



## ASSESSMENT OF TERMITES ATTACKS ON BUILDING IN ONDO STATE, NIGERIA

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### ABSTRACT

*This study was to determine the severity and prevalence termite attack and to provide adequate preventive and remedial measures against its attack on buildings. Preliminary data on indigenous knowledge of termite infestation and mitigation on buildings in Ondo state were collected and analyzed. Data was collected using structured questionnaire, interview schedule; focus group discussion (FGD) and personal observations. Across Ondo state, a total of 400 houses were randomly inspected with 79.5 % building were attacked of which 36.2% severely attacked. Result shows further that education and monthly family income of house owners affects their management strategy of termite infestation before and after building. Furthermore, 21% and 67% of the respondents used bio-preservatives and synthetic chemicals respectively against termite attack.*

**Keyword:** Termites, Bio-preservative, Indigenous knowledge, built environment, Ondo State

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### INTRODUCTION

The world's temperate, tropical, and subtropical climates are all home to various termite species; a social insect and ecosystem engineer, with tropical forests having the most diversity (Eggleton, 2000; Wako, 2015). Termites attack structural timbers in building such as roofs, window frames, and door frames. Furniture and other household items like clothing and books are not left out in the advent of termite infestation on buildings (Owoyemi, 2008; Tagbor, 2009). The annual economic losses based on termite infestations are estimated to be in the billions of dollars worldwide (EPA, 2017; Ye *et al.*, 2004). However, due to the difficulty in gathering such information from builders and homeowners, it is difficult to gather information on costs associated with termite damage specifically for many developing countries. Numerous studies have described preventive and corrective techniques to control building termites around the world, but

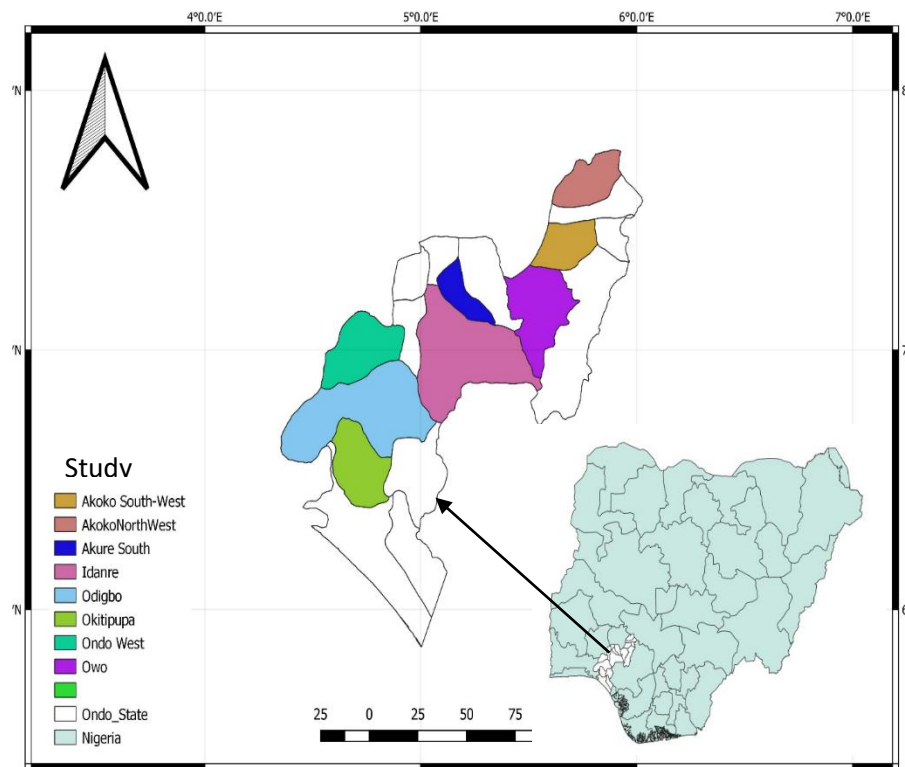
little is known about how home owners in Nigeria manage termite infestations on their buildings and their level awareness of termite control in their homes. In Nigeria, using wood for building purposes directly without initial drying and preservative treatment is common practice among builders and home owners (Emmanuel and Owoyemi, 2018; Owoyemi and Olaniran, 2014). However, when people choose to use preservatives, they buy chemical preservatives on the merchant's advice without consulting with experts in this area to know what chemicals will be effective or applicable for their buildings (Emmanuel and Owoyemi, 2018). Solignum and spent engine oil applied to wood as a preventative measure have not completely stopped termites from attacking buildings (Ugbomeh and Diboyesuku, 2019). Furthermore, pressure impregnation treatments of wood are far more effective than the brushing and soaking methods commonly used in Nigeria for wood treatment.

