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Ecological study of palm borers species belonging to the genus *Oryctes spp* in Basra and Maysan provinces.

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Abstract

The results of the field survey of the species belonging to the genus *Oryctes*, which are *O. elegans* prell, 1914, *O. sinaicus* walker, 1817, *O. agamemnon* Burmeister, 1847 and *O. sahariensis* Demire, 1960 and the infection percentage with borers belonging to the genus *Oryctes* in Basra province was 65.5%, while the highest infection percentage was in Abu Al-Khasib district, which amounted to 72%. The lowest infection percentage was in the district of Al-Hartha, which amounted to 52%, and the cultivar Al-Sayer was the most infected species, with a rate of 84%. As for Maysan province, the infection percentage was 58%, and the highest infection percentage was in Al-Salam district, which amounted to 74%, and the lowest infection percentage was in Qal'at Saleh district, which amounted to 46% and the cultivar Bint Al-Soudah had the highest infection percentage and reached 90.90% among the cultivars included in the study. The species *O. agamemnon* recorded the highest population density in Basra province during the month of August, reaching 13 adults/trap, with significant differences from the rest of the species, and that the dominance among the species was for the species *O. agamemnon*. and that the activity of the species was from the month of April until the month of October, and that the peak of the activity was during the months of August and June. In Maysan province, the species *O. elegans* recorded the highest population density during the month of June, reaching 13.33 adults/trap, with significant differences from the rest of the species, and that the dominance was for the type *O. elegans*, and that the species activity was in the month of March until the month of October, and the peak of the activity was during the months of May and June of the year.

Keywords: palm borers, genus, *Oryctes spp*, palm cultivation

Introduction

Iraq is considered one of the most suitable environments for palm cultivation, where the ancient peoples cultivated palms to benefit from them in several aspects, Dates are considered one of the most important agricultural crops and the main source of livelihood for a large proportion of the country's population, especially in the southern region (Ismail, 2010). Palm trees and their fruits are affected by many insect and non-insect pests and pathogens (Al-Bahili, 2004; Khalaf, 2014; Mahmoudi et al., 2008). Among these pests are the borers, which include *Jebusea hammerschmidti*, the *Oryctes elegans* belonging to the genus *Oryctes*, and *Phonapate frontalis* 90-100% in some province of Iraq, where it is considered a major pest in many countries of the Arab world (Al-Jubouri, 2007; Saleh, 2012). These pests attack the stem, fronds, and larks through digging tunnels and feeding in them, and this leads to

breaking these affected parts and weakening the palm and their low productivity. In addition, these borer contribute to preparing palm trees for fungal diseases because of the wounds inflicted on palm trees, which increases the weakness of the palm, its deterioration, and ease of breakage in areas of severe injury by borers .Palm borers are widely spread in most of the palm-cultivated areas in the world, and there are up to 44 types of borers that belong to the genus *Oryctes*, spread globally, including up to four species spread in the Arab region, which are called rhinoceros beetles (Khalaf and Mahmoud, 2021)Insects belonging to the genus *Oryctes* infect, in addition to date palm trees, coconut palms, *Cocos nucifera* and oil palms, *Elaeis guineensis* (Kakeh and Zayed, 2020).In view of the increasing prevalence of borers belonging to the genus *Oryctes spp* and the damage it causes to palm trees in the province of Basra and Maysan.This study aimed to conduct a survey of the species belonging to the genus *Oryctes*, estimate the incidence of infection, calculate the annual presence and numerical density, and determine the most dominant species.

Materials and methods:

Field survey and infection percentage calculation:

A field survey was conducted for the types of palm borers belonging to the genus *Oryctes* in provinces of (Basra and Maysan) Where the study included the areas (Abu al-Khasib, Shatt al-Arab, al-Haritha, al-Qurna) in Basra provinces and the areas (Markaz, al-Kahla, Qal'at Saleh, al-Salam) in Maysan province to know the extent of the borers' spread during the 2020-2021 season. Where three orchards were selected from each region and 50 palm trees were chosen from each orchard randomly in each location, and the data for each palm (variety, age) that was obtained from the owner of the orchard.The symptoms of infection were relied on to determine the percentage of infection, and the percentage of infection was calculated through the law (Al-Sakini, 2006):

$$\text{Percentage of infection} = \frac{\text{The number of infected trees}}{\text{The total number of trees}} \times 100$$

Annual presence and numerical density of types of palm borers:

The annual presence of oryctes in the provinces of Basra and Maysan was studied by studying the average of numbers for types of sex for a full year from January 2020 to December 2021 using Makna optical traps produced by the imported Russell IPM company that operates on solar energy, which is the process of lighting It has an automatic light that starts at sunset and turns off with the appearance of the first light in the morning the next day. In this study, three traps were used for each province, where the location in each province was chosen on the basis of the presence of light traps and the distance between one trap and another. The location was chosen in Basra provinces, in the Shatt Al-Arab district, which was planted with different types of date palms, and the location of Maysan provinces was located in the district of the Center, which was planted with different types of palms.The readings were taken every 30 days, and the insects that were caught were collected in plastic containers, and the complete data was recorded on them

It was transferred to the laboratory for the purpose of calculating numbers, isolating and diagnosing species, and calculating the relative presence and sexual percentage.

