



Assessment of awareness level of insect pests of mahogany (*Khaya senegalensis* (Desv.) A. Juss) in Sabon-gari Local Government Area, Kaduna state, Nigeria

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ABSTRACT

African mahogany is an important tree species found in parts of west and central Africa, including Nigeria. The species is vulnerable to a range of insect pests that can reduce its growth, leading to economic losses. However, lack of knowledge about insect pests makes it difficult to implement effective control strategies. This study assessed awareness level of farmers on insect pests of mahogany in Sabongari Local Government Area, Kaduna State Nigeria. Multistage sampling technique was used after the sampling locations has been stratified to wards in the Local Government Area to three (3) farming communities each in the first stage. Random sampling technique was used in the second stage to administer 40 copies of the questionnaire in each of the stratified wards, thereby having a total of 360 selected respondents, out of which 338 were retrieved. The data collected were analyzed using simple descriptive statistics. The study revealed that 95% of farmers were familiar with the tree species, 45% were aware of its insect pests, and 30% have knowledge in pest identification and management. The study also identified challenges faced by farmers such as changes in prevalence/severity, wide host range, seasonally variation, cost of pesticides, limited information on pest identification and management. Most effective way to control pests according to farmers is use of chemical/pesticides and other less harmful methods, and they also believe that professional advice is needed when dealing with insect pests. Critical ways of managing insect pests of the trees were the use of traditional/cultural practices, planting of improved and resistant species, and maintaining healthy tree through proper silvicultural practices. These factors are crucial because they are effective and sustainable ways to manage insect pests. Therefore, there is need to raise awareness among farmers about insect pests of mahogany tree, and to develop and promote effective and sustainable pest management strategies that are tailored to their needs.

Keywords: Mahogany species; pest management; chemical/pesticides

INTRODUCTION

Mahogany tree is an important economic and ecological resource in many African countries. It is a valuable source of timber, medicine, and food for both humans and animals. It occurs from Mauritania and Senegal to northern Uganda. Common names include African

mahogany, dry zone mahogany, Gambia mahogany, Khaya wood, Senegal mahogany, and its local names in Nigeria are madaci (Hausa), ono (Igbo) and aganoo (Yoruba) (Orwa *et al.*, 2009). It is a large, deciduous tree with a straight bole, that can reach heights of up to 45 m and has a dense crown of compound leaves (Iwuagwu *et al.*, 2017). The tree is known for its valuable timber, which is used in furniture making, construction, and carvings, among other applications (Fawibe *et al.*, 2019). The tree is also known for its medicinal properties, as different parts of the tree have been used traditionally to treat various ailments such as malaria, stomach aches, and respiratory infections (Udoamaka *et al.*, 2018). African mahogany is a tropical hardwood tree species highly valued for its timber, and production primarily occurs in countries such as Senegal, Mali, Guinea, Ivory Coast, Ghana, Nigeria, and Cameroon, which have suitable climatic conditions for its growth. These countries have established plantations and forestry management practices to sustainably harvest the timber, and international trade of mahogany is significant, as it is in demand in various markets worldwide (FAO, 2018). It is commonly planted within its natural area of distribution, mainly as ornamental and roadside tree. In drier zones in Sri Lanka, it has become a priority species for timber plantation establishment since mid-1990s, with more than 500ha of plantation established by 2004 and 200ha/year of new plantations planned for the future. (Arnold, 2004).

However, like other crop or plant, it is vulnerable to various insect pests that can significantly reduce its productivity and cause economic losses to farmers (FAO, 2003). However, lack of knowledge about insect pests that attack the trees makes it difficult to implement effective pest management strategies. Therefore, raising awareness about insect pests that affects the tree is crucial to ensuring its sustainable management and conservation. By educating farmers about effect of insect pests, we can reduce damage caused and increase yield of this valuable resource. As Food and Agriculture Organization (FAO, 2018) notes, awareness and understanding of pest problems and their management are essential components of sustainable pest management strategy. Through awareness-raising initiatives, farmers can be educated to manage insect pest problems more effectively and sustainably. To be aware of existence of pests is one thing, to know how to recognize them, understand their life history and damage they can cause, and to appreciate their economic and environmental significance is another. Awareness is just the beginning of an effective pest management program (FAO, 2003).

