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Influence of socio-economics on consumer acceptability of Bee brood *(Apis mellifera)* as an alternative source of protein for improved food security

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Abstract

Bee keeping improves livelihood of rural communities due to its low capital requirement and low technical knowhow. Currently, bee brood is removed by beekeepers as part of a strategy to lower the population of the destructive mite (*Varroa destructor*) and is disposed of to keep the hive healthy and avoid colony collapse. The study aimed at investigating the influence of socio-economics on consumer acceptability of bee brood *(Apis mellifera)* as human food. The Theory of Planned behavior of planning that predicts deliberate behavior was used. The target population was 2415 and the sample size was 343 respondents. Stratified and simple random sampling was adopted in five counties along Lake Victoria region of Kenya namely: Busia, Homabay, Migori, Kisumu and Siaya. Descriptive research design using questionnaires, Key Informant Interviews and Focus Group Discussions were used. Data was analyzed and presented using thematic analysis, inferential and descriptive statistics with the aid of SPSS. Mean and standard deviation and inferential statistics including multiple regression and correlation analysis were used. The results showed that Occupational characteristics (M=3.44, S. D=1.17, p=0.034), Taste, aroma and texture (M=4.05, S. D=0.96, p=0.000), Consumer characteristics (M=3.84, S. D=0.91, p=0.000), Sensory analysis (M=3.63, S. D=1.05, p=0.003), market (M=3.63, S. D=1.27, p=0.001) and finance access (M=3.73, S. D=1.26, p=0.000) factors were significant. The results for Pearson correlation indicated that socio-economic factors (r=0.163 p=0.006) had significant statistical influence on acceptability of bee brood. The study recommended that production, value addition and market information concerning bee brood be availed as an innovation to stakeholders to improve bee brood acceptability as contribution to sustainable development goals.

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Introduction

Eating insects is a widespread practice in many countries all over the world. It has been recorded that over 2 billion people eat insects on a regular basis (Van Huis *et al.,* 2013). Entomophagy seems like a great alternative for cattle, perhaps not to replace it completely, but at least partially. Insects have a higher conversion rate, which means that they need far less feed in order to produce the same amount of weight as cattle does. The feed conversion rate [FCR], the amount of kilograms needed to produce one kilogram of edible meat differs greatly between cattle and insects (Abbasi & Abbasi, 2011). According to Van Huis (2013), the following FCRs were calculated; 2.5 for chicken, 5 for pork, 10 for beef and a staggering average of 1 for house crickets. Insects are easy to farm; they need little space, grow quickly and reproduce easily. When switching from cattle to insects, the area that used to be cultivated with crops for animal feed – such as maize or soy - can then also be used for crop cultivation to feed people (Premalatha & Abbasi, 2011).

At the global level, bee brood of the honey bee (*Apis mellifera*) is a particularly promising edible resource, as honey bees are kept by humans worldwide, and in many cultures eaten as a delicacy (Annette *et al.,* 2015). The edible larvae and pupae of honey bees have a nutty flavour with a crunchy texture when eaten cooked or dried, and is a versatile ingredient used in soups and egg dishes (Annette, 2015). In other regions of the world, drone bee brood removal has become part of regular hive maintenance by beekeepers as a strategy for managing populations of the varroa mite *(Varroa destructor)* widely recognized as the most harmful parasite affecting honey bees worldwide (Dietemann *et al.,* 2013).

In Europe, particularly in Nordic countries this technique of using bee brood as food combined with bee brood removal for control of Varroa species of mites are recommended Integrated Pest Management (IPM) strategy. In this respect using brood as a food by product of bee keeping and honey production proves having both ecological and economic sense. Bee brood and in particular drone brood, is a by-product of sustainable Varroa mite control, can therefore pave the way for the acceptance of insects as a food in the world (Annette, 2015). The theory behind drone brood removal is due to the fact that Varroa are more attracted to drones than workers.

The brood of honey bees is naturally found in bee hives during the honey production season and has great potential as a food source. Whole brood of honey bee can be produced for human consumption as such and/or as an ingredient in other foods for the whole population (Annette, 2015).

Marketing of bee brood as a foodstuff has been possible in other areas of the world due to the commercialization of this insect species under specific conditions (FBKA, 2015). Value addition on bee farming products should address measures targeting not just honey but other economic products such as propolis, beeswax, bee brood, royal jelly and venom (Hilmi *et al.,* 2011).

