

**FORAGING ACTIVITY AND POPULATION DENSITY FOR
DIFFERENT CASTES OF SUBTERRANEAN TERMITE,
AMITERMES DESERTORUM
(DESENUX) (ISOPTERA: TERMITIDAE) AT ASWAN
GOVERNORATE, EGYPT**

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ABSTRACT: The desert subterranean termite, *Amitermes desertorum*, infested several species of wood and fruit trees widely planted in different region of the Egyptian environment. The different caste of the termite, *Amitermes desertorum* individuals were fluctuated according to foraging activity and many factors of environmental conditions. Monthly population of caste individuals demonstrated that the worker castes recorded the highest number (5632workers) during August, while the minimum number (487 workers) was observed during January. Moreover, the highest number of nymph stages, soldiers and winged adults were recorded during August (1276 nymphs), May (386 soldiers) and August (1160 winged adults), while the minimum number of nymphs and winged adults were recorded during January recording 153 and 75 individuals respectively, whereas soldier castes were recorded 116 individuals during October. Total numbers and percentages of collecting caste individuals from traps during months detected that the highest percentage reached 20.01% during August, while the minimum percentage was 2.1% during January, as well as , the ranges of monthly percentages varied for different castes through tested months, recording 1.77% (January), -20.44% (August) for workers, 2.51% (January), -20.89% (August) for nymphs, 3.9% (October), - 12.99% (May) for soldiers and 1.34% (January), -20.73% (August) for winged adults. The relation between worker and soldier castes showed that the ratio of soldiers / 1000workers represented 97.34%. Positive significant correlation was recorded between each of air & soil temperature and termite stage populations. The correlation was positive and insignificant with wind speed while the correlation was negative and insignificant with RH%, whereas mostly no correlation was recorded with rainfall.

Key words: Subterranean termites, *Amitermes desertorum*, foraging, population, climatic factors.

INTRODUCTION

Subterranean termites are social insects that live in large colonies in each of the ground and attacked wood trees planted in infested earth, the mature colony consist of three castes, these castes are workers, soldiers and reproductive castes (king and queen). Subterranean termites able to attack wood trees, trunks of palms, and olive trees (El-Haemesy, 1976) also, some field crops such as sugarcane, cotton, wheat and peanut are attacked by termites (Badawi *et al.*, 1986). The individuals of subterranean termites make mud tunnels on the trees, these tunnels connect to the colony and the individuals move inside to reach the cellulose material in date palm

trees and olive tress (Badawi *et al.*,1985) and (Helal &El-Sebay, 1994).

Many Ecological studies of subterranean termites are carried out to estimated caste composition, activity of foraging and relative density therefore, different methods have been used such as rolls of toilet paper (Lafage *et al.*, 1973, and Said, 1979), wooden stakes and blocks (Jones, 1990), fiberboard (Lafage *et al.*, 1983) and rolls of corrugated cardboard (El-Sebay 1991 and El- Bassiouny, 2001).

Subterranean termites, *Amitermes desertorum* is one of the important economic pests in Egypt. This subterranean termite species is widely spread in Egyptian desert and on both sides of

River Nile (Rizk *et al.*, 1985) and (Sands, 1992). The individuals of *A. desertorum* attack palm trees and cause severe damage to date palms and timber trees in Giza, (Kaschef and El-Sherif, 1971), Aswan governorate (Ahmed and El-Sebay 2008) and (Ahmed and Khater, 2011).

In North Sinai governorate Batt *et al.* , 2006 showed that the *A. desertorum* infested ten tree species (sunt, tamarisk, acacia, mulberry, eucalyptus, casuarina, mango, citrus, olive and palm trees) and they found that the highest percentage of infestation recorded in palm trees, while the least percentage recorded in olive and citrus trees furthermore they detected that the palm fronds were attracted the highest number of termite individuals, while eucalyptus cuttings attracted the minimum numbers. Ghesini and Marini (2017) studied the morphological and genetic analysis for termite species (*Microcerotermes eugnathus* Silvestri, *Microcerotermes palestinensis* Spaeth, *Amitermes vilis* Hegen and *A. desertorum*) in the South Sinai governorate.