Sabongari Local Government Area is known for its diverse agricultural activities. The area has significant population of mahogany trees which are crucial source of income for many local farmers. However, there is limited knowledge about insect pests that affect the trees in the area, and this can lead to significant losses and reduced productivity. Therefore, this study aims to assess level of awareness of insect pests on mahogany trees among farmers and other stakeholders.

MATERIAL AND METHODS

Study Area

Sabon Gari Local Government (Latitude: 11⁰ 06' 60"N and Longitude: 07⁰ 43' 59"E and 686m above sea level) is one of the 23 local government area in Kaduna State, with headquarters at Dogarawa. The area lies in the Northern Guinea Savannah ecological zone with woodland vegetation and underlying grass species (Raji *et al.*, 2004). The climatic condition of the area is tropical continental climate also described as tropical savannah,

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characterized by two seasons (dry and wet season). The annual rainfall ranges from 1,000 to 1300 mm. The rainfall duration is about 5months, beginning in May and ending around October after which the dry season begins and ends around May/June. The mean maximum temperature of the area ranges from 27.2°C to 35°C in April. It has an average daily temperature of 38°C with guinea savannah vegetation. It is one of the local government areas in Zaria metropolis as well as being one of districts of Zazzau emirate council. There are 11 wards in the local government namely (Basawa, Bomo, Chikaji, Dogarawa, Hanwa, Jama'a, Muchia, Sabon Gari, Samaru, Unguwan Gabas and Zabi). The Local Government council has a population of 430,500 (NBS, 2020), with a total land area of about 263km². It shares boundaries with other local areas such as Giwa to the West, Kudan to the East, Zaria in the South and Soba in the South-East.

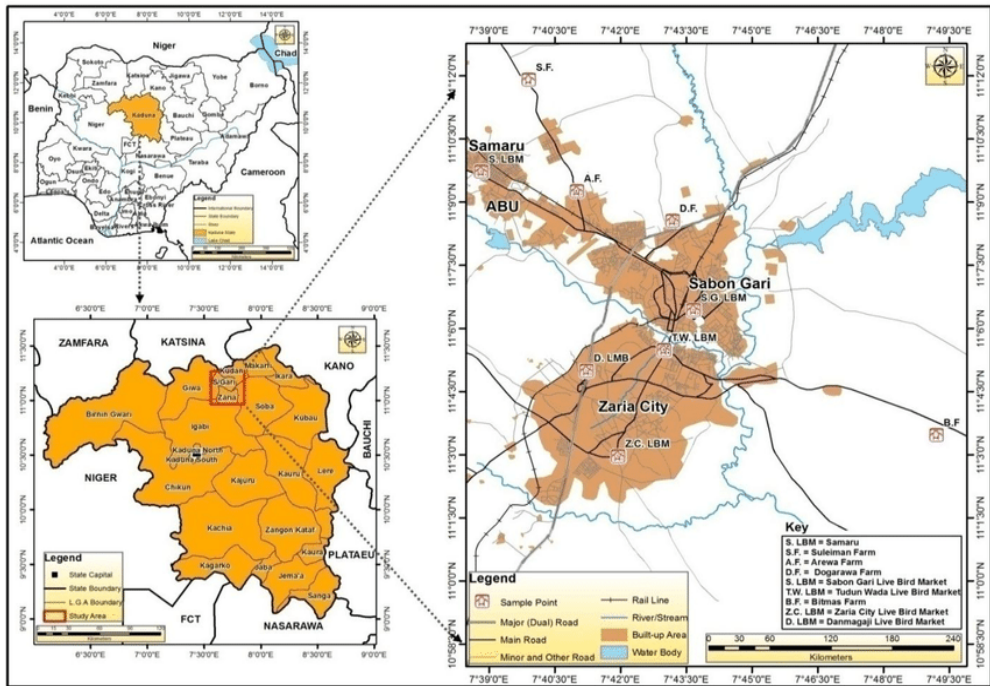


Figure 1: Map of Kaduna State showing the study area
Source: Adapted from Administrative map of Kaduna State.

