AN ATTEMPT TO DELINEATE *ANACANTHOTERMES OCHRACEUS* (BURM) FORAGING TERRITORIES IN ISMAILIA GOVERNORATE

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Abstract

For the first time in Egypt, a new method was devised to determine the number of *A. ochraceus* termite colonies under ground in a certain area, and its activity in different seasons of the year.

By means of such new technique, eleven colonies were detected in an area of 936 m^2. The main activity of surface foraging was during winter and the main activity of either soil translocation or food consumption was during summer. The largest foraging territory area ranged from 25 - 28m^2, the largest translocated soil area ranged from 35 - 37 m^2, and the largest food consumption area ranged from 35 - 36m^2. Number of attracted foragers by traps ranged from 20519 - 5008 individuals/colony/year. The quantity of translocated soil ranged from 6726 - 1878g, and weight of food consumption ranged from 1906 - 535g/colony/year.

Delineation of termite territories models revealed the occupied areas which differed according to seasons of the year. Territorial area of the colonies moved towards north-east direction during spring and returned back to south-west during winter.

INTRODUCTION

The subterranean termite *Anacanthotermes ochraceus* (Burm), is widely

distributed in Egypt as well as in North African countries. It attacks rural buildings constructed from mud bricks, trunks of date palms, palm leaves, grain stores, wood and paper products (Kassab *et al.*, 1960).

Due to the hidden life behaviour of the harvester termite *A. ochraceus*, it is very difficult to study its ecology and reveal its foraging territories.

Several researchers had investigated certain techniques for studying foraging territories and colony size, mapping territories of harvester, mound-building, and subterranean termites as nest excavation (king and Spink 1969; Darlington 1982), behavioral studies (Nel 1968; Levings and Adams 1984; Roisin *et al.*, 1987), radioisotopic tracers and other chemical markers (Spragg and Fox 1974; Lai 1977; Holt and Easy 1985; Su and Scheffrahn 1988), analysis of spatial and temporal patterns of termite attack on baits (haverty *et al.*, 1975; Hosny and Said 1980; Badawi *et al.*, 1984) and analysis of termite chemicals (Clement 1986; Roisin *et al.*, 1987).

Jones (1990) applied a combination of three techniques i.e., release and recapture of dyed termites, spatial and temporal patterns of termites attack on baits, and agonistic behaviour.

In order to study the number of colonies in a certain area, territory size of the colonies, and mapping colony boundaries under Egyptian environment, spatial and temporal patterns was conducted using El-Sebay modified traps (El-Sebay 1991).

MATERIALS AND METHODS

The present work was carried out in Ismailia Regional Experimental Research Station during 1991 - 1992 using El-Sebay modified traps for monitorin termite activity. The selected location was sandy alluvial soil usually cultivated with annual crops such as wheat, barley, beans and persimmon.

Two hundred and thirty four traps were distributed over 936 m and aligned in 39 rows and 6 columns at 2 meter intervals between two adjacent traps. Each trap

thus subtended an area of 4 m^2. Traps were burried in the ground at 15 cm depth.

Traps were prepared at laboratory; dried at 105^oC in an oven for 24 h. and weighed before and after application.

The experimental area was regularly cleaned up from any plants or herbs, so the traps were considered the only source of termite's food.

The traps were renewed monthly (12 times/year) by another preweighed ones, and then sent to the laboratory. Collected traps were examined separately for the number of attracted termites to determine termite's activity (population density). After removing the insects, the traps were placed in an oven at 105^oC for 24h then reweighed to evaluate the rate of termite's food consumption. To determine the rate of construction activity of termites, soil built attached to the traps were translocated to petri-dishes, dried in an oven and weighed.

Number of attracted termites to the traps in each site was monthly recorded until 12 readings were completed. The readings were then divided according to the four seasons of the year, spring, summer autumn and winter. The four data groups were plotted separately on a square millimeter paper. In order to determine the border and area of each colony, adjacent traps which caught higher numbers of termites were considered the boundary of the colony.