Nevertheless, cost of repairs or replacement of damaged timber structures by homeowners in Nigeria have led to a greater understanding of the significance of termite damage to buildings. Therefore, there needs to be a concerted effort by builders, homeowners, and the government through advocacy to end the financial loss due termite activities on the built environment. In order to establish a baseline of knowledge about the indigenous knowledge of building owners in Ondo state on the management of termites' infestation of their buildings, this study aims to assess the prevalence of termite's infestation on buildings in Ondo state and the indigenous knowledge of building owners in managing termite's infestations.

## MATERIALS AND METHODS

### Study Area

This study was carried out in Ondo State, Nigeria (Fig.1). It lies between latitude  $5^{\circ} 45'$  and  $8^{\circ} 15'$  North and longitude  $4^{\circ} 45'$  and  $6^{\circ} 15'$  East of the tropics. The State is bounded in the North-West by Ekiti State, West-Central by Osun State, South-East by Ogun State, South-East by Delta State and in the South by Atlantic Ocean. The climate is tropical with two distinct seasons, the rainy season, (April-October) and dry season (November – March) with slight variations from year to year. The annual rainfall varies from 1,150mm in the northern parts to 2,000mm in the south. The State generally enjoys luxuriant vegetation. The vegetation consists of coastal forest and mangrove swamp forest in the south, moist lowland forest, and the savannah in the north (ODSG, 2010).



**Figure 1: Map of the study area**

The survey was carried out using structured questionnaire, interview schedule; focus group discussion (FGD) and personal observations. Information of interest and which were included in the instruments were on the age of the house,

what type of treatment given during the course of infestation, and grading of the damage such as mud tubes, mound, and wood damage. The instruments were validated by homeowner and pre-tested at Akure, using respondents who do

not form part of the final sample for the study. The pre-testing was very useful as it enabled the instruments to be revised such that redundant questions were removed, while vital questions that were previously omitted were included.

### **Sample size**

The sample size was determined using the following procedures; sixteen local governments out of eighteen in the state were purposely selected for study. The selected local governments fall into the savannah (6) and rainforest (10) ecological zone of the state. Fifty percent (50%) of the local governments were chosen from each ecological zone, that is savannah (3) and rainforest (5) ecological zone. Five community were chosen from each selected local government, making it 40 communities. Ten household per community were randomly selected. In addition, a total of 400 houses were randomly assessed for termite infestation based on visual observation of signs such as termite mud tubes on the walls, pores in walls, damaged parts such as roofs, windows and door frames, wood in walls, and wooden furniture among others. When a house is found infested, its condition will be recorded according to Debelo and Degaga (2014) as:

**Collapsed:** a highly damaged house, which is collapsed or had wood completely eaten out causing the collapse of the supported structure. Pieces of wood in the premises and wooden fences were also inspected for those houses which had wooden fences.

**Severely attacked:** windows, door frames, some of the woods in walls and/or roofs eaten out completely, and windows and/or door frames cut off or slanted;

**Moderately attacked:** woods, walls, windows and door frames, roofs, or woods supporting roofs have been partially eaten, but not completely;

**slightly attacked:** only mud tubes on walls, roofs, windows and door frames, and mounds (nests) at the base of walls and inside houses without any sign of damage or little damage;

**No attack:** no presence of mud tubes on walls, roofs, windows and door frames, and mounds (nests) at the base of walls and inside houses.

The content of the questionnaires includes the age of the house and roof, preconstruction preventive methods and post construction control measures used by the homeowner, type of wood used, resistance level of the wood to termites, what type of chemical/plant extract treatment given during the cause of infestation, and grading of the damage such as mud tubes, mound, and wood damage. The data collected from the questionnaire survey were analysed with the use of SPSS to obtain the frequency distribution and chi-square to test the level of significance and correlation to determine the relationship between variables.

