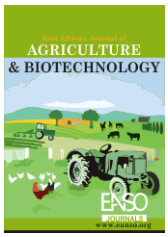

East African Journal of Agriculture and Biotechnology
eajab.eanso.org
Volume 7, Issue 1, 2024
p-ISSN: 2707-4293 | e-ISSN: 2707-4307
Title DOI: https://doi.org/10.37284/2707-4307

EAST AFRICAN NATURE & SCIENCE ORGANIZATION

Original Article

Farmers' Knowledge and Perceptions in the Production of Coconut Rhinoceros Beetle (Oryctes rhinoceros) for Enhanced Food Security in Kenya

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Article DOI : https://doi.org/10.37284/eajab.7.1.1683

Date Published:

11 January 2024

Keywords:

Coconut Farmers, Oryctes Rhinoceros, Knowledge and Perception (KP), Kilifi.

ABSTRACT

Local knowledge and perceptions regarding the value of edible insects among smallholder farmers are critical to introducing such enterprises and designing effective insect productivity-enhancing interventions. However, limited studies have been done in Kenya regarding insects as agricultural enterprises, specifically in the Kilifi region. A survey was carried out among 207 smallholder farmers of coconut palm in Kilifi North and South sub-counties to assess their knowledge and perceptions about Oryctes rhinoceros as a farm enterprise. The primary data was collected using a structured questionnaire triangulated by key informant interviews from the Department of Agriculture, Nuts and Oil Crop Directorate, and farmer group leaders. Descriptive statistics and a chi-square test were the major analyses. Results showed farmers had adequate knowledge and positive perceptions regarding the beetle and its useful larval stage, represented by the mean of 0.97 and 3.44, respectively. The age, education level, prior exposure to training on edible insect farming, religion, and years of coconut farming of the farmers are associated with the levels of knowledge and perceived values of the Oryctes rhinoceros farming. Considering the positive knowledge levels and perceptions among Kilifi farmers, rather than focusing on general awareness creation, there is a need to enhance the access to and use of agricultural training resources to learn the importance of agricultural innovations as a tool for food insecurity alleviation through intensive processes. The extension systems need to incorporate the concepts of edible insects. This will render an innovation sustainable and useful for economically disadvantaged people. Further studies should be done among livestock feed traders and even food and feed processors to enable effective commercialisation interventions.

APA CITATION

Ong'or, D. O., Orinda, M. A. & Abel, B. O. (2024). Farmers' Knowledge and Perceptions in the Production of Coconut Rhinoceros Beetle (Oryctes rhinoceros) for Enhanced Food Security in Kenya. *East African Journal of Agriculture and Biotechnology*, *7*(1), 13-25. https://doi.org/10.37284/eajab.7.1.1683

CHICAGO CITATION

Ong'or, Dennis Ouma, Mary Akinyi Orinda and Benard Otieno Abel. 2024. "Farmers' Knowledge and Perceptions in the Production of Coconut Rhinoceros Beetle (Oryctes rhinoceros) for Enhanced Food Security in Kenya". *East African Journal of Agriculture and Biotechnology* 7 (1), 13-25. https://doi.org/10.37284/eajab.7.1.1683

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

HARVARD CITATION

Ong'or, D. O., Orinda, M. A. & Abel, B. O. (2024) "Farmers' Knowledge and Perceptions in the Production of Coconut Rhinoceros Beetle (Oryctes rhinoceros) for Enhanced Food Security in Kenya", *East African Journal of Agriculture and Biotechnology*, 7(1), pp. 13-25. doi: 10.37284/eajab.7.1.1683.

IEEE CITATION

D. O. Ong'or, M. A. Orinda & B. O. Abel "Farmers' Knowledge and Perceptions in the Production of Coconut Rhinoceros Beetle (Oryctes rhinoceros) for Enhanced Food Security in Kenya", *EAJAB*, vol. 7, no. 1, pp. 13-25, Jan. 2024.

MLA CITATION

Ong'or, Dennis Ouma, Mary Akinyi Orinda & Benard Otieno Abel. "Farmers' Knowledge and Perceptions in the Production of Coconut Rhinoceros Beetle (Oryctes rhinoceros) for Enhanced Food Security in Kenya". *East African Journal of Agriculture and Biotechnology*, Vol. 7, no. 1, Jan. 2024, pp. 13-25, doi:10.37284/eajab.6.1.1683.