RESULTS AND DISCUSSION

Data in Table 1 show that as indicated by the three aspects of the traps, eleven colonies were detected in the tested area (936m^2). The colonies differed in their territorial area and among each other due to intercolony differences. This was evident throughout the four seasons of the year.

Number of attracted termites and foraging area

Data presented in Table 1 show that the largest number of attracted termites through the four tested seasons (20519 individuals) was observed in colony No. 10,

followed by colony No. 1 and 6 (19488 and 19338 individuals, respectively). The lowest numbers (5008 and 6739) were in colonies No.11 and 3. The largest number of attracted insects throughout the whole area (48931) was noticed during winter followed by autumn (43126), spring (30583) and summer (8700).

Data demonstrated in Table 2 show the largest area occupied by foragers which ranged from 28 - 25 m^2. The smallest area ranged from 1.4 - 2.6 m^2. The largest area of foraging (207m^2) which represented 22% of the whole area under study, was during winter followed by autumn (163m^2), summer (115m^2) then spring (109m^2) which represented 12% of the whole tested area.

Haverty (1975) determined the average foraging territories as 12.5m^2, while Jones (1990), found that this average was 13.9m^2 for *Heterotermes aureus*, subterranean termite. In the present work however, the average was 20m^2.

The results of the present investigation revealed eleven complete territories at 936m^2.

Translocated soil and area of construction activity

Table 1 show that the largest weight of translocated soil to the distributed traps allover the year was 6726g in colony No. 1, followed by 6553g in colony No. 2. The lowest weight was 1878g in colony No. 9. The largest quantity of soil (16434g) was found during summer followed by 13244, 6358, and 6261g during autumn, winter and spring, respectively. As shown in Table 2, the largest foraging area of soil translocation was 287m^2 representing 31% of the tested area and ranged between 35 - 37 m^2 for the colony during summer. The lowest (145m^2) was during winter and spring (ranged 1.4 - 3.4 m^2 for one colony) and represented 16% of the whole tested area.

Food consumption and area of consumption activity

As shown in Table 1, the largest weight of food consumption (1906 g) was observed in colony No. 11, followed by colony No. 1 (1732g). The least number of consumption quantity was in colony No. 9 (346g).

The largest weight of food consumption (4764) was noticed during autumn, followed by summer (3042g), winter (1946g) and spring (1590g).

On the other hand, results in Table 2 show that the largest area of consumption was 290.8m^2 rpresenting 31% of the whole tested area during summer (ranged between 35 - 36m^2/colony), while the least area was 153m^2, representing 16% of the whole area during spring (ranged between 2.6 - 6.6m^2/colony). It is therefore evident that the large colonies are mostly joined with large quantity of either translocated soil or food consumption.

Concerning the season of foraging and the area in which the colony had reached its peak, it was during winter, but the largest activity of soil translocation was observed during summer and food consumption was during autumn.

It is clear then that the size of foraging territories is correlated positively with either soil translocation or food consumption. On the other hand, when the season is taken into consideration, the foraging activity was found during winter, soil translocation activity was during summer and food consumption was during autumn.

Delineation of colonies territories

Plotting the number of attracted termites to the distributed traps in spatial and temporal patterns and drawing the border or delineation of territory of each colony, had revealed an apparent line picture of termite activity and a number of colonies under ground in certain areas.

Applying the two other ecological aspects (weight of translocation soil and/or weight of consumed traps), showed the same pattern. Meanwhile, as shown in Figs. 1,2 and 3, eleven colonies were detected under ground within an area of 936m.

In conclusion, the territorial area of any colony is not stable in a fixed position, but the colony moves according to the season of the year. Diagrams shown in Figs 1, 2 and 3, indicate the movement towards north-east during spring and backwards to south-west during winter. The border of the colony differs in size according to the season of the year. The foraging activity (number of attracted

Table 1. Territorial area of eleven detected colonies of *A. ochraceus* as indicated by three ecological aspects of activity during Nov. 1991 - Oct. 1992.

