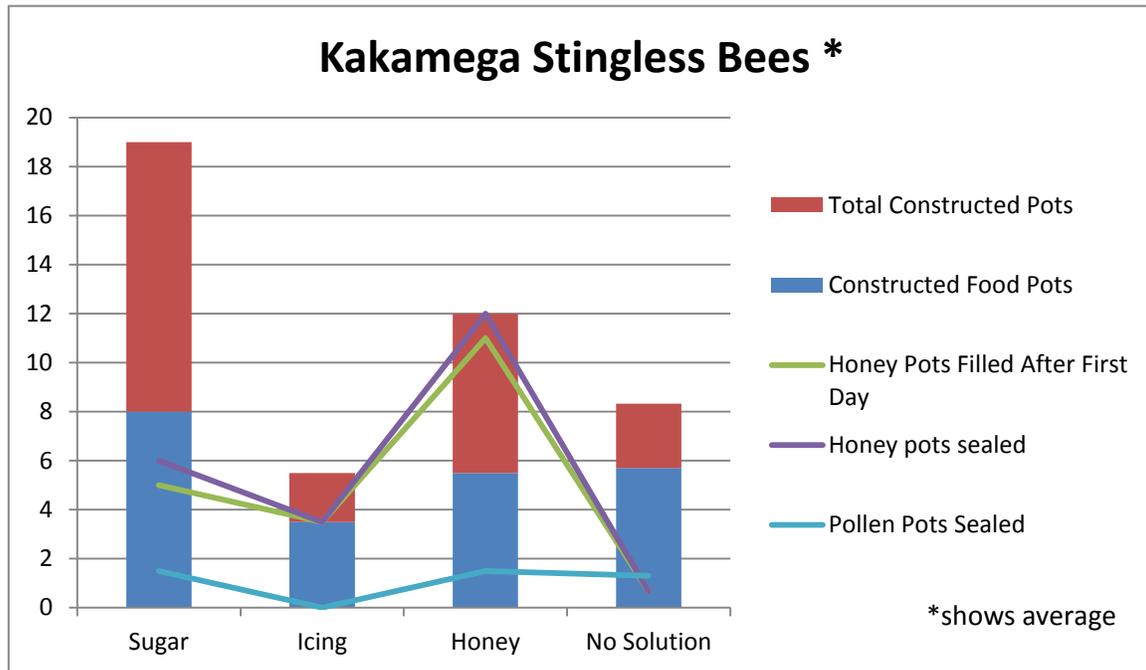
The experiment has proven that feeding bees a syrup solution during the drought season does in fact improve the colony's health and food storage. Moreover, it has been shown that feeding a honey solution to the bees is the most effective in colony build up. With feeding, the bees became more active, but since one solution was given to multiple hives, the average was taken of the hives fed one particular solution.

Figure 1: Hive Data Collected

Average Number of Cells Daily

	Constructed Food Pots	Total Constructed Pots	Honey Pots Filled After First Day	Honey pots sealed	Pollen Pots Sealed
Sugar	8	19	5	6	1.5
Icing	3.5	5.5	3.5	3.5	0
Honey	5.5	12	11	12	1.5
No Solution	5.7	8.33	0.67	0.67	1.3

Figure 2: Data Collection Graph



*NOTE: “Total Constructed Pots” includes the cells that were built previously to the experiment and are included for understanding.

Conclusion

Sugar: The hives fed sugar solution showed the greatest average increase in food pot construction. The hive sealed some of the constructed pollen pots, but had an obvious excess of unsealed food pots. This still remains a benefit to the hives though, since these pots will now be ready for food after rainy season has finished and the bees can forage once again.

Icing: The hives fed icing sugar solution showed the least amount of growth in all aspects. The hives constructed, on average, the least amount of food pots. The hive also did not seal any of the honey pots constructed, and sealed no pollen pots. While the other hives studied with other solutions showed a consistent amount of pollen pots being sealed, the hives fed icing sugar showed a decrease in production.

Honey: Hives fed honey solution showed the greatest increase in food pots being sealed. On average, all the food pots created by the bees were filled by the end of the experiment. These bees showed the greatest amount of activity. Yet, while this yielded the best results, this solution also takes the honey harvested by the beekeeper for profit and use.

No Solution: This hive was used as the control hive. It is seen that without feeding the bees, the production of the hive deteriorates and the bees filled the least amount of pollen and honey pots.