INTRODUCTION

The global population is on the rise, with an estimated 9 billion people inhabiting the world by the year 2050 (van Huis et al., 2013). To ensure food availability, there is a need to increase current food production by 70% (FAO, 2009). To meet the food and nutrition challenges today and tomorrow, what we eat and how we produce it needs to be reconsidered. The trend necessitates the need to have agricultural innovations in place to enhance the productivity of farms (FAO, 2018). Entomophagy, the collection and consumption of insects as food, is envisaged as the most viable solution to the sub-Saharan African countries, notably Kenya (Alemu et al., 2015). Edible insect enterprise is an important agricultural practice in many countries; for instance, in Asia, Latin America, and Africa, hundreds of forest insect species have been used as human food to increase alternative protein supply demands (Banjo et al., 2006). Insects have high nutritional benefits and are less detrimental to the environment than conventional livestock (FAO, 2013).

The global consumption of insects cut across nearly all insect species with beetles, accounting for 31% of edible insect species (Jongema, 2014), particularly *Oryctes rhinoceros'* larva and an adult beetle, which are consumed in many countries (Resh & Cardé, 2009). Several pieces of research have been done on the utilisation value of *Oryctes rhinoceros* in several countries, including Thailand, Cameroon, and Nigeria (Gahukar, 2016; Muafor et al., 2012; Olowu et al., 2012). Results point to successful enterprises for food and feed.

In Kenya, *Oryctes rhinoceros,* locally referred to as "chongwa," is abundantly found in the coastal region (Mwachiro & Gakure, 2011). Though regarded as a highly destructive pest in coconut farms, causing damage to up to 80% of the palms (Wheatley, 2015; Pole et al., 2014), there are few undocumented cases in the coastal part of the country of heavy use of the *Oryctes rhinoceros'* larva as poultry feeds and some Mijikenda sub-communities of the Giriama, Chonyi, and Jibana consuming the beetle larva. Farmers cut down the infested palm trees to harvest the larvae from the tree trunks. But this is not sustainable, thus relegating consumption to subsistence or when the insect larvae are available. Although the beetle species is reported to be edible globally, its utilisation in Kenya is still confined to these communities at the coast, and people are not taking it as a mainstream food or feed. In line with Satterthwaite et al. (2010) findings, urbanisation negatively impacts food and farming. The disappearing culture of the consumption of such insects may be attributed to this fact and competition from other preferred foods.

Many reports show that Kilifi County is one area where food insecurity and malnutrition are prevalent (county government of Kilifi, 2018; Chege et al., 2016; Wekesa et al., 2017). Explicitly, the region depends on coconut farms and other agricultural products for their livelihood, but due to climate change, the supply of these products has been deprived (Wekesa et al., 2017). Nonetheless, many pieces of research have been done on possible eradicating measures, but efforts to reduce the prevalence of the pest have not been successful (Wheatley, 2015; Bedford, 2014). This calls for a sustainable and useful way of eradicating or utilising the larvae. In this regard, farming the Coconut Beetle as an economic enterprise is one way the farmers can

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

ameliorate the destruction of the pest as they will be utilising its value and deriving income and other essential nutrients throughout the year. Furthermore, the *Oryctes rhinoceros* larva's proximate nutrient composition has been reported to comprise crude proteins and carbohydrates in the quantities of 50.79±1.01 and 33.30±0.60 dry weight, respectively (Okaraonye & Ikewuchi, 2009), which are beneficial to the human and animal metabolic activities.

The fact that the beetle is found in this region and is a delicacy to these communities means that there is still limited research on the beetle as a potential enterprise for food security, which formed the baseline of this research. To meet this rationale, the paper sought to evaluate knowledge and the perceptions of farmers towards the production of the beetle that is necessary for the recommendation of policy intervention strategies.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Kilifi North and Kilifi South sub-counties of Kilifi County between the months of January and March 2021. The two sites are located in the Coconut Cashew Nut-Cassava ecological zone, which varies in altitude from 30-310m above sea level with mean temperatures of 900 mm per annum (County Government of Kilifi, 2021). Besides heavy coconut growing in the sites, the two sites were purposively selected because they experience the menace of Rhinoceros beetle, an important coconut pest, and have instances of *Oryctes rhinoceros* larval consumption among the Giriama and the Chonyi Mijikenda sub-communities. The two sites are found in a wider Kilifi County in the former coast province, about 420 km south-east of Nairobi and 60 km North of Mombasa. Kilifi shares its borders with four other counties: Mombasa and Kwale to the South, Tana River to the north, and Taita Taveta to the west. The county lies between latitude $2^{o}30^{o}$ and $4^{o}0^{o}$ South and between longitude 38^{o} 45^{o} and 40^{o} 15^{o} East. It covers an area of 12,609.74 square kilometres. It is divided into seven subcounties with several wards. The population of the Kilifi North Sub-County was 39,912 households, and Kilifi South was 53,074 households (KNBS, 2019).

