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Antimicrobial Activities of Tanzania Honey Bees in Relation to Vegetation Types

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Abstract

The effect of area and vegetation types on antimicrobial activity of stinging honey bees in Tanzania was studied. Twelve potential honey producing areas with various vegetation types were selected and 36 beekeepers were randomly sampled and involved in the study. Areas selected included Itigi, Nyakanazi, Gairo, Inyonga, Bukombe, Dodoma rural, Dodoma urban, Manyoni, Morogoro, Kisarawe and Tabora. Honey samples were taken direct from the bee hives, three samples were collected from the same area and same vegetation type, bulked to obtain one representative sample. The honey sugar and water content were determined, antimicrobial activities using four pathogenic micro organisms namely *Staphylococcus aureus, Salmonella typhi, Escherichia coli* and *Candida albicans* were tested. Results showed that all honey were acidic with pH ranging from 4.05 to 4.8. Area, vegetation types and their interactions significantly affected antimicrobial activities of honey. Gairo honey (*A. digitata* and *A. malvaceae*) significantly inhibited growth of both bacteria (*E. coli* 26.5mm, *S. aureus* 35.5mm and *S. typhi* 27.5mm) and fungus (*C. albicans* 30.5mm). Similarly, honey from Manyoni (*Baphia massaiensis, Baphia burtu, Raphia pruinoides* and *Pseudoprosopsis fischeri*), Morogoro (Eastern Arc forests), Kisarawe (*E. bicompacta*), Itigi (*Baphia massaiensis, Baphia burtu, Raphia pruinoides* and *Pseudoprosopsis fischeri*) and Dodoma (*Brachystegia* spp., *Julbernadia* spp. and *Isoberlinia* spp.), Dodoma (sunflower and *A. digitata*) resisted bacteria and fungus growth. It was concluded from the study that honey quality and composition depends much on vegetation types available in an area. Human activities that results into deforestation for any reason affects honey composition and quality.

Key words: Medicinal, Properties, Stinging, Bees, Variation, Areas

INTRODUCTION

Honey is an organic, naturally sweet substance, produced from nectar and sugary exudation of plants by honey bees like *Apis mellifera* and *Trigona meliponini* (Codex Standard, 1996). Nectar of flowers is gathered, modified, mixed with some enzyimes and regurgitated and transformed by honey bees into honey cell (Stefan, 2009).

Currently consumption of honey is increasing because of its beneficial biological and physical chemical properties including antibacterial activities. Tanzania produces an estimate of 10,000 tons of honey annually (UNDP, 2014). more than half of the honey produced in Tanzania is consumed locally as food and medicine. The rest is sold to other countries particularly European Union member countries such as UK, Netherlands and German. Other

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countries are Oman, United Arab Emirates, Iran, Uganda, Kenya, and Rwanda (Mwakatobe and Mlingwa, 2004).

Honey being a natural product with many qualities that are beneficial for human beings, it is considered to be important in human nutrition and health (Alis *et al*., 2012). For thousands of years (since 2100 BC), ancient Greeks used honey as traditional food and healing agent (Alisi *et al*., 2012). Its properties make it potential to serve as a natural food with high sugar, hydrogen peroxide and high acidity which are responsible for its medicinal properties. In addition to inhibiting pathogenic microbial growth, some of honey components have a role to play in controlling inflammation and promoting the healing process through the modulation of cytokines, fibroblast proliferation and angeo-genesis (Tonks *et al*., 2003). It has powerful immune system booster and carbohydrates that provide strength and energy to the body. Presence of enzymes in honey helps to improve digestive system, and it decreases muscle fatigue of the body (Rodriguez, 2004).

