



ASSESSMENT OF INSECT PESTS ASSOCIATED WITH STORED SHEA NUTS AND THEIR MANAGEMENT PRACTICES AT IFEDAPO REGION IN OYO STATE, NIGERIA

*¹Ugwu, J.A., ² Kareem, K.T., ³Alabi, O. Y. and ²Odeyemi, O.O.

¹ Federal College of Forestry Ibadan, Forestry Research Institute of Nigeria, P.M.B.5087, Jericho Hills, Ibadan, Oyo State, Nigeria.

² Institute of Agricultural Research and Training, Obafemi Awolowo University, Ile ife

³Department of Crop Protection and Environmental Biology, University of Ibadan, Nigeria

*Corresponding author's email: dr.amaka2013@gmail.com

Abstract

Insect pests' infestation is a major biotic factor affecting the quality and quantity of many agricultural products in storage including shea nuts. A study was conducted to assess the insect pests associated with stored shea nuts in nine communities at Ifedapo region in Oyo state. A random sampling technique was used to obtain information from 135 shea nut farmers using structured questionnaire and samples of stored shea nuts were randomly collected from the study area for laboratory assessments. Majority of the respondents were female (76.0%) and 58.0% of the respondents indicated that they observe insect pests in stored shea nuts. Five insect's species (carpenter ants, weevils, beetles, mites and cockroaches) were commonly seen in stored shea nuts. Laboratory assessment revealed that insect infestation is a serious challenge to stored shea nuts. Insect infestations were observed in samples from the nine communities and stored shea nuts were mostly attacked by beetles and mites. Samples from Ago-are recorded the highest insect attack (58.6%), followed by Oje-owode (46.7%). None of the respondents applied synthetic insecticides to protect shea nuts from insect attack and the most common storage system adopted is bagging. There was negative correlation ($r = -0.064$; $p = 0.461$) between the impact of insect pests and income generation from shea nuts. Thus, insect damage is major problem to stored shea nuts in the study area and there is need to educate farmers on the available control strategies to protect their stored shea nuts against insect attack for maximum income generation.

Key words: Control strategies, income generation, insect infestation, storage, *Vitellaria paradoxa*

Introduction

The shea-nut tree, *Vitellaria paradoxa* (C.F.Gaertn) of Sapotaceae family is one of the major constituent of the woody plants of the Sudan and Guinea savannah vegetation zones of sub-Saharan Africa (Lovett and Hag, 2000). The shea nut tree is native to sub-Saharan Africa and are found usually in arid and semi-arid northern area of humid forest zones (Center for Agriculture and Bioscience International (CABI), 2003). The shea nut tree is one of the several non-timber trees that is economically important but its potentials as an economic tree are not widely documented in Nigeria (Ani *et al.*, 2012). The shea tree is not domesticated but it naturally grows in the wild and on farm lands and around homes. The tree was recommended among other trees like *Parkia* species as plant products priorities that requires funding for development because of its usefulness in tropical Africa (FAO, 1991). Shea tree has prospects in maintaining the ecological balance and soil fertility for agricultural purposes and can also provide good fuel wood both as energy for household use and source of income. Almost all parts of the tree have some practical uses, the bark, leaves and roots are used for medicinal purposes for curing various illnesses and the shell of the nuts can repel mosquitoes (Ani, 2012). The shea butter is extracted from the dried shea kernel and the oil is widely used for domestic purposes like skin moisturizer, cooking and as a lubricant (Lovett and Hag, 2000). At commercial level, shea butter is used as ingredient in pharmaceuticals, cosmetics and edible products (Abbiw, 1990). The shea tree fruits which has sweet and spicy flavor pulp provides several nutritional benefits to humans and animals such as elephants, sheep, pigs, bats and birds. It has been reported that shea fruits provides vital supports to the livelihoods of parkland communities (Okullo *et al.*, 2004; and Maranz *et al.*, 2004).

