SOME STUDIES ON THE SUBTERRANEAN TERMITE *AMITERMS DESERTORUM* DESN. (ISOP. TERMITIDAE) IN NORTH SINAI GOVERNORATE

BATT, A. M., M. M. ABDEL-AZIM, G. N. GIRGIS, A. M. OKIL AND M. A. M. BATT

Plant Protection Research Institute, ARC, Egypt

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Abstract

Ten tree species were infested with subterranean termite, *Amiterms desertorum* in North Sinai governorate, these were eucalyptus, sunt, tamarisk, acacia, casuarina, mulberry, mango, citrus, olive and palm trees.

Relative susceptibility of infested trees showed that the palm had highest percentage of infestation (37.5 %), while citrus and olive recorded the minimum percentage (3.13 %).

Study of host preference revealed that palm fronds attracted the largest number of termite individuals (106 individuals) and gave the highest percentage of lost wood (65 %), while eucalyptus cuttings attracted the minimum number (22 individuals), whereas the least percentage of lost wood occurred in casuarina cuttings (23 %).

Percentages of infestation increased with the increase of the exposed part of fronds above ground, it recorded 10-90 % for cuttings above ground with 20-80 cm height. The same trend was recorded with the lost wood. No infestation appeared on fresh fronds which fully buried under ground. The oblique fronds showed 70 % infestation and gave about 0-74 % of lost wood.

The results indicated also that the optimum distance between the remedial traps was 50 cm which prevent attack of termites or gave 100% mortality. Also, experiment determined a new effective method, using plastic pipes, in control of subterranean termites. This method gave 82.5, 97.5 and 100 % protective when Basudin insecticide used at 1, 2, 3 % concentration, respectively.

INTRODUCTION

Termites are social insects, live in colonies and utilize cellulose which they normally obtain from wood or other plant materials. Various species of termites were widely distributed in Egypt, these species were belonged to two groups, the first: subterranean termites as *Psammotermes hypostoma* Desn., *P. fascufemoralis* Emer., *P. asswanensis* Siost. (Rhinotermitidae), *Anacanthotermes ochraceus* Burm. (Hodotermitidae), *Amitermes desertorum* Desn. and *Microcerotermes eugnathus* Silvestri (Termitidae) which universally present in stumps, logs and other woody materials in contact with the ground and attack wood located away from the ground where supply of water is not available by construct covered passageways (shelter tubes), The second: nonsubterranean termites, as *Cryptotermes brevis* Walke. and *Kalotermes flavicollis* Fab. (Kalotermitidae) which attack structural timber and other woodwork in buildings, furniture, piles of lumber, wood pulp or fiber insulation boards,

other wooden materials and dried sites on trees, these termites have rarely any contact with soil. They live and feed entirely within woody material

In Egypt, Some studies on termites were conducted by kassab *et al.* (1960), Soliman (1963), Nour *et al.* (1965), Hosny and Said (1980), Helal and Ali (1981), El-Sebay (1991 and 1995), Nasr and Moein (1992), Moein (1997), Moein and Farrag (1998) and Moein and Nasr (1999).

This work was carried out in order to study percentage of infestation and relative susceptibility, host preference, relation between host position (under and upper ground) and infestation, determination of the optimum distance between remedial traps and evaluation of a new method to control of subterranean termite, *A. desertorum* using pipes.

MATERIALS AND METHODS

1. Percentage of infestation and relative susceptibility:

Trees encountered along the public street (from El-Arish to Rafah districts) and some kinds of fruit orchards were inspected for external signs of termite activity between May to August 2004. Total number of each tree species and number of infested trees were recorded. The percentage of infestation and relative susceptibility were estimated as follows:

$$\text{Percentage of infestation} = \frac{\text{Number of infested trees / species}}{\text{Total number of inspected trees}} \times 100$$

$$\text{Relative susceptibility} = \frac{\text{No. of infested trees of each species}}{\text{Total number of infested trees}} \times 100$$

2. Host preference:

The experiment was carried out in pestilential ground with subterranean termite (tested prior by corrugated cardboard traps and symptoms of infestation were clear - cut on wooden fence around this ground) at El-Arish district, North Sinai governorate.

