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Studying the Seasonal Activity of Termites *Microcerotermes diversus* Silv. using Bait Stations in Nineveh Governorate

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Abstract

The study was conducted in the forest nursery of the Department of Forestry / College of Agriculture and Forestry / University of Mosul, The results showed that the number of ground workers varied significantly among them according to the stations and the date of examination, and that the first appearance of the workers inside these traps was in the fourth week of April, with an average of 26.67 99 workers / station at the averages of 29 °C and 64.7% for the temperature and relative humidity, respectively. The number of worker bees reached its peak on 1/5 with an average of 99 workers / station at the mean averages of 33°C and 60% for the temperature and relative humidity, respectively. After that, the numbers of these workers continued to gradually decrease in numbers to disappear (zero / station), in the last week of June and the first week of July 1/7/2021, at averages of 42 °C and 33% of the temperature and relative humidity, respectively.

To reappear again and forcefully, at the beginning of the second week of September, with an average of 134.67 workers / station, at an average of 38 °C and 30% of the temperature and relative humidity. The presence of this insect continued after that during the months of October and the first week of November, to disappear again. again during the second week of November, specifically on 112021/15/, and for all used bait stations (zero / station), at averages of 25 °C and 60% of the temperature and relative humidity, respectively.

The results of the study of the correlation between temperatures and relative humidity on the one hand, and the number of these workers during the study period 2021 showed that there was a negative and insignificant correlation (-0.212) between the number of land workers and the

average temperature, while the correlation was positive and insignificant (0.227 +) between the number of ground workers and humidity Relativity.

Key words: Seasonal activity, Microcerotermes diversus, Bait Stations
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Introduction

Termites are important economic insects that attack wood and wood products in tropical, subtropical, and temperate regions [1] and [2]). There are more than 2800 described species in the world, belonging to 282 genera around the world [3], and approximately 285 species of them are considered pests.

The most recent classification of termites, according to the report (ITIS), is that they fall within the order Blattodea, and it includes 15 subfamilies and 7 families [4], three of these families are called lower or less developed terrestrial, as they feed only on dry or decomposed wood powder. They are (Mastotermitidae, Kalotermitidae and Hodotermitidae), while the other four families, which are called the upper ground and are the most developed as they can feed on healthy and dry wood, are (Termopsidae, Rhinotermitidae, Serritermitidae, and Termitidae) [5].

April 23The Termitidae family is the highest in number of species worldwide, comprising approximately 85% of known genera and 70% of known termite species [6].

In the Arab world, the number of known species does not exceed 24, 12 of which belong to the Termitidae family [7]. Of the diagnosed species of termites in Iraq, seven species belong to three families ([8], [9], and [10]), three of which belong to the Termitidae family.

The species *Microcerotermes diversus* silv. is considered one of the important economic insects in most of the governorates of Iraq. In addition to the economic losses, it causes great problems and psychological anxiety for homeowners that cannot be estimated in material values [11]. Termites cause huge losses to agricultural crops, forest trees, and buildings made of wood. The global economic losses of Subterranean termite are estimated at about 22 billion US dollars, including the costs of chemical control and the restoration of damaged buildings [12].

Termites live in sects, the number of individuals ranges from hundreds to several million, and some species live below the surface of the soil and at different depths that may sometimes be difficult to reach [13]. Ground workers are distinguished by their persistence in searching, as they travel distances of up to 150 feet in search of food [14]. It prefers to spread in moist and dark places, especially under the trunks of trees [10].

The subsurface builds its colonies in the soil and searches for food above the surface of the soil, where it attacks buildings through cracks and builds tunnels on the walls that it uses to connect between the colony and the food source [15].

Environmental studies related to the presence of the insect and its feeding activity, as well as the effect of temperature and humidity on this activity, are very important as they are necessary and required for the success of any control program.

In a study by [16] it showed a negative correlation when feeding on grafts with soil moisture in relation to the activity of the type *Copttermes getroi* (Wasmann) while the correlation was positive with soil moisture in relation to the type *Heterotermes longiceps* Synder, other studies showed that seasonal changes in Subsurface foraging behavior may influence the effectiveness of bait station baiting programs due to reduced activities during the winter season ([17], [18]).

In view of the recent history of the presence of the termite and its spread in the Nineveh Governorate, which is apparently linked to the history of the establishment of the Mosul Dam, which dates back to the eighties of the last century, compared to the central and southern governorates of Iraq, and therefore the lack of studies on this insect, especially environmental studies and the extent of its spread in the center of the Mosul district, as well as its sub-districts and sub-districts. Therefore, the aim of the current study was to know the seasonal activity of the individuals of the ground workers and that it is responsible for feeding the queen and the rest of the members of the sect as well as the possibility of access to it by using bait stations as it is responsible for the total losses caused by this insect to agricultural crops and residential buildings and the success of control operations Depends on knowing the times of appearance and presence of these individuals during the year.