The most important product of shea tree is the shea butter which is extracted from the dried kernels. Shea butter is referred to as 'women's gold' owing to the benefits that women farmer obtain from shea processing and production and across the value chain to improve their livelihood (Chen, 2017). The vegetable fat from shea nut is considered the second to palm oil in Africa (Hall *et al.*, 1996; Bup *et al.*, 2014). Insect pests is one of the major biotic factors causing damage and reducing the quality of many stored products including shea nuts (Aneni *et al.*, 2020). It is estimated that 40.0-50.0 % of crops are lost to pests, diseases and poor storage system in many developing countries including Nigeria before they get to the market which is a threat to food security and income of farmers (Aneni *et al.*, 2020). According to Odebiyi *et al.* (2004), 33 insect species from 17 families were associated with shea tree in the moist wood land savanna, dry savanna and southern guinea savanna of Nigeria. The study by Aneni *et al.* (2020) revealed that three insect species were observed in stored shea nuts and the mites and beetles were the major insects causing damage on stored shea nuts in Niger state, Nigeria. There is dearth information of the insect pests of store shea nut and their management practices by farmer in Nigeria. Therefore, insect species associated with stored shea nuts were assessed and the management practices among farmers in nine communities of Ifedapo area in Oyo State were determined.

Materials and Method

Study Area

The field survey was carried out at Ifedapo region of Oyo state while laboratory study was conducted at Biology and Entomology Laboratory of Federal College of Forestry, Ibadan. Ifedapo region is located in the Northern part (savannah belt) of Oyo State, Nigeria. It comprises three Local Government Areas (LGAs) out of the 33 LGAs in Oyo State: Saki West (Saki town), Saki East (Ago-Amodu) and ATISBO (Tede) (Figure 1). It has an estimated land area of 6410km and is located in Oyo North Senatorial District of Oyo State and located between Latitude 8.5° North and Longitude 3.5 ° East (Akanmu, 2013). The area is endowed with favourable climate and vegetation which permit the luxuriant grasses and crop.

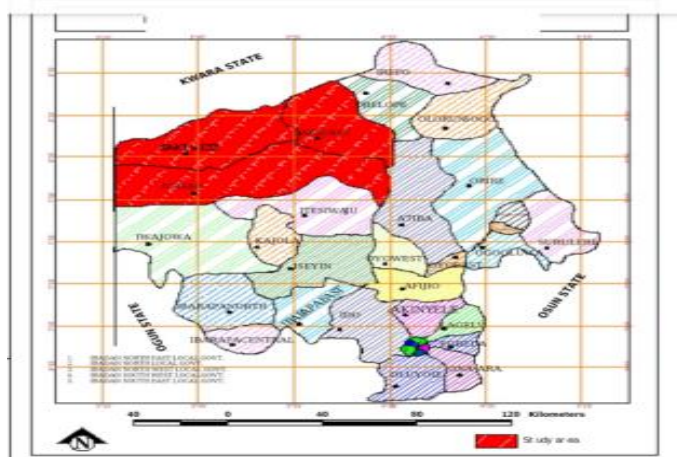


Fig 1: Map of Oyo state showing the study area

Sampling Technique and Data Collection

Three communities known for Shea nut production were purposely selected from each of the three LGAs in Ifedapo, Oyo State; Saki West (Ilua, Ago-oluwabi and Igbo-ologun), Saki East (Ago-amodu, Sepeteri and Oje-owode) and Atisbo (Tede, Irawo-owode and Ago-are). Structured questionnaire was used to collect data from respondents in the nine selected communities. Fifteen respondents were chosen from each community and a total of one hundred and thirty-five (135) questionnaires were administered and retrieved. Shea nuts were collected from the store at each community visited and were brought to the Biology and Entomology laboratory of Federal College of Forestry, Ibadan for insect pest infestations assessment. Laboratory assessment was done by close examination of all the shea nuts for signs of insect exit hole and larvae inside the nuts. Larvae samples collected were reared to adult for proper identification.

Data analysis

Descriptive and inferential statistics were used to analyze the data obtained from field survey while data from laboratory assessment of sampled shea nuts were subjected to analysis of variance and significant means were separated using Turkey's Honestly Significant Difference (HSD).