Seven wood tree species were tested to determine their preferable to infestation with termites. So, fresh eucalyptus, casuarina, acacia, sunt, tamarisk, mulberry and palm fronds cuttings (each about 50 cm long and 3.5 cm diameter) were obtained and grouped to 10 groups each contain one cutting from each host. These groups were partial buried in ground until Mid. Monthly examination was made during the period from Sep. 2004 to January 2005. Number of muddy tubes over the bark, number of internal tunnels, lost percentage in bark and wood and number of individuals collecting were estimated. Lost percentage was calculated as follows:

$$\text{Lost percentage} = \frac{\text{Length of eatable part}}{\text{Length of cutting}} \times 100$$

3. Relation between host position (under and upper ground) and infestation

Fresh palm fronds cuttings (each about 100 cm long and 2.5-3.5 cm diameter) were collected. Ten cuttings were fully buried underground, 10 cuttings placed upon ground, 4 groups each included 10 cuttings were partial buried at 20, 40, 60 and 80 cm height and 10 cuttings inserted with oblique angle to be touch with surface ground. The cuttings were examined monthly during period from 1st week of Aug. 2004 to 4th week of Jan. 2005. Percentage of infestation and percentage of lost wood were determined as follows:

$$\text{Percentage of infestation} = \frac{\text{Numbers of infested cuttings}}{\text{Total number of cuttings}} \times 100$$

$$\text{Percentage of lost wood} = \frac{\text{Length of eatable wood}}{\text{Length of cutting}} \times 100$$

1. Determination of the optimum distance between remedial traps:

Two field tests were conducted to determine the optimum space between remedial traps, during the period from September to December 2004. The exp. was done near to an infested fence of one olive orchard at El-Arish district. Each test consisted of three trials, each 3 m^2 (3x1 m.) of ground, using modified El-Sebay trap (1991). The traps of each trial were distributed as follows:

In the first test, remedial traps (treated with diazinon at rate of 10 cm^3 per trap) were buried in soil at one meter distance (8 traps / trial) while discovery traps (untreated) were placed between other treated out and inside treatment, 13 between treatment at 50 cm distance, 12 out treatment at 100 cm distance and 12 out treatment at 50 cm distance (of each trial), Fig. (1).

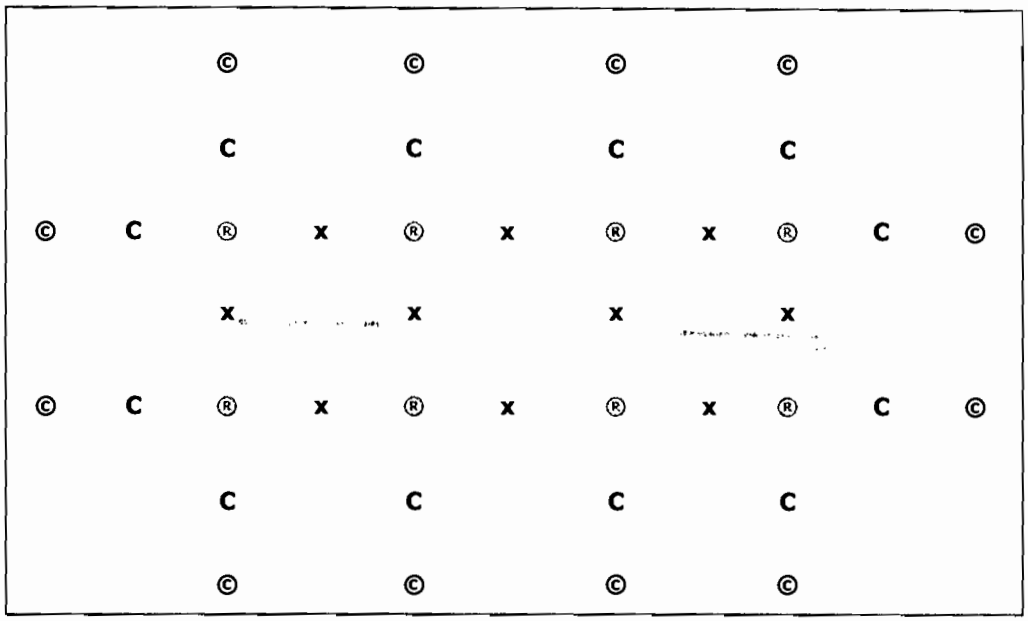
In the second test, the remedial traps / trial were placed at 50 cm distance while the discovery traps were distributed as follows: 14 traps at 25 cm dist. between remedial traps, 20 traps at 50 cm dist. and 20 traps at 25 cm dist. out treated (of each trial), Fig. (2).