Results and discussion :

Field survey and infection percentage calculation:

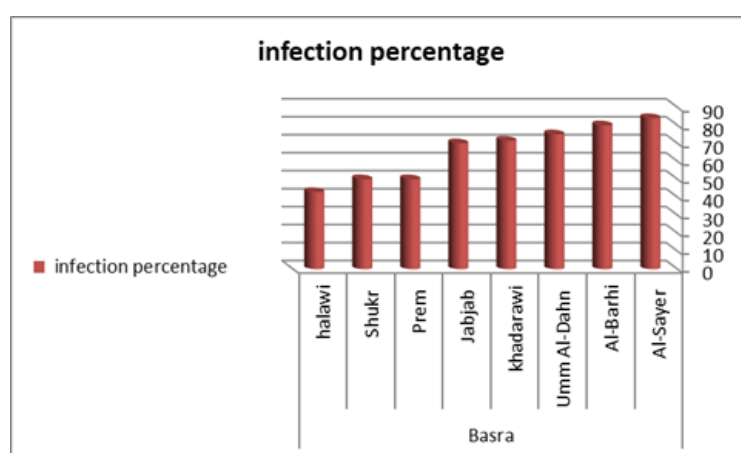
The results of the field survey shown in Table (1) showed that there are four types of borers belonging to the Dynastidae family, namely, *O.elegans* prell, 1914, *O.sinaicus* walker, 1817, *O.agamemnon* Burmeister, 1847 and *O.sahriensis* Demire, 1960 in the provinces of Basra and Maysan. The presence of four types of borer belonging to the genus *oryctes* in each of Basra and Maysan provinces does not agree with what was mentioned by Al-Saadi, 2015, who mentioned that the species belonging to the *oryctes* genus spread in Basra provinces are: *O.elegans*, *O.agamamenon* and *O.sinaicus*, and in Maysan provinces, he mentioned The only species present is *O.elegans*. The results of the study shown in Table (2) showed the percentage of infection with borers belonging to the genus *Oryctes* spp. In Basra provinces, it reached 65.5%, where the highest infection percentage was in Abu Al-Khasib district. With an infection percentage of 72%, then Al-Qurna district with an infection percentage of 70%, then Shatt Al-Arab district, and the infection percentage was 68%, and in Al-Haritha district, the infection percentage was 52%. As for the percentage of infection of different cultivars of date palms by diggers belonging to the *oryctes* genus in Basra province, the Al-Sayer cultivar was the most infested, with a percentage of 84%, followed by the Al-Barhi cultivar, and the percentage of infection was 80%, and the Umm Al-Dahn cultivar and the infection percentage was 75%. The Jabjab cultivar had a percentage of infection of 70%, then the Brim and Shukr cultivars, with the percentage of infection of 50% for each of them, and finally the Halawi cultivar, and the infection percentage was 42.85% (Fig. 1). In Maysan province, the results of the study in Table (3) showed that the infection percentage was 58%, and the highest percentage of infection with borers belonging to the *oryctes* genus was in Maysan province in Al-Salam district, and the infection percentage was 74%. Then the city center and the infection percentage was 68%, then Qala'at Saleh district, and the infection percentage was 46% Finally, in the district of Al-Kahla, the percentage of infection was 44%. As for the percentage of infection of different species with borers belonging to the genus *Oryctes*. The results indicated that the cultivar Bint Al-Soudah had the highest infection percentage among the remaining cultivars, and the infection percentage was 90.90%, followed by Sayr cultivar with a percentage of 81.81% and Derry cultivar with a percentage of 77.77% Al-Khadrawi cultivar with 72.5% infection percentage, Al-Zuhdi cultivar with 69.23% infection percentage, Barhi cultivar with 60.86% infection percentage, Abdul Hadi cultivar with 57.14% infection percentage, and finally Prem cultivar with an infection percentage of 39.28 % (Fig. 2). And this increase in the percentage of infection with borers belonging to the genus *Oryctes* in the province of Basra and Maysan is a dangerous indicator of the great economic damage caused by these insects, especially since the largest percentage of palm trees in those governorates are of relatively large ages and it suffers mainly from neglect in addition to the appropriate environmental conditions in those areas for the insect to live, and not paying attention to the damage of these insects will lead to the elimination of large numbers of trees. The loss of this national wealth, and that the competent authorities in the Ministry of