Farmer Sampling

The sample was drawn from a population of 47,561 households of smallholder farmers growing coconut in the county (KNBS, 2019). This represents 16% of the 92 586 total number of households in the county. Based on the Cochran (1963), the sample size was derived as;

$$n = \frac{Z^2 Pq}{e^2} \quad (1)$$

Where n is the sample size, Z is the standard variant at a given confidence level (1.96), P is the proportion of the population containing the major attribute of interest (16%), q is the weighting variable (1-p), and e is the level of precision.

$$n = \frac{(1.96)^2 (0.16)(0.84)}{(0.05)^2} = 207 \quad (2)$$

Table 1: Proportionate distribution of sample per Sub-County

Sub County	Households	Cumulative	Prob (%)	Proportionate sample
Kilifi North	6,322	6322	42.68	97
Kilifi South	8492	14814	57.32	110

Source: KNBS, 2019

Study Design and Data Collection

The study employed a cross-sectional design. Both primary and secondary data were used. During the sampling process, a multistage sampling procedure was employed. In the first stage, the county of the study was purposively selected due to the huge palm farming activities being undertaken in the region and the menace of *Oryctes rhinoceros*. In the second stage, Kilifi North and Kilifi South Sub Counties were purposively chosen. The choice was based on the fact that the sub-counties are made up of sub-communities, Giriama and Chonyi, that consume

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

Oryctes rhinoceros larvae. In the last stage, the systematic sampling method was used to identify the target farmers**.** With the help of a coconut farmer group list from the sub-county department of agriculture and the Kipepeo project (an affiliate of the museum of Kenya), the names of the farmers/households in a non-ordered format were serially numbered and then selected at intervals of five numbers to get the target farmers. Consequently, the distribution of farmers was in 4 wards, including Chasimba, Matsangoni, Mwarakaya, and Watamu, with a total of 207 farmers. The specific household was then traced with the help of group leaders of the farmers' group to lead to the homes of the identified farmers. The primary data was collected through structured questionnaires administered to the farmers and supplemented by key informant interviews involving farmer group leaders, representatives from the Nuts and Oil Crops Directorate (NOCD), and the sub-county department of agriculture officers. Secondary data was collected from the agricultural reports, museum, and NOCD reports.

Development of Knowledge-Perception (KP) Questionnaire

The instrument for this research was a pretested, structured researcher-administered interview. The authors reviewed the literature on *Oryctes rhinoceros* on its essential nutrients, Nutritional value, medicinal value, environmental and weather-related attributes, and economic potential of the beetle for developing questionnaires on knowledge and perceptions about edible insect enterprises. All knowledge and perception questionnaires had responses using various Likert-type answers. As a part of the questionnaire, a key informant checklist was also used in the research.

Data Analysis

Descriptive statistics were used to analyse data using IBM SPSS Version 26. Descriptive tables were the main descriptive analysis used to assess the distribution of farmers and their knowledge and perceptions across the different sites of study. All the summary statistics were reported as percentages with 95% CI for categorised variables and as means and Standard deviation for continuous variables. Qualitative data was organised according to emerging themes and patterns and assigned numbers to make them measurable.

Knowledge of the farmers was measured on a 3 scale Likert statement of true, false, or do not know. To permit analysis, every true answer was assigned one point while a zero for false or do not know responses (1=True, 0=False). The determination of the mean knowledge score was guided by equation 3.

$$Mean\ knolwdge\ score = \frac{n}{N} \qquad (3)$$

Where n is the total score of the respondents for correct answers,N is the maximum obtainable score.

The means were categorised into low and high levels, with low and high levels falling below and above the mid-point (0.5).

This technique was employed as it effectively quantifies and summarises the collective knowledge of smallholder farmers concerning the value of the beetle as a farm enterprise. Also, the method was preferred as it ensures simplicity and ease of interpretation, enabling straightforward communication of the findings.