Each remedial trap in the two pervious tests was treated for about 4 litres water, while the discovery traps were distributed in ground after 7 days of treatment and were examined after one month.

The percentages of infestation of discovery traps were estimated at different distances as indicated to the optimum distance for use the remedial traps in control of subterranean termites.

$$\% \text{ Infestation} = \frac{\text{Number of infested traps at definite distance}}{\text{Total number of discovery traps at same distance}} \times 100$$

Fig. 1. Distribution of remedial traps at 100 cm distance and discovering traps at 50 and 100 cm distance.

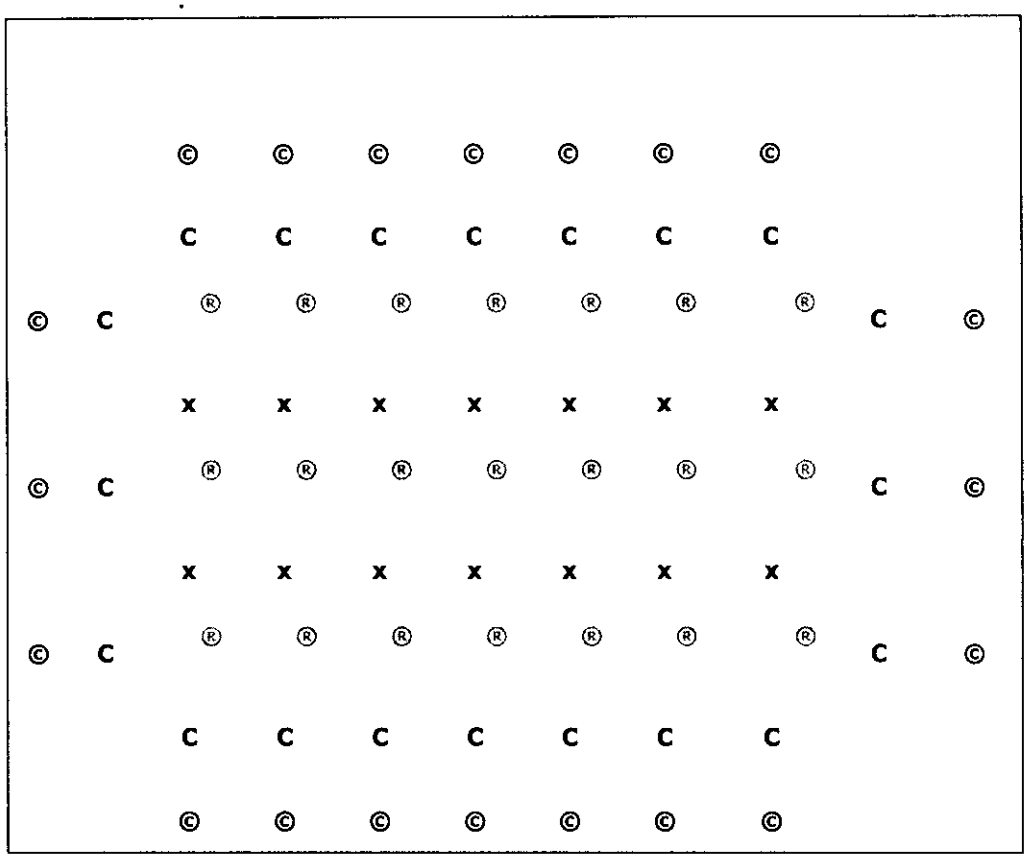


Where: ® = represent remedial traps at 100 cm distance (8 traps)
C = represent discovering traps out treatment at 50 cm distance (12 traps)
© = represent discovering traps out treatment at 100 cm distance (12 traps)
x = represent discovering traps within treatment at 50 cm distance (10 traps)

5. New method to control of subterranean termites

Plastic irrigation pipes (each 10 m. long and 15 mm. diameter) have holes regularly distributed at 20 cm. of each, were used. The holes were provided with protuberances in T-shape (sprayers) which guarantee diffusion of insecticidal solution to down ground and horizontal up to 50 cm. distance. Three infested fences with subterranean termite, *A. desertorum*, were chosen and percentages of infestation were determined, each fence was placed between two fore-mentioned pipes at 50 cm. dist., each pipe was attached with plastic container of 80 litres volume, Fig. (3). Three concentration of Basudien insecticide (1%, 2%, and 3%) were used, one of each fence. 70 litres of insecticidal solution placed in each container. One week after treatment, the discovery traps buried within fences. The traps were examined each 3 months during one year. The percentage of protective efficacy was estimated.