Beekeeping in Africa is extremely fragmented, making it difficult to quantify accurately the actual production and growth levels (Moinde, 2016). Beekeeping remains a subsistence activity due to several factors that affect production, processing and access to lucrative markets. In Nigeria, beekeeping is a useful means of strengthening livelihoods and has been identified as a viable agricultural practice that could alleviate poverty and sustain rural employment (Kumwenda, 2016). The demand for honey and other hive products in the world market is high compared to the current production. Honey and beeswax production in Africa is estimated to be less than 10 and 25 per cent of the potential respectively.

Socio-economics are defined as factors that influence allocation of household resources in agricultural production activities undertaken by farmers. The outcome of the decision-making process of the farm household is reflected in their production pattern, farm productivity, incomes and livelihoods (Pender, 2012). In a study to investigate the Socio-economic factors influencing adoption of modern bee keeping technologies in Baringo County, Kenya, Factors

influencing adoption of modern bee keeping technology were found to be; gender, age, Family size and education level of the household head were found to influence adoption of modern bee keeping technologies, while land size and livestock holding does not (Bunde & Kibet, 2015), The size of the family, the age of the beekeeper, and the level of education are identified as socio-demographic predictors for the usage of systematic hives in Saudi Arabia (Adgaba *et al.,* 2014).

Farming households have differences in their socio-economic characteristics such as location, education level, age, farm size and household size among others. Socio-economic factors determine the success and development of an enterprise (Guzman & Santos, 2011). On the other hand, food security is influenced by household structure, income, savings behavior, socio-cultural orientation and nutrition awareness (Nyangweso *et al.,* 2007).A survey on socio-economic factors influencing smallholder pumpkin production, consumption and marketing in Eastern and Central Kenya regions found that proximity of the study areas to markets and permanent water sources gave a comparative advantage in production over other growing regions (Ndegwa, 2016).Gender difference is found to be one of the factors influencing adoption of new technologies (Bunde and Kibet 2016). Young people on the other hand prefer consuming "modern foods" and do not identify with indigenous and traditional foods (Matenge *et al.,* 2012).

In Netherlands, House (2016) studied consumer acceptance of insect-based foods Academic and commercial implications. This study outlined empirical work, theoretically and methodologically informed by a critical appraisal of previous research, with consumers of insect-based convenience foods in the Netherlands. Reported initial motivations for trying insect foods are shown to be substantially different from factors such as price, taste, availability, and 'fit' with established eating practices which affect repeat consumption. Further, a reorientation of consumer acceptance research is proposed. Research should shift from attempts to forecast acceptance and engage with 'actual' examples of insect consumption; social, practical and contextual factors affecting food consumption should be emphasized.

In South Africa, Taruvinga and Mushunje (2018) sought to determine factors that influence honey value addition selection choices among smallholder beekeepers. A census of all active smallholder beekeepers in the Eastern Cape Province during the period of study was considered for this study. Using descriptive statistics to profile most common value addition initiatives pursued by beekeepers, the study found that liquid honey processing, bottling and beeswax processing were the major value addition pursued by the farmers. Regression estimates revealed that honey value addition selection choices among smallholder beekeepers were mainly conditioned by; gender, household size, group membership, training, quantity of honey harvested, number of colonized hives, access to market information and extension services. The study recommended that to promote honey value addition initiatives among smallholder beekeepers focus should be more on institutional and technical support. The research did not consider other bee products like bee brood as human food.

In Uganda, Kalanzi *et al.* (2015) carried out socio-economic analysis of beekeeping enterprise in communities adjacent to Kalinzu forest, Western Uganda. This study was based on a survey of 60 beekeepers in areas adjacent to Kalinzu forest. The study employed a logistic regression model to assess the factors that influence the adoption of improved beehives. Results showed that education and training in beekeeping were the major factors influencing adoption of improved beehives. The honey value chain was dominated by beekeepers, middlemen and commercial processors. Middlemen were constrained by high costs of transport, low quantities of honey collected and non-cash payments by buyers. Commercial processors were faced with honey adulteration, expensive equipment and unreliable honey supply. Commercialization efforts should therefore focus on specialized trainings that overcome the constraints identified in the value chain. The research only dwelt on honey production but not bee brood.