Materials and Methods

The study was conducted in the forest nursery of the Forestry Department / College of Agriculture and Forestry / University of Mosul, which was preceded by extensive surveys of the various areas of Mosul, including the aforementioned site. (10 stations) around the field and between the lines, and they are examined every two weeks, in addition to the wooden pegs of eucalyptus trees (28 * 4 * 2.5 cm), which are installed as bait for insects. Its weight, as the individuals are counted in 1 gram of the termite colony and then multiplied by the weight of the total sample in order to obtain the total number of these individuals in one sample.

Each station consists of a plastic box with a cover 16 cm deep and 6.5 cm in diameter. Its base is pierced with small holes with a diameter of 0.5 cm. Side slits are made in it, 4 cm wide and 8 cm long [19]. A bundle of eucalyptus wood planks 15 cm long is placed in each station. As in the picture (1) with the recording of temperatures and relative humidity obtained from the Meteorology Department in Nineveh Governorate, and the study continued for a full year.

Picture (1) a local bait station with a wooden bundle inside

Results and Discussion

It appears from Table (1) that the numbers of ground workers varied significantly among themselves according to the different stations and the date of the examination, and that the first appearance of the workers inside these traps was in the fourth week of April, and that the number of these workers was clear when the examination was conducted on 1/5/2021 for average 33 °C and 60% for temperature and relative humidity, respectively, and their numbers ranged from 65-136 workers/station, with an average of 99 workers/station. After that, the numbers of these workers continued to gradually decrease in numbers to disappear (zero / station), in the last week of June and the first week of July 1/7/2021, at averages of 42 °C and 33% of the temperature and relative humidity, respectively.

While this situation continued (the lack of ground workers) throughout the months of July, August and the first week of September and for all the bait stations used in the study, due to the high temperatures, to reappear again and strongly, at the beginning of the second week of September, where their numbers ranged, specifically on 15/9/ 2021 from 79-195 workers / station, with an average of 134.67 workers / station, at an average of 38 °C and 30% of the temperature and relative humidity. The presence of this insect continued after that during the months of October and the first week of November, to disappear again during the second week of November. The month of November, specifically on 11/12021/, and for all used bait stations (zero / station), at averages of 25 °C and 60% of the temperature and relative humidity, respectively.

The statistical analysis of the general average of the effect of history showed that there were significant differences, and that the highest average number of workers in the six stations was 134.67 workers / station, on 9/15/2021, with a significant difference from the rest of the averages. The results of the general average for the station indicate that the average number of workers in the six stations ranged between 16.2 - 61 workers / station during the study period, and the study showed that the average number of workers in Station No. 4 (61 workers / station) exceeded all averages and with a significant difference from the rest of the stations.

Table (1) Seasonal activity of termites using bait stations during the study period for the year 2021.

Examination date	bait stations						General average of history	averages	
	1	2	3	4	5	6		temperature relative	humidity
21/4	35 F	0 Q	19 M	45 B	24 J	31 I	26.67 g	29	64.7
1/5	113 h	65 w	93 m	136 e	89 n	98 l	99 b	33	60
15/5	102 k	43 C	81 q	109 j	71 v	74 t	80 d	35	51.9
1/6	73 u	24 J	55 y	88 o	43 C	41 D	54 e	40	38.2
15/6	41 D	0 Q	34 G	39 E	21 L	17 O	25.33 h	37	30.4
1/7	0 Q	0 Q	0 Q	0 Q	0 Q	0 Q	0 j	42	33.3
15/7	0 Q	0 Q	0 Q	0 Q	0 Q	0 Q	0 j	43	26.5
1/8	0 Q	0 Q	0 Q	0 Q	0 Q	0 Q	0 j	44	23.1
15/8	0 Q	0 Q	0 Q	0 Q	0 Q	0 Q	0 j	42	28.1
1/9	0 Q	0 Q	0 Q	0 Q	0 Q	0 Q	0 j	43	27.4
15/9	182 b	79 r	123 f	195 a	112 i	117 g	134.67 a	38	30.5
1/10	145 d	32 H	74 t	157 c	87 p	76 s	95.17 c	34	35.7
15/10	73 u	0 Q	35 F	98 l	54 z	60 x	53.33 f	33	37.3
1/11	22 K	0 Q	14 P	48 A	18 N	24 J	21 i	28	41.1
15/11	0 Q	0 Q	0 Q	0 Q	0 Q	0 Q	0 j	25	60.7
station average	52.4 b	16.2 f	35.2 d	61 a	34.6 e	35.87 c			

Dissimilar letters indicate that there are significant differences at the 5% probability level, according to Dunkin's multiple range test.

