

# A Study on feeding Preferences of sapwood and heartwood for some forest trees by termite, *Microcerotermes gabrielis* Weld.(Isoptera : Termitidae )

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## Abstract

Ten local and imported wood species of forest trees were evaluated for susceptibility to attack by termite, *Microcerotermes gabrielis*. The results showed that all sapwood and heartwood of Acer, *Acer spp.*, Eucalyptus, *Eucalyptus microthica*, Normal Oak, *Quercus aegilopes*, American Poplar, *Populus euramericana*, Willow, *Salix babilonica*, Yellow Pine, *Pinus sylvestes*, Black Pine, *Pinus nigra*, Walnut, *Juglanus regia*, Cypress, *Cuppressus spp.* and Wild Fig, *Ficus carica* were non preferable by termite under natural infection conditions at Haibet Sultan mountains on altitude 1000 m. above sea level. On the other hand, results of wood preferences of termite showed a significant differences among species tested under artificial infection conditions in the botanical garden after 12 weeks. It has been found that walnut, *Juglanus regia* and wild fig, *Ficus carica* species was more susceptible than other species and the general mean of wood weight loss during the period of experiment were 7.06 and 3.46 gm., respectively, while Yellow Pine, *Pinus sylvestes*, Black Pine, *Pinus nigra* and Cypress tree, *Cuppressus spp.* Showed more resistance for infestation with the rate of 0.19, 0.20 and 0.27 gm, respectively. Generally, in this field test the sapwood of tree species were more preferable to attack by termite comparison with the heartwood with a total average 2.21 and 1.79 gm., respectively. Results indicated that the physical properties, moisture content and specific gravity of sapwood and heartwood of trees showed that there were no clear relation between these properties and wood preferences according to the amount of wood weight loss by termite.

## Introduction

Wood is one of the basic materials that have been naturally and abundantly available to mankind. Nowadays the global demand of wood, paper and other wood industries has been increased. It's a complex heterogeneous aggregate cell wall fiber's composed primarily of cellulose and hemicelluloses, joined by polymers of lignin, to form a rigid lignocelluloses matrix (Scheffrahn, 1991).

Most termite species are xylophagous, feeding on the lignocellulosic xylem of woody plants. It is well know that the termites causes serious damage to furniture, within buildings and it many attack standing trees of different wooden and ornamental trees, forest products, timber in stores and in use books and to other cellulosic origin materials (Azuma *et al.*, 1984; Tho and Kirton, 1990). There are over 2000 species of termite known today (Pearce, 1997).

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Key words: termite, *Microcerotermes gabrielis*, wood, preferences.

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Subterranean termites, particularly species of genus *Microcerotermes*, widely recognized pests of timber in building in Iraq (Al-Allway, 1989, Mustafa, 2004). The Timber species recommended for various building components are distinctly variable in wood quality, being largely grouped according to wood density and or wood strength classes (Wong *et al.* 1998). The distribution of subterranean termite damage in the humid tropics are found at west Africa, Asia, India, Pakistan, Australia and central and South America (Pearce, 1997). French and Ahmed (2002) reported that the termites causing billions of dollars in damage to timber in service worldwide in Australia.

It has also been suggested that extractives from naturally durable woods could be applied to susceptible timbers or used as models for new wood preservatives (Carter and Camargo, 1983; Laks *et al.*, 1988).

Many approaches are available for the development of an Integrated Pest Management system for controlling termites (Lewis, 2003) Such as using naturally durable woods in manufacturing and

construction represent alternatives to the use of soil insecticides and wood preservatives to protect susceptible trees and lumber (Beal *et al.*, 1974; Bultman *et al.*, 1976; Su and Tamashiro, 1986; Scheffran, 1991; Grace and Ramamoto, 1994; Grace *et al.*, 1996; Al-Mallah *et al.*, 2010). It has also been suggested that extractives from naturally durable woods could be applied to susceptible timbers or used as models for new wood preservatives (Carter and Camargo, 1983; Laks *et al.*, 1988).

This project carried out to study feeding preferences per sapwood and heartwood for tree species and evaluate the susceptibility of different species of forest trees to termite in Koysinjak city, Koya region.

## Materials and Methods

### 1-Feeding activity:

Studies on the natural host preferences of the subterranean termite *Microcerotermes gabrielis* Weld. Two locations were chosen, First location Haibet Sultan mountain at 1000 m., above sea level when we can find natural oak forests (natural infection conditions) and The Second location was botanic garden (artificial infection conditions). Both studies extended from early April to the end of Jun out during 2008 in Koysinjak city, Koya region.