Discussion and Future Work

In the area of Kakamega, Kenya that I worked in, stingless bees have a major impact on people's lives, both directly and indirectly. The bees are one of the best sources of pollination in the area, and the honey can be sold to turn a profit. The honey is also very medicinal. In a survey I facilitated in the Kakamega area during my study, I found that the tribal uses of stingless bee honey crosses a wide spectrum. The honey of *H. gribodoi* alone is thought to cure cough, chest pain, abdominal pain, and ulcers. The many other stingless bee honeys in the area cover things such as asthma, tuberculosis, helps with HIV and AIDS, sinuses, and whooping cough.

Stingless bees play a vital role in agriculture, but they are being threatened by Colony Collapse Disorder that is currently found in honeybees worldwide. Colony collapse occurs when a hive is no longer functioning for any apparent reason. Beekeepers report the bees seem to disappear from the hive, leaving behind the queen, brood, and food. There are many theories why the bees disappear, but nothing has been completely proven.

Currently, stingless bees have a problem with swarming. They leave their hive to move to another place. Beekeepers in the area are worried it is a step towards Colony Collapse, and are looking for ways to build up their hives and keep the bees in their hive. Some farmers have begun feeding their hives mixtures of primarily icing sugar solution to build up the hives. The following are the thoughts about each solution studied.

Sugar: The sugar solution shows the most benefits for the hive in my opinion. It has given the bees a good amount of constructed hives for them to have ready, but also gives them enough food to sustain when they cannot leave the hive to forage. The bees maintained pollen pot production.

Icing: The hives fed icing sugar showed the least amount of production, and actually showed an overall average decrease compared to the "no solution" control hive. This hive also showed a decrease in pollen pots sealed. This is inconsistent with the pollen pots sealed in all other hives. This brings up the question about whether the icing solution (which is currently being fed to bees and is even encouraged) has an agent that is harming the bees. The bees in these hives being surveyed also displayed a sluggish appearance, and made little to no effort to defend the hive when opened.

Honey: The hives fed honey solution showed the greatest increase in the amount of honey and pollen pots sealed. On average, all constructed hives were sealed by the end of the examination period. However, it should be brought up how beneficial feeding hives a honey water mixture truly is. Essentially, we are putting the honey just extracted by the beekeeper back into the hive. Perhaps, this data shows us that farmers are over harvesting the honey from the hives, and more should be left in the hives for the bees to live on. However, this may just show that the honey was the most alluring to the bees, since it is in fact the food of their own making and their primary source of energy they consume.

No Solution: This hive was used as a control hive in the experiment. It showed us the behaviors of a hive that is left alone during this time of year. As observed, this hive had the least amount on average of honey and pollen pots sealed. We can see that hives in the area are in need of supplemental feeding during the rainy season.

In the future, it would be beneficial to examine the relationship between icing sugar solution and *H. gribodoi*. What component of the sugar affects the bees? Why does this certain component bother the bees? Is it a permanent effect on the bees?

Personal Experiences and Interactions

“Karibu!” This is the Swahili word for welcome, and it was a word I heard everywhere I went. The people of Kenya welcomed me with open arms, and I immediately felt like family in a place halfway around the world. This simple word made Kenya feel like home to me. On my way to Kenya, I felt nervous and anxious, but also very excited. I was nervous because I was leaving the familiar, the normal, and my family and friends behind. But I was excited for the adventure of being in a new culture and experiencing a new independence. I developed lasting friendships in both urban Nairobi and in the villages of Kakamega, with people from all walks of life and of all ages.

“Asili.” This is the Swahili word for nature or natural. This was the lifestyle of the people while I was doing my field work in Kakamega. The people use what they have to the best benefit, and don’t let things go to waste. They live in mud houses with grass thatched rooftops. The women cook over an open fire and travel miles every day to gather firewood and water for their family. Land is wealth, and their main crops are sugar cane and tea, along with smaller crops of corn, bananas, and coffee, and other various fruits, vegetables, roots, and nuts. Many adults in the area had little education growing up, and while the children are encouraged to not only graduate high school and further their education by going to college, the parents can’t afford to send their children to college.