Sample Size and Sampling Procedure

The target population for the study consist of individuals residing in Sabongari Local Government Area who have direct or indirect interactions with mahogany trees. The sample size was determined using Krege and Morgan (1970) table based on NBS 2022 population projection of Sabongari LGA (430,500). Sample size of 360 respondents was used at 5% level of significance. Three wards (Basawa, Bomo and Jushin Waje) that are predominantly agrarian communities from the Local Government Area were selected as the study samples. Multistage sampling technique was used after the sampling locations has been stratified to

wards in the Local Government Area to three (3) farming communities each in the first stage. Random sampling technique was used in the second stage to administer 40 copies of the questionnaire in each of the stratified wards to make a total of 360 respondents in all, out of which 338 (94%) were retrieved. The stratification was based on the concentration of mahogany trees in the three wards in the local government area.

Data Collection and Analysis

Data for this study were collected using structured questionnaire designed purposely to gather information on demographic characteristics of respondents, awareness of insect pests affecting mahogany, perceived impact of these pests on the trees, and respondents' knowledge of preventive and control measures. The questionnaire consists of closed-ended and open-ended questions to obtain both quantitative and qualitative data. Simple descriptive statistics such as frequency table, counts and percentages were used to analyze the data. A 5 points Likert rating scale was used to assess respondent range of opinions on challenges faced in the control of insect pest of mahogany as well as rating of factors for managing their infestation using SPSS statistical package. The ratio and mean of respondents rating were determined from the maximum score from the total number of respondents in the study. Ratio from respondents score having mean value less than 2.5 are considered not significant and less effective.

RESULTS AND DISCUSSION

Demographic Characteristics of Respondents

Some demographic characteristics play a critical role on the assessment of awareness of insect pest of mahogany in Sabongari Local Government Area of Kaduna State. The variables assessed in this study are age, gender, marital status, education, occupation and annual income.

Results in Table 1 showed that 38.3% of sampled respondents were within the age bracket of 21-30 years, which implies that they are at middle and economically active phase of their life that could impact positively on their standard of living. Gender distribution of respondents revealed that men (55%) are the majority against their women counterpart (45%), and this suggest that men are more likely to participate in surveys and research of this nature. This may also be due to religion and traditional norms, which has suppressed women role as household help and thus, a seemingly higher proportion of male counterpart than female is involved in forestry and farming and are more knowledgeable. On marital status, most of the respondents are married (51.7%), 35.0% are single, 10.0% are divorced, and 3.3% are widowed. This is an indication that most of the married people in the study area understands the economic and other allied importance of mahogany trees in their environment. Furthermore, result of the analysis of sampled respondents showed that 36.7% had secondary education, 35.0% had tertiary education, 16.7% had primary education and 11.7% had informal education. This suggests that respondents are relatively well-educated, and secondary education being the minimum educational requirement for most jobs in the country. Njoku (1991) observed that having any form of formal education will have positive influence on one's life. This was further corroborated by Enete, *et al.* (2011) who reported

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that there is a positive and highly significant relationship between respondents' level of education with the level of knowledge and awareness on climate issues.