Results and Discussion

Socio-demographic characteristics of respondents

The socio-demographic characteristics of respondents in the study area are shown in Table 1. The results revealed that majority (76.3%) of the shea nut processors were female while 23.7% were male. The results of this present study corroborate earlier report by Al-Hassan (2012) that over 90.0% of shea nut processors in Ghana are women, while minor roles are played by men. The most active group of people involved in shea nut processing are within the ages of 46-55 years which represented 31.1% of respondents. This result corresponds with the study by Matanmi *et al.* (2011) who reported that over 80.0% of shea nut processors in Kwara State were above 40 years of age. About thirty-two percent (32.0%) of the respondents were not formally educated while 30.4% had primary education. This is in line with the report by Matanmi *et al.* (2011) who also accounted that most shea nut processors were not well educated. The low level of education of the respondents may contribute in their production output. According to (Tshivunza *et al.*, 2001), low level of education could affect the adoption of new practices among farmers such as improved processing methods and use of new technologies. Majority (80.0%) of the respondents in the study areas were married.

The result agrees with Matanmi *et al.* (2011) who reported that most shea nut processors were married. This could imply that shea nut processing could be regarded as a major domestic activity of married women in the study area. The percentage of divorce among the respondents in the study area was very low with only 8.9%. This could imply that shea trees are generally owned by men in the study area of which their wives are engaged in their processing activities with the permission of their husbands. According to Kipot and Franzel (2012), in matrilineal societies, the rights of women to their husbands' land, trees etc cease to exist upon divorce. Since the study area is a matrilineal society, the involvement of married women in shea nut processing indicated that only married women have access to shea trees belonging to their husbands. The results of this study further revealed that higher proportion (48.1%) of the respondents had household size of 4-6 people. This could imply that higher household size facilitates the shea nut processing than small household size. Similarly, Ani *et al.* (2012) reported that majority of the household size of shea nut processors in Benue state was 6 and above. Majority (61.5%) of the respondents were Muslims, follow by Christian with 33.3%, with few traditional worshipper of 5.2%. The study area is known to be dominated by Muslim religion, follow by Christians.

Table 1. The socio- demographic characteristics of the respondents in the study area

Socio-demographic characteristics	Frequency	Percentage
Sex		
Male	32	23.7
Female	103	76.3
Total	135	100
Age		
15-25	6	4.4
26-35	9	6.7
36-45	41	30.4
46-55	42	31.1
56 and above	37	27.4
Total	135	100.0
Education status		
No formal education	43	31.9
Primary education	41	30.4
Secondary education	42	31.1
OND/NCE	5	3.7
HND/University	2	1.5
Others	2	1.5
Total	135	100.0
Marital status		
Single	6	4.4
Married	108	80.0
Divorce	9	6.7
Widow/Widower	12	8.9
Total	135	100.0
Family size		
1- 3	10	7.4
4 -6	65	48.1
7 - 9	48	35.6
10 and above	12	8.9
Total	135	100.0
Religion		
Christianity	45	33.3
Islam	83	65.5
Traditional religion	7	5.2
Total	135	100.0

Source: Field survey, 2021

Shea butter production experience, patronage and profitability among respondents in the study area

The results of the shea butter processing experience, patronage, profitability and shea nut accessibility among the respondents in the study area is shown in Figure 2. The results revealed that 48.1% of the respondents had been involved shea butter production for 11-15 years, 24.4% had 16 years and above experience, 15.6% had 6-10 years experience, while 11.9% had 1-5 years experience. This result implies that the respondents were quite experienced in shea nuts/butter production in the study area. Majority

(85.2%) of the respondents in the study area indicated that Shea butter production business is highly profitable while 14.8% said it is not lucrative. The finding agrees with the report of Adams *et al.* (2016) that Shea nut processing is an important source of income earning for many women in Wa Municipality Ghana and a major source of income for some people in the region. Sixty (60.0%) of the respondents indicated that shea nuts /butter business are being patronized by foreigners while 40.0% indicated local customers (indigenes) patronize their business. Our findings agree with Akosah-sarping (2003) and Moore (2008) who reported that Shea nuts/butter are export products for the usage in cosmetics industry as a component in lotions, makeup, baby ointments, hair care products and soaps.

