

FIELD EVALUATION OF DIFFERENT TYPES OF TRAPS FOR SUBTERRANEAN TERMITE ACTIVITIES

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Abstract

Field experiments were conducted in Ismailia governorate to evaluate different types of traps (El-Sebay modified corrugated card-board trap, toilet paper trap, PVC toilet paper trap and PVC corrugated card-board trap) for estimating field activities (attracted individuals, consumed food and translocated soil) of subterranean termites, *Psammotermes hybostoma* (Desneux). The obtained data revealed that El-Sebay modified traps was the most efficient recording the highest rates of attraction (28577.5 individuals), consumed food (1554.45 gm), and soil translocation (4094.4 gm) followed by toilet paper trap (21737.9 individuals, 1403.09 gm and 3227.87 gm for attracted termites, consumed food and translocated soil, respectively). The two tested types of PVC traps recorded the lowest rates of termite activities. Statistical analysis of data proved that the differences in the three aspects of subterranean termite activities between the four tested types of traps were insignificantly correlated. It could be recommend to use of El-Sebay modified-trap (Corrugated card-board), because of ease in preparation, very lower in cost and attract the highest numbers of subterranean termites, as well as termites stay alive in these traps for long times.

Key Words: El-Sebay-modified trap; Toilet paper trap; PVC trap; corrugated card-board; *P. hybostoma*; attraction; consumption; translocation.

INTRODUCTION

Subterranean termites are social insects which live in tunnels underground and feed on cellulose substances. So it is necessary to find a suitable method to detect termite castes for different studies. Researchers used different types of traps to study population activity of subterranean termites. These traps have variable cellulose substances, such as wooden stakes 5x10x45 cm (Johnson *et al.*, 1971 and Lafage *et al.*, 1983), wooden blocks 2.5x15x15 cm (Lafage *et al.*, 1973), litter bags of wood plots 5x10x25 cm (Whitford and Noble 1982) and toilet paper trap (Wood, 1974 and Said, 1979). These different types of traps were usually used to study population density, food consumption, soil translocation, foraging activity and termite territories (Haverty *et al.* 1975, and Hosny&Said, 1980). Recently, El-Sebay-modified trap which

consists of carton corrugated card-board was widely used to investigate population activities of subterranean termites (El-Sebay, 1991).

El-Sebay, 1993, Ahmed, 1997, El-Bassiouny, 2001 and Abdel-Latif, 2003, they mentioned that the all traps depend on their attractiveness as a cellulose material preferred by termites rather than any other materials, and then, the corrugated card-board were modified to PVC trap (PVC perforated cover trap).

This work conducted during 2014 to assess the efficacy of four different traps types for *Psammodermes hybostoma* throughout three ecological aspects (number of attracted termites, food consumption and soil translocation) to determine the best trap for easily studying of termites ecology.

MATERIALS AND METHODS

Tested Traps:

Four types of traps were used:

- 1- El-Sebay-modified trap (Corrugated card-board), (Fig., 1a) which consists of corrugated card-board wrapped in a roll shape, 7-10 cm in diameter and 12 cm in length, covered with polyethylene sack except 1-2 cm at the end position fixed with rubber band.
- 2- Toilet paper trap (Candle paper roll) (Fig., 1b) that consists of candle paper roll, 10cm in diameter and 12 cm in length, covered with polyethylene sack except 1-2 cm. at the end position fixed with rubber band.
- 3- PVC toilet paper trap (used for first time) (Fig., 1c) which consists of toilet paper roll covered by PVC cover opened from bottom and top.
- 4- PVC corrugated card-board trap (PVC perforated trap), modified by Ahmed (2003) (Fig., 1d) that consists of El-Sebay-modified trap covered by PVC perforated cover which closed from top and bottom.



Fig. (1): Traps of subterranean termites

Laboratory and Field Work:

An infested area was selected in Agric. Res. Station, Ezz El-Deen Region, Ismailia Gov., (120 km east of Cairo).

One hundred of El-Sebay-modified traps were randomly distributed a month before treatment in the infested area to detect and determined the heavily infested localities. After that ten traps of each type (El-Sebay modified trap, Toilet paper trap, PVC toilet paper trap and PVC corrugated card-board trap) previously prepared at Termite Research Unit, Plant Protection Research Institute, Dokki, Giza, were used. These traps were drying in an electrical oven at 105 °C for 24 hours, then, weighted (50gm.) for each trap type and monthly sent to the experimental area in the field. Five hundred ml of water were added to each tested trap which randomly put in a circular form on equal distances from the center of the colony (1m) for all the tested places (10 replicates) as shown in Fig (2). Bodin (1975), in Texas, USA, mentioned, that, population density of attracted termite was determined according colony size, and surface to subsurface proportion of termites represented 1:114.

