Delineate of Foraging Territories and Estimate The Densities of Colonies of Sand Subterranean Termite *Psammotermes hybostoma* (Desneux)in Aswan

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ABSTRACT

The present study is an attempt to determine numbers of *P. hybostoma* subterranean termite colonies under ground in certain area, and their activities in different seasons of the year. Data revealed that, eight colonies were detected in an area of 1000 m^2. in Kom-Ombo region, Aswan Governorate. The main activity of surface foraging was observed during winter season and the main activity of either soil translocation or food consumption was during summer. Largest foraging territory area ranged from 25.3 - 29.4 m^2, food consumption area from 31.2-38.6 m^2, and translocated soil area from 31.4 - 39.5m^2. Delineation of subterranean termite territories models clarified the occupied area and it was differed according to the seasons of the year. Territorial area of colonies were moved from west to east direction during spring and back during winter season.

Key words: ***Delineation, Foraging territories, Colonies, Subterranean termite.***

INTRODUCTION

The subterranean termite, *Psammotermes hybostoma* (Desneux), is widely distributed in Egypt as well as in north African countries. It attacks rural buildings constructed from mud bricks, grain stores, wood and paper products (kassab *et al.* 1960). Due to the hidden life behaviors of the sand subterranean termite, *P. hybostoma,* it is very difficult to study the ecology and emphasis its foraging territories. Several researchers had carried out investigations aimed to find out certain technique for studying foraging territories and colony size, mapping territories of harvester, mound building, and subterranean termites as nest excavation (King and Spink 1969 and Darlington, 1982), behaviour studies (Nel, 1968; Levings and Admas 1984 and Roisin. *et al* 1987), analysis of spatial and temporal patterns of subterranean termite attack on baits (Haverty *et al*. 1975; Hosny and Said 1980; Badawi *et al.* 1984; and El- Sebay 1993) and analysis of termite chemicals (Clement, 1986; and Roisin *et al.* 1987). Ahmed (2003) applied the mark release recapture technique of dyed subterranean termites for studying the number of territories, territory size of colony, and mapping colony boundaries. Spatial and temporal patterns of termites attack on baits and agonistic behavior. The objectives of this work were to study number of colonies, territory size of colony, and mapping colony boundaries under Aswan environments.

MATERIALS AND METHODS

The present work was carried out in Kom-Ombo region, Aswan Governorate, during October 2010 to November 2011, by using poly vinyl chloride (P.V.C. trap), for monitoring subterranean termites activity. These traps consists of cylindrical container from a thermo plastic polymer, length 12cm and 7cm in diameter. The cylindrical container was drilled 6-9 drills and inside it corrugated card board roll at the same measure and the cylindrical container was closed with numbered plastic cover. Rolls of corrugated card board were used as a source of cellulose material (represent the main food for termites). Two hundred and fifty P.V.C. traps were distributed over 1000 m^2. and aligned in 25 rows and 10 Columns at 2 m intervals between two adjacent traps. Each trap thus subtended an area of 4 m^2. Traps were prepared laboratory, dried at 105 ^oC in an oven for 24 hours and weighed before and after application. The experimental area was regularly cleaned up from any herbs or dead wood, so the traps were considered the only source of subterranean termites food. Traps were buried in the ground at 12 cm depth. Traps were renewed, monthly (12 times/year) by anther pre-weighed ones and then send to the laboratory. Collected traps were examined separately for the number of attracted termites to figure out subterranean termites activity (population density). After removing insects, traps were placed in an oven at 105^oC for 24 hours and reweighed to evaluate the rate of subterranean termites food consumption. To determine the rate of construction activity of termites, soil build and attached to the traps were translocated to Petri-dishes and dried in an oven and weighed. Number of attracted termites to the traps in each site was monthly recorded until completed 12 reading, 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. To find out the border and area of each colony, adjacent traps caught higher number of subterranean termites were considered the boundary of the colony. Data were analyzed by (ANOVA) analysis of variance and LSD values were obtained at 0.05 level, according to Steele and Torrie (1984).