Aspects	Seasons	Detected colonies											
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	Total
No. of Attracted Termites	Spring	5640	4798	1509	1511	1522	7111	1239	3789	489	2763	212	30583
	Summer	1390	850	818	993	1624	1031	815	198	224	680	77	8700
	Autumn	7707	5404	1891	3240	3523	3487	3032	4001	1991	7526	1324	43126
	Winter	4751	5724	2521	4738	1933	7709	2423	4398	1789	9550	3395	48931
	Total	19488	16776	6739	10482	8602	19338	7509	12386	4493	20519	5008	131340
	Av.	4872	4194	1685	2621	2151	4835	1877	3097	1123	5129	502	------
Weight of Translocated Soil	Spring	1028	1336	505	355	759	835	620	195	150	334	144	6261
	Summer	3321	2685	577	1265	2042	1580	1808	1226	799	662	469	16434
	Autumn	1296	1533	455	1786	1678	1133	803	861	797	1612	1290	13244
	Winter	1081	999	398	964	355	1043	639	406	132	230	111	6358
	Total	6726	6553	1935	4370	4834	4591	3870	2688	1878	2838	2014	42297
	Av.	1682 gm	1638 gm	484 gm	1131 gm	1080 gm	1148 gm	968 gm	672 gm	469 gm	709 gm	504 gm	----- gm
Weight of Consumed Traps	Spring	356	256	95	167	162	58	136	109	32	109	110	1590
	Summer	448	409	90	469	423	266	292	235	122	211	77	3042
	Autumn	650	407	243	354	514	168	284	279	176	365	1324	4764
	Winter	278	246	107	246	81	158	166	163	34	72	395	1946
	Total	1732	1318	535	1236	1180	650	878	786	364	757	1906	11342
	Av.	866 gm	484 gm	134 gm	309 gm	295 gm	163 gm	220 gm	197 gm	91 gm	189 gm	477 gm	----- gm

Table 2. Delineation of eleven detected areas of *A. ochreaceus* termites as indicated by three ecological aspects during Nov. 1991 - Oct. 1992.

Aspects	Seasons	Occupied area by detected colonies in m^2												Infestation /whole area
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	Total	
Attracted Insects	Spring	10.6	18.0	4.6	12.6	15.4	9.4	9.4	14.6	2.6	10.0	1.4	108.6	12 %
	Summer	12.6	17.4	6.0	14.0	16.0	12.0	9.4	8.6	6.0	8.6	4.0	114.6	12 %
	Autumn	16.6	17.4	11.4	22.0	22.6	18.6	13.4	15.4	9.4	9.4	6.6	162.8	17 %
	Winter	20.0	24.6	16.6	28.0	24.0	16.0	18.0	19.4	12.6	15.4	12.6	207.2	22 %
	Av.	15	19.4	9.6	19.6	19.6	12.6	12.6	14.6	7.6	10.8	6.2	148.3	--
Translocated Soil	Spring	14.0	19.4	10.0	20.6	19.4	14.6	14.6	12.6	7.4	10.0	3.4	146.0	16 %
	Summer	25.4	26.0	30.6	37.4	34.6	22.0	24.6	26.0	20.0	24.0	16.6	287.2	31 %
	Autumn	23.4	22.0	16.6	29.4	29.4	18.6	19.4	21.4	16.6	19.4	12.6	228.8	24 %
	Winter	21.6	20.6	10.6	18.0	16.6	12.6	13.4	12.6	6.6	10.6	1.4	144.6	16 %
	Av.	19.4	22.0	19.4	26.4	25.0	17.0	18.0	18.2	17.6	16.0	8.6	201.7	--
Consumed Traps	Spring	19.4	20.0	9.4	20.6	16.6	14.0	14.6	14.0	6.6	15.4	2.6	153.2	16 %
	Summer	27.4	26.0	29.4	36.0	35.4	22.6	28.6	28.0	20.6	21.4	15.4	290.8	31 %
	Autumn	20.0	19.4	16.0	29.4	25.4	18.0	15.4	21.4	16.6	16.6	12.6	210.8	23 %
	Winter	27.4	28.6	19.4	22.6	32.0	21.4	21.4	24.0	19.4	18.0	19.4	253.6	27 %
	Av.	23.6	23.6	18.6	27.2	27.4	19.0	20.0	21.8	15.8	17.8	12.6	227.1	--