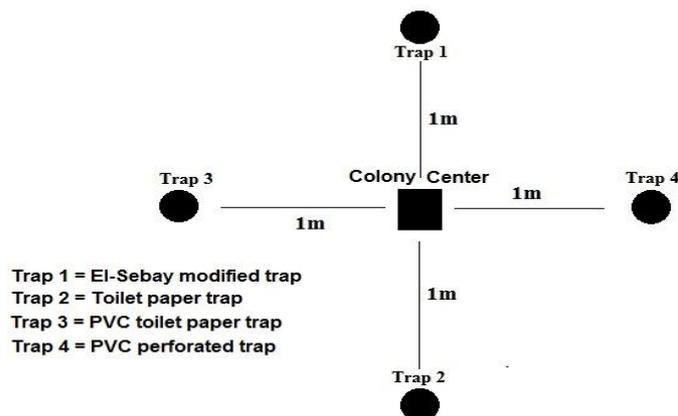


Fig. (2): Drawing shows distribution of tested traps around colony center

Each trap was marked and buried at 15 cm depth in soil. Traps were replaced monthly by new ones throughout 2014. The collected traps were transferred to the laboratory to estimate the seasonal activity of termites. In the Lab., traps were inspected where individuals were collected from traps by small brush to count the attracted termites. Soil translocated were separated from infested trap, and dried in an electric oven at 105°C for 24 hours, and weighted. The infested traps were also dried at 105°C for 24 hours and re-weight to calculate food consumption, according to the following;

$$FC = TWb - TWa$$

FC = food consumption trap (gm).

TWb= trap weight before (gm).

TWa = trap weight after (gm).

The weight of consumed food was used as an index for termite foraging activity (Lafage *et al.*, 1973). The weight of translocated soil was also taken as a second index of foraging activity.

Statistical analysis:

Simple correlation "r", and estimated values corresponding for attraction, food consumption and soil translocation of *P. hybostoma* during 2014, and data were worked out, according to Proc ANOVA in SAS (SAS Institute 1988).

RESULTS AND DISCUSSION

I- Monthly activities of termite in El-Sebay- modified traps:

Data in Table (1) show that the mean number of attracted termites average to El-Sebay traps were 2271.3, 2410.1, 3104, 2331.6, 1546.2, 0811.1, 1009.8, 1318.6, 1663.5, 3377.3, 3716 and 5018 in Jan., Feb., Mar., Apr., May, June, July, Aug, Sept., Oct., Nov. and Dec. 2014 respectively. The total number was 28577.5 Termites during a year. The monthly food consumption at the same year was 102.00, 118.22, 163.02, 120.76, 093.11, 090.57, 116.08, 109.00, 117.66, 152.20, 167.09 and 204.74gm with total amount of food consumption of 1554.45 gm during the year. The corresponding monthly soil translocations were 152.51, 205.20, 415.19, 400.22, 365.14, 166.18, 308.30, 342.00, 112.65, 512.23, 401.55 and 713.23 gm/12 months throughout 2014, respectively. The total amount of translocated soil was 4094.4 gm/year.

Data in Table (1) show that the largest mean number of attracted termites for El-Sebay traps, were 5018 individuals representing 17.55% when was investigated during winter season in December, followed by 3716.0 (13.00%) and 3377.3 individuals (11.81%) during November and October, respectively. While the lowest number was 0811.1 individuals (02.83%) that was found during summer season in June. The largest quantity of consumed traps was recorded during December (204.74 gm representing 13.17%) followed by that recorded during November and March (167.09 and 163.02 gm representing 10.74 and 10.48% respectively). But the lowest amounts of 090.57 and 093.11 gm (05.82 and 05.98%) were showed during June and May, respectively. The highest weight translocated soil was 713.23 gm (17.41%)

which was found during winter season in December, while the lowest quantity occurred during autumn in September (112.65 gm. representing 02.75%)

El-Sebay (1993), mentioned that, such traps were used to describe three ecological aspects of subterranean termites, number of attracted termite, food consumption and soil translocation. Ahmed H. M. (1997), El-Bassiouny (2001) and Abdel-Latif (2003) found that this trap gave a good result. Johson *et al.* (1971) found that traps of cellulose materials were more attractive for termites than those of other materials. Such methods carried out in the semi-arid grass lands gave good results such as in Egypt (Hosny and Said, 1980) and in Saudi Arabia (Badawi *et al.*, 1984)

Table 1. Monthly activities of *P. hybostoma* (Desn.) termite, in El-Sebay-modified traps (corrugated card-board) during 2014.