### 2-Resource of termite:

Notified that termite colonies which contain large numbers of winged individuals for both study locations, Haibet Sultan mountains and botanic garden in Koysinjak city, Koya region.

### 3-Wooden pieces that used in this study:

Wooden pieces (5x5) cm. of the ten tree species per sapwood and heartwood were used which they are the most common species in Iraq (table 1), namely (Acer, *Acer spp.*; Eucalyptus, *Eucalyptus microtheca*; Poplar, *Populus euramericana*, Normal oak, *Quercus aegilops*; Willow, *Salix babilonica*; Black pine, *Pinus nigra*, Yellow pine, *Pinus sylvestris*, Walnut, *Juglanus regia*; Cypress, *Cupressun spp.*) and Fig, *Ficus carica*.

**Table (1): List of tree species with their collection locations.**

Scientific name	English name	Arabic name	Family	Collection location
<i>Acer spp.</i>	Acere	Allacer	Aceracea	Karatapa-Kifre –Dyalla.
<i>Eucalyptus microthica</i>	Eucalyptes	Yucalyptus (Keena)	Myrtaceae	Kaller-Sulimania.
<i>Quercus aegilops</i>	Normal oak	Blot (Sendian)	Fagacea	Koya –Erbil.
<i>Populus euramericana</i>	Poplar	Kauk (Hoor)	Salixacea	Erbil.
<i>Salix babilonica</i>	Willow	Safssaf	Salixacea	Kaller – Sulimania.
<i>Pinus nigra</i>	Black pine	Senober asswad	Pinacea	Faculty of Forestry, Istanbul University
<i>Pinus sylvestris</i>	Yellow pine	Senober assfer	Pinacea	Faculty of Forestry, Istanbul University
<i>Juglanus regia</i>	Walnut	Juz	Juglandace	Shaklowa -Erbil
<i>Cupressus spp.</i>	Cypress	Sauru	Cupressace	Koya-Erbil
<i>Ficus carica</i>	Wild Fig	Teen bery	Moracea	Erbil

### 4- Moisture content:

Wooden pieces (5x5x5) cm. were measured for all samples per sapwood and heartwood according to the Panshen (1987) as follow:

$$\text{Moisture content (M.C. \%)} = \frac{\text{green wt. of wood} - \text{oven dry wt. of wood}}{\text{oven dry weight of wood}} \times 100$$

**3-Specific gravity:**

wooden pieces 5x5x5 cm., were dried in oven 100 C for 48 hours then weight, also the volume calculated depended on removed water volume when wood sample put in the water. The density can get by divided oven dry weight / volume, according to the Haygreen and Bowyer (1982) per Sapwood and heartwood for trees, three replicates per sapwood and heartwood for ten species of forest trees.

$$\text{Specific gravity} = \frac{\text{Weight of sample}}{\text{Volume}}$$

**4- Degree of infestation:**

This study extended from April to June during 2008, according to the Abdel – Malak (1990) the rate of infestation was calculated as:

$$\text{Degree of infestation} = \frac{\text{Number of infested trees}}{\text{Number of examined trees}}$$

and it was categorized as follow:

Zero	No. infestation	"O"
0 <	Rare	"R"
0 – 10	Low	"L"
10 – 20	Moderate	"M"
20 >	High	"H"

**5. Field studies:**

Field experiment was carried from April to July during 2008 at two locations were chosen, first location Haibet Sultan Mountain (natural infection conditions) at 1000 m., above sea level when we can find natural oak forests, and the second location botanic garden (artificial infection conditions) at suitable soil surface.

**a- Wood preference under natural infection condition:**

Wooden pieces (5 x 5 x 5) cm., were cut from the sap wood and heartwood for the selected tree species, 10 tree species per sapwood and heartwood were prepared from the following tree species: (Acer, *Acer spp.*; Eucalyptus, *Eucalyptus microtheca*; Normal oak, *Quercus aegilopes*; Poplar *Populus euramericana*, Willow, *Salix babilonica*; Black pine, *Pinus nigra*, Yellow pine, *Pinus sylvestris*, Walnut, *Juglanus regia.*; Cypress, *Cuppressun spp.*) and Fig., *Ficus spp.*, and the average of temperature and relative humidity were 20±0 C. 66,2±2%, respectively, during period of wooden bury, wooden specimens were green and weighted by sensitive digital balance and then the pieces of woods were oven dried 100 C overnight and weighted. The wood pieces were subjected to a twelve-week in-ground bioassay at a Haibet Sultan mountain an test site during a period of almost daily rainfall, The chosen field site is in a forested area (natural oak forests), well-drained, shaded, moist and of high