“Pole pole.” This is the Swahili phrase for slowly slowly. This describes the people of Kenya, not as laziness, but rather their patience. I heard this often in the beginning of my internship. I was always in a hurry and a rush to get things done. When I learned what this meant, something in me clicked. I live in a society at home in which we are always in a rush to get things done, and I realized that we sometimes miss important things along the way. While in Kenya, I learned patience and to appreciate the beauty I saw around me. I slowed down and learned about the culture, why things happen the way they do, and to really get to know the people I met. If something didn’t happen one day, it would happen tomorrow. There was always time to sit down for lunch or tea and visit with people. There was always time to talk to the children you meet along the road, there was always time to talk to the visitor, and there was always time to help someone out when they needed it.

“Nzuri.” The Swahili word for beautiful, and a term that is barely adequate to describe the beauty of Kenya, particularly while I was in Kakamega. While in Kakamega, I felt I walked in one of the world’s most natural and beautiful settings. The lay of the land still felt rugged and untamed, and the natural plants still grew. There was every shade of green in existence and the air was pure and didn’t have the smog and dirtiness found in cities. While hiking the mountains of Kakamega, we used the foot trails that people had been using for years, and we delighted in the surprises we found along the way, such as a waterfall emerging from the crevices of rocks to a small little hut tucked between the trees. While in the forest, we trekked under towering trees shaken by the travels of monkeys above while we weaved our way around giant leaves and huge tree root systems. I felt rejuvenated while in the field, and inspired to find the beauty in everything.

“Kushiriki.” The Swahili word for share. While in the field, I worked in an area of the most impoverished people I have met. I saw how little a person makes in a month, and how little food they would have to consume in a day. They live in an area with no electricity, in a world that thrives on technology. But they knew the meaning of community. They were all there for each other, and would help others when times are rough. They would work together to harvest a field, watch the neighborhood children, and build a house. They were not selfish with what they had, and shared it with those around them. They would welcome me, a mzungu, or white person, into their homes, ready with hot tea, warm chapatti or ugali, and good conversation.

“Upendo.” Love. I have developed an extreme love for Kenya – the people, the land, and the lifestyle. Not only did I learn about another culture, lifestyle, and people but I also learned more about myself. I learned that one person can make a huge difference and that even the littlest things might make a huge impact on somebody else. I have learned to be strong no matter what is happening, and to be there for others. My eyes were opened in Kenya, and I have a passion to not only bring others this similar passion, but to put my passion to work and help people worldwide. I have become a citizen of the world, and it is something I don’t want to give up. Kenya showed me to love others more and to put the needs of others before your own. It showed me to stop and enjoy the beauty of life and to appreciate what I have. Kenya humbled me, and I will be forever grateful of my experience there.

“Asante sana!” Thank you. Thank you. Thank you. I cannot say these words enough. I have been changed as a person, a permanent change. I view the world in a different way now, and I have developed a broader sense of life beyond my tiny farm town. I know now that it is people like me, the other Borlaug Ruan interns, and youth worldwide that want to make a difference, who will make a change in the world. We will be the ones to bring people out of poverty and guide nations in the war against hunger. We will be following in the footsteps of the hunger fighters before us, and blazing new paths ahead. I am ready for the challenge, and my internship has given me the final push I needed to realize this.



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Appendices

Appendix 1

Survey About Traditional Uses of Stingless Bee Honey

Kakamega, Kenya

Name: _____ Age: _____

Gender: Male Female Date: _____

Are you married? Yes No

How many people live in your household/home? _____

Do you personally own hives? Yes No How many? _____

If you don't own hives, do you still use honey medicinally? If so, where do you acquire it? -

Are your hives primarily for personal use/recreation or for monetary income?

What type of home/hive do you provide for your bees? (structured bee hive box, hollow log, clay pots, etc.)

What are some types of honeybees that you raise?

Do you think the honey of stingless bees has medicinal/healing qualities?

What are some ailments you treat by using honey? How is the honey applied?

Ailment / Disease	Honey Application

Appendix 2: Data Collection Sheet

Site specific: _____

Site Number: _____

Type of colony: _____

Date	Movement	Hour	Blood cells			Food pits			
			Open bar empty	open bar food	Social	intentional and empty	food with honey but not sealed	food with pollen but not sealed	Social and intakes pollen
Day	Night	05-105							
		105-125							
		125-145							
		145-165							
		165-185							
		185-205							
Day	Night	05-105							
		105-125							
		125-145							
		145-165							
		165-185							
		185-205							
Night	Day	05-105							
		105-125							
		125-145							
		145-165							
		165-185							
		185-205							