Several studies on subterranean termites were conducted in arid and grassy lands have give naccurate results in different locations of many countries as in Kingdom Saudi Arabia (Badawi *et al.*, 1985 & 1986) and in Egypt (Hosni and Said, 1980), (Moein, 1997), (Ahmed, 2003), (El-Bassiouny *et al.*, 2014 a,b) and (Abd El-Qawi *et al.*, 2022).

Aswan governorate is one of the most common areas where subterranean termites are infested. The objective of the current work is to study the foraging activity and annual population of subterranean termite castes, *Amitermes desertorum* under climatic changes and prevalent dominant weather factors at Aswan governorate.

MATERIAL AND METHODS

Location

This study was conducted at El-Kobanya region, Aswan governorate, during the period from January, 2022 until December, 2022. The tested area (200m²) was carefully cleaned-up from any materials of cellulose to prevent interferences of nutrient material with used traps

Termite traps

Fifty termite traps corrugated cardboard traps were prepared in rolls shape (each, 10cm high and 5-7 cm diameter) at termite research laboratory (P.P.R.I), rolls were placed inside perforated PVC (12cm height and 5-7cm diameter) .

Field work

The traps were wetted with water and buried regularly in the tested soil, inside holes, each 12cm depth, arranged in 5columns and 10 rows with 2 meters separated between traps. The traps were covered with plastic cover appear at surface ground.

To examine for subterranean termite foraging individuals population, each trap was removed from its hole, shaken into a plastic container to remove all individuals of subterranean termite handing to the bottom and inside of the trap and transferred to the laboratory at Plant Protection Research Institute. Individuals of subterranean termite were counted using a fine brush, sorted into different castes and identified. Each roll trap was placed back to its hole; severely attacked traps were replaced by new ones. After month of collecting, insects were kept for each trap involved, the number of workers, nymphs, soldiers, and winged adults and the ratio of soldier numbers per 1000 workers were calculated. (S/1000 W ratio).

The monthly and annual population percentages for different castes were determined by the following equations:

$$\text{Monthly percentage of caste population} = \frac{\text{Monthly number of caste individuals}}{\text{Total monthly number of different castes individuals}} \times 100$$

$$\text{Annual percentage of different termite castes} = \frac{\text{Monthly population of caste individuals} \times 100}{\text{Annual population of same caste individuals}}$$

The values of dominate climatic factors as air & soil temperature, relative humidity, the amount of rain fall and wind speed were obtained from meteorological station and the effect of these factors were statically analysed by simple correlation and regression values, with SAS (2001).

RESULTS

Monthly population of different caste individuals

The recorded data for different castes individuals of *A. desertorum* termite at El-Kobunya region, Aswan governorate, during 2022 year Table (1) demonstrated the monthly population and percentages of different castes under climate and weather factors of Aswan governorate.

The obtained results in Table (1) revealed that the population of termite castes were fluctuated along studied months, where the workers caste recorded the highest numbers during August (5632 workers), followed by July (3592 workers), May (2839workers), November (2679 workers), June (2576 workers) and September (2134) while, the minimum numbers were 487 and 683 workers recorded during January and February, respectively. The highest numbers of nymphs caste were recorded during August (1276 nymphs), followed by May (758nymphs), July (638nymphs) and April (531nymphs), while the minimum numbers were 153, 165 and 247 nymphs recorded during January, October and February respectively. The highest numbers of soldiers caste were observed during May (386soldiers), August (383 soldiers), July (341soldiers), September (279 soldiers) and April (276 soldiers), while the least numbers were recorded as 116, 165, 169, 189 and 198 soldiers at October, November, January, June and February, respectively. The highest population of winged adults were recorded during August (1160 winged adults), followed by December (854 winged adults), July (753 winged adults), May (530winged adults), while the least numbers were 75,132, 218 and 280 winged adults were recorded during January, February, April and October, respectively.