RESULTS AND DISCUSSION

Data in Table (1) show that, as indicated by the three aspects of P.V.C. traps, eight detected colonies were found in the tested area of 1000 m. Colonies were different in their territorial area among each other and also in the same colony in different four seasons of the year. The presented data in Table (1) show that The largest number of attracted termites in spring season was observed in colony No.1 and No. 5 (7531 and 6190 individuals), followed by colony No. 2 (5262 individuals). While the lowest ones were recorded in colony No. 8 (1239 individuals). At summer season the largest number of attracted termites was noticed in colony No. (6423 individuals), and the lowest ones were recorded in colony No. 2 (1283 individuals). Concerning the autumn season, the largest number of attracted termites was observed in colony No.8 (6432 individuals) followed by colony No. 1 and No. 4 (5637 and 5421 individuals). While the lowest ones were recorded in colony No. 5 (1453 individuals). The largest number of attracted termites throughout the winter season was observed in colony No. 1 (9645 individuals), followed by colony No. 6 and No. 8 (8130 and 8645 individuals, respectively). While the lowest ones were recorded in colony No.4 and No. 7 (4586 and 6253, respectively). The largest number of attracted insects throughout the whole area (59008) was noticed during winter followed by autumn (33209), spring (31931) and summer (24702). Statistical analysis of the obtained data in Table (1) showed a significant difference between the number of attracted termites and winter season (high significant), while there was no significant difference with other seasons. The results indicated a high significant between the weight of food consumed and autumn season, while there was less significant with summer season as compared with other seasons, the weight of translocated soil was a high significant with four seasons. From data in Table (2) the largest area occupied by foragers was ranged from 29.4 - 25.3 m^2, while the least area ranged from 4.6 - 5.7 m^2. The largest area of foraging (167 m^2), represented 26 % of the whole area under investigation, as during winter followed by summer (88.0 m^2) and spring (85.1 m^2) or autumn (82.8 m^2) which represented 13% of the whole tested area. Haverty (1975) determined average foraging territories as 12.5 m^2, while Jones (1990) found that this average was 13.9 m^2 for subterranean termites *Heterotermes aureus,* while in this study, the average was 18.0 m^2. Nutting and Lafage (1975) found at area of 40x40 m, 26 complete and 12 partial territories for *H. aureus* while in this study, was found eight complete territories at 1000 m. El-Seaby (1995) found eleven colonies were detected in an area 936 m^2, and found the largest foraging territory area ranged from 25 - 28 m^2 and the largest translocated area ranged from 35 - 37 m^2, while the largest food consumption ranged from 35- 36 m^2. As shown in Table (1) the largest weight of food consumption 346 g) was observed in colony No.1 during spring season, followed by colony No.2 (245 g), while the least ones were recorded in colony No. 3 (89 g). The largest weight of food consumption (552 g) was noticed in colony No.1 during summer, followed by colony No.2 (508 g),while the least ones were recorded in colony No.3 and 7 (64 g). In winter season the largest weight of food consumption was observed in colony No. 7 (368 g), followed by colony No.8 (345 g), while the least ones were recorded in colony No. 3 (108 g). The largest weight of translocated soil (2142 g) was observed in colony No.6 during spring season, followed by colony No.2 (1786 gm), while the least ones were recorded in colony No. 8 (154 g). The largest weight of translocated soil (3420 g) was noticed in colony No.1 during summer, followed by colony No.2 (2486 g), while the least ones were recorded in colony No.3 (456 g). In winter season the largest weight of translocated soil was observed in colony No. 5 (1843 g), followed by colony No.8 (1546 g), while the least ones were recorded in colony No. 3 (387 g). On the other hand ,results in Table (2) show that, the largest area of consumption was 220.4 m^2 and represented 34% of the whole tested area during summer (ranged between 20.4 - 38.6 m^2/colony), while the least area was 95.6 m^2, represented 14% of the whole area during spring (ranged between 6.3- 6.6 m^2/colony). As shown in table 2) the largest foraging area of soil translocation was 211.0 m^2 (represented 32 % of tested area) and ranged between 31.4 -39.5 m^2 for the colony, during summer, while the lowest one 113.7 m^2 was during spring (ranged between 7.5- 9.6 m^2 for one colony) and represented 17% of the whole tested area. According to obtained data in Table (2) statistical analysis revealed there was a high significant between the attracted termites and winter season as compared with other seasons, while the weight of food consumed and weight of translocated soil were a high significant and summer season compared with other seasons. According to the previous data, the large colony mostly joined with large quantity of either translocated soil or food consumption.