Honey differs in composition and quality between types, batches, production methods, husbandry and area where honey emanates (French *et al*., 2005).This variations also results into variation of antimicrobial properties of honey. It has been reported elsewhere that ability of honey to inhibit pathogenic microbial growth vary with area where honey emanates (Kumar *et al*., 2010; Jones, 2001). However, available studies in Tanzania have reported on physico-chemical properties of Tanzanian honey (Gidamis *et al*., 2004; Masoud, 2014). There is scanty information on antimicrobial activities of Tanzanian honey. Therefore, the objective of this study was to investigate the influence of geographical area, vegetation types where bees are foraging on antimicrobial properties of Tanzanian honey and recommend the best honey in the country based on antimicrobial activity.

Various pathogenic microorganisms such as bacteria including *Escherichia coli*, *Salmonella typhi, Staphylococcus aureus* and fungus such as *Candida albicans* are detrimental to health and food as they can cause diseases, food spoilage and food poisoning (Blackburn, 2006). *Escherichia coli* cause sickness, food poisoning and are potential indicator organisms to test environmental hygiene for contamination (Feng *et al*., 2002). Bacteria such as *Salmonella typhi* cause illnesses such as typhoid fever, and food poisoning (Ryan and Ray, 2004). *Staphylococcus aureus* is a common causative of boils, impetigo, cellulites, toxic shock syndrome and food poisoning (Levinson, 2010). In the same way fungus such as *Candida albicans* is a causal agent of oral and genital infections in humans. All these pathogens, cause food borne diseases and become a cause of major health concerns. Therefore, alternative use of natural food products such as honey with biological properties can help in suppression and prevention of these pathogenic microorganisms.

MATERIALS AND METHODS

Honey sampling procedure

A purposive sampling protocol was used to select high honey producing areas and vegetation types. Twelve available areas were selected. Each 3 beekeepers were selected randomly belonging to each area and vegetation type, making a total of 36 beekeepers who were involved in the study. Areas selected and vegetation types are as shown in Table 1.

Honey was harvested directly from the beehives and bulked according to the area and vegetation type, packaged in sterilized plastic bottles (330ml) then transported and stored at ambient temperature (25±2°C) at laboratory of Micro-Biology at the Nelson Mandela Institute of Science & Technology, Arusha-Tanzania.

Antimicrobial sensitivity test

Antimicrobial sensitivity test of the honey samples was determined by Agar Wells Diffusion method as described by Clinical Laboratory Standard Institute (2009). Where Mueller-Hinton Agar (composed of 2g beef extract, 17.5g

Table 1. Selected study sites and vegetation types

Area	Vegetation type	Plant type (s)
Itigi	Itigi thicket	*Baphia massaiensis* *Baphia burtu* *Raphia pruinoides* *pseudoprosopsis fischeri*
Nyakanazi	Miombo woodland	*Brachystegia spp.* *Julbernadia spp.* *Isoberlinia spp.*
Gairo	Mixed	*Adansonia digitata* *Astripomoea malvaceae*
Inyonga	Miombo woodland	*Brachystegia spp.* *Julbernadia spp.* *Isoberlinia spp.*
Bukombe	Miombo woodland	*Brachystegia spp.* *Julbernadia spp.* *Isoberlinia spp.*
Dodoma rural	Crops	*Helianthus sp.* (Sunflower)
Dodoma urban	Mixed	*Adansonia digitata*
Manyoni	Itigi thicket	*Baphia massaiensis* *Baphia burtu* *Raphia pruinoides* *pseudoprosopsis fischeri*
Morogoro	Eastern Arc forests	Various
Kisarawe	Coastal	*Euphobia bicompacta*
Tabora	Miombo woodland	*Brachystegia spp.* *Julbernadia spp.* *Isoberlinia spp.*
Dodoma	Miombo woodland	*Brachystegia spp.* *Julbernadia spp.* *Isoberlinia spp.*

acid hydrolysate of casein, 1.5g starch and 17g agar) medium was used for antimicrobial susceptibility test. The medium was prepared following the manufacturer's instructions. After autoclaving (121°C for 15min) the medium was left to cool to 50°C. Then 25ml per plate (15 ×100mm) was measured and pouring in a way that level pouring surface within the petridish was uniform to a depth of 4 mm and was incubated in an incubator (35±2°C) for 24 h.

