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WOOD-BORING INSECTS FROM ZARIA.

*MBAH, C.E. & CHAGBE, S. A.

Department of Biological Sciences, Ahmadu Bello University
Zaria, Nigeria.
*drcemba@yahoo.com

ABSTRACT
A total of 697 wood-boring insects subsumed under two Orders: Isoptera and Hymenoptera; three families: Formicidae, Apidae and Termitidae; and nine species were collected using sweep net, bark-scraping and hand-picking methods (Youdeowei, 1977). The most abundant were the ants 491(77.45%), while the least were carpenter bees 10(1.43%). Four species of ants – *Camponotus maculatus* Fab., *C. vestitus* Smith., *Pheidole liengmei* Forst and *Pheidole* sp. acting as a group or in conjunction with other wood-borers attacked and destroyed *Azadirachta indica* Juss, *Albizia lebbeck* (Linn.) Benth.,*Senna siemea* Lam and *Delonix regia* (Boj. Ex. Hook) Raf. Comparison of wood-borers from different sample sites showed no significant difference between insect species collected.The Carpenter bees *Xylocopa inconstans* Friese drill numerous holes into "Obeche" timber *Triplochiton scleroxylon* Schum due to repeated infestation while termites belonging to *Macrotermes bellicosus* Smeathman and *Odontotermes* sp. destroyed the neem tree *Azadirachta indica* Juss and *Eucalyptus camaldulensis* Dehnh used as poles for electric power transmission. Recommended control methods for wood-boring ants is the application of Maxforce® granular stomach poison that allows insects to bring the bait back to the nest to destroy the whole colony including the queen. Timbor® and Cyonara® are recommended for killing termites and carpenter bees respectively in the short-term while insect-borer resistant trees like *Khaya senegalensis* and *Isoberlina doka* should be planted to replace damaged or destroyed trees as a long-term measure.

Keywords: insects, wood-borers, Zaria

INTRODUCTION

Wood-boring is carried out by many insects either to obtain food or as a means of protecting their eggs, larvae and pupae. Many insects and a few other invertebrates are wood-borers. Some of them obtain both sustenance and shelter from the wood, while others use it only as their habitat. Certain species attack only living trees, others are found mainly in freshly felled or dying trees; a few infest only dry woodland, while others attack only old moist wood. Those that attack trees and fresh logs frequently bore and live in the inner bark for a variable period of time, before they penetrate the wood. They also can be considered to be inner back borers. Some insects that attack only freshly killed or felled trees can survive and develop slowly in dried wood. Therefore these species often continue boring into wood that has been dried and processed (Anderson, 1960).

Many insects feed and make their homes in the bark, trunk, and branches of shade trees, shrubs, porches, garages, shade ceilings, trims, railings, roof overhangs, dead wood and outdoor wooden furniture. Insect-borers including bark beetles belong to several different insect groups including a variety of Coleoptera (beetles), Lepidoptera (moths) Hymenoptera (bees, wasps, ants), Trichoptera (Caddis flies), Isoptera (Termites) and Ephemeroptera (Mayflies).These insects damage plants by tunneling through the inner-bark layer (cambium) into the sapwood (xylem) that transports nutrients and water to the leaves. When the cambium layer is completely girdled, the plant eventually dies above or beyond the damage site. On occasion, tunneling makes the tree weak causing trees and branches to fall. Killing of trees or plants therefore is usually the result of heavy, sustained feeding on the leaves, twigs or rots by concentrated boring in the inner bark cambium-phloem region or by boring in the growing tips (Metcalf, 1962).

Insect-borers attack a wide range of agricultural, ornamental, landscape and forest trees. Wood-boring insects are particularly problematic because injury is not generally noticed until extensive damage has occurred, which makes effective management of these pests difficult. Relatively little is known about the general biology and behavior of many species of insect borers. In addition, comparatively little research has been conducted on the relationships between wood-borers and their host plants. Borer infestations often go unnoticed until plants or parts of plants begin to die or show external signs of damage (Erteld *et al.,* 1964).

Wood remains a major raw material for furniture manufacturing in Nigeria despite the relatively recent incursion of plastic, glass and aluminum. Also, wooden furniture manufacturing remains a major source of employment generation in the country (Olorunisola, 2000). Abdullahi (1999) reported that the furniture industry alone represents about 80% of the wood-based industries in the country. It is also the most widely distributed of all wood-based industries in the country.