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Table 1: Territorial area of detected colonies of *P. hybostoma* as indicated by three ecological aspects of activity during October 2010-November 2011.

Aspects	Seasons	Detected colonies									
		No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	Mean±S.D	Total
No. of attracted termites	Spring	7531	5262	3689	3421	6190	1439	3160	1239	3991.38b ±2209.57	31931
	Summer	2450	1283	1963	2653	4532	2645	6423	2753	3087.75b ±1631.64	24702
	Autumn	5637	4952	2154	5421	1453	4620	2540	6432	4151.12b ±1841.89	33209
	Winter	9645	6867	7432	4586	7450	8130	6253	8645	7376.00a ±1541.81	59008
Weight of consumed traps (g)	Spring	346	245	89	187	186	106	115	165	179.87b±84.58	1439
	Summer	552	508	64	468	368	251	64	356	328.87ab±188.93	2631
	Autumn	653	603	315	364	259	356	1240	185	496.87a ±340.65	3975
	Winter	248	284	108	253	157	158	368	345	240.13b±93.05	1921
Weight of translocated soil (g)	Spring	1786	1363	608	758	875	2142	687	154	1046.62a±663.09	8373
	Summer	3420	2486	456	2064	1670	895	1254	487	1591.50a±1033.80	12732
	Autumn	1269	1455	534	1787	1706	2132	2103	1324	1578.75a±520.35	12310
	Winter	1057	989	387	869	1843	568	645	1546	988.00a±495.20	7904

For attracted termites, F =8.45 LSD_{05} = 1868.59
For consumption , F= 3.63 LSD_{05} = 209.62
For translocated, F=1.59 LSD_{05} = 728.63

Table 2: Delineation of eight detected area of *P. hybostoma* as indicated by three ecological aspects of activity during October 2010- November 2011.

Aspects	Seasons	Occupied area by detected colonies in m2										
		No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	Mean±S.D	Total	Infestation /whole area
No. of attracted termites	Spring	12.3	16.0	7.0	12.6	9.5	5.7	10.0	12.0	10.64b ±3.31	85.1	13%
	Summer	10.6	18.2	4.6	14.2	12.0	13.4	6.4	8.6	11.00b ±4.42	88.0	13%
	Autumn	14.2	12.4	11.3	12.9	16.0	16.0	7.0	9.0	12.35b ±3.19	82.8	12%
	Winter	19.5	25.3	18.7	29.4	22.0	14.8	17.3	20.0	20.87a ±4.64	167.0	26%
Weight of consumed traps (g)	Spring	12.0	14.2	11.0	18.5	19.6	7.4	6.3	6.6	11.95b ±5.19	95.6	14%
	Summer	24.1	27.0	31.2	38.6	28.2	20.4	26.5	24.4	27.55a ±5.48	220.4	34%
	Autumn	21.3	18.0	17.6	15.0	13.4	15.6	12.0	7.3	15.02b ±4.25	120.2	18%
	Winter	19.0	20.0	13.0	23.0	28.0	10.0	7.2	9.0	16.15b ±7.46	129.2	20%
Weight of translocated soil (g)	Spring	19.2	20.0	7.6	20.4	14.0	7.5	15.4	9.6	14.21c ±5.45	113.7	17%
	Summer	26.3	25.0	28.5	39.5	21.5	15.2	23.6	31.4	26.37a ±7.17	211.0	32%
	Autumn	18.0	18.0	16.3	22.5	16.0	23.0	21.4	24.0	19.90b ±3.18	159.2	24%
	Winter	24.3	26.4	22.4	19.2	21.3	18.6	13.0	15.0	20.02b ±4.53	160.2	25%

For attracted termites, F =12.00 LSD_{05} = 4.04
For consumption , F= 11.39 LSD_{05} = 5.85
For translocated, F=7.06 LSD_{05} = 5.41

