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Susceptibility of classroom furniture to drywood termites

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Abstract

A survey was conducted to assess the infestation of drywood termites in the classroom's furniture. The study was conducted in the University of the Philippines Los Baños, College of Forestry and Natural Resources, Laguna, Philippines on February 2016. A nonparametric statistical test was executed to determine if types of furniture, the materials used and coating can influence the susceptibility of the furniture to drywood termites. Only 15% of all furniture inspected was infested with drywood termites, Presence of signs (fecal pellets) and apparent drywood termite damage was observed. Kruskal wallis test showed that there is a statistically significant difference amongst the medians of the damage rating in different types of furniture and material used at the 95.0% confidence level. The Mann-whitney U test showed that the infestation of drywood termites is significantly higher in unpainted furniture. The presence of cracks, natural checks, overlapping or adjoining wood pieces, or exposed end grain in furniture will make the furniture susceptible to drywood termite infestation because these will serve as the entry point for swarmers (alates)

Keywords: Drywood termites, infestation, furniture, susceptibility, *Cryptotermes*

1. Introduction

Drywood termites are a common name for a group of termites belonging to Family Kalotermitidae. They are called as such due to its less moisture requirement and they lived entirely within the wooden material [1]. The Kalotermitidae are the second largest of seven families in the exclusively eusocial order Isoptera [2].

Detection of drywood termite infestation is hard because of its cryptic habit. Usually, the only sign of termite infestation is the presence of small fecal pellets, expelled from the gallery system through small holes in the wood surface [3]. Fecal pellets which are hard and hexagonal in cross section are feces excreted by drywood termites [4]. The number of pellets produced per termite is about one per day [5].

Drywood termites are pests of sound dry structural lumber or wood furniture [6]. In the Philippines, this group of termites is a serious problem of wooden material however the extent of their damage is usually underestimated [7]. There are two species of this group that is a very common pest in the country, viz., Cryptotermes dudleyi Banks and C. cyanocephalus Light [7, 8]. In the United States, Estimates of the total economic impact from drywood termites and their control costs vary from 5 to 20 percent of the total $1.5 billion to $5 billion spent on wood-destroying insect control each year [9] but worldwide losses are not fully documented [10]

Studies regarding the actual assessment of drywood termite damages have not yet been conducted in the Philippines. However, some authors [8, 11, 12] considered this group of termites as serious structural pest and very common in almost all households and other buildings. This study presented the assessment of infestation of drywood termite in classroom's furniture at the College of Forestry and Natural Resource (CFNR), University of the Philippines, Los Baños (UPLB).

2. Materials and Methods

2.1 Study site: Assessment of drywood termite damage was conducted at the UPLB-CFNR, Los Baños, Laguna, Philippines, on February 2016. The assessment was only limited to furniture that is found inside the classroom since classrooms are more accessible than faculty offices. To observe the presence of fecal pellets (sign of drywood termite infestation), the actual inspection was done early in the morning before the maintenance personnel has cleaned the room.

2.2 Assessment: All wooden furniture was inspected for signs of infestation and the level of damage was classified (Table 1). Types of furniture, the material used and coating were determined and were analyzed using non parametric test to ascertain if these factors can influence the susceptibility of the furniture to drywood termites, however, the information about manufacturing date and species used were not available hence not included in the analysis.

Table 1: Classification of drywood termite damage [13, 14].

Classification	Definition
None	There is no visible indication of the presence or activity of drywood termites at time of inspection
w/ signs	There is the presence of signs (fecal pellets) but no apparent drywood termite damage.
Low	<20% of the furniture were damaged
Moderate	20 - <40% of the furniture were damaged
Heavy	>40% of the furniture were damaged

Statistical analysis: For coating, the data were group into two: painted (coded as 1) and unpainted (coded as 2). The assessment classification was also coded as 1, 2, 3, 4, 5 corresponding to none, w/ sign, low, moderate and high. The data were subjected to mann-whitney U test (nonparametric, 2 independent sample) to determine which factor caused significantly higher infestation. For types of furniture and material used. A kruskal wallis H test (nonparametric, K independent sample) were used. The furniture was coded as 1,2,3,4,5,6 and 7 representing cabinet, table, stool, arm chair, lectern, blackboard and bulletin board respectively. Types of material used were also coded as 1,2,3,4, and 5 representing lumber/plywood/glass, lumber/plywood/vinyl, lumber/steel, lumber/plywood and lumber respectively. The analysis was done using SPSS v. 18.