Table 1: Demographic characteristics of respondents

S/No	Variable	Frequency	Percent
1	Age in Years		
	≤ 20	17	5.0
	21-30	129	38.3
	31-40	79	23.3
	41-50	68	20.1
	≥ 51	45	13.3
	Total	338	100
2	Gender		
	Male	186	55.0
	Female	152	45.0
	Total	338	100
3	Marital Status		
	Single	118	35.0
	Married	175	51.7
	Divorced	34	10.0
	Widow	11	3.3
	Total	338	100
4	Educational Level		
	Primary	56	16.7
	Secondary	124	36.7
	Tertiary	118	35.0
	Others	40	11.7
	Total	338	100
5	Occupation		
	Farming	107	31.7
	Trading	90	26.7
	Civil servant	17	5.0
	Artisan	51	15.0
	Student	73	21.6
	Total	338	100
6	Annual Income		
	<500,000	281	83.3
	500,000-1,000,000	34	10.0
	1,000,000-2,000,000	23	6.7
	>2,000,000	0	0
	Total	338	100

This is expected as educated respondents may understand and process information provided by different sources regarding environmental issues in an area (Bambale *et. al.*, 2022). The distribution of sampled respondents according to livelihood activities and annual incomes shows that majority engaged in farming (31.7%) as their primary occupation, 26.7%

trader, 21.6% are students, 15.0% are artisans and 5.0% are civil servants. The majority of respondents that are farmers, which is the most common occupation in the country suggests that they are involved in primary sector of the economy. The result of sampled respondents according to income generated from their livelihood activities showed that 83.3% earned an annual income of <500,000, 10.0% earned annual income of 500,000-1,000,000, 6.7% earned 1,000,000-2,000,000, and none of the respondents earns more than 2,000,000 annually. This confirms that majority of the respondents are below the national poverty line and are struggling to make ends meet. Socioeconomic attributes play a critical role in the lives of farmers as it influences their decision-making process and willingness to adopt innovation. Socioeconomic characteristics also helps in raising productivity of an enterprise and standard of living, and this can be used to understand communities better.

Level of Awareness of Insect Pest of Mahogany

Results in Table 2 showed level of awareness of sampled respondents on insect pests of mahogany in the study area. Majority of the respondents are familiar with mahogany tree (95%), while (5%) are not familiar. Majority (75%) of the respondents have noticed some insect pests damage while (25%) have not noticed such damage. However, 45% of the respondents are aware of insect pests that commonly attack the tree in the area and 30% are quite knowledgeable in identifying and managing the insect pests. While 55% are not aware of insect pests attack and 70% do not have knowledge in identifying and managing the insect pests. This suggests that there is lack of awareness among respondents about insect pests that attack the trees, and their management. This could lead to a serious problem, as insect pests can have significant impact on growth and health of the plants.

Table 2: Level of awareness of insect pest of mahogany

S/N	Variable	Yes		No		Total	
		F	%	F	%	F	%
1	I am familiar with <i>Khaya senegalensis</i> (African mahogany) trees	321	95.0	17	5.0	338	100
2	I noticed some insect pests damage on Khaya trees in my area	253	75.0	85	25.0	338	100
3	I am aware of specific insect pests that commonly attack Khaya in my area	152	45.0	186	55.0	338	100
4	I am quite knowledgeable in identifying and managing insect pests of Khaya trees	101	30.0	237	70.0	338	100
5	I have received training and information on pest management of Khaya trees	123	36.3	215	63.7	338	100
6	I am concerned about impact of insect pests on Khaya trees	248	73.3	90	26.7	338	100
7	Insect pests have significant effect on growth and health of Khaya trees	242	71.7	96	28.3	338	100
8	I am currently implementing measures to control insect pests on Khaya trees	96	28.3	242	71.7	338	100
9	I have interest in receiving more training and information on pest management of the tree	282	83.3	56	16.7	338	100
10	Insect pest control is affected by climate, information and economy	231	68.3	107	31.7	338	100

Results further revealed that 36.7% of sampled respondents have received training and information on pest management of the tree and 28.3% are currently implementing measures to control insect pests. This suggests that there is a need for more training and information on pest management of the trees. However, 83.3% of respondents are interested in receiving more training and information on insect pest management of the tree. This suggests that there is willingness among respondents to learn more about pest management and to take steps to protect the trees from insect pests.

Overall, the results provide some insights into level of awareness of sampled respondents on pest issues of mahogany plant. It indicates lack of awareness about insect pests that attack mahogany trees and their management. However, there is willingness among sampled respondents to learn more about pest management and to take steps to protect the trees from insect pests.