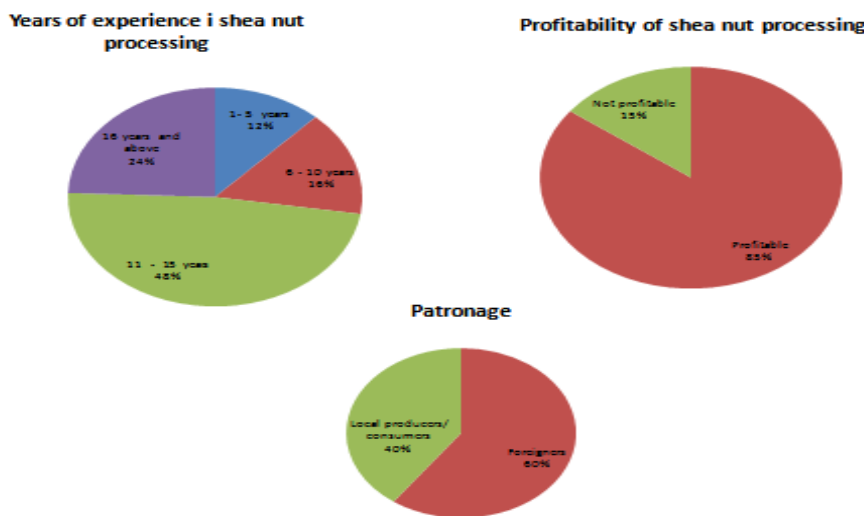


Figure 2. Shea nut processing experience, patronage and profitability in the study area

Estimated income generation from shea nut among farmers in the study area

Majority (62.2%) of the respondents generates monthly income of ₦16,000 - ₦35,000, About 17.8% of the respondents generates income of ₦36,000 - ₦45,000, 11.9% of the respondents generates above ₦46,000 while 8.1% of the respondents generates a monthly income of ₦5000 - ₦15000. This implies that shea nuts provides substantial income to members of the community. Only 5.2% of the respondents indicated that insect damage on stored shea nuts affect the price of the nut negatively by reducing the price during sales while 94.8% of the respondents indicated the insect damage on stored shea nuts do not affect the price of the shea nuts during sales (Figure 3).

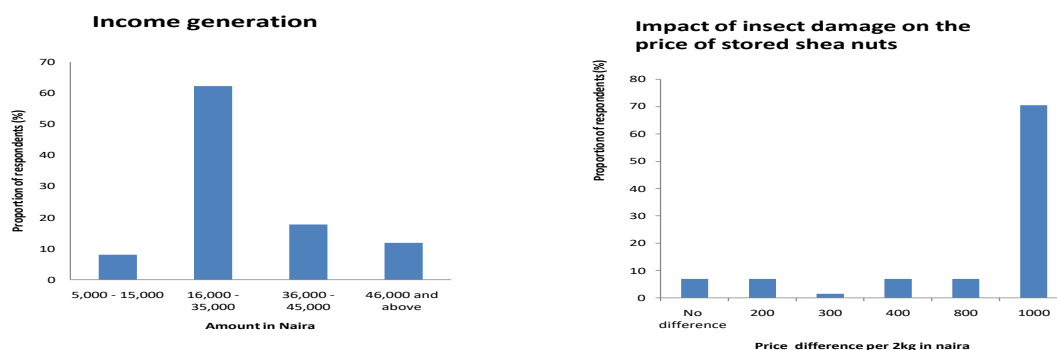


Figure 3 Income generation from Shea nuts and impact of insect damage in Ifedapo region

Shea nuts storage practices among the farmers in the study area

The result of the shea nuts storage practices among the farmers in the study area is presented in Table 2. Majority of the respondents (77.8%) stores their Shea nuts after purchase while 22.2% sells them immediately. The most common storage duration among 35.6% of the respondents was 9- 12 months, followed by 5-8 months (25.2%). Seventeen percent (17.0%) of the respondents stores shea nuts for about 13-16 months while 3.7% stores their Shea nut for 17 months and above. This result supports earlier report by USAID (2004) that shea nuts can be stored for several years by retaining their moisture content between 6.0% and 7.0%. Most respondents (88.1%) store their Shea nuts until the price increases and the demand is high but 11.9% store until they are able to get buyers for their product. This implies that the major reason for storing the shea nuts is to attract higher prices during the scarcity. A good number of the respondents (47.4%) stores their shea nuts in jute bags, 28.9% stores by exposing them in empty room, 11.1% stores in containers while 12.6% store using other means of storage like keeping them in raised platform in the kitchen. This implies that the most common means of storing shea nuts in the study area is bagging system on jute bags. This result is in line with report by FAO and CFC (2005) that in West Africa Jute bags from Cocoa industry are widely use for storing Shea nuts.

