Pak. j. sci. ind. res. Ser. B: biol. sci. 2022 **65B**(3) 292-296

Short Communication

Biotic and Abiotic Factors Affecting the Feeding Behaviour of Subterranean Termite *Odontotermes obesus* (Ramber) (Blattoidea: Termitidae) Under Field

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(received October 7, 2020; revised March 10, 2021; accepted March 17, 2021)

Abstract. The present study was conducted to evaluate the feeding behaviour of termite *Odontotermes obesus* (Ramber) under field conditions under abiotic and biotic factors. Eight wood species include *Mangifera indica* (mangoes), *Albizia lebbeck* (albizia), *Populus euramericana* (popular), *Melia azedarach* (bead tree), *Vachellia nilotica* (kiker,thorny acacia), *Eucalyptus camaldulensis* (eucalyptus), *Dalbergia sissoo* (shesham) and *Eugenia jambolana* (Jamun) was offered to termites to feed under field trials. Results found that *P. euramericana* and *M. indica* were the most palatable woods to termite. In choice bioassay *E. camaldulensis* was more consumed.

Keywords: feeding preference, *Odontotermes obesus* (Ramber), different woods, termite, abiotic and biotic factors

In the history of social evolution, termites were the first animal to live together in an organized colony (Wang *et al*., 2015). Termites are the most destructive and economically important pests of wood and other cellulose products**.** Most termite species are xylophagous, feeding on the lignocellulosic xylem of plants. Termite cause remarkable losses to agricultural crops, forest trees and wood works in buildings as well as agricultural pests found mostly in the tropical regions, where they play an important ecological role in the recycling of wood and other cellulose based material (Mustafa *et al*., 2020). Termites live in groups belonging to the order Blattodea Infra order Isoptera). They have active bioreactor that can efficiently decompose lignocellulos, hence play a key role in universal carbon cycle. Termites are of great ecological importance for their ability to recycle wood materials by breaking down cellulose. However, when they began to destroy wooden products such as homes, buildings and other commercial wood products, they become serious economic pests. Subterranean termites are one of the most important termite pests in the world with a widespread global distribution. Therefore, effective control methods for termites have been established and considerable efforts have been made for controlling them (Suhara, 2020). Except Antarctica, termites present all over the continents and their diversity in tropical and subtropical areas is highest. Termites are very diverse group of animals. Approximately 3,000 species of termite has been defined consisting of 7 families and 280 genera. Only 80 species cause damage to wood and wood structures. Out of these 38 species are subterranean termites and are important pest of wood and wood structures due to their crypto biotic nature. Naturally, all over the world, termite attacks every, where on the wood and timber that are supposed or designed for numerous projects and purposes and cause a huge economic loss every year (Kuswanto *et al*., 2015). *Microtermes obesi*, *Odontotermes obesus* (Rambur), *Coptotermes heimi* (Wasmann) (Holmgren) and *Heteroterme indicola* (Wasmann) are the well known termite species in Pakistan and cause severe damage to wood and wooden structure. *H. indicola* is the important pest of home structures in Pakistan and become the dangerous pest species in Lahore (Manzoor and Mir, 2010). *C. heimi* (Wasmann) is distributed throughout the Pakistan and destroy the woods and even standing plantations (Rasib and Ashraf, 2014). Many social insects port their colonies in nests that show organized micro climate e.g. humidity and temperature. These factors are helpful in maintaining of survival, reproduction and development of individuals.

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Some termite species leave the nest when forage for food and construct galleries and tunnels to defend them selves or may adopt to forage at night. Other than such strategies, foraging rates are directly affected by the seasonal variations (Ferreira *et al*., 2019). The termite colonies are affected by the environmental factors. For example, temperature, precipitation, elevation and properties of soil are known to affect the diversity of termite (Bourguignon *et al*., 2015). Seasonal variations of temperature and relative humidity perform a key role in the biology and behaviour of termite. Subterranean termites are susceptible to temperature variations. They never forage in an area where the temperature of soil surface is too hot or cold (Smith and Rust, 1994). In micro-habitat, the dispersal of foraging termites is influenced by soil type interaction and availability of moisture contents (Cornelius and Osbrink, 2010). Abiotic and biotic factors are very essential for any species. Their role is very prominent in establishing successful aggressive species. Amongst the abiotic factors, temperature and moisture level play important role in defining the appropriate areas for the establishment.