### **RESULT**

The result of demographic characteristics of the respondents presented in Table 1 shows that the male gender has the highest with 55.25 % while the major age group is 40-59 years with 59 % and also the family size of 5-12 has 59 %. Furthermore, Yoruba is the major ethnic group with 97.5 %, the majority of the respondent is educated up to secondary level with count of 39.5%, the major occupation of the respondent is farming and monthly family income is in the range of #21,000-39,000. The result of the Chi-square test is presented Table 2 the result of the effect of education on the roof management strategy before and after termite infestation of the building. It revealed there was a significant association with the Pearson Chi-Square Sig. value (0.000) is lesser than 0.05. This revealed that education level of house owners affects how they manage termite infestation before and after completing their buildings. Also, the effect of education level of respondents and the strategies employed by building owners on management of buildings against termite infestation had no significant association with the Pearson Chi-Square (P-value = 0.131, greater than 0.05). Hence, the education level of house owners does not influence how they manage timber in their buildings against termite infestation. The result further showed that the effect of building types did not significantly determine if termite infestation will occur in a building. Additionally, result showed the effect of building ages on

termite infestation. It revealed there was significant association ( $p$  value less than 0.05) between the ages of buildings and termites' infestation of buildings in Ondo State. Also, the distribution of the rate of termites' attack on sampled buildings presented in Figure 2 showed that 2.3% of the attacked building were collapsed, 36.2% were severely attacked, 16.1% were

moderately attacked, 26.5% were slightly attacked, while 18.9% of the building had no sign of attack. The result of area of the buildings attacked (Figure 3) showed that door frames, roof trusses, window frames, ceiling, kitchen cabinet and wall, walldrope, furniture, bathroom walls 58.5%, 56.3%, 51.8%, 45.5%, 42.5%, 17.3%, 15.8%, 11.3% and 4% respectively figure 3.

**Table 1: Demographic Characteristics of the Respondents**

Demographic Characteristics		Total	Percentage (%)
Sex	Male	221	55.25
	Female	179	44.75
	Total	400	100
Age	20-39 years	38	9.5
	40-59 years	236	59
	60-79 years	118	29.5
	>80 years	6	1.5
	Total	398	99.5
Family Size	<4	46	11.5
	5-12	236	59
	>13	118	29.5
	Total	400	100
Ethnic group	Hausa	2	0.5
	Yoruba	390	97.5
	Igbo (Ibo)	5	1.25
	Others	3	0.75
	Total	400	100
Education	No Formal	81	20.25
	Primary	50	12.5
	Secondary	158	39.5
	Tertiary	111	27.75
	Total	400	100
Occupation	Trading	93	23.25
	Farming	119	29.75
	Civil Servant	85	21.25
	Artisan	93	23.25
	Not Disclose	10	2.5
	Total	400	100
Income	< #20,000	16	4
	#21,000-39,000	152	38
	#40,000-59,000	146	36.5
	#60,000-79,000	36	9
	#80,000-99,000	18	4.5
	>100.000	32	8
Total	400	100	

**Table 2: Summary of tests for associations**

Association Pair	df	Pearson Chi-Square
Building type*termite infestation	4	0.293 <sup>ns</sup>
Age of building* termite infestation	<b>10</b>	0.000*
Family income*management of roof in building before termite infestation	30	0.000*
Family income*management of roof in building after termite infestation	30	0.000*
Family income*management of other wooden building materials before termite infestation	5	0.002*
Family income*management of other wooden building materials after termite infestation	5	0.218 <sup>ns</sup>
Indigenous Knowledge*Management of termite infestation in Building	12	0.000*
Education*Roof Management Strategy before termite Infestation of the Building	18	0.000*
Education*Roof Management Strategy after termite Infestation of the Building	18	0.000*
Education* other wooden building materials before termite Infestation of the Building	3	0.131 <sup>ns</sup>
Education* other wooden building materials after termite Infestation of the Building	3	0.131 <sup>ns</sup>

\* = Values less than 0.05 are significant, ns = Not significant

The results in Figure 4 represent how the building owners use bio preservatives in the treatment of their buildings' wooden materials against termite infestation. It shows that 21% of the respondents used bio-preservatives and 79 % does not use bio-preservatives in the treatment of their building's wooden materials against termite infestation. Likewise, the use of plant leaves as bio preservatives (figure 6) showed that 35 of the respondents uses *Azadirachta indica* leaves extract as preservatives, 20 uses *Euphorbia tirucalli*, 14 uses *Vernonia amygdalina* and *Datura metel* respectively, 6 uses *Nicotiana tabacum*, and 3 uses *Ocimum gratissimum* leaves extract as preservatives. Furthermore, figure 5 revealed that 15% of the respondent that uses bio-preservatives uses *Pakia biglobosa* seed water against termites' attack. The result of the use of Synthetic Chemicals as management of termite attack is presented in table 3, it shows that 33% of the respondent do not use Synthetic Chemicals to treat their wood before and after attack by termite while other respondent 5%, 21%, 9% and 16% uses Sniper, Soligium and Gammalin – 20, spent engine oil respectively.