Agriculture should develop programs and plans to limit the spread of this insect and find appropriate means to combat it, reduce its damage, and include it among the important economic pests on which annual control operations are conducted. As for the percentage of infection of different date palm cultivars by diggers belonging to the oryctes genus in Basra province, it is noted that the Sayer cultivar was the most infested than the rest of the cultivars, followed by Al- Barhi cultivar. While the cultivar Bint Al Souda was the most infested, followed by the Sayer cultivar in Maysan province, and in this regard, (Al-Kuraiti, 2015 and Khalaf et.al, 2012) indicated that the Brem cultivar and the Usta Omran cultivar are the most sensitive cultivars to the infection of the borer *O. elegans* and the cultivar al-Zuhdi, Barhi, Khadrawi, Khastawi and Oweedi are the least affected by the infection, and this discrepancy in borers infection may be due to the difference in the chemical composition and physical characteristics of the cultivar and to the abundance of the nutritional elements that the cultivar contains, which is a major factor in attracting the insect to the cultivar.

province	<i>O. sahariensis</i>	<i>O. sinaicus</i>	<i>O. agagemnon</i>	<i>O. elegans</i>
Basra	√	√	√	√
Maysan	√	√	√	√

Table (2) The Percentage of infection with borers belonging to the genus *Oryctes* in Basra province

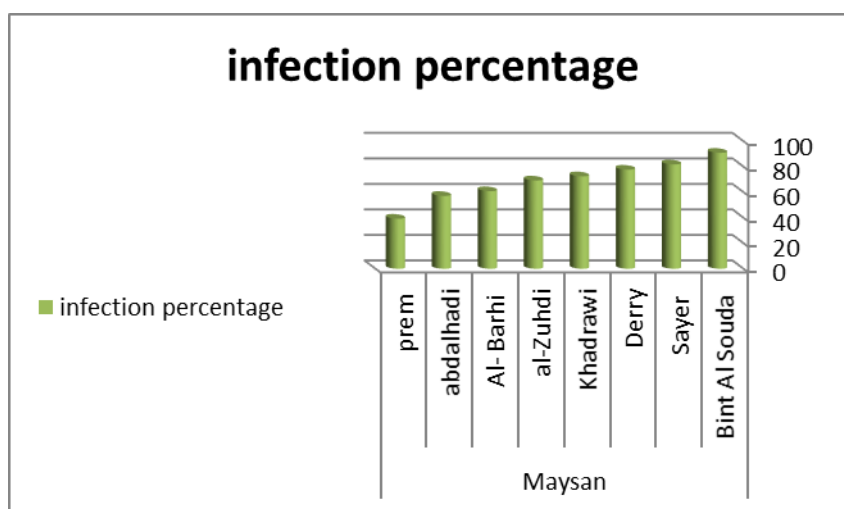
province	Location	infection percentage
Basra	Abu al-Khasib	72 %
	Shatt Al Arab	68 %
	Al-Hartha	52 %
	Al-Qurna	70 %
average		65.5 %



Figure(1) The percentage of infection of different cultivars of palm trees by borers belonging to the genus *Oryctes* in Basra province.

Table (3) Infection percentage of borers belonging to the genus *Oryctes* in Maysan province :

province	Location	infection percentage
Maysan	Center city	68 %
	alkahla	44 %
	Qaleat salih	46 %
	Alsalam	74 %
average		58 %

**Figure (2) The percentage of infection of different cultivars of palm trees by borer belonging to the genus *Oryctes* in Maysan province.****Annual presence and population density of the oryctes palm borer species:**