Table 2 Shea nuts storage practices among the farmers in the study area

Variables	Yes		No	
Storage options	Freq.	%	Freq.	%
Store	105	77.8	30	22.2
Sell immediately	30	22.2	105	77.8
Duration of storage				
1-4 months	25	18.5	110	81.5
5-8 months	34	25.2	101	74.8
9-12 months	48	35.6	87	64.4
13-16 months	23	17.0	77	83.0
17 months and above	5	3.7	130	96.3
Reason for Storage				
Store till you see customer	16	11.9	119	88.1
Store pending the time the demand is high and the price is increased	119	88.1	16	11.9
Method of storage				
Bags	64	47.4	36	26.6
Containers	15	11.1	120	88.9
Exposed in room	39	28.9	39	71.1
Others	17	12.6	118	87.4

Insect species associated with shea nuts and their management practices in the study area

The insect species reported to be associated with stored shea nuts by the respondents and management practices adopted by farmers in the study areas is presented in Table 3. The results revealed that five insect species namely; carpenter ant, weevil, mites, beetles and cockroaches are commonly observed on stored shea nuts. Majority of the respondents (79.3%) reported that carpenter ants is one of major insect species that are commonly observed on stored shea nuts while 21.7% decline that they do not observe carpenter ant on their stored shea nuts. About Forty -five percent (45.2%) agrees that they usually observe weevils on their stored shea nut while 54.2% did not observe weevil on stored shea nuts. More so, 64.4% of the respondents reported that they observe Beetles on stored shea nuts while 36.6% declined that they do not find weevil. Similarly, 64.4% of the respondents identified that mites attack stored shea nuts while 36.6% of the respondents declined. Above seventy percent (71.9%) of the respondents submitted that they found cockroaches in stored shea nuts but 28.1% declined. The results of this study is in line with recent report of Aneni *et al.*(2020) who reported that Weevils, Mites, Carpenter Ant, and Beetles were observed causing damage to stored shea nuts in Bida, Niger State. In contrast, cockraoches were not reported to be associated with stored shea nut, However, cockroaches are commonly found everywhere especially in dirty environments and warehouses. The study also revealed that hundred percent (100.0%) of the respondents in the study area do not use any form of chemical to protect their stored shea nut from pest damage. However, 85.1% of the respondents submitted that they sundry shea nuts properly before storage while 14.9% do not sundry. Furthermore, 71.9% of the respondents sort their shea nut before storage by separating the good ones from the bad ones as a means of protecting the stored shea nut from pest damage during storage but 28.1% do not sort their shea nuts before storage. Also, 62.2% stores their shea nuts in a cool and dry place but 37.8% do not consider the storing environment. The results of this study is in line with the report by Aneni *et al.* (2020) who reported that proper drying of shea nuts before storage prevent pest attack.

Table 3. Insect species associated with stored shea nuts and their management practices in the study area

Name of the insect pests	Yes		No	
	Freq.	%	Freq.	%
Carpenter ant (Formicidae)	107	79.3	28	21.7
Weevils (Curculionidae)	74	54.2	61	45.2
Beetles	87	64.4	48	36.6
Mites	87	64.4	48	36.6
Cockroach	97	71.9	38	28.1
Pest Management practices				
Application of chemical pesticide to protect the shea nut from pest attack	0	0.0	135	100.0
Storing the infested shea nut separately	97	71.9	38	28.1
Keeping of shea nut in cool and dry place	84	62.2	51	37.8
Sun drying the shea nut properly s before storage	115	85.1	20	14.9

Source: Field survey, 2021

Observed insect damage on shea nuts by laboratory assessments

The results of the laboratory assessments on the sampled shea nuts revealed that insect pest attack stored shea nuts (Figure3). All the samples collected from different study sites showed signs of pest infestation at varied rates. Samples from Ago-are recorded highest (58.6%) insect pest infestation signs on shea nuts, followed by Oje-owode with 47.6%, while the lowest was Irawo-owode (13.7%). There was significant variation on the percentage infestation of shea nuts collected from different location,