Evaluation of the farmers' perception involved the use of a 5-point Likert scale to solicit responses from the respondents with a scale ranging from (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree on the perceived barriers and values of the *Oryctes rhinoceros*. Mean and standard deviations for perception responses were then determined by equation 4. The results were then mapped on the scale. Mean values greater than the mid-point were categorised as high perceptions, while those below the mid-point (3) were characterised as low.

$$\bar{x} = \frac{\Sigma X_I}{N} = SD = \sqrt{\frac{\Sigma (X_I - \bar{x})^2}{N-1}} \qquad (4)$$

Mean and standard deviation as analytical methods represent a highly desirable approach for

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

this objective. By utilising the mean, the research can ascertain the average perception level of smallholder farmers regarding the production of the beetle as a farm enterprise. This measure offers a valuable summary of the central tendency of the responses, providing insights into the typical perception of beetle production among the participants. Additionally, incorporating the standard deviation allows for the examination of the dispersion or variability in farmers' perceptions around the mean. The combination of mean and standard deviation enhances the research's ability to uncover nuanced patterns and variations in perception, contributing to a comprehensive and well-rounded understanding of farmers' attitudes towards the production of the beetle.

Evidence of association between the demographic variables and knowledge and perceptions (KP) of *Oryctes rhinoceros* was explored by cross-tabulation and measured using Chi-square tests.

RESULTS AND DISCUSSIONS

Demographic Characteristics

In this study, 207 farmers took part in the survey. Participants' demographic characteristics are detailed in *Table 2*.

Table 2: Demographic characteristics

		N	%	Mean	SD
Gender	Male	141	68.12		
	Female	66	31.88		
Age	20-40 years	47	22.71		
	41-60 years	110	53.14		
	Above 60 years	50	24.15		
Education level	No formal Education	35	16.91		
	Primary	119	57.49		
	Post-primary	53	25.6		
Training on Insect farming	Yes	110	53.14		
	No	97	46.86		
Religion	Christianity	148.00	71.50		
	Islamic	59.00	28.50		
Household size				6.66	1.89
Farm Size				3.03	0.9872
Farming experience				12.613	4.461
Income				72989.4	19440.3

Source: Survey data, 2021

More than half (68.12%) of the coconut farmers surveyed were male, with their female counterparts only contributing to 31.88%. Regarding the education level, the majority of the farmers had only primary level (57.49%), with only 25% accounting for post-primary. A paltry 16.91% had no formal education. The majority of farmers (N=110) were between ages 41-60, with only 50 of the respondents having ages of above 60 years. Regarding training in the production of insects, the majority of the farmers (N=110) have received insect farming within the region, with only 97 having no experience in such enterprises. The results showed that Christianity and Islam are the two dominant religions within the study area. 71.50% of the respondents were Christians, with 28.50% belonging to Islam. The household composition had an average of 6 members with earnings of over Ksh. 70,000 annual incomes. On average, farmers had 3 acres of coconut production with more than 12 years of experience in coconut farming.

Knowledge of farmers about Oryctes rhinoceros.

Knowledge was measured in terms of Knowledge of the presence of essential nutrients, Nutritional value, the medicinal value of the insect, environmental and weather-related attributes, and economic potential of CRB (*Table 3*).

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

Table 3: Knowledge score of each attribute

Knowledge Statements	Chasimba (n=54) %	Matsangoni n= (57) %	Mwarakaya (n=56) %	Watamu (n=40) %	Total (n=207) %
CRB contains essential nutrients good for health	100	89.5	96.4	82.5	92.8
The high nutrient composition in CRB can eliminate diseases	92.6	84.2	85.7	65	83.1
CRB feed on coconut saps, and it is that feed resource that makes them healthy, nutritious, and safe	94.4	94.4	96.4	90	94.2
CRB cooking can enhance its edibility and provide nutrients	61.1	68.4	69.6	57.5	64.7
CRB has high levels of health properties incomparable to other animal products	35.2	42.1	30.4	45	37.7
CRBs are found throughout the year and are hardly affected by weather changes	77.8	94.7	94.6	90	89.4
CRB can be easier and cheaper to produce in comparison to other livestock	40.7	89.5	73.2	75	69.6
CRB can generate constant income for households	96.3	96.5	89.3	100	95.2
CRBs are important food products in household food security	63	68.4	75	45	64.3
CRB production can provide employment for rural people	51.9	87.7	75	80	73.4
Mean Knowledge Score	Mean= 0.98 SD= 0.136	Mean=1 SD=0	Mean=0.96 SD= 0.187	Mean=0.93 SD = 0.267	Mean=0.97 SD=0.168