Months	Attracted termites	%	Consumption (gm)	%	Translocation (gm)	%
Jan.	2271.3	07.94	102.00	06.56	152.51	03.72
Feb.	2410.1	08.43	118.22	07.60	205.20	05.01
Mar.	3104.0	10.86	163.02	10.48	415.19	10.14
Apr.	2331.6	08.15	120.76	07.76	400.22	09.77
May	1546.2	05.41	093.11	05.98	365.14	08.91
June	0811.1	02.83	090.57	05.82	166.18	04.05
July	1009.8	03.53	116.08	07.46	308.30	07.52
Aug.	1318.6	04.61	109.00	07.01	342.00	08.35
Sep.	1663.5	05.82	117.66	07.56	112.65	02.75
Oct.	3377.3	11.81	152.20	09.79	512.23	12.51
Nov.	3716.0	13.00	167.09	10.74	401.55	09.80
Dec.	5018.0	17.55	204.74	13.17	713.23	17.41
Total	28577.5		1554.45		4094.4	

II- Monthly activities of termite in Toilet paper traps:

Data in Table (2), show that the monthly mean numbers of attracted termites to Toilet paper traps were 1301.2, 2125.1, 2314.6, 1741.2, 0674, 0951.9, 0755.3, 1012.7, 2024, 2501.1, 3121.6 and 3215.2 individuals, in Jan., Feb., Mar., Apr., May, June, July, Aug, Sept., Oct., Nov. and Dec. 2014, respectively (the total number was 21737.9 Termites). Food consumption at the same periods was 075.01, 104.11, 132.45, 144.17, 082.02, 100.22, 062.77, 110.13, 132.55, 156.00, 151.01 and 152.65 gm. (with total number of 1403.09 gm.), respectively. The corresponding soil translocation weights were 154.01, 172.00, 312.17, 323.05, 301.02, 142.11, 210.50, 344.22, 110.14, 302.44, 333.01 and 523.20 gm. respectively (with total weight of 3227.87gm/year).

Data in Table (2) show that the largest mean number was 3215.2 individuals representing 14.79% which was found during winter season in December, followed by

that was investigated in November and October (3121.6 and 2501.1 individuals that represented 14.36 and 11.50% respectively). While the lowest number was 0674 individuals (03.10%) that was found during summer in May. The highest quantity of consumed traps was found during October (156.00 gm) representing 11.11% followed by that was shown in December and November (152.65 and 151.01 gm representing 10.87 and 10.76% respectively). While, the lowest one was 062.77 gm. (04.47%) was found in July. The highest quantity of translocated soil 523.20 gm was found during winter season in December (representing 16.20%), while the least quantity occurred during spring in September (110.14gm., representing 03.41%).

Table 2. Monthly activities of *P. hybostoma* (Desn.) termite, in Toilet paper traps during 2014.

Months	Attracted termites	%	Consumption (gm)	%	Translocation (gm)	%
Jan.	1301.2	05.98	075.01	05.34	154.01	04.77
Feb.	2125.1	09.77	104.11	07.42	172.00	05.32
Mar.	2314.6	10.64	132.45	09.43	312.17	09.67
Apr.	1741.2	08.00	144.17	10.27	323.05	10.00
May	0674.0	03.10	082.02	05.84	301.02	09.32
June	0951.9	04.37	100.22	07.14	142.11	03.84
July	0755.3	03.47	062.77	04.47	210.50	06.52
Aug.	1012.7	04.65	110.13	07.84	344.22	10.66
Sep.	2024.0	09.31	132.55	09.44	110.14	03.41
Oct.	2501.1	11.50	156.00	11.11	302.44	09.36
Nov.	3121.6	14.36	151.01	10.76	333.01	10.31
Dec.	3215.2	14.79	152.65	10.87	523.20	16.20
Total	21737.9		1403.09		3227.87	

Nutting *et al.* (1975) carried out an experiment based on toilet paper rolls baits on the soil surface; he found that the cast composition was 4% soldiers and 96% non-soldiers, and the foraging of *G. preplexus* have been reported to contain mainly workers and only about 0.4% soldiers. Said (1979), in Egypt, used toilet paper at 2m distances within area of 30x30m², he found that the foraging activity of *Anacanthotermes ochraceus* (Burm.), was minimal between mid-December and early-April, and assumed its maximal in July, August and September. The peak activity was found during the second week of August in 1997. Then foraging declined between early-October and early-December and the attack of *A. ochraceus* was 37.3% of the traps.