Challenges Faced in Insect Pest Control of Mahogany Tree

Results in Table 3 show the rating of challenges faced by sampled respondents in insect pest control of mahogany trees. The most critical challenging aspects of pest control of mahogany are changes in prevalence or severity of insect pests (3.47) that suggests that pest population is constantly changing making it difficult to control, wide host range of the pests (3.17) which means that they can also attack other plants making it difficult to isolate mahogany trees for treatment, seasonal variation in pest abundance (3.25) causing pest population to fluctuate depending on time of the year making it difficult to predict when and where treatment is needed or where/when pest will attack, cost of pesticides/chemicals to control pests (4.25) being a major challenge for many farmers as cost of pest control can be high and limited availability of information on pest identification and management (3.10) which makes it difficult for farmers to learn how to effectively control pests.

This finding can be used to develop pest control programs for mahogany by addressing most critical challenges of pest control to enable farmers effectively protect mahogany trees from pest attack.

Table 3: Rating of challenges faced in insect pest control of mahogany tree

S/N	Indices	Score	Ratio	Mean
1	Changes in prevalence or severity of insect pests on mahogany trees	1155	0.683	3.47
2	Insect pests have wide host range apart from mahogany tree	1053	0.623	3.17
3	Abundance of pests of mahogany can vary seasonally	1082	0.640	3.25
4	Have adequate knowledge in identifying and managing insect pests of mahogany tree	946	0.560	2.85
5	Concern about impact of insect pests on mahogany tree	997	0.590	3.00
6	Cost of pesticides/chemicals to control insect pest	1414	0.837	4.25
7	Information source is limited	1031	0.610	3.10
8	Pest can be difficult to identify	918	0.543	2.81
9	Pest can be resistant to pesticide	1020	0.603	3.07

Other challenges identified in the study are also significant, but they are not as severe as those listed above, and they include concern about impact of insect pests on mahogany

(3.00) whereby farmers are concerned about damage that insect pests can caused. This damage can range from minor defoliation to death of tree. Pests can be difficult to identify (2.81) thereby making it difficult for farmers to control insect pests without proper knowledge of their biology and ecology. This can lead to more severe pest attacks. Having adequate knowledge in identifying and managing insect pests of mahogany tree (2.85) means that there is need for proper identification of insect pests at any point in time to prevent use of wrong control measures that can lead to severe outbreak. Pests are resistant to pesticides (3.07) which means that pests have evolved to be able to withstand effects of pesticides, thereby making it more difficult to control them. Therefore, these results suggest that pest control poses a significant challenge to farmers, and these challenges are varied and complex. However, understanding these challenges, an appropriate and effective pest control strategy can be developed to help protect the species.

Ways to Resolve Insect Pest Problems on Mahogany Tree

Results in Table 4 present different ways suggested by sampled respondents to address insect pest infestation on mahogany trees. The result showed that 51.1% of the respondents believed that most effective way to solve insect pest of mahogany is the use of chemicals/pesticides, 11.7% depends on experts/extension agents, 10.6% agreed on planting of improved/resistant varieties, 8.3% of the respondents believed in the use of integrated pest control, 6.7% aligned with the use of silvicultural practices and removal of infested plants, while 5% agreed on the use of biological control. The high percentage of respondents agreeing on use of chemicals/pesticides is likely due to the fact that they are quick and effective way to kill insect pests. However, they can also be harmful to environment and to human health. Similarly, the high opinion for consultation with experts/extension agents highlights importance of professional advice when dealing with insect pests. Other methods such as silvicultural practice, planting of improved/resistant varieties, integrated control, measures removal of infested plants and biological control are all effective, sustainable and environmentally friendly. The highlights of above findings according to majority of sampled respondents is that use of chemicals/pesticides is the most effective way to solve insect pest problems of mahogany trees, and that there are other less harmful methods which can be used in a sustainable manner.