The test organisms included bacteria (*Escherichia coli* (ATCC 25922), *Salmonella typhi* (ATCC14023) and *Staphylococcus aureus* (ATCC 25923) and fungus (*Candida albicans*-isolated from clinical samples), were streaked on to a non-inhibitory agar medium (broth agar) to obtain isolated colonies. After incubation at 35°C overnight, 4 to 5 colonies were picked and inoculated into broth (Mueller- Hinton broth) and incubated at 35°C for 24 h. A sterile cotton swab was dipped into the suspension, pressed firmly against the inside wall of the tube just above the fluid level, then streaked over the entire surface of the medium rotating the plate approximately 60 degree after each application to ensure an even distribution of the inoculums.

Finally cotton were placed all around the edge of the agar surface. Small holes of 5 mm were made on the petri dishes with agar by using sterile loops, and then 100μl of honey sample was placed in the agar hole using sterile micropipette. The plates were inverted and incubated at 37 ±1°C for 24 h for tested microorganisms. After incubation period the diameter (mm) of the zones of complete

Table 2. pH, sugar and water contents of stinging bee honey collected from different places in and vegetation types in Tanzanian

Area	Mostly foraged vegetation	Sugar content	Water content	pH
Itigi	Itigi thicket*	78	20	4.60
Nyakanazi	Miombo woodland**	81	18	4.49
Gairo	*Adansonia digitata, Astripomoea malvaceae*	83	18	4.05
Inyonga	Miombo woodland**	79	20	4.43
Bukombe	Miombo woodland**	82	17	4.55
Dodoma	Sunflower	80	18	4.18
Manyoni	Itigi thicket*	82	17	4.74
Dodoma	*Adansonia digitata*	78	20	4.34
Morogoro	Eastern Arc forests	76	22	4.55
Kisarawe	*Euphobia bicompacta*	76	22	4.19
Tabora	Miombo woodland**	74	24	4.50
Dodoma	Miombo woodland**	76	24	4.80

NOTE: *Itigi thicket-*Baphia massaiensis, Baphia burtu, Raphia pruinoides* and *pseudoprosopsis fischeri*
**Miombo woodland - *Brachystegia* spp., *Julbernadia* spp and *Isoberlinia* spp.

inhibition (including the diameter of the disk) was measured and recorded. The measurements were made with ruler on the undersurface of the plate without opening the lids.

Honey pH determination

pH of honey samples was determined using a digital portable pH meter (JENWAY, UK 3305P) in accordance with International Honey Commission (2009). In between the readings of different samples, the electrode was washed with distilled water and dried with tissue paper, and inserted into prepared honey samples and recorded. The experiment was done in triplicates.

Honey total sugar and water content

The honey sugar and water content wasdetermined using a digital portable honey refractometer that was held on a flat surface and a drop of honey was inserted on a glass prism that determines refractive index. The measurement key was pressed and results were displayed on the backlit LC-Display. In between the readings of different samples, the surface of the glass prism was washed with distilled water and dried with tissue paper before another honey sample was inserted.

Statistical data analysis

Data obtained from antimicrobial analysis were analyzed using SAS software. Analysis of Variance (ANOVA) was used to determine the influence of main independent variables, the factor influence was considered to be significant when $p<0.05$. Mean comparison between area and vegetation types was done using Duncan Multiple Range Test (DMRT) and results were presented as Mean $\pm$SD.