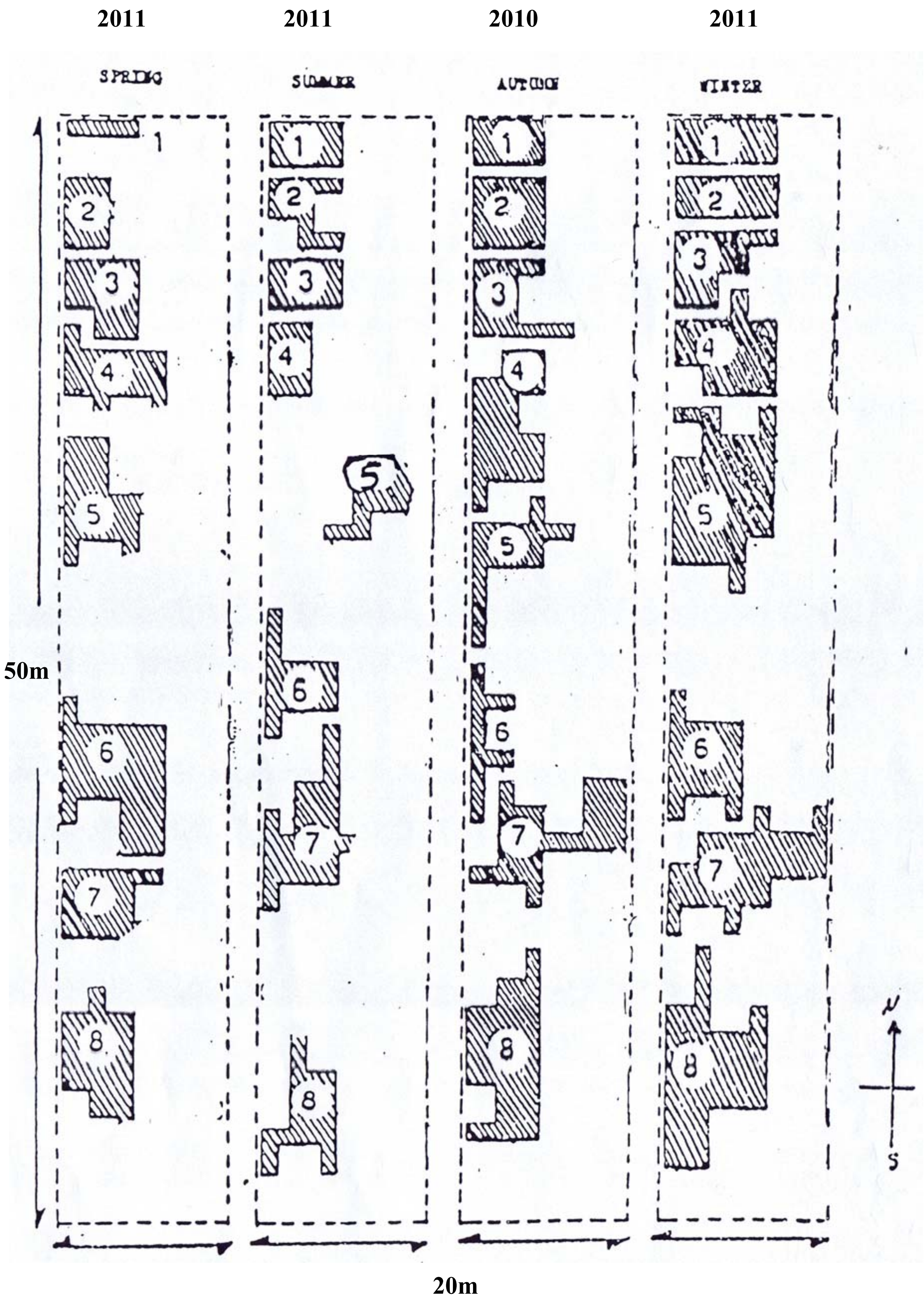

Fig. 1: Delineation of *Psammotermes hybostoma* foraging territories indicated by number of attracted termitesto the traps during October 2010 to November 2011.

