

INFLUENCE OF WOODEN DIVERSITY ON INFESTATION LEVELS BY SUBTERRANEAN TERMITE *Psammotermes hybostoma* (DESNEUX) AT FAYOUM GOVERNORATE

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By
H.M.Ahmed

Plant Protection Research Institute ,Agricultural Research Center, Dokki, Giza, Egypt.

ABSTRACT

Throughout the field experiment tests, five species of local woods grown in Egypt; White mulberry, River oak, Sisso, Blue gum and Date palm trees and five species of imported wood species, European spruce, Mirbeck oak, Beech, Swedish pine and Mahogany were tested for their resistance or susceptibility to subterranean termite, *Psammotermes hybostoma* (Desneux) infestation. Except for River oak, Blue gum trees and Mahogany classified as durable woods, all other wood species exhibited varying degrees of subterranean termite infestation levels. Date palm and Beech were perishable and heavily infested with subterranean termite within short period (four months), and showed the highest damage and ratings.

Key words: *damage ratings, imported woods, infestation, local woods, psammotermes hybostoma, resistance.*

1. INTRODUCTION

Wood is becoming more and more scarce as a natural resource with increasing demand for its use in both building and industry. Subterranean termite species are considered one of the most important wood destroyers in the tropical and subtropical localities (Haverty & Nutting 1975, Bultman *et al.*, 1979, Badawi *et al.*, 1985 and Delate & Grace 1995). Subterranean termites are responsible for much of the degradation of woods and other cellulose materials in the terrestrial environment. Cellulose being the principal food of subterranean termite, wood and wood products such as paper, fabrics and wood structures are avidly consumed and destroyed by them, and hence, a constant effort is directed toward their control. Field studies indicated that, some wood species are susceptible but others are resistant to attack by subterranean termite (Abreu & Silva 2000). Subterranean termites cause a great damage to wood in buildings, in storage and in use (Beal *et al.*, 1974 and Grace *et al.*, 1998). In Egypt, the damage is caused by subterranean termite species *Psammotermes hybostoma* (Desneux) to the rural buildings constructed with mud bricks as well as termite is considered an important pest of furniture and framed wood within buildings (Rizk *et al.*, 1982 and Ahmed, 1997). This insect pest is a wide spread destructive to the local and imported wood species

in Fayoum Governorate. Information are not available about the resistance or susceptibility of the local and imported wood species against subterranean termite, *P. hybostoma* infestation in Egypt, specially at Fayoum Governorate. Therefore the aim of this work was to study the influence of wooden diversity (local and imported wood species) on subterranean termite, *P. hybostoma* infestation levels.

2. MATERIALS AND METHODS

The experiments were conducted in Kasr Al-Gebaly location, Youssef El- Sediek district, at Fayoum Governorate from Jan. 2004 to Jan.2005. Two heavy infested locations by sand subterranean termite, *Psammotermes hybostoma* (Desneux) and two uninfested locations were chosen as control. The 1st location was 15x10 m., while the 2nd one was 15x 12m. All superficial and partially buried of dead and debris woods were removed from these areas to prevent any nutrient interferences with the applied wood species .The soil was straightened and irrigated then left to full dry. For every location, 150 holes were dugged with small axe, where; the holes were arranged in 10 rows (each row contains 15 holes). The distance between holes was one meter and the hole depth was 20 cm. Thirty wooden stakes (40 cm length) from all tested wood species were obtained from wood atelier at Fayoum Governorate. Five local wood species, White

mulberry (*Morus alba* L.), River oak (*Casuarina equisetifolia* Mig), Sisso (*Dalbergia sisso* Roxb), Blue gum (*Eucalyptus rostrata* Schelchy) and Date palm (*Phoenix dactylifera* L.) and five imported wood species, European spruce (*Picea* sp.), Mirbecks oak (*Quercus mibekii* Dur.), Beech (*Fagus* sp.), Swedish pine (*Pinus* sp.) and Mahogany (*Khaya* sp. Desr.) were used in the present study. Wooden stakes were distributed randomly (each row contains three stakes per wood species) and fixed in the holes, where 20 cm was above the soil surface. Four months after initiating these experiments, the wooden stakes were pulled out and examined three times (10 wooden stakes per species per times) throughout the year of study on May, Sept. and Jan. The infestation levels were arranged according to Beal (1979) as follows:

- (0) No attack (-)
- (1) Little damage (+)
- (2) Little damage with termite penetrate (+ +)
- (3) Medium damage with termite penetrate (+ + +)
- (4) Heavy damage with termite penetrate (+ + + +)
- (5) Completely damage (+ + + + +)

Statistical analysis of the obtained data were carried out using analysis of variance ANOVA.

