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Research Article

Indigenous Utilization and Control of Termites (*Macrotermes bellicosus*) by Farmers in Zuru Local Government Area, Kebbi State, Nigeria

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Abstract

In addition to being destructive pests, termites are also used by many African communities as food, medicine, livestock feed, soil amendment. In this study, termites (Macrotermes bellicosus) and mound products were recorded as being used by the local people and compared the effectiveness of the traditional and modern termite control methods among the farmers in Zuru Local Government Area (LGA) of Kebbi State, Nigeria. A descriptive survey research design was adopted and the sample size was 120 respondents drawn in six villages of the 32 villages in Zuru LGA using the multistage sampling technique. The structured questionnaire was used to collect data which was analyzed using frequencies and percentages. The results indicate that 87.5% of the farmers regularly consumed winged termites (24.17%) - mainly fried and 30% roast for good taste and cultural tradition (26.67%) while 27.5% used them medicinally. 85.83% of the farmers used termite mound soil for uses such as construction materials (44.17%), fertilizer (30.83%) and remainder for other uses while 79.17% biomass termites for livestock feed. Eighty eight (88.33%) of the farmers practised termite management, the most used was chemical pesticides (35.83%) while the traditional methods were physical (26.67%), cultural (19.17%), biological (10%) and botanical (8.33%) and most farmers learned about them from their elders (66.67%). The high cost of chemicals (36.67%) and environmental concerns (22.5%) were the most important challenges reported and 85.83% of the farmers indicated that they were willing to learn improved methods. The study ends on the conclusion that the termites are valuable multipurpose resources in Zuru and sustainable utilization of termites together with Integrated Pest Management (IPM) approach is recommended, which is a combination of effective use of chemicals with strengthening of indigenous practices.

Keywords: *Indigenous knowledge; termite utilization; termite control; Macrotermes bellicosus; Integrated Pest Management.*

INTRODUCTION

In addition to their harmful effects on crops, termites are also used in a beneficial way in a number of African societies, in food provision, medicine, animal nutrition and soil improvement (Netshifhefhe *et al.,* 2018). Seasonal collection of winged alates of Macrotermes spp. is used as a nutritious source of high protein content (32-77% dry weight), rich in essential amino acids, fats and minerals, and helps to combat malnutrition in rural communities (Cheseto *et al*., 2024). Roasted or fried Macrotermes bellicosus alates are eaten as snacks or food supplements in Nigeria especially by children and pregnant women (Anyiam *et al*., 2022). The termite mound soils are higher in organic carbon, N, P and cation-exchange capacity, and are extensively used as soil amendments in poor quality farmlands throughout the region (Jouquet *et al.,* 2017). In Africa, farmers with limited resources rely heavily on traditional farming practices as their main line of defense against pests and diseases, which are synthetic pesticides that are harmful to the environment and human health (Abebe, 2024). Other methods include wood ash, shea butter and toad in Bauchi (Nigeria); mounding followed by the use of salt, neem-leaf extract, and smoking in Benin; and the use of plant species like Kigelia africana, Vernonia amygdalina and Tithonia diversifolia as botanical anti-termitic agents in Uganda (Hassan and Disina, 2020; Loko *et al.,* 2015; Okori *et al*., 2022).

However, excessive use of synthetic pesticides harms the environment, poses health risks and leads to resistance in the termite population (Khan and Ahmad, 2018), while traditional practices like termaleates consumption or the use of mound soil are not always considered, thus limiting the opportunities for sustainable benefits (Loko *et al*., 2017). There has been a recent trend in the literature towards Integrated Pest Management (IPM) using indigenous knowledge to lower the use of chemicals and achieving sustainable outcomes (Abebe, 2024). But the indigenous utilization and comparative data on effectiveness of control are still limited in Zuru LGA. Hence, the present study recorded the utilization of M. bellicosus and the product of their mounds in Zuru LGA; farmers traditional and modern termite control practices and the effectiveness of such practices.

MATERIALS AND METHODS

Study Area

The study was carried out in Zuru Local Government Area (LGA) of Kebbi State in the north western part of Nigeria between latitude 11°25'N to 11°45'N and longitude 4°50'E to 5°15'E and encompassing about 653 km2 (2006 census). The LGA is a part of the Sudan-Sahel agro-ecological zone, with a semi-arid climate and an annual rainfall of 700-1,000 mm, and a temperature range of 28-35°C (up to 40°C), which is conducive to termite mound-building and foraging (Jouquet *et al.,* 2017). The vegetation is savanna type and cellulose rich substrates (such as Acacia spp., shea butter trees) provide termite habitat. More than 80% of the population engaged in small farmer agriculture, Lelna (Dakarkari), Hausawa and Fulani are the major ethnic groups and their subsistence agriculture is greatly influenced by indigenous knowledge systems.