Wood-borers constitute the greatest threat to timber and timber products, even more than other factors combined (Beal, 1981). Desch, (1981) states that the destructive tendencies of borers reduce the value and quality of wood as construction and decorative material due to the destruction of the qualities and properties of the wood that make it valuable. A number of insects attack seasoned or partly seasoned lumber mill. The finished timber product is also threatened by termites and other woodborers (Wood, 1978). A worrisome fact about insect destruction of wood is that there is no stage of development that is free of their attacks. There is an array of insect's injuries at one particular time or the other (Ashiru, 1996).

Despite concerted efforts to control the activities of wood-boring insects, their damage has been on the increase over the years, partly because, there are diverse kinds of insects which are able to adapt to any kind of habitat where there is wood and due to the differences in their boring activities. There is therefore a need for a fresh look at the varieties of insects causing damage to economic trees and timber wood.

MATERIALS AND METHODS

Methods employed in the collection of insects for this study were some of the ones outlined by Oldroyd (1958), Little (1972) and Youdeowei (1977) using Sweep netting found suitable for catching butterflies, moths, beetles, bees and other flying insects.

The barks of trees were scrapped with a pen knife to collect insects that live under the tree barks. Some insects such as ants, termites, were collected using this method.

Collected insects were killed in a killing jar made by placing cotton wool soaked in chloroform into wide mouth glass container.. After killing, the insect specimens were preserved either by pinning in the case of adults or in liquid preservative of 70% alcohol and a few drops of glycerin for immature stages.

Wood samples were identified at the Department of Silviculture, Savannah Forestry; tree samples and insects were identified in the Department of Biological Sciences, Ahmadu Bello University

Herbarium and Museum. Analysis of variance (ANOVA) was used to compare the various species of insect found in different sites.

RESULTS

A total of 697 wood-boring insects were collected from September to November 2008. They were subsumed under two Orders, Isoptera and Hymenoptera; three families Formicidae, Apidae and Termitidae and nine species (Table 1).

Relatively few groups of insects were collected. The larger groups of wood-borers encountered were the *Pheidole sp*, *Pheidole liengmei* Forst. and *Camponotus maculatus* Fab.and *C. vestitus* which were found quite frequently. *Pheidole sp* had the highest population of all the insects collected 170 (24.39%) Table 1. The least of the wood-boring insects encountered was *Xylocopa inconstans* Friese 10(1.43%).

The Order Hymenoptera consists of the families Formicidae and Apidae while the Order Isoptera had only one family Termitidae. The order Hymenoptera was mainly represented by ants while the Order Isoptera are the termites. The family Formicidae had the highest number of species 5 (55.56%) and the family Apidae had the least number 1 (11.11%) Table 1.

TABLE 1. RELATIVE ABUNDANCE OF WOOD-BORING INSECTS AND WOODS/ TREES ATTACKED IN ZARIA.

Species	Number collected (%)	Woods/Trees Attacked
Camponotus maculatus Fab	100(14.35)	*Azadirachta indica* Juss. *Albizia lebbeck* (Linn.) Benth
Camponotus vestitus Smith.	83(18.91)	*Azadirachta indica* Juss.
Macrotermes bellicosus Smeathman	42(6.03)	*Azadirachta indica* Juss.
Odontomachus sp	33(4.73)	*Azadirachta indica* Juss. *Albizia lebbeck* (Linn.) Benth
Odontotermes sp	76(10.90)	*Eucalyptus camaldulensis* Dehn
Pheidole sp	170(24.39)	*Senna siemea* Lam. *Delonix regia* (Boj. Ex. Hook) Raf. *Albizia lebbeck* (Linn.) Benth
Pheidole liengmei Forst.	138(19.80)	*Senna siemea* Lam.
Xylocopa inconstans Friese.	10(1.43)	*Triplochiton scleroxylon* Schum
Macrotermes nigeriensis Sjostedt	45(6.46)	*Senna siemea* Lam.
TOTAL	**697**	

It was observed that the various wood-borers attacked different types of wood and trees. Some trees were attacked by more than one species of wood-boring insect. Wood like *Triplochiton scleroxylon* (Plate 7) was used as hand rails and fascia boards, *Eucalyptus camaldulensis* (Plates 5) was used as electric pole. *Azadirachta indica* (Plate 4) was a dead tree while the others were living trees. *Triplochiton scleroxylon* was attacked by *Xylocopa inconstans* Friese, *Eucalyptus camaldulensis* was damaged by *Odontotermes* sp, *Delonix regia* was destroyed by *Pheidole sp* while *Senna siemea, Albizia lebbeck* and *Azadirachta indica* were attacked by two or more wood borers. It was observed that *Pheidole* sp attacked more woods than any other insect species encountered Table.1.