In addition results in Table (1) show that the total number of collected castes were 42226 individuals obtained from 200 m² throughout the year with 211.13 individuals / m² or 886746 individuals as determined number /4200 m², also, the annual percentages of different castes from total collecting individuals were 65.25%, workers, 14.46% nymphs, 7.04% soldiers and 13.25 % winged adults.

Total numbers and percentages of collecting caste individuals along months

The total number and annual monthly percentages of different individuals were recorded in Table (1) and Fig (1), the total number of different castes revealed that the percentages of total individuals varied along tested months, where the highest percentage was recorded during August as 20.01% followed by 12.61% during July and 10.69% during May, while the minimum percentages were observed during winter months recording 5.49% 2.98% and 2.1% through March, February and January, respectively. The other percentages were ranged between 6.06% during October to 8.71% during December.

According to results depicted in Fig (1) the monthly percentages of different caste individuals, during 2022year, recorded 1.77% (January) to 20.44% (August) for workers caste; 2.51% (January) to 20.89% (August) for nymphs caste; 3.9% (October) to 12.99% (Mat) for soldiers and 1.34 (January) to 20.73% (August) for winged adults caste.

Monthly percentages of caste individuals from the total castes

The monthly percentages of different castes were fluctuated throughout the year Table (1), the highest percentages for workers were 78.08%, 77.54% and 71.24% during October, November and June, while the minimum percentages were at December (50.30%), February (54.21%) and January (55.09%). The highest percentages for nymphs were 20.5% and 20.18% during March and December, respectively, while the least one was at October (6.44%) and November (7.52%). The highest percentages for soldiers were recorded at winter months as 19.12% (January), 15.71% (February) and 10.27% (March), while the least percentages were at August (4.54%), October (4.53%) and November (4.77%); the highest percentage for winged adults was during December recorded 23.23% winged adults, while, the minimum percentages were recorded during January (8.48%) and March (9.41%).

Table (1): Annual and monthly percentages of caste stages of *A. desertorum* at El-kobanya region, Aswan governorate during 2022 year.

| Inspection time | Number and percentages of different castes | | | | | | | | | |
|-----------------|--|-------|--------|------|----------|------|---------------|------|-------|-------|
| | Workers | | Nymphs | | Soldiers | | Winged adults | | Total | |
| | No. | M% | M% | No. | M% | No. | M% | No. | No. | M% |
| Jan. | 487 | 55.09 | 17.31 | 153 | 19.12 | 169 | 8.48 | 75 | 884 | 2.1 |
| Feb. | 683 | 54.21 | 19.60 | 247 | 15.71 | 198 | 10.48 | 132 | 1260 | 2.98 |
| Mar. | 1385 | 59.80 | 20.51 | 475 | 10.28 | 238 | 9.41 | 218 | 2316 | 5.49 |
| Apr. | 1697 | 57.86 | 18.11 | 531 | 9.41 | 276 | 14.60 | 428 | 2932 | 6.94 |
| May | 2839 | 62.91 | 16.80 | 758 | 8.55 | 386 | 11.74 | 530 | 4513 | 10.69 |
| Jun | 2576 | 71.24 | 13.08 | 473 | 5.23 | 189 | 10.45 | 378 | 3616 | 8.56 |
| Jul. | 3592 | 67.47 | 11.98 | 638 | 6.41 | 341 | 14.14 | 753 | 5324 | 12.61 |
| Aug. | 5632 | 66.64 | 15.10 | 1276 | 4.53 | 383 | 13.73 | 1160 | 8451 | 20.01 |
| Sept. | 2134 | 65.86 | 12.01 | 389 | 8.61 | 279 | 13.52 | 438 | 3240 | 7.67 |
| Oct. | 1998 | 78.08 | 6.45 | 165 | 4.53 | 116 | 10.94 | 280 | 2559 | 6.06 |
| Nov. | 2679 | 77.54 | 7.52 | 260 | 4.81 | 166 | 10.13 | 350 | 3455 | 8.18 |
| Dec. | 1849 | 50.30 | 20.19 | 742 | 6.28 | 231 | 23.23 | 854 | 3676 | 8.71 |
| Total | 27551 | 65.25 | 14.46 | 6107 | 7.04 | 2972 | 13.25 | 5596 | 42226 | 100 |