In Kenya, Berem, Owuor and Obare, (2014) assessed Value Addition in Honey and Poverty Reduction in ASALs: Empirical Evidence from Baringo County, Kenya. Using survey data from 110 randomly selected honey producers from two divisions in Baringo County, this paper analyzed the constraints and drivers of value addition in honey, an economic activity with a potential to improve household livelihoods.

The results showed that the decision to add value is positively and significantly influenced by the amount of honey harvested, group membership and number of hours spent on off-farm activities, while it is negatively influenced by the age of the farmers and the education level of the household head. Value addition contributes to the reduction of poverty through the improvement of household incomes. It is apparent that measures need to be established that would encourage and facilitate the practice of value addition if the welfare of the poor rural population is to be improved.

Another study by Warui, Mburu, Kironchi and Gikungu (2020) analyzed existing value addition initiatives enhancing recognition of territorial traits of three Kenyan honeys. This study evaluated the existing value addition initiatives enhancing recognition of territorial or local traits of the three Kenyan honeys, that is, honey from Kitui, West Pokot, and Baringo. The authors argued that initiatives undertaken by actors in the honey subsector and other sectors to promote recognition of Kenyan honeys and their territorial and local traits have not been documented.

Data collection methods used included literature review as well as interviews with relevant stakeholders in the honey subsector and other relevant sectors. Results showed that development of honey value chains, product certification, product promotional and marketing activities, and awareness on the link between product quality and geographical origin have greatly contributed to recognition of West Pokot, Baringo, and Kitui honey as well as their territorial traits.

Materials and methods

Study site

The present study was carried out between August-December 2020 in five Kenyan riparian counties (Siaya, Kisumu, Busia, Homabay and Migori) olong Lake Victoria.

Target Population

The target population is 2018 bee keepers (questionnaire respondents) who directly deal with the bee brood, 181 bee apex organization members, 36 Non-Governmental Organizations representatives, 167 County Livestock Officers and 49 development partners in the five Kenyan Lake Victoria riparian Counties.

The study was carried out through a descriptive research design. A descriptive survey design is a research design that describes a phenomenon or characteristics associated with a subject population, estimate the proportion of a population that has these characteristics and discover associations among different variables (Cooper & Schindler, 2003).

Sampling procedure

A stratified random sampling and simple random sampling was used to select the respondents from each County (Table 1). Purposive sampling was used to select key informants from each County due to their knowledge and involvement in bee keeping.

Systematic sampling of bee keepers (respondents) at interval of six derived from;

$$\text{Sampling interval} = \frac{\text{Total sample frame}}{\text{Sample size}}$$

$$\text{Sample interval} = \frac{2018}{343} = 6 \text{ respondents}$$

Table 1. Sample Size Distribution.

Study Population	Target Population	Sampling Method	Sample Size	Data Collection Instruments
Beekeepers	2018	Simple random	263	Questionnaires
Bee apex organizations.	181	Purposive	50	FDG
Non-Governmental Organizations	36	Purposive	10	KII
Livestock Officers	131	Purposive	10	KII
Development. Partners	49	Purposive	10	KII
Total	2,415		343	

Source: Author (2022)

Sample Size Determination

Purposive sampling was used to select Siaya, Busia, Migori, Homabay and Kisumu Counties. The sample size will be generated according to Israeli, (2009) as shown below:

$$n = \frac{N}{1+N(e)^2}$$

Where:

- n = desired sample size.
- N = Population size of the total households involved in the study.
- e = desired level of statistical precision. (±5 margin of error the precision level is 0.05).

Using this formula, the sample size was the generated as below:

$$n = \frac{2415}{1+2451(0.05)^2} = 343$$

Systematic sampling of bee keepers at interval of six derived from;

$$\text{Sampling interval} = \frac{\text{Total sample frame}}{\text{Sample size}}$$

$$\text{Sample interval} = \frac{2415}{343} = 6$$

Data analysis

The data was first imported to the Statistical Package for Social Sciences (SPSS) software for simple descriptive statistics and frequency analysis. During data analysis, results were summarized using descriptive statistics. Regression analysis assumes that the independent variable x is at least in part a cause or a predictor of the dependent variable y. These relationships will be used to draw conclusions on the contribution of value-added products of bee brood on the farm. Frequency means and standard deviation was used using descriptive statistics to summarize discrete data. During data analysis, results were summarized using descriptive statistics.

Table 2. Hypotheses Test.