To restore the situation proper understanding of termites will be of great importance. Current study was conducted to find the most preferred wood species to termite under field condition. These woods would be used in baiting station and for termite trapping.

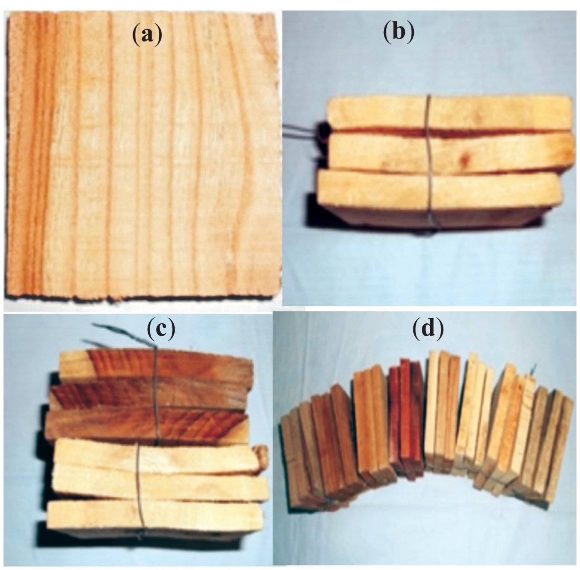

Fig. 1. **(a)** Single wood block, **(b)** Wood block tide with wire, **(c)** Two wood species tied with wire, **(d)** Eight wood specie tide with wire (n=3).

The quantity of wood consumed in 12 weeks was calculated by using the following formula:

$$WL = \frac{W1 - W2}{W1} \times 100$$

whereas:

WL is the wood mass consumed, W1 and W2 were the pre and post weights of the wooden block respectively. The wood consumed by termites in 12 weeks was calculated by using the following formula:

$$WC = W1 - W2$$

whereas:

WC is the mass consumed, W1 and W2 are the pre and post weights respectively.

Among the wood blocks, offered to termite *O. obesus* in combination of two woods in choice bioassay under field conditions, the maximum feeding was noted in *P. euramericana* and *D.sisso* (23.3 and 0.67 g) and minimum feeding was recorded in *M. azedarach* and *E. camaldulensis* (0.67 and 3.6 g). Feeding preferences of termites for the combinations in descending order were as follow: PE/DS > AL/EJ > MI/VN > MA/EC. The difference in mass loss for each pair of wood blocks was significantly different ($P > 0.05$, paired comparison t. test) shown in Table 1.

Table. 1. Mean (X ± SD) wood mass loss (g) in four different wood pairs exposed to the workers of *Odontotermes obesus* for MI/VN *(Mangifera indica* and *Vachellia nilotica*) AL/EJ *(Albizia lebbeck* and *Eugenia jambolana*), PE/DS *(Populus euramericana and Dalbergia sissoo)* and EC/MA *(Melia azedarach*

Table. 1. Comparison of wood mass losses

	Wood mass loss (g)		
Comparison	Wood 1	Wood 2	Probability
MI/VN	10.3±0.145	2.0±0.145	0.001
AL/EJ	15.0±0.260	4.0±0.289	0.001
PE/DS	23.3±0.208	0.67±0.123	0.000
MA/EC	0.67±0.241	3.6±0.291	0.011

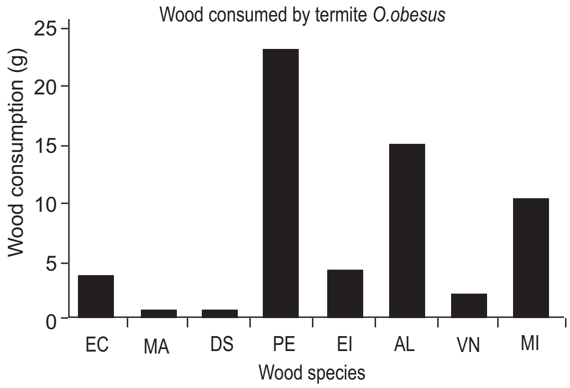

Fig. 2. Wood consumption (g) by *O. obesus* in choice bioassay.