3. RESULTS AND DISCUSSION

3.1. Local wood species

Data in Table (1) show that, the wood of date palm tree (*Phoenix dactylifera* L.) was the most susceptible to insect infestation of the tested wooden stakes; followed by the wood of white mulberry (*Morus alba* L.) while wood species of Sisso tree (*Dalbergia sisso* Roxb) was the lowest susceptible to insect infestation. River oak wood (*Casuarina equisetifolia* Mig.) and the wood of Blue gum tree (*Eucalyptus rostrata* Schelchy) showed durable resistance to the subterranean termite *P. hybostoma* infestation. The mean numbers of the previous mentioned wood species were significantly different which were 7.33, 6.00, 1.67, 0.00 and 0.00 (stakes per 30 stakes) for Date palm, White mulberry, Sisso, River oak and Blue gum wood species, respectively. The corresponding rate of damage for these wood species were 2.2, 1.2, 0.23, 0.00 and 0.00, respectively. These results revealed that, the two wood species River oak (*Casuarina equisetifolia* Mig.) and Blue gum (*Eucalyptus rostrata* Schelchy) were highly resistance to the subterranean termite *P. hybostoma* infestation

where, no record of any infested wood stakes during the three inspections. Sisso trees (*Dalbergia sisso* Roxb) wood stakes were relatively resistance to *P. hybostoma* infestation where, only five wooden stakes were infested during the three inspections. Date palm and white mulberry woods were perishable. Therefore, tested wood species could be arranged according to their resistance to subterranean termite *P. hybostoma* infestation as follows: River oak (*Casuarina equisetifolia* Mig.), Blue gum trees (*Eucalyptus rostrata* Schelchy), Sisso trees (*Dalbergia sisso* Roxb), White mulberry (*Morus alba* L.) and Date palm trees (*Phoenix dactylifera* L.), respectively. These obtained results are in agreement with that of Rizk *et al.*, 1982. They found that, the wood species Blue gum trees (*Eucalyptus rostrata* Schelchy), and River oak (*Casuarina equisetifolia* Mig.), were the lowest preferable wood for subterranean termite *Amitermes desertorum* (Desneux). In their study on the Egyptian woods, such as Bombax tree (*Bombax malabricum*), Entreolobium (*Entreolobium timbora*) and Emeri tree (*Terminalia arjume*), they found that, these wood species are considered the most favorable for subterranean termite *A. desertorum*. Badawi *et al.*, 1984, tested the five local wood species in Saudi Arabia as follows: Athel (*Tamarix aphylla*), Sidir (*Zizyphus spina-christi*), Hamat (*Ficus pseudosycamorus*), Talh (*Acacia etbaica*) and Arar (*Juniperus procera*) for their susceptibility of subterranean termite infestation. The wood species Arar (*Juniperus procera*) classified moderately durable, while the wood species Hamat (*Ficus pseudosycamorus*) was heavily infested with subterranean termite and showed the highest damage ratings. The other wood species exhibited varying degrees of subterranean termite infestation.

3.1.1. Imported wood species

Data in Table (2) show that, the wood of Beech (*Fagus* sp.) was the most susceptible to subterranean termite *P. hybostoma* infestation of the tested wooden stakes followed by European spruce (*Picea* sp.), while the wood of Mirbeck oak (*Quercus mirbekii* Dur.) was the least susceptible to insect infestation. Mahogany (*Khaya* sp.) and Swedish pine (*Pinus* sp.) showed durable resistance to the subterranean termite *P. hybostoma* infestation. The mean numbers of the previous mentioned wood species were significantly different being 3.67, 2.33, 1.67, 0.33 and 0.00 (stakes per 30 stakes) for Beech, European spruce, Mirbeck oak, Swedish pine and