Research Design and Sampling

A descriptive survey design with both quantitative and qualitative approach was used (Creswell and Creswell, 2018). All six districts of Zuru LGA were purposively selected because of the reported termite incidence with the understanding that all the villages within these districts would be sampled. One village was randomly selected from each district and the farmers in each village were randomly sampled using the help of the village heads as guides giving a total of 120 farmers for sampling from six villages of Zuru LGA which are Semi Yala, D'koto, Rafin Mose, Amanawa, Tajaye and Elembelu.

Instrument and Data Collection

The data in this paper were derived from Section C of the structured 'Farmers' Perception and Indigenous Utilization of Termites Questionnaire' (FPIUTQ) which seeks to capture termite control practices and effectiveness (8 items) as well as Section D, which inquiries about indigenous utilization of termites (11 open/closed questions), and supplemented by semi-structured interviews with 12 key informants (KI) (elder and extension agents from each district) (Hassan and Disina, 2020; Creswell and Creswell, 2018). It was translated into C'lela/Hausa and culturally tested in a pilot study. The data was taken at dry season for three months (February-April 2026) using face-to-face technique with audio recording for three months (30-45 minutes) after the consent of the respondents.

Method of Data Analysis

Data were analysed using descriptive statistics — frequencies and percentages — with results presented in tables, consistent with the analytical approach adopted in comparable studies (Loko *et al*., 2017; Hassan and Disina, 2020).

Ethical Considerations

Data collection was carried out with the consent of the village heads and community leaders, informed consent was obtained from all respondents, and participation in the study was voluntary, no personal identifiers were collected (Creswell and Creswell, 2018).

RESULTS

Termite Control Practices and Effectivene

Table 1: Termite Control Practices and Effectiveness (n = 120)

Variable	Frequency	Percentage (%)
Practice termite control: Yes	106	88.33
Method used: Chemical	43	35.83
Method used: Physical	32	26.67
Method used: Cultural	23	19.17
Method used: Biological	12	10
Method used: Botanical	10	8.33
Perceived most effective: Chemical pesticides	78	65
Perceived most effective: Physical methods	15	12.5
Perceived most effective: Cultural methods	13	10.83
Control timing: When damage appears	65	54.17

Major challenge: Cost of chemicals	44	36.67
Major challenge: Environmental concerns	27	22.5
Major challenge: Lack of knowledge	22	20.83
Learned indigenous methods from elders	80	66.67
Rated indigenous methods effective/very effective	53	44.17
Rated indigenous methods less/not effective	60	50
Willing to learn improved methods: Yes	103	85.83

Source: Field survey, 2025.

As shown in table 1, 88.33% of the farmers had termite control programmes in place, but the practices and the effectiveness of these varied. The most widely adopted chemical pesticide (35.83%) was the most effective pesticide (65%), because of its quick action. The traditional methods that were found to be widely used but least effective were physical (26.67%), cultural (19.17%), biological (10%) and botanical (8.33%). Control was mostly reactive, as 54.17% of the farmers controlled only when injury was observed. The most significant issues were the cost of chemicals (36.67 %), environmental issues (22.5 %) and the lack of knowledge (20.83 %). The predominant sources of learning indigenous methods were from elders (66.67%) with only 44.17% rating them as effective while 65% rated chemicals as effective. Despite this, 85.83% of farmers agreed to the need to learn better ways to control pests, which showed a positive attitude towards Integrated Pest Management (IPM).

Indigenous Utilization of Termites

Table 2: Indigenous Utilization of Termites (n = 120)

Variable	Frequency	Percentage (%)
Consumption of winged termites: Regular	29	24.17
Consumption of winged termites: Occasional	64	53.33
Preparation: Fried/roasted	82	68.33
Reason for consumption: Good taste	36	30
Reason for consumption: Cultural tradition	32	26.67
Reason for consumption: High nutrition	25	20.83
Use of termites for medicine: Yes	33	27.5
Use of termite mound soil: Yes	103	85.83
Mound soil purpose: Building materials	53	44.17
Mound soil purpose: Fertilizer	37	30.83
Mound soil purpose: Medicine	18	15
Use of termites as livestock feed: Yes	95	79.17
Sale of termites: Yes	29	24.17
Rating of utilization: Important/very important	73	60.83
Belief termites should be conserved: Yes	63	52.5
Willing to receive training on management: Yes	98	81.67

Source: Field survey, 2025.

Multipurpose use of Macrotermes bellicosus is recorded in table 2. A combined 87.5% of farmers consumed winged termites occasionally (53.33%) to regularly (24.17%), primarily for good taste (30%) or cultural tradition (26.67%), which were mainly fried or roasted (68.33%). 27.5% of farmers used it for medicinal purposes. The use of termite mound soil was very high, 85.83%, mostly for making building materials 44.17% and fertilizer 30.83%, reflecting the farmers' belief (see companion paper) that termites enhance soil fertility. Livestock feed use was high (79.17%) and 24.17% of the farmers sold termites for income. More than half (52.5%) indicated that the conservation of the termite was desirable, with 81.67% willing to be trained in termite management, suggesting this species could be utilised in addition to controlled.