Hypotheses Statement	Hypothesis Test	Decision Rule
H01: There is no significant relationship between socio-economic factors and improved food security.	Karl-Pearson's coefficient of correlation -F-test (ANOVA) -T-test H01: $\beta_1 = 0$	Reject H01 if P- value ≤ 0.05 otherwise fail to reject H01 if P is > 0.05

Results and discussions

Socio-economic factors have been acknowledged to be one of the factors that influence consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security. Results are shown in Table 3 below.

Table 3. Influence of Socio-Economic Factors on Consumer Acceptability.

One-Sample Test

	N	Mean	Std. Deviation	t	P-Value
Occupational characteristics has an influence on acceptability of bee brood	293	3.44	1.17	7.356	0.034*
Consumer characteristics influence the affordability of bee brood.	293	3.84	0.91	17.047	0.000*
Nutritional characteristics of bee brood have made me to consistently seek information on value addition.	293	3.34	1.09	5.951	0.329
Variability in sensory analysis has negative influence on acceptability of bee brood as food	294	3.63	1.05	12.536	0.003*
I have sufficient access to market information concerning agricultural products	293	3.11	1.36	3.197	0.543
Agricultural extension officers are readily available for technical information	294	2.96	1.30	2.734	0.611
Distance to market is a hindrance in selling our agricultural produce	293	3.63	1.27	11.296	0.001*
Yield of harvested bee brood hinders consumption of bee brood	289	3.30	1.21	6.400	0.221
Training has enabled me to be aware and technically equipped on bee brood as food.	294	3.14	1.26	4.216	0.421
Marketing channel affects my profit margins	293	3.40	1.29	7.149	0.112

	N	Mean	Std. Deviation	t	P-Value
Access to finance hinders my value addition efforts	292	3.73	1.26	16.185	0.000*
Years of experience in bee keeping has enabled me to appreciate bee brood as food.	292	3.06	1.24	4.635	0.423
Consumers associate colors with certain food types from their birth and equate these colors to certain flavors and taste throughout their life.	294	3.67	1.04	9.187	0.121
Combination of cognitive and post-ingestive factors is critical in explaining the satiation effect of food texture on food acceptability.	294	3.52	1.06	8.141	0.081
Just like taste and aroma, the texture is an indicator of food quality and it strongly affects food acceptability.	294	4.05	0.96	18.862	0.000*
N-Listwise	279	3.45	1.16		

Source: Reseacher Data (2021)

The results in Table 2 above shows that Nutritional characteristics (M=3.34, S. D=1.09, p=0.329), Yield of harvested bee brood (M=3.30, S. D=1.21, p=0.221),access to market information (M=3.197, S. D=1.66, p=0.543), Training(M=3.14, S. D=1.26, p=0.421), Marketing channel(M=3.40, S. D=1.29, p=0.112), Years of experience in bee keeping(M=3.06, S. D=1.24, p=0.043), Combination of cognitive and post-ingestive factors(M=3.52, S. D=1.06, p=0.081) and agricultural extension officers availability (M=3.63, S. D=1.27, p=0.611) do not affect consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security. However, Occupational characteristics (M=3.44, S. D=1.17, p=0.034), Taste, aroma and texture is an indicator of food quality and it strongly affects food acceptability (M=4.05, S. D=0.96, p=0.000), Consumer characteristics (M=3.84, S. D=0.91, p=0.000), Sensory analysis variability (M=3.63, S. D=1.05, p=0.003), distance to market (M=3.63, S. D=1.27, p=0.001) and access to finance (M=3.73, S. D=1.26, p=0.000) are social economic factors having the highest impact on consumer acceptability of bee brood for improved food security.

There is a positive correlation between socio-economic factors and improved food security at significant 0.05 level, the strength is average, at 16.3 %. The findings reveal that socio-economic factors are individually statistically significantly related to improved food security p-value<0.05.

This corroborates findings of Kalanzi *et al.* (2015) that showed that education and training in beekeeping were the major factors influencing adoption of improved beehives. Commercial processors were faced with honey adulteration, expensive equipment and unreliable honey supply. Commercialization efforts should therefore focus on specialized trainings that overcome the constraints identified in the value chain.

Berem, Owuor and Obare, (2011) results showed that the decision to add value is positively and significantly influenced by the amount of honey harvested, group membership and number of hours spent on off-farm activities, while it is negatively influenced by the age of the farmers and the education level of the household head. Value addition contributes to the reduction of poverty through the improvement of household incomes. It is apparent that measures need to be established that would encourage and facilitate the practice of value addition if the welfare of the poor rural population is to be improved.