subterranean termite activity, the design of the field test protocol is as follows: a ditch of consistently 20-30 cm depth is dug to partly layered with residues, and the woods buried random in termite colony. Distance between a pieces of woods is (10) cm and the ground covered with top soil, (3 replications) per sapwood and heartwood of ten studied trees, were kept together according to species to aid identification unearthed, the woods carefully retrieved, weighed immediately to determine the final wet weight losses of the test samples after 12 weeks were subjected to analysis of variance (C.R.D) and means significantly different at the 0.05 level were separated by Duncan's multiple rang test (SAS, 1987). Preference has most often been evaluated by measuring the reduction in wood weight (weight loss), (Smith and Carter, 1970; Beal et al., 1974; Usher and Ocloo, 1979; Rizk and Beal, 1982; Supriana, 1988; Grace, 1996 and Mustafa, 2004), according to the determine the amount of loss in weight of dry wood were before and after infestation by termite per sapwood and heartwood for each one of tree species.

Determinations of wood visual rating, wood loss, percentage wood loss, degree of infestation and infestation percentage, the test woods were also rated according to an arbitrary 0 - 5 visual rating scale as follows 0 = sound, 1 = surface nibbles, 2 = light attack, 3 = moderate attack with bore holes, 4 = heavy / severe, attack, and 5 = completely destroyed (Wong et al., 1998, Mohd and Azlan, 1994)

#### **b. Food preference under artificial infestation conditions:**

Wooden pieces (5 x 5 x 5) cm., were cut from the sap wood and heartwood for the selected timber species, species induced in this report are : Acer, *Acer spp.*, Eucalyptus, *Eucalyptus microthica*, Normal oak, *Quercus aequilopes*, Poplar, *Populus euramericana*, Willow, *Salix babilonica.*, Black pine, *Pinus nigra*, Yellow pine, *Pinus sylvestris*, Walnut, *Juglanus spp.*, Cypress, *Cupressus spp.*, and Fig., *Ficus carica*. respectively, during period of wooden bury, wooden specimens were green and weighted by sensitive digital balance and then the pieces of woods were oven dried (100°) for 24 hours and weighted. The wood pieces were subjected to a twelve-week in-ground bioassay at botanical garden an test site, termites were collected from an active field, the chosen field site is in a garden area well design of the field test protocol is as follows: a ditch of consistently 20-30 cm depth is dug to partly layered with residues, and the woods buried random in termite colony. Distance between a pieces of woods is (10) cm and the ground covered with top soil, (3 replications) per sapwood and heartwood of ten studied trees, were kept together according to species to aid identification unearthed, the woods carefully retrieved, weighted immediately to determine the final dry weight losses of the test samples after a twelve week (90 day) field exposure, the woods were recovered and dried and the oven dry mass change recorded, and determine the weight loss of wood according to the equal and were subjected to analysis of variance (C.R.D) and means significantly different at the 0.05 level were separated by Duncan's multiple rang test (SAS, 1987). In this field test, the average of temperature was  $27 \pm 3$  C° and relative humidity  $78,0 \pm 2$  % . Preference has most often been evaluated by measuring the reduction in dry wood weight (weight loss), (Smith and Carter, 1970; Beal et al., 1974; Usher and Ocloo, 1979; Rizk and Beal, 1982; Supriana, 1988; Grace, 1996 and Mustafa, 2004), according to the determine the amount of loss in weight of dry wood were before and after infestation by termite per sapwood and heartwood for each one of tree species.,

Determinations of moisture contents of wood, specific gravity, visual rating, wood loss, percentage of wood loss, degree of infestation and infestation percentage, wood samples were subjected to a twelve week, this bioassay includes (a) visual rating of the test blocks using the scale of 0 = sound, 1 = surface nibbles, 2 = light attack, 3 = Moderate attack, 4 = heavy attack, 5 = completely destroyed. (Wong et al. 1998). b (evaluation of oven dry wood mass).