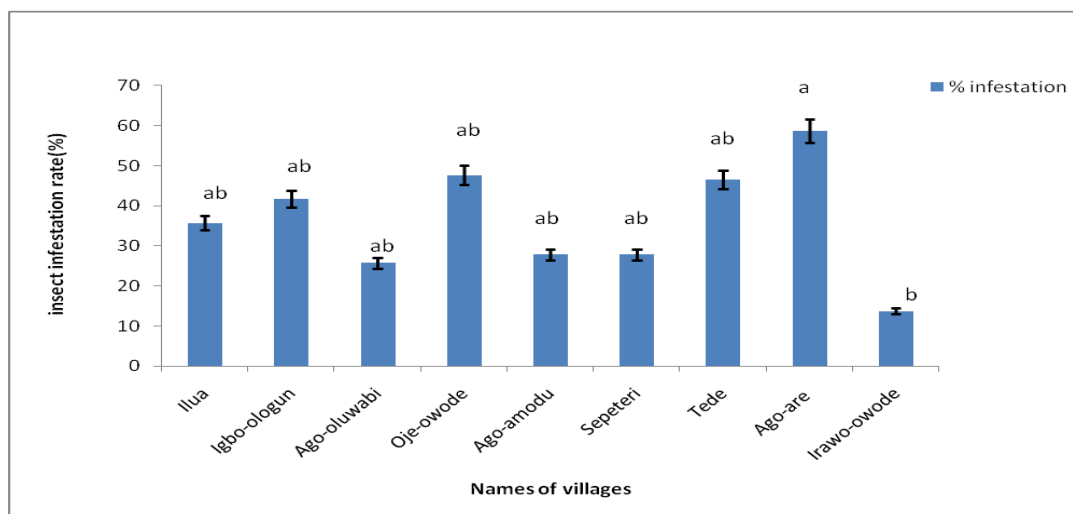


Figure. 4 Observed insect damage on shea nuts collected from the study area

Correlation between pest damage on stored shea nuts and income generation of farmers

Pearson correlation analysis revealed a negative relationship between the impact of pest damage and the cost of shea nuts (Table 7). The results revealed that there is negative relationship between impacts of insect pest attack on income generation of farmers on stored shea nuts with r value of -0.064 and P value of 0.461. As the incidence of insect pest infestation increases, the income generation decreases as it negatively affect the prices of the infected shea nuts. This result implies that there is need for the farmer in the study area to employ pest control measures to protect stored shea nuts from pest damage.

Table 4 Relationship between insect damage on shea nut and income generation of farmers

Variable	P	R
Income generation Vs	0.461	-.064

Infestation of insect pest damage

Source: Field survey, 2021

Conclusion

The study revealed five insect species associated with stored shea nuts in the study area. The laboratory assessment showed that insect pests are major problems affecting stored shea nuts in the study area. However, the respondents did not relate insect pest damage as a major problem affecting their shea nuts in storage. The pest control measure for insect damage and shea nut storage facilities is very poor in the study. The study revealed that shea nuts are mostly stored in bags and they do not apply any pest control measures to protect their stored shea nuts from pest attack. There is negative relationship between the impact of insect pests damage and income generation of shea nuts farmers.

Recommendations

- ◆ Farmers should be trained on how to apply control measures to mitigate the problem of insect pests associated with stored shea nuts.
- ◆ Farmers should be trained on strategies for preserving their shea nuts in storage to minimize pest infestation.
- ◆ Adequate storage facilities should be provided by Government or NGOs to the shea nuts farmers in other to maximize their income generation.
- ◆ Further studies are required to assess the impact of insect pests on the quality of shea butter produced in the area.