In summary, using t-test nutritional characteristics, access to market information Training, Marketing channel, Years of experience in bee keeping, Combination of cognitive and post-ingestive factors, Occupational characteristics, Taste, aroma and texture is an indicator of food quality and it strongly affects food acceptability, Consumer characteristics are social economic factors having the highest impact on consumer acceptability of bee brood for improved food security.Using regression analysis its was established that R Square of 0.027 implying that socio-economic factors determine 2.7% variations in consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security.

The findings of the study based on the theoretical framework is supported by Ajzens (1991) the Theory of Planned Behavior (TPB) of planning that predicts deliberate behavior because behavior can be deliberative or planned. The researcher used this theory as a base model to determine how attitudes, subjective norms, and perceived behavioral control predict the intention of bee keepers to accept and adopt bee brood value added commodities.

The socio-economics such as consumer characteristics and sensory analysis indicators are well anchored to the findings of the study. The target behavior will be defined carefully in terms of its target, action and time. To improve consumption, target behavior can be measured in terms of quantities consumed. Bee brood consumption, demand and action are the actual eating demonstration and the time taken for behavior change after consumption

Social-economic Factors Correlation Analysis

The study sought to establish the relationship between the socio-economic factors and consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security. The findings are presented in Table 3.

Table 3. Correlation Analysis between Social-economic Factors and Improved Food Security.

		Improved Food Security	Socio-economics
Improved Food Security	Pearson Correlation	1	0.163**
	Sig. (2-tailed)		0.006
	N	294	294
Socio-economics	Pearson Correlation	0.163**	1
	Sig. (2-tailed)	0.006	
	N	294	294

**Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficient r = 0.163, p= 0.006 implies that there is a positive relationship between socio-economic factors and improved food security. This conclusion implies that socio-economic factors are a significant predictor of improved food security.

Social-economic Factors Response Regression Analysis

Simple Linear regression test was run to determine the predictive power of socio-economic factors on consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security results are shown in Table 4.7.

Table 4. Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.163[a]	0.027	0.023	0.70072

a. Predictors: (Constant), Socio-economic factors

Table 4 shows R Square of 0.027 implying that socio-economic factors determine 2.7% variations in consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security.

Table 4. Relationship between Socio-economic Factors and Improved Food Security.

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3.716	1	3.716	7.569	0.006[b]
	Residual	136.009	277	0.491		
	Total	139.725	278			

a. Dependent Variable: Improved Food Security

The probability value of p<0.006 indicates that the regression relationship was significant in predicting how socio-economic factors influence improved food security. The researcher further sought to establish the level at which socio-economic factors influence improved food security. The results were shown in Table 4.9.

Table 5. Coefficients[a].

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.689	0.335		8.028	0.000
	Socio economics	0.264	0.096	0.163	2.751	0.006

a. Dependent Variable: Improved Food Security

From Table 5 results, it was observed that holding socio-economic factors to a constant zero, improved food security would be at 2.689. Thus, a unit increase in socio-economic factors would lead to increase in improved food security by factor 0.264.

Specifically, bee brood extraction techniques have the highest positive influence on improved food security, followed by socio-economic factors and lastly County government support tools. Individual significance of the predictor variables was tested using t-test. The findings reveal that socio-economic factors and bee brood extraction techniques were individually statistically significantly related to improved food security p-value<0.05.

The findings in the table 6 established that taking all factors into account (bee brood extraction techniques', socio-economic factors and county government support tools) constant factor was 1.219 due to variation. Also, a unit change in socio-economic factors while setting the coefficient of other independent variables at zero would lead to a change in improved food security by a factor of 0.223; a unit change in bee brood extraction techniques while setting the coefficient of other independent variables at zero would lead to an increase in improved food security by a factor of 0.419;

Using the bêta coefficient, the established regression model was as follows:

$$Y = 1.219 + 0.223X_1 + 0.419X_2$$

Where;

Y= Consumer acceptability 1.219= Constant term, $0.223X_1$= socio-economic factors, $0.419X_2$ bee brood extraction techniques.

The findings reveal that socio-economic factors and bee brood extraction techniques were individually statistically significantly related to improved food security p-value<0.05. Hence all the three hypotheses were rejected implying that socio-economic factors and bee brood extraction techniques influence improved food security.