### **Results and Discussion**

Ten tree species per sapwood and heartwood have been arrange in two studies, First study : No damage in tree species by termite ( natural infection conditions), Second study : damaged in timber species ( artificial infection conditions ) For two different locations in Koysinjak city, Koya region,

Haibet Sultan mountains ( natural infection conditions ) and Botanical garden ( artificial infection conditions ) in field tests , to determine the termite preference of these trees depending on the weight loss due to the attack by termite, as followed :

1 : No damage by termite for tree species :-

Table (2) showed ten tree species per sap and heartwood have not been attacked by the workers termite ( visual rating of wood . and infestation percentage %) the obtained data were agree with those of Ali *et al.*(1982) in Egypt who found that wood species , *Eucalyptus rostorata* , *Casuarina equisetifolia* , *Cupressus semperverns* and *Acacia arabica* were non preferences to subterranean termite , *Amitermes desertorum* during eight weeks force feeding test.

Results of field study in natural infection condition obtained reveal the ten timber species within the period of exposure 12 weeks , this may be interpreted as an indication of variability in pattern of termite feeding behaviour within certain period of time or the existence of some chemical constituents that are distasteful or repellent rather than high cellulose content (Abdel-Karim *et al.*, 2006) , the same behaviour was found by Wolcott (1909) The results of field study showed no infestation of wooden trees by termite *Microcerotermes gabrielis*, at Haibet Sultan mountains under natural infection conditions as a result natural residues of oak trees , like , fallen leaves, branches ,tree barks and humus cumulative materials were founded on ground soil at Haibet Sultan mountains with heights about 1000 m. above sea level ,these residues of living oak trees on soil surface are preferred by termites. , termite resistance also depends on choice , in the case of a termite living in a single piece of wood there may be little choice , since there is only one food source available , the termite will have to eat or die, this may also be seen in the field ( Pearce,1997) , the presence of a food source is also important ; whether it be indigenous shrubs or crops , some termite ( e.g. Macrotermitinae ) have reserve food supplies for times when food is short or the climate is too harsh for forging , plant damage from pests other than termites , wind , weeding or animal feeding or trampling can encourage termite attack., some of the factors affecting termite presence , as well as examples of different predators of termites (Pearce , 1997)

**Table (2): Woods with no loss of tree species per sapwood and heartwood to *M. gabrielis* feeding during 12 weeks force feeding test under natural infestation condition.**

Non-infestation species ( sapwood and heartwood )	Visual ** rating (wood)	No. attacked / Total observation	Infestation percentage
<i>Acer spp.*</i>	.	0 / 6	0
<i>Eucalyptus microthica</i>	.	0 / 6	0
<i>Quercus aegilops</i>	.	0 / 6	0
<i>Populus euramericana</i>	.	0 / 6	0
<i>Salix babilonica.</i>	.	0 / 6	0
<i>Pinus nigra</i>	.	0 / 6	0
<i>Pinus sylvestris</i>	.	0 / 6	0
<i>Juglanus regia</i>	.	0 / 6	0
<i>Cupressus spp.</i>	.	0 / 6	0
<i>Ficus carica</i>	.	0 / 6	0

\* Per mean represented ( 2 ) replicates per sapwood and heartwood.

\*\* Woods were visually rated as 0 = sound , 1 = surface nibbles , 2 = light attack , 3 = moderate attack , 4 = heavy attack , or 5 = completed destroyed.

### 3: Ddamaged of tree species:-

The accelerated subterranean termite preference assessments ( from wood pieces ) for both sapwood and heartwood of ten tree species as followed ; weights of green wood and dry wood before and after infestation (table 3) , moisture content ,specific gravity ,visual rating , amount wood loss ,wood loss % , degree of infestation and infestation percentage are presented in tables (4,5 ) based upon both visual rating of termite damage and wood mass loss according to Grace *et. al.*(1996),wood species are devisable in to four categories of relative termite resistance ;( resistant , moderately resistant , slightly resistant and susceptible ).

### 3-Classification of wood resistance:-

**Group a:** more resistant species: regarding to the statistical analysis of the data obtained after twelve weeks of exposure (table 3,4,5 ). The results revealed that the sapwood of cypress tree ,*Cuppressus spp.* was the more resistant wood species to the termite *M. gabrielis* ( visual rating : 0 , wood loss : 0,1 gm. ) , followed by both heartwood and sapwood of yellow pine, *Pinus sylverstrias* and Black pine, *P. nigra* with a rate 0,17, 0,23 and 0,24 gm., respectively , Gosswald ( 1946) and Asenjo *et. al.*(1909 ) reported that the resistant to termite of West Indian Mahogany, family Meliaceae is due to high lignin content ; and the presences of extractives like, oils , waxes and resins that was strongly repellent to termite ( Al-Mallah *et al.*,2010).