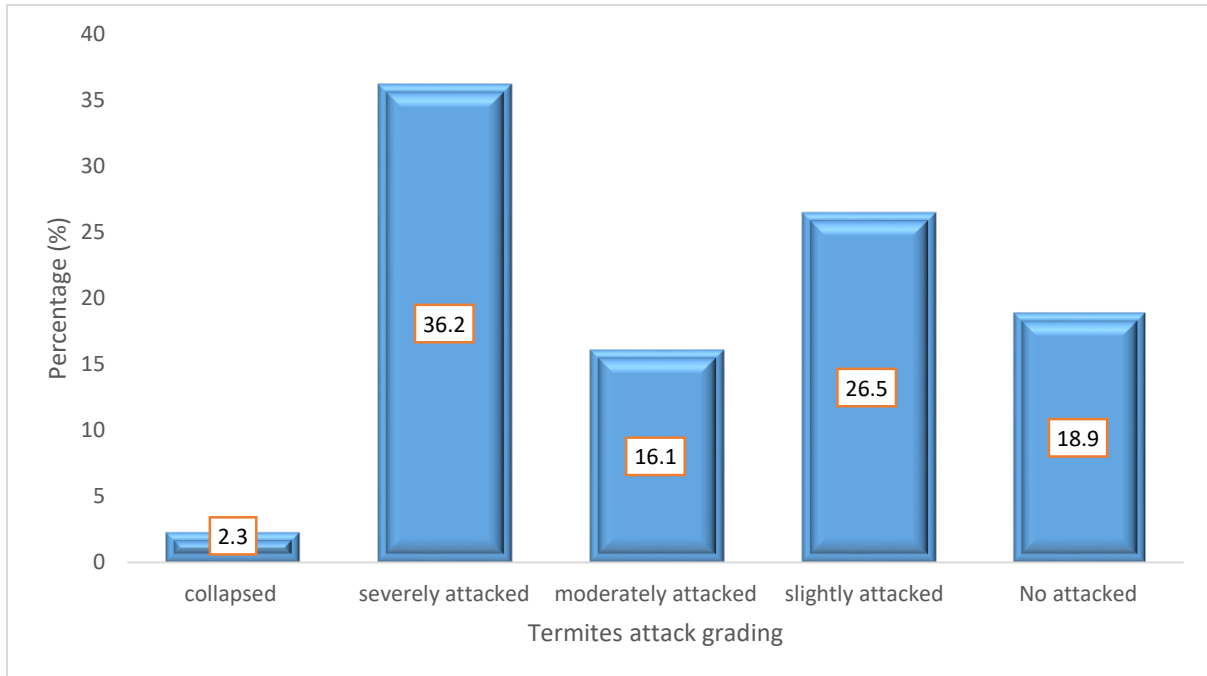


Figure 2: Rate of termites Attack to building

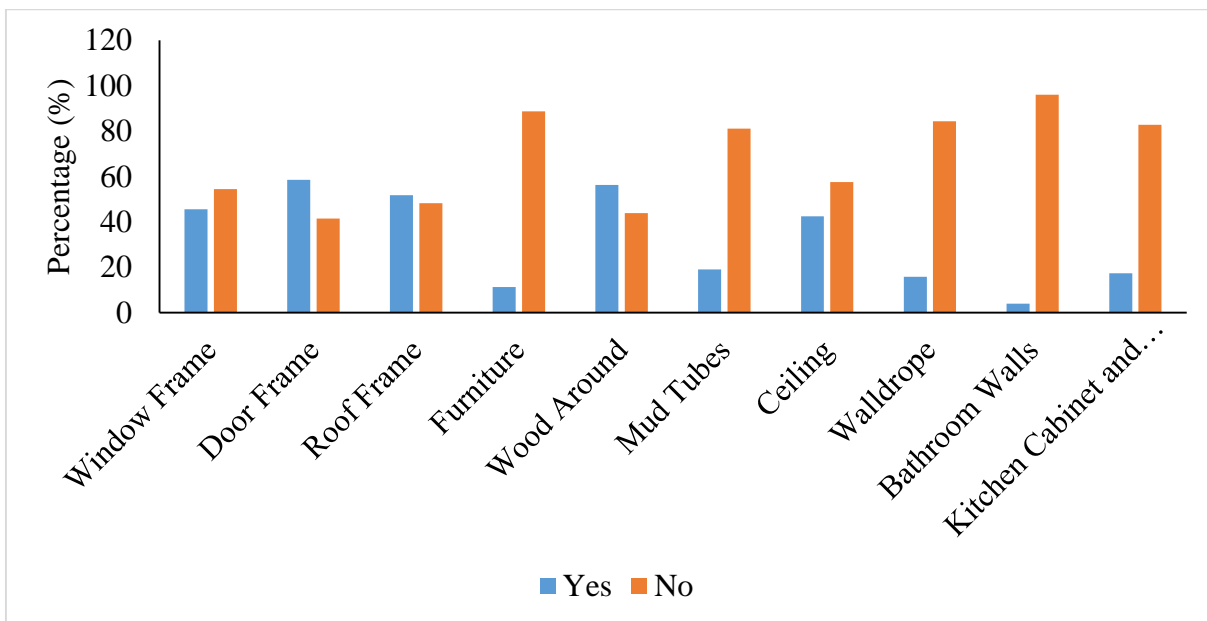


Figure 3: Area of termite attack in the building

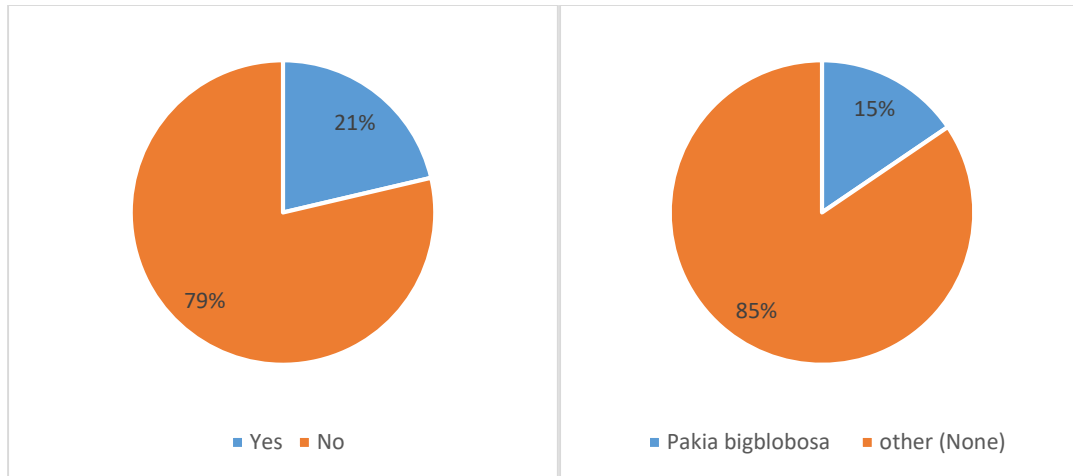


Figure 4: The use of bio preservatives

Figure 5: The use of seed as bio preservatives

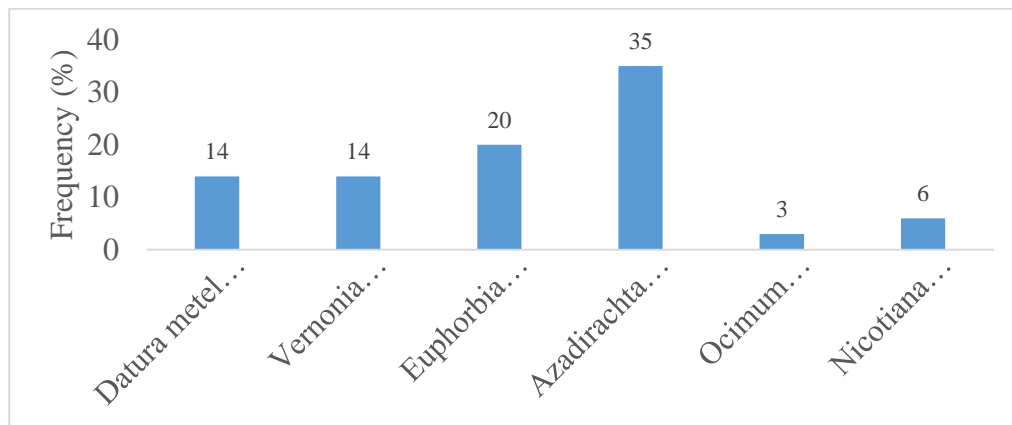


Figure 6: The use of plant leaves as bio preservatives

Table 3: The use of synthetic chemicals as management of termite attack

Synthetic Chemicals	Percent (%)
Sniper	5
Soligium	21
Gammalin – 20	9
Taurus SC	4
Kerosine	1
Paraforce	2
DD Force	1
Pest off	1
Spent engine oil	16
Spectracide	1
Termidor foam	1
Raid	2
Adrex 40	1
Termiguard	1