RESULTS AND DISCUSSION

pH, sugar and water contents of stinging bee honey

Table 2 shows the composition and chemical properties of honey collected from various areas with various vegetation types. The pH of honey samples used in this study ranged from 4.05 to 4.8 which means that all honey samples were acidic.The pH rangeobserved in sampled honeys falls within the range reported by Gidamis *et al*. (2004) while working with Tanzanian honey collected from Dodoma, Tanga, Morogoro, Same, Arusha and Tabora, reported a pH range of 4.4 - 4.87. Also, complies with the range reported by United Republic of Tanzania - Ministry of Natural Resources and Tourism (2007) who

Table 3. The effect of area and vegetation type on ability to inhibit growth of pathogenic micro-organisms

Area	Vegetation type	Inhibition zone (mm)
Gairo	*Adansonia digitata* and *Astripomoea malvaceae*	30.0[a]
Manyoni	Thicket*	23.50[b]
Morogoro	Eastern Arc forests	22.75[c]
Kisarawe	*Euphobia bicompacta*	22.50[c]
Dodoma	*Adansonia digitata*	21.0[d]
Bukombe	Miombo woodland**	18.62[e]
Itigi	Thicket*	17.75[f]
Dodoma	Miombo woodland**	17.75[f]
Dodoma	Sunflower	17.63[f]
Tabora	Miombo woodland**	16.38[g]
Nyakanazi	Miombo woodland**	16.38[g]
Inyonga	Miombo woodland**	15.13[h]
Pr>F=0.0001	Pr>F=0.0001	±SE=0.064

Means bearing the same superscript along the same column are not significant different (P>0.05)

NOTE: *Itigi thicket-*Baphia massaiensis, Baphia burtu, Raphia pruinoides* and *pseudoprosopsis fischeri*

**Miombo woodland-*Brachystegia* spp., *Julbernadia* spp. and *Isoberlinia* spp.

Table 4. Variation in ability of Tanzanian honey types to inhibit growth of various pathogenic micro-organisms

Honey types	Plant dominantly foraged	Inhibition zone (mm)			
		Candida albicans	*Escherichia coli*	*Staphylococcus aureus*	*Salmonella typhi*
Bukombe	Miombo woodland**	17.5[b]	0.0[g]	32.5[b]	24.5[b]
Dodoma	Sunflower	8.5[e]	0.0[g]	31.5[b]	30.5[a]
Inyonga	Miombo woodland**	7.5[e]	0.0[g]	28.5[cd]	24.5[b]
Nyakanazi	Miombo woodland**	10.5[d]	0.0[g]	26.5[d]	28.5[b]
Tabora	Miombo woodland**	0.0f	20.5[b]	26.5[d]	18.5[c]
Gairo	*Adansonia digitata, Astripomoea malvaceae*	30.5[a]	26.5[a]	35.5[a]	27.5[a]
Itigi	Thicket*	10.5[d]	10.5[e]	21.5[f]	28.5[a]
Kisarawe	*Euphobia bicompacta*	12.5[d]	22.5[b]	29.5[c]	25.5[b]
Manyoni	Thicket*	14.5[bc]	22.5[b]	31.5[b]	25.5[b]
Morogoro	Eastern Arc forest	16.5[b]	15.5[d]	30.5[bc]	28.5[a]
Dodoma	*Adansonia digitata*	11.5[d]	18.5[c]	23.5e	30.5[a]
Dodoma	Miombo woodland**	14.5[bc]	7.5f	23.5e	25.5[b]

Means bearing the same superscript along the same column are not significant different (P>0.05)

NOTE: *Itigi thicket-*Baphia massaiensis, Baphia burtu, Raphia pruinoides* and *pseudoprosopsis fischeri*

**Miombo woodland-*Brachystegia* spp., *Julbernadia* spp. and *Isoberlinia* spp.

reported a pH range of 3.42 to 6.10 for Tanzanian honey. However, the observed pH range in this study was higher than that reported by Masoud (2014) working with 26 honey producing areas in Tanzania who reported a pH range of 2.6 to 4.4. The difference could be due to difference in soil type and vegetation growing in areas where the samples were collected. Despite the slight differences in pH the honey samples in the present study might have potential medicinal properties as its acidic nature could have resulted from organic acids which remarkably create an acidic micro-environment that threatens pathogenic microbial growth (Aparna and Rajalakshmj, 1999).

The total sugar content that ranged from 74~83% (Table 2) was within a range observed by other researchers in Tanzania. Masoud (2014) working on the quality of Tanzanian honey collected from 26 honey potential producing areas reported a sugar content range of 64.2 to

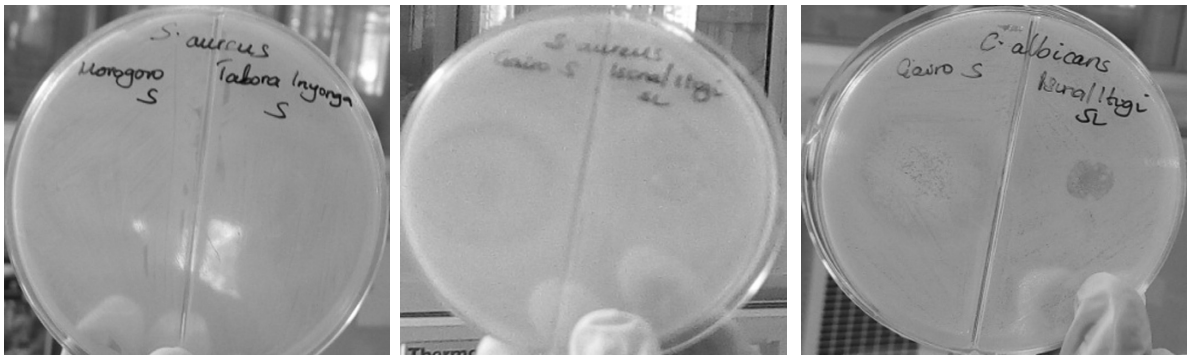

Plate 1. Antimicrobial activities of Tanzanian honey collected from various areas.

84.8%. Furthermore, it is above the minimum standards of Tanzanian honey of not less than 65% (URT, 2007). The sugar contained in studied honey was sufficient enough to produce high osmotic effect that could dehydrate microbial cells (Molan, 1992 and Bogdanov *et al*., 1997). Gluconic acids which remarkably create an acidic micro - environment prevents the growth of many micro-organisms (Cooper, 2007).

There was an inverse relationship between sugar and water contained in honey. The minimum value observed in this study was 17% with a maximum value of 24%. Some honey in this study had higher water content than the recommended range of 20~22% (URT (2007) for Tanzanian honey. High water content contributes to reduced shelf life of honey that undergoes fermentation and spoil more easily (Cortopassi *et al*., 2006). However, despite the high water content of some few honey samples, the results of this study suggest that Tanzanian honeys could be among the best honeys that can be used not only as food but also as remedies to various microbial infections.

Effect of area, vegetation and their interaction on microbial growth

Generally, area from which honey was collected, vegetation type on which honey bees foraged, test micro-organisms and its interaction influenced significantly (df=47, F=454, P=0.0001) the antimicrobial properties of honey.

It is evident from Table 3 that honey from Gairo where bees foraged on *Astripomoea malvaceae* and *Adansonia digitata* was the best honey (df=5, F=101.30, P=0.0001) as it had relatively strongest ability to inhibit microbial growth than other honeys. The Manyoni thicket honey was the second best honey as followed by Morogoro Eastern Arc forest honey that did not differ in inhibiting microbial growth with that from Kisarawe where bees mostly foraged on *Euphobia bicompacta*. Honey from Inyonga exhibited significantly (df=11, F=316.18, P=0.0001) lowest ability to inhibit microbial growth, generally most of honey from Miombo woodland including Nyakanazi and Tabora had unexpectedly lower ability to inhibit microbial growth (Table 3, Plate 1).

The difference in ability to resist microbial growth could probably be due to differences in vegetation types between these areas (Kumar *et al*., 2010). Different vegetation types contain different floral types that vary in pollen and nectar which influence the honey medicinal qualities and composition (Jones, 2001).

The conclusive selection of the best honey can not only be judged by looking at the overall resistance on microbial growth alone. The ability of honey to inhibit multiple microorganisms or to have a broader spectrum antimicrobial ability could be the best property to be looked at.

Antimicrobial spectrum of Tanzania stinging bee honey

Table 4 presents the antimicrobial spectrum of honey in relation to the vegetation types that bees foraged on. It is clearly observed that the Gairo honey obtained from bees foraging on *Adansonia digitata* and *Astripomoea malvaceae*, significantly (df=32, F=147.56, P=0.0001) inhibited the growth of both, pathogenic fungus (*C. albicans* 30.5mm) and bacteria (*E. coli* 26.5mm, *S. aureus* and *S. typhi* 27.5mm) followed by honey originating from Manyoni-thicket (*C. albicans* 14.5mm, *E. coli* 22.5mm, *S. aureus* 31.5mm and *S. typhi* 25.5mm), Morogoro-Eastern Arc forest (*C. albicans* 16.5mm, *E. coli* 22.5mm, *S. aureus* 30.5mm and *S. typhi* 28.5mm), Kisarawe-Euphobia bicompacta (*C. albicans* 12.5mm, *E. coli* 22.5mm, *S. aureus* 29.5mm and *S. typhi* 25.5mm) Itigi-thicket (*C. albicans* 10.5mm, *E. coli* 10.5mm, *S. aureus* 21.5mm and *S. typhi* 28.5mm) and Dodoma-Miombo woodland (*C. albicans* 14.5mm, *E. coli* 7.5mm, *S. aureus* 23.5mm and *S. typhi* 25.5mm) and Dodoma-*Adansonia digitata* (*C. albicans* 11.5mm, *E. coli* 18.5mm, *S.aureus* 23.5mm and *S. typhi* 30.5mm). Other honeys such as Tabora honey from Miombo woodland could not resist the growth of *C. albicans*, from Miombo woodland (Nyakanazi, Inyonga and Bukombe) and Dodoma honey from sunflower could not resist the growth of *E. coli* respectively. Based on the criteria of honey to contain relatively broader medicinal properties and thus be broad spectrum antimicrobial, it can be said that the priory mentioned honeys could be the best as far as this study is concerned.

The general characteristics of honey to prevent bacterial or fungal growth have been explained by various scientists. Garcial *et al*. (1986); Wahdan (1998); Molan (1999a) and Khan *et al*. (2007) reported inhibition of pathogenic microbial growth to be due to presence of hydrogen peroxide resulting from the action of glucose oxidase enzyme produced from hypopharyngeal glands of workers bees on glucose in presence of oxygen that inhibits microbial and fungal growth. Presence of physical-chemical properties such as high sugar content (about 80% w/w) that results into high osmotic effect that dehydrate micro-organism has been reported to inhibit microbial growth (Molan, 1992 and Bogdanov *et al*., 1997). Aparna and Rajalashmj (1999); White (1978) suggested inhibition of microbial growth to be due to presence of diverse organic acids such as gluconic acids that remarkably creates an acidic micro-environment (pH 3-4.5) that prevents growth of many micro-organisms. Apart from hydrogen peroxide as a factor that inhibits microbial growth, Cabrera *et al*.(2006) elucidated inhibition of microbial growth to be due to presence of non-peroxidic substances such as polyphenols which possess anti-microbial activity. Furthermore, Molan (1992a) reported that in most of honey antimicrobial growth depends on enzymatic generation of hydrogen peroxide to varying degree, but in some honeys there are additional phytochemical antibacterial factors. Cooper *et al*. (2002) elucidated that antimicrobial agents have been applied to wounds for 1000 years ago but many ancient remedies have been discontinued because the evidence to support their efficacy was anecdotal. He further, said that failure to identify botanical sources of honey used in many of the studies or to determine their antibacterial potency makes comparison of reported sensitivity unreliable. Jones (2001) also reported that it is remarkable that ancient physicians were selective in the honeys they utilized in their remedies. All these observations reported exhibits that there is variation in medicinal contents depending on area and type of vegetation where honey bees forages. This means that the antimicrobial composition depends on whether the plant foraged is a medicinal plant or not.The broader antimicrobial spectrum observed on Gairo honey where bee forages on *Adansonia digitata* and *Astripomoea malvaceae* could be attributed not only by acidity, osmolarity and hydrogen peroxide production but also by phytochemical components of that honey. Baobab fruits

pulp and seeds are rich in vitamin C and protein and are apparently effective against dysentery and circulatory disease. On the other hand, *Astripomoea malvaceae* is a medicinal plant, in Tanzania a root decoction is drunk or the ground roots are taken inorder to treat hookworms. In Malawi a poultice of crushed roots is applied to the swellings and inflammations, especially to treat eye infection, also the sap of leaves and flowers is applied to inflammation of eyeball. In Zimbabwe, a root decoction is drunk to treat coughs, female infertility, dizziness and abdominal pain in babies (Schmetzer and Gurib, 2013). Similar arguments also stand for the Kisarawe honey where honey bees were foraging on *Euphobia bicompacta*. The plant sap of *Euphobia bicompacta* is used in Kenya to treat East Coast Fever in cattle whereas a decoction of its leaves and stem bark is given to drink to cattle to control ticks (Schmetzer and Gurib, 2013). Furthermore, in Angola the root fusion of *Euphobia* is drunk to treat pain in hips and madness. An infusion of *Euphobia* roots is taken to treat stomach ache, dropsy, stitch, urogenital problems, excessive menstruation, Tuberculosis and cardiac palpitation, the latex is used as fish poison (Schmetzer and Gurib, 2013).

It can be said from findings of this study that honey differs in antimicrobial properties due to differences in constitution and quality of pollen and nectar. Nectar and pollen from medicinal plants is far better to produce honey with broader antimicrobial spectrum. This study supports the study by Tonl *et al*. (2003) who reported that the Manuka honey produced by bees foraging on Manuka plants in Australia and New Zealand is believed to have superior antimicrobial properties hydrogen peroxide content, phytochemical contents or presence of dihydroacetone in the nectar which is derived from methyglyoxal.

Human activities have been reported to influence so much the honey quality and composition. Schmetzer and Gurib (2013) pointed out that genetic diversity of many plants species in Africa is being eroded sometimes at an alarming rate as a consequence of habitat destruction and over exploitation. The replacement of landraces of cultivated species by modern cultivars by seed companies is another cause of genetic erosion. This was observed in this study that honey from sunflower had relatively low ability in inhibiting microbial growth (*C. albicans* 8.5mm, *E. coli* 0.0mm, *S. aureus* 31.5mm and *S. typhi* 30.5mm). Surprisingly, honey from Miombo woodland seemed to have lowest medicinal ability (Table 4). This could be attributed by forest encroachment where most of trees are cut down by agro-pastoralists to open up areas for crop farming and creating unfavorable environment for tsetse flies that affects their livestock.

CONCLUSIONS

From the results of this study it can be concluded that low pH and high sugar content of honey creates acidic environment and osmolarity that results into antimicrobial properties of Tanzanian honey. Furthermore, the variation in ability to inhibit microbial growth was exhibited to vary with the vegetation types. Vegetation with medicinal properties foraged by honey bees tended to produce honey with high ability to inhibit microbial. Human encroachment to natural forests impacts on plant genetic diversity by deforestation to create crop lands and chase out tsetse flies for wellbeing of their livestock, affects plants that are foraged by bees, and thus, making bees to forage mainly on cultivated crops with scanty or no medicinal value.

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