Table 3

Generally, the most resistant wood species in this study was represented by *Pinus sylvestris*, *Cupressus spp.* and *Pinus nigra.*, by total average of wood consumption of 0.19, 0.20 and 0.20 gm., respectively (table 3) These results obtained were in agreement with those of Rizk *et al.* (1982) Scheffrahn (1994) and Mustafa (2004) they found that Pine and Cypress trees has less preferable timber to termite *Microcerotermes diversus*, these results of this phenomenon may be due to occurrence of lignin, phenol compounds and extractives like oils, wax and resinous materials in timber samples may have a role in the resistance of wood as repellent to termite also contain the chemical determinants which given the degree of resistance of a wood sample to damage infested by termites and addition that extractives also contain the chemical determinants which given the degree of resistance of a wood sample to damage infested by termites, these data were in complete concordance with those for Wong *et al.* (1998) who stated that the softwoods *Araucaria cunninghamii* and *Pinus sylvestris* to be completely susceptible to subterranean termites replicated wood blocks lost after four weeks and reported that woods are easily degraded despite the toxicity of some resinous extractives against termites, and the contents of which may be insufficient to override the presence of feeding stimulant chemicals in the wood (Grace, 1997), In this study, under artificial infection conditions, greatest termite attack occurred on *Juglanus regia*, (wood loss 4.47 gm., and wood loss 90.7%) followed by *Ficus carica*, (wood loss: 3.72 gm., wood loss: 90.7%) and the least feeding occurred on *Pinus sylvestrius*. (Wood loss: 0.17 gm., wood loss: 3.8%) Only, *Pinus sylvestris* and *Cupressus spp.* (wood loss: 0.17 gm., wood loss: 0.4%) were considered "resistant" to termite attack, followed by *Pinus nigra*, (wood loss: 0.17 gm., wood loss: 0.4%) the relatively high mortality of termites fed Yellow Pine, Cypress and black Pine in this test, however, indicates the presence of toxic extractives and suggests that this wood may less preferred than other available susceptible wood species by termites (Mustafa 2004). Both Pine and Cypress trees are extensively used for woody industries, construction and other purposes (Al-Hilly, 1986), however, although the principle chemical constituent of resistance species are toxic to many insect species,. Both pine and Cypress wood are less preferred by termites than Walnut, suggesting that this tree could be useful for important wood industries like paper manufacturing, planting and ornamental arboriculture in Iraq even if not suitable for wood harvesting, Similar results were obtained by Ali *et al.* (1982) who showed that *C.sempervirens* is less preferable timber for the subterranean termite, *Amitermes desertorum*, Also Rizk *et al.* (1982) stated that *C. sempervirens* is unfavorable host for *P.hybostoma*, the same results were obtained by Abdel-karim *et al.* (2006) who found that Cypress tree, *C.sempervirens* seemed to be more resistant to the dry wood termite *Cryptotermes brevis*.

#### **Group b : Susceptible species :**

This susceptible group was represented by both sapwood and heartwood of walnut, *Juglanus regia*, (visual rating : 0, 0, wood loss : 6.66, 4.47 gm. infestation percentage 100, 100%), respectively, followed by sapwood of acer, *Acer spp.* (visual rating : 3, wood loss : 4.12 gm., infestation percentage