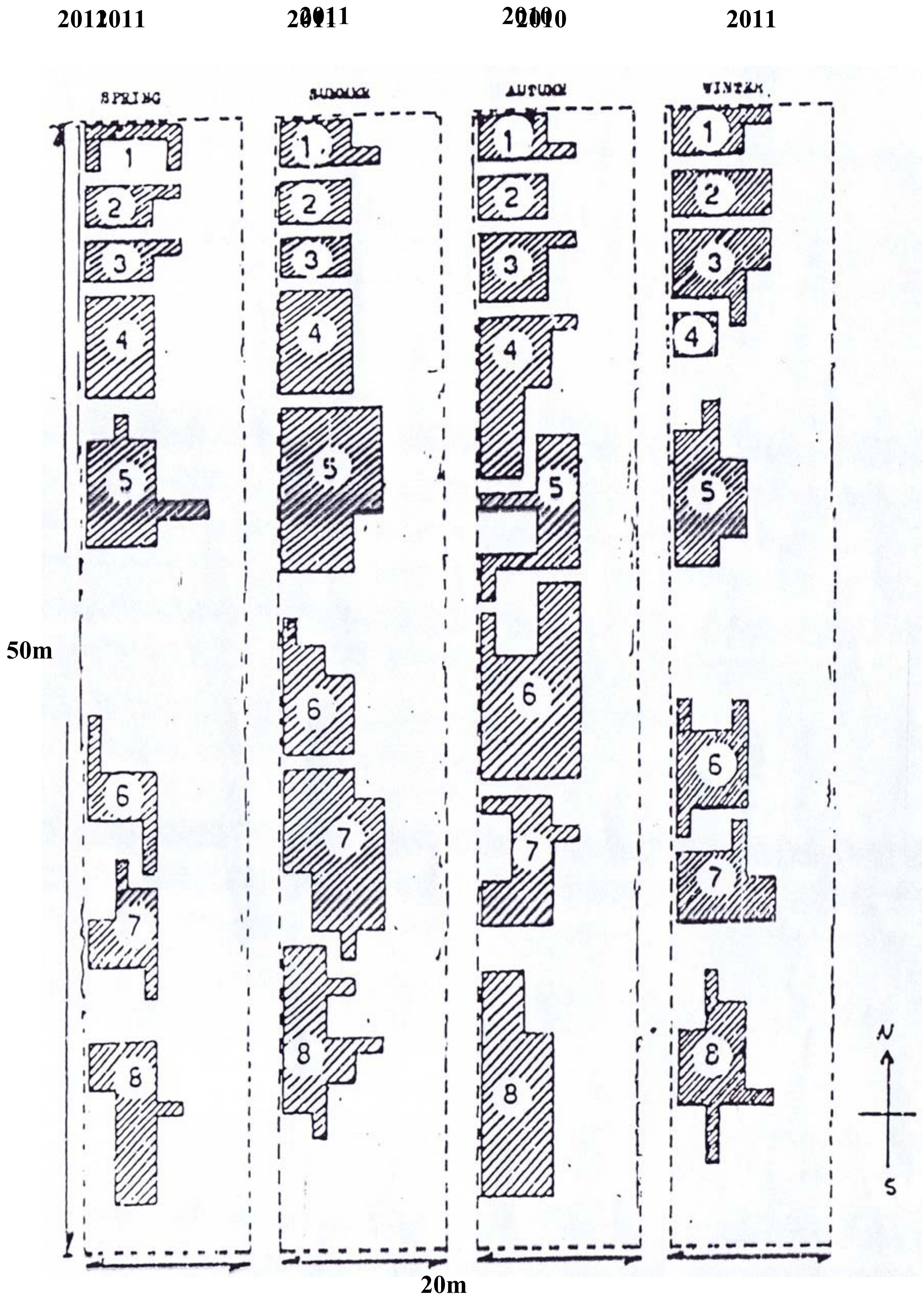

Fig. 2: Delineation of *Psammotermes hybostoma* foraging territories indicated by weight of consumed traps during October 2010 to November 2011.