3. Results and Discussion

3.1 Inspection

Wooden furniture found in the classrooms was armchairs, stools, tables, cabinets, blackboards, lecterns. Only 15% of all furniture inspected was infested with drywood termites, the presence of signs and apparent drywood termite damage was observed. It was expected that damage would be low since this furniture were regularly used and heavily attacked furniture were either repaired or replaced regularly. The low percentage of infestation maybe attributed to the habit or characteristic of drywood termite. This group of termites has lesser colony members usually numbering only a few hundred to a few thousand individuals rather than the thousands or millions found in subterranean termite colonies, the damage occurs more slowly [3] and the disturbance caused by constant used of furniture may also have an impact on termite growth and reproduction. Drywood termites dig galleries right below the wood surface, leaving a paper-thin (veneer) layer that breaks very easily during inspection [15, 16] as observed, students and other users tend to remove or pierce the thin layer of veneer exposing the gallery of termite thereby disturbing termite activity and thus may affect its growth and development.

3.2 Susceptible furniture design

In all the furniture inspected only the stool (with steel stand) was not infested/attacked by drywood termites. Fecal pellets were not observed. All other furniture has signs and apparent drywood termite damage was observed. Although wood species preference of drywood termite in the Philippines is not well studied especially the *Cryptotermes spp.*. These species feeds on cellulosic material including woods, books, dried plants, furniture and structural wood [17]. *C. cynocephalus* ranks second for destroying wood and wood-based panels [18]. A feeding preference study found out that *Cryptotermes brevis* Walker have species preferences where the preferred species will be consumed more than the less preferred but there were no wood species that the termite cannot consume [19]. The resistance of stool to the attack of drywood termites is, therefore, cannot be explained by species.

Table 2: Kruskal wallis test for termite infestation among types of furniture.

Furniture	N	Rank
Cabinet	28	484.95
Bulletin	4	441.38
Table	85	400.59
Lectern	10	386.10
arm chair	254	324.00
blackboard	20	314.68
Stool	251	283.00

Chi square = 140.34 P=.000

Kruskal wallis test showed that there was a statistically significant difference amongst the medians of the damage rating in different types of furniture at the 95.0% confidence level (Table 2). This showed that the manufacturing or design of furniture can influence the infestation of drywood termites. The manufacturing of stool was relatively simple compared to other furniture where the wooden material is simply attached to steel by a screw. The thickness of the wood varied from 1 inch to as thick as 4 inches. Cracks and other openings were very less or absent in stool chairs thus making the stool inaccessible to drywood termites. Drywood swarmer (alates or winged termites) usually enter wood through cracks, natural checks, overlapping or adjoining pieces, or exposed end grain to start a new colony [15, 20]. The manufacturing of other furniture like table and armchairs provides more overlapping or adjoining pieces of wood favorable for the entry drywood termite.

The materials used for the construction of furniture varied from pure lumber to mixture of lumber, plywood, steel, glass and vinyl. The kruskal wallis H test showed that there is a statistically significant difference amongst the medians of the damage rating in different materials used to manufacture furniture at the 95.0% confidence level. Infestation of drywood termites occurs in all groups of materials. As shown in Table 3 Lumber/plywood/vinyl cover seemed to have higher drywood termite infestation. The design of furniture can be a factor to susceptibility of furniture to drywood termites however, it cannot be concluded in this study since data of other factors like (age, species) were not available. In the study conducted [21], there is a slight difference in the mass loss of plywood and wood when exposed to drywood termites.

Table 3: Kruskal wallis test for termite infestation among furniture considering the materials used

Material	N	Mean Rank
Lumber/plywood/vinyl cover	28	468.61
lumber/plywood/glass	47	393.77
Lumber	231	333.51
lumber/plywood	69	314.68
Lumber/steel	257	271.00
Total	632	

Chi square = 123.09 P=.000

3.3 Coating
Both painted and unpainted furniture were attacked by drywood termites. Signs (fecal pellets) and apparent drywood termite damage was observed. However as discussed earlier only 15% of the furniture were infested with termites. Using paint as a barrier against drywood termite has not been thoroughly investigated [22].

Table 4: Mann-whitney U test for the termite infestation between painted and unpainted furniture.

Coating	N	Mean rank
Painted	609	321.43
Unpainted	40	379.33

Mann-whitney U = 10,007 P=.002

The Mann-whitney U test showed that the infestation of drywood termites was significantly higher in unpainted furniture (Table 4). Paint on exposed wood will provide some protection against drywood termite as the paint fills pores, cracks, and openings thereby blocking termite entry [23] however through time pointed out that paints will degrade and can be breached by termites and some feeding damage may occur [24]. Painting may also not effective, especially when prior to painting no other treatments (heating) were done to eliminate termites already or just building a colony inside the wood.

4. Conclusion
The manufacturing or design of furniture can be a factor for drywood termite infestation. A wooden furniture with cracks, natural checks, overlapping or adjoining wood pieces, or exposed end grain was more susceptible to drywood termite infestation since these will serve as the entry point for swarmer (alates). Paint may provide temporary protection against drywood termite provided that prior to painting other treatments were done (heating) to eliminate termites inside the wood. However as paint degrades termites may enter through openings and can start a colony. The materials (wooded) used would not matter much since drywood termite naturally consumes cellulosic material.

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