٦٦ %), and fig, *Ficus carica*, ( visual rating : ٣,٤ , wood loss : ٣,٢٠ and ٣,٧٢ gm. infestation percentage ٦٦,٦٦ %) ( table ٤ ). Statistical analysis showed significant differences according to the tree species , wood species and wood loss , however , the resistance of *Salix babilonica* was better ( visual rating : ١ , wood loss : ٠,٦٦ gm., infestation percentage ٣٣ %) than that of *Juglans regia* where all the replicate woods of the latter were completely consumed after twelve weeks (visual rating : ٥ , wood loss : ٧,٠٦ gm. infestation percentage ١٠٠ %) ( table ٥). Results obtained from choice feeding and wood consumption ( amount of wood loss) tests proved that walnut tree , *Juglanus regia* and fig , *Ficus carica* are the most susceptible wood for termite , *Microcerotermes gabrielis* infestation, these results were in agreement with the finding of Rizk and Beal (١٩٨٢) who found that *Carya pecan*, family Juglandacea is susceptible to the affected by termite *P.hybostom* and Abdel- Malak (١٩٩٥) who found that *Morus alba*, *Ficus cannighamiana* and *Quercus ilex* are highly susceptibility to *K.flavicollis* in Egypt with infestation percentage ١٠٠ %. Similar the same results were obtained by Abdel-Karim (٢٠٠٦) who found that *Acer oblongum* was attacked by the termite *K.flaicollis* .These results obtained was uncompleted concordance with those found by Smythe and Carter (١٩٦٩) who stated that walnut trees was not susceptible to subterranean termite, *Reticulitermes flavipes* in Egypt.

#### Group c: Moderate resistance species:

It was represented by three species per sapwood and heartwood according to their descending resistance of willow, *Salix babilonica*. ( visual rating : ١,١); wood loss : ٠,٦٢,٠٠,٦٩ gm., infestation percentage ٣٣,٣٣ %), and Eucalyptus , *Eucalyptus microthica* ( visual rating : ٢,٢; wood loss : ١,٩٥,١,١٤ gm., infestation percentage ٣٣,٣٣ %) respectively (table ٤). Abdel-Malak (١٩٩٥) who reported that *Salix babilonica* was not susceptible to feeding by dry wood termite *Kalotermes flavicollis* in Egypt, similar results were obtained by Nkunica (١٩٩١) found that *Eucalyptus spp.* as living trees were attacked by the termite, *K.banks*. Generally, the most moderate resistance species in this group was represented by *Salix babilonica* , *Quercus aegilopis* and *Eucalyptus microthica* by total average of wood consumption (wood loss) of ٠,٦٦,١,٢٨ and ١,٥٤ gm., respectively (table ٥) , this result obtained was uncompleted concordance with those found by Abdel-Nur(١٩٨٠) who stated that *E.microthica* was highly resistant to *P.hybostoma* and Grace *et al.* ( ١٩٩٦ ) who found that *E.microcorys* is light attack by termites in Hawaii region.

#### Group d : Light resistance species :

This group was represented by two tree species per sapwood and heartwood of normal Oak, *Quercus aegilopis* ( visual rating : ٢,١); wood loss : ٢,١٢,٠٠,٤٥ gm., infestation percentage ٣٣,٣٣ %), and Poplar, *Populus euramericana* ( visual rating : ٣,٢ ; wood loss : ٢,٩٣,١,٤٠ gm. infestation percentage ٦٦,٦٦ %), (table ٤), respectively. Kassab *et al.* (١٩٦٠) found that woods of poplar , sycamore , Egyptian Willow , White Mulberry and Egyptian *Acacia spp.* were attacked by *Anacanthotermes ochraceus* Burm., after ٤ to ١٠ months exposure. The light resistant species was represented *Quercus aegilopis* and *Populus euramericana* with a wood loss rate of ١,٢٨ and ٢,١٦ gm., respectively.(table ٥), these results obtained were uncompleted concordance with Rizk and Beal (١٩٨٢) and Abdel-Kareem (٢٠٠٦) they reported that *Populus nigra* is more resistance host for termite , *P.hybostoma*, while Abdel-Malak (١٩٩٥) in Egypt who found that *Quercus robur* was susceptibility to termite , *K.flavicollis* while *Q.canariensis* and *Q.ilex* were not attacked by *K.flavicollis*. Generally, the results of this study showed that the sapwood of tree species were more preferable to attack by termite comparison with the heartwood with a total average ٢,٢١ , ١,٧٩ gm., respectively.

#### ٤-Effect of some Physical properties per sapwood and heartwood for tree species to termite attack:

Study the effect of some physical properties like moisture content and specific gravity of trees ; namely ( *Acer spp.*, *Eucalyptus microtheca*, *Quercus aegilopes*, *Populus euramericana* , *Salix babilonica* , *Pinus nigra*, *Pinus sylvestris* , *Juglanus regia*, *Cuppressus spp.* and, *Ficus spp.*) to termite feeding