Total applied PVC traps were 50 /month

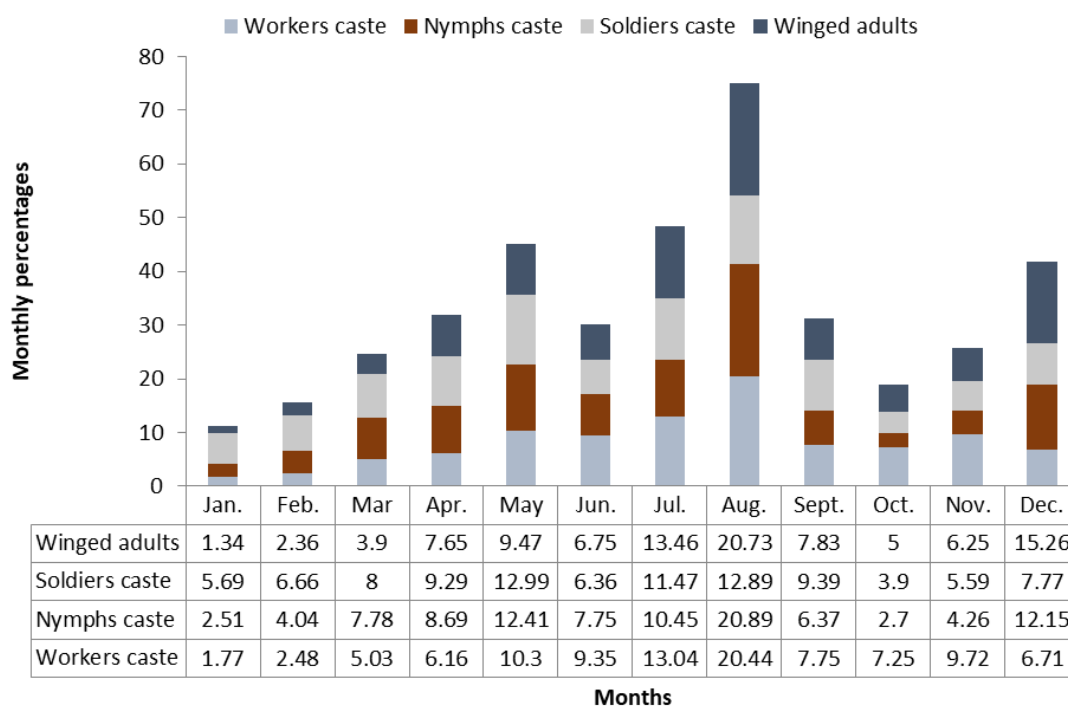


Fig (1): Monthly percentages of subterranean termite castes, *A. desertorum* at El-Kobanya region, Aswan governorate during 2022 months.

The relationship between workers and soldier castes

The numbers of worker and soldier individuals of caught *A. Desertorum* termite per trap and the ratio of soldiers /1000 workers throughout the experimental period were clarified in Table (2). The total number of caught workers and soldiers from 375traps were 30522 individuals divided to 27551 workers and 2971 soldiers. These numbers detected that mean catching number of each trap were 73.47 workers and 7.922 soldiers, viz.81.39 W&S/ trap. The data also showed that the soldiers / 1000workers represented 97.34%.

In the current study the numbers of caught individuals for *Amitermes* sp/ trap were larger than previously recorded by Badawi *et al* (1985) who reported that the percentages of workers and soldiers for *Amitermes* sp. were 26.4% and 16.4% respectively, while Ahmed and El-Sebay (2008) found that these ratios were 14.20% and 13.47% for *P.hybostoma* termite at Giza governorate.

Effect of some environmental factors on *A. desertorum* population

The most prevalent environmental conditions were air and soil temperature degrees, rainfall, relative humidity and wind. These factors play an important role in population of different individuals of termite castes along year months. Obtained monthly data on total individuals of termite castes under the effect of certain factors were illustrated in Figure (2).