Table (1): Resistance of five local wood species to subterranean termite infestation *P. hyalostoma* in Kafr Al-Ghaly location, Yousef El-Sedick district, at Fayoum Governorate, from Jan. 2004 to Jan. 2005

Local wood species Common and scientific name	1 st inspection			2 nd inspection			3 rd inspection			Mean	
	Damage rating	Number of damage stakes	Mean rate of damage	Damage rating	Number of damage stakes	Mean rate of damage	Damage rating	Number of damage stakes	Mean rate of damage	Number of damage stakes	Rate of damage
White mulberry <i>Morus alba</i>	+	5	1.1	+	6	1.3	+	7	1.5	6.0	1.2
	++			++			+				
	+++			+++			++				
	+++			+++			++				
	+++			+++			+++				
Balsam <i>Cassia occidentalis</i>	-	0	0.0	-	0	0.0	-	0	0.0	0.0	0.0
Sesuvium <i>Zizyphus ssp.</i>	+	1	0.1	+	1	0.1	++	1	0.2	1.67	0.23
Blue gummara <i>Acacia senaria</i>	-	0	0.0	-	0	0.0	-	0	0.0	0.0	0.0
Dark pine <i>Pinus acutata</i>	+	6	1.5	+++	7	1.7	+++	9	2.8	7.13	2.2
	++			+++			+++				
	+++			+++			+++				
	+++			+++			+++				
	+++			+++			+++				
	+++			+++			+++				
	+++			+++			+++				
Mean number of damage		2.4			1.2			1.4			
Mean rate of damage			0.34			0.6			0.84		

L.S.D. (5%) = 0.766

Table (2): Resistance of five imported wood species to subterranean termite infestation *P. hyalostoma* in Kafr Al-Ghaly location, Yousef El-Sedick district, at Fayoum Governorate, from Jan. 2004 to Jan. 2005

Local wood species Common and scientific name	1 st inspection			2 nd inspection			3 rd inspection			Mean	
	Damage rating	Number of damage stakes	Mean rate of damage	Damage rating	Number of damage stakes	Mean rate of damage	Damage rating	Number of damage stakes	Mean rate of damage	Number of damage stakes	Rate of damage
European spruce <i>Picea sp.</i>	+	1	0.1	+++	3	0.8	+++	3	1.3	2.33	0.73
				+++			+++				
				+++			+++				
Moroccan <i>Quercus morifolia</i> (Det.)	-	0	0.0	+	2	0.2	++	3	0.7	1.67	0.3
				+			++				
				+			+++				
Beech <i>Fagus sp.</i>	+	3	0.6	+++	3	1.1	+++	3	2.2	3.67	1.3
	++			+++			+++				
	+++			+++			+++				
	+++			+++			+++				
	+++			+++			+++				
Swedish pine <i>Pinus sp.</i>	-	0	0.0	-	0	0.0	-	0	0.0	0.00	0.00
Margayee <i>Chenop. sp.</i> (Det.)	-	0	0.0	-	0	0.0	-	0	0.0	0.00	0.00
Mean number of damage		0.6			1.6			2.4			
Mean rate of damage			0.16			0.42			0.86		