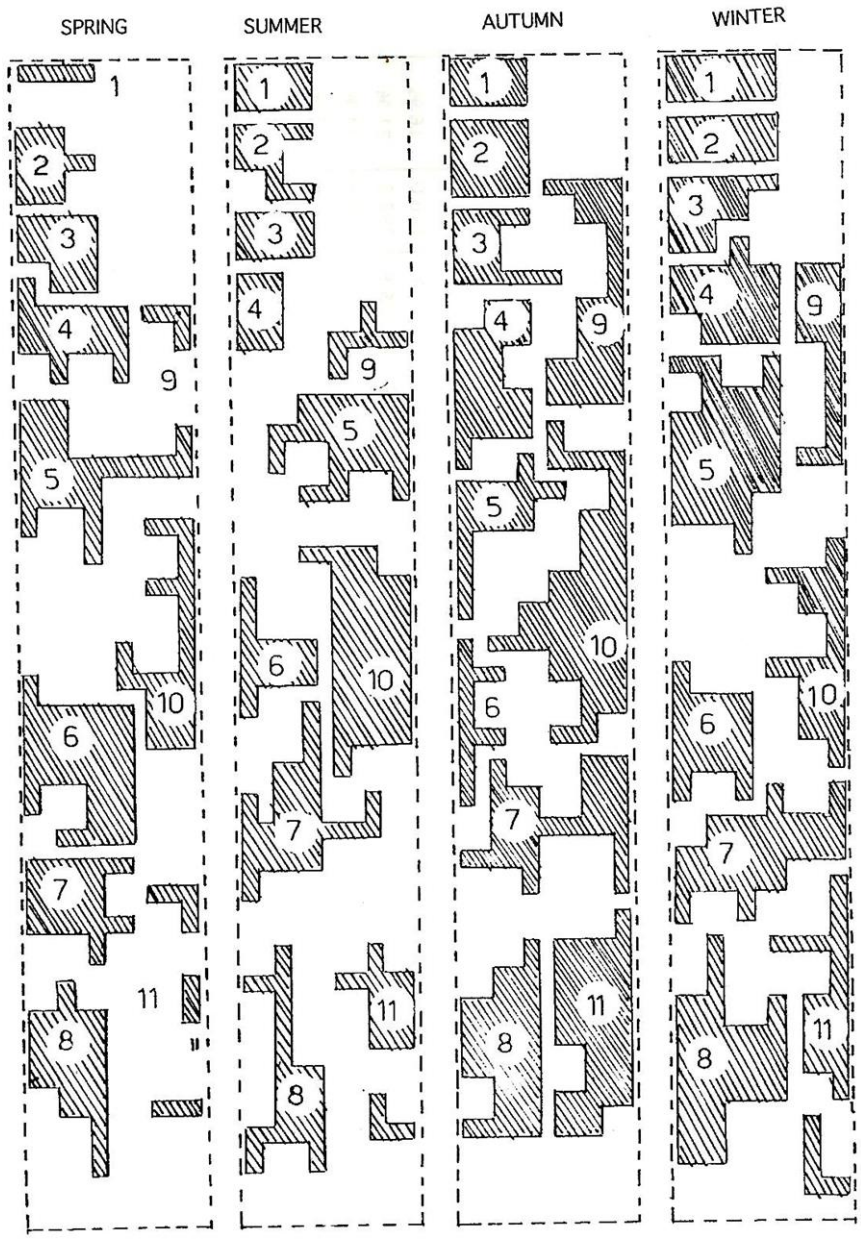

Fig. 1. Delineation of *A. ochraceus* foraging territories as indicated by number of attracted termites to the traps during Nov. 1991 - Oct. 1992.