References

- Abbiw, D. K. (1990). Useful plants of Ghana, West African uses of wild and cultivated plants. Intermediate Technology Publications and The Royal Botanic Gardens, Kew, London. pp. 66-67.
- Adams, A.M., Abudulai, I. and Motin Bashiru, M. (2016). The Shea Industry and Rural Livelihoods among Women in the Wa Municipality, Ghana. *Journal of Social Science Studies* 23, (2) 40-56.
- Akanmu, A. A. (2013). Appraisal of Agricultural Freights Transportation in Saki Area of Oyo State, Unpublished M.Sc. dissertation, Olabisi Onabanjo University, Ago-Iwoye, Nigeria.
- Akosah-Sarping, K. (2003) Demand for West Africa's Shea butter in cosmetic industry In: *West Africa Review*. 4 (1).
- Al-Hassan, S. (2012). Market Access Capacity of Women Shea Processors in Ghana. *European Journal of Business Management* 4(6).
- Aneni, T. I., Adaigbe, V. C. Eziashi, E. I., Esiegbuya, O. D. (2020). Insect Pest Management of Post Harvest Shea Fruits in Storage. *International Journal of the Science of Food and Agriculture*, 4(3), 330-337. DOI: 10.26855/ijfsa.2020.09.013.
- Ani, D.P., Aondona, G. and Soom, A. (2012). Economic Analysis of Shea Butter Plant in Ukum Local Government, Benue State, Nigeria. *American-Eurasian Journal of Agronomy* 5 (1): 10-18.
- Bup, D.N.; Mohagir, A.M.; Kapseu, C.; Mouloungui, Z (2014). Production Zones and Systems, Markets, Benefits and Constraints of Shea (*Vitellaria paradoxa* Gaertn) Butter Processing. *OCIL Oilseeds Fats* 21, D206.
- Center for Agriculture and Bioscience International (CABI) (2003). Introgression from genetically modified plants into wild relatives and its consequences, ed./H.Nijis; D. Bartsch.
- Chen, T. (2017). Impact of the Shea Nut Industry on Women's Empowerment in Burkina Faso; A Multi-Dimensional Study Focusing on the Central, Central-West and Hauts-Bassins regions; Food and Agriculture Organization of the United Nations (FAO): Rome, Italy.
- FAO (1991). Non wood forest products: the way Ahead, Forestry paper, pp: 97.
- FAO and CFC. (2005). International Workshop on Processing and Marketing of Shea Products in Africa. Proceeding of a Workshop held by the Food and Agriculture Organization of the United Nations, the Common Fund for

- Commodities and the Centre de suivieécologique; Technical Paper no. 21. CFC (Netherlands), Dakar (Senegal).
- FAO.(2007).Corporate Document Respiratory. Minor oil crops <http://www.fao.org/docrep/X5043E/x5043E0b.htm>. Retrieved on 23.3.2007.
- Hall, J.B., Aebischer, D.P., Tomlinson, H.F., Osei-Amaning, E., Hindle, J.R.(1996). *Vitellaria paradoxa*: A Monograph; School of Agricultural and Forest Sciences; University ofWales: Bangor, UK, ; 105p.
- Lovett, P. N. and Haq, N. (2000). Diversity of shea nut trees (*Vitallaria paradoxa* C. F. Gaertn.). In Ghana. *Genetic Resources and Evolution* 47: 293-304.
- Kipot, E. and Franzel, S. (2012). Gender and Agroforestry in Africa: A Review of Women Participation. *Agroforestry Systems*. Vol 94(1): 35-58.
- Matanmi, B.M., Adesiji G.B., Olasheinde E.M andOladipo F.O. (2011). Assessment of Usage of Upgraded Shea Butter Processing Technology by Women Processors in Kwara State, Nigeria *Agrosearch*. www.ajol.info/index/agrosh/artucle/view/75054.
- Maranz, S., Kpikpi, W., Wiesman, Z., Sauveur, A., D., Chapagain, B. (2004). Nutritional Values and Indigenous Preferences for Shea Fruits (*Vitellaria Paradoxa* C.F. Gaertn. F.) in African Agroforestry Parklands. *Journal of Economic Botany*, 58(4): 588-600.
- Moore, S. (2003). The role of *Vitellaria Paradoxa* in poverty reduction and food security in the Upper East region of Ghana. In: *Earth & Environment* 3: 209-245.
- Odebiyi, J. A., Bada, J. A., Omoloye, A. A., Awodoyin, R. O., and Oni, P. I. (2004). Vertebrate and insect pests and he-mi-parasitic plants of *Parkia biblobosa* and *Vitellaria paradoxa* in Nigeria, *Agroforestry Systems* 60: 51-59.
- Okullo, J., B., L., Hall, J., B., Obua, J. (2004). Leafing, flowering and fruiting of *Vitellaria paradoxa* subsp. *nilotica* in Savanna parklands in Uganda. *Agroforestry Systems*, 60, 77-` 91.
- USAID. (2004). Shea butter value chain, production transformation and marketing in West Africa. WATH Technical report No.
- Tshivunza, M.; Lemchi, I. J. and Uloma, O. (2001).Factors influencing the spread of cooking banana processing methods in Nigeria.*Tropicultural* 19 (2): 90-96.