The highest numbers of population were recorded during August month (8451 individuals) when air and soil temperature degrees were 34.67°C and 36.47°C, respectively, while values of air and soil minimum temperature were 16.25 °C and 18.62°C, showed that the total number for termite castes were 884 individuals during January month.

The highest amount of rainfall was observed during November (13.6 mm) correlated with high numbers of termite castes as 3455 individuals, while the lowest amount of rainfall was recorded during winter months (January 4,50 mm, February 0.40 mm and March 0.10 mm correlated with low termite numbers as 884, 1260 and 2316 individuals, respectively. The remaining months were no rain where no activity for termites was observed.

The highest percentage of relative humidity was 41.94% during December recorded 3676 termite individuals, while, the minimum percentage of relative humidity 12.67% during April recorded 2932 termite individuals. Also, the wind speed (miles per hours) showed the same trend for RH% on population density.

The statistical analysis of the data in Table (3) recorded positive significant correlation between each of air & soil temperature and population of termite caste individuals ($r = 0.7003$ and 0.6841) for each of air & soil temperature, respectively. Also, there were positive correlation and insignificant with wind speed, while negative correlation and insignificant with RH%, and no correlation with rainfall amount.

Table (2): Number of caught workers and soldiers of *A. desertorum* per trap and ratio of soldiers /1000 workers throughout the experimental period.

| Number of attractive traps | Number of catching individuals | | | Soldiers /1000 workers |
|----------------------------|--------------------------------|----------|-------------------|------------------------|
| | Workers | Soldiers | Workers & Soldier | |
| 375 traps | 27551 | 97.34 | 30522 | 97.34 |
| One trap | 73.47 | 7.922 | 81.19 | |