From the foregoing, it is clear from our study that there are two periods, spring and autumn, for the presence of termite workers, and this is consistent with what was mentioned by [20], in which, as far as the matter relates to the species *M.diversus*, it is indicated that there are two periods for the presence of this insect in Basra Governorate, which is spring and autumn, and that the highest density of this The species was in the month of April, which amounted to 560 insects / traps, and also agrees to some extent with what [21] mentioned in a study to find out the seasonal activity of the subsurface *Heterotermes aureus*, where the results showed that the minimum activity in the search for food was during December to February, then the activity increases during the spring and then decreases during the summer, After the temperature reached more than 33 C, the number of workers searching for food decreased, and this is also consistent with what was mentioned by [22] where it was found that the highest rate of subsurface infection was 46.67% during the first week of October, and 43.33%. during the first week of October and the second week of May, and 43.33% during the second week of December and the first week of June, on the crops yellow corn, sunflower and millet, respectively.

The results of the study of the correlation between temperatures and relative humidity on the one hand, and the number of these workers during the study period 2021 showed that there was a negative and insignificant correlation (-0.212) between the numbers of land workers and the average temperatures, while the correlation was positive and insignificant (0.227 +) between the numbers of ground workers and humidity Relativity Figure (4, 5).

From the foregoing, it is clear, after our review of previous research in this field, that the response of the termite to temperature and relative humidity differs according to the type of termite, and this was confirmed by [23] in their research, where they found that the species *Reticulitermes tibialis* and *R. flavipes* preferred environments with low temperature and high humidity. This is consistent with our current study on the species *M.diversus*, while the species *Heterotermes aureus* Snyder and *R. hageni* preferred hot climates and relatively low humidity.

It also agrees with what was mentioned by [20] in the province of Basra that the presence of the species *M.diversus* stabilized in its presence in the spring and autumn periods, which obviously means low or moderate temperatures compared to summer temperatures, as well as high relative humidity, especially when it rains. Where he indicated that there is a significant positive correlation between the population density of this species and the ground water level.

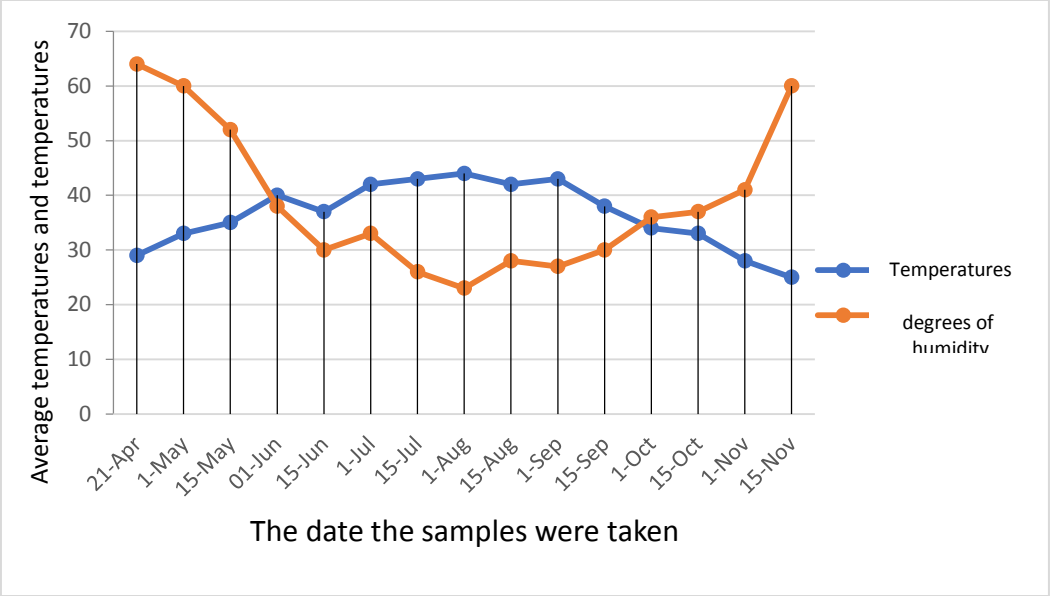

Figure (1) Average temperatures and relative humidity during the study period for the year 2021.