showed that there was no clear relation between the wood physical properties and the weight loss in wooden pieces due to termites workers feeding, the results of Duncan test showed varied significant and no significant values according to the tree species, wood species and physical properties of the woods, the relative moisture content was between 12,2- 10,2 % per heartwood and sapwood for both *Salix babilonica* and *Pinus nigra*, respectively. (total mean 13,3 and 14,9 gm.), respectively, (table 2), whereas the specific gravity ranged between 0,70-0,82 gm. per heartwood of *Eucalyptus* and sapwood of *Salix babilonica* and *Cupressus spp.*, respectively., (total mean. 0,73; 0,80 and 0,88 gm.), respectively (table 2). These data were in agreement with those found by Al-Mallah *et al.* (2009) who found that physical properties of wood and amount of wood loss were no clear relation in termite feeding preferences to the tested woods., whereas, Behr *et al.* (1972) who found positive correlation between the amount of termite feeding (by % wood weight loss) and both wood hardness and density, Rudman and Gay (1967) who found three factors are known to influence susceptibility of wood to termite attack like density, nature of the wood substance and nature of the extraneous materials, extractives and nutrients. The variation in resistance is ascribed to a natural variation in the amount of deterrent extractives to an ageing of the extractives and to a lesser extent to a density factor. on the other hand, Scheffrahn (1994) Concluded that the basis of termite resistance in any wood is not high lignin content, or hardness, but a specific chemical constituent, often present in only minute quantity, therefore the termite resistance depends on many factors such as hardness and chemical content.

**Table (4) : Total averages of moisture content, specific gravity, visual rating, wood mass loss, amount of wood loss, degree of infestation and infestation percentage for both sapwood and heartwood of trees exposed to termite in field test under artificial infestation conditions.**

Tree species	Wood species	Moisture * content %.	Specific gravity gm.	Visual rating (wood)	Amount of Wood loss gm.	amount of wood loss <sup>2</sup> (%)	Degree of infestation <sup>3</sup>	Infestation percentage %
<i>Acer spp.</i>	Sapwood	10,0 h	0,70 c	3	4,12 f	72,0	2/3	77
	heartwood	03,0 de	0,70 d	1	0,99 abc	20,2	1/3	33
<i>Eucalyptus microthica</i>	Sapwood	77,7 b	0,70 b	2	1,90 cd	23,8	1/3	33
	heartwood	77,8 b	0,75 a	2	1,14 abc	14,7	1/3	33
<i>Quercus aegilopes</i>	Sapwood	17,9 j	0,77 c	2	2,12 cde	20,8	1/3	33
	heartwood	23,2 i	0,72 b	1	0,80 ab	0,0	1/3	33
<i>Populus euramericana</i>	Sapwood	09,1 c	0,82 g	3	2,93 efd	02,9	2/3	77
	heartwood	77,7 b	0,80 f	2	1,80 bc	29,1	2/3	77
<i>Salix babilonica.</i>	Sapwood	74,4 b	0,82 g	1	0,73 ab	27,2	1/3	33
	heartwood	10,2 a	0,89 f	1	0,79 ab	27,4	1/3	33
<i>Pinus nigra</i>	Sapwood	12,2 l	0,38 h	0	0,24 ab	4,8	0/3	0
	heartwood	17,7 k	h0,80	0	0,27 ab	0,2	1/3	33
<i>Pinus sylvestes</i>	Sapwood	23,9 i	0,88 g	0	0,23 ab	0,0	1/3	33
	heartwood	21,8 j	0,87 fg	0	0,17 a	3,8	0/3	0
<i>Juglanus regia</i>	Sapwood	37,8 h	0,88 fg	0	7,77 g	80,7	3/3	100
	heartwood	30,8 h	0,82 ef	0	7,87 g	90,7	3/3	100
<i>Cupressussp.</i>	Sapwood	82,8 g	0,82 g	0	0,10 a	1,2	0/3	0
	heartwood	88,9 fg	0,87 fg	0	0,81 ab	4,2	1/3	33
<i>Ficus carica</i>	Sapwood	87,0 fg	0,85 e	3	3,20 ef	00,0	2/3	77
	heartwood	00,7 e	0,80 e	4	3,72 f	09,0	2/3	77

\* Means within a column followed by the same letter are not significantly different at 0% level according to Duncan multiple range test.

- <sup>1)</sup> Woods were visually rated as ∙ = sound = , √ = surface nibbles , √ = light attack , √ = moderate attack , × = heavy attack , ∅ = completed destroyed .
- <sup>2)</sup> wood loss ( % ) = amount of wood loss / wt. wooden pieces ( dry )
- <sup>3)</sup> Degree of infestation = No. attack ( wood ) / Total observation.