III- Monthly activities of termite in PVC Toilet paper traps:

Data in Table (3), show that the mean numbers of attracted termites to PVC Toilet paper traps were 0955.7, 1505.2, 2066, 0841.3, 0780, 0401.5, 1033.1, 1000,

1115.3, 2006, 1427.6 and 3101.2 in Jan., Feb., Mar., Apr., May, June, July, Aug, Sept., Oct., Nov. and Dec., respectively (with total of 16232.9 Termites). Food consumption quantities throughout the same periods were 084.00, 107.10, 133.00, 068.11, 100.72, 055.52, 110.90, 092.00, 102.02, 166.01, 118.00 and 187.60 gm., (with total of 1324.98 gm.). Monthly soil translocation weights were 198.15, 144.02, 116.00, 293.42, 300.32, 207.10, 210.50, 150.30, 111.00, 261.12, 350.91 and 200.00 gm during 2014, respectively (with total of 2542.84 gm.).

Table 3. Monthly activities of *P. hybostoma* (Desn.) termite, in PVC Toilet paper traps during 2014.

Months	Attracted termites	%	Consumption (gm)	%	Translocation (gm)	%
Jan.	0955.7	05.88	084.00	06.33	198.15	07.79
Feb.	1505.2	09.27	107.10	08.08	144.02	05.66
Mar.	2066.0	12.72	133.00	10.03	116.00	04.56
Apr.	0841.3	05.18	068.11	05.14	293.42	11.53
May	0780.0	04.80	100.72	07.60	300.32	11.81
June	0401.5	02.47	055.52	04.19	207.10	08.14
July	1033.1	06.36	110.90	08.36	210.50	08.27
Aug.	1000.0	06.16	092.00	06.94	150.30	05.91
Sep.	1115.3	06.87	102.02	07.69	111.00	04.36
Oct.	2006.0	12.35	166.01	12.52	261.12	10.26
Nov.	1427.6	08.79	118.00	08.90	350.91	13.79
Dec.	3101.2	19.10	187.60	14.15	200.00	07.86
Total	16232.9		1324.98		2542.84	

Data in Table (3) show that the highest mean number of attracted termites to PVC Toilet paper traps, was 3101.2 individuals (19.10%) that was found during winter season in December, followed by those were recorded in March and October (2066 and 2006 individuals, that represented 12.72 and 12.35%, respectively). While the least mean number of 0401.5 individuals (02.47%) was found during summer in June. The largest quantity of consumed traps was shown during December (187.60 gm. representing 14.15%) followed by that were investigated during October and March (166.01 and 133.00 gm representing 12.52 and 10.03%, respectively). On the other side, the lowest one of 055.52 gm (04.19%) was found in June. The highest weight of translocated soil of 350.91 gm. (13.79%), was found during winter season in November followed by that was obtained in May (300.32 gm representing 11.81%), but the lowest one of 111.00 gm., (04.36%) was shown during autumn season in September, 2014.

IV- Monthly activities of termite in PVC corrugated card-board traps:

Data in Table (4) show that the mean numbers of attracted termites to PVC corrugated card-board traps were 1034, 1305.7, 1551.1, 0746, 0820, 0560.2, 1003.5, 0800.8, 1010.1, 1306, 1222 and 2783.2 in Jan., Feb., Mar., Apr., May, June, July, Aug, Sept., Oct., Nov. and Dec. respectively. The total mean number throughout 2014 was (14142.6 termites). Food consumption of the same periods was 103.00, 112.00, 107.00, 066.13, 074.00, 086.11, 103.50, 088.04, 100.15, 118.77, 103.01, and 121.20 gm. (with total amount of 1182.91 gm.), respectively. Soil translocation weights were 162.11, 114.00, 112.30, 233.21, 236.00, 200.00, 188.21, 170.00, 100.00, 163.19, 208.00 and 125.01 gm respectively. The total amount of translocated soil throughout 2014 was 2012.03 gm. Ahmed (1997), in Egypt, used PVC trap, consisted of corrugated card-board roll, placed inside perforated PVC pipe, closed from each end by polyethylene sac which fixed with rubber band. He mentioned that, the highest number of harvester termite, *A. ochraceus* was occurred during January and increased gradually until April.