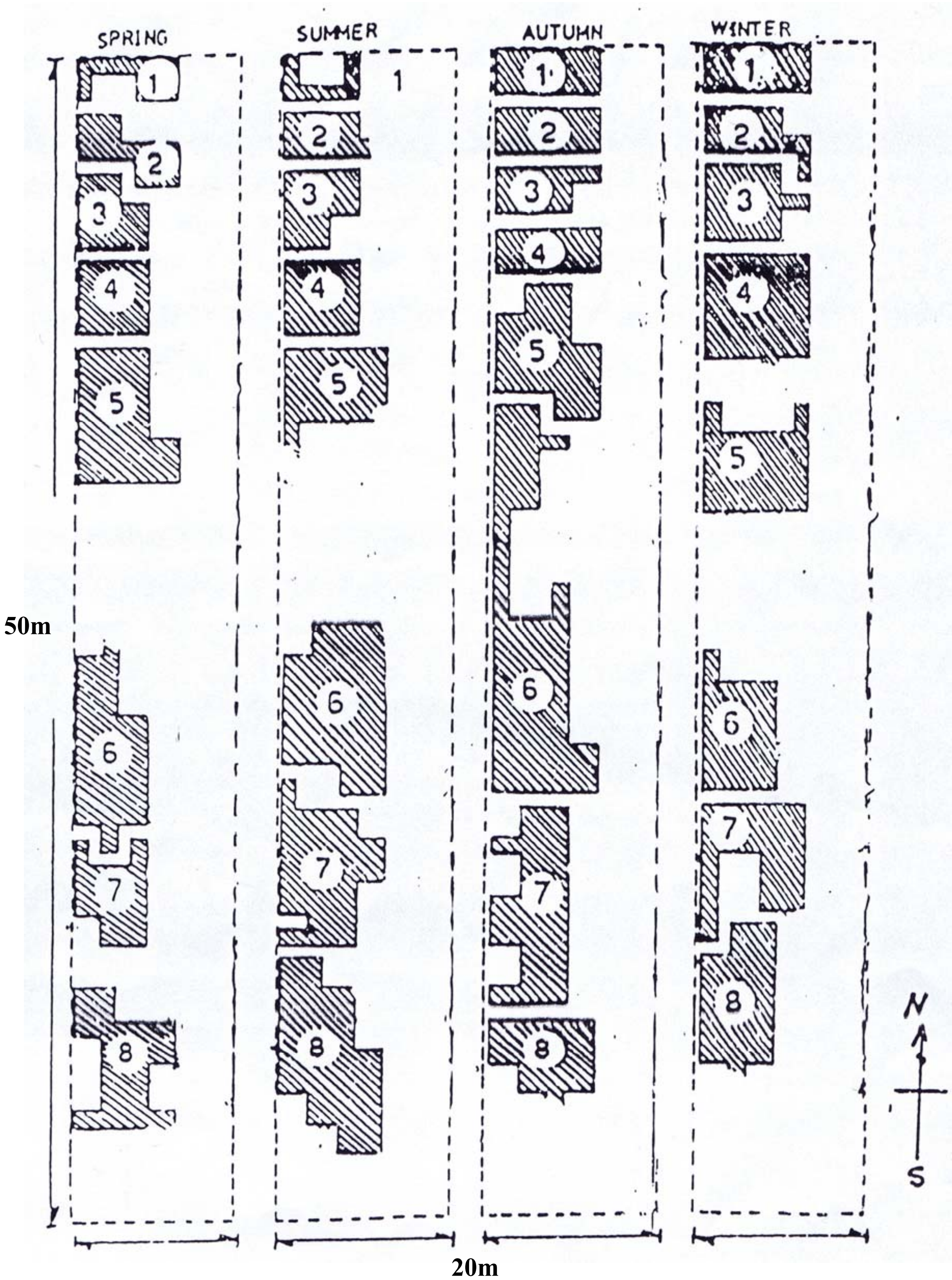

Fig. 3: Delineation of *Psammotermes hybostoma* foraging territories indicated by weight of translocated soil to the traps during October 2010 to November 2011.

Concerning the season of foraging and area the colony reached its peak during winter, but the largest activity of soil translocation and food consumption were observed during autumn. Conclusively, size of foraging territories is correlated positively with either soil translocation or food consumption. On the other hand, when season is taken into consideration, the foraging activity was found during winter, while soil translocation activity and food consumption were noticed during autumn. Concerning the delineation of colonies territories, plotting number of attracted subterranean termites to the distributed traps in spatial and temporal patterns and drawing the border or delineation of territory of each colony, showed an apparent line picture of termites activity and number of colonies under ground in certain area. Applying the other two ecological aspects, weight of translocated soil and weight of consumed trap, showed the same picture. Meanwhile, as shown in Figs (1, 2 and 3), it could be detected eight colonies under ground within an area of 1000 m^2. Detected colonies revealed that the territorial area of any colony is not stable in affixed the year. Diagrammatic drawn in Figs (1, 2 and 3) show the movement toward west-east during spring season and backwards during winter season. Border of the colony differs in size according to the season of the year. The foraging activity (number of attracted termites) increased during winter and autumn seasons and vice versa during summer and spring seasons as a result of increasing of surface activity during the two preceding seasons. Taking the two other aspects into consideration Figs (2 and 3) revealed that the subsurface activity increased by summer and autumn seasons, and the activity area increased during winter and spring seasons.