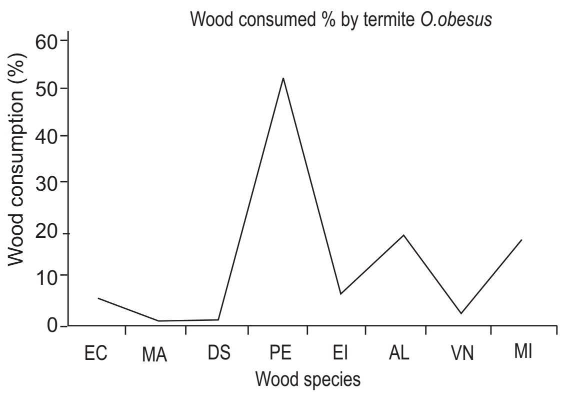

Fig. 3. Wood consumption (%) by *O. obesus* in choice bioassay.

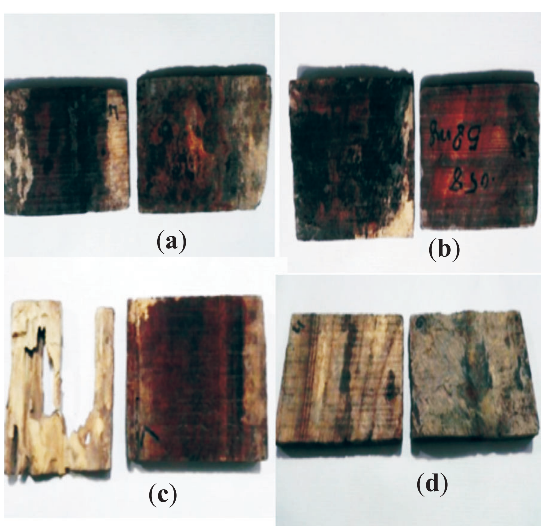

Fig. 4. **(a)** *Mangifera indica* and *Vachellia nilotica*, **(b)** *Albizia lebbeck* and *Eugenia jambolana* **(c)** *Dalbergia sissoo* and *Populus euramericana* **(d)** *Eucalyptus camaldulensis* and *Melia azedarach* .

Table. 2. Mean (X ± SD) wood mass loss (g) in eight different woods exposed to the workers of *O. obesus* in no choice field trials.

Wood species	Wood consumed (g)	Wood consumed %
Populus euramericana (Control)	28 ± 0.289	76.38
Mangifera indica	21 ± 0.441	42
Albizia lebbeck	10 ± 3.01	13.76
Melia azedarach	1.34 ± 0.15	2.16
Eugenia jambolana	12.34 ± 1.47	21.28
Vachellia nilotica	26.6 ± 0.291	39.11
Eucalyptus camaldulensis	5.34 ± 0.434	7.03
Dalbergia sissoo	3.67 ± 0.294	6.33

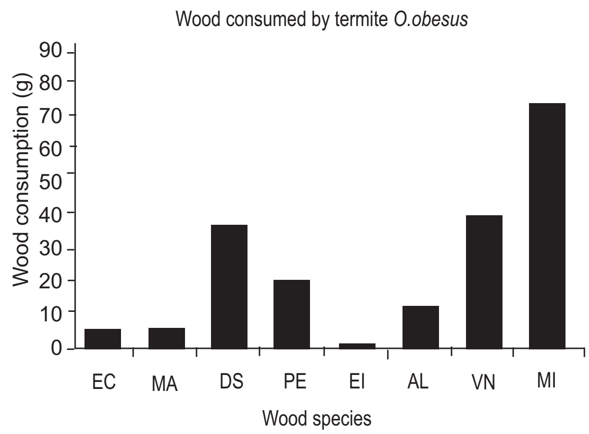

Fig. 5. Wood consumption by *O. obesus* in no-choice bioassay.

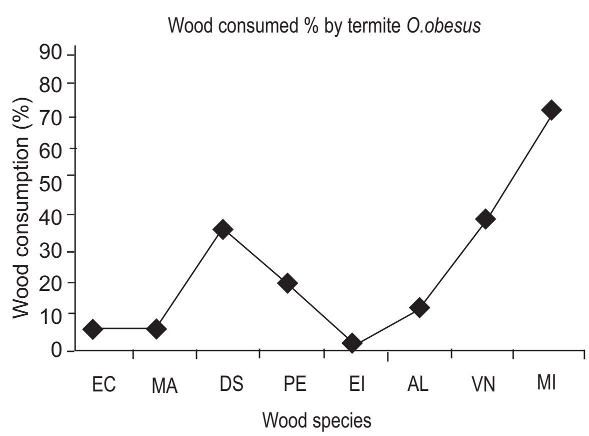

Fig. 6. Percentage wood consumption by *O. obesus*.