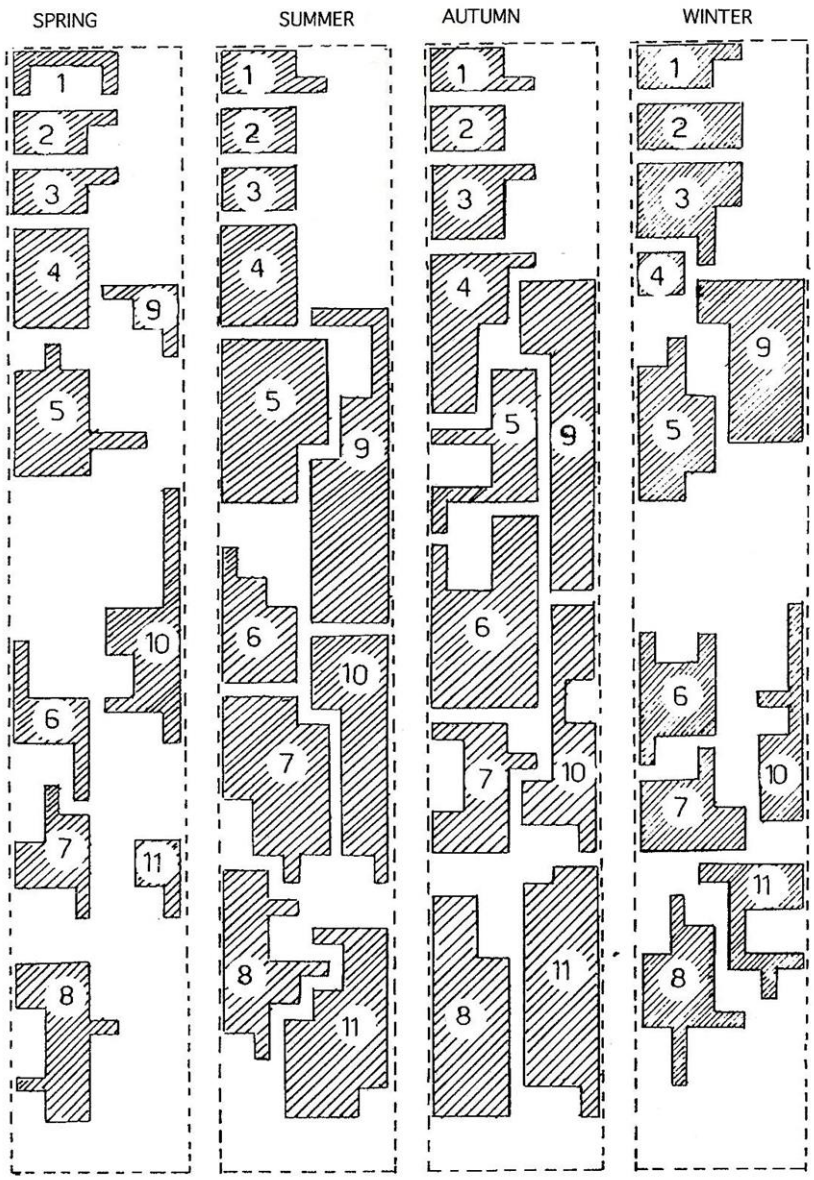

Fig. 2. Delineation of *A. ochraceus* foraging territories as indicated by weight of consumed traps during Nov. 1991 - Oct. 1992.