The Order Hymenoptera was found to have the highest number of species recorded 5(55.56%) in all the sites. The family Formicidae recorded the highest number of species while the family Apidae recorded the lowest number of species.

Site A accounted for the highest number of species 5 (55.56%) while sites C and D had the lowest number of species with 2 species each (22.22%), Tables 2 and 3.

Despite these differences, when the result was subjected to statistical analysis using one way ANOVA to compare the species in the various sites, there was no significant difference ($p > 0.05$) between the species of insects collected from the four sites.

TABLE 2. WOOD-BORERS FROM DIFFERENT SITES IN ABU MAIN CAMPUS, SAMARU ZARIA, NIGERIA.

SITE	SPECIES
Area A, Botanical Garden Dam Area (A)	*Camponotus maculatus* Fab. *Macrotermes bellicosus* Smeathman *Odontomachus sp* *Pheidole sp* *Odontotermes sp*
Faculty of Science, Faculty of Education and ICSA/ Ramat Hostel (B)	*Xylocopa inconstans* Friese. *Pheidole sp* *Camponotus maculatus* Fab.
Faculty of Social Sciences, Faculty of Medicine and Danfodio Areas (C)	*Pheidole liengmei* Forst. *Macrotermes nigeriensis* Sjostedt
New Gymnasium, DAC, Areas BZ, F and G (D)	*Odontotermes sp* *Camponotus vestitus* Smith.

DISCUSSION

Investigation into the activities of wood-boring insects in Zaria incriminated pests belonging to two Orders: Hymenoptera and Isoptera and three families (Formicidae, Apidae and Termitidae). Altogether, nine species were involved. Ants (Hymenoptera) were the most abundant that attacked and destroyed four species of wood and trees either as a group or in conjunction with other wood-borers.

TABLE 3. MONTHLY DISTRIBUTION OF WOOD-BORERS (SEPTMBER TO NOVEMBER, 2008).

MONTH	SITE A(%)	SITE B(%)	SITE C(%)	SITE D(%)	TOTAL
September	122(57.44)	128(73.14)	110(62.50)	104(68.87)	464(66.57)
October	48(24.62)	17(9.71)	52(29.55)	30(19.87)	147(21.18)
November	25(12.82)	30(17.14)	14(7.95)	17(11.26)	86(12.34)
Total	195	175	176	151	697

Site A: Area A, Botanical Garden and Dam Area,
Site B: Faculty of Science, Faculty of Education and ICSA/ Ramat Hostel,
Site C: Faculty of Social Sciences, Faculty of Medicine and Dan Fodio Areas,
Site D: New Gymnasium, DAC, Areas BZ,F and G.

PLATE 1. *Senna siemea* ATTACKED BY *Pheidole liengmei* FORST

PLATE 2. *Albizia lebbeck* ATTACKED AND DESTROYED BY ANTS *Pheidole sp*

PLATE 3. *Delonix regia* ATTACKED BY *Pheidole sp.*

PLATE 4. *Azadirachta indica* JUSS ATTACKED AND DESTROYED BY *Camponotus maculatus* FAB. *Camponotus vestitus* SMITH,*Odontomachus sp* AND *Macrotermes bellicosus* SMEATHMAN

PLATE 5. ELECTRIC POLE FROM *Eucalyptus camaldulensis* DEHNH. ATTACKED AND DESTROYED BY TERMITES *Odontotermes sp.*

PLATE 6. *Senna siemea* ATTACKED BY *Macrotermes nigeriensis* SJOSTEDT

PLATE 7. PAINTED WOODEN HAND RAIL FROM *Triplochiton scleroxylon* SCHUM ATTACKED AND DESTROYED BY *Xylocopa inconstans* FRIESE

Pheidole liegmei Forst attacked *Senna siemea* Lam (Plate 1). *Pheidole* sp. attacked and destroyed *Albizia lebbeck* (Plate 2) and the stem of *Delonix regia (*Plate 3). *Camponotus maculatus* Fab. and *C. vestitus* Smith (Carpenter ants) in conjunction with other wood-borers attacked and destroyed *Azadirachta indica* Juss (Plate 4).