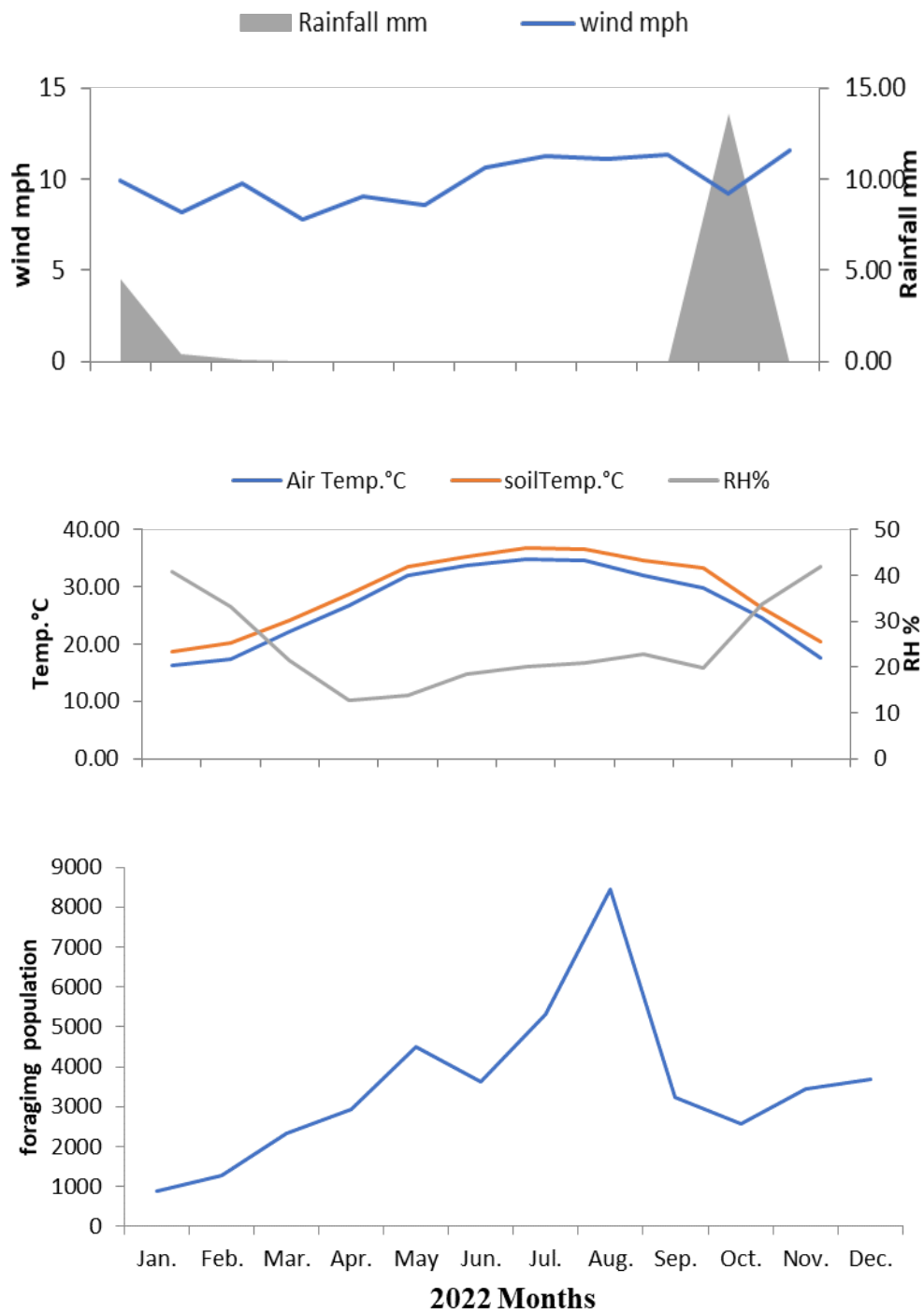


Fig. (2): Population fluctuation of foraging *A. desertorum* termite during 2022 months, under environmental conditions of El-Kobanya region, Aswan governorate.

Table (3): Statistical analysis for correlation between air & soil Temp., RH%, amount rainfall, wind speed and termite population.

| Weather factors | Simple correlation and regression values | |
|------------------|--|--------|
| | r | b |
| Air Temperature | 0.7003 | 196.53 |
| Soil Temperature | 0.6841 | 198.32 |
| RH% | -0.3783 | -75.78 |
| Rainfall | -0.157 | -77.87 |
| Wind | 0.3742 | 562.15 |

DISCUSSION

The current work carried out to throw light on foraging activity and population density of *A. desertorum* termite castes under ecological conditions of Kobanya region, Aswan governorate as the most infested localities with subterranean termites. The monthly and annual population density and percentage of castes revealed that the activity peaks of workers were recorded during October (78.17%), November (77.53%) and June (71.23%), while the highest population of nymphs were recorded through March (20.50%), December (20.18%), February (19.60%) and April (18.11%). The highest population density of soldiers appeared during winter season recording 19.11%, 15.71% and 10.27% during January, February and March, respectively, on the other hand the winged adult castes register redone peak with high density (25.33%) during December month of Autumn season. In Egypt, some ecological studies were carried out on some different species of Subterranean termite, where Ahmed (2003) mentioned that the traps were recorded 169538 individuals of *A. desertorum* termite at 250m² throughout the year with rate 678.33 individuals /m², furthermore, the percentages of different castes recorded 71.32% workers, 28.02% nymphs, 0.56% soldiers and 0.02% winged adults. Also, Ahmed and Mahrous (2012) reported that the total number of catshed *A. desertorum* individuals was 31,245 individuals collected by 40 traps distributed in 400m², with an average of 6.50 individuals /m², the highest attracted numbers of workers were recorded during winter and autumn seasons, while the

lowest numbers were observed during summer months. Other studies on subterranean termite were carried out by (El-Bassiouny 2001), who reported that the highest numbers of *Psammotermes hypostoma* workers were recorded during winter, while the lowest numbers were during summer in Ismailia governorate. In addition, Ahmed 2007 in Nubaria found three peaks of *P. hybostoma*, where the first peak was recorded during March as 3745 individuals, the second peak was recorded during May as 2492 individuals, and the third peak was recorded during October as 2687 individuals. Furthermore, the individuals of subterranean termite, *Anacanthotermes ochraceus* were fluctuated and reached the peak during April, Ghoniemy *et al.* (1999) while, Abdel-latife (2003) reported the highest peak of *A. ochraceus* at summer and early autumn, and relatively was less during winter and spring seasons. Also, Thabit *et al.* (2019) recorded two peaks per year for *A. ochraceus* at Ismailia governorate, the first was recorded during March (high) and second was observed during September (low).