DISCUSSION

The control practices that were carried out varied significantly in method and perceived effectiveness, with 88.33% of farmers practising control. Chemical pesticides were found to be the dominant pesticides (65% of respondents) and were tagged as the most effective pesticides because of their quick action, as reported by Hassan and Disina (2020) in Bauchi, Khan and Ahmad (2018) in Pakistan, and Shindi *et al.* (2022) who stated that chemicals are preferred for rapidness across sub-Saharan Africa. But, high cost (36.67%) and environmental concerns (22.5%) reduces their usage over a long period, which is also reported by Beyene and Kenea (2022) and Forschler (2011). Traditional practices such as physical (mound destruction, queen removal), cultural (crop rotation, early planting, sanitation, intercropping), biological (introduction of fire ants, other predators, such as underground seeding of neem seed pods) and botanical (neem-leaf extract, wood ash) practices were common and were mostly learnt from elders (66.67%), which agrees with Hassan and Disina (2020), Loko *et al.* (2017) and Abebe (2024). However, the use of these methods was less effective than the use of

chemicals, which is in line with Beyene and Kenea (2022), and Sileshi *et al.* (2009), who found that the efficacy of botanicals like neem varied with the method of preparation. The majority of respondents selected reactive control (54.17%) which occurs when damage is observed, and this decreases the overall efficacy as warned by Forschler (2011) in the IPM literature. The high level of willingness to learn new methods (85.83%) suggests high receptivity to IPM approaches that are effective and sustainable, using native methods (Forschler, 2011; Tambo and Wünscher, 2018). Indigenous use was diverse in purpose and broad in use. 87.5% of the farmers consumed the winged termites in their fried or roasted form, as they are a good nutritional source for human consumption during a specific season, probably due to their nutritional value as reported by Netshifhefhe *et al.,* (2018) in South Africa, Cheseto *et al.,* (2024) and Siddiqui *et al.,* (2023) who reviewed edible termites as food with good nutritional value, and Khadijah et al. (2024) who further confirmed the edible alates value for the food industry during this specific period. Ethno-medical knowledge in Kenya as reported by Netshifhefhe *et al*., (2018) and Abebe (2024) shows that medicinal use of termites, especially the alates and queen, by 27.5% of farmers to cure ailments like malnutrition, anaemia, and infertility and use of mound soil for curing inflammation, confirms medicinal use. Of the 85.83% of farmers using termite mound soil, the majority used it for building materials (44.17%) and fertilizer (30.83%) which corroborates results of Jouquet *et al*., (2017) and Mugerwa *et al.* (2011) who found that the soil of termite mounds contains high concentrations of clay, organic matter, nitrogen, phosphorus and potassium, while Nkurunungi *et al*., (2025) documented termite mound soil use for fertilizer in Uganda. Another indicator of the integration of termites into farming systems was their use as livestock feed, with 79.17% reported by Mali *et al*., 2018 in Uganda. The fact that 52.5% of the farmers felt that termites should be preserved despite the damage to the crops indicates the farmers' realization of the importance of ecosystem services which is in line with the suggestions of Silesi *et al.,* 2009, who recommended the incorporation of ethno-ecological knowledge into the sustainable use of termites. This is a dual role as both pest and resource, which undermines the concept of "blanket" eradication in favour of management based upon a species-specific and a selective approach.

CONCLUSION

Farmers in Zuru LGA are great users of termites as multipurpose resources since 87.5% of them consume it for food, 27.5% for medicine, 85.83% for building materials and fertilizer and 79.17% as livestock feed; and a little income was obtained from its sale (24.17%). A high level of termite control is practiced (88.33%), mainly the chemical pesticide as perceived as most effective, but indigenous methods (66.67% learned from elders) are also practised, but to a lesser degree and reactively. Limited resources for chemicals and environmental issues are limiting sustainable control, but farmers are very interested (85.83%) in learning better approaches. The findings suggest that the strategy of termite management in Zuru should shift from eradication to species specific Integrated Pest Management (IPM) technique that will reduce crop damage and still sustain the beneficial use of Macrotermes bellicosus.

RECOMMENDATIONS

Based on these findings, it is recommended that:

i) Government and non-governmental organizations should promote sustainable harvesting and utilization of winged termites or reproductive forms and termite as food, feed and termite mounds organic fertilizer
ii) Farmers should be train on Integrated Pest Management which combines effective and economically-threshold, with improvement in traditional methods which were already learned from elders.
iii) Extension services should actively discourage reactive spraying and encourage preventive cultural practices
iv) Further experimental research be conducted in order to scientifically evaluate the efficacy of indigenous termite-control.

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