**Table ( 6 ) : Means of moisture content, specific gravity, visual rating , wood mass loss, degree of infestation and infestation percentage for sapwood of trees exposed to termite in field test under artificial infection conditions.**

\* means within a column followed by the same letter are not significantly different at 5% level according to Duncan multiple range test.

### References

Tree species	Moisture content. %.	Specific gravity gm.	Visual rating	Wood mass loss	Wood loss (%)	Degree of infestation	Infestation percentage %.
<i>Acer spp.</i>	44.2 e	0.72 c	2	2.00 e	41.1	0.49	49.0
<i>Eucalyptus microthica</i>	66.7 b	0.72 a	2	1.04 cd	19.2	0.31	33
<i>Quercus aegilopes</i>	20.1 h	0.79 b	1.0	1.28 bc	14.4	0.31	33
<i>Populus euramericana</i>	62.8 c	0.47 e	2.0	2.16 de	41.0	0.76	76
<i>Salix babilonica</i>	72.3 a	0.40 e	1	0.77 ab	20.3	0.31	33
<i>Pinus nigra</i>	14.9 h	0.39 f	0	0.20 a	0	0.16	16.0
<i>Pinus sylvestris</i>	22.8 g	0.40 e	0	0.20 a	4.4	0.16	16.0
<i>Juglanus regia</i>	36.3 f	0.50 de	0	7.07 g	88.1	1.00	100
<i>Cupressus spp.</i>	40.8 e	0.44 e	0	0.20 a	0.7	0.16	16.0
<i>Ficus carica</i>	49.1 d	0.54 e d	3.0	3.46 b	57.2	0.76	76

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لبعض اشجار الغابات  
*Microcerotermes gabrielis* Weld. ( Isoptera : Termitidae )

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الخلاصة

اختبرت عشرة أنواع من الأخشاب المحلية والمستوردة من أشجار الغابات ذات الاستخدامات المتعددة في مجالات الحياة المختلفة وذلك لمعرفة مدى حساسية أو مقاومة الأرضة للخشب العصاري والصممي لبعض الاشجار المدروسة وهي الاسر ، اليوكالبتوس، البلوط العادي، القوغ الامريكي، الصفصاف الباكي، الصنوبر الاسود ، الصنوبر البري، الجوز، السرو والتين البري. اظهرت نتائج الدراسة أن الخشب العصاري والصممي ولجميع الأنواع المدروسة كانت غير مفضلة من قبل الأرضة في ظروف العدوى الطبيعية على جبل هيبه سلطان في منطقة كويسنجق وعلى ارتفاع ١٥٠٠ م فوق مستوى سطح البحر ، بينما أظهرت نتائج التفضيل الغذائي للأخشاب وجود فروق معنوية بين الأنواع المختبرة في الحديقة النباتية تحت ظروف العدوى الاصطناعية بعد ١٢ أسبوع من الاختبار ، لوحظ من الدراسة أيضا أن أشجار الجوز والتين البري كانت أكثر حساسية للإصابة بالأرضة خلال مدة التجربة بمعدل فقد بلغ ٧٠,٦ و ٣,٤٦ غم ، على التوالي ، فيما اختلفت النتائج بالنسبة لأشجار الصنوبر البري و الصنوبر الأسود والسرو، اذ كانت من الأنواع الأكثر مقاومة لفعل الإصابة بمعدل فقد للخشب بلغ ٠,١٩ ، ٠,٢٥ ، ٠,٢٧ غم على التوالي في ظروف العدوى الاصطناعية. كما أوضحت النتائج أن الخشب العصاري للأشجار المدروسة كانت أكثر تفضيلا من قبل الأرضة مقارنة بالخشب الصممي بمعدل فقد بلغ ٢,٢١ و ١,٧٩ غم على التوالي، أما بالنسبة لنتائج بعض الصفات الفيزيائية،المحتوى الرطوبي والوزن النوعي لأنواع الأشجار المدروسة للخشب العصاري والصممي فقد كانت العلاقة غير واضحة بين هذه الصفات ومعدل الفقد في أوزان القطع الخشبية نتيجة تغذية شغالات الأرضة ، كما بينت الدراسة ان مقاومة الأشجار للإصابة بحشرة الأرضة تعتمد على بعض العوامل مثل الصلادة والمحتوى الكيميائي .