Table 4: Way to resolve insect pest problems on mahogany tree

S/No.	Ways to Resolve Insect Pest Problems	Frequency	Percent
1	Silvicultural practices	23	6.7
2	Planting of improved/resistant varieties	36	10.6
3	Removal of infested plant	23	6.7
4	Integrated pest control	28	8.3
5	Use of chemicals/pesticides	172	51.1
6	Biological control	17	5.0
7	Consultation with experts/extension agents	39	11.7
	Total	338	100

Rating of Factors for Managing Insect Pest of Mahogany Trees

Result in Table 5 shows rating of various factors for managing insect pest of mahogany trees. Each factor was rated on a given score, ratio and mean value based on its

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effectiveness. The factors were ranked in descending order of their mean scores. The top three factors are maintenance of health trees through proper agricultural practices (3.75), use of traditional/cultural practices (3.28) and planting of improved/resistant mahogany plants (3.25). These factors were highly ranked because they are the most effective and sustainable ways to manage insect pest population. Traditional/cultural practices have been used for centuries to control insect pests, and they are often effective based on understanding of pest biology and ecology. Planting of improved/resistant varieties can also be an effective way to reduce pest damage, as these varieties are less susceptible to pest attack. And maintaining health tree through proper agricultural practices will help create an unfavourable environment for pest development thereby reducing pest incidence or damage on the trees. Following these are other factors such as consultation with an expert in crop protection (3.25), local collaboration and knowledge sharing among farmers (3.08) and use of biological control strategies to reduce insect pest population (3.07). These factors are also important because it will help farmers have a better understanding of insect pest, reduce insect pest population in a more sustainable way, shared information among themselves and get valuable information and advice on effective insect pest management strategies.

Table 5: Rating of factors for managing insect pest of mahogany tree

S/N	Factors	Score	Ratio	Mean
1	Activities of local extension services/agents	958	0.567	2.83
2	Effective use of traditional/cultural practices	1110	0.657	3.28
3	Workshop demonstration and networking by research institutes with local farmers	930	0.550	2.75
4	Local collaboration and knowledge sharing among cooperative farmers	1042	0.617	3.08
5	Planting of improved variety and resistant mahogany plants	1115	0.660	3.30
6	Consultation with an expert in crop protection	1082	0.640	3.25
7	Use of chemicals/pesticides in an eco-friendly manner	1031	0.610	3.05
8	Introduction of biological control to keep down pest population	1020	0.603	3.07
9	Adequate knowledge and understanding of pest life cycle	1031	0.610	3.05
10	Maintenance of health trees through proper agricultural practices	1268	0.750	3.75

However, factors such as use of chemicals/pesticides in an eco-friendly manner (3.05), local agricultural extension services/agents (2.83) and workshop and networking by research institutes with local farmers (2.75) were ranked low because they are less effective and unsustainable. Though, local extension services/agents and research institutes can play a role in educating farmers about pest management, but they are often not well-funded or well-staffed. Similarly, workshop demonstrations can be an effective way to share information, but they can be expensive and time-consuming to organize. Likewise, use of chemical control in an eco-friendly manner can be difficult and expensive, and it can also have negative environmental impacts. Therefore, the above findings show that there are a number of effective and sustainable ways to manage insect pest populations of mahogany. These factors should be prioritized by farmers and pest management professionals.

CONCLUSION

This study assessed level of awareness of insect pest of mahogany in Sabongari LGA of Kaduna State, challenges faced by farmers and ways these problems are resolved. It was observed that there is lack of awareness about insect pests of the trees and their management

in the study area. Lack of awareness of insect pests can have a number of negative consequences such as damage to the trees, reduction in their productivity and value, difficulty in insect pest control and spread of insect pests to other areas. Therefore, raising level of awareness of insect pests and management practices will help to protect these trees from insect pests and ensure they continue to provide valuable benefits to people and the environment. Farmers should be educated about importance of pest management and various methods of controlling them. Hence, awareness campaign, improving and implementing various pest management strategies is essential for sustainability of this valuable species, and local community in Sabongari Local Government Area will better protect and utilize these trees for their economic and environmental benefits.

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