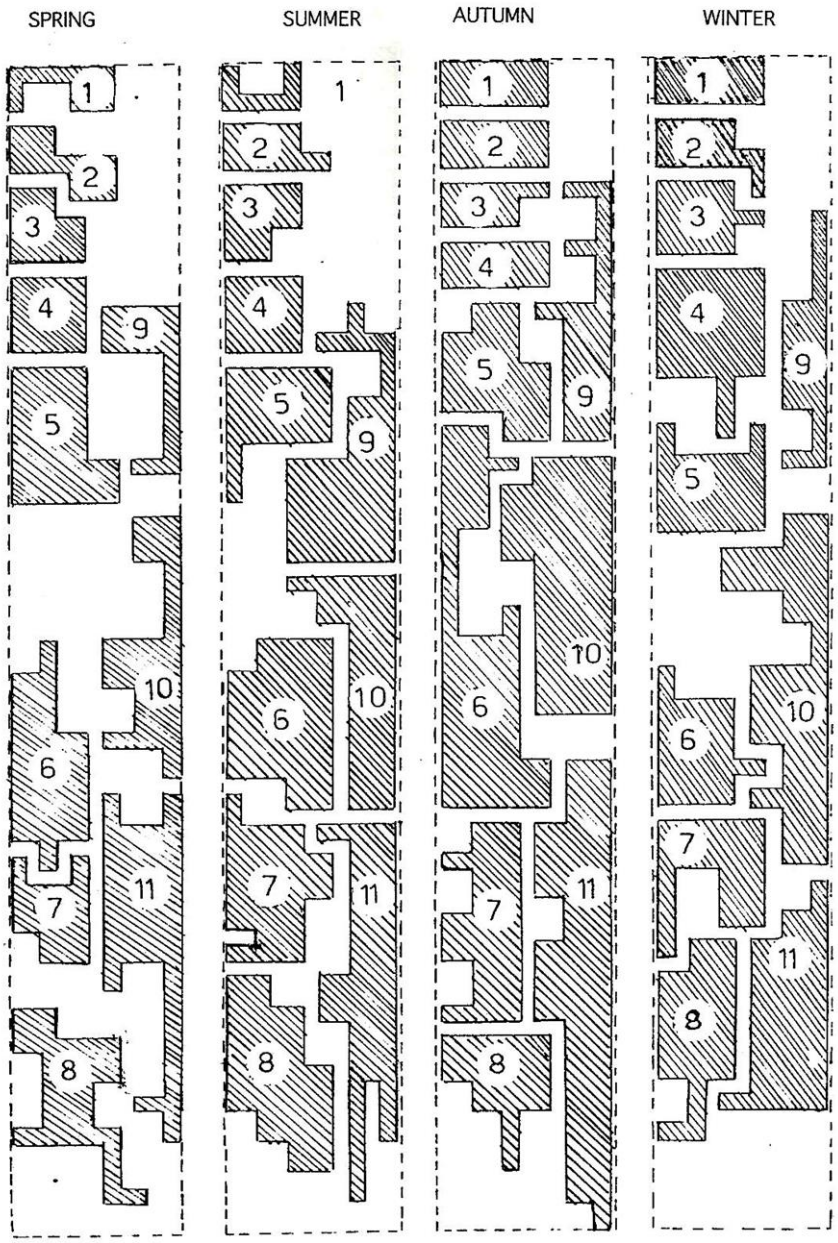

Fig. 3. Delineation of *A. ochraceus* foraging territories as indicated by weight of translocated soil to the traps during Nov. 1991 - Oct. 1992.

termites) increased during winter and autumn and vice versa during summer and spring as a result of the increase of surface activity during the two preceding seasons. Taking the two other aspects into consideration (Figs. 2 and 3), the subsurface activity increased in summer and autumn seasons, and the activity area ceased during winter and spring.

REFERENCES

1. Badawi, A., A. A. Faragalla and Dabbour, 1984. The distribution of foraging termites and densities of colonies of two species of subterranean termites in Al-Kharja Oasis, Central Region of Saudi Arabia. Z. Angew. Entomol. 97:387-93.
2. Clement, J. L. 1986. Open and closed societies in *Reticulitermes* termites (Isoptera, Rhinotermitidae): geographic and seasonal variations. Sociobiology 11:311-323.
3. Darlington, J. P. E. C. 1982. The underground passages and storage pits used in foraging by a nest of the termite Macrotermes michealseni in Kajiado, Kenya. J. Zool. (Lond.) 198:237-247.
4. El-Sebay, Y. 1991. A modified El-Sebay trap for subterranean termites. 4th Arab Cong. of Plant Protection, Cairo, Egypt. Dec. 1991. pp. 245-247.
5. Haverty, M. I., W. L. Nutting and J. P. LaFage, 1975. Denisity of colonies and spatial distribution of foraging territories of the desert subterranean termite *Heterotermes aureus*. Environ. Entomol. 4:105-109.
6. Holt, J. A. and J. F. Easey, 1985. Polycalic colonies of some-mound-building termites (Isoptera; Termitidae) in north eastern Australia. Insect Soc. 32:61-69.
7. Hosny, M. M. and W. A. Said, 1980. Certain ecological aspects of the subterranean termite *Anacanthoterme ochraceus* (Burm) in Egypt. Sociobiology 5:133-146.
8. Jones, S. C. 1990. Dilineation of *Heterotermes aureus* (Isoptera; Rhinotermitidae) Foraging territories in a Sonoran Desert Grassland. Environ. Entomol. 19(4):1047-1054.
9. Kassab, A., M. L. Hassan, A. M. Chaarawi and A. M. Shahwan, 1960. The termite problem in Egypt with special reference to control. Min. Agric. Cairo.