Source: Survey data, 2021

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

The results showed that 92.8% of the respondents the farmers, reiterated that the beetle contains essential nutrients good for the health of both humans and animals, and 83.1% confirmed that these nutrients could actually eliminate deficiency diseases among vulnerable groups such as children. Regarding the safety of such nutrients, 94.2% were privy to the beetle's food, making it safer for livestock and human consumption. Further, a significant proportion of 64.7% confirmed that adding value through cooking can enhance the edibility of the beetle. Concerning the health properties of the beetle, only 37.7% confirmed that the beetle has health-promoting properties. 89.4% of the respondents confirmed that the beetle is less affected by climate change. During harsh conditions, they dig dippers in the trunks of the infested trees and stay there for quite a long time. 69.6% of the farmers acknowledged that the beetle could be cheaper to produce relative to other livestock enterprises. In support of this attribute, a good number of farmers (95.2%) confirmed that it could generate constant incomes for the household. When asked about the contribution of the beetle, 63.4% confirmed that it could be an important food product for household food security, while 73.4% acknowledged that it could employ rural people.

On average, Matsangoni farmers were more knowledgeable (mean=1.00) about various aspects of the beetle, while farmers from Watamu ward were the least knowledgeable (mean=0.93). This is attributable to the high number of farmers from Matsangoni farmers enrolled in insect farming training in the Kipepeo Project. Chasimba and Mwarakaya farmers also had good knowledge of the value of the beetle. In sum, the results showed that farmers in the four sites had good knowledge of the attributes of the *Oryctes rhinoceros*, with a mean of 0.97 (± 0.168). Each individual ward had a mean greater than the mid-point (0.5) of the scale, which justifies the good knowledge. The findings confirm that of Kuehne et al. (2017), who found that farmers often have retained knowledge of their traditions that take time to disappear. Consequently, while some of the ideas will disappear due to civilisation, tradition is rooted in the traditional knowledge of indigenous people. Contribution such as education only adds value to what exists. Nearly half of the Farmers (46.86%) in the study sites stated they had no prior exposure to training in insect farming. This shows that, while there may be knowledge among the farmers concerning insect consumption, continued education through extension services is pivotal to promoting such innovative production systems. According to a study by Omoro (2015), extension services are vital for imparting rural people with prerequisite knowledge and other information required to increase the productivity and sustainability of farming systems. This assessment was important as farmers' knowledge of an enterprise may improve production. Ntawuruhunga et al. (2020) noted that knowledge is vital in determining the type of enterprise and contributes to the success of such enterprises.

Perception of farmers about *Oryctes rhinoceros* Production

Table 4 shows a summary of the results of means of various perception statements showing perceived barriers and value towards the introduction of *Oryctes rhinoceros'* production as a farm enterprise.

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

Table 4: Mean rating of farmers' perceptions towards the production of CRB.

	Perception statements	Mean	SD	Cronbach Alpha
Perceived barriers	CRB farming can be a women's activities/business	3.22	1.383	0.521
	CRB is only poor people's food and traditional lifestyle.	2.66	1.111	
	CRB consumption may cause health problems	1.87	1.074	
	CRB is unfashionable and not trendy as compared to other foods.	2.90	1.494	
	CRB farming can be time-consuming and cumbersome.	2.36	1.307	
	The taste and appearance quality of CRB is not as good as that of modern food and feed products and can be hard to be taken up by people.	4.08	1.259	
Perceived values	CRB can be a viable enterprise	3.85	1.207	0.715
	CRB can be farmed and sold for food and feed.	4.39	.922	
	CRB can be cheap to produce and maintain supply compared to other enterprises.	3.83	1.245	

Source (Survey data, 2021)

The Cronbach alpha for perceived barrier statements was 0.521. As noted by Yusoff (2012) and Streiner et al. (2015), items are considered to have an acceptable internal consistency level if the alpha value falls between 0.5 and 0.7. However, values falling above 0.7 are considered a good level. Therefore, 0.521, in this case, shows that the scores for the various barrier statements are acceptable to be summed up into an overall score. The overall mean of the perceived barrier score computed was 2.8483 and significantly lower than the average point of the scale (t=59.004, P<0.000). This indicates that the study participants, on average, disagreed that the barriers were not significant enough to deter people from venturing into the enterprise.