The results of the study, which are shown in Table (4), showed that there were significant differences between the species under the probability level of 0.05. In Basra province, the presence of the four species was recorded in the month of April, when the average temperature was 20.56 °C and the relative humidity was 41.16%. While no presence of the four species was recorded in the months of January, February, March, November, and December of the year 2020, the highest average for the four species was recorded in the month of August, reaching 6.33 adult/month when the average temperature was 36.51 m° and the relative humidity was 17.87% While the lowest rate was in the month of April, and it was 1.17 adult/month, when the average temperature was 26.30 °C and the relative humidity was 47.51%, and in the month of June the average was 5.58 adult /month, the average temperature was 36.49 °C and the relative humidity was 19.19% In July, the average species was 5.50 complete/month, average temperature 39.20°C and relative humidity 17.04%, while the average for May was 5.33 adult/month, average temperature 32.19°C and relative humidity 36.05%, and in September the average was 2.50 adult/month. Temperature 35.20 C°.The relative humidity was 25.61%, and the average number in December was 2.17 complete/month, the average temperature was 27.35 °C, and the relative humidity was 41.26%. As for the presence of species, the highest rate was 3.69 for *O. agamemnon* species,

and the lowest average was 1.31 for *O.sinaicus*, while the average Species *O.elegans* 2.28 and *O.sahariensis* average 2.25. *O. agamemnon* recorded the highest density during August, reaching 13 adults/trap, with significant differences from the rest of the species. *O.sahariensis* recorded 4.67 adults/trap, while *O.sinaicus* recorded 4.33 adults/trap, and *O.elegans* recorded 3.33 adults/ trap. As for the rest of the densities recorded by the rest of the species during the months of the study, the highest density of *O.sahariensis* was recorded during the month of June, and it reached 7.67 adults/trap, and the highest density of *O.elegans* was recorded during the month of July, which amounted to 8.67 adults/trap, and *O.sinaicus* recorded The highest density during the month of August was 4.33 adults/trap. From the foregoing, it is clear that the dominance was for the species *O. agamemnon*, that the activity of the species was from the month of April until the month of October, and that the peak of activity was during the months of August and June, and in this regard it was mentioned (Alousuf et. al, 2020) The activity of the species belonging to the genus *Oryctes* in Basra province was between the months of March - November, and the apical of the activity was during the months of July - September. In Maysan province, the four species belonging to the genus *oryctes* were present, and the first occurrence of the type *O.elegans* was recorded in the month of March, when the average temperature was 18.06 °C and the relative humidity was 58.27% The presence of the species was not recorded in the months of January, February, November and December of the year 2020, and the highest average for the four species was recorded in the month of May, which amounted to 8.92 adults/ month, and the lowest rate was in the months of March and October, which amounted to 0.25 adults/ month, and the average temperature was 18.06 and 25.30 ° and the relative humidity is 58.27 and 37.85%, respectively. The average adult insects in April was 3.58 whole/month, the average temperature was 24.08°C and the relative humidity was 46.59%, while the average in June was 7.50 adults/month when the average temperature was 35.58°C and the relative humidity was 17.97%, and the average in July was 3.08. adults/ month and average temperature 37.99 ° C°. The relative humidity was 29.36 %. In the months of August and September, the average was 1.08 and 1.00 adults/month, the average temperature was 35.62 and 33.84 °C, and the relative humidity was 20.97 and 29%, respectively. As for the highest density of species during the months, *O.elegans* recorded the highest density during the month of June, reaching 13.33 adults/trap with significant differences from the rest of the species, while *O.sinaicus* recorded 11.33 adults/trap, and *O.sahariensis* recorded 3.33 adults/trap and *O.sinaicus* recorded 3.33 adults/trap. *agamemnon* 2 adult/trap during the same month. The activity of the species belonging to the genus *oryctes* in Maysan province was from the month of March - October, and that the peak of activity was during the months of May - June of the year, and that the dominance was for the type *O. elegans* and with significant differences from the rest of the species, and that the density of the species belonging to the genus *Oryctes* corresponds to the increase in temperature rates and the density decreases with the decrease in the temperature. (Soltani, 2010) indicated that the adult insects of the genus *Oryctes* need high heat for the purpose of carrying out their various vital functions. From the above, it appears that there is a discrepancy in the numbers of adult insects that were caught during the season of the year 2020 in Basra province, Table (5), where the highest numbers were for the species *O.agamemnon*, which amounted to 133 adults/season, and the number of females was 60, while the number of males was 73, and the sexual percentage was 0.82 Females: 1 male, and