10.King, E. G., Jr. and W. T. Spink 1969. Foraging galleries of the formosan subterranean termite, *Coptotermes formosanus* in Louisiana. Ann. Entomol. Soc. Am. 62:536-542.

11.Lai, P-Y 1977. Biology and ecology of the formosan subterranean termite, *Coptotermes formosanus*, and its susceptibility to the entomogenous fungi *Beauveria bassiana Metarrhizium anisopliae* .Ph. D. dissertation, Univ. Hawaii, Honolulu.

12.Levings, S. C. and E. S. Adams 1984. Intra-and interspecific territoriability in *Nasutitermes* in Panamian mangrove forest. J. Anim. Ecol. 53:705-715.

13.Nel, J. J. C. 1968. Aggressive behaviour of harvester termite *Hodotermes mossambicus* (Hagen), and *Trinervitemes trineroides* (Sjostedt). Insects Soc. 15:145-156.

14.Roisin, Y., J. M. Pasteels and J.C. Breakman 1987. Soldier diterpene patterns in relation with agressive behaviour, spatial distribution and reproduction of colonies in *Nasutitermes princeps*. Biochem. Syst. Ecol. 15:253-261.

15.Spragg, W. T. and R. E. Fox 1974. The use of a radioactive tracer to study the nesting system of *Mastotermes drwiniensis* Frogatt. Insects Soc. 21:309-3.

16.Su, N-Y and R. H. Scheffrahn 1988a. Foraging population and territory of Formosan subterranean termite in an urban environment. Sociobiology 14:353-359.

محاوله لتحديد مقاطعات تجوال النمل الأبيض التحت أرضي (أنا كانثوتيرمس أوشرا سيوس) بمحافظة إسماعيليه

يسرى السباعى

معهد بحوث وقاية النباتات – مركز البحوث الزراعيه – الدقي.

تم استخدام طريقة لتحديد عدد مستعمرات النمل الأبيض التحت أرضي الحاصد في مساحه معينه ونشاط المستعمرات تحت الأرض سنوياً في كل موسم.

من خلال الدراسه أمكن تحديد إحدى عشر مستعمره تحت الأرض في المساحه الصغيره المختبره (٩٣٦ م٢) كما أن أكبر نشاط للسروح السطحي للأفراد كان خلال موسم الشتاء وأكثر نشاط بنائي واستهلاكي كان خلال فصل الصيف.

كانت أكبر مساحه للسروح السطحي بين ٢٥–٢٨ م٢ ومساحة النشاط البنائي بين ٣٥–٣٧ م٢ ومساحة النشاط الإستهلاكي بين ٣٥–٣٦ م٢.

تراوح عدد الأفراد التي انجذبت للمصائد بين ٥٠٠٨ – ٢٠٥١٩ فرداً للمستعمره سنوياً ، وتراوحت كمية الماده البنائيه بين ١٨٧٨ – ٦٧٢٦ جراماً للمستعمره سنوياً وتراوحت كميه الإستهلاك الغذائي بين ٥٣٥ – ١٩٠٦ جراماً للمستعمره سنوياً.

ومن خلال استخدام المصائد أمكن تحديد مساحات السروح (المقاطعه) للحشره والتي ثبت تحركها في اتجاه الجنوب الشرقي في الربيع ثم تعود مكانها في الشتاء.