The strongest perceived barriers were that the taste and appearance of coconut rhinoceros beetle larva cannot match the modern food items (mean=4.08) and that beetle farming can be a women's activity (mean=3.22). Farmers disagreed that beetle farming is unfashionable and not trendy, represented by a mean of 2.90. Additionally, farmers showed their disagreements with the idea that the beetle is old people's food, farming could be time-consuming, and its consumption may cause health problems, as depicted from the means of 2.66, 2.36 and 1.87, respectively. All these means were falling below the mid-point scale, showing overall disagreement of the farmers to the mentioned barriers.

In contrast, the Cronbach alpha for value statements was 0.715, showing that the scores for the various value statements can be summed up into an overall score. The overall mean value score computed was 4.023 and significant (t=63.903, P<0.000). The strongest perceived value was that CRB can be farmed and sold for food and feed (mean=4.39). The viability of the beetle's enterprise came second with a mean of 3.85. Lastly, farmers affirmed the cost benefits of producing the beetle and maintaining supply compared to other enterprises (mean=3.83). All the means in perceived values fell above the midpoint scale, illustrating strong agreement of the farmers towards the adoption of this enterprise.

In comparison, a paired sample t-test (t=-13.953; P<0.000) revealed a significant difference between the scores. Researchers, therefore, concluded that farmers have a significantly higher perception of the *Oryctes rhinoceros* production as a farm enterprise. In sum, value perceptions were generally stronger and more outspoken than perceived barriers. Thus, farmers have a high degree of acceptance of this novel enterprise. These findings are in line with that of Verbeke et al. (2015), who found the perceived

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

benefits of utilising insects' value outweigh the perceived risks or barriers of insect acceptance. Similarly, drawing evidence from Oppong's work (2017), the perceived value of BSFL as fish feed among Ghanaian farmers outweighed the perceived risks.

Association between the Demographic Characteristics and Knowledge and Perceptions About CRB Value as an Enterprise

Cross tabulation (*Table 5*) was carried out to examine any association between sociodemographic variables and the knowledge and perceptions of the respondents on *Oryctes rhinoceros's* enterprise. This could inform the policy interventions to directly target the variables that showed a relationship towards the know-how and the perceived value of *Oryctes rhinoceros*.

Table 5: Association between demographic characteristics and the KP of farmers

Demographic factors		N	%	Mean	df	P. value
Gende	Male	141	68.12	18.535	1	0.062
	Female	66	31.88			
Age	20-40 yrs	47	22.71	90.811	2	0.002*
	41-60 yrs	110	53.14			
	Above 60 yrs	50	24.15			
Education level	No formal Education	35	16.91	63.185	2	0.048*
	Primary	119	57.49			
	Post-primary	53	25.6			
Training on Insect farming	Yes	110	53.14	17.627	1	0.001*
	No	97	46.86			
Religion	Christianity	148	71.5	21.05	1	0.037*
	Islamic	59	28.5			
Household size	Under 5	158	28.02	63.111	2	0.084
	Between 6 and 9	142	68.6			
	Above 10	7	3.88			
Farm Size	Less than 1 acre	23	11.11	58.313	3	0.72
	1-2 acres	28	13.53			
	2-5 acres	75	36.23			
	Above 5 acres	81	39.13			
Farming experience	Under 5 years	8	3.86	73.383	3	0.00*
	5-15 years	143	69.08			
	16-20 years	50	24.15			
	Above 20 years	6	2.9			
Income	Below 10,000 KSH	0	0	72.461	3	0.096
	10001-40000 KSH	15	7.25			
	41,000-80,000 KSH	103	49.76			
	Above 81,000 KSH	89	43			

** Significance level at 5%.*

The results show that age, education level, prior exposure to training in edible insect farming, religion, and years of coconut farming determined the levels of knowledge and perceived values of the *Oryctes rhinoceros* farming. Of note is the outcome of gender that agreed with the findings of Kabir et al. (2016), who found that sex is insignificantly associated with knowledge of climate change and its health. In this research, the insignificance of the gender can be attributed to the fact that both males and females within the area had equal exposure to knowledge resources. There is no male dominance and priority to accessing and using a diverse set of knowledge.