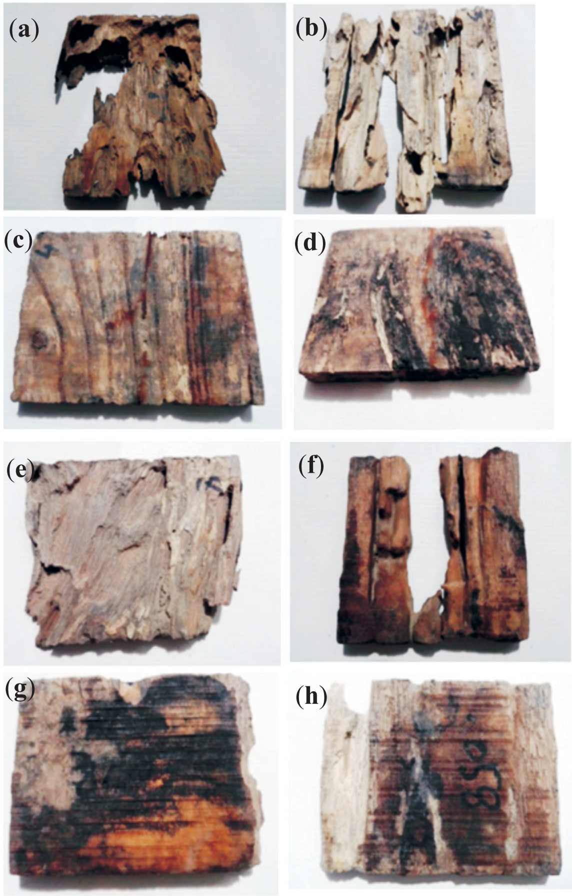

Fig. 7. Wood species infested by termite **(a)** *Populus euramericana* **(b)** *Mangifera indica* **(c)** *Albizia lebbeck* **(d)** *Melia azedarach* **(e)** *Eugenia jambolana* **(f)** *Vachellia nilotica* **(g)** *Eucalyptus camaldulensis* **(h)** *Dalbergia sissoo*.

and Eucalyptus camaldulensis) in 12-week choice experiment under field conditions.

Current study found that *P. euramericana* and *M. indica* woods were the favourite food source to termite *O. obesus.* Maximum feeding and mass loss was observed in these two woods in both tests. Softening of *P. euramericana* and *M. indica* makes these woods palatable to termite. More than 70% consumption was noted in case of *P. euramericana.*

Visually, it was found that both woods were heavy attacked, even the woods were collapsed. Termites were penetrated inside the woods and maximum wood was consumed. In comparison, heartwoods of *A. lebbeck*, *M. azedarach, E. camaldulensis, E. jambulana, V. nilotica* and *D. sisso* were not desired wood species. Minimum wood consumed in case of these woods and fall under the category of "slight to superficial attack". Among these woods, *M. azedarach* and *E. camaldulensis* found to be most resistant to termites. Only 1.34 g wood *M. azedarach* was consumed in no choice mentioned in (Table 2) and 0.15 g in choice bioassay mentioned in (Table 1) and *E. camaldulensis* was consumed 3.6 g in choice bioassay (Table 1) and 7.3 g in no choice bioassay mentioned in (Table 2). *P. euramericana* and *M. indica* are the favorite woods to termites under different environmental conditions and can be used in termite trapping and bait station. Our results match with the other parts of the world termitologists studied various aspects of termite under abiotic and biotic conditions (Ferreira *et al*., 2019; Zukowski and Su 2017; Iqbal *et al*., 2015; Little *et al*., 2013; Rasib *et al*., 2014; Rasib and Ashraf 2014; Mugerwa *et al*., 2011; Sheikh *et al*., 2010; Manzoor and Mir 2010; Smith and Rust 1990).

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