Fig. 2. Distribution of remedial traps at 50 cm distance and discovery traps at 25 and 50 cm distance.



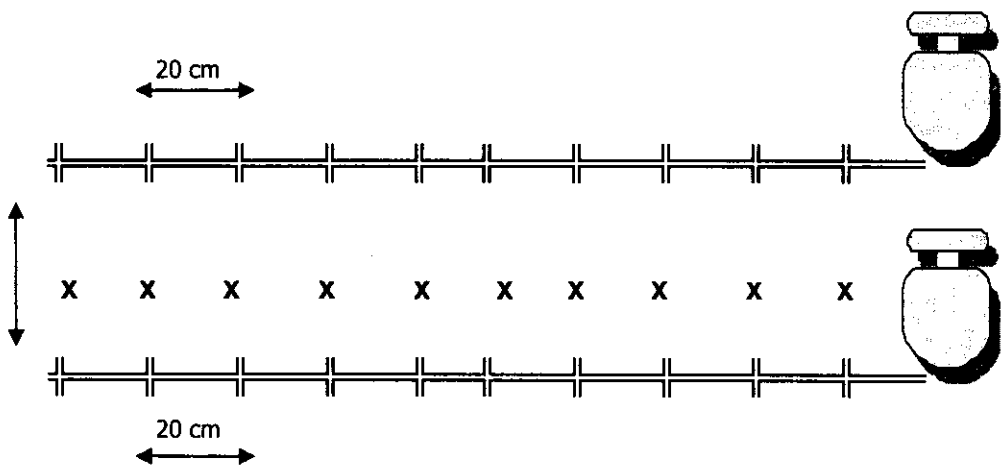
Where: ® = represent remedial traps at 50 cm distance (21 traps)

C = represent discovery traps out treatment at 25 cm distance (20 traps)

© = represent discovery traps out treatment at 50 cm distance (20 traps)

x = represent discovery traps within treatment at 25 cm distance (14 traps)

Fig. (3): Control of termites by pipes



Where: **x** = represent discovery traps within treatment (4 traps / m).

= represent sprayers of insecticidal solution at about 20 cm distance.

RESULTS AND DISCUSSION

Observation on infestation of subterranean termite, *A. desertorum*.

This species of subterranean termite is widely spread in all districts of North Sinai governorate. It observed in various localities to infest wood in its different features in houses, schools, libraries, fences, telephone and telegraph poles, furniture, fruit and wood trees. Besides, shrubs, nersery stock, fabrics derived from cotton, herbal plants, books, paper products and different cellulosic materials. The infestation also observed in dried upper branches on healthy trees through mud pipes made by termites on external bark of trees. More important infested trees were eucalyptus, sunt, tamarisk, acacia, casuarina, mulberry, mango, citrus, olive and bases of fronds on palm trees, severely infestation were found in fences made from dried fronds around orchards. Successive examinations of soil neighboring to wooden fences showed existence to winged individuals during the period from September to December as well as tunnels and some chambers to termites.

1. Percentage of infestation and relative susceptibility

Data in Table (1) indicated that out of 20 observed tree species, 10 species were infested with *A. desertorum* termite. The highest percentage of infestation was recorded on palm trees (5.3 %) while the minimum percentage recorded of olive trees (0.5 %). Relative susceptibility of infested trees was discendingly arranged as follows: palm (37.5 %) > eucalyptus (15.63 %) > sunt (9.38 %) > each of tamarisk and acacia (7.8 %) > ach of casuarina and mulberry (4.69 %) > each of citrus and olive (3.13%).

2. Host preference

Presented data in Table (2) pointed to effect of host species on the infestation with *A. desertorum* termite. The largest number of muddy tubes on bark surface were constructed on eucalyptus (13 tubes), while minimum number built on mulberry (4 tubes), however the largest number of internal tunnels (17 tunnels) was found in palm fronds cuttings, whereas the minimum number (3 tunnels) observed in casuarina cuttings. Highest percentage of lost bark (80%) observed of palm fronds cuttings, while least percentage (35 %) was for casuarine cuttings. The same trend recorded to percentages of lost wood of palm (65 %) and casuarina (23 %). The total number of individuals collecting showed that palm fronds cuttings attracted the highest number of termites (106 individuals) followed by sunt (87 individuals),

Table 1. Total number of examined trees, percentage of infestation and relative susceptibility with *A. desertorum* termite, along the puplic street El-Arish / Rafah, during 2004.