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

Farmers who are aged (>60 years) were likely to have good knowledge of the beetle and perceived it better as a possible farm enterprise than those who were young (<60 years). Coconut rhinoceros larvae were a delicacy to the indigenous Giriama and Chonyi people. Therefore, those who are elderly were more exposed to the idea than the young. This finding is in line with Kabir et al. (2016), who also found the relevance of age as a determinant of knowledge. David et al. (2012) also confirm that most farmers have retained knowledge of their traditions that take time to disappear. Therefore, the older the respondent was, the more knowledge retained from the previous generation. This explanation can also be tied to the outcome of years of experience in farming coconut. Over time, farmers who have stayed longer in farming have been exposed to the disastrous pest and have earned good knowledge.

Training also proved to have a significant association with Knowledge and perceptions. In concurrence with Omoro (2015), training is vital for imparting rural people with prerequisite knowledge and other information required to increase the productivity and sustainability of farming systems.

Religion also proved a key determinant in the knowledge and perceptions of farmers. Religions globally follow some standardised code of ethics that guide their behaviour. Islam is one of the dominating religions in the study area (This is Kilifi, 2021). Muslims have halal operations observed under numerous Halal standards across the globe (Rahim, 2018). According to Rahim, several Islamic countries have established their own guidelines for the type of food permissible for consumption on top of the SMIIC (The Standards and Metrology Institute for Islamic Countries). The study revealed that respondents who cited that religion would deter them from the production of the beetle were the majority with few proportions of Christians confirming the same. Therefore distorting their perceptions and any urge to learn about the beetle as possible food and feed. The study by Lang (2018) in determining the role of religion in agriculture confirms these findings that religion is a determinant in the development of agriculture, with some being deterred by religious forces.

CONCLUSION AND RECOMMENDATIONS.

The importance of utilising the value of edible insect pests as an alternative feed or food source is gaining traction in the modern world. Drawing on Roman's (2004) arguments that eating invasive species is the only way to control them, expanding our palate utilising invasive pests such as *Oryctes rhinoceros* will be a sure way of reducing their prevalence. The study is one of the first to collect the farmers' perceptions and levels of knowledge on the value of *Oryctes rhinoceros* as a viable agricultural enterprise, particularly in the hinterland communities of the coast region of Kenya. The results indicate that Kilifi farmers possess a satisfactory level of knowledge (mean knowledge score: 0.97) and exhibit a positive willingness to embrace this agricultural enterprise (mean perceptions score: 3.44). The determinants of farmers' knowledge and perceived value of *Oryctes rhinoceros* farming were found to be influenced by factors such as age, education level, prior exposure to training in edible insect farming, religion, and years of coconut farming. These factors may have contributed to the lack of adoption of beetle farming in the region despite the favourable knowledge and perceptions among farmers.

It is essential to consider farmers' personal feelings and knowledge when planning developmental programs. Considering the positive knowledge levels and perceptions among Kilifi farmers, rather than focusing on general awareness creation, it is crucial to reassess and refine the approach to promote the adoption of beetle production. First, providing farmers with the necessary training about general agricultural innovations as tools for addressing food insecurity, malnutrition, and employment creation would make them better understand the potential benefits of edible insect farming. To achieve this rationale, government

Article DOI : https://doi.org/10.37284/eajab.7.1.1683

extension systems need to incorporate the concept of edible insects and actively engage farmers in discussions and training programs to familiarise them with these novel ideas, making them a part of normal agricultural activities.

Moreover, agricultural officers should work closely with farmers to understand their specific needs, concerns, and preferences related to beetle farming to address the barriers. For instance, agricultural officers can work closely with the farmers to bridge the gap between religious beliefs and the farming of the beetle. As a result, the existing trust between them would make it convincing enough for the farmers who are bound to religious ties to farm the beetle entirely as feeds, while those without prior training experience would enrol for training sessions.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the financial support for this research. The researchers owe a lot of gratitude to the NOCD, Mombasa branch, and representatives for being part of Key informant interviews. Also, in a special way, we acknowledge the contribution of the Kipepeo project and the sub-county department of agriculture for facilitating the researcher with farmers' lists that eased the work and helped gain resourceful information that shaped this paper.

Funding

This research was funded by INSEFOODS through Jaramogi Oginga Odinga University of Science and Technology.

Declaration Of Conflicts of Interests.

The authors declare that they have no known competing interests.

Ethics Approval

Ethical approval was granted by JOOUST Ethics Review Committee and the National Commission for Science, Technology, and Innovation (NACOSTI).

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