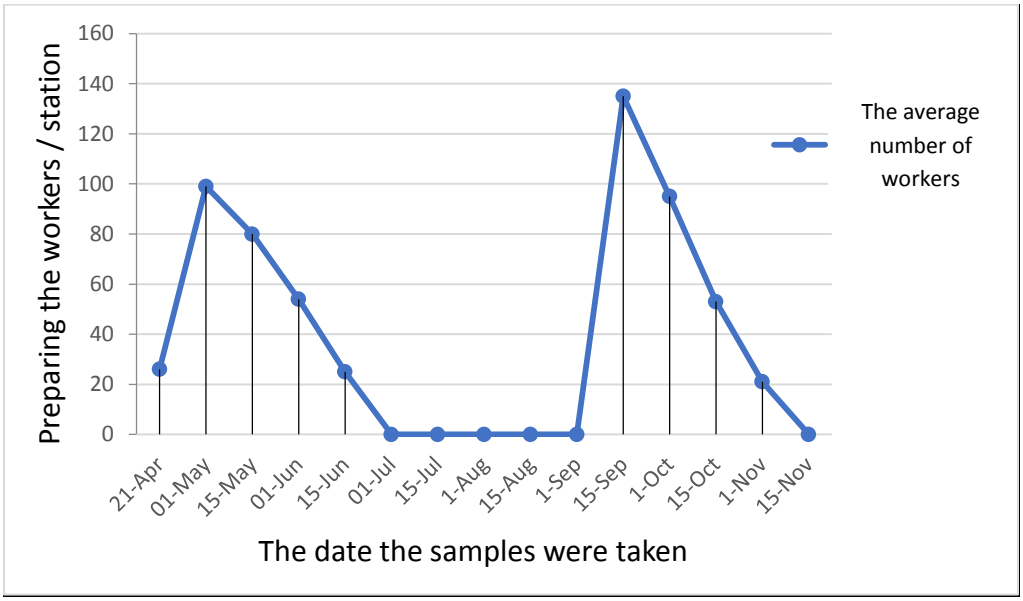

Figure (2) The number of registered land workers during the study period for the year 2021.

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دراسة النشاط الموسمي لحشرة الارضة *Microcerotermes diversus* Silv. باستخدام محطات الطعوم في محافظة نينوى

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- تاريخ استلام البحث 26/12/2023 وتاريخ قبوله 06/02/2023
- البحث مستل من اطروحة دكتوراه للباحث الاول .

المستخلص

اجريت الدراسة في مشتل الغابات التابع لقسم الغابات / كلية الزراعة والغابات / جامعة الموصل حيث اظهرت النتائج ان اعداد شغالات الارضة قد تباينت معنويا فيما بينها بتباين المحطات وتاريخ الفحص وان اول ظهور للشغالات داخل هذه المصائد كان في الاسبوع الرابع من شهر نيسان بمتوسط بلغ 26.67 99 شغالة / محطة عند متوسطي 29 مْ و 64.7 % لدرجات الحرارة والرطوبة النسبية على التوالي وبلغت اعداد الشغالات ذروتها بتاريخ 1 / 5 بمتوسط بلغ 99 شغالة / محطة عند متوسطي 33 مْ و 60 % لدرجات الحرارة والرطوبة النسبية على التوالي . استمرت اعداد هذه الشغالات بعد ذلك بالتناقص تدريجيا في اعدادها لتختفي (صفر/ محطة) وذلك في الاسبوع الاخير من شهر حزيران والاسبوع الاول من تموز 2021/7/1 عند متوسطي 42 مْ و33% لدرجات الحرارة والرطوبة النسبية على التوالي.

ليعاود الظهور مرة ثانية وبقوة وذلك في بداية الاسبوع الثاني من شهر ايلول بمتوسط بلغ 134.67 شغالة / محطة ، وذلك عند متوسط 38 مْ و30% لدرجات الحرارة والرطوبة النسبية واستمر تواجد هذه الحشرة بعد ذلك خلال شهري تشرين الاول والاسبوع الاول من شهر تشرين الثاني ليعاود الاختفاء مرة ثانية خلال الاسبوع الثاني من شهر تشرين الثاني وتحديدا في 2021/11/15 ولجميع محطات الطعوم المستخدمة (صفر/ محطة) وذلك عند متوسطي 25 مْ و60% لدرجات الحرارة والرطوبة النسبية على التوالي .

أظهرت نتائج دراسة الارتباط بين درجات الحرارة والرطوبة النسبية من جهة واعداد هذه الشغالات خلال فترة الدراسة 2021 وجود ارتباط سالب وغير معنوي (0.212−) بين اعداد شغالات الارضة ومتوسط درجات الحرارة في حين كان الارتباط موجب وغير معنوي (0.227+) بين اعداد شغالات الارضة والرطوبة النسبية .

الكلمات المفتاحية : النشاط الموسمي ، محطات الطعوم، Microcerotermes diversus