Tree species	Total no. of observed trees	No. of infested trees	Percentage of infestation	*Relative Susceptibility*
Eucalyptus	216	10	4.6	*15.63*
Sunt	175	6	3.5	*9.38*
Tamarisk	327	4	1.2	*6.25*
Acacia	425	5	1.2	*7.80*
Casuarina	149	5	3.4	*7.80*
Mulberry	68	3	4.4	*4.69*
Mango	119	3	2.5	*4.69*
Citrus	257	2	0.8	*3.13*
Olive	443	2	0.5	*3.13*
Palm	457	24	5.3	*37.50*
Pear	97	—	—	—
Plum	54	—	—	—
Peach	1647	—	—	—
Apple	435	—	—	—
Apricot	76	—	—	—
Almond	517	—	—	—
Fig	915	—	—	—
Sycamore	84	—	—	—
Grapevine	214	—	—	—
Nabk	34	—	—	—
Total	*6709*	*64*		

tamarisk (63 individuals), acacia (56 individuals), mulberry (49 individuals), casuarina (31 individuals), while minimum number (22 individuals) recorded of eucalyptus cuttings

Table 2. Effect of host species on the infestation with *A. desertorum* termite.

Host species	Total numbers of		Lost percentage		Total number of individuals collecting
	Muddy tubes over bark	Internal tunnels	Bark	Wood	
Eucalyptus	13	4	48	31	22
Casuarina	8	3	35	23	31
Acacia	6	8	54	44	56
Sunt	11	13	50	53	87
Tamarisk	7	11	75	48	63
Mulberry	4	9	55	41	49
Palm	10	17	80	65	106

3. Relation between host position under and upper ground

Data in Table (3) revealed the effect of host position from ground on the infestation and lost wood with *A. desertorum* termite. Palm fronds buried on different depths indicated to clear differentiation in each of percentage of infestation and lost wood by *A. desertorum* termite. No infestation was observed on fully buried fronds (the cuttings kept moist throughout experiment period), while fronds placed upon ground had 30 % infestation. The oblique fronds on ground recorded 70 % infestation. Percentage of infestation increased with increase the exposed part from fronds above surface ground, may refer.

Table 3. Effect of host position from ground on the infestation and lost wood with *A. desertorum* termite.

Position of palm fronds	% of infestation	Percentage of lost wood			
		Within all cuttings		Within infested cuttings	
		Range	Mean	Range	Mean
Under ground	0	0	0	0	0
20 cm above ground	10	0-5	0.5	---	5 ± 0
40 cm above ground	20	0-30	4.8	18-30	24 ± 6
60 cm above ground	50	0-61	25.3	29-61	50.6 ± 12.2
80 cm above ground	90	0-83	59.3	48-83	65.9 ± 12.1
Upon ground	30	0-57	14.1	36-57	47 ± 8.6
Oblique on ground	70	0-74	41.3	33-74	59 ± 13.0

to quick dryness of cuttings. Recorded percentages of infestation were 10, 20, 50, and 90 % for cuttings above ground with 20, 40, 60 and 80 cm height, respectively.

Highest percentage of lost wood within all cuttings in different position was 59.3 % recorded in palm fronds cuttings with 80 cm height above ground, while the minimum percentage 0.5 % recorded in cuttings with 10 cm height above ground. On the other hand, the highest percentage of lost wood within infested cuttings was 65.9 % (range, 48-83 %) recorded in cuttings with 80 cm above ground, while least was 5 % recorded in cuttings with 10 cm above ground. However, the percentage of lost wood for oblique cuttings on ground was between 33-74 % with a mean of 59 % within infested cuttings, whereas, it was 41.3 % within all cuttings.

4. Determination of the optimum distance between remedial traps.

Data in table (4) showed the effect of distance between remedial traps on the infestation with *A. desertorum* termite. It evident that, the discovery traps placed at 100 cm from remedial traps appeared 100 % infestation with termites, while the discovery traps placed at 50 cm from treated traps showed 70 % to 80 % of traps found within remedial traps and 75 % - 91.7 % of traps out treatment.