REFERENCES

Ahmed H.M. (**2003**): Ecological and control studies on subterranean termites under Fayoum conditions. Ph.D. Thesis Fac. Agric. Fayoum, Cairo University. pp.148

Badawi, 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- 393.

Clement, J. L. (**1986**): Open and closed societies in *Reticulitermes* termites (Isoptera, Rhinotermitdae) geographic and seasonal variations. Sociobiology. **11**: 311-323.

Darlington, J.P.E.C. (**1982**): The under grouned passages and storage pits used in foraging by a nest of the termite *Macrotermes michealseni* in Kajiado, Kenya. J.zool. (Lond.) **198**: 237-247.

El-Sebay, Y. (**1993**): Ecological studies on the harvester termites *Anacanthotermes ochraceus* (Burm.) in Egypt. Bull. Soc. Ent. Egypt. (**47**): 48-54.

El-Sebay, Y. (**1995**): An attempt to delineate *Anacanthotermes ochraceus* (Burm) foraging territories in Ismailia governorate. J. Agric. Res., **73** (**1**): 57-69.

Haverty, M.I., W.L. Nutting and J.P.Lafage, (**1975**): Denisty of colonies and spatial distribution of foraging territories of the desert subterranean termite *Heterotermes aureus*. Environ. Entomol. **4**: 105-109.

Hosny, M. M. and W.A. Said, (**1980**): Certain ecological aspects of the subterranean termite *Anacanthotermes ochracues* (Burm.) in Egypt. Sociobiology **5**: 133-146.

Jones, S.C., (**1990**): Dilineation of *Heterotermes aureus* (Isoptera: Rhinotermitidae) Foraging terratories in a sonoran Desert Grassland. Environ. Entomol. **19** (**4**): 1047-1054**.**

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. Cario.

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

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

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

Nutting, W.L. and Lafage, J.P. (**1975**): Enviromental factors correlated with the foraging behaviour of the desert subterranean termite *Heterotermes aureus* (Banks) (Isoptera:Termitidae) Sociobiology **2** (**3**): 155-164.

Roisin, Y., J.M. Pasteels and J.C. Breakman (**1987**): Solider diterpene patterns in relation with aggressive behaviour, spatal distribution and reproductuion of colonies in *Nasutitermes princeps* Biochem. Syst. Ecol. **15**: 253- 261.

Steel R.G., Torrie J.H. (**1984**): Principles and procedure of statistics. pp.137-167.

الملخص العربى

تحديد مقاطعات سروح النمل الابيض تحت الارضى من النوع *Psammotermes hybostoma* (Desneux) وتقدير كثافة مستعمراته بمحافظة أسوان

حسن محمد أحمد على
معهد بحوث وقاية النباتات – الدقى- الجيزة

هذه الدراسه ماهى إلا محاوله لتحديد عدد مستعمرات النمل الابيض تحت الارضى *P. hybostoma* وذلك فى مساحه معينه فضلا عن نشاط المستعمرات تحت الارض فى كل موسم من السنه هذا وقد تم تحديد ثمانية مستعمرات فى المساحه المختبرة ١٠٠٠ متر مربع ووجد ان اكبر نشاط للسروح السطحى للافراد كان خلال موسم الشتاء واكبر نشاط بنائى واستهلاكى كان خلال موسم الصيف وتراوحت مساحة السروح السطحى بين ٢٥,٣-٢٩,٤متر مربع ومساحة النشاط الاستهلاكى بين ٣١,٢- ٣٨,٦ ومساحة النشاط البنائى بين ٣١,٤ – ٣٩,٥ متر مربع ومن خلال إستخدام مصائد (بى. فى. سى.) تم تحديد مساحات السروح (المقاطعات) للشغالات السارحة للنمل الابيض تحت الارضى والتى ثبت تحركها من إتجاه الغرب الى الشرق فى الربيع ثم تعود لمكانها فى الشتاء.