the relative presence of females was 45.11%. The relative presence of males is 54.88%, then comes *O.elegans*, where the number of insects amounting to 82 adults/season, the number of females 54 and males 28, and the sexual percentage of 1.92 females: 1 males, and the relative presence of females is 65.85% and males 34.14% and then the type *O.Sahariensis*, the number of adults caught was 81 adults/season, the number of females was 53, the number of males was 28, and the sexual percentage was 1.89 females: 1 male, and the relative presence of females was 65.43% and males 34.56% and in the last place was the species *O.Sinaicus* with the number of 47 adult insects/season, 24 females, 23 males, sexual percentage 1.04 females: 1 male, the relative presence of females 51.06%, and the relative presence of males 48.43%. In Maysan percentage, the results of Table (6) showed the presence of the same discrepancy in the number of adult insects, where the dominance of *O.elegans* was 127 adults/season, the number of females 40 and males 87, and the sexual ratio of 2.17 females: 1 males, and the relative presence of females was 31.49% and that of males 68.50% , Then the species *O.Sinaicus* with the number of insects 88 adults/season, the number of females 66 and the males 22, the sexual percentage 3 females: 1 males, the relative presence of females 75% and males 25%, then the type *O.Sahariensis*, the number of adults reached 49 adults/season, the number of females 29 and males 20 The sex ratio is 1.45 females: 1 male, and the relative presence of females is 59.18%. The relative presence of males is 40.81%, and the species *O.agamnon* ranked last in presence, where the number of hunted insects was 44 adults/season, the number of females 19 and males 25, and the sexual percentage of 0.76 females: 1 males, the relative presence of females 43.18% and males 56.81%. These increasing numbers of adult insects may be attributed to the difference in palm numbers and density, in addition to neglect and drought, as the palm trees' lack of sufficient water causes weakness in these trees. In this regard, he pointed out (Mattson and Haack, 1978). Continuous drought is one of the factors that help attract insect pests because drought makes the plant tissues fragile and easy to penetrate, and feeding the insect inside it is easier, and the fluctuation in numerical density during the different months of the year , It may be due to the difference in the thermal assembly required to complete the life cycle in addition to the presence or absence of vital enemies in addition to the role of climatic factors such as temperature, humidity, and rain in determining the population density of the insect

Table (4) Averages of the numerical density of oryctes species in the province of Basra and Maysan during a year:

Species average	December	November	October	September	August	July	June	May	April	March	February	January	species	Province
3.69	0.00	0.00	2.67	5.33	13.00	5.67	6.67	9.00	2.00	0.00	0.00	0.00	<i>O. agamemnon</i>	Basra
2.28	0.00	0.00	1.67	1.67	3.33	8.67	6.00	5.00	1.00	0.00	0.00	0.00	<i>O.elegans</i>	
1.31	0.00	0.00	2.33	1.00	4.33	2.33	2.00	3.00	0.67	0.00	0.00	0.00	<i>O.sinaicus</i>	
2.25	0.00	0.00	2.00	2.00	4.67	5.33	7.67	4.33	1.00	0.00	0.00	0.00	<i>O.sahariensis</i>	
2.38	0.00	0.00	2.17	2.50	6.33	5.50	5.58	5.33	1.17	0.00	0.00	0.00		average months

1.22	0.00	0.00	0.00	1.00	1.33	2.00	2.00	6.00	2.33	0.00	0.00	0.00	<i>O. agamemnon</i>	Maysan
3.53	0.0	0.00	0.67	1.67	2.00	6.00	13.33	11.00	6.67	1.00	0.00	0.00	<i>O.elegans</i>	
2.44	0.00	0.00	0.33	0.67	0.67	1.00	11.33	11.67	3.67	0.00	0.00	0.00	<i>O.sinaicus</i>	
1.36	0.00	0.00	0.00	0.67	0.33	3.33	3.33	7.00	1.67	0.00	0.00	0.00	<i>O.sahariensis</i>	
2.14	0.00	0.00	0.25	1.00	1.08	3.08	7.50	8.92	3.58	0.25	0.00	0.00		average months

L.S.D for province (0.48), species (0.68), months (1.18) and interaction(3.34.)

Table (5) Number of adults belonging to the genus *Oryctes* SPP. The relative presence in Basra province:

relative presence		sexual percentage	male	female	Average	species
male	female					
%54.88	%45.11	1:0.82	73	60	133	<i>O.agamemnon</i>
% 34.14	%65.85	1:1.92	28	54	82	<i>O.elegans</i>
% 34.56	% 65.43	1:1.89	28	53	81	<i>O.Sahariensis</i>
% 48.93	% 51.06	1:1.04	23	24	47	<i>O.Sinacus</i>
			152	191	343	average

Table (6) Number of adults belonging to the genus *Oryctes* SPP. The relative presence in Maysan province:

relative presence		sexual percentage	male	female	Average	species
male	female					
% 68.50	% 31.49	1:2.17	87	40	127	<i>O. elegans</i>
% 25	% 75	1:3	22	66	88	<i>O. Sinacus</i>
% 40.81	% 59.18	1:1.45	20	29	49	<i>O.Sahariensis</i>
% 56.81	% 43.18	1:0.76	25	19	44	<i>O. agamemnon</i>
			154	154	308	average

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