Data in Table (4) show that the largest mean number of attracted termites to PVC corrugated card-board traps was 2783.2 individuals (19.67%) which was found during winter season in December, followed by that were recorded in March and October (1551.1 and 1306 individuals which represented 10.96 and 09.23%, respectively). While the least mean number was 0560.2 individuals that represented 03.96%, which was found during summer in June. The largest quantity of consumed traps was found during December 121.20 gm. representing 10.24% followed by that were obtained in October and February (118.77 and 112.00 gm representing 10.04 and 09.46%, respectively). On the other hand, the lowest one was 066.13gm representing (05.59%) that was found in April. The highest mean of translocated soil of 236.00 gm was found during summer season in May that represented 11.72%, followed by which were recorded in April and November (233.21 and 208.00 gm. that represented 11.59 and 10.33%), while the least one occurred during autumn in September (100.00 gm., representing 04.97%).

In general, statistical analysis of data revealed that the corrugated card-board (El-Sebay-modified trap) was the best trap to estimate subterranean termite field activities of attracted individuals, consumed food and translocated soil. These types of traps were considerable good shelter where it contains tunnels and contact with soil directly. The toilet paper traps occupied the 2nd rank, followed by PVC toilet paper and PVC corrugated card-board traps. It could be recommend using El-Sebay-modified trap (corrugated card-board) which is easily in preparation, very

lower in cost and attracting of highest numbers of subterranean termites, in addition termites stay in trap for long period.

Statistical analysis for data showed no significant correlation for the three acting aspects (attraction, consumption and translocation) between the tested trap types during 2014.

Table 4. Monthly activities of *P. hybostoma* (Desn.) termite, in PVC corrugated traps during 2014.

Months	Attracted termites	%	Consumption (gm)	%	Translocation (gm)	%
Jan.	1034.0	07.31	103.00	08.70	162.11	08.05
Feb.	1305.7	09.23	112.00	09.46	114.00	05.66
Mar.	1551.1	10.96	107.00	09.04	112.30	05.58
Apr.	0746.0	05.27	066.13	05.59	233.21	11.59
May	0820.0	05.79	074.00	06.25	236.00	11.72
June	0560.2	03.96	086.11	07.27	200.00	09.94
July	1003.5	07.09	103.50	08.74	188.21	09.35
Aug.	0800.8	05.66	088.04	07.44	170.00	08.44
Sep.	1010.1	07.14	100.15	08.46	100.00	04.97
Oct.	1306.0	09.23	118.77	10.04	163.19	08.11
Nov.	1222.0	08.64	103.01	08.70	208.00	10.33
Dec.	2783.2	19.67	121.20	10.24	125.01	06.21
Total	14142.6		1182.91		2012.03	

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تقييم حقلى لأنواع مختلفة من مصائد النمل الأبيض تحت أرضى

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أجريت تجارب حقلية بمحافظة الإسماعيلية خلال عام 2014 لتقييم بعض أنواع المصائد (مصيدة السباعى الكرتونية - مصيدة لفائف المناديل الورقية - مصيدة المواسير البلاستيكية للمناديل الورقية - مصيدة المواسير البلاستيكية للكرتون) فى تقدير النشاط الحقلى للنمل الأبيض تحت أرضى "ساموترمس هيبوستوما" (عدد الأفراد المنجذبة - كمية الغذاء المستهلك من المصيدة - معدل البناء أو التربة المنقولة) .

وقد أثبتت النتائج أن مصيدة السباعى الكرتونية كانت أكثر الأنواع المختبرة كفاءة حيث سجلت أعلى معدلات النشاط الموسمى لمتوسطات التعداد والإستهلاك والبناء وكانت البيانات (28577,5 فرد و 1554,45 جم و 4094,4 جم) خلال 2014 على التوالى . وجاءت مصيدة لفائف المناديل الورقية فى المرتبة الثانية (21737,9 فرد و 1403,09 جرام و 3227,87 جرام) لنشاط التعداد والإستهلاك والبناء على التوالى . ثم كانت المصائد المواسير البلاستيكية بنوعها المناديل الورقية والكرتونية أقلها فى تقدير فى أنشطة النمل الأبيض تحت أرضى حيث سجلت النتائج (16232,9 فرد و 1324,98 جم و 2542,84 جم) لمصيدة المواسير البلاستيكية للمناديل الورقية و (14142,6 فرد و 1182,91 جرام و 2012,03 جرام) لمصيدة المواسير البلاستيكية للكرتون للثلاث ظواهر الإيكولوجية على التوالى .

وقد أثبت التحليل الإحصائى إرتباط غير معنوى لأنشطة النمل الأبيض تحت أرضى بين أنواع المصائد المختلفة . ويمكن التوصية بإستخدام مصيدة السباعى الكرتونية حيث أنها رخيصة الثمن وسهلة التحضير والحمل وللميزات الحقلية فى دراسة النشاط الموسمى للنمل الأبيض تحت أرضى .