The effect of environmental factors of subterranean termites *A. desertorum* were reported by El-Bassiouny *et al.* (2012) who found *A. Desertorum* termite in New Valley governorate at soil humidity between 41.0 - 65.5 RH& soil temperature between 20.6 to 39.7°C, while in Aswan governorate, *A. desertorum* was found at soil relative humidity degrees between 26.7 to 45.5 RH., & soil temperature degrees between 17.7 to 39.7°C. throughout 2000 to 2010 years.

The results of this article indicated that foraging activity and population of castes of the subterranean termite *A. desertorum*, were differed according to the time of year (annual seasons), environmental conditions, food kind, level of ground water, rainfall or dryness, amount of cellulose materials and number of distributed traps in tested and chosen ground areas infested with subterranean termite

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نشاط السروح وكثافة تعداد الطوائف المختلفة للنمل الأبيض التحت أرضي
Amitermes desertorum (Desenux) (Isoptera: Termitidae)
بمحافظة أسوان - مصر

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الملخص العربى

إستهدف هذا العمل دراسة نشاط السروح وكثافة تعداد النمل الأبيض التحت أرضي *Amitermes desertorum* الذى يصيب الأشجار الخشبية وأشجار الفاكهة تحت تأثير الظروف البيئية المختلفة بمحافظة أسوان وذلك لمدة عام 2022. أظهر التعداد الشهري لأفراد الطوائف المختلفة أن التعداد الأعلى للشغالات سجل خلال شهر أغسطس (5632 شغالة) بينما سجل التعداد الأقل لهذه الطائفة خلال شهر يناير (487 شغالة)، وأظهر التعداد الأعلى لكل من الحوريات والجنود والحشرات المجنحة 1276 حورية خلال أغسطس، 386 جندي خلال مايو، 1160 حشرة مجنحة خلال أغسطس، بينما ظهرت الأعداد الأقل لأفراد الطوائف المختلفة خلال شهر يناير وسجلت 153 حورية و 75 حشرة مجنحة بينما كان أعداد الجنود 116 جندي خلال شهر أكتوبر.

أظهر تعداد الأعداد الكلية والنسب المئوية لأفراد الطوائف المجمعة من المصائد خلال الأشهر المختلفة أن النسب المئوية الأعلى بلغت 20,1% خلال أغسطس بينما النسبة المئوية الأقل كانت 2,1% خلال يناير، وقد اختلف المدى للنسب المئوية السنوية للطوائف المختلفة خلال الأشهر المختلفة حيث تراوحت بين 1,77% (يناير) - 20,44% (أغسطس) للشغالات، 2,51% (يناير) - 20,89% (أغسطس) للحوريات، 3,9% (أكتوبر)-12,99% (مايو) للجنود، 1,34% (يناير)-20,73% (أغسطس) للحشرات المجنحة.

وقد أظهر التحليل الاحصائي وجود ارتباط موجب بين طائفة الشغالات والجنود وأن نسبة الجنود / 1000 شغالة كانت تمثل 97,34%.

وقد وجد أيضا ارتباط معنوى موجب بين كل من درجة حرارة الهواء وحرارة التربة مع تعداد أفراد الطائفة وكان الارتباط موجب وغير معنوى مع سرعة الرياح ، بينما كان الارتباط سالب وغير معنوى مع الرطوبة النسبية ، كما لم يسجل ارتباط لأعداد الحشرة تحت الدراسة مع كمية الأمطار المتساقطة.