The dominance of ants is probably because they find food and suitable habitat for breeding. Ankre & Hansen (1990) found that ants attacked Cotton wood, Soft maple and flowering stone fruits in Texas. A research on urban pest ants in the United States indicated that colonies of ants that attack wood are first established in pre-existing cavities, usually in faulty or rotten wood, and then expand into both rotting and undamaged adjacent wood (Smith, 1965). Klotz *et al.,* (1995) also found that infestation of Florida carpenter ants account for approximately 20% of all ants' complaints by home owners. The dominant insect Order was the Hymenoptera. This order has been considered to be the most beneficial because it contains many parasites, predators or injurious insects as well as the most important pollinators. The Hymenopterans constitute the greatest threat to woods and trees in Florida (Klotz *et al.,* 1995).

Four species of termites attacked and destroyed woods and trees. *Macrotermes bellicosus* attacked *Azadirachta indica* Juss. *Odontomachus* sp. attacked both *Azadirachta indica* and *Albizia lebbeck* (Linn.) Bentham. *Odontotermes* sp. attacked *Eucalyptus camaldulensis* Dehnh (Plate 5), while *Macrotermes nigeriensis* Sjostedt attacked *Senna siemea* Lam (Plate 6). This is in agreement with Sands (1962) and Malaka (1996), who reported the damage caused by termites to *Delonix regia*, *Azadirachta indica* and *Eucalyptus* trees. *Macrotermes bellicosus* and *M. subhyalinus* cause the greatest damage to *Eucalyptus* in the savanna vegetation zones. Termites attack and destroy growing trees, dead and dying trees, furniture, wooden telephone poles, insulators, electric cables and man-made fabrics (Usher & Barnacle, 1974; Malaka, 1983). They attacked and destroyed *Eucalyptus* wooden electric poles used for power transmission (Plate 5). Termites scavenge on the barks of trees and dead branches eating grooves in the roots and constructing runways in the stems. They nest within the roots, loosening the soil and weakening the anchorage of trees making them susceptible to toppling by strong wind. This poses danger to buildings, cars and human life (Malaka, 1983).

The carpenter bee *Xylocopa inconstans* Friese was the least species collected. This might be due to the nature of their nest and location which made the collection very difficult. Carpenter bees are solitary bees that burrow into wood to make their nest (Oldroyd, 1973). They drilled holes on only one type of wood – *Triplochiton scleroxylon* used for fascia board and side rails of houses built by man (Plate 7). Carpenter bees drill their circular holes usually on the underside of any wood surface including siding, soffits, overhangs, decks, fence posts, fascia boards and window frames. *http://www.pestproducts.com/carpenterbees.htm*

An important observation made during this study was that the insects were abundant during the wet than during the dry season. This accounts for the few groups of insects collected. Brown & Mizell, (1993) also found that, borer populations are often limited by environmental conditions and food. Borror *et al.,* (1976), reported that few insects can be collected during the dry season due to the fact that the period promotes inactivity in insects.

Several trees and wood were attacked by various species of wood boring insects. *Azadirachta indica* Juss. was more susceptible to attack by different species of wood-boring insects than any other species of wood (Table 3). The reason might be that the wood has already been stressed by other factors which made it more vulnerable to attack by various species of wood-boring insects. Stressed trees are generally thought to be more susceptible to wood-borer attack because their defense mechanisms are weakened (Brown & Mizell, 1993). Healthy, vigorously growing trees often have very efficient mechanism to prevent wood-borer infestation. Proper sap flow can be a good deterrent to many borer pests by preventing them from tunneling into the vascular tissue. Wound induced callus tissue, or penderm, can also act as a mechanism for borer resistance (Brown & Mizell, 1993). The high

moisture content of bark and secondary plant chemicals such as resins may also play a role in host plant resistance.

It was observed from this study that carpenter bees *Xylocopa inconstans* Fries attacked painted *Triplochiton scleroxylon* Schum. Woods are treated or painted to discourage pest attack, so the attack by *Xylocopa inconstans* Friese on *Triplochiton scleroxylon* Schum. indicates that painting of wood does not completely prevent attack by these pests. It was also found that *Odontotermes sp* attacked and destroyed electric poles made from *Eucalyptus camaldulensis* Dehnh (Plate 5). This is a very serious problem because *Eucalyptus* is the major species of wood used as electric poles across the country. If proper measures are not taken, this may pose serious danger to the programme of the Federal Government of Nigeria aimed at providing uninterrupted electricity for all communities by the year 2020.

Pheidole sp was found to attack the highest number of trees than other species of wood-boring insects. It is therefore logical, to say that *Pheidole* sp is better adapted to habitats where there are susceptible woods.