L.S.D. (5%) = 0.467

Mahogany, respectively. The corresponding rates of damage of these wood species were 1.3, 0.73, 0.3, 0.03 and 0.00, respectively. These results revealed that, the wood of Mahogany (*Khaya* sp.), was highly resistance to the subterranean termite *P. hybostoma*, where, no record of any infested wood stakes during the three inspections, followed by Swedish pine (*Pinus* sp.) (Considered relatively resistance) where, only one wooden stake was infested during the three inspections. The wood of Beech (*Fagus* sp.) and European spruce (*Picea* sp.) were perishable. Tested wood species could be arranged according to their resistance to the subterranean termite *P. hybostoma* infestation as follows: Mahogany (*Khaya* sp.), Swedish pine (*Pinus* sp.), Mirbeck oak (*Quercus mirbekii* Dur.), European spruce (*Picea* sp.) and Beech (*Fagus* sp.), respectively. These results are in agreement with those of Badawi *et al.*, 1984. They found that, the wood of Mahogany (*Khaya* sp.) was characterized by durable resistance to subterranean termite *P. hybostoma*, while, the wood of Beech (*Fagus* sp.) was heavily infested with the same species of termite and showed the highest damage and ratings. The other wood species spruce (*Picea* sp.), pine (*Pinus* sp.) and Apitong (*Dipterocarpus* sp.) exhibited varying degrees of subterranean termite infestation. Beal *et al.*, 1982, tested 92 American woods species by using the host selection and force feeding methods. These wood species were arranged into five resistance categories according to the percentage of wood consumption by workers of *P. hybostoma*. They mentioned that, workers survived 6 weeks on 11 wood species from 92 wood species within 81 resistance woods (1st group) and survived 6 weeks on 5 wood species. Creffield *et al.*, (1985), showed that, the wood of *Pinus radiata* was more resistant to attack by subterranean termite *Coptotermes acinaciformis* than *Eucalyptus regnans*. This termite species caused a mean percentage consumption of 58.26% in *Eucalyptus* against 50.66% in pine. The pine wood seemed to be more susceptible to attack by subterranean termite than *Eucalyptus* wood. Grace and Yamamoto (1994), mentioned that, the wood of red wood (*Sequoia sempervirens*) has a fairly high durability in short term exposures to high termite activity, while, the wood of, Alaska yellow cedar (*Chamaecyparis nootkatensis*) was considerably more durable than red wood. The wood of Laotian teak (*Tectona grandis*) was considerably resistant

to subterranean termite attack, its resilience in field tests. Grace *et al.*, (1998), showed that, subterranean termite colonies feed on Pecan, (*Carya illinoensis*) and red gum (*Liquidambar styraciflua*). These wood species were highly preferred by subterranean termite *Coptotermes formosans* Shiraki. Regina *et al.* (2004), found that, the wood consumption rates were not correlated significantly with their wood densities, there was a tendency of the soft woods (*Eucalyptus robusta* and *Pinus* sp.) to be more consumed by subterranean termites than the woods of intermediate hardness (*E. pellita* and *E. urophylla*). Among the *Eucalyptus*, (*E. robusta*), showed to be more susceptible to attack by subterranean termites than (*E. pellita* and *E. urophylla*), indicating that, the former is more susceptible to termite attack.

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تأثير التنوع الخشبي على مستويات الإصابة بالنمل الابيض تحت الأرضي *Psammotermes hybostoma* (Deseneux) بمحافظة الفيوم.

حسن محمد أحمد

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة -مصر

ملخص

إستهدفت هذه الدراسة إجراء إختبارات حقلية لبعض انواع الاخشاب المحلية والمستوردة تجاه الإصابة بالنمل الابيض تحت الأرضي *Psammotermes hybostoma* (Desneux) ، وكانت أنواع الاخشاب المحلية المختبرة هي التوت ؛ والسرسوع ؛ والكازورينا ؛ والكافور ونخيل البلح . كانت التوت والسرسوع ونخيل البلح قابلة للإصابة بهذه الحشرة بمستويات مختلفة خلال فترة اربعة أشهر من ملامستها للتربة المصابة بالنمل الابيض. ويستنتى من ذلك خشب كلا من النوعين الكازورينا والكافور حيث أظهر مقاومة للإصابة. وبالتالي يمكن التوصية باستخدامهما فى المباني المنشأة فى المناطق الموبوءة بحشرات النمل الأبيض لتجنب حدوث ضرر بهذه الآفة. ومن بين انواع الاخشاب المستوردة المختبرة (الخشب الابيض ؛ والخشب الأرو والزان ؛و السويدى والماهوجنى حيث تعرضت جميع الاخشاب للإصابة بمستويات مختلفة ويستنتى من ذلك النوع الماهوجنى حيث لم تظهر عليه أية أعراض للإصابة لمدة عام و لذلك يمكن التوصية باستخدامه فى عمل الاثاث الخشبي. وقد أظهرت النتائج أن خشب الزان كان أكثر أنواع الأخشاب حساسية للإصابة يليه الخشب الابيض ثم الأرو ثم السويدى الذى أظهر مقاومة نسبية للإصابة بهذه الآفة الحشرية الخطيرة.

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