The percentage of infestation of discovery traps placed at 50 cm from remedial traps showed 55 % – 70 % infestation. No infestation was found between traps at 25 cm, while the percentage 0 - 10 % at the same distance out treatment.

These results indicated that the optimum distance between the remedial traps was 50 cm which prevent attack of termites or give 100 % mortality.

5. Evaluation of new method to control of subterranean termites using pipes

Data in Table (5) detected the effect of insecticide on infestation with subterranean termite, *A. desertorum* using pipes method. It evident that, Basudine 3 % gave 100 % protective during experiment period (one year), while the concentration 2 % appeared 97.5 % protective after 12 months of treatment. The minimum effect showed 82.5 % protective when the concentration of insecticide was 1 %.

These results emphasize that the pipes method was one of effective methods in the control of subterranean termites.

Table 4. Effect of distance between remedial traps on the infestation with termites.

Distances between remedial traps	Discovery traps		Total no. of traps / trial	Percentage of infestation
	Position	Distance		
50 cm	Within treated traps	25 cm	14	0 %
	Out treated traps	50 cm	20	55 - 70 %
		25 cm	20	0 - 10 %
100 cm	Within treated traps	50 cm	10	70 - 80 %
	Out treated traps	100 cm	12	100 %
		50 cm	12	75 – 91.7 %

Table 5. Effect of insecticide on the infestation with subterranean termite, *A. desertorum* using pipes method.

Basudin concentration	Percentage of infestation before treatment	% protective efficacy in different months after treatment		
		3	6	12
1 %	86.5	95.0	90.0	82.5
2 %	92.5	100	100	97.5
3 %	100	100	100	100

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بعض الدراسات على النمل الابيض التحت ارضى *Amiterms Desertorum* فى محافظة شمال سيناء.

عبد الغنى محمد بط ، محمود محمد عبد العظيم ، جورج نسيم جرجس ، عادل محمد عقيل ، محمدعبد الغنى بط

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – جيزة

اجرى هذا البحث في محافظة شمال سيناء لعمل بعض الدراسات على النمل الأبيض التحت أرضي *A. desertorum* المنتشر فى هذه المنطقة ، ودلت نتائج الدراسات على:-

١. وجد عشرة أنواع من الأشجار تصاب بالنمل الأبيض هى الكافور والسنط والعبل وألاكاسيا والجازورينا والتوت والمانجو والموالح والزيتون والنخيل وقد أظهرت الإصابة النسبية أن أعلى نسبة مئوية للإصابة كانت فى أشجار النخيل (٣٧،٥ %) بينما اقل نسبة مئوية سجلت فى أشجار الزيتون والموالح (٣،١٣%).
٢. أظهرت دراسة أفضلية العوائل أن جريد النخيل جذب العدد الأكبر من أفراد النمل (١٠٦ فرد) والذى اظهر أعلى فقد للخشب (٦٥ %) بينما جذبت عقل الكافور اقل عدد من أفراد النمل (٢٢ فرد) فى حين سجلت اقل نسبة فقد الخشب فى عقل الجازورينا (٢٣ %).
٣. وجد أن النسب المئوية للإصابة تزداد بزيادة الجزء المعرض من العقل فوق سطح الأرض حيث تراوحت نسبة الإصابة من ١٠-٩٠ % للارتفاعات من ٢٠-٨٠ سم فوق سطح التربة، ونفس الاتجاه سجل للخشب المفقود. وفى حين لم تظهر إصابة على جريد النخيل المدفون بالكامل فى التربة فان الجريد الموضوع مائلا واكبر ملامسه للتربة اظهر ٧٠ % إصابة ووصل الفقد للخشب فى بعض العقل الى حوالى ٧٤ %.
٤. أظهرت التجربة لتحديد المسافة المثلى للمصائد العلاجية للنمل الأبيض أن مسافة ٥٠ سم بين المصيدة والأخرى منعت هجوم النمل و اعطت ١٠٠% موت للنمل.
٥. صممت طريقة جديدة لعلاج النمل الأبيض والوقاية منه باستعمال انابيب بلاستيكية مزودة برشاشات تضمن انتشار محلول المبيد الى مسافة ٥٠ سم وقد أعطت نتائج هذه التجربة ٨٢،٥% و ٩٧،٥% و ١٠٠% وقاية و ذلك عند استعمال الباسودين بمعدل ١% و ٢% و ٣% على التوالى.