Area A, Botanical garden and Dam areas recorded the highest number of species of wood-boring insects. An obvious reason is that the area is dominated by vast species of trees which provide the insects with suitable habitat for nesting than other sites with sparsely distributed trees.

This investigation has shown that attack by wood-boring insects on economic trees and different kinds of wood are increasing by the day. This causes a lot of damage to the trees and in some cases death resulting in deforestation.

It is recommended that more pest resistant indigenous trees such as *Khaya senegalensis* and *Isoberlina doka* should be planted to replace damaged or dead trees. Trees to be used as electric poles should be properly treated with appropriate chemicals to prevent insect-borer attack or in the alternative concrete electric poles should be used. There should be an integrated pest control programme for wood-boring insects in Zaria area to arrest this trend.

REFERENCES

Abdullahi, A. (1999). Potentials of Nigeria's Wood Resources for Export. A Keynote address delivered at a 2-day workshop on value-added wood and wood products for export organized by the *African Network for Wood Research and Development* (ANWORD) February 10-12, 1999, Held at the Conference centre, University of Ibadan, Ibadan Nigeria.

Anderson, F.R (1960). *Forest and Shade Tree Entomology.* John Wiley and Sons, Inc. New York, London.

Ankre, R. D & Hansen, L. D. (1990). *Management of Carpenter Ants,*.In: R.K.Vaneder Meer.K. Jaffe and A. Cedeno [ed], Applied Myrmecology, a world perspective West View, Boulder,Co.

Ashiru, M. O. (1996). *Management of Insect pest and diseases of Forest Tree Species in Nigeria*.1996 proceeding of IUFRO Symposium on Impact of Disease and Insect Pest in Tropical Forest.

Beal, R. H. (1981). *Termite control Studies in Panama.* US Department of Agriculture,Forestry Services and Resources.

Brown, L. N & Mizell, R. F. (1993). *The Clearing Borers of Florida.* Tropical Lepidopterans 4. Supplement 4.

Borror, D. J., Delong, D. M. & Triplehorn, C. A. (1976). *An introduction to the study of insects.* Holt, Reinhart and Winston, New York.

Desch, H. E. (1981). *Timber: its Structures, Properties and Utilization.* 6th edition, Macmillan Education Ltd, London.

Erteld, W., Mette, H. J. & Achterberg, W. (1964). *Defects in Wood*. Leonard Hill (Books) Limited London.

Klotz, J. H. Mangold, J. R, Vail, K. M, Davis jnr. L. R & Patterson, R. S. (1995). A Survey of the Urban Pest Ants (Hymenoptera: Formicidae) of Peninsular Florida, *Florida Entomologist* 78:112-3.

Little, V. A. (1972). *General and Applied Entomology.* Harper and Row Publishers, New York.

Malaka, S. L. O. (1983). *Economic importance of Termites:* Six case studies in Nigeria and Ghana. *Nigerian Field* 47(4):222- 230.

Malaka, S. L. O. (1996). *Termites in West Africa.* University of Lagos Press.

Metcalf, C. L. (1962). *Destructive and useful Insects: their Habits and Control.* Mc Graw-Hill Book Company, London.

Oldroyd, H. (1958). *Collection, Preserving and Studying Insects*. Hutchinson and Co (publishers) Limited, London.

Oldroyd, H. (1973). *Insects and Their World.* Staples Printers Limited, London.

Olorunisola, A. O. (2000). Workshop Structure in the Small scale Furniture Industry in Ibadan Metropolis. *Journal of Tropical Forest Resources*.16 (1):22-27.

Professional Pest Control Products [online]. *http://www.pestproducts.com/carpenterbees.htm* Accessed on (21/5/2010).

Sands, W. A. (1962). Evaluation of Insecticides as Soil and Mound Poisons Against Termites in Agriculture and Forestry. *West African Bulletin of Entomology Revision* 53:179-192.

Smith, M. R. (1965). *House Infesting Ants of Eastern United States*: Their Recognition, Biology and Economic Importance. *Technical Bulletin* No. 1326, US Department of Agriculture, Washington D.C

Usher, M. B. & Barnacle, J. E. (1974). Termites and telegraph poles in the Northern Region of Ghana. *Ghana Journal of Science* 14(1): 39-48.

Wood, T. G. (1978). Food and Feeding Habits of Termites. In: *Production Ecology of Ants and Termites* (Brain M.V. ed), Cambridge University Press.

Youdeowi, A. (1977). *A Laboratory Manual of Entomology.* Oxford University Press Ibadan, Nigeria.