Rocket	1
None	33
<b>Total</b>	<b>100</b>

**DISCUSSION**

The findings of this indicated that the age of a building does influence if termites will attack it or not. This gives a possibility that buildings can be attacked by termites as long as there is an available food source, which in this case can be untreated wood used in any part of the building. Another factor that may predispose a building to attack by termites at any point in the building life can be inadequate removal of dead woods and other ligno-cellulosic materials before constructing the foundations. It was found in this study that building damage ratings for samples houses ranged from 2.3% of collapsed buildings

to 36.2% that were severely attacked by termites, and onward to 16.1% of buildings that were moderately attacked by termites, 26.5% of buildings that were slightly attacked, and 18.9% that were not attacked at all by termites. Furthermore, the outcome of this study has shown that the type of building has no effect on how termites attack it. This indicates that no building is completely immune from termite attack especially if the needful in terms of adequate treatment of timber used in the building is not done. The results of the assessment of the effect of education on the management of termite infestation of the building before and after the attack shows that education of respondents influenced how they manage timber used in roof construction against termite infestation before and after building constructions. Furthermore, monthly family income of building owners affects the management of timber used in roof construction before and after building their houses. This could be because of the possibility that many of the building owners are medium or low-level income earners who have struggled to build the houses to give them a shelter to live in; while the few who are wealthy may be able to afford the service of professional fumigators or wood treatment for regular maintenance of the building. Another pattern that can be observed in the result is that a vast proportion of the respondents uses some synthetic chemicals and spent engine oil, while 33% did not use the synthetic chemicals. Some of the respondents based on their indigenous knowledge uses plants/seed extracts from various plant species including *Azadirachta indica*, *Euphorbia tirucalli*, *Vernonia amygdalina*, *Datura metel*, *Nicotiana tabacum* and *Ocimum gratissimum* leaves extract (Figure 6). Previous studies have shown that plant extracts used by the respondents are effective in resisting termite attack. For example, Sotannde *et al.* (2011) reported that *Azadirachta indica* Leave extract was effective against termites' attack compare to other plant extract used in their study. Also, Olufunmilayo *et al.* (2020) agreed that a mixture of extracts of *Nicotiana tabacum* and *Azadirachta indica* offered the best protection to the treated wood

blocks against termite attack. Furthermore, Okanlawon *et al.* (2023) submitted that *Datura metel* plant has the potential of being a good bio-preservative against termites. Bobmanuel (2020); Ojianwuna and Enwemiwe (2021), further submitted that *Ocimum gratissimum* could repel and limit the destructive activities and economic losses caused by termites. Several authors others have reported effectiveness of plant extracts in the control of termites (Okechukwu *et al.*, 2020; Ekhuemelo *et al.*, 2017a; Ekhuemelo *et al.* 2018; Ekhuemelo *et al.* 2017b; Agbidye *et al.*, 2020; Ekhuemelo *et al.*, 2020; Ekhuemelo and Musa, 2015).

In general, that the proportion of house that were not attacked by termites was low (18.3%), and the survey has shown that more than 60% (Table 3) of the respondents uses synthetic chemicals and spent engine oil could only mean either that the chemicals used were not very effective against termites or that users of those chemicals lack the right knowledge about the concentration that should be used. For example, Ugbomeh and Diboyesuku (2019), asserted in their work that wrong applications, use of fake Solignum, or termite resistance to the effect of the Solignum and other chemicals have rendered them ineffective. This is an indication that more studies are required on finding more effective control measures against termite attack in the study area.

## CONCLUSION

The knowledge about the safe-use of wooden materials in an environment is of utmost importance to builders as this will serve as a guide in adopting precautions and appropriate construction technology that will preserve the integrity of wood in service. This study clearly proved termites' presence across Ondo state with its rate of severity of attack on many buildings sampled. However, regardless of the level of severity in any of the locations, wood should be treated with preservative to guarantee all season protection and also integrated pest management (IPM) practice should be adopted in termites control management.



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