Conclusion

The objective of the study was to establish the influence of socio-economic factors on acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security. Results show that access to market information and agricultural extension officers are readily available to provide technical information do not affect consumer acceptability of bee brood *(Apis mellifera)* as an alternative source of protein for improved food security. However, taste and aroma, the texture is an indicator of food quality and it strongly affects food acceptability, distance to market and access to finance are social economic factors having the highest impact on improved food security. Therefore socio-economics have a significant effect on bee brood acceptability as alternative to improved food security.

Recommendations

The study recommends that market information concerning bee brood should be availed to the consumers. Moreover, agricultural extension officers should be engaged to sensitize farmers on the consumption of bee brood and its products. Moreover, joint concerted efforts to popularize entomophagy through collaboration among developed and developing nations should be initiated. Extensive surveys of insects, search of literature, research on nutritional value of unknown species as well as socio-economic aspects (including acceptance of these foods by consumers) would open new vistas for food security. A multi-faceted and linked global strategy is, therefore, needed to ensure sustainable and equitable food security and bee brood consumption can play an inter-disciplinary role associated with forestry, traditional medicine, agriculture and animal husbandry.

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References

Adgaba N, Al-Ghamdi A, Shenkute AG, Ismaiel S, Al-Kahtani S, Tadess Y, Ajzen I. 1975. Effects of information on interpersonal attraction: Similarity versus affective value, Journal of Personality and Social Psychology **29(3),** 374-380.

Ajzen I. 1985. From intentions to actions: A theory of planned behavior. In J. Kuhi& J. Beckmann (Eds.), Actionó control: From cognition to behavior. Heidelberg: Springer.

Ajzen I. 1991. The theory of planned behavior, Organizational Behavior and Human Decision Processes **50(2),** 179-211.

Ajzen I. 2002. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior, Journal of Applied Social Psychology **32(4),** 665-683.

Annette BJ. 2015. Association of Officiating Analytical Chemists (1996). Official methods of analysis (16th Ed.). Washington, DC: Author.

Berem RM, Owuor GO, Obare G. 2011. Value addition in honey and poverty reduction in ASALs: Empirical evidence from Baringo County, Kenya. Livestock Research for Rural Development. Volume 23, Article *#243*. Retrieved April 20, 2020, from http://www.lrrd.org/lrrd23/12/bere23243.html

Bunde AO, Kibet K. 2016. Socio-Economic Factors Influencing Adoption of Modern Bee Keeping Technologies in Baringo County, Kenya, International Journal of Science and Research **5(6),** 2319-7064.

Dietemann V, Nazzi F, Martin SJ, Anderson D, Locke B, Delaplane KS, Ellis JD. 2013. Standard methods for Varroa Research. In V. Dietemann, J. D. Ellis, & P. Neumann (Eds.), The COLOSS BEEBOOK, Volume II: standard methods for *Apis mellifera* pest and pathogen research, Journal of Apicultural Research **52(1),** 1-18.

Hilmi M, Bradbear N, Mejia D. 2011. Beekeeping and Sustainable Livelihoods. Food and Agriculture organization of the United Nations. Rome: Italy.

House J. 2016. Consumer acceptance of insect-based foods in the Netherlands: Academic and commercial implications. Appetite **107,** 47-58. https://doi.org/10.1016/j.

Matenge STP, Van der Merwe D, De Beer H, Bosman MJC, Kruger A. 2012. Consumers' beliefs on indigenous and traditional foods and acceptance of products made with cow pea leaves, African Journal of Agricultural Research **7(14),** 2243-2254.

Taruvinga A, Mushunje A. 2018. Factors that influence smallholder beekeepers' selection choices of honey value addition initiatives, Journal of Advanced Agricultural Technologies **5(3),** 23-34.

Van Huis A, Van Itterbeeck J, Klunder H, Mertens E, Halloran A, Muir G, Vantomme P. 2013. Edible insects: future prospects for food and feed security (p. 201). Rome: FAO. Retrieved from http://www. fao.org/docrep /01 /i3253e/i3253e.pdf

Warui M, Mburu J, Kironchi G, Gikungu M. 2020. Analyzing existing value addition initiatives enhancing recognition of territorial traits of three Kenyan honeys. The Journal of